Chapter 6: Effects during Construction of the Project

This chapter discusses how construction of the 6-Lane Alternative would affect the natural and built environment in the project area. The No Build Alternative is not discussed in this chapter because it would not involve any construction and would not have construction effects. The 6-Lane Alternative options are compared to the extent that their construction methods, timing, and/or effects differ from one another.

Specific construction activities would affect portions of the SR 520 project area for varying amounts of time. All of the construction effects would be temporary, although some would last for several years. Areas outside the SR 520 right-of-way would be restored to their original condition as soon as possible after construction.

6.1 Transportation

Construction effects on transportation near I-5, the Delmar lid, and the SR 520/Montlake interchange would be similar for all the design options. However, reconstruction of the NE Montlake Boulevard/NE Pacific Street intersection in Options K and L would have much greater adverse effects on traffic operations and transit facilities, particularly near the Montlake Triangle. The effects would result from the road closure and traffic shifts that would be required to modify the Montlake Boulevard and NE Pacific Street intersection, as well as the amount of truck traffic required for construction of the new interchange. The following sections describe construction effects on local streets, regional freeways, transit, nonmotorized travel (i.e., bicycles and pedestrians), and parking.

KEY POINT

Transportation

All options would have similar construction effects on transportation through most of the project area, with differences in the vicinity of the Montlake Boulevard interchange. Options K and L would result in more effects than Option A because of the amount of truck traffic required for construction of the new SPUI and the traffic effects during the closure of NE Pacific Street.

How would ramp and road closures affect traffic?

Throughout the construction period, there would be intermittent short-term closures on-ramps, local streets, and the freeway. Closures would be limited to nights and weekends when traffic volumes are lowest. These closures are not expected to substantially affect traffic operations; however,

some travelers might experience delays or be required to choose an alternate route to reach their destination.

There would be two long-term road closures under Option A and three long-term road closures under Options K and L. All options would include closures of the Lake Washington Boulevard/SR 520 ramps and the Delmar Drive bridge over SR 520. Options K and L would also include a closure of NE Pacific Street at NE Montlake Boulevard. Exhibit 6.1-1 shows the locations of these closures.

Construction Coordination

Prior to and throughout the entire construction period, WSDOT will coordinate with the City of Seattle, University of Washington, King County Metro, and Sound Transit to maximize the effectiveness of construction traffic management and minimize construction effects on weekday traffic. WSDOT would also coordinate with University of Washington event traffic, the UW Medical Center, and local and cross-lake bus service.

Exhibit 6.1-1. **Road Closures**

Closure of the Lake Washington Boulevard Ramps

The Lake Washington Boulevard ramps would be closed and removed during construction of all design options, as discussed in Chapter 3. The ramp closures would mostly affect local street operations and are not expected to have a substantial effect on SR 520 operations. Traffic that currently uses the ramps would be detoured to use the ramps at Montlake Boulevard. Therefore traffic volumes on Montlake Boulevard would increase. Several roadway improvements would be made to the SR 520 ramps and intersections at Montlake Boulevard before closing these ramps to help offset the effects of the closure. The improvements along East Montlake Boulevard must be completed prior to closure of the Lake Washington Boulevard ramps to prevent substantial delays on Montlake Boulevard at SR 520. Table 6.1-1 shows the expected changes in traffic volumes on the freeway ramps due to the closures.

Table 6.1-1. Expected Change in Traffic Volumes During Construction with the Closure of Lake Washington Boulevard Ramps (AM and PM peak hours)

Freeway Segment	Existing/Year 1		Years 2-3[a]		Years 4-5	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Eastbound Montlake on-ramp	840	900	same as existing		1,470	1,250
SR 520 main line east of Montlake eastbound off-ramp	3,520	3,220	same as existing		4,150	3,570
Eastbound Lake Washington Blvd on-ramp	630	350	same as existing		0	0
Westbound Lake Washington Blvd off-ramp	340	440	0	0	0	0
Westbound Montlake off-ramp	670	750	1,010	1,190	1,010	1,190[f]

Note: Adding the suboptions to Option A, K, or L would not change the expected traffic volumes listed in this table.

Closure of Delmar Drive East

The Delmar Drive East bridge over SR 520 would be closed temporarily under all options to accommodate construction on SR 520 beneath the bridge, as well as construction of the 10th Avenue and Delmar Drive East lid. The Delmar Drive East bridge would be closed for approximately 12 months for Options A, K, and L. Traffic would be required to detour via 10th Avenue East or Boyer Ave East, which would increase travel times for all vehicles including transit and nonmotorized.

Closure of NE Pacific Street

In Options K and L, a portion of NE Pacific Street would be closed to allow for lowering of the Montlake Boulevard/Pacific Street intersection. This would affect a short segment of NE Pacific Street just west of Montlake Boulevard in front of the University of Washington Medical Center. The closure would last for 9 to 12 months.

During this closure, traffic from NE Pacific Street would be detoured onto NE Pacific Place. Several improvements would be made to NE Pacific Place and its intersection with Montlake Boulevard to accommodate the additional traffic (Exhibit 6.1-2). These improvements would include temporary widening of Montlake Boulevard NE and temporary widening of NE Pacific Place. New right and left turn pockets would be added to the Montlake Boulevard NE/NE Pacific Place intersection to accommodate turning vehicles. A westbound left turn pocket from NE Pacific Place to the University of Washington Medical Center would also be added for emergency vehicles and hospital visitors.

KEY POINT

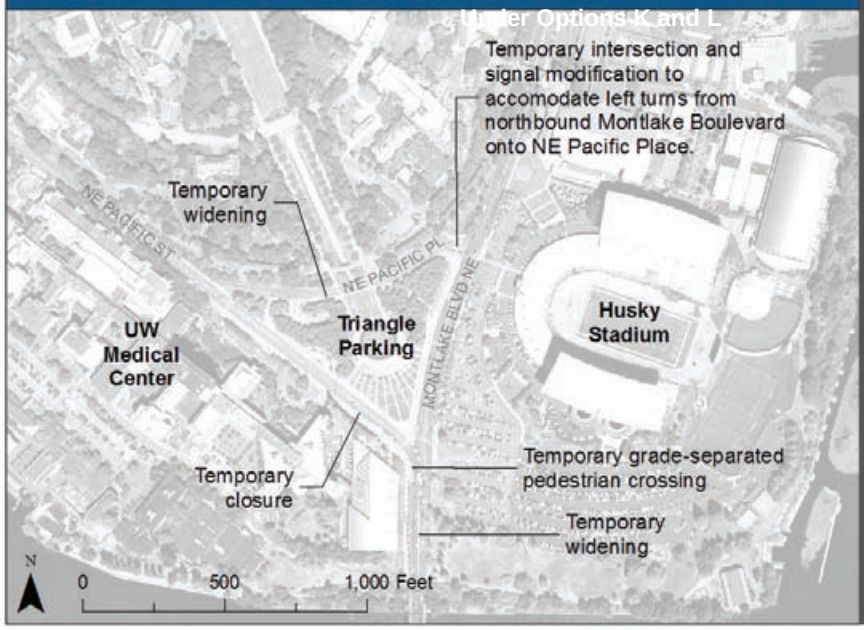
Road Closures and Detours

All options would close the Lake Washington Boulevard ramps and Delmar Drive East for a period of time during construction. Traffic from Lake Washington Boulevard would be detoured to the ramps at Montlake Boulevard and from Delmar to 10th Avenue NE.

Options K and L would close NE Pacific Street for 9 to 12 months. Detour traffic would use the Montlake Boulevard NE/NE Pacific Place intersection to make any turning movements.

Temporary access for emergency vehicles to the University of Washington Medical Center may be provided from Montlake Boulevard along an existing paved pedestrian trail that runs along the south side of the medical center.

Exhibit 6.1-2. **Closure of NE Pacific Street under Options K and L**



When NE Pacific Street is closed, vehicle delays at the intersection of NE Pacific Place/Montlake Boulevard NE would increase substantially. This intersection would operate at LOS F during the morning and afternoon peak hours, and long queues are expected on eastbound NE Pacific Place. Much of the delay would be experienced by vehicles traveling to and from NE Pacific Street and Montlake Boulevard NE. Since this is a heavily used transit route, many transit users would be affected. Table 6.1-2 shows existing peak-hour intersection traffic conditions in the area of NE Pacific Street and the estimated conditions during construction for Options K and L. The intersection would operate differently during various stages of construction.

Sound Transit is constructing a light rail station for the University Link line at Husky Stadium, just east of the intersection of Montlake Boulevard NE and NE Pacific Street. Based on current construction schedules, excavation for the station and light rail tunnels is expected to be complete before the closure of NE Pacific Street would occur. If excavation is not complete, closure of NE Pacific Street would have a substantial effect on construction hauling activities for the University Link station. Station construction may be ongoing at the time of closure and some Sound Transit construction traffic is expected. Coordination with Sound Transit is required to minimize project conflicts and unnecessary cumulative construction effects. The coordination effort is underway and will continue throughout project construction.

Table 6.1-2. Traffic Conditions in Montlake Boulevard/Pacific Street Area During Construction of Options K and L

Intersection	Existing LOS	Year 1 LOS	Years 2-3 LOS	Years 4-5 LOS
AM Peak Hour				
Montlake Boulevard/ NE Pacific Street	C	B	B	A
Montlake Boulevard/ NE Pacific Place	A	B	B	F
NE Pacific Street/ NE Pacific Place	B	B	B	C
PM Peak Hour				
Montlake Boulevard/ NE Pacific Street	D	D	C	A
Montlake Boulevard/ NE Pacific Place	C	C	C	F
NE Pacific Street/ NE Pacific Place	C	C	C	B

Note: Adding the suboptions to Option K or L would not change the traffic conditions listed in this table.

Effects of Suboptions

- Adding the Lake Washington Boulevard ramps to Option A would result in a slight difference to the road closure durations described above. Because the new Lake Washington Boulevard westbound off-ramp would reopen when the Lake Washington Boulevard eastbound on-ramp is closed, there would be less traffic detoured through the 24th Avenue East/Boyer Street intersection during construction. Adding the Lake Washington Boulevard ramps would result in a slight improvement to the ramp and road closure effects as described earlier for Option A.
- Adding the eastbound HOV direct-access ramp or the constant-slope profile to Option A would not result in differing effects on road closures.
- Adding the suboptions to Option K or L would result in no additional road closures and effects would not differ from those described above.

How would construction haul routes affect traffic?

Local Roads

As discussed in Chapter 3, WSDOT would use designated truck routes and other arterial streets for haul routes to the greatest extent possible. However, some residential streets may still experience haul truck traffic

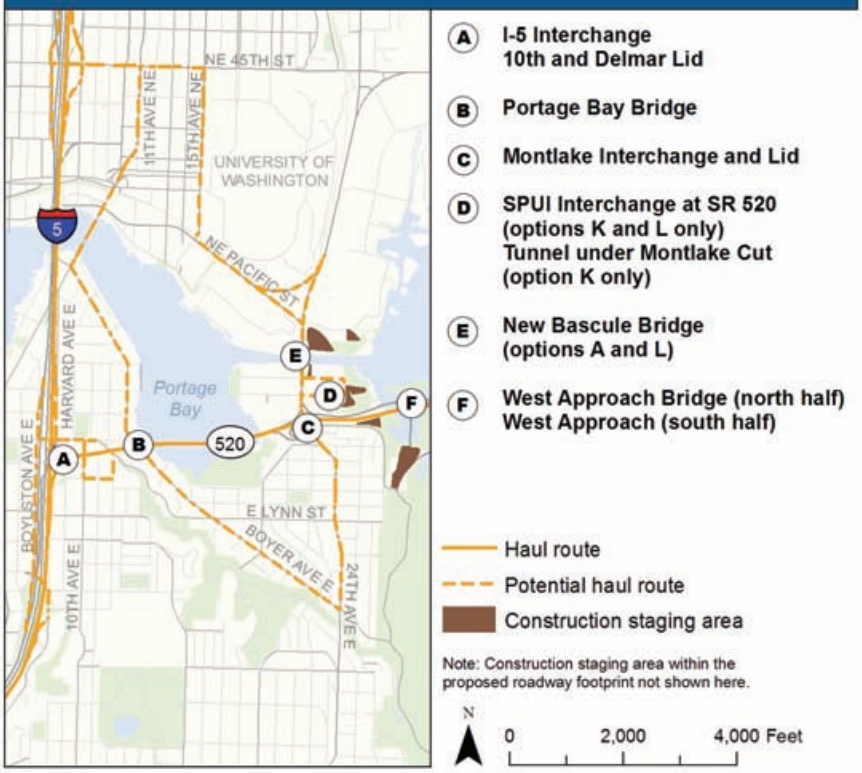
KEY POINT

Haul Routes

All options would require construction-related truck traffic on local streets. Most of the trips would use Montlake Boulevard to access SR 520. A few other arterials would be affected, and the estimated number of truck trips along these arterials would be relatively low compared to overall arterial volumes.

during construction of nearby facilities. Residential streets that might be used for truck haul routes include 11th Avenue East between Delmar Drive and East Miller Street, East Miller Street between 11th Avenue East and 10th Avenue East, East Shelby Street east of Montlake Boulevard (Options K and L), and East Hamlin Street east of Montlake Boulevard (Options K and L). Haul routes on local roads would be subject to review and approval by the City of Seattle. Exhibit 6.1-3 illustrates the potential haul routes that could be used for all options, and Table 6.1-3 estimates the number of truck

Exhibit 6.1-3. **Potential Haul Routes by Project Component**



trips that could be generated as a result of construction activities. For the purpose of developing construction duration estimates that meet the current schedule, it was assumed that construction activities would typically occur 16 hours a day, with 10 hours each day to haul material for most construction activities.

Most of the construction truck trips on local streets would use Montlake Boulevard to access SR 520. A few other arterials would be affected, and the estimated number of truck trips along these arterials would be relatively low compared to overall arterial volumes. The exception would be East Shelby Street and East Hamlin Street, which are residential streets in Montlake that may need to be used to access construction occurring near MOHAI under Options K and L. Peak-hour truck volumes on East Shelby Street and East Hamlin Street during peak construction periods could be as much as 5 to 20 trucks per hour, depending on which

option is selected. Peak-hour traffic volumes on East Shelby Street and East Hamlin Street are currently low, approximately 40 to 50 vehicles per hour during the morning and evening peak hours. Construction truck volumes could increase traffic by approximately 10 percent to 40 percent on these streets during peak construction periods.

Table 6.1-3. Haul Routes and Estimated Truck Trips

Construction Element (Locations Shown in Exhibit 6.1-3)	Construction Duration (months)	Truckloads per Day[a]		Local Roads Used to Access the Freeway
		Average	Peak	
(A) – I-5 Interchange	21	5	60	East Roanoke Street, Harvard Avenue East, 10th Avenue East, 11th Avenue East, East Miller Street, Boylston Avenue East, Boyer Avenue East, Fuhrman Avenue East, Eastlake Avenue East
(A) - 10th and Delmar Lid	27	11	80	
(B) - Portage Bay Bridge	72	11 to 12	50	
(C) - Montlake Interchange and Lid	45	5	50	NE Pacific Street, 15th Avenue East, NE 45th Street, Montlake Boulevard
(D) - SPUI Interchange at SR 520 (options K and L only)	60 to 78	13 to 50	120 to 300	East Shelby Street, East Hamlin Street, Montlake Boulevard
(D) - Tunnel under Montlake Cut (Option K only)	45	17	120	
(E) - New Bascule Bridge (options A and L)	27 to 30	1 to 2	40	Montlake Boulevard
(F) - West Approach Bridge (north half)	30 to 54	4 to 6	100	Direct access to freeway
(F) - West Approach (south half)	30	12	175	Direct access to freeway
East Approach and bridge maintenance facility	30	6	100	Direct access to freeway
Other	72	26	120	

[a]Based on 10-hour haul day for most activities.
Note: Adding the suboptions to Options A, K, or L would not change the estimated truck trips listed in this table.

A construction access ramp may be provided directly into the construction zone from the SR 520 westbound Montlake off-ramp. Outbound trucks could also re-enter the westbound Montlake off-ramp near the intersection with Montlake Boulevard. These trucks could either go straight to access the SR 520 westbound on-ramp or turn left and travel to the SR 520 eastbound on-ramp to reach their final destinations. Providing temporary construction access directly from the Montlake westbound off-ramp would reduce the volume of construction trucks on East Shelby and East Hamlin streets.

Effects of Suboptions

- Adding the suboptions to Option A, K, or L would result in no additional haul routes, and effects would not differ from those described above.

Regional Freeway System

This section describes construction truck trips that would use SR 520, I-5, I-405, and I-90 to travel to and from the work site. Note that the percentages of truck trips discussed add up to more than 100 because many trips would make use of more than one regional freeway.

SR 520

Approximately 75 percent to 85 percent of daily construction truck trips would use SR 520. A total of 350 to 620 truck trips per day—or one truck trip every 1 to 2 minutes—is expected along SR 520 during construction (Table 6.1-4). Given the anticipated peak-period congestion levels on SR 520, this would have a moderate to substantial effect on traffic flow, depending on the option selected. Option K would have a greater effect on SR 520 traffic operations than Option A or Option L due to its high estimated truck trips during construction.

Table 6.1-4. Summary of Effects of Truck Traffic in Seattle

Regional Freeway	Estimated Number of Peak-Period Haul Route Trips					
	Per Day[a]			Per Hour		
	A	K	L	A	K	L
SR 520	350	620	420	44	69	64
I-5	268	403	303	34	53	50
I-405	187	323	222	20	37	34

[a]Based on 10-hour haul day for most activities.
Note: Adding the suboptions to Option A, K, or L would not change the estimated truck traffic listed in this table.

I-5

An estimated 55 percent to 60 percent of the haul routes during construction would use I-5. A total of 268 to 403 truck trips per day—or one truck trip every 1 to 2 minutes—is expected along I-5 during construction. While peak congestion on I-5 is generally high, the relatively low volume of trucks related to the SR 520 construction is anticipated to result in a moderate effect on I-5 traffic operations. Option K would have a greater effect on I-5 traffic operations than Option A or Option L due to its higher volume of estimated truck trips during construction.

I-405

Approximately 35 percent to 40 percent of haul trips would use the I-405 corridor. A total of 187 to 323 truck trips per day—or one truck trip every 1.5 to 3 minutes—is expected along I-405 during construction. The overall effect on I-405 traffic operations with this level of truck traffic would be

low to moderate. Option K would have a greater effect on I-405 traffic operations than Option A or Option L due to its higher volume of estimated truck trips during construction.

I-90

Haul routes and truck traffic resulting from project construction are not expected to affect I-90.

How would construction affect transit operations?

Construction would affect several transit stations and associated bus operations along SR 520, as well as several bus stops on local streets in the construction zone. Road closures, lane shifts, and intersection modifications would affect existing transit facilities and require service adjustments or other accommodations to maintain operations.

The most substantial differences between the design options would occur near the NE Pacific Street/Montlake Boulevard NE intersection, which would be reconstructed under Options K and L. The effects in that area are described below, followed by the effects that are common to all options, including removal of the Montlake Freeway Transit Station.

Because final construction staging and schedules have not yet been determined, WSDOT will continue to coordinate with local and regional transit agencies regarding potential construction effects on transit service and facilities and ways to maintain service to transit users.

KEY POINT

Construction Effects on Transit

All options would permanently close the Montlake Freeway Transit Station, relocate transit stops on Montlake Boulevard, and temporarily close the Evergreen Point Road Transit Station for 4 to 6 months. Options K and L would temporarily relocate several transit stops on NE Pacific Street and Montlake Boulevard.

Pacific Street Transit Stops

Options K and L would require several transit stops on NE Pacific Street and Montlake Boulevard to be relocated during construction of the NE Pacific Street/Montlake Boulevard intersection. The University of Washington transfer point located on NE Pacific Street, in front of the University of Washington Medical Center, provides access to the University of Washington Medical Center, the main University of Washington campus, and Husky Stadium. Both the westbound and eastbound stops would be relocated to NE Pacific Place during construction. When traffic is detoured onto NE Pacific Place, the transit stops are likely to increase traffic delays on NE Pacific Place. Transit pull-outs could be provided at these temporary stops to help facilitate traffic flow and reduce congestion; however, pull-outs may also increase transit delays if buses are unable to re-enter congested traffic.

The transit stops located on the east and west sides of the NE Pacific Street/Montlake Boulevard intersection would also need to be relocated during construction. The stop on the east side of the street could be moved south to allow riders access to a temporary pedestrian bridge that is proposed to be constructed across Montlake Boulevard. This temporary crossing would be designed to provide both safety for pedestrians and

access for workers in the construction zone. The transit stop located on the west side of the street could be moved north of the construction area. These stops serve one route and are not heavily used.

Transit Facilities and Operations near the Montlake Triangle

The detour of traffic from NE Pacific Street to NE Pacific Place under Options K and L would substantially increase traffic volumes and delays at the intersection of NE Pacific Place and Montlake Boulevard NE. This would particularly affect the transit routes that currently make turns to and from Montlake Boulevard and NE Pacific Street.

During reconstruction of the NE Pacific Street/Montlake Boulevard NE intersection, lane shifts on Montlake would also require closure of transit priority lanes. Removal of the transit priority lanes would prevent buses from bypassing congestion on Montlake Boulevard.

The existing bus layover space on NE Pacific Place would be removed during construction to allow for roadway widening. The layover space is necessary to maintain transit reliability. The Montlake Triangle also serves as a turnaround location for buses. This function would be disrupted during construction in Options K and L when the southbound transit-only, right-turn lane from Montlake Boulevard to NE Pacific Street would be removed.

The closure of NE Pacific Street and removal of layover and turnaround functions at the Montlake Triangle would prevent trolley operation in the current configuration. A detour of the existing trolley routes onto NE Pacific Place would require temporary transit improvements such as new overhead trolley wires, switches, and poles to maintain service.

Montlake Freeway Transit Station

Because the Montlake Freeway Transit Station on SR 520 would be permanently closed after construction begins, people would need to ride a different bus or board their bus at other transit stops. Some riders may have increased walking distances to reach the nearest stop, while others would have reduced distances. Riders who travel from the east side of Lake Washington to Montlake Boulevard or the University District would need to transfer to a University District bus at one of the Eastside transit stations instead of using downtown Seattle routes. Riders who currently use the Montlake Freeway Transit Station to access buses to downtown Seattle would need to board local buses on Montlake Boulevard. Riders who use this transit station to board buses to the east side of Lake Washington would need to use the NE Pacific Street bus stop near the University of Washington Medical Center and board one of the University District SR 520 routes. Some eastbound transit passengers may need to transfer once more than they normally do to reach their destination.

Closure of the Montlake Freeway Transit Station would likely occur before the second year of construction. Since the number of routes available for travel to the Eastside would be reduced, additional bus service could be needed between the University District and the Eastside to accommodate the passengers affected by the closure of the Montlake station.

Montlake Boulevard Transit Stops

All options would require relocation of transit stops on Montlake Boulevard during project construction. The existing bus stop at Montlake Boulevard and the SR 520 eastbound ramp would be closed, and riders would be redirected to a nearby stop on Montlake Boulevard. The current transit stop at the Montlake Boulevard/SR 520 westbound ramp serving northbound routes would be combined with the existing transit stop at Montlake Boulevard and Shelby Street. The relocations of bus service would require riders to walk approximately two additional blocks to access bus service.

Evergreen Point Transit Station

Under all options, the freeway transit station at Evergreen Point Road would close temporarily when traffic on SR 520 shifts to the newly constructed westbound east approach bridge and construction continues on the eastbound east approach bridge. The station would be closed for 4 to 6 months.

One transit station on the east side of Lake Washington would remain open through the duration of construction to allow passengers to transfer between Seattle- and University-bound buses. A shuttle service could be provided between the Evergreen Point Transit Station and the transit stop at 92nd Avenue NE to help riders who are affected by the closure. The transit stop at 92nd Avenue NE would need to accommodate all of the added demand from the Evergreen Point Station. Closure of the Evergreen Point Transit Station is likely to increase travel times for some riders.

Electric Trolley Buses

Options A, K, and L would all shift traffic on 10th Avenue East to a temporary bridge for construction of the new 10th Avenue East crossing over SR 520. Similarly, traffic on Montlake Boulevard would be shifted during demolition and re-construction of the existing bridge over SR 520. These shifts would require installation of temporary overhead trolley wire, switches, and poles, or other transit service improvements to maintain service.

Effects of Suboptions

- Adding the potential suboptions to Option A, K, or L would result in no additional transit effects.

How would construction affect bicycle and pedestrian travel?

Construction of the 6-Lane Alternative, under all design options, would have some effects on bicycle and pedestrian access within the project corridor. In addition to general construction activities that would affect bicycle and pedestrian access, some local bicycle and pedestrian routes would be closed during construction.

KEY POINT

Pedestrians and Bicycles

All options would close the 24th Avenue East bridge and the Bill Dawson Trail for most of the construction duration, leaving only Montlake Boulevard open to pedestrian and bicycle traffic. Bicycle and pedestrian access may be restricted to one side of Montlake Boulevard.

Montlake Area

Under all design options, the 24th Avenue East bridge and the Bill Dawson Trail would be closed to pedestrian and bicycle access during the majority of construction. Montlake Boulevard would remain open to pedestrians and bicycles during construction.

The Bill Dawson Trail is proposed as a construction access road and would be closed to pedestrians and bicycles for 2 to 3 years of construction. Bicycles and pedestrians would need to use Montlake Boulevard to cross SR 520 during construction.

There is an on-street bicycle route on 24th Avenue East, between East Shelby Street and East Lake Washington Boulevard. Under all design options, the 24th Avenue East bridge would be demolished and replaced as part of the Montlake lid. Pedestrians would need to use Montlake Boulevard to cross SR 520 during construction.

A portion of the Ship Canal Waterside Trail would be closed within East Montlake Park. However, the remainder of the trail could be accessed from the trailhead in West Montlake Park during project construction. After construction, trail access would be restored.

Major construction activities are proposed along Montlake Boulevard near SR 520 for all of the design options. Construction may restrict bicycle and pedestrian access to one side of Montlake Boulevard over SR 520 during construction. WSDOT would place restrictions on construction activities to ensure that bicycles and pedestrians in the Montlake area can cross SR 520 during the entire construction period. When traffic is detoured from the Lake Washington Boulevard ramps to the Montlake ramps, bicyclists riding in the street may face increased potential for conflicts with vehicles due to the higher volume of traffic.

When the Montlake Freeway Transit Stop is closed, cyclists who board buses to cross the Evergreen Point Bridge would have to travel to NE Pacific Street to board an SR 520 route. The number of available bike racks on cross-lake buses would be reduced since there would be fewer routes to choose from. When the Montlake Freeway Transit Station is closed, the highly utilized bicycle lockers at that location would also be closed. These lockers could be relocated near the Montlake Triangle.

Delmar Drive Bridge

When Delmar Drive is closed during construction, bicyclists and pedestrians would need to use alternative routes such as Boyer Avenue East on the east side of Delmar Drive and 11th Avenue East to 10th Avenue East on the west side of Delmar Drive. Both routes are feasible for bicycle and pedestrian traffic; however, 11th Avenue East is particularly steep. Depending upon the route traveled, the Boyer Ave East detour could require longer out-of-direction travel.

NE Pacific Street Intersection

During construction of the NE Pacific Street/Montlake Boulevard intersection proposed under Options K and L, existing pedestrian and bicycle routes may be modified. Pedestrian access would be maintained on one side of Montlake Boulevard NE within the construction zone at all times during the construction period. Pedestrian crossings would be provided at intersections.

A temporary pedestrian overpass would be provided just south of the Montlake Boulevard/NE Pacific Street intersection. This temporary overpass would help maintain pedestrian access to the east and west sides of Montlake Boulevard during construction.

Bicycle routes along Montlake Boulevard and NE Pacific Place connecting to the Burke Gilman Trail may be rerouted through or around the construction zone.

Foster Island and Arboretum

During construction of the west approach bridge, the portion of the Arboretum Waterfront Trail that currently travels under the existing SR 520 main line would be closed. Access to the Arboretum Waterfront Trail from East Montlake Park would not be affected. However, the parking lot at the trailhead near East Montlake Park is proposed as a construction staging area for all design options, and parking available to the general public would be very limited.

Effects of Suboptions

- Adding the suboptions to Option A or K would result in no additional bicycle and pedestrian effects.
- Adding northbound capacity on Montlake Boulevard to Option L would result in some differences in the effects described above. The new capacity would require replacement of sidewalks on the east side of Montlake Boulevard and reconstruction of three existing pedestrian crossings, which may temporarily affect access for people who use the lots east of the UW campus and who need to cross Montlake Boulevard. Construction could also temporarily affect transportation to special

events at UW facilities along Montlake Boulevard. Adding left-turn access from Lake Washington Boulevard onto the SPUI south ramp would result in no measurable change to the effects as described above.

How would construction affect parking?

Construction would affect parking in the project area, particularly near Husky Stadium. Table 6.1-5 presents the construction effects on parking supply. The most substantial effects are described below.

- All ten parking stalls at the Bagley Viewpoint would be eliminated. The viewpoint would be closed at the start of construction, so the stalls would not be needed.
- All 150 stalls in MOHAI's parking lot would be eliminated to make room for construction staging under all design options. Because MOHAI is planning to move by the time construction begins, eliminating this lot would not affect the museum's operation. Access to the northern portion of East Montlake Park would be maintained during construction, but parking would be limited.
- Construction activities would permanently eliminate five on-street parking stalls located just west of MOHAI on the west side of 24th Avenue East, just south of East Hamlin Street. The removal of these parking spaces would have minimal effect on the community because the average use is only 20 percent (i.e., one parking space).
- In the UW E-11 and E-12 lots south of Husky Stadium, construction would cause temporary loss of 54 spaces under Option A, up to 549 spaces under Option K, and 211 spaces under Option L.

KEY POINT

Parking

All options would use the MOHAI parking lot for construction staging and would remove the five on-street parking spaces on 24th Avenue East. Museum operations would not be affected because operations would be moved prior to the start of construction. All options would remove parking spaces in the UW E-11 and E-12 lots.

Effects of Suboptions

- Adding the suboptions to Option A, K, or L would result in no additional parking effects.

Table 6.1-5. Parking Effects During Construction

Location	Existing Capacity	Spaces Closed During Construction		
		Option A	Option K	Option L
Bagley Viewpoint[a]	10	10	10	10
MOHAI[a]	150	150	150	150
Husky Stadium[b]				
Lot E-11	429	54	--	204
Lot E-12	746	--	549	7
Total	1,335	194	709	371

[a]Spaces at these locations would be closed permanently and would not be replaced, as the facilities they serve would be relocated.

[b]Existing capacity shown for Lots E-11 and E-12 is after reconfiguration required for Sound Transit's University Link construction.

Note: Adding the potential suboptions to Option A, K, or L would not change the parking effects listed in this table.

How can the project minimize negative effects on transportation during construction?

As with any large construction project, traffic congestion is expected in the project area as a result of construction activities. The project construction plans will include staging techniques and temporary improvements, described earlier, to mitigate the potential construction effects on traffic. These plans include specific restrictions on construction methods, prescribed work times for construction to avoid peak travel periods, and temporary roadway improvements.

These methods will optimize the timing of construction activities and alleviate capacity constraints through the construction area. In addition to these physical methods, the strategies described below may be used to manage the flow of traffic and minimize the traffic demand during construction.

Traffic Management Plan

The contractor selected to construct the project will be required to prepare a traffic management plan (TMP) to be approved by WSDOT, in coordination with the City of Seattle, to ensure that construction effects on local streets, property owners, and businesses are minimized. The TMP will include, as a minimum, the following measures:

- Details on required street and lane closures (duration and timing)
- Proposed detours and signing plans (for vehicles, pedestrians, freight, and bicycles)
- Measures to minimize effects on transit operations and access to/from transit facilities (in coordination with transit service providers)
- Traffic enforcement measures, including deployment of police officers
- Coordination with emergency service providers
- Measures to minimize traffic and parking effects from construction employees
- Measures to minimize effects of truck traffic for equipment and material delivery
- Measures to minimize disruption of access to businesses and properties
- Measures to minimize conflicts between construction activities and traffic during events (this may or may not include stopping construction activities during certain hours)
- Public outreach communication plan

Work Zone Management Techniques

Other mitigation options include developing and implementing work zone management strategies. These strategies may include using intelligent

transportation systems, traveler information, real-time work zone monitoring, traffic incident management, and enforcement techniques. More details on strategies feasible for this project are described below.

Traveler Information Systems

Traveler information systems are designed to inform the general public of construction activities and transportation system operating conditions. They allow drivers to avoid traffic problems, save time, and reduce frustration. Examples include, but are not limited to, dynamic and variable message signs, highway advisory radio, e-mail alerts, and project Web sites that provide real-time information on traffic conditions around construction and outlying areas. The traveler information system already in place will be used for this project, which includes all the above-mentioned examples except for a project-specific Web site with real-time information.

Incident Management Systems

WSDOT's current incident response program will continue to be used for this project. Incident management systems are planned and coordinated strategies to detect, respond to, and remove traffic incidents to restore traffic capacity as safely and quickly as possible. The process of restoring traffic capacity involves a number of public and private sector partners, which can include law enforcement, fire and rescue, emergency medical services, transportation, public safety communications, emergency management, towing and recovery services, hazardous materials contractors, and traffic information media. Incident management systems can help reduce effects during construction in the following areas:

- Incident clearance time: reduction of 38–66 percent
- Emergency vehicle response time: reduction of 20–30 percent
- Primary crashes: reduction of 35–40 percent
- Secondary crashes: reduction of 30–50 percent

Active Traffic Management

Active traffic management technology dynamically controls traffic based on the prevailing conditions. Using integrated systems and a coordinated response, both recurrent and non-recurrent congestion can be managed to improve roadway safety and traffic flows. Potential tools used as part of an active traffic management system include:

- **Overhead sign bridges** - to display variable speed limit and real-time traffic information over each lane.
- **Variable speed limit** - to dynamically and automatically reduce speed limits approaching areas of congestion, collisions, or special events.
- **Queue warning** - to warn commuters of downstream queues (or backups) and direct through-traffic to alternate lanes.

- **Junction control** - to use variable traffic signs, dynamic pavement markings, and lane use control to direct traffic to specific lanes (main line or ramp) based on varying traffic demand.
- **Hard shoulder running** - to use the shoulder as a travel lane during congested periods or to allow traffic to move around an incident.
- **Dynamic rerouting** - to change destination signs to account for current traffic conditions.
- **Travel time signs** - to display estimated travel time and other condition reports as well as communicate travel and traffic conditions. WSDOT currently uses variable message signs to post travel time information.

Construction Worker Shuttle Service

This service shuttles workers from outlying temporary or permanent parking facilities into the work zones, thereby reducing the number of vehicles arriving at and leaving the work zone areas and the parking demand in the work zones.

Special Events

Several strategies can be used to help mitigate construction activities during special events, including graduation, City functions, and sporting events at the University of Washington:

- Tailor special event traffic management plans to consider project construction congestion, including transit priority and special event shuttle services.
- Increase shuttle services so access is provided both to and from events.
- Provide discounts for transit shuttle (e.g., discount tickets by the cost of transit shuttle).
- Implement additional event date/time-specific parking restrictions, (e.g., further up and down Montlake Boulevard and other key corridors).
- Add police officer traffic control as needed.
- Provide a Web site and other outreach regarding construction and travel options to special events that is accessible and understandable.
- Request that the City revise routes for parades and other annual events.

Transportation Demand Management

Transportation demand management (TDM) includes a variety of strategies that provide alternatives to driving in single-occupant vehicles, particularly during peak traffic periods. TDM programs include financial incentives, outreach to increase public awareness about travel options, and services that help people choose a new travel option. They even provide new travel options such as vanpools to encourage a shift away from travel in single-

occupant vehicles. Transportation demand management is implemented in a regional context through a variety of ongoing state and local jurisdiction TDM programs.

Purpose of TDM During Construction

The SR 520 project will be built over a period of up to 7 years, and as with any major project, construction activities will affect the normal travel patterns of road users within the project vicinity. TDM may be used, in addition to other mitigation techniques, to minimize these affects by reducing the traffic demand through the project area.

TDM and Transit

The goal of TDM is to increase the efficiency of travel on roadways by moving more people in fewer vehicles. Transit is typically a primary consideration for any comprehensive TDM program because it is a reliable mode of moving many people in few vehicles. This is particularly true in urban areas with well-established transit systems in place. The people-moving capacity of transit is necessary for many TDM strategies to be successful. When additional transit capacity is needed during construction, enhanced service may be included as a TDM program element. Since congestion often increases near construction sites, the project should evaluate and incorporate measures such as transit priority that would help maintain the reliability of transit as an alternative to driving.

Implementing TDM During Construction

The WSDOT Public Transportation Division will develop a strategy focused on maintaining traffic during construction. This strategy is expected to include a set of temporary TDM and transit enhancements that will provide additional travel options to the public during construction.

Many jurisdictions where SR 520 users live and work have existing TDM programs. Bellevue, Kirkland, Redmond, and Seattle each have established programs that provide travel options to commuters. King County also provides these services through its own efforts in addition to operating a popular vanpool program. WSDOT supports local jurisdictions through its investment in a variety of strategies and through the Commute Trip Reduction (CTR) program.

One of the principal elements of the project's TDM strategy will be to support existing programs rather than implement an entirely new program during the construction period. Therefore, a major aspect of the strategy will involve communication and cooperation with local experts who are already implementing successful programs. The project is working closely with WSDOT demand management specialists to establish a plan for coordination with jurisdictions affected by SR 520. The coordination plan will be designed to enhance the effectiveness of the project's TDM efforts by offering services to travelers through programs they already use. This

approach will encourage continuity in the services provided to users and minimize the level of planning and development required to implement a project strategy. When construction is complete, it will allow a streamlined transition of project-related TDM services back to the ongoing programs managed by the local jurisdictions.

Conditions often change during the construction of complex projects, and it will be necessary to communicate changes quickly and effectively to those affected. The TDM strategy will include a feedback process to monitor its effectiveness. The feedback will be used to identify improvement opportunities and under-performing elements so that adjustments can be made to ensure that the project meets its goals.

The TDM strategy and goals for the project will be developed during the final planning phase of the project. WSDOT will develop demand management goals based on the estimated construction effects on traffic for the project. The goals will be designed to complement the other construction traffic management techniques that will be implemented. WSDOT will evaluate areas of greatest need and benefit to maximize traveler options in those areas.

6.2 Land Use and Economic Activity

This section covers effects on existing land uses along the SR 520 corridor as well as potential effects on the regional and local economy that would occur during the multi-year construction period. Construction durations and sequencing of activities are described in Chapter 3 by geographic area between I-5 and Medina. The 6-Lane Alternative would relocate or remove existing land uses during construction. Because these effects would be permanent or occur over a multi-year construction period, they are described under Project Operation and Permanent Effects in Section 5.2.

KEY POINT

Land Use

Construction would occur within existing WSDOT right-of-way, adjacent to SR 520, to the extent possible. However, in some places within the project area, land now used for other purposes would be used for construction purposes.

Options K and L would relocate the UW's WAC throughout the construction duration.

The loss of parking near Husky Stadium with Options K and L could inconvenience event attendees and campus visitors.

How would construction affect land use?

All options would increase noise, dust, and truck traffic during construction. These types of construction effects are described in detail in Section 6.1, Transportation; Section 6.3, Social Elements; Section 6.4, Recreation; Section 6.7, Noise; and Section 6.8, Air Quality.

WSDOT would secure construction easements for staging areas for equipment and construction zones along the SR 520 corridor; the timing and duration of these easements would vary depending on the construction sequence of project elements.

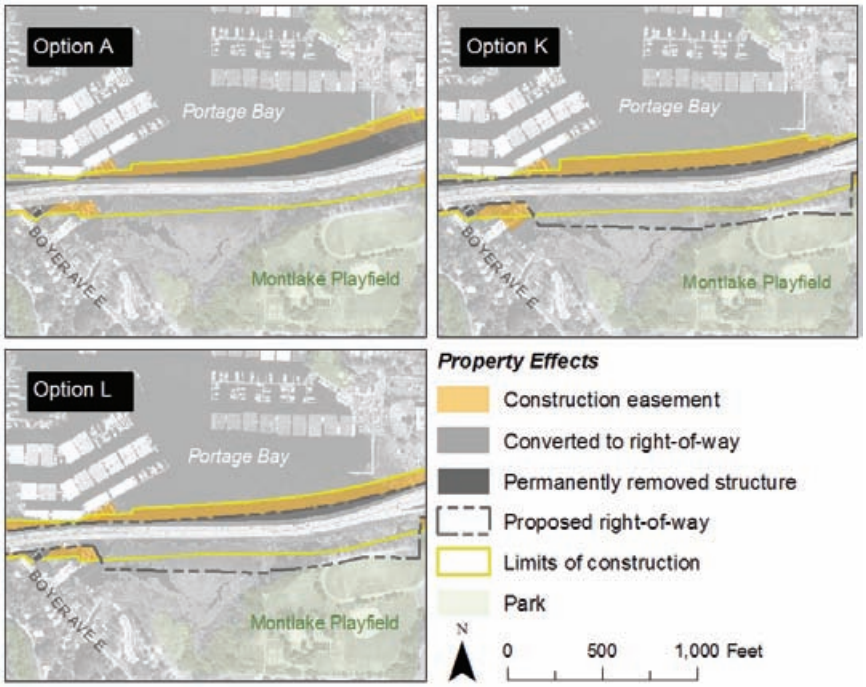
During construction, neighboring properties in the Eastlake, North Capitol Hill, Portage Bay/Roanoke, Montlake, and Madison Park neighborhoods, as well as the Washington Park Arboretum, would experience increased noise, dust, traffic congestion, and possibly glare from nighttime construction lighting. The Laurelhurst neighborhood would also likely

experience some construction noise, but to a much lesser extent than neighborhoods adjacent to SR 520. Construction activities would occur adjacent to Seattle Fire Station 22 on East Roanoke Street (Exhibit 6.2-1). However, during construction, the station would be fully operational, access would be maintained, and emergency response would not be affected. See Section 6.3, Social Elements, for a detailed description of potential effects on area neighborhoods.

Construction would occur within existing WSDOT right-of-way, adjacent to SR 520, to the extent possible. However, in some places within the project area, land now used for other purposes would be used for construction purposes. Exhibits 6.2-1 through 6.2-4 show the areas where construction would occur and the affected properties.

Exhibit 6.2-1. **Property Affected by Construction in the I-5 Area**

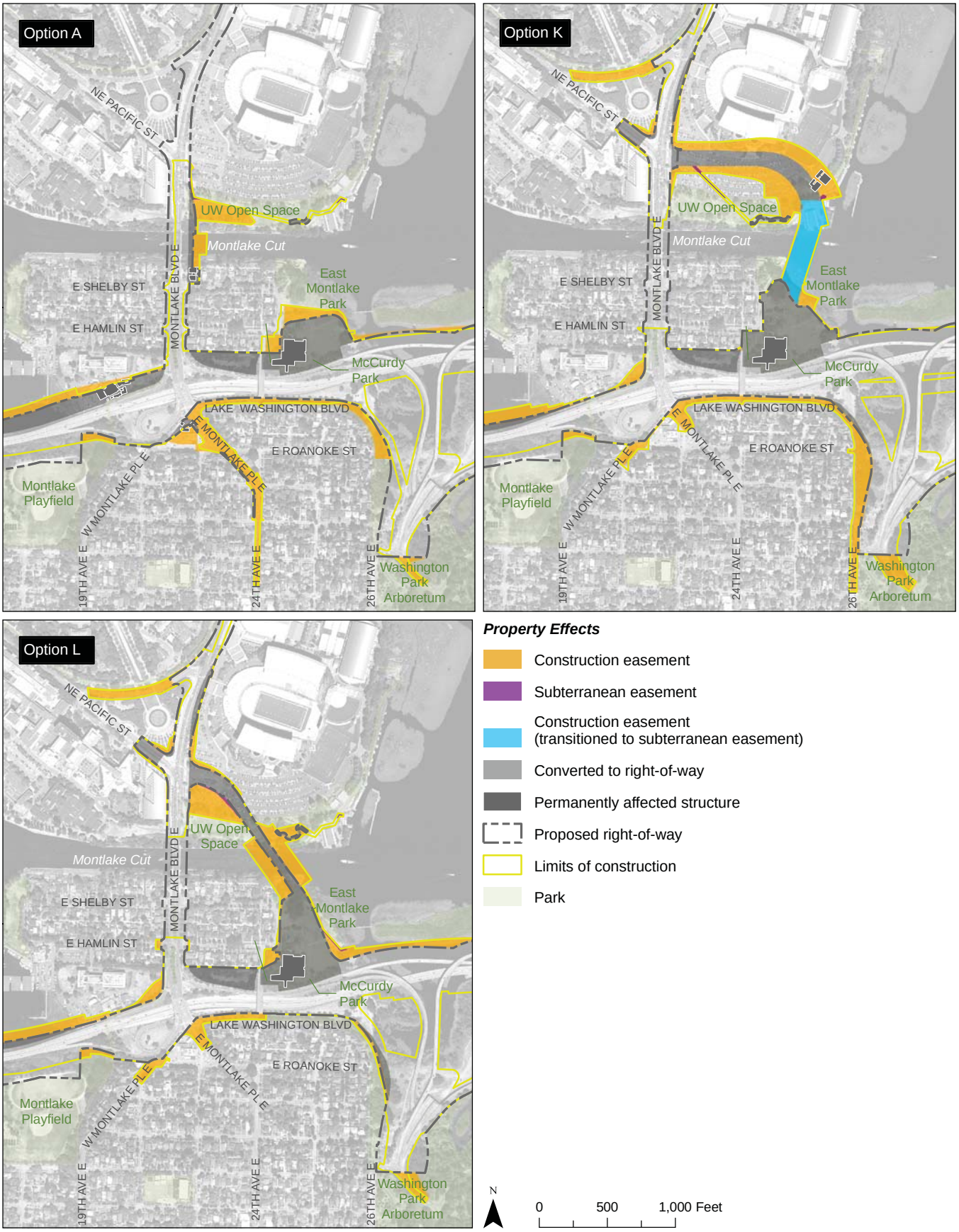
Exhibit 6.2-2. **Property Affected by Construction in the Portage Bay Area**



Boat slips on the south side of the Queen City Yacht Club and at the Bayshore Condominiums would be removed (see Section 5.2 in Chapter 5) to accommodate construction work bridges north and south of the Portage Bay Bridge over its estimated 6-year construction period. These moorages would be replaced in their original locations after construction is completed.

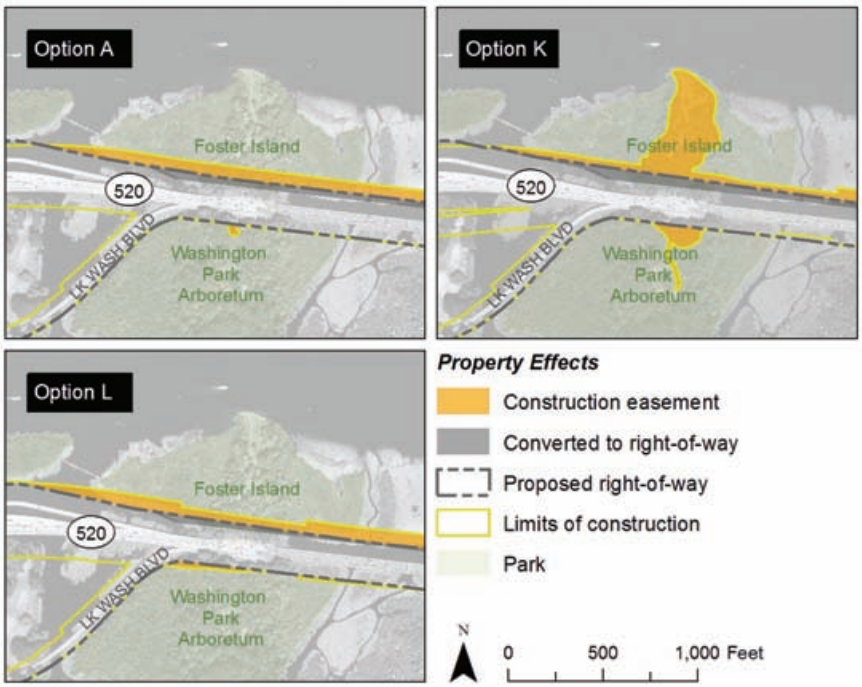
The University of Washington's Waterfront Activities Center is located southeast of Husky Stadium on Union Bay and the Montlake Cut. The Washington Yacht Club, Sailing Team, Kayak Club and Union Bay Rowing Club organize their activities at the WAC. The WAC also offers canoe and rowboat rentals, storage for private non-motorized boats, and waterfront

Exhibit 6.2-3. **Property Affected by Construction in the Montlake Area**



activities for students, staff, and alumni association members. Options K and L would relocate the functions of this facility during the multi-year construction period.

Exhibit 6.2-4. **Property Affected by Construction in the West Approach Area**



Construction activities under Options A, K, and L in the Montlake area could deter some patrons from attending sporting events, exhibitions, and other events held at the University of Washington. The loss of parking near Husky Stadium with Options K and L would affect event attendees and campus visitors.

The Montlake interchange is a primary travel route to the University of Washington and associated businesses to the north, and to Capitol Hill and a small commercial area along NE 24th Street south of the interchange. The economic effects of construction would be similar under all 6-Lane Alternative options. Although a few customers would likely be deterred from visiting these areas because of construction at the interchange, most of these businesses serve local customers who would travel to them on local streets. Any economic effects on businesses in this area during construction would be small. WSDOT would minimize traffic delays by phasing and scheduling construction activities outside of high traffic demand periods as much as possible. In addition, access to businesses and residences throughout the study area would continue during the construction period. If roadways and direct business access were closed, detours would maintain

access. If practical, short-term roadway closures would occur at night or during low-traffic-volume periods during the day.

Effects of Suboptions

- Adding the suboptions to Option A, K, or L would result in no additional effects because construction would occur within the areas proposed for permanent right-of-way use.

How would construction affect economic activity?

Generally, the economic effects of construction would be similar for all 6-Lane Alternative options. Differences among the options are described below. On balance, the positive effects of construction-related jobs, spending (for example, project spending and spending by construction workers), and resulting sales tax revenues would be more widely dispersed through the local and regional economies than the location-specific negative effects of increased traffic congestion and noise. For this reason, construction of the 6-Lane Alternative is expected to have a net beneficial economic effect.

KEY POINT

Economic Activity

The positive effects of construction-related jobs, spending (e.g., project spending and spending by construction workers), and resulting sales tax revenues would be widely dispersed through the local and regional economies.

Option A

Construction of Option A would take approximately 6 years and would result in approximately 7,700 full-time jobs in the peak year (2015). Of the total full-time jobs, 3,300 would be direct jobs and 4,400 would be indirect and induced jobs.

DEFINITION

Direct jobs are those created directly from project construction (e.g., construction worker).

Indirect and induced jobs are those created through the purchase of commodities and services that support project construction (e.g., concrete suppliers).

Construction activities would change access for some nearby businesses and residents, specifically those located along East Roanoke Street, Delmar Drive East, Montlake Boulevard East, 24th Avenue East, and Lake Washington Boulevard East. Under Option A, construction of the new Montlake Interchange and lid would take approximately 45 months (over 3.5 years). Unlike Options K and L, Option A would not require closure of NE Pacific Street.

Option A would have the smallest effect on parking in University of Washington lots E-11 and E-12. Approximately 54 stalls would be acquired for construction staging, which would represent approximately 5 percent of total stalls in these two parking lots. According to Commuter Services at the University of Washington, more than 11,400 parking stalls were available for campus parking in 2007, and the average parking utilization was 71 percent (University of Washington 2008). Parking fees generated nearly $4.2 million in revenue for Commuter Services. The number of stalls that would be used for construction staging would represent less than 1 percent of the total campus parking spaces available.

Option K

Construction of Option K would take approximately 7 years and would result in approximately 12,600 full-time jobs in the peak year (2014). Of the

total full-time jobs, 5,400 would be direct jobs and 7,200 would be indirect and induced jobs.

Construction activities would change access for some nearby businesses and residents, specifically those located along East Roanoke Street, Delmar Drive East, Montlake Boulevard East, Lake Washington Boulevard East, and NE Pacific Street. Under Option K, construction of the SPUI, the tunnel under the Montlake Cut, and the NE Pacific Street lid would occur over approximately 78 months (6.5 years). Under this option, a partial closure of NE Pacific Street would be required for up to 12 months and would detour traffic to NE Pacific Place at the NE Pacific Street interchange, which would reroute access to the University of Washington Medical Center.

Option K would require the use of approximately 549 parking stalls for construction staging at University of Washington lots E-11 and E-12. This would represent approximately 47 percent of the total stalls in these two parking lots. Of the three options, Option K would inconvenience the largest number of visitors and employees to that part of the campus. However, the number of stalls that would be used for construction staging would represent less than 5 percent of the total campus parking spaces available. According to the Draft Westside Construction Traffic Technical Memorandum (WSDOT 2009c), the parking spaces affected under Option K would be taken in phases and not all at once. While parking in other parts of the campus might help mitigate the loss of some of the parking in lots E-11 and E-12 during construction, the available lots might not be convenient for those working at the University of Washington Medical Center.

Option L

Construction of Option L would take approximately 6 years and would result in approximately 9,500 full-time jobs in the peak year (2014). Of the total full-time jobs, 4,000 would be direct jobs and 5,500 would be indirect and induced jobs.

Construction activities would change access for some nearby businesses and residents, specifically those located along East Roanoke Street, Delmar Drive East, Montlake Boulevard East, Lake Washington Boulevard East, and NE Pacific Street. Under Option L, construction of the SPUI and the NE Pacific Street lid would occur over approximately 60 months (5 years). Similar to Option K, Option L would require a partial closure of NE Pacific Street for up to 12 months and would detour traffic to NE Pacific Place at the NE Pacific Street interchange, which would reroute access to the University of Washington Medical Center.

Option L would require the use of approximately 211 parking stalls for construction staging at University of Washington lots E-11 and E-12. This

would represent approximately 18 percent of total stalls in these two parking lots, and less than 2 percent of the total campus parking spaces available. Similar to Option K, the parking spaces affected under Option L would be taken in phases. While parking in available spaces in other parts of the campus might help mitigate the loss of some of the parking in lots E-11 and E-12 during construction, the available lots might not be convenient for those working at the University of Washington Medical Center.

Effects of Suboptions

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

How would construction affect employment?

During construction, transportation projects usually increase employment and spending near the project. The extent of these effects would largely depend on two factors: (1) the source of project funding and (2) the makeup of the construction crews (for example, number of workers and whether they were local or from areas beyond the affected communities).

How much a highway project affects a region economically depends on the source of project funding. Funds from local (City of Seattle) or regional (Puget Sound) sources are transfers that could have been spent by residents and businesses on other economic activities. Typically, only "new money" (state or federal funds) to a region has a measurable economic effect on employment and income gains resulting from project construction. For the 6-Lane Alternative, state and federal funds would be used, resulting in some income and job benefits that would otherwise not occur.

During construction, spending would increase demand for construction materials and jobs. These expenditures could increase the output (for example, of sand) of firms in other industries, which would supply the demand for inputs (for example, concrete) to the construction industry. Finally, wages paid to workers in construction trades or supporting industries would be spent on other goods and services in their local communities and the region. Workers generally spend their incomes on goods and services in the communities in which they live. This localized spending would generate local and state sales and use taxes over the entire construction period.

Some local firms and workers from the Seattle/Eastside areas might be directly involved in the construction of the facility. Other local firms and their employees would supply construction materials such as cement, asphalt, wood, steel, gravel, and electrical equipment. Firms within the four-county Puget Sound region would likely provide most of the workers and supplies. Ultimately, it would be up to the selected contractor to secure vendors and subcontractors and to assemble the workforce.

Table 6.2-1 summarizes the employment estimates during construction for each option. Using the Washington State Office of Financial Management's job-estimating methodology for construction projects, it is estimated that the project would result in approximately 7,700 to 12,600 direct, indirect, and induced jobs during the peak year of construction (Washington State Office of Financial Management 2009).

Table 6.2-1. Full-time Jobs[a]

	Option A	Option K	Option L
Construction period	6 years	7 years	6 years
Peak year	2015	2014	2014
Cost in 2014 dollars (billions)[a]	$2.9	$5.0	$3.5
Number of jobs in peak year[b]	7,683	12,620	9,526

[a]Includes preliminary engineering, right-of-way, and construction costs.
[b]Includes direct, indirect, and induced employment.

Effects of Suboptions

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

How could the project minimize negative effects during construction?

As described in this section, construction effects on existing land uses and businesses adjacent to the SR 520 corridor would primarily relate to increases in noise, dust, and truck traffic during construction. Measures that would minimize these effects are described in detail in Section 6.1, Transportation; Section 6.3, Social Elements; Section 6.4, Recreation; Section 6.7, Noise; and Section 6.8, Air Quality. No negative effects on the regional economy would occur.

WSDOT would coordinate with business owners to reconfigure or provide alternative access for customers during construction. Signage would be used that clearly marks detour routes and indicates that businesses are open.

Land use effects on the University of Washington during construction would result in a reduction in parking and associated revenues at the Husky Stadium. WSDOT would coordinate with the University of Washington on appropriate mitigation for these effects.

WSDOT would coordinate with property owners to identify relocation or other mitigation options for relocation of the Waterfront Activities Center (Option K) and boat moorages that would be affected over the multi-year construction period (see Chapter 5, Section 5.2).

6.3 Social Elements

This section discusses potential construction effects on residents and neighborhoods adjacent to the SR 520 corridor, including construction effects on neighborhood streets, transit service, bicycle and pedestrian linkages, visual quality, and community cohesion. Potential effects on low-income and minority populations and on public service providers and utilities are also discussed. Effects from construction-related noise on neighborhoods are discussed in Section 6.7, Noise.

How would construction of the project affect neighborhoods?

Project construction could affect the interaction of residents within and between neighborhoods along the corridor and temporarily reduce community cohesion during periods of heavy construction activity. Although construction would be sequenced along the corridor, related activities would be noticeable in adjacent neighborhoods for periods lasting from several months to several years.

Project area neighborhoods adjacent to construction could experience negative effects from detour routes, haul truck traffic, and relocated bus stops on neighborhood streets. Construction effects on communities would also include increases in noise, dust, and visual clutter in residential, business, and park areas adjacent to construction zones. These effects could reduce residents' quality of life and limit connections to community resources, patronage at neighborhood businesses, or use of recreational amenities. Partial closures of sidewalks, bicycle paths/routes, trails, and park areas could also discourage neighborhood activity and use of community resources.

Exhibit 6.3-1 shows the locations of neighborhoods and community resources relative to areas where construction would occur.

KEY POINT

Neighborhoods

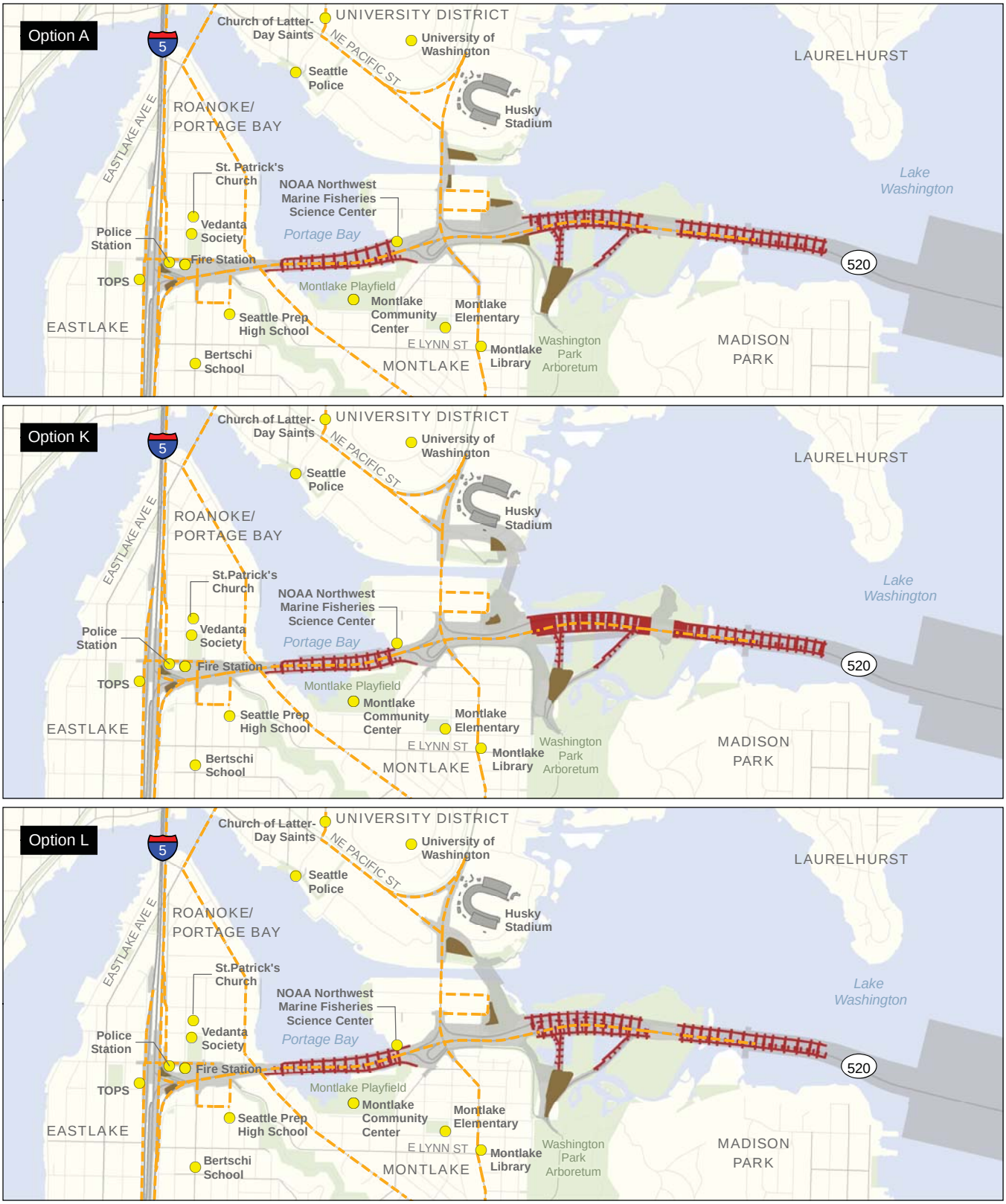
All options would affect adjacent neighborhoods during construction. These neighborhoods could experience negative effects from detour routes, haul truck traffic, and relocated bus stops. Construction would also increase noise, dust, and visual clutter in residential, business, and park areas adjacent to construction zones. These effects could reduce residents' quality of life and limit connections to community resources, patronage at neighborhood businesses, or use of recreational amenities.

Effects on Neighborhood Streets

Project area neighborhoods may absorb some of the diverted traffic volumes from the roadway and ramp closures described in Section 6.1. "Cut-through" routes along residential streets could increase as drivers try to avoid congested detour routes. As a result of more traffic on local roads, travel times to neighborhood schools, community centers, neighborhood businesses, and the University of Washington could increase during construction.

As described in Chapter 3 and Section 6.1, Transportation, haul routes and detour routes would follow arterials and/or designated truck routes wherever possible. WSDOT has attempted to minimize truck trips on the non-arterial neighborhood streets; however, portions of neighborhood

Exhibit 6.3-1 Community Resources Relative to Construction Staging Areas



Note: Contractor would stage within the limits of construction area.

residential streets in Montlake and North Capitol Hill may need to be used for truck haul routes due to the location of proposed construction activities and the lack of available arterial routes immediately adjacent to construction sites.

On-street bicycle routes on local streets subject to roadway closures would be re-routed. Bicycle routes along Montlake Boulevard and NE Pacific Place connecting to the Burke-Gilman Trail would be rerouted through or around the construction zone.

KEY POINT

Partial closures of sidewalks, bicycle paths/ routes, trails, and park areas could discourage neighborhood activity and use of community resources.

Transit Service

Road closures, detours, and station closures during construction may result in effects on transit riders. Transit riders would also experience noise, dust, and visual effects at any of the transit stops in proximity to construction activities. Section 6.1 includes additional information on construction effects on related transit service.

Pedestrian and Bicycle Linkages

All of the project area neighborhoods feature parks, trails, and community centers, many of which are linked by pedestrian and bicycle paths. Construction under all options would require periodic closures of the Ship Canal Waterside Trail, portions of the Arboretum Waterfront Trail, the Bill Dawson Trail, and the East Campus bicycle route for varying durations. See Section 6.1, Transportation, for a detailed description of temporary closures.

Visual Quality

Construction of all design options of the 6-Lane Alternative would be very noticeable from many locations in project area neighborhoods. The most visible construction features would be work bridges, barges, and cranes on Lake Washington, detour bridges, and the presence of construction equipment in work zones adjacent to the highway.

Bridge construction from barges

Construction work bridges would be trestle-like structures erected on both sides of the Portage Bay Bridge, at the west approach to the Evergreen Point Bridge through the Washington Park Arboretum, and at the east approach of the Evergreen Point Bridge. Both near and distant views of the corridor and Lake Washington would change over the duration of construction. Also visible would be the results of ongoing construction and mitigation activities, such as exposed cut areas, stockpiled soil, silt fences and mulched areas, and temporary sedimentation ponds. See Section 6.5 for more detail on visual quality effects.

Community Cohesion

Eastlake

Construction at the I-5/SR 520 interchange and of the I-5/Roanoke lid at East Roanoke Street would affect the Eastlake neighborhood near the interchange, east of Eastlake Avenue East. Construction activities for these elements are common to Options A, K, and L and would occur over a 21-month period.

The proposed haul route for material transport is along East Roanoke Street and Boylston Avenue East to access I-5. As part of construction in this area, Boylston Avenue would be narrowed temporarily and shifted to the west. Trucks would use Boylston Avenue East adjacent to the TOPS school. The school and Rogers Playground (located a block west of the interchange) could also experience increased noise and dust. Rogers Playground is located over 500 feet from where lid construction would occur. Noise and dust effects on the park are expected to be minor.

North Capitol Hill

- Construction of the 10th Avenue East/Delmar Drive East lid would affect North Capitol Hill residences adjacent to SR 520 and along proposed haul routes. Seattle Preparatory School, a private high school, is located on 11th Avenue East and could also experience increased traffic volumes from haul truck trips.
- Construction activities would require the Delmar Drive bridge to be closed for approximately 9 months. A temporary bridge at 10th Avenue East would cross SR 520 and include sidewalks for safe pedestrian and bicyclist movements. All construction activities in this area are common to Options A, K, and L and would occur over a 27-month period.

Portage Bay/Roanoke

Construction of the 10th Avenue East /Delmar Drive East lid and the Portage Bay Bridge would affect the Portage Bay/Roanoke neighborhood near the I-5/SR 520 interchange for up to 27 months and residences along the east shore of Portage Bay for up to 42 months. These elements are common to Options A, K, and L.

Roanoke Park and the surrounding neighborhoods would experience construction noise and dust, especially in the southern part of the neighborhood near Roanoke Street. The haul routes along 10th Avenue East and Roanoke Street would increase truck traffic along the borders of the neighborhood, although these are both arterial streets with high volumes of existing traffic. These effects would be temporary and would occur during construction.

Two religious institutions, Saint Patrick's Catholic Church and Vedanta Society of Western Washington, are located north of Roanoke Park, but are not on haul routes. Construction-related traffic may result in more

circuitous travel routes for those who typically access these institutions from SR 520 or across Delmar Drive East.

Fuhrman Avenue East and Boyer Avenue East are also proposed as a potential haul route for material transport to and from the Portage Bay Bridge.

Montlake

Construction in the Montlake area would affect residents and community resources in the Montlake neighborhood between the Montlake Cut on the north and the area bounded by the Arboretum and Interlaken Park on the south, east, and west. Construction activities would occur over a 5-year period under Option A, a 6 1/2-year period under Option K, and a 5-year period under Option L.

Several haul routes proposed in the Montlake area are associated with lid construction and interchange improvements under all options (see Exhibit 6.3-1). During peak construction periods, Options K and L may use a loop through the Shelby/Hamlin portion of the Montlake neighborhood to transport materials for construction of the SPUI and construction of the tunnel under Option K. This haul route would be used intermittently; the majority of truck trips would access SR 520 from an access ramp onto the Montlake westbound off-ramp. Options K and L would have the greatest potential effects on the Shelby-Hamlin portion of the Montlake neighborhood because of their higher truck trips and the greater intensity and duration of construction activity in the MOHAI area.

KEY POINT

Montlake Area

All options would have similar effects except in the Montlake and UW south campus areas, where the scale and intensity of construction would differ. The scale and intensity of construction-related effects within these areas would be greatest with Option K. Construction would cause longer and more intense effects due to noise, dust, vibration, construction traffic, and visual changes with construction of the tunnel (Option K) or new bascule bridge and ramps (Option L).

University District

Although there are no residences in the University District close to proposed construction activities, temporary effects on community cohesion could still result from construction activity and access disruptions near University of Washington facilities along Montlake Boulevard East. Construction truck trips through the University District would use Montlake Boulevard, NE Pacific Street, and 15th Avenue NE.

KEY POINT

UW Medical Center

Under Options K and L, closure of NE Pacific Street could affect response times and emergency access to UW Medical Center.

Construction activities would affect access to the University of Washington's south campus and athletic facilities. Students, employees, and visitors who use Montlake Boulevard East and NE Pacific Street to access the campus would experience additional congestion and longer travel times. Under Options K and L, construction of the tunnel or new bascule bridge across the Montlake Cut and lowering the NE Pacific Street/NE Montlake Boulevard intersection would create longer and more intense construction effects of noise, dust, vibration, construction traffic, and visual changes on the University of Washington campus than Option A.

Madison Park

Residents of Madison Park would experience construction noise from construction of the work bridges and permanent bridges in the west

approach area (see Section 6.7). The closure of the Lake Washington Boulevard ramps would require a change in travel patterns for residents in Madison Park who use Lake Washington Boulevard through the Arboretum.

Construction in the Lake Washington portion of the project area, including replacement of the Evergreen Point Bridge, would employ barges, work bridges, and cranes. These would result in reduced visual quality for the Madison Park neighborhood over a period of several years.

Laurelhurst

The Laurelhurst neighborhood would experience no construction effects on recreation facilities, community services, or pedestrian, bicycle, and transit facilities. Because Laurelhurst is more than 2,000 feet away from in-water construction activities such as pile-driving, no audible increase in noise levels is anticipated. Construction activities and equipment would be visible from residences overlooking Lake Washington and its shoreline areas for several years.

Medina

As described in the transportation section, the freeway transit station at Evergreen Point Road would be closed for 4 to 6 months during construction of the east approach. Transit agencies are considering the possibility of providing shuttle service between the Evergreen Point Freeway Transit Station and the transit stop at 92nd Avenue NE. Views of Lake Washington from residences along the Medina shoreline would also be affected by replacement of the Evergreen Point Bridge. Haul routes for construction of the east approach would travel westbound on SR 520 to I-5 southbound and northbound or eastbound SR 520 to I-405 southbound or northbound. Construction near Fairweather Park would consist of minor grading and restriping of SR 520.

Effects of Suboptions

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

How would project construction affect low-income, minority, and LEP populations?

Neighborhoods

Construction would affect low-income, minority, and LEP residents of neighborhoods in the project study area in the same way that it would affect other residents. As discussed in Chapter 5, demographic analysis shows that neighborhoods in the project study area have relatively low proportions of low-income, minority, or LEP populations compared to adjacent, unaffected neighborhoods. Construction-related effects on neighborhoods

would not fall disproportionately on low-income, minority, or LEP populations.

The majority of construction effects associated with Options A, K, and L would occur within the Montlake neighborhood. This neighborhood has relatively low percentages of low-income, minority, and LEP residents (3 percent low-income, 13 percent minority, and less than 1 percent LEP). The University District has the highest concentrations of minority populations (44 percent minority and just over 3 percent LEP). The University District would experience construction effects near the south end of the neighborhood in the vicinity of the Montlake Bridge under Option A and Husky Stadium under Options K and L. However, because no residences are near where construction activities would occur, no negative effects are expected.

Tribal Fishing

Construction of the 6-Lane Alternative would take place within the open waters of Lake Washington and Portage Bay and the shoreline areas of Union Bay, which are within the usual and accustomed fishing area of the Muckleshoot Indian Tribe (see Section 4.3).

During demolition of the Evergreen Point Bridge and installation of the transition spans, periodic closures of several days would be required at the west and east navigation channels. These closures could prevent or limit access to usual and accustomed tribal fishing areas. Construction from barges would also have the potential to conflict with tribal fishing in Portage Bay, Union Bay, and Lake Washington. Construction would occur over a 4- to 6-year period.

Under Options A, K, and L, fish populations could be affected by in-water construction activities such as pile-driving (see Section 6.11, Ecosystems). Use of best management practices during construction would minimize the potential for effects such as accidental spills of hazardous materials or pollutants in the water, or falling debris associated with bridge demolition or construction, which could kill or injure fish. The construction bridges and the new west approach bridge structures would increase shading, which could reduce aquatic vegetation in the area during construction. Fish that directly or indirectly rely on this vegetation could be adversely affected. Section 6.11, Ecosystems, includes more information on potential construction effects on fish and aquatic habitat.

Option K, which includes construction of twin tunnels under the Montlake Cut, would include substantially more in-water and overwater work than Options A and L, which would result in a comparatively higher risk for affecting fish. Construction of the SPUI approach section east of the Montlake shorelines would fill 2.7 acres of open-water area, which has the potential to adversely affect fish and aquatic resources in the Union Bay

KEY POINT

Tribal Fishing

All options would adversely affect the usual and accustomed fishing areas of the Muckleshoot Tribe during project construction. Overwater and in-water construction could affect tribal fishing opportunities and fish populations, although the risk of harming fish is low for Options A and L compared to Option K.

area. Option K would also require more ground-disturbing work along the Washington Park Arboretum and Lake Washington shoreline, which increases potential hazards for water quality and runoff contamination that could adversely affect fish populations.

Because project construction and operation would adversely affect the usual and accustomed fishing areas of the Muckleshoot Tribe, a minority population would experience appreciably more severe effects than the general population. For these reasons, Native American tribes are expected to experience disproportionately high and adverse effects as a result of construction effects on fishing. Mitigation measures would be implemented to reduce the likelihood of conflict with tribal fishing (see Mitigation section below).

Foster Island

All options would affect the Foster Island presumed TCP through construction activities and by requiring additional land for construction easements beyond the permanent right-of-way expansions discussed in Chapter 5. For all options, the majority of the construction easement would be on the north side of the existing right-of-way. As stated previously, the portion of Foster Island south of the existing SR 520 alignment, which includes the historic south island, has greater cultural significance than the northern portion. The only construction easement on the south part of the island would be immediately adjacent to the existing bridge.

KEY POINT

Foster Island

Option K would have the greatest effect on the presumed Foster Island TCP and the highest potential to encounter cultural resources due to the larger amount of excavation in this area.

Options A and L would require clearing and grading on Foster Island, as well as small amounts of excavation (0.02 to 0.03 acre) for placement of bridge columns. Option K would require 2.8 acres of excavation on Foster Island for pilings and to accommodate the land bridge. Therefore, the potential for encountering cultural resources would be greater for Option K than for A and L due to the higher degree of ground disturbance.

If project construction were to encounter important cultural resources of significance to Native American tribes on Foster Island, a minority population could predominantly bear construction effects. If this were to occur, Native American tribes are expected to experience disproportionately high and adverse effects. As such, WSDOT would need to consult with the tribes and DAHP to identify appropriate mitigation measures.

Effects of Suboptions

- Adding the Lake Washington Boulevard ramps to Option A would increase the number of construction support piles by 55 and the amount of lake bed disturbed by 170 square feet; however, the overall effects on tribal fishing would not differ.

- Adding an eastbound HOV direct-access ramp or changing the profile of Option A to a constant slope in the west approach would not change the construction effects described above.
- Adding the eastbound off-ramp to Montlake Boulevard to Option K would result in no differences in the effects described above. Although adding the ramp would include the installation of three additional in-water piles near the southeast shoreline of Portage Bay, the overall effects as described above would not differ.
- Adding the potential suboptions to Option L would result in no difference in the effects described above because the suboptions are located in upland areas.

How would construction of the project affect public services and utilities?

Construction activities along Roanoke Street would occur adjacent to Seattle Fire Department Station 22 and the Washington State Patrol. Access and egress would be maintained at all times for these two public service providers, and the temporary bridge at 10th Avenue East would be constructed prior to any demolition work. Therefore, the closure of the Delmar Drive East bridge is not expected to result in negative effects on emergency response times. Detour routes would be developed and shared with these providers in advance to minimize effects.

Construction-related closures of the Lake Washington Boulevard ramps and NE Pacific Street would change emergency vehicle access to the University of Washington Medical Center. Detour routes would be developed in advance and shared with providers of fire, emergency medical, and police services to minimize negative effects.

Increased police security may be needed to protect equipment and materials at construction sites and staging areas. Also, depending on the magnitude of construction that is occurring along the corridor, there could be an increased demand on emergency medical aid from fire departments due to the increased risk of construction site accidents. A westbound left-turn pocket from NE Pacific Place would be added to the Montlake Boulevard NE/NE Pacific Place intersection to accommodate turning vehicles.

WSDOT's existing system of lighting, traffic control, and ramp metering would continue during construction. The use of temporary electrical systems would ensure that traffic control systems and lighting on temporary bridges and construction areas are able to operate without interruption.

During construction, pile-driving or earth-moving may affect utilities both below ground (pipes and conduits) and above ground (overhead wires). Utility lines and/or cables may be rerouted or protected in place, which could cause temporary outages. These outages would likely be short-term and intermittent.

Relocation of some utilities may affect other utilities near the relocation work. These effects would be reviewed and approved on a case-by-case basis prior to action. Before construction, WSDOT would prepare a consolidated utility plan verifying the exact location and depth of utilities with utility providers, and construction methods would be developed to minimize utility effects. For utilities with WSDOT franchise agreements, any relocation would be addressed under the provisions in each provider's agreement.

Effects of Suboptions

- Adding the suboptions to Options A and K would result in no measurable difference to the public services and utilities effects described above.
- Adding northbound capacity on Montlake Boulevard to Option L would result in some minor differences in the effects described above. Widening Montlake Boulevard may require the relocation of the Seattle Public Utilities (SPU) water main and the relocation of SPU stormwater lines that connect to the existing King County sewer trunk line. Adding the left-turn lane to the southbound SPUI ramp under Option L would result in no measurable differences from those described above.

How would the project minimize negative effects during construction?

Potential mitigation measures that WSDOT may implement to avoid or minimize construction effects during construction are identified below.

Social Elements

- WSDOT will continue to work with the project area neighborhoods to keep residents informed and to develop neighborhood-specific measures to address anticipated construction effects.
- A traffic management plan would be prepared that would identify measures and practices to minimize construction effects on local streets, transit and transit users, property owners, and businesses (see Section 6.1, Transportation).
- Construction access to and from the construction zone could possibly be provided along the Montlake Boulevard westbound off-ramp or along alternate routes to reduce the volume of construction trucks using the residential streets of East Shelby, East Hamlin, and East Park Drive East.

Additional mitigation measures to reduce noise and dust levels, minimize visual effects, reduce traffic congestion, and minimize effects on park and recreational facilities during construction are identified in Section 6.4, Recreation; Section 6.5, Visual Quality; Section 6.7, Noise; and Section 6.8, Air Quality.

Environmental Justice

- WSDOT is coordinating with the Muckleshoot Tribe to identify important access points to usual and accustomed fishing areas in areas where proposed structures would be built. There would be additional coordination to avoid construction conflicts with tribal fishers harvesting salmon in Portage Bay, Union Bay, and Lake Washington.
- During construction, contractors would be required to use best management practices to minimize the potential adverse effects of pile-driving, falling debris, unintentional discharge of sediment, and other construction effects that could harm fish habitat.
- Construction would be restricted to identified in-water work windows in order to reduce potential adverse effects on fish populations or habitat.
- Mitigation measures to restore shorelines, floodplain areas, wetlands, and riparian vegetation would be implemented to compensate for effects on habitat (see Section 6.11, Ecosystems).
- In the event construction encounters cultural or archaeological resources on Foster Island, the resources would be evaluated to assess their historical significance, and WSDOT would consult with the tribes and the Washington State Department of Archaeology and Historic Preservation to create and implement a treatment plan.

Public Services and Utilities

- WSDOT will work with affected communities to provide advance notice of any service disruptions or outages.
- WSDOT will notify service providers of construction schedules, street closures, and utility interruptions in advance.
- WSDOT will coordinate with law enforcement agencies to implement crime prevention plans for construction sites and staging areas.
- WSDOT will notify and coordinate with police departments prior to construction to plan for adequate staffing for traffic and pedestrian movement control.
- WSDOT will notify and coordinate with the fire departments throughout project construction regarding traffic congestion and road closures.
- WSDOT will notify and coordinate with fire departments for water line relocations that could affect water supply for fire suppression, and establish alternative supply lines prior to any service interruptions.
- WSDOT will notify and coordinate with fire departments for utility service interruptions (power and phone) that could affect fire detection and notification systems, and establish alternatives prior to any service interruption.

- WSDOT will work with utility service providers to prepare a consolidated utility engineering plan consisting of key elements such as existing locations, potential temporary locations, and potential new locations for utilities; prepare sequenced and coordinated schedules for utility work; and develop detailed descriptions of any service disruptions

6.4 Recreation

KEY POINT

All options would affect adjacent parks during construction. These parks could experience negative effects from property acquisitions, construction-related truck traffic, and construction noise and visual clutter.

Construction would affect access to and use of Seattle parks. As discussed below, the project would require acquisition and construction easements of parts of the Bagley Viewpoint, Interlaken Park, Montlake Playfield, McCurdy Park, East Montlake Park, the Washington Park Arboretum, and University of Washington campus facilities. It would also require periodic closures of portions of the Bill Dawson Bike Trail (Montlake Bike Path) and the Arboretum Waterfront Trail that runs under SR 520. Table 6.4-1 and Exhibit 6.4-1 show the recreational areas affected by construction. Permanently acquired park areas, discussed in Section 5.4 of Chapter 5, would also be closed during construction. Effects of adding the suboptions to Options A, K, and L are discussed only where they would result in a measurable difference.

Table 6.4-1. Construction Effects on Parks (acres)

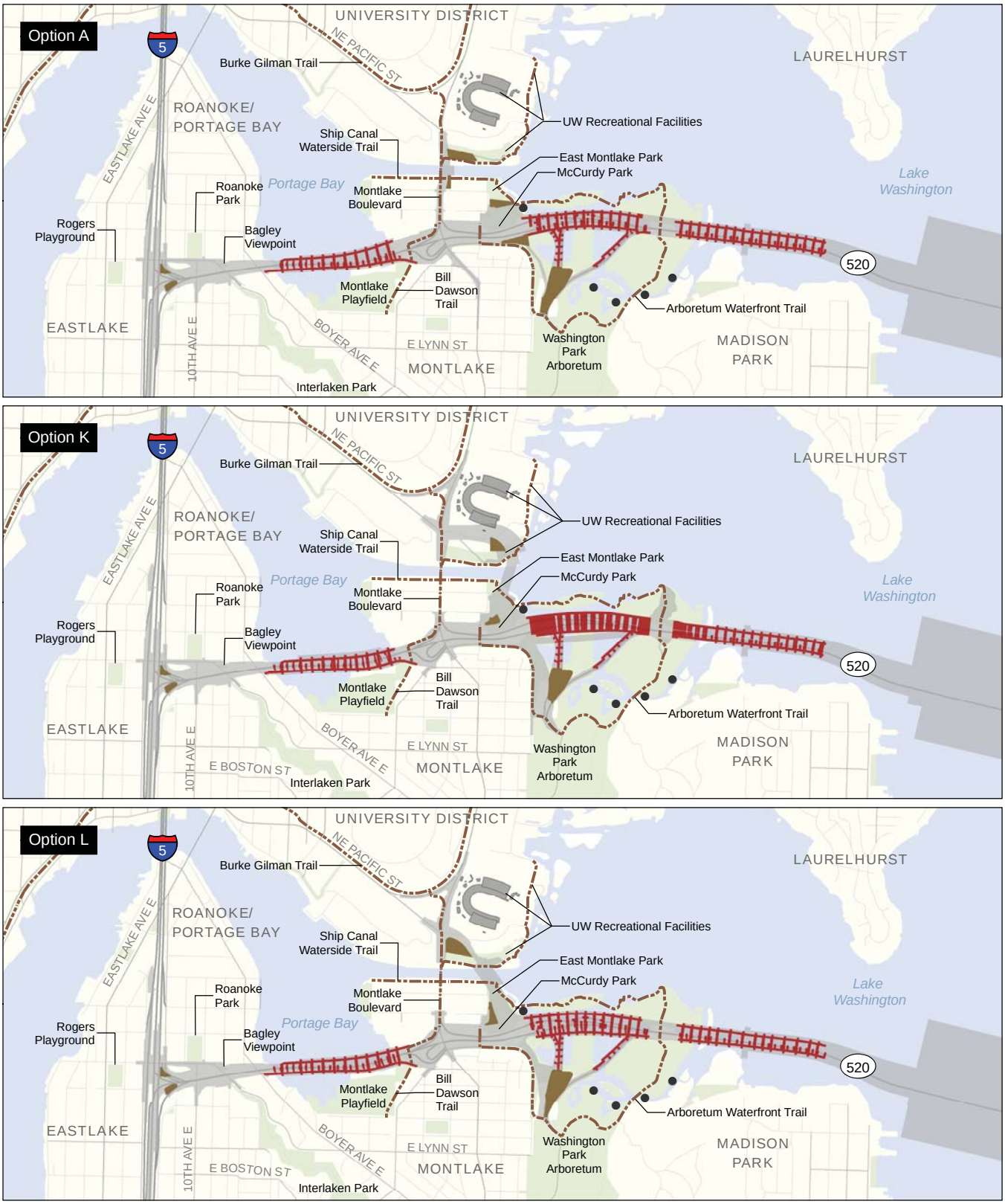
Resource	Park Size	Option A	Option K	Option L
Rogers Playground	1.9	0	0	0
Roanoke Park	2.2	0	0	0
Bagley Viewpoint[a]	0.1	0[a]	0[a]	0[a]
Interlaken Park	51.7	0.05	0.05	0.05
Montlake Playfield	27	0.3	0.2	0.2
East Montlake Park	7.1	1.2[b]	0.9	1.6
McCurdy Park[a]	1.5	0[a]	0[a]	0[a]
Washington Park Arboretum	193	2.4[b]	5.3	3.5
University of Washington Open Space	630	1.1	0.5	0.9
Total Effects	--	5.1[b]	7.0	6.3

[a]All of Bagley Viewpoint and McCurdy Park would be permanently acquired prior to construction; therefore, these totals appear in the operations discussion.

[b]Adding the suboptions to Option A would temporarily affect an additional 0.1 acre of East Montlake Park and 0.3 acre of the Arboretum during construction.

Note: Adding the suboptions to Options K and L would result in no measurable difference in the park effects listed in this table.

Exhibit 6.4-1 **Construction Effects on Parks**



How would construction affect recreation resources?

Roanoke Park, Bagley Viewpoint, and Interlaken Park

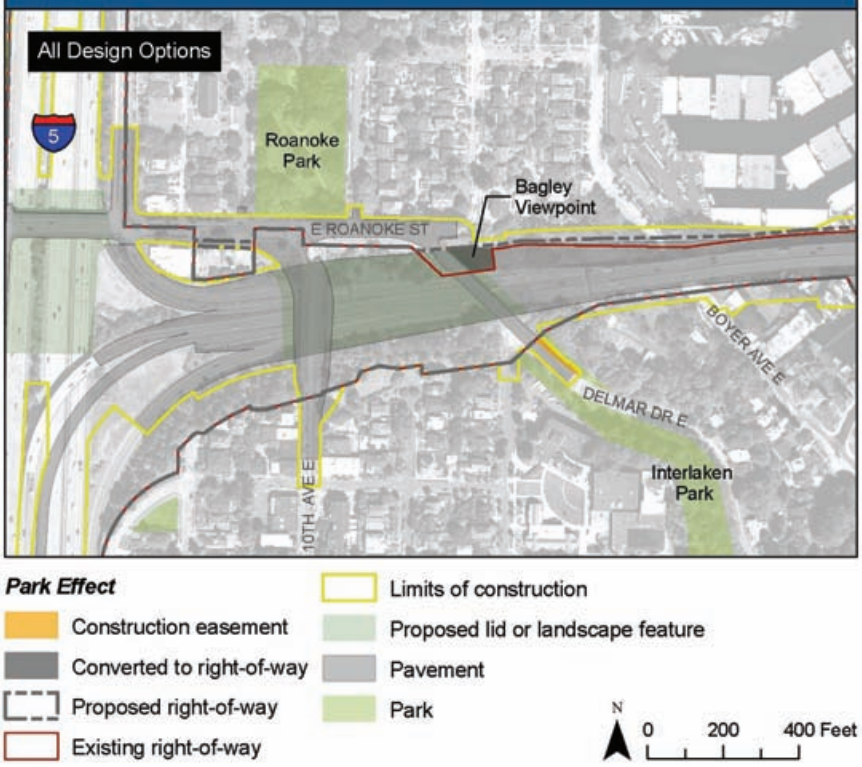
Construction of the 10th Avenue East and Delmar Drive East lid would affect Rogers Playground, Roanoke Park, Bagley Viewpoint, and Interlaken Park. Construction activities would last up to 27 months, creating increased noise, dust, and traffic in areas within close proximity to construction work.

The entire 0.15-acre Bagley Viewpoint would be permanently acquired and used during construction (Exhibit 6.4-2). Because Roanoke Park is adjacent to the proposed haul route along East Roanoke Street, noise and visual effects associated with truck traffic may affect park users. Access to the park would be maintained at all times.

KEY POINT

All options would acquire Bagley Viewpoint in its entirety, and all options include a proposed haul route adjacent to Roanoke Park. Construction effects on these parks would be the same for all options and would last approximately 2 years.

Exhibit 6.4-2. **Construction Effects on Bagley Viewpoint**



Interlaken Park is divided into two portions by Delmar Drive East. Construction would occur within the park while curbs and sidewalks are replaced along Delmar Drive East. A small portion (0.05 acre) of Interlaken Park would be temporarily used as a construction easement under all design options (Exhibit 6.4-2 and Table 6.4-1). This area would be returned to park use after construction.

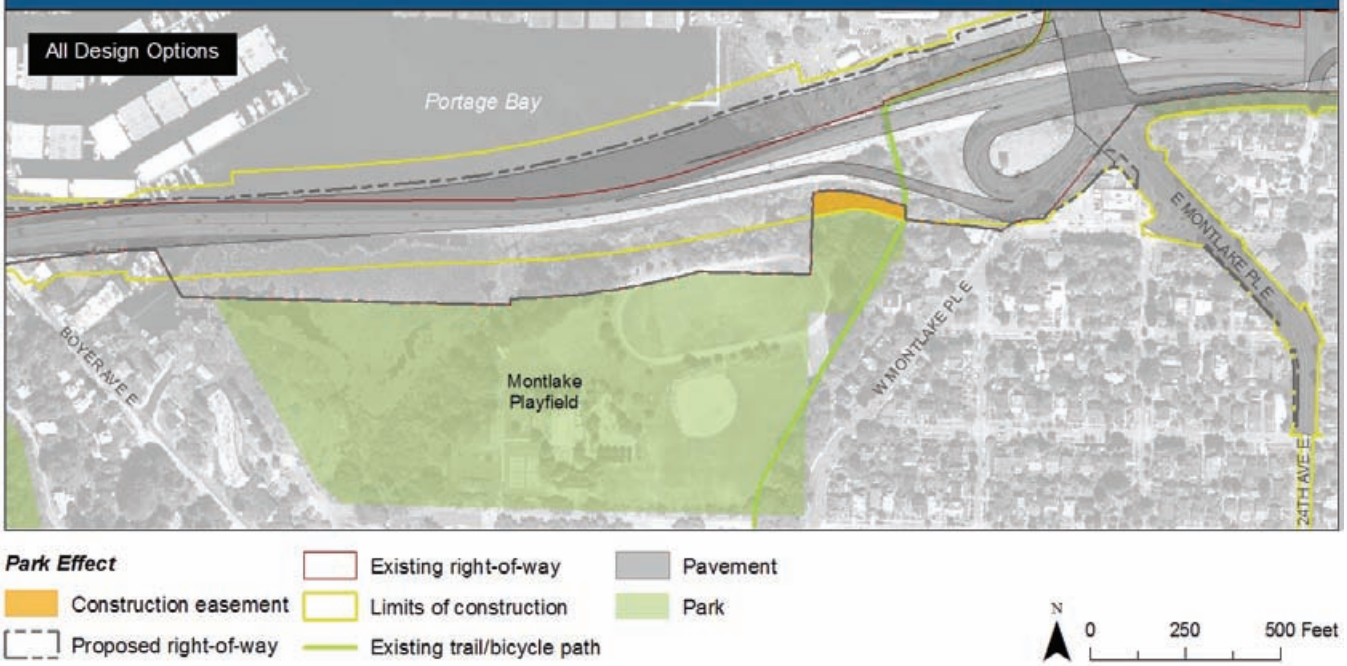
Bicyclists and pedestrians who currently use the on-street bike path to access the park would be routed along the 10th Avenue East construction

crossing. This area of the park would also experience noise and dust from construction activity associated with the construction of the 10th Avenue East/East Delmar Drive lid for approximately 15 to 24 months. Construction noise is discussed in Section 6.7.

Montlake Playfield and Bill Dawson Trail

Construction of the Portage Bay Bridge would affect Montlake Playfield and the Bill Dawson Trail. Montlake Playfield is located along the south side of the SR 520 right-of-way, as shown in Exhibit 6.4-3. SR 520 would be widened to the north, and construction would extend approximately 30 feet west of the existing Bill Dawson Trail, within the park boundary. However, none of the park facilities would be affected. Construction would require building a temporary support structure for 30 to 36 months in the park to remove and replace the SR 520 off-ramp to Montlake Boulevard; the interim structure would be removed upon completion.

Exhibit 6.4-3. **Construction Effects on Montlake Playfield**



Construction activities are expected to generate dust and construction-related noise and vibration in close proximity to the active-use areas of the park. Construction limits are similar for each design option. Section 6.7 provides information on construction noise.

The Bill Dawson Trail extends from Montlake Playfield under SR 520 to Montlake Boulevard. Portions of the trail would be detoured east of the project during construction, where the trail would be relocated during operation. The reestablished trail would continue to be located within the

SR 520 right-of-way approximately 50 feet west of the existing location. Closures along the trail would occur for between 30 and 36 months during rebuilding of the Portage Bay Bridge and the Montlake Boulevard interchange. Detours for bicyclists and pedestrians to avoid construction would be provided to Montlake Playfield from the Montlake Boulevard neighborhood.

East Montlake Park, McCurdy Park, and University of Washington

Construction of the Montlake interchange and the west approach would affect East Montlake Park, McCurdy Park, and the University of Washington recreation facilities. Construction activities would vary among the options with increased noise, dust, and traffic in areas within close proximity.

KEY POINT

East Montlake Park, McCurdy Park, and the UW

All options would affect East Montlake Park, McCurdy Park, and the University of Washington recreation facilities. The scale and intensity of construction near these parks would vary between the options with increased noise, dust, and traffic in areas within close proximity. All options would permanently close McCurdy Park and a portion of East Montlake Park. All options would also use a portion of the UW campus for construction and staging.

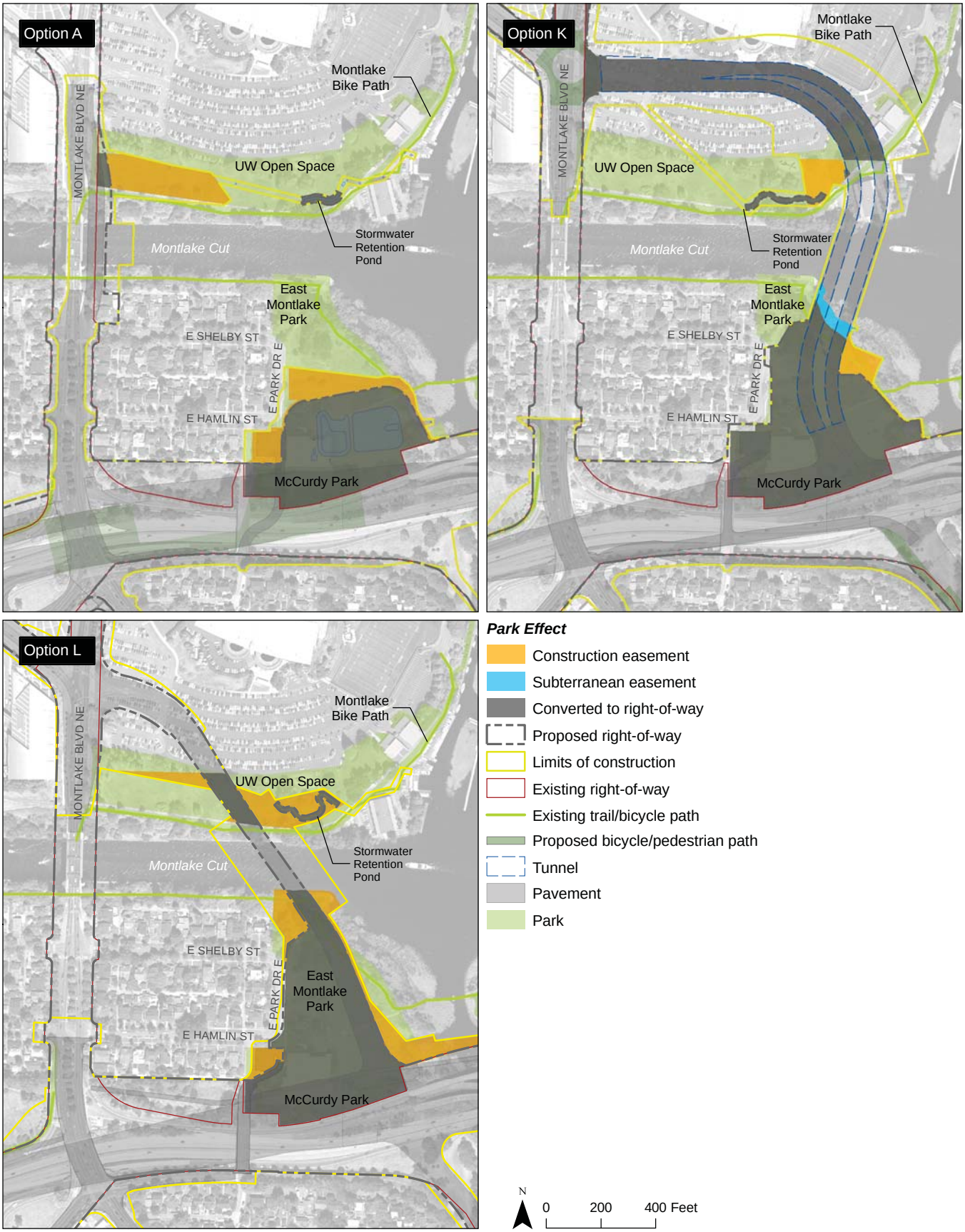
Exhibit 6.4-4 shows construction effects on East Montlake and McCurdy Parks. McCurdy Park, MOHAI, and the associated parking lot would be permanently closed at the start of construction. The 24th Avenue East crossing, which provides access to MOHAI and is a designated city bike route, would also be closed during construction, with detours directed to Montlake Boulevard. The northern portion of East Montlake Park and the trailheads for the Arboretum Waterfront Trail and the Ship Canal Waterside Trail would remain open during construction, with exceptions as noted below.

As shown in Exhibit 6.4-4, portions of the University of Washington open space could be used as staging areas. The University's main recreational facilities are located immediately north of the Montlake Cut. The stadium parking lots (E11 and E12) are used primarily by faculty, students, staff, and visitors to the UW Medical Center but also support the recreational facilities. Loss of parking and limited access through the parking lots could limit the recreational opportunities in their immediate vicinity, although the campus contains many other parking areas and is well served by transit (see the Transportation Discipline Report in Attachment 7). On the University of Washington campus, all options would somewhat reduce access to recreational facilities and result in some traffic delays during construction. As described in Section 6.1 of this chapter, WSDOT would work with the UW and transit service providers to implement alternative transit and parking opportunities for events in the south campus area.

Option A

Option A would temporarily affect 1.2 acres of East Montlake Park (Exhibit 6.4-4). In combination with the 2.8 acres of permanent effect in East Montlake Park and 1.5 acres in McCurdy Park, this would result in closure of over 60 percent of the parks' current area for staging and for construction of the westbound off-ramps and detention ponds. Only the northern portion of East Montlake Park would remain in recreational use.

Exhibit 6.4-4. **Construction Effects on East Montlake Park, McCurdy Park, and UW Open Space**



During construction of the new Montlake bascule bridge, the Arboretum Waterfront Trail and trail access in East Montlake Park, as well as the Ship Canal Waterside Trail and trail access from Montlake Boulevard, are likely to be periodically closed during construction for safety reasons. Detours would be provided where possible during construction.

The kayak and canoe launch point on the Lake Washington shoreline would also be periodically inaccessible. Access to the Ship Canal Waterside Trail from the park would remain open, although passage beneath Montlake Boulevard would be temporarily closed for between 24 and 30 months during construction of the new bascule bridge. Parking for all these facilities would be closed during construction.

The new bascule bridge would be located east of the existing bridge on the east side of Montlake Boulevard. Construction of the new bascule bridge would mainly affect access to the University of Washington Open Space adjacent to the WAC. It would also temporarily remove 4 percent of the total parking spaces at Husky Stadium. In addition, approximately 1.1 acres of construction easement would be required at the western end of the University of Washington Open Space.

Construction closures of the East Campus Bicycle Route and the Burke-Gilman Trail are expected as Montlake Boulevard is widened from two to three lanes. Construction effects are likely to last between 36 and 42 months. Traffic destined for the E-12 parking lot would be re-routed through the Montlake Boulevard/NE Pacific Street intersection.

KEY POINT

Trails

All options would require periodic closure and detours of the Ship Canal Waterside Trail, trail access from Montlake Boulevard, trail access in East Montlake Park, and the Arboretum Waterfront Trail. The kayak and canoe launch point on the Lake Washington shoreline would also be periodically inaccessible.

Option A Suboptions

- Adding the Lake Washington Boulevard ramps to Option A would temporarily affect an additional 0.1 acre of East Montlake Park during construction. Other suboptions of Option A would not result in additional effects.

Option K

Construction activities for Option K would occur over a longer duration than Option A. A cut-and-cover tunnel and freeze pit would be constructed in East Montlake and McCurdy parks, creating a greater level of noise, dust, visual quality, and construction traffic effects because these areas would require the excavation of a substantial amount of soil.

Option K would temporarily affect 0.9 acre of parkland in East Montlake Park (Exhibit 6.4-4). In combination with 4.5 acres of permanent acquisition in East Montlake Park and 1.5 acres in McCurdy Park, approximately 80 percent of the park area would be closed for 54 to 60 months during construction. Only a small area in the northwest corner of East Montlake Park would remain in recreational use. The other construction effects of Option K, including temporary closure of trail

access and watercraft launch points, would be similar to those described above for Option A, although the length of closures would be longer.

Because of the depth of the Option K tunnel and the supporting infrastructure, the types of construction effects at the University of Washington recreational facilities would differ from those of Options A and L. Access to Walla Walla Road through the Husky Stadium parking lot would be detoured for the 4-year duration of tunnel construction and only available from parking facilities north of the stadium. Traffic destined for the E-12 parking lot or Walla Walla Road would be rerouted through the Montlake Boulevard/NE Pacific Street intersection. Much of the E-11 and E-12 parking lots would be used for construction staging; a total of 549 parking spaces would be closed during this time. Access and parking effects on these resources are described in Section 6.1, Transportation.

Tunnel construction would require temporary relocation of the WAC, which would affect the Washington Yacht Club, Sailing Team, Kayak Club (flat and white water), and Union Bay Rowing Club. The WAC also rents canoes and rowboats to the general public. Most renters use the canoes to cross the Montlake Cut and access the Arboretum.

Construction of the intersection of NE Pacific Street and Montlake Boulevard NE would also require modifications to the existing pedestrian and bicyclist routes. Access would be maintained on one side of Montlake Boulevard NE at all times during the construction period, and pedestrian crossings would be provided at intersections. A temporary pedestrian overpass is also proposed just south of the NE Pacific Street and Montlake Boulevard NE intersection to maintain pedestrian access during construction on the east and west sides of Montlake Boulevard NE.

The East Campus bicycle route, climbing wall, and Burke-Gilman Trail spur would not be accessible during construction of the tunnel and the lowered NE Pacific Street/Montlake Boulevard NE intersection. A construction easement of approximately 0.5 acre would be required from the UW Open Space (Exhibit 6.4-4).

Option L

Option L would temporarily affect 1.6 acres of area in East Montlake Park (Exhibit 6.4-4). Combined with 4.3 acres of permanent acquisition in East Montlake Park and 1.5 acres in McCurdy Park, this would close over 75 percent of park area for between 27 and 36 months during construction. The other construction effects of Option L, including temporary closure of trail access and watercraft launch points, would be similar to those described above for Option A.

Construction of the new bascule bridge across the Montlake Cut would affect access to the University's southeast campus recreational facilities and the Burke-Gilman Trail during the 3-year construction period. Walla Walla

Road would be detoured for access to the WAC and through the Husky Stadium south parking lot to the NE Pacific Street/Montlake Boulevard NE intersection. Bridge construction would relocate the climbing wall and portions of the East Campus Bicycle Route for the duration of construction.

Option L would require temporary closure of 0.9 acre in the UW Open Space. Construction easements would close 211 parking spaces and local road access through the E-11 and E-12 parking lots. Access and parking effects on these resources are discussed in Section 6.1. Construction of the bridge span and support columns would require periodic closure of the trails, the Canoe House, the climbing wall, and the WAC. Lowering the NE Pacific Street/Montlake Boulevard NE intersection and construction of the lid could affect access to Husky Stadium.

Option L Suboptions

- Adding capacity on Montlake Boulevard north of the Montlake Cut would result in temporary impacts on access to the Burke-Gilman Trail from the east side of Montlake Boulevard during reconstruction of pedestrian overpasses. Additionally, the existing sidewalks and planter strips along Montlake Boulevard would be removed and replaced with new planter strips and sidewalks. A wider roadway and more traffic could affect the pedestrian experience along this corridor. Adding left-turn access from Lake Washington Boulevard onto the SPUI south ramp would result in no difference to the recreation impacts described under Option L.

West Approach Area

Under all design options, construction of the proposed improvements would require periodic closure of the section of the Arboretum Waterfront Trail located under SR 520 on Foster Island. Resulting effects are described below by option and shown on Exhibit 6.4-5. In addition to the on-land closures, boats would be prevented from passing beneath all structures while work bridges are in place during in-water construction. Although the canoe and kayak launch point near the north end of Foster Island would remain in use, paddling would be restricted to the waterways north of SR 520.

KEY POINT

All options would construct work bridges in Portage Bay, Union Bay, and Lake Washington in the west approach area. The use of recreational vessels such as canoes or kayaks would be prohibited in this area during construction.

Exhibit 6-4.5. Contruction Effects on Washington Park Arboretum

Park Effect

- Construction easement
- Converted to right-of-way
- Proposed right-of-way
- Existing right-of-way
- Limits of construction
- Construction work bridge
- Pavement
- Park
- Existing trail/bicycle path
- Proposed bicycle/pedestrian path

The trail segment between East Montlake Park and the northern portion of Foster Island could be accessed from the East Montlake Park trailhead, although this trail access would be subject to closures due to construction activities at East Montlake and McCurdy Parks. During such closures, trail users would be unable to use any portion of the trail between East Montlake Park and the limits of construction. Throughout the construction period, park users would be able to access the remainder of the trail, including the portion of Foster Island south of SR 520, from the Arboretum's Graham Visitor Center.

All design options would remove the existing Lake Washington Boulevard ramps and R.H. Thomson Expressway ramps. Although removal of the ramps would occur entirely on WSDOT property, adjacent areas could be affected by dust, noise, and vibration during their demolition.

Option A

Option A would cross Foster Island within the Washington Park Arboretum on a pier and span bridge. Construction would include work bridges alongside SR 520 in the west approach area (see Chapter 3). The work bridges would be removed after completion of the permanent structure. Construction of the west approach area adjacent to Foster and Marsh islands and the Washington Park Arboretum is scheduled to take up to 6 years.

As shown in Exhibit 6.4-5, the Foster Island construction easement, totaling 2.4 acres, would extend south into the Arboretum to accommodate waterfront trail reconstruction, and north of the existing bridge to allow completion of the construction bridge.

Throughout the west approach area, WSDOT would use pile-driving techniques to construct both temporary and permanent bridges. Pile-driving would take place throughout the established in-water work windows indicated in Chapter 3, or for approximately 3 months at a time, but would be limited to daylight hours to minimize noise effects. See Section 6.7 for more information on construction noise.

Option A Suboptions

- Adding Lake Washington Boulevard ramps to Option A would temporarily affect an additional 0.3 acre of the Arboretum during construction.
- Adding an eastbound HOV direct-access ramp and changing the profile of Option A to a constant slope in the west approach would result in no measurable difference to the recreation effects described under Option A.

Option K

In Option K, a land bridge would cross Foster Island, with the roadway lidded by an earthen berm. The Arboretum Waterfront Trail would be

reconstructed over the land bridge and on fill material extending to the north end of Foster Island. A total of 5.3 acres of construction easements would be needed on Foster and Marsh islands for work bridges, trail construction, and fill (Exhibit 6.4-5), but these areas would be revegetated and returned to park use once construction is completed. The land bridge would be covered by a landscaped area (similar to an urban park), which would be owned by WSDOT and managed by Seattle Parks and Recreation.

Option L

A pier and span bridge would cross Foster Island, similar to Option A. However, because SR 520 would be wider in this area than under Option A, there would be a larger construction footprint on Foster Island. This would require 3.5 acres of construction easements for work bridges and trail construction (see Exhibit 6.4-5). These areas would be revegetated and returned to park use once construction is completed.

Lake Washington Area

Although there are no formally designated recreation facilities on the waters of Lake Washington in the project area, construction activities would affect people who are swimming or boating nearby. Construction of the floating portion of the bridge would last at least 33 months. Construction work bridges and construction equipment in the area would affect views, while some construction noise would be audible to swimmers and boaters in the vicinity.

Eastside Transition Area

No construction would occur within Fairweather Park.

How would the project minimize negative effects on recreation during construction?

Possible mitigation measures for the identified project construction effects are as follows:

- Prepare a detour plan in coordination with Seattle Parks and Recreation to address the manner in which the Bill Dawson Trail and users of Montlake Playfield would be rerouted during times of trail closure.
- Assist Seattle Parks and Recreation in revegetating the Union Bay shoreline with appropriate species and developing a planting plan.
- Prepare a detour plan in coordination with Seattle Parks and Recreation to address the manner in which on-street bicycle traffic and the Ship Canal Waterside Trail would be rerouted during times of trail closure.
- Replace parking spaces in the immediate vicinity of the parks upon completion of construction.

- Prepare a detour plan in coordination with the Washington Park Arboretum and Seattle Parks and Recreation to address the manner in which Arboretum Waterfront Trail users and users of Foster Island would be rerouted during times of trail closure.
- Assist the Washington Park Arboretum in revegetating Foster Island with appropriate species and developing a planting plan.
- Reconstruct portions of the Arboretum Waterfront Trail disturbed during project construction.
- Assist the University of Washington in revegetating the open space along the Montlake Cut shoreline with appropriate species and developing a planting plan.
- Coordinate with the University of Washington for replacement of parking spaces in the immediate vicinity of the recreation facilities upon completion of construction.

For Options K and L only, to minimize harm, WSDOT would:

- Assist the University of Washington in identifying the location of temporary facilities for the Waterfront Activities Center during periods of closures and/or relocation.
- Identify a location for replacing the climbing wall, the East Campus Bicycle Route, and associated pedestrian amenities.

6.5 Visual Quality

Construction equipment would be noticeable throughout the active construction period, whether moving next to the traffic lanes during work hours or parked beside the roadway after hours. Also visible would be the results of ongoing construction and mitigation activities, such as construction bridges, exposed cut areas, stockpiled soil, silt fences and mulched areas, and temporary sedimentation ponds. These sights would be out of character with the project area and would greatly detract from visual quality, but they would not be permanent. WSDOT would remove equipment and restore the areas as soon as construction was complete.

Roanoke Landscape Unit

Construction activities in the Roanoke landscape unit would be visible from a few homes, the upper floors of Seward School, and nearby roadways and surface streets. The 2 years of construction activity associated with mobilization and construction of the Roanoke lid, eastbound and westbound mainline ramps, and reversible HOV ramp would have a high impact on visual character and quality for all viewers. However, viewpoints with long-distance views across Portage Bay or to the west would be minimally affected by construction in Roanoke because most construction activities would occur along the roadway corridor.

The greatest effect on views would result from large-scale activities that involve heavy equipment and collectively span 2 years. These would include demolition of ramps and bridge overcrossings; construction of new ramps; replacement of bridges at Roanoke Street, 10th Avenue East, and Delmar Drive East; and construction of the new I-5 and 10th and Delmar lids. Removal of the Delmar Drive East overcrossing and construction of detour bridges would result in the removal of Bagley Viewpoint and the tree buffer below it. Temporary detour bridges during construction of the new structures would be large, complex structures that would clutter views from the roadways and overcrossings. Construction equipment and activities would be visible from homes along I-5 because the newly constructed noise walls along Boylston Avenue and Harvard Avenue in the vicinity of Roanoke Street would be removed to build the I-5 lid.

Construction would remove some trees and shrubs from the I-5 median and in the I-5/SR 520 interchange. Preparation for constructing the lids would permanently remove mature roadside trees and shrubs along both sides of SR 520. Views from homes that are currently screened by these trees and walls would then overlook ongoing construction actions and equipment.

Portage Bay Landscape Unit

Construction activities would be visible from most locations around Portage Bay. The greatest change to visual quality would result from the size and complexity of construction bridges on both sides of the Portage Bay Bridge. The later construction of the new Portage Bay Bridge would increase the effects.

The combination of the construction bridges, falsework finger piers, and the phased demolition and reconstruction of the Portage Bay Bridge over the course of more than 6 years would result in substantial degradation of visual character and quality of the south part of Portage Bay. The bridges would block water and ground level views near these structures. The viewers most affected by these changes would be commuters crossing the bridges, residents on houseboats and near the bridge ends, park users at Montlake Playfield, and boaters at the marinas (Queen City and Seattle yacht clubs).

Heavy earthwork equipment would be required to excavate the bridge piers near Boyer and contour the terrain near Boyer Avenue East and Montlake Playfield for stormwater and landscaping. This equipment would be visible from nearby locations. Vegetation under the west end of the bridge on either side of Boyer Avenue East would be removed, but this area is currently an unmaintained landscape.

Montlake Landscape Unit

Option A

The greatest effects on views and visual quality would be from construction activities and equipment used to reconstruct the Montlake interchange adjacent to the NOAA campus and homes along Lake Washington Boulevard. The viewers most affected by these changes would be commuters on SR 520, all travelers on Montlake Boulevard, people at NOAA, and residents facing East Montlake Park and SR 520. Construction activities would clutter all views, especially for boaters in the Montlake Cut and SR 520 commuters, both of whom would be sensitive to visual quality.

Considerable earthwork would be undertaken for Option A in the Montlake landscape unit. Widening of the road and grading for the stormwater ponds at the MOHAI site would bring earthwork equipment within sight of some residences in the Shelby-Hamlin area and users of the Arboretum and Ship Canal Waterfront Trails.

Preparation for construction of the new bascule drawbridge across the Montlake Cut would require removal of a band of the mature, dense woods along the cut, which would diminish the quality of views. The new bascule bridge would also remove two single-family homes and bring traffic and the new bridge closer to homes that are now buffered by those homes and vegetation.

Widening Montlake Boulevard north of the Montlake Cut would remove a portion of the UW Open Space, including many specimen conifers that now act as an informal gateway to the UW campus and as the ground-level terminus of Rainier Vista. Removal of these conifers would be noticeable to both those familiar with the view and casual viewers. The loss of these trees could change the character of the lower part of the panoramic view. It is also possible that some of the construction activities would be visible from Drumheller Fountain on the UW campus, but neither the removal of the trees nor construction activities would interfere with or degrade views of Mount Rainier from the Rainier Vista.

KEY POINT

All options would require a considerable amount of earthwork for widening SR 520 and grading for the stormwater ponds, which would affect views from residences in the Shelby-Hamlin area and for users of the Arboretum and Ship Canal waterfront trails. Construction work bridges would also clutter views, especially for boaters in the Montlake Cut and SR 520 commuters, both of whom would be sensitive to visual quality.

Option A Suboptions

- Adding the Lake Washington Boulevard ramps to Option A would involve the removal of mature poplars and other specimen trees to the east of Lake Washington Boulevard East where the ramps would transition to the existing roadway. These trees now buffer the view of the roadway from several Montlake homes and the boulevard. Other Option A suboptions would have no visual effects in the Montlake Area.

Option K

Construction activities in the Montlake landscape unit for Option K would be similar to Option A west of Montlake Boulevard, but much more intensive elsewhere because of the excavation needed to build the depressed SPUI and tunnel and to lower the NE Pacific Street/Montlake Boulevard NE.

Changes to visual quality resulting from construction would be very noticeable at the NE Pacific Street/Montlake Boulevard NE intersection and in the East Montlake Park/MOHAI area.

Excavation, soil hauling, and construction of formwork and a temporary detour bridge would have a very high level of effect on visual character and quality in the East Montlake Park area. However, trail closures or detours would result in fewer users seeing the construction activity. The greatest change to visual quality would result from excavation for and construction of the new SPUI and the tunnel entrances in East Montlake Park and in the south parking lot of Husky Stadium. Excavation of the tunnels under the Montlake Cut would not be visible, but the freezing operation and SEM machinery would be visible for 2 or more years. The depth of the SPUI would necessitate formwork for tall retaining walls around the interchange and columns to support the overhead main line.

KEY POINT

Under Option K, the greatest effect on views would be from the extreme change in landform, and the construction of ventilation towers for the tunnels. A temporary detour bridge south of the existing west approach would add to the clutter.

Excavation, earth-moving equipment, work and detour bridges, and false-work for the tunnels and SPUI would be visible to people in the east Shelby-Hamlin neighborhood, on the Arboretum Waterfront Trail, along the Montlake Cut, and at the UW WAC. A temporary detour bridge south of the existing west approach structure could clutter views from and of SR 520 because of its size and complexity. Whether this activity would be visible from Laurelhurst or Union Bay depends on the condition of the shoreline tree buffer. This high level of degradation of visual quality and character from demolition and construction could last for 6-1/2 to 7 years.

Excavation for the tunnel would remove the grassy slope of East Montlake Park and could affect character-defining shoreline vegetation that acts as a visual buffer. The loss of tree buffers, the extreme change in landform, and the construction of ventilation towers for the tunnels and pump houses for stormwater would dramatically change the park-like character of this area.

In the NE Pacific Street/Montlake Boulevard NE intersection area near Husky Stadium, excavation for the north entrance of the tunnel and the lowered intersection could remove established landscaping. This would include a portion of the vegetation and specimen trees in the UW Open Space south of the parking lot. Visual effects would be similar to those of Option A.

Option K Suboption

- Adding the eastbound off-ramp to Montlake Boulevard to Option K would result in no measurable differences in the visual quality effects described above. This is because the added ramp would be located within the existing right-of-way of the current Montlake Boulevard interchange.

Option L

Construction activities in the Montlake landscape unit for Option L would be similar to those of Option K, except that Option L would have fewer effects on shoreline vegetation but would add large above-ground bridge structures. As with Option K, there would be no effects near the existing Montlake Bridge and the adjacent portion of the Montlake Cut; however, very high levels of change to visual character, quality, and views would occur at the east end of the Montlake Cut, the east Shelby-Hamlin neighborhood, the East Montlake Park area, and the NE Pacific Street/ Montlake Boulevard NE intersection.

Excavation, soil hauling, and construction of formwork and temporary detour bridges would have a very high level of effect on visual character and quality in the east Montlake area. The greatest change to visual quality would result from excavation for and construction of the elevated Montlake SPUI, the depressed main line under the SPUI, and the new bascule bridge over the east end of the Montlake Cut with its approaches in East Montlake Park and the Husky Stadium parking lot.

Construction activities and equipment would be visible to people in the east Shelby-Hamlin neighborhood, on the Arboretum Waterfront Trail, along the Montlake Cut, and in the UW WAC area. Whether this activity is visible from Laurelhurst or Union Bay depends on the condition of the shoreline tree buffer. Degradation of visual quality and character from mobilization, demolition, and construction activities could last for 5 to 6 years.

Visual effects from lowering the NE Pacific Street/Montlake Boulevard NE intersection would be similar to those described under Option K.

Option L Suboptions

- Adding northbound capacity on Montlake Boulevard to Option L would cause some visual effects as a result of change due to construction equipment, vegetation removal, and grading. Adding left-turn access from Lake Washington Boulevard onto the SPUI south ramp, however, would result in no difference to the visual quality impacts because it would require no additional construction.

West Approach Landscape Unit

Under all design options, the greatest temporary change to visual character and quality would result from demolition of the Lake Washington ramps to

and from the Arboretum and construction and presence of construction and detour bridges because of their size and complexity. Vegetation would be removed in 30- to 60-foot-wide swaths for the work bridges. Subsequent construction of the permanent new west approach bridges would compound the effects. The combination of the construction bridges, detour bridges, finger piers, and the existing and new bridges would result in substantial degradation of visual character and quality of the south part of Union Bay. The structures would block water- and ground-level views for viewers near the structures. The viewers most affected by this change would be commuters crossing the bridges, park users and boaters, and residents in north Madison Park. Views from the Broadmoor Golf Course would be screened most of the year by tall trees along the shoreline.

Option A

Effects of Option A would be the same as those described above for all design options.

Option A Suboptions

- Adding an eastbound HOV direct-access on-ramp from Montlake Boulevard and the Lake Washington Boulevard ramps to Option A would result in some additional construction activities that would be visible from distant viewpoints. Because of their height, the ramps themselves would add to the complexity of the overall structure.

Option K

Construction activities would be visible from most locations around the bay. Temporary changes to visual character and quality would be substantial for views from or near the west approach bridges and from Husky Stadium, where Foster Island and the Arboretum ramps are visible from seats in the northeast corner of the stadium. This is a signature view from the stadium, and construction activities would have substantial visual effects on those views. From north Union Bay, visual changes would be moderate or minimal. There would be minimal or barely noticeable effects on distant views (such as from Laurelhurst) or oblique views (such as from Lake Washington).

KEY POINT

The work bridges would be highly visible at breaks in the tree line in the Arboretum. Barges and tall cranes would stand out and further diminish visual character and quality. Temporary changes to visual character and quality would be high for views from or near the west approach bridges and from Husky Stadium, where Foster Island and the Arboretum ramps are visible from seats in the northeast corner of the stadium.

Construction of the land bridge at Foster Island would probably not be visible from distant viewpoints, such as Laurelhurst, because of shoreline trees to be retained around the perimeter of the site. However, most of the trees and shrubs in the interior of north Foster Island would be cleared for placing fill soil to create the north connection of the land bridge to the tunnel. A swath of trees along the south side of the new tunnel would be removed to allow placement of fill soil to complete the south portion of the land bridge.

This degree of clearing, grubbing, earthwork, and construction would result in a substantial change to visual character and quality. For safety purposes,

the area would be closed to park users during construction. Therefore, even though pedestrians would not have access to this area during construction, commuters and particularly boaters and visitors to Husky Stadium would be aware of and sensitive to construction activities.

Earthwork would also be required near McCurdy Park for the cofferdams needed to connect the depressed SPUI and the west approach bridge. This construction activity could have negative visual effects.

Removal of mature poplars and other specimen trees to the east of Lake Washington Boulevard East for the new ramps and turn-around would remove the tree screen that now buffers the view of the roadway and its ramps from several Montlake homes and the boulevard. It would also change the visual character and quality of the historic, tree-lined boulevard. Construction of the multi-lane terraced roadway, without the benefit of a tree screen, would bring excavation, concrete, and pavement equipment into views from the parkway, the WSDOT peninsula, and the Arboretum shorelines.

Option L

Construction activities for Option L would result in visual effects similar to Option K. Visual changes would result from the presence of west approach work bridges, removal of vegetation through the Arboretum, and demolition and removal of the existing Lake Washington ramps.

Although effects described above for Option K's depressed SPUI would not occur for Option L, equipment and formwork for the elevated SPUI would be visible from part of Marsh and Foster islands as well as from some locations south of SR 520. The viewers most affected would be commuters on the bridge, residents near the bridge ends, park users in the Arboretum, and boaters.

Lake Washington Landscape Unit

The greatest change to visual quality in the Lake Washington landscape unit would result from the presence of construction equipment, barges, and tall cranes, and from construction of work bridges because of their collective size and complexity. The combination of the large interim structures and the existing and new bridges would result in a substantial degradation of visual quality for viewers on or near the structures.

The viewers most affected by this change would be commuters crossing the bridges, residents near the east approach in Medina, and boaters near the bridges. Construction equipment and activities would have minimal effect on the visual quality of views from Kirkland or Laurelhurst because of the distance.

Construction of the bridge maintenance facility under the new SR 520 east approach would be less visible because most of the construction is set back

from the shoreline. However, the excavation, embankments, and retaining walls would be visible to boaters in the vicinity. Construction of the dock would be visible from the shoreline and possibly from adjacent properties because the dock extends out over the water.

Eastside Transition Area Landscape Unit

The greatest temporary change to visual quality in the Eastside transition area landscape unit would result from the presence of construction equipment and structures for the floating bridge. Barges and boats serving as construction platforms would be part of the near-distance views toward the lake for many homes. Cofferdams and other structures would likely be visible only to boaters and residents standing on their docks. Construction activities would have a very high negative effect on the visual character and quality of views from shoreline and hillside homes in Medina, particularly for residents north of the current floating bridge and east approach.

How would the project minimize negative effects during construction?

Standard BMPs such as construction screening, standardized work hours, and low-impact construction methods, materials, and tools would be used to reduce construction effects on surrounding neighborhoods. WSDOT would revegetate areas where natural habitat, vegetation, or neighborhood tree screens would be removed. These areas are under Portage Bay Bridge in Roanoke Park; through Montlake, in particular at the NOAA Northwest Fisheries Science Center and East Montlake Park and the Arboretum; and along the roadway in the Eastside study area. The Roadside Classification Plan (WSDOT 2007) requires that areas within the right-of-way and construction easements be revegetated to align with the goals for the designated roadside classification. Mature vegetation could generally be used to revegetate parks and re-establish tree screens in these areas in consultation with local jurisdictions and agencies. Revegetation plans would also provide for adequate irrigation and monitoring until trees and plants are well established.

6.6 Cultural Resources

Construction-related effects on historic properties within or near the SR 520 corridor would include demolition; construction noise, dust, and glare; and increased traffic from haul routes. These effects are described in the following sections. All effects determinations are preliminary and subject to change, pending SHPO concurrence. The properties are grouped by project area, west to east, as they are in Chapters 4 and 5. Effects of adding the suboptions to A, K, and L are discussed under the area in which the suboption would be located.

KEY POINT

Cultural Resources

All options would affect adjacent historic properties during construction, particularly the Montlake Historic District. These properties could experience negative effects from property acquisitions, construction-related truck traffic, and construction noise and visual clutter. The Foster Island presumed TCP would also be affected.

How would the project affect cultural resources during construction?

I-5 Area

Historic properties along this section of the project would experience increased noise, fugitive dust, and possible vibration from construction. The noise and other effects would vary during construction, depending on which activities are occurring. Glare from nighttime construction lighting may also occur. The specific effects on historic properties that may result from construction will be fully analyzed once the details of construction are further developed and more information on the potential effects is available.

During construction, Roanoke Street would experience temporary lane closures and detours while the realignment of the Roanoke Street/10th Avenue East intersection is occurring, including short-term closures during off-peak times. This may mean brief detours resulting in temporarily restricted access to the four contributing properties along East Roanoke Street in the Roanoke Park Historic District. However, it is assumed that at least one lane (if not more) would be open at all times to allow traffic access on Roanoke Street. In addition, the historic district could still be accessed from other bounding streets, including Harvard Avenue East and Boyer Avenue East.

Boylston Avenue East in front of the Seward School campus would be narrowed and shifted to the west to allow for the I-5 lid abutment and wall construction. However, the roadway would remain within the existing right-of-way and would not encroach on school property.

Portage Bay Area

The historic properties along this section of the project would be affected by increased noise, fugitive dust, glare from nighttime construction lighting, and possible vibration during demolition and reconstruction of the Delmar Drive and Portage Bay bridges—including pile-driving associated with construction of new piers. The specific effects on historic properties that may result from construction will be fully analyzed once the details of construction are further developed and more information on the potential effects is available.

The construction bridges and barges used for demolition and construction of the Portage Bay Bridge may also introduce new visual effects, especially to the Kelley House, because one of the work bridges is planned to be at the current location of the Portage Bayshore Condominium docks next door. Upon completion, the work bridges would be removed and the condominium docks would be replaced.

Temporary construction supports and barges used for in-water activities may occasionally interfere with the Seattle Yacht Club's marine activities in

the Montlake Cut. In-water construction activities are allowed only from October 1 through April 15, so most marine activities in the cut from mid-April to the end of September would be unaffected.

Options A and L include a new bascule bridge spanning the official navigation channel in the Montlake Cut. The cut must be open to ship traffic all year around, and bridge construction would not be allowed to interfere with marine navigation. The only exception to this is a few short periods of time when spans are being erected, requiring the cut to be closed to marine traffic (see Section 6.14, Navigation). However, those closures would be limited to short durations and would not occur during opening weekend of the boating season.

Montlake Area

Historic properties in this area would experience effects from construction. All of the options would affect the Montlake Historic District with increased noise, fugitive dust, glare from lights for nighttime construction, and possibly vibration from demolition and construction. Particularly affected would be portions of the historic district in the Shelby-Hamlin area east of Montlake Boulevard, which would be affected by construction in East Montlake and McCurdy Parks and truck traffic on Shelby and Hamlin Streets. The specific effects on historic properties that may result from construction will be fully analyzed once the details of construction are further developed and more information on the potential effects is available.

Effects common to the design options include:

- Increase in traffic from haul routes on some streets in the historic district
- Increased noise, dust, traffic, and possible vibrations from construction, and glare from lighting for nighttime construction associated with removal of Lake Washington Boulevard and R. H. Thomson Expressway ramps, construction of new ramps, demolition of Montlake Boulevard and 24th Avenue East bridges over SR 520 and construction of new lids, and demolition and construction of the west approach to the Evergreen Point Bridge
- Traffic detours and congestion

As discussed in Chapter 5, Options A and L would have an overall adverse effect on the historic district. This effect would result primarily from property acquisitions and changes in the historic setting.

Effects of Suboptions

- Adding the Lake Washington Boulevard ramps to Option A would introduce noise and dust, especially for those properties on Lake Washington Boulevard East and 26th Avenue East.

- Adding the eastbound off-ramp to Montlake Boulevard to Option K would result in no measurable difference in the effects described above.
- Adding northbound capacity on Montlake Boulevard to Option L would involve removing three existing pedestrian bridges over Montlake Boulevard, widening the roadway to the east, and then reconstructing new pedestrian bridges. All three of these pedestrian bridges are eligible for the NRHP, constituting an adverse effect. The demolition and construction could cause noise, fugitive dust, glare from lights for nighttime construction, and possible vibration on adjacent historic properties, including Graves Hall, Bloedel Hall, Winkenwerder Forest Sciences Laboratory, Hewitt Wilson Ceramics Laboratory, Wilcox Hall, More Hall, the University of Washington Club, and McMahon Hall. However, the construction effects on these buildings would not be adverse. Adding left-turn access from Lake Washington Boulevard to the SPUI south ramp would have no effects on cultural resources.

West Approach Area

All options could affect the Washington Park Arboretum because construction activities would generate dust and construction-related noise and vibration in proximity to the active areas of the park. During construction, bicycle and pedestrian access to the park would be affected (see Section 6.4, Recreation). Although the canoe and kayak launch point near the north end of Foster Island would remain in use, paddling would be restricted to the waterways within the park. These effects would temporarily affect the setting of the historic Arboretum, and they would occur intermittently; therefore they would have little effect on the historic qualities of the park and are not considered adverse effects on the historic property.

All options would affect the Foster Island presumed TCP through construction activities and by requiring additional land for construction easements beyond the permanent right-of-way expansions discussed in Chapter 5. For all options, the majority of the construction easement would be on the north side of the existing right-of-way. As stated previously, the portion of Foster Island south of the existing SR 520 alignment, which includes the historic south island, has greater cultural significance than the northern portion. The only construction easement on the south part of the island would be immediately adjacent to the existing bridge.

Construction activities for all options would generate dust and construction-related noise and vibration on Foster Island. Construction of all options would include construction bridges on Foster Island. These bridges would be removed and construction easement property would be returned to park use after construction was completed. During construction, access to the north part of the island would be restricted, but based on WSDOT's current understanding, access to this area is not as

important for traditional cultural activities. No construction staging would occur on the island outside of the construction easement. Consultation with SHPO and tribes is ongoing to reach a determination of effects on the presumed TCP from the project. Once the final alignment is determined, additional investigation will be done to determine the formal boundaries of the presumed TCP. Once specific construction effects are more clearly identified, WSDOT will refine the evaluation of potential adverse effects from construction activities.

For Options A and L, the pier and span bridge would require expansion north of the existing SR 520 alignment in the area that was historically a channel between the north and south islands. Option A would include 2.08 acres of construction easement, and Option L would include 3.5 acres of construction easement. Construction is scheduled to take up to 6 years (72 months) for both Option A and Option L. Locating the pier-and-span bridge north of the existing alignment in the area that was historically a channel between the north and south islands would use less of the significant land from the presumed TCP. For both these options, the construction would not interfere with any ongoing cultural activities that may occur on the southern part of Foster Island, and would involve little or no ground disturbance within the known historic land area of the south island.

Under Option K, SR 520 would cross Foster Island beneath a "land bridge" with the right-of-way expanded north of the existing alignment. Option K would require 5.3 acres of construction easement on Foster Island for work bridges, trail reconstruction, and fill. Construction is expected to take 7 years to complete. The SR 520 right-of-way would be expanded to the north, which would use less of the significant land from the presumed TCP. However, because of land bridge construction south of the existing alignment, Option K would have the potential to interfere with cultural activities that may occur on the southern part of Foster Island. Construction for the land bridge would involve excavation of approximately 2.8 acres to a depth of about 4 feet across Foster Island, grading, a substantial amount of fill, and the loss of all vegetation within the construction area. Option K requires a much more invasive construction approach than Options A and L and would result in a considerable change to the setting of the presumed TCP. In addition, it would have the highest potential to disturb archeological resources that may be present. This degree of construction disturbance and extreme change to the setting of the historic island could be determined to be an adverse effect on the presumed TCP.

Under Option K, a large amount of dewatering is likely to occur, and such dewatering might cause settlement of adjacent loose sands. The settlement could affect nearby structures or utilities in the zone of influence. However, typical design and construction mitigation measures identified for the

SR 520, I-5 to Medina project would reduce the chance of structure settlement. These measures include using cofferdams, slurry cutoff walls, and secant pile walls to minimize the amount of water flowing into the construction area.

All options could result in increased noise at the Edgewater Condominiums from demolition and construction of the new west approach to the Evergreen Point Bridge. However, this effect would be temporary in nature and would not be so severe that it would affect the integrity of the property, and therefore is not considered an adverse effect.

Lake Washington Area

All options would demolish the floating bridge, which is individually eligible for the NRHP, resulting in an adverse effect.

Eastside Transition Area

The NRHP-eligible James Arntson House and the WHR-eligible Helen Pierce House may experience noise associated with demolition of the east approach of the Evergreen Point Bridge and pile-driving for construction of the new approach structure. Both structures may experience fugitive dust and short-term noise associated with construction of the bridge maintenance facility and dock, which would be located approximately 160 feet north of the existing bridge. The specific effects on historic properties that may result from construction will be fully analyzed once the details of construction are further developed and more information on the potential effects is available.

How would the project minimize or mitigate adverse effects on cultural resources during construction?

General minimization efforts that would avoid or minimize effects on historic properties include:

- Monitor and ensure compliance with local noise regulations for construction and equipment operation. See the Noise Discipline Report (Attachment 7) for additional construction noise information.
- Protect facades of affected historic buildings from an accumulation of excessive dirt and dust during construction, and/or clean them in an appropriate manner at the conclusion of construction. WSDOT would consult with the SHPO and/or the Seattle Historic Preservation Officer before implementing any protection or cleaning methods.
- Maintain pedestrian and vehicular access to historic properties, except for unavoidable short periods during construction.
- Locate any construction sheds, barricades, or material storage away from historic properties, and avoid obscuring views of historic properties.

Specific measures to minimize or mitigate adverse effects on particular historic properties include the following:

- Every effort should be made to keep the Canoe House accessible and functional during and after construction of the tunnel in Option K and the new bascule bridge in Option L. Every precaution would be taken to ensure that the Canoe House is not affected during construction of the tunnel or bridge by vibrations, excavations, or heavy equipment. No construction staging or storage would occur on the Canoe House property.
- Under Option A, safeguards would be put in place to ensure that the existing historic Montlake Bridge is protected and not physically affected in any way by construction of the new Montlake Bridge.
- Under Option A, the two residences on Montlake Boulevard NE that would be removed should be recorded to Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) standards before demolition, and all architectural elements should be salvaged for re-use, such as historic doors, windows, brackets, and moldings. After these two houses are removed, solid fencing should be erected and vegetation planted to form a landscape screen and buffer between the construction on Montlake Boulevard and the adjacent house on East Shelby Street.
- Under all options, because of its geographical location relative to the existing bridge, the project cannot entirely avoid Foster Island. However, prior to the opening of the Montlake Cut in 1918, Foster Island was two islands separated by about 250 feet of open water. The replacement bridge would be built largely north of the existing bridge. It would cross the present-day Foster Island in a position mostly within the gap between the two historic islands. Project engineers may be able to refine the bridge alignment to further maximize this geographical avoidance.
- If a significant archaeological site was present on Foster Island, potential adverse effects could be avoided or greatly minimized by using sophisticated remote sensing techniques (such as ground-penetrating radar) to identify subsurface cultural features. If successful, such techniques could help WSDOT reduce the amount of excavation necessary in areas with known resources to avoid or minimize potential adverse effects on archaeological properties.
- Under all options, consultation among WSDOT, FHWA, the SHPO, and interested tribes would be necessary to identify mitigation for any potential adverse effect on Foster Island.
- Under all options, removal of the Evergreen Point Bridge could be mitigated by providing Level II HABS/HAER documentation for the bridge, which would include photographs, measured drawings, and a written history component. Additional mitigation for the loss of the

bridge could include funding of a bridge- or transportation-related community project, such as a survey of historic transportation elements in the area, funding of an educational display at a local museum on historic bridges of the Puget Sound region, or funding of an educational publication or development of a Web site featuring historic bridges and/or transportation.

6.7 Noise

During construction, people living and working near the construction areas would be affected by noise from a variety of activities and equipment. The loudest construction-related activities are pile-driving and demolition of existing structures.

KEY POINTS

Noise

During construction, people living and working near construction areas would be affected by noise from a variety of activities and equipment. The loudest construction-related noise activities are pile-driving and demolition of existing structures. Typical construction equipment is expected to have a range of 62 to 105 dB maximum noise level 50 feet from the source.

Major non-impact noise-producing equipment would include concrete pumps, cranes, excavator, haul trucks, loaders, and tractor trailers. Maximum noise levels from this equipment could reach up to 92 dB at the nearest residences (50 to 100 feet).

How would construction of the project affect noise levels?

Typical construction equipment used for many roadway and structural activities would be required to complete the project. Table 6.7-1 lists equipment typically used for this type of project, the activities they would be used for, and the corresponding maximum noise level under normal use measured at 50 feet.

State and local regulations restrict the noise from construction activities by imposing different noise limits, depending on type of activity and time of day and property type (less noise is allowable for residential than for commercial or industrial receivers). Table 6.7-2 lists the state-wide (Washington Administrative Code) noise regulations for the three types of receivers. Daytime construction noise is exempt from these regulations, however.

The City of Seattle has developed a set of construction-specific allowable noise-level limits that would apply to construction within the Seattle city limits. Unlike the Washington Administrative Code, the Seattle Municipal Code does not exempt daytime construction activities from regulation. Although the City of Seattle has not generally enforced its regulations on daytime construction activities for highway projects, the contractor should discuss its plans with the City of Seattle and obtain variances as needed. Table 6.7-2 includes the maximum permissible sound levels depending on the district designations of the sound source and receiving properties (rural, residential, commercial, or industrial).

Most project construction could be performed within the indicated noise limits shown in Tables 6.7-2 if the work was performed during normal daytime hours. If construction occurred at night, WSDOT would be required to meet the noise level requirements for night-time construction or obtain a noise variance from the governing jurisdiction.

Table 6.7-1. Construction Equipment Maximum Noise Levels

Equipment	Typical Expected Project Use	Maximum Noise Level (dB)[a]
Air compressors	Used for pneumatic tools and general maintenance - all phases	70 - 76
Backhoe	General construction	78 - 82
Concrete pump	Pumping concrete	78 - 82
Concrete saws	Concrete removal, utilities access	75 - 80
Crane	Materials handling, removal, and replacement	78 - 84
Excavator	General construction and materials handling	82 - 88
Forklifts	Staging area work and hauling materials	72
Haul trucks	Materials handling, general hauling	86
Jackhammers	Pavement removal	74 - 82
Loader	General construction and materials handling	86
Pavers	Roadway paving	88
Pile-drivers	Support for structure and hillside	99 - 105
Power plants	General construction use, nighttime work	72
Pumps	General construction use, water removal	62
Pneumatic tools	Miscellaneous construction work	78 - 86
Service trucks	Repair and maintenance of equipment	72
Tractor trailers	Material removal and delivery	86
Utility trucks	General project work	72
Vibratory equipment	Shore up hillside to prevent slides and soil compacting	82 - 88
Welders	General project work	76

[a]Typical maximum noise level under normal operation as measured at 50 feet from the noise source.

The noise limits listed in Table 6.7-2 have some exemptions, shown in Table 6.7-3, which are based on the minutes per hour that the noise limit can be exceeded.

Impact Construction

Impact construction equipment (e.g., pavement breakers, pile-drivers, jackhammers, and sandblasting tools) may exceed the noise level limits given in Table 6.7-2 in any 1-hour period between 8 a.m. and 5 p.m. on weekdays and 9 a.m. and 5 p.m. on weekends and holidays. The allowable noise limit exceedance also applies to other types of equipment or devices that create

impulse or impact noise or that are used as impact equipment, as measured at a property line or at 50 feet from the equipment, whichever is greater. However, the noise limits listed in Table 6.7-4 should never be exceeded.

Table 6.7-2. City of Seattle and Washington State – Maximum Permissible Sound Levels

District of Sound Source	District of Receiving Property within the City of Seattle (Maximum Allowable Sound Level in dB[a])		
	Residential	Commercial	Industrial
Residential[b]	55	57	60
Commercial	57	60	65
Industrial	60	65	70

[a]Applies to daytime hours of 7:00 a.m. to 10:00 p.m.
[b]The levels are reduced by 10 dB between the hours of 10:00 p.m. and 7:00 a.m. on weekdays and 10:00 p.m. and 9:00 a.m. on weekends.

Table 6.7-3. Washington State and City of Seattle Exemptions for Short-Term Noise Exceedances

Minutes Per Hour	Adjustment to Maximum Sound Level
15	+5 dB
5	+10 dB
1.5	+15 dB

Note: For any source of sound that is periodic, has a pure tone component, or is not measured with an impulse sound level meter, the levels are reduced by 5 dB. Electrical substations are exempt from this penalty.

Table 6.7-4. City of Seattle – Maximum Noise Levels for Impact Types of Equipment

Noise Level (dB)	Time Duration Exceedance Prohibited
90	Continuously
93	30 minutes
96	15 minutes
99	7.5 minutes, with noise variance for noise levels over 99 dB

Non-Impact Construction

Major non-impact noise-producing equipment used during construction could include concrete pumps, cranes, excavators, haul trucks, loaders, and tractor trailers. Maximum noise levels could reach 82 to 86 dB at the nearest residences (50 to 100 feet) for non-impact construction activities related to site preparation work (see Table 6.7-1). Other less noticeable noise-producing equipment expected to be used during site preparation work includes backhoes, air compressors, forklifts, water pumps, power plants, service trucks, and utility trucks.

The loudest non-impact noise sources during new bridge construction would include cement mixers, concrete pumps, pavers, haul trucks, and tractor trailers. The cement mixers and concrete pumps would be required to construct the superstructure and substructure for the new bridges. The pavers and haul trucks would be used to provide the final surface on the roadway and to construct the transitions from the at-grade roadways to the new structures. Maximum noise levels would range from 82 to 94 dB at the closest receiver locations.

Demolition

Demolition of the existing structures would require heavy equipment such as concrete saws, cranes, excavators, hoe-rams, haul trucks, jackhammers, loaders, and tractor trailers. Maximum noise levels could reach 82 to 92 dB at the nearest residences.

Table 6.7-5 identifies the noise levels for each of the four typical construction phases as measured at 50 feet from the construction activity. The construction noise analysis assumed that there would be construction staging areas along the proposed bridges during demolition and construction. The noise levels listed in Table 6.7-5 are the typical maximums and would occur only periodically during the heaviest periods of construction. Actual hourly noise levels could be substantially lower than those stated, depending on the level of activity at that time.

Using the information provided in Table 6.7-5, WSDOT projected typical construction noise levels for several distances from the project work area. Exhibit 6.7-1 shows general noise level versus distance for the phases of construction.

Pile-Driving

The loudest noise during construction preparation would come from pile-drivers and vibratory equipment. Pile-driving can produce maximum short-term noise levels of 99 to 105 dB at 50 feet. Actual levels can vary, depending on the distance and topographical conditions between the pile-driving location and the receiver location. Furthermore, the noise levels for pile-driving depend on the frequency of pile-driving and the number of

pile-drivers operating at one time in any one area. In general, pile-driving would take place throughout the established in-water work windows indicated in Chapter 3, or for approximately 3 months at a time, but would be limited to daylight hours to minimize effects on neighborhoods and meet the requirements of the local noise ordinance.

Table 6.7-5. Noise Levels for Typical Construction Phases at 50 Feet from Work Site

Scenario[a]	Equipment[b]	L_{max}[c] (dB)	L_{eq}[d] (dB)
Construction preparation	Air compressors, backhoes, concrete pumps, cranes, excavators, forklifts, haul trucks, loaders, water pumps, power plants, service trucks, tractor trailers, utility trucks, vibratory equipment	94	87
Construction of new structures and roadway paving	Air compressors, backhoes, cement mixers, concrete pumps, cranes, forklifts, haul trucks, loaders, pavers, pumps, power plants, service trucks, tractor trailers, utility trucks, vibratory equipment, welders	94	88
Miscellaneous activities, including striping, lighting, and signs	Air compressors, backhoes, cranes, forklifts, haul trucks, loaders, pumps, service trucks, tractor trailers, utility trucks, welders	91	83
Demolition of currently existing structures	Air compressors, backhoes, concrete saws, cranes, excavators, forklifts, haul trucks, jackhammers, loaders, power plants, pneumatic tools, water pumps, service trucks, utility trucks	93	88

[a] Operational conditions under which the noise levels are projected.
[b] Normal equipment in operation under the given scenario.
[c] L_{max} is an average maximum noise emission for the construction equipment under the given scenario.
[d] L_{eq} is an energy average noise emission for construction equipment operating under the given scenario.
Note: Noise levels are combined worst-case levels for all equipment at a distance of 50 feet from work site.

Exhibit 6.7-1. **Hourly Maximum Construction Noise for Different Distances from Construction Site**

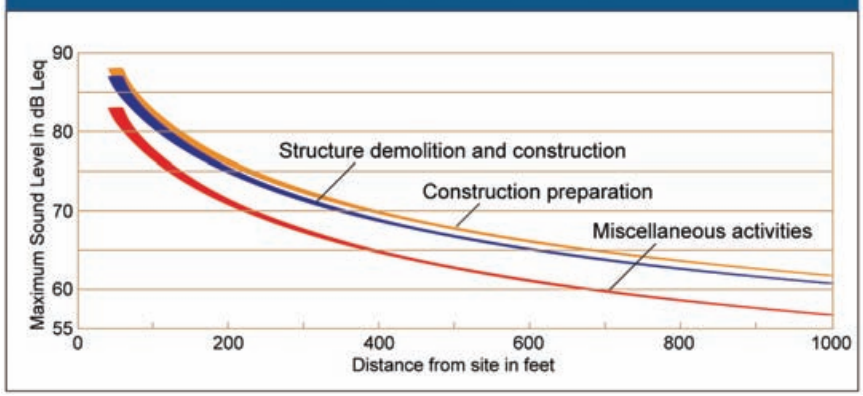
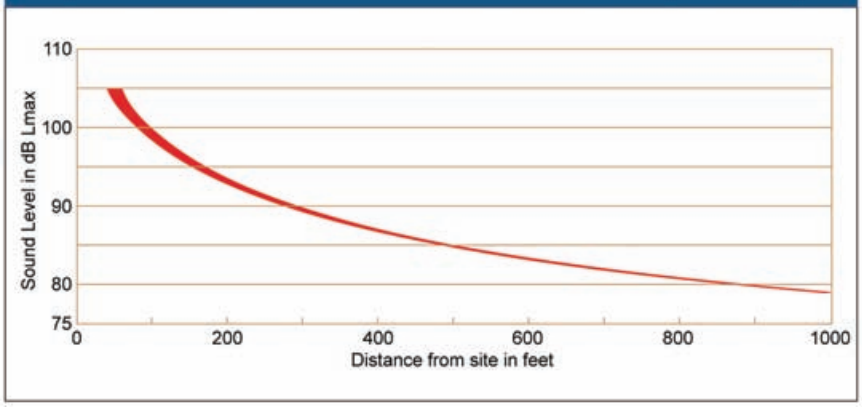


Exhibit 6.7-2 is a graph of maximum pile-driving noise levels versus distance from 50 to 1,000 feet. Exhibit 6.7-3 was created based on this graph and illustrates how noise levels would change based on distance. The contours shown should serve as a conservative estimate because they ignore attenuation resulting from ground and atmospheric absorption (see Section 6.11 for information on construction noise and wildlife).

Exhibit 6.7-2. **Typical Maximum Pile Driving Noise Levels Assuming 105 dB at 50 Feet**



Construction Vibration Effects

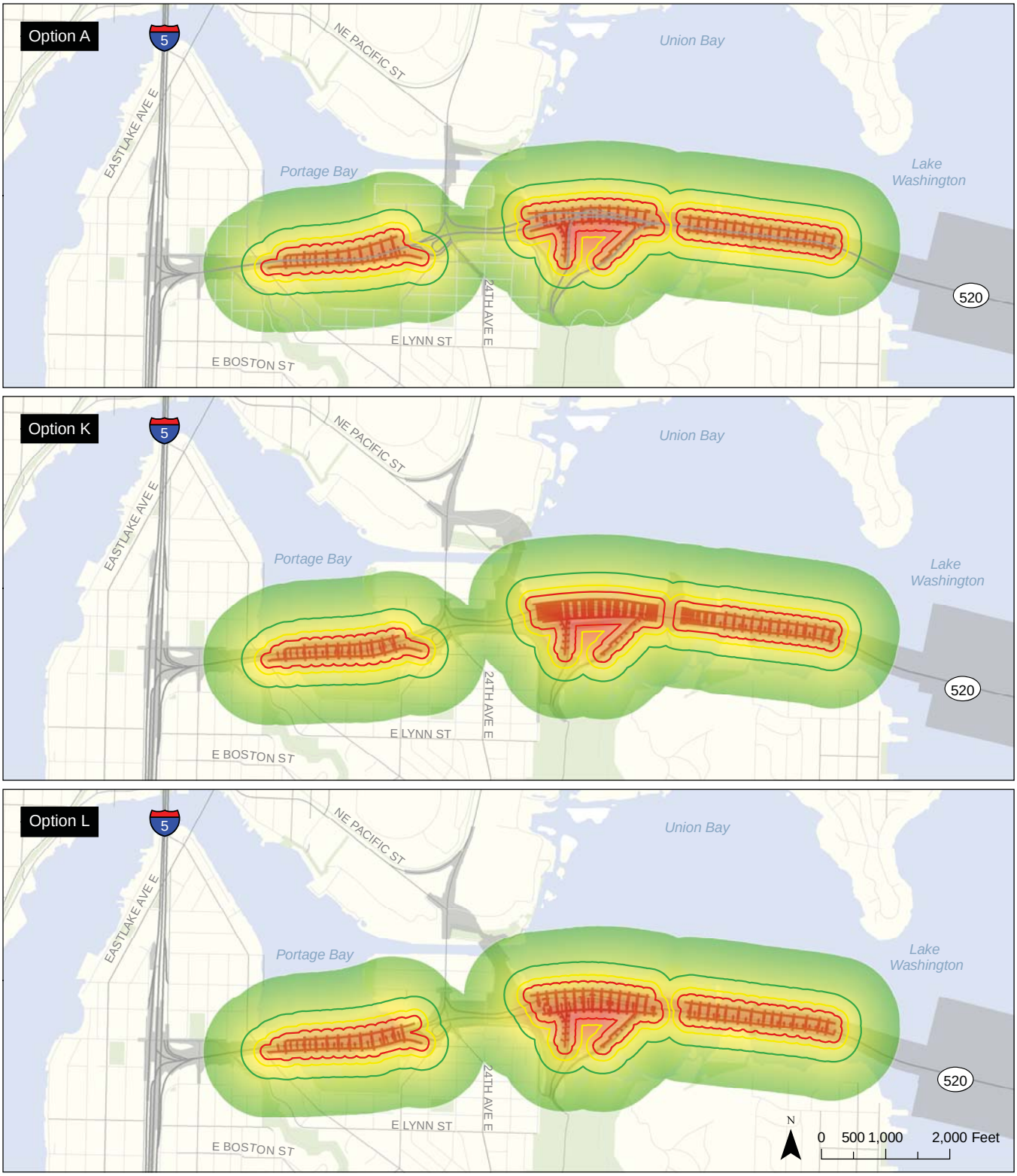
Vibration associated with general construction can affect surrounding receivers. Of particular concern are receivers that use vibration-sensitive equipment such as medical or scientific equipment. In the project area, the only such known receiver located close to construction activities is the NOAA Northwest Fisheries Science Center, which uses floating electron microscopes in its research.

Major vibration-producing activities would occur primarily during demolition and preparation for the new bridges. Activities that have the potential to produce a high level of vibration include pile-driving, vibratory shoring, soil compacting, and some hauling and demolition activities. Vibration effects from pile-driving or vibratory sheet installations could occur within 50 to 100 feet of sensitive receivers. It is unlikely that vibration levels would exceed 0.5 inch per second at distances greater than 100 feet from the construction sites. The building in which the electron microscopes are housed at the NOAA facility is more than 100 feet from the construction area. However, WSDOT would work with NOAA to ensure that researchers are aware of potential vibration-producing activities near the facility.

Effects of Suboptions

- Adding the suboptions to Options A and K would result in no measurable difference to the noise effects described above.
- Adding northbound capacity on Montlake Boulevard to Option L would result in construction-related local noise impacts to the Burke-Gilman trail and adjacent portions of the UW campus including outdoor areas near the Edmundson Pavilion athletic building entrance. Adding left-turn access from Lake Washington Boulevard to the south SPUI ramp would result in no measurable differences to noise effects.

Exhibit 6.7-3 **Pile Driving Noise versus Distance**



Pile driving noise versus distance:

- 100-feet, (noise levels of 99 dB)
- 200-feet, (noise level of 93 dB)
- 400-feet, (noise level of 87 dB)
- 1000 ft buffer around work bridge
- Construction work bridge
- Limits of construction

How can the project minimize negative effects during construction?

The project will need to meet the requirements of the City of Seattle Noise Ordinance and the conditions of any variance that may be obtained. Several construction noise and vibration abatement methods—including operational methods, equipment choice, or acoustical treatments—could be implemented to limit the effects of construction. The methods used might vary in the project corridor, depending on the type of construction. The following sections describe some of the more common construction noise and vibration abatement methods.

Operation of construction equipment would be avoided wherever possible within 500 feet of any occupied dwelling unit in evening or nighttime hours (7:00 p.m. to 7:00 a.m.) or on Sundays or legal holidays, when noise and vibration would have the most severe effect. Mufflers would be required on all engine-powered equipment, to be installed according to the manufacturer's specifications, and all equipment would be required to comply with EPA equipment noise standards.

WSDOT could limit activities that produce the highest noise levels (such as hauling, loading spoils, jackhammering, and using other demolition equipment) to between 7:00 a.m. and 7:00 p.m.

Mitigation of the noise associated with pile-driving could include augering rather than driving piles (although using an auger is not likely to be feasible for this project) or limiting the time the activity could take place. Other less effective methods of reducing noise from pile-driving are coating the piles, using pile pads, or using piston mufflers.

A construction log could be kept for each of the construction staging areas. The log could contain general construction information such as the time an activity took place, type of equipment used, and any other information that might help with potential noise effects.

A complaint hotline could also be established to investigate noise complaints and compare them to the construction logs. A construction monitoring and complaint program could help to ensure that all equipment met state, local, and manufacturer's specifications for noise emissions. Equipment not meeting the standards would be removed from service until proper repairs were made, and the equipment re-tested for compliance. This procedure would be used for all haul trucks, loaders, excavators, and other equipment that would be used extensively at the construction sites and that would contribute to potential noise effects.

The following is a list of potential noise mitigation measures for inclusion in the construction contract specifications:

- Require all engine-powered equipment to have mufflers that were installed according to the manufacturer's specifications.
- Require all equipment to comply with pertinent EPA equipment noise standards.
- Limit use of impact pile-drivers, jackhammers, concrete-breakers, saws, and other forms of demolition equipment to daytime hours of 8:00 a.m. to 5:00 p.m. on weekdays, with more stringent restrictions on weekends.
- Minimize noise by regular inspection and replacement of defective mufflers and parts that do not meet the manufacturer's specifications.
- Install temporary or portable acoustic barriers around stationary construction noise sources and along the sides of the temporary bridge structures, where feasible.
- Locate stationary construction equipment as far from nearby noise-sensitive properties as possible.
- Shut off idling equipment.
- Reschedule construction operations to avoid periods of noise annoyance identified in complaints.
- Notify nearby residents and institutions whenever extremely noisy work would be occurring.
- Restrict the use of back-up beepers during evening and nighttime hours.

Additional noise mitigation measures may be implemented as more details on the actual construction processes are developed and as part of any noise variance that may be required.

WSDOT could require vibration monitoring of all activities that might produce vibration levels at or above 0.5 inch per second whenever there are structures located near the construction activity. This would include pile-driving, vibratory sheet installation, soil compacting, and other construction activities that have the potential to cause high levels of vibration. Virtually no method effectively eliminates vibration effects from construction; however, by restricting and monitoring vibration-producing activities, vibration effects from construction can be kept to a minimum.

6.8 Air Quality

During construction, soil-disturbing and demolition activities, diesel equipment, traffic congestion, and paving with asphalt would generate emissions that may temporarily affect air quality in the vicinity of the construction activity.

KEY POINT

Air Quality

Soil-disturbing activities, diesel equipment, traffic congestion, and paving with asphalt would generate emissions that may temporarily affect air quality in the vicinity of the construction activity.

Would air quality change as a result of construction of the project?

Construction activities would temporarily generate particulate matter and small amounts of carbon monoxide and nitrogen oxides (NO_x). If not properly mitigated, fugitive dust would escape from the construction site and from soil blown from uncovered trucks carrying materials. Vehicles leaving the site would deposit mud on public streets, which would become a source of dust after it dries. Construction equipment would emit CO and NO_x. These emissions would be greatest during the excavation phase because most emissions would be associated with removing dirt from the site.

Dust emissions would be associated with demolition, land clearing, ground excavation, cut-and-fill operations, and roadway and interchange construction. Particulate emissions would vary from day to day, depending on the level of activity, specific operations, and weather conditions. Particulate emissions would depend on soil moisture, the soil's silt content, wind speed, and the amount and type of equipment operating. The quantity of particulate emissions would be proportional to the area of the construction operations and the level of activity.

In addition to particulate emissions, heavy trucks and construction equipment powered by gasoline and diesel engines would generate CO and NO_x in exhaust emissions. These emissions would be temporary, would be limited to the immediate area surrounding the construction site, and would contribute a small amount compared to automobile traffic in the project area.

Some construction phases (particularly during paving operations using asphalt) would result in the emission of volatile organic compounds (VOCs) and odorous compounds. Odors might be detectable to some people near the project site, and would be diluted as distance from the site increases.

The total emissions and the timing of the emissions from these sources would vary depending on the phase of the project and the option chosen. CO emissions from construction activities that exceed 5 years must be evaluated for conformity with the State Implementation Plan. When a preferred alternative is selected, a detailed construction emissions analysis will be conducted and included in the Final EIS.

Effects of Suboptions

- Adding the suboptions to Option A or K would result in no measurable difference in the air quality effects described above.
- Adding a northbound lane on Montlake Boulevard north of the Montlake Cut may result in construction-related air quality impacts to the Burke-Gilman Trail and adjacent portions of the UW campus,

including outdoor areas near the Edmundson Pavilion athletic building entrance. Impacts may include fugitive dust, construction equipment engine exhaust emissions, VOCs, and odorous compounds emitted during asphalt paving. Adding left-turn access from Lake Washington Boulevard to the SPUI south ramp would not change air quality effects.

What are the proposed mitigation measures for construction of the project?

For temporary effects during construction, state law requires construction site owners and/or operators to take reasonable precautions to prevent fugitive dust from becoming airborne. Fugitive dust may become airborne during demolition, material transport, grading, driving of vehicles and machinery on and off the site, and through wind events. WSDOT will comply with the procedures outlined in the Memorandum of Agreement between WSDOT and the PSCAA for controlling fugitive dust (WSDOT 1999). Controlling fugitive dust emissions may require some of the following actions:

- Spray exposed soil with water or other dust suppressant to reduce emissions of PM_{10}.
- Design construction phases to keep disturbed areas to a minimum.
- Use wind fencing to reduce wind disturbance of soils.
- Minimize dust emissions during transport of excavated or fill materials by wetting down loads or by ensuring adequate freeboard (space from the top of the material to the top of the truck bed) on trucks.
- Promptly clean up spills of transported material on public roads.
- Restrict traffic onsite to reduce soil upheaval and the tracking of material onto roadways.
- Provide wheel washers to remove particulate matter from vehicles before it is carried offsite.
- Locate construction equipment and truck staging areas away from sensitive receptors as practical and in consideration of potential effects on other resources.
- Cover dirt, gravel, and debris piles as needed to reduce dust and wind-blown debris.
- Street cleaning in immediate area of construction and along haul routes.

Federal regulations have been adopted that require the use of ultra-low-sulfur diesel fuel in on-road trucks, and regulations will require the use of these fuels for construction equipment by 2010. These regulations will require reduction of the sulfur content of diesel fuel from its current level of 500 ppm to 15 ppm—a 97 percent reduction—and they will result in a decrease in both sulfur dioxide (SO_2) and PM emissions from these engines. WSDOT encourages its contractors through contract specifications to

reduce idling time of equipment and vehicles and to use newer construction equipment or equipment with add-on emission controls.

6.9 Energy and Greenhouse Gases

How would construction of the project affect energy consumption?

Project construction would consume energy during the mining and production of construction materials, during transportation of materials to the project site, and during operation of construction equipment and worker vehicles. In general, the amount of energy consumed is proportional to the cost of building the project. To calculate how much energy would be used for construction of the project, WSDOT applied a construction energy consumption factor, developed by the California Department of Transportation, to the estimated cost of the 6-Lane Alternative design options (for more details, see the Energy Discipline Report in Attachment 7).

Option K would consume the most energy because of the larger amount of construction activity required for the depressed interchange and tunnel, which is reflected in the higher construction costs. The energy needs are estimates intended to show approximate relative differences among the build options. Actual use could be different based on specific equipment and construction methods. Table 6.9-1 shows the energy use anticipated for the 6-Lane Alternative.

KEY POINT

Energy

Onsite construction energy requirements for Option A would be 15,006,000 MBtu. Option K has the largest onsite construction energy consumption estimate of 34,299,000 MBtu. Option L's onsite energy consumption estimate is 18,781,000 MBtu.

Table 6.9-1. Estimated Onsite Energy Use for Construction

Alternative	MBtu
6-Lane Alternative: Option A	15,006,000
6-Lane Alternative: Option K	34,299,000
6-Lane Alternative: Option L	18,781,000

DEFINITION

CO_2 Equivalent

CO_2 equivalents provide a universal standard of measurement against which the impacts of releasing different greenhouse gases can be evaluated. Every GHG has a global warming potential (GWP), a measure of the impact that particular gas has on the additional heat/energy that is retained in the Earth's ecosystem through the addition of this gas to the atmosphere.

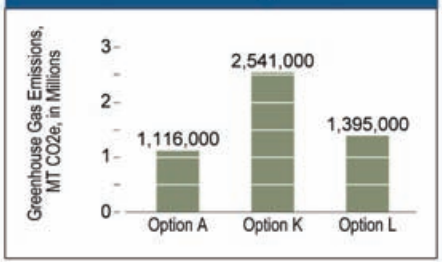
Effects of Suboptions

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

What effect would project construction have on greenhouse gas emissions?

Exhibit 6.9-1 shows the estimated construction GHG emissions for each design option (including pontoon transport) in CO_2 equivalents. The emissions estimates include both facility construction activities and towing the pontoons to the site, as well as construction of additional pontoons not covered in the SR 520 Pontoon Construction Project.

Exhibit 6.9-1. **Project Construction GHG Emissions Comparison**



Option A would have the lowest level of construction GHG emissions. Construction of Option L would produce approximately 20 percent more emissions than Option A, while Option K would have the highest level of construction emissions—more than twice the emissions of Option A.

These estimates are based on the results of the energy analysis. Because the energy analysis was based on applying an energy conversion factor to project costs, GHG emissions are directly proportional to project costs. This methodology does not rely on an in-depth analysis of construction techniques and equipment. Actual GHG emissions would depend on the type of equipment used and construction methods chosen.

KEY POINT

Greenhouse Gas

During construction, the primary source of GHG emissions would be fuel combustion, with the GHG emissions being proportional to the amount of energy used. Option A would have the lowest level of construction GHG emissions. Option K has the highest emissions potential at roughly double that of Option A. Option L would produce approximately 20 percent more emissions than Option A and less than Option K.

Effects of Suboptions

- Adding the suboptions to Option A, K, or L would result in no measurable difference in the greenhouse gas emissions described above.

How can the project minimize negative effects during construction?

Building the proposed project would consume large amounts of energy that would no longer be available for other purposes. WSDOT would undertake measures to conserve energy during construction. Possible measures might include:

- Limiting idling of equipment
- Encouraging carpooling of construction workers
- Locating staging areas near work sites

Because GHG emissions are related to fuel consumption, any steps taken to minimize fuel use would reduce GHG emissions as well.

6.10 Water Resources

Construction effects on surface water bodies were evaluated by determining construction actions that could disturb soil and in-water sediments and by evaluating the potential for accidental spills of hazardous materials. Potential effects on surface water bodies from constructing any of the three options of the 6-lane Alternative in the study area would be related to the installation, use, and removal of work bridges, construction of the new bridges, and demolition of the existing bridges.

KEY POINT

Water Resources Effects during Construction

All options could result in increased turbidity in water bodies near construction areas. From the land-based activities, the most likely source would be from construction-exposed soils eroding during rainstorms and flowing into nearby water bodies. For water-based activities, the most likely source would be from direct disturbance of sediments through activities such as placing columns or anchors. Another potential risk is spills of pollutants such as fuel and lubricants. WSDOT would use construction BMPs to minimize the potential for these effects.

How would construction of the project affect water resources?

Construction activities can affect water quality by increasing turbidity (suspended soils or sediments) in water bodies. Turbidity can harm aquatic life, especially benthic (sediment-dwelling) organisms that are an important part of the food chain. It can result from direct disturbance of sediments through activities like placement of columns or anchors, or from

construction-exposed soil eroding during rainstorms and flowing into nearby water bodies. Another potential risk to water quality during construction occurs when pollutants like fuel or lubricants are spilled. Such spills can seriously damage nearby aquatic organisms and habitat.

Effects of Suboptions

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

What measures would be used to protect water quality during construction?

Construction of the project would require the development and implementation of TESC and SPCC plans (WSDOT 2008a). A TESC plan would detail the risk of erosion in different parts of the study area and would specify BMPs to be installed prior to construction activities. The SPCC plan would be prepared by the contractor(s) selected to complete the final design of the project, as required by WSDOT Standard Specification 1-07.15(1) (WSDOT 2008a). Each of these plans would include performance standards based on state regulations, such as turbidity and total suspended solids (TSS) levels in stormwater discharged from construction staging and work areas. Construction of any of the three options for the 6-Lane Alternative would require compliance with approved TESC and SPCC plans that would be based on these performance standards.

DEFINITION

Turbidity

Turbidity refers to small particles of sediment suspended in water. It makes water cloudy, limiting light and visibility for aquatic organisms, and can smother gravel and eggs in salmon spawning areas. Construction BMPs are used to control turbidity during in-water work.

The project would also require a concrete containment and disposal plan (CCDP). In the CCDP, the contractor would explain how concrete would be managed, contained, and disposed of. The contractor would also identify how high pH levels would be mitigated to ensure that pH of concrete used does not harm aquatic species.

Containment of pollutants during in-water construction is key to maintaining water quality. WSDOT would implement the following procedures as appropriate for demolition materials and wastes (solid and liquid), soil or dredging materials, or any other materials that could cause or contribute to exceedances of water quality standards. More specific information on in-water construction is proved in Section 6.11, Ecosystems.

- Construction stormwater pollution prevention planning - Preparation of a stormwater pollution prevention plan (SWPPP), TESC plan, and a SPCC plan would be completed prior to any construction or demolition activities.
- Floating sediment curtain - This barrier is designed to control the settling of suspended solids (silt) in water by providing a controlled area of containment. This turbidity is usually created by disrupting natural

conditions through construction or dredging in the marine environment. The containment of settleable solids is desirable to reduce the impact area.

- Underwater containment system/temporary cofferdam - The contractor could implement this element to prevent sediment, concrete, and steel debris from mixing with surface waters. Examples could include a temporary cofferdam, an oversized steel casing, or another type of underwater containment system that is developed by the contractor. This application would allow demolition work to be completed on and around an underwater structure and isolate the work zone. The system would also allow work to be completed at or below the mudline as determined by removal requirements by the state and the contractor. Construction water and slurry within the containment system could be removed, treated, and pumped to an approved discharge location upon completion of the demolition.
- Construction water treatment systems - These systems generally consist of temporary settling storage tanks, filtration systems, transfer pumps, and an outlet. The temporary settling storage tank provides residence time for the large solids to settle out. The filtration system is provided to remove additional suspended solids below an acceptable size (typically 25 microns). The pumps provide the pressure needed to move the water through the filter and then to an acceptable discharge location. Once the solid contaminants are filtered out, the clean effluent is then suitable for discharge to a municipal storm drain or an acceptable discharge location. These systems can be located on a work bridge or a barge.
- Oil containment boom - An oil containment boom is a floating barrier that can be used to contain oil and help to prevent the spread of an oil spill by confining the oil to the area in which it has been discharged. The purpose of containment is not only to minimize the extent of pollution but to assist in the removal of the oil.

How would project construction affect groundwater?

Construction of roadways and bridges may temporarily alter the flow of groundwater. For example, groundwater could be affected by the temporary piles being driven into the ground to provide a framework for bridge or wall construction. Piles or shafts act as obstacles that groundwater must flow around. Such effects are typically minimal and would be temporary in nature.

Another construction activity that could temporarily alter groundwater flow is the use of dewatering wells to lower groundwater levels to allow subsurface construction in a dry environment. The need for dewatering would be fairly minor for all options except Option K, which would require

KEY POINT

Dewatering

The need for dewatering is expected to be high for Option K, due to the fact that much of the large excavation for the depressed SPUI would occur below the water level.

substantial excavations below the water table and could consequently involve disposal of large volumes of water.

Groundwater generated from dewatering activities during construction would be stored either in temporary treatment ponds at or near the location of the permanent stormwater treatment wetlands or in portable steel tanks. Water would be stored for a sufficient amount of time to allow particles to settle out, or chemicals could be used to reduce suspended particles to achieve discharge water quality requirements before the water is discharged to an approved location. For more details, see the Water Resources Discipline Report in Attachment 7.

Effects of Suboptions

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

How can the project minimize negative effects during construction?

WSDOT would avoid or minimize adverse effects on surface water bodies during construction by implementing water quality pollution control measures outlined in the required TESC and SPCC plans and by following permit conditions. Potential sedimentation effects during construction would be minimized in the following ways:

- Avoidance - Use of retaining walls to minimize effects on streams, wetlands, and other critical areas. Staging areas and stockpiling areas would be located well away from streams and lakes.
- Prevention - Use of appropriate BMPs to reduce the risk of erosion and reduce or minimize the chance of sediments entering project water bodies. Erosion and sediment control measures could include mulching, matting, and netting; filter fabric fencing; quarry rock entrance mats at construction area exits; sediment traps and ponds; surface water interceptor swales and ditches; and placing construction material stockpiles away from streams. In addition, a TESC plan would be prepared and implemented to minimize and control pollution and erosion from stormwater. Erosion and sediment control BMPs would be properly implemented, monitored, and maintained during construction.

Even with BMPs, some temporary, short-term water quality effects from sediment (such as increases in turbidity) could occur, particularly during large storm events. However, the magnitude of these effects would be small, and not likely to adversely affect overall water quality within project area water bodies.

6.11 Ecosystems

Installing the construction bridges, finger piers, and detour bridge over Portage Bay and Union Bay could affect nearby wetlands. Some construction effects would be the removal of vegetation and shading in these areas and an increased potential for erosion and sediment discharge into the wetlands.

Construction activities in the waters of Lake Washington could have a variety of effects on fish and other aquatic species. These activities include noise and vibration from pile-driving; temporary shading from work and detour bridges; and turbidity resulting from anchor placement and column removal in the lake. Wildlife and habitat may be affected by temporary clearing and shading of vegetation. The Ecosystems Discipline Report (Attachment 7) provides a detailed technical discussion on potential effects.

KEY POINT

Wetlands

All options include construction bridges, work platforms, staging areas, and construction access roads that would have transient effects on wetlands due to vegetation clearing or shading during the 5- to 7- year construction period. In general, Option K would have more effects on wetlands from construction than Options A and L. Option K would also result in more wetland buffer being filled and shaded during construction.

How would construction of the project affect wetlands?

All the 6-Lane Alternative options include construction bridges, work platforms, staging areas, and construction access roads that would have temporary effects on wetlands due to vegetation clearing or shading during the 5- to 7-year construction period. In general, Option K would have more effects on wetlands from construction than Options A and L. Option K would also result in more wetland buffer being filled and shaded during construction.

Tables 6.11-1 and 6.11-2 summarize construction effects on wetlands and Exhibits 6.11-1, 6.11-2, and 6.11-3 illustrate those effects that would occur within the Portage Bay and west approach areas. There would be no construction effects on wetlands associated with the I-5, Montlake, floating bridge, or Eastside transition areas.

Table 6.11-1. Wetland and Wetland Buffer Fill or Clearing During Construction (acres)

		Portage Bay Area	Montlake Area	West Approach Area	Total Effect
Option A	Wetland	<0.1	0	0.6[a]	0.6
	Buffer	0.2	<0.1	2.6[a]	2.8
Option K	Wetland	0	0.5	0.5	1.1
	Buffer	0.1	0.7	2.3	3.2
Option L	Wetland	<0.1	0.1[b]	0.4	0.5
	Buffer	0.1	0.5	2.2	2.8

[a]Adding the Lake Washington Boulevard ramps to Option A would result in clearing an additional 0.1 acre of wetland and 0.4 acre of buffer in the west approach area.

[b]Adding northbound capacity on Montlake Boulevard to Option L would result in additional clearing of less than 0.1 acre of wetland in the Montlake area.

Note: Totals may not add up due to rounding.

Table 6.11-2. Wetland and Wetland Buffer Shading During Construction (acres)

		Portage Bay Area	Montlake Area	West Approach Area	Total Effect
Option A	Wetland	1.7	0	4.7[a]	6.4
	Buffer	0.1	0	0.1[a]	0.2
Option K	Wetland	1.8	<0.1	6.4	8.1
	Buffer	0.1	<0.1	0.4	0.6
Option L	Wetland	1.8	<0.1	4.6	6.4
	Buffer	0.1	<0.1	0.1	0.2

[a]Adding the Lake Washington Boulevard ramps to Option A would result in shading of an additional 0.4 acre of wetland and less than 0.1 acre more buffer in the west approach area.
Note: Totals may not add up due to rounding.

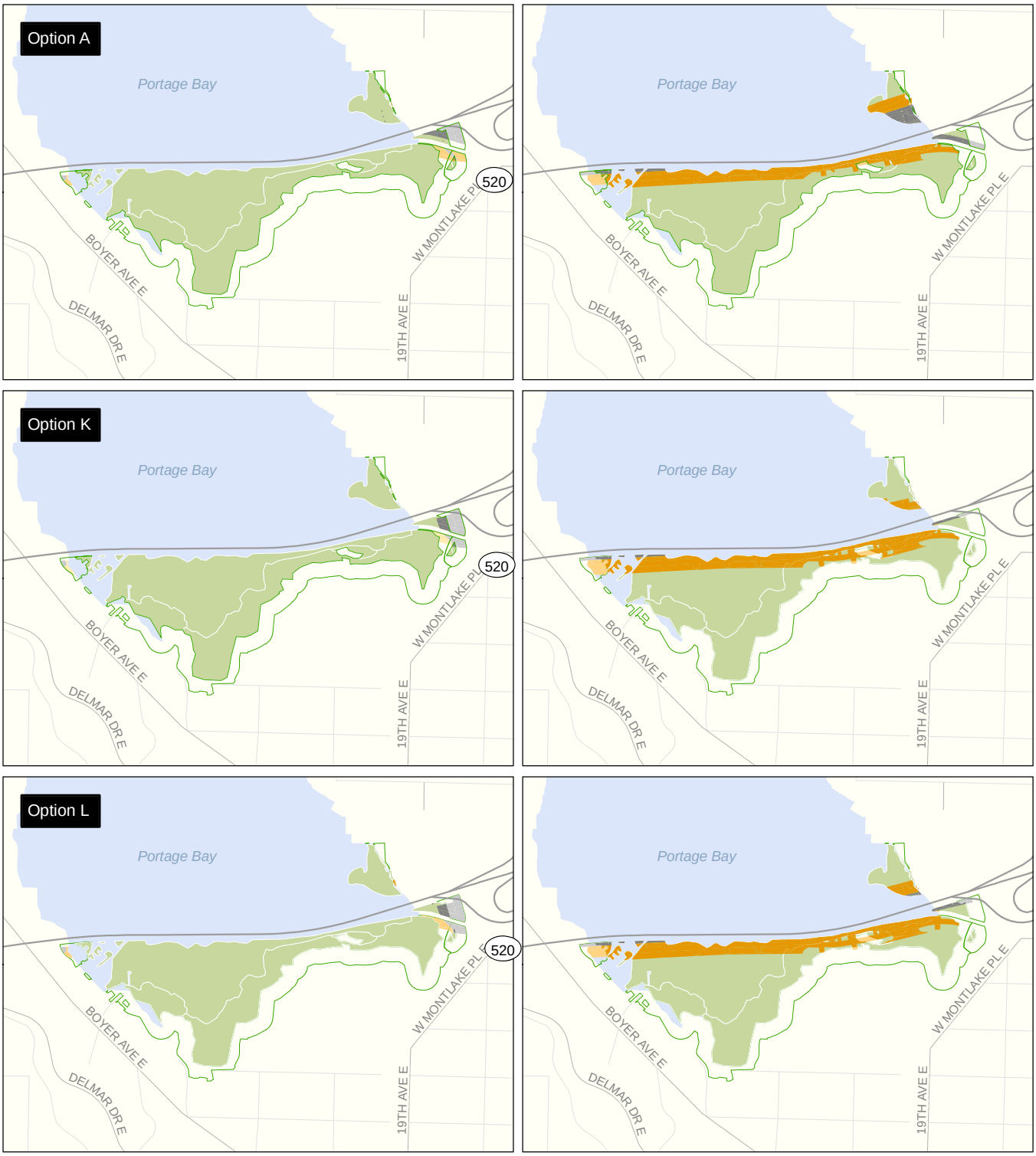
Construction of Option K would result in more wetland area filled than Options A and L. Options A and L would result in equal areas of wetland shaded, most of which are aquatic bed wetland; Option K would shade 1.7 acres more than options A and L. Options A and L would result in similar areas of wetland buffer filled and shaded. Option K would cause slightly more wetland buffer fill and shading than Options A and L (Table 6.11-2). Exhibits 6.11-1 and 6.11-3 illustrate the shading effects from construction for each option.

Effects of Suboptions

- Adding the Lake Washington Boulevard ramps to Option A would result in an additional clearing of 0.1 acre of wetland and 0.4 acre of buffer. An additional 0.4 acre of wetland and less than 0.1 acre of buffer would be shaded.
- Adding an eastbound HOV direct-access ramp and changing the profile of Option A to a constant slope in the west approach area would result in no measurable differences to the effects discussed for Option A.
- Adding the eastbound off-ramp to Montlake Boulevard to Option K would result in no additional wetland effects. This is 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 clear an additional 0.1 acre of wetland. This effect would be from construction activities related to the increased capacity and the relocation of a stormwater facility.

Exhibit 6.11-1. Construction Effects on Wetlands and Buffers in Portage Bay

Fill and Clearing Effects | **Shading Effects**



Construction Effect
- Affected wetland
- Affected buffer

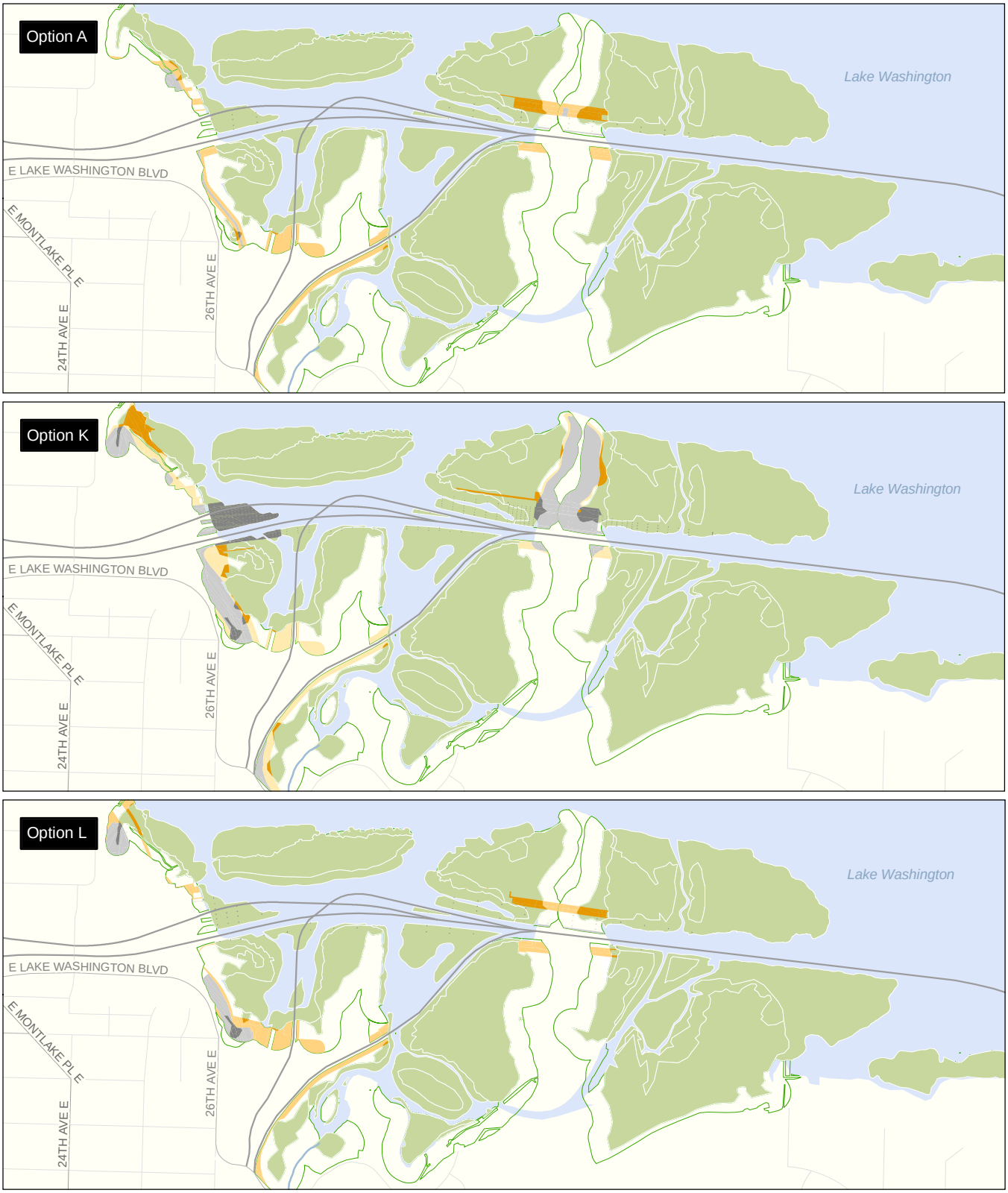
Operational Effect
- Affected wetland
- Affected buffer

- Wetland
- Wetland buffer

N

0 250 500 1,000 Feet

Exhibit 6.11-2. Construction Fill and Clearing Effects on Wetlands and Buffers in Lake Washington



Construction Effect
- Affected wetland
- Affected buffer

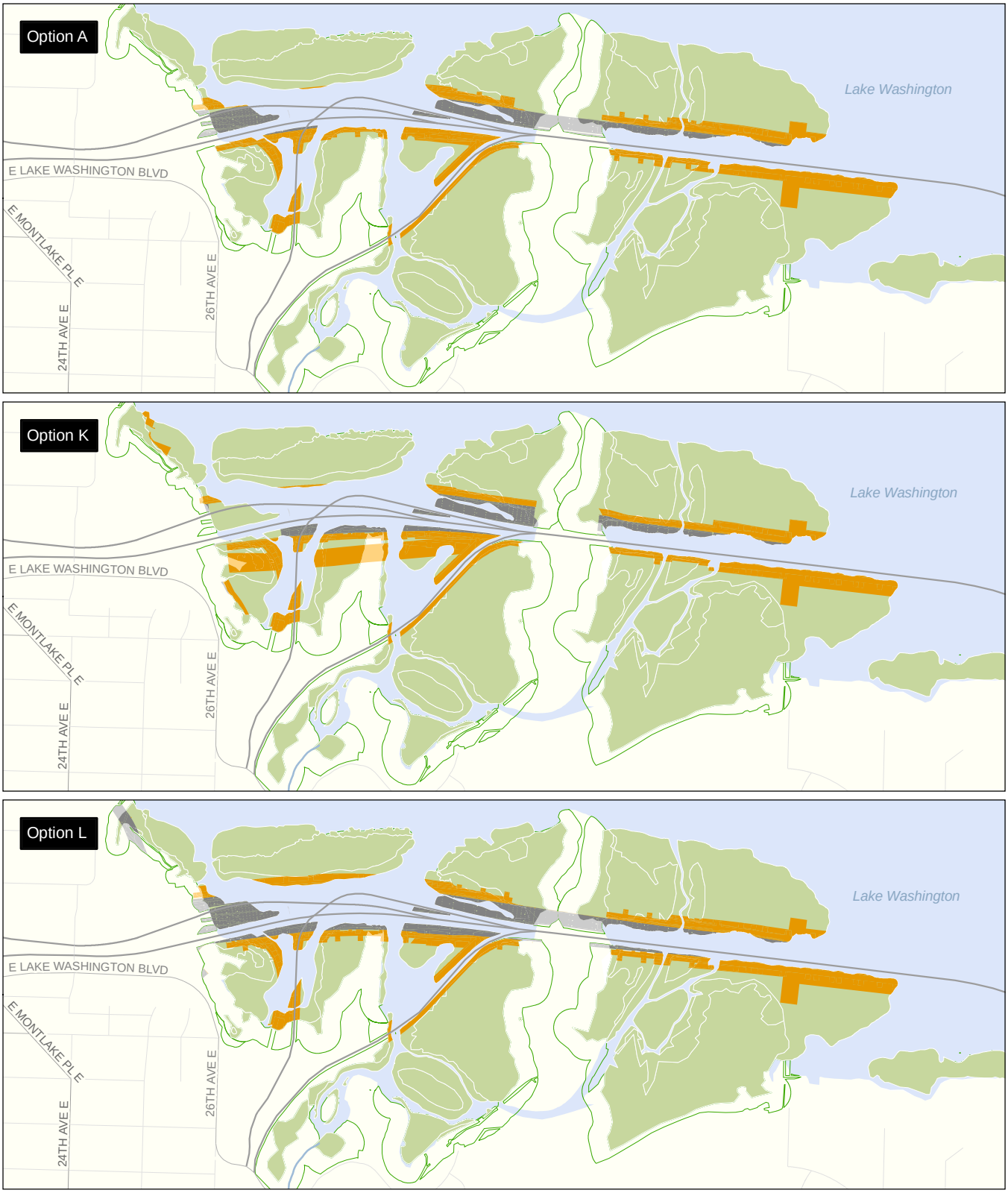
Operational Effect
- Affected wetland
- Affected buffer

- Wetland
- Wetland buffer

N

0 250 500 1,000 Feet

Exhibit 6.11-3. Construction Shading Effects on Wetlands and Buffers in Lake Washington



Construction Effect
- Affected wetland (shade)
- Affected Buffer (shade)

Operational Effect
- Affected wetland (shade)
- Affected buffer (shade)

- Wetland
- Wetland buffer

N

0 250 500 1,000 Feet

How would construction of the project affect fish resources?

Pile-Driving

Substantial in-water pile-driving activities would be required for all 6-Lane Alternative options to construct construction bridges in shallow-water areas that cannot be accessed by barge. The underwater sound levels generated during pile-driving activities can disturb or alter the natural behavior and habitat of juvenile salmonids and other aquatic species, and in some instances cause injury or mortality.

Adult salmonids migrating through the project area to their spawning grounds may be affected by in-water construction activities, particularly pile-driving. Although adult Chinook normally pass through the Ship Canal in 2 or fewer days (Fresh et al. 1999, 2000) and sockeye average 6 days (Newell and Quinn 2005), high summer temperatures and dissolved oxygen levels in the Ship Canal and Lake Union have been shown to delay or alter migration timing and, in extreme conditions, likely contribute to pre-spawn mortality. Elevated in-water noise levels from project construction activities could be an additional stressor on fish, potentially affecting fish migration behavior (timing and routes). However, based on the relatively fast migration times of adult salmonids through the Ship Canal and the employment of noise attenuation BMPs to reduce in-water noise, additional effects due to construction noise would likely be relatively minor.

The type and magnitude of pile-driving effects on fish and other aquatic species depend on a wide range of factors, including the type and size (diameter) of pile, type of pile-driving hammer, pile-driving duration, amount of air in the water, size and number of surface waves, depth of the site, sound minimization BMPs employed, and the geologic conditions that govern the penetration rate of the pile and the penetration depth required. These variables influence either the magnitude of the initial sound or the attenuation of the sound as it radiates out from the source. The magnitude of potential effects on aquatic species also decreases with range, as sound levels attenuate with distance from the source.

It is anticipated that at least some of the pile-driving activities can be accomplished using a vibratory hammer to minimize in-water sound levels (see sidebar). However, some impact pile-driving would be needed to achieve adequate load-bearing capacity for the piles. The temporary piles would be removed with a vibratory hammer.

Site-specific evaluations were conducted in October 2009 to assess the sound levels generated by pile-driving in Portage Bay, Union Bay, and Lake Washington for this project. These evaluations will help identify appropriate measures to minimize the potential effects of pile-driving on fish and other aquatic species. Specific in-water construction periods will also be

Pile-Driving

Two general types of pile-driving hammers (impact and vibratory) are available and expected to be used for the project. Impact hammers use various mechanical methods to pound the piles into the substrate, while a vibratory pile-driver uses an oscillatory motion and heavy weight to force the pile into the substrate. These differences result in substantially different underwater sound characteristics and potential effects on fish, with vibratory methods having less effect than impact methods.

In October 2009, WSDOT tested various pile-driving methods to better identify anticipated noise levels and test potential migration measures. Preliminary results indicate that the use of bubble curtains during construction would result in substantial reductions in underwater noise.

This BMP produces a wall of bubbles around the pile being driven to reflect, absorb, and attenuate the sound energy emanating from the pile.

established through the project permitting process to minimize potential effects of pile-driving and other in-water construction activities on salmonid species. Complete results of the studies were not available prior to preparation of this section, but will be included in the FEIS. In general, however, the results indicated that the use of bubble curtains during construction substantially reduces underwater noise. These results have been shared with resource agencies and will be further refined during the permitting process.

Despite noise minimization measures planned for pile-driving activities in the study areas, the number of temporary piles needed for the construction bridges and the overall duration of pile-driving activity would likely have a negative effect on fish and other aquatic organisms in the area.

Cofferdam

Cofferdams may be used to provide a dry work area when construction takes place within a water body.

Other In-Water Construction

In addition to the pile-driving activities, in-water construction would also include installing temporary cofferdams to isolate some work areas from the aquatic environment and minimize the overall effects. Cofferdams are generally constructed with steel sheet piling vibrated into the mud with a vibratory hammer—typically to approximately 20 feet below the mud line. The area within the cofferdam is then de-watered to effectively isolate additional construction activities from the aquatic environment. While the cofferdams are intended to minimize biological and water quality effects of construction, the dewatering process can result in stranded fish within the enclosure. To minimize such effects, WSDOT fish handling and exclusion protocols would be implemented (WSDOT 2009).

Construction activities would also include replacing upland and in-water permanent bridge support structures (piers). The types of piers to used would vary based on geological conditions, groundwater depth, water depth (if the structure is placed in water), and weight of the superstructure and the load it will carry. Substructure foundation types expected for this project include spread footings (upland only), drilled shafts, concrete columns, and water- or mudline shaft caps (see Chapter 3). Regardless of the type of substructure, construction BMPs would be implemented to minimize the potential adverse effects on fish or aquatic habitat.

In-water construction activities may generate turbidity plumes from disturbance of the bottom sediments. Increased turbidity could occur during installation of temporary piles, but turbidity risks are considered more likely to occur during removal of support piles for the temporary work platforms. Turbidity can also be affected by BMPs implemented to offset other construction effects, such as bubble curtains and cofferdams.

Increased turbidity can alter the behavior of aquatic species, impair their ability to capture prey, and in severe cases cause physical injuries such as gill abrasion in fish. However, the relatively calm and protected waters in

Portage Bay and Union Bay are unlikely to cause substantial dispersion of any suspended sediment that might occur from construction activities, thereby limiting the overall potential to affect aquatic species or habitat conditions. The depth of Lake Washington would limit the effects of turbidity from placement of the bridge anchors because fewer species are expected to use the deeper areas of the lake. Implementation of appropriate BMPs also expected to minimize potential effects of any turbidity resulting from construction activities.

After completion of the replacement bridge structures, the existing bridges would be removed. Most of this work would be conducted from the construction bridges, although the bridge support structures would be cut off at the mud line and would require additional in-water work. The pier removal process would occur inside of dewatered cofferdams to minimize potential effects on the aquatic environment. Appropriate BMPs would be implemented to minimize any spillage of demolition material into Lake Washington.

Other potential short-term construction effects could include spills of hazardous materials (e.g., oil and gasoline), chemical contaminants, or other pollutants. To reduce potential spills of petroleum and hydraulic fluids in sensitive areas, maintenance or fueling of construction equipment, vehicles, or vessels would not be allowed within 200 feet of the area waterways. Materials that modify pH—including cement, cement grindings, and cement saw cuttings—would be managed so that they will not contaminate surface water runoff or otherwise enter the area waterways. The contractor would be required to submit a spill prevention and control plan and a concrete containment and disposal plan before beginning work (see Section 6.10, Water Resources).

Demolition of Existing Structures

Over-water demolition would require special precautions to prevent debris or concrete-laden water from entering the natural water system. Standard overwater and in-water construction and demolition BMPs would be implemented in accordance with environmental regulatory permit requirements. Therefore, this process is expected to have limited potential to affect either fish or aquatic habitat in the area. BMPs would include use of cofferdams to isolate in-water work areas from the aquatic environment. In-water structures would be demolished to the mud line, leaving foundations below the mud line intact wherever possible.

How would construction lighting affect fish and aquatic habitat?

Lighting associated with nighttime highway construction could affect the distribution and behavior of fish, depending on intensity and proximity to the water. Responses to light are not universal for all species of fish. Some species school and move toward light sources: some predatory fish are adapted for hunting in low light intensities, while others are attracted to higher light intensities (Machesan et al. 2005). Artificial lighting could also affect the migration rates of fish passing through the project area. Slower migration rates through the area, when combined with the ambient light levels, could result in greater exposure of fish to predators.

The potential effects of construction lighting on fish behavior and predator-prey relationships could be greater in the shallow water areas, which occur in much of the project area, where the light could affect the entire water column. However, construction lighting is expected to be concentrated in the work areas, decreasing effects from light with distance

KEY POINT

Fish Habitat

All of the options would create larger areas with reduced fish habitat functions, primarily due to increased shading by the work bridges and barges. Compared to the existing structures, the proposed overwater structures are about twice as wide for all options. All options would result in the same area of temporary overwater structure in the Portage Bay Area (3 acres). 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.

from the work area. The effects from lighting would be the same for all options.

How would overwater structures affect fish and aquatic resources?

In-water shading from construction bridges could directly or indirectly affect fish, including native salmonids, by reducing the growth of aquatic vegetation in shallower areas, as well as potentially affecting salmonid migration and the distribution of predators. However, the influence of in-water shading on fish behavior is complex and varies by width and height of the structures, species, time of year, and other factors.

Additional aquatic habitat shading would also occur from construction barges temporarily anchored in the deeper water areas. Using barges as staging and construction platforms would likely reduce the overall effects of bridge construction because they do not require in-water pile-driving, would result in only limited disturbance of the substrate, and would remain in any one place for a shorter time than the work bridges.

Temporary support piles for work bridges would also affect substrate in nearshore areas of Portage Bay and Union Bay. Tables 6.11-3 and 6.11-4 show the area of shading from temporary overwater structure and the number of support piles for each 6-Lane Alternative design option.

KEY POINT

Lake Bottom Substrate

All options would result in the temporary loss of lake bottom substrate that supports aquatic vegetation as a result of work bridges.

Table 6.11-3. Shading from Temporary Overwater Structures (acres)

Location	Portage Bay	West Approach	East Approach	Total
Option A	3.0	7.6[a]	0.3	10.9
Option K	3.0[b]	8.5	0.3	11.8
Option L	3.0	7.0	0.3	10.3

[a]Adding the Lake Washington Boulevard ramps to Option A would require additional interim structures in the west approach area totaling less than 0.1 acre resulting in less shading from temporary overwater structures in the west approach area.

[b]Adding the eastbound off-ramp to Montlake Boulevard to Option K would result in additional temporary shading from structures in the Portage Bay area totaling less than 0.1 acre.

Portage Bay

Effects from shading and temporary support piers would be the same for all 6-Lane Alternative options in Portage Bay. The construction work bridges constructed within Portage Bay would result in approximately 3 acres of temporary overwater shading (Table 6.11-3). Although these work bridges are relatively narrow (typically 30 feet), the combined shading effects of the existing bridge structure, the two work bridges, and the new highway bridge structures could result in shading an area as wide as

approximately 350 feet. The construction work bridge would remain in place for more than 5 years in Portage Bay.

Table 6.11-4. Temporary Support Piles and Affected Area of Substrate

Alternative	Portage Bay	West Approach	East Approach	Total
Option A	741 (2,327 sq/ft)	1,987[a] (6,241 sq/ft)	165 (520 sq/ft)	2,893 (9,099 sq/ft)
Option K	698[b] (2,194 sq/ft)	2,797 (8,786 sq/ft)	165 (520 sq/ft)	3,660 (11,500 sq/ft)
Option L	704 (2,211 sq/ft)	1,984 (6,233 sq/ft)	165 (520 sq/ft)	2,853 (8,964 sq/ft)

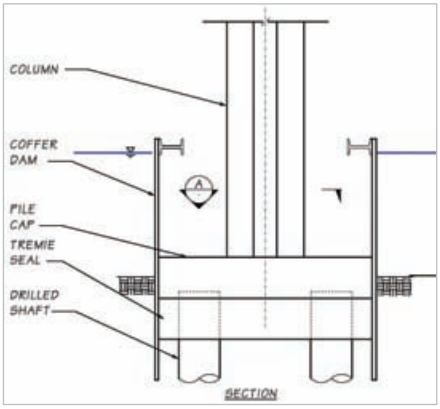
[a]Adding the Lake Washington Boulevard ramps to Option A would require an additional 55 temporary support piles and affect an additional 170 square feet in the west approach area.

[b]Adding the eastbound off-ramp to Montlake Boulevard to Option K would require the installation of 3 additional in-water piles near the southeast shoreline of the Portage Bay area.

Note: Area calculations were based on 24-inch-diameter piles.

The construction of these construction bridges would require installing hollow steel support piles in Portage Bay (Table 6.11-4). The piles would be installed in bents (rows) spaced at approximately 30-foot intervals, with 3 to 4 piles per bent. An additional 300 temporary piles would be needed to support falsework for constructing the architectural treatment on the replacement bridge. All temporary support structures would be removed after completion of the new Portage Bay Bridge.

The proposed permanent bridge support structures would have drilled shaft foundations (see sidebar illustration). This would minimize potential effects on fish and other aquatic species by eliminating the need for impact pile-driving to construct foundations for the columns. Installation of column shaft cap configurations would require cofferdams, while individual columns could be installed inside a larger diameter sleeve.



Cross Section of Drilled Shaft Cap and Column Configuration

Effects of Suboptions

- Adding the potential suboptions to Option A or L would not result in an increase in effects on fish and aquatic resources in the Portage Bay Area.
- Construction activities related to the eastbound off-ramp to Montlake Boulevard under Option K would require the installation of three additional in-water piles near the southeast shoreline of Portage Bay. Adding the suboption to Option K would only slightly increase the effects on fish and aquatic habitat from construction.

Montlake Area

Option A

Construction activities in the Montlake area that could affect fish and aquatic habitat under Option A would be from building a second bascule bridge across the Montlake Cut. This second bridge would be approximately 60 feet wide, similar to the existing bridge. Construction would likely be limited to overwater work. In-water work (such as the placement of structures) would be done from barges. Most of the activity to construct the bridge supports would occur in upland areas away from aquatic habitat areas, where the potential for effects is expected to be substantially reduced. There would be no construction work bridges and, as a result, no shading.

Implementation of appropriate BMPs would prevent sediment from exposed soil areas or wet concrete from entering Montlake Cut, and WSDOT would install containment systems to prevent debris from falling into the water. No refueling of equipment would occur within 200 feet of the embankments. Other standard BMPs for construction activities adjacent to water bodies would also be implemented to further reduce the potential for effects on aquatic habitats and species.

Option A Suboptions

- Adding the potential suboptions to Option A would not affect fish resources in the Montlake area.

Option K

Option K would require considerably more in-water and over-water construction in the Montlake area compared to Options A and L. The roadway through the Montlake area under Option K would be wider than Option A. This increased width is primarily to accommodate the depressed SPUI and the separate access ramps to and from the twin Montlake Cut tunnels. The SPUI would be constructed below the high-water elevation of the lake.

The lower approach elevation in the Washington Park Arboretum would require approximately 328 5-foot-diameter in-water drilled shaft piles, and approximately 2,160 micropiles in the boat section east of the SPUI to support the new roadway. These 10-inch-diameter micropiles would be supported by the drilled shaft structures. It is assumed that the drilled shafts in the SPUI area would be installed within a large cofferdam encompassing the entire SPUI footprint.

The SPUI would also require extensive ground-disturbing excavation work along the Washington Park Arboretum shoreline and the construction of retaining walls extending out into the water, which would also increase the potential risks of water quality effects from runoff from the extensive area of exposed soils. However, construction BMPs would minimize such risks.

Because the soils beneath the Montlake Cut are soft and high in water content, SEM tunnel construction would require freezing the ground to stabilize the soil prior to tunneling. The work would start from two "freeze pits" at the north and south portals to the SEM tunnels. Pipes to convey a freezing liquid would be inserted all the way around the tunnel circumference at about 5-foot intervals. It would take approximately 6 months for the soil to become sufficiently frozen for work to begin. After the initial freezing has been completed and the frozen barrier is in place, the refrigeration capacity required to maintain the frozen barrier would be substantially reduced.

Option K Suboption

- Adding the eastbound off-ramp to Montlake Boulevard to Option K would result in no additional effects on fish resources in the Montlake area.

Option L

Under Option L, the Montlake interchange and the Lake Washington Boulevard ramps would be replaced with a new elevated SPUI at the Montlake shoreline. A new bascule bridge would span the east end of the Montlake Cut from the new interchange to the intersection of Montlake Boulevard NE and NE Pacific Street. Similar to Option A, the construction of the bascule bridge would likely result in limited effects on fish and aquatic habitat because the construction activities would require limited in-water work, except for maneuvering and anchoring barges in the Montlake Cut to install the pre-fabricated bridge spans. There would be no construction work bridges and as a result no shading from construction.

Option L Suboptions

- Adding the potential suboptions to Option L would not affect fish resources in the Montlake area.

West Approach Area

All of the 6-Lane Alternative design options would replace the west approach to the Evergreen Point Bridge with a new 6-lane bridge. In-water construction would occur from construction bridges where water depths would allow construction staging from barges. Potential effects associated with project construction in this geographic area would be similar to those described above for Portage Bay. Construction work bridges would remain in place for about 4.5 years for Options A and L, and 5.5 years for Option K.

Pile-driving in the waters south of Marsh Island would likely affect only fish in this relatively confined area. The dense aquatic vegetation in this area likely limits the use of this habitat by fish, particularly salmonids. Pile-driving in waters east of Foster Island would produce a much larger area of potential effect. Based on existing methods of estimating noise, in-water pile-driving without mitigation in this area could produce sound levels exceeding the fish

disturbance threshold for up to 6.2 miles (for a 30-inch-diameter pile). Radiating in all directions, the potential disturbance zone would likely extend across Lake Washington and Union Bay, except for areas where the sound waves would be blocked by a land mass. However, testing done in October 2009 (as described earlier in this section) indicates that, with mitigation, the disturbance zone would be considerably smaller. The Final EIS will include additional information on noise effects and mitigation.

Option A

Option A would include approximately 7.6 acres of overwater work bridges in the west approach area. The bridges would require the use of 1,987 temporary support piles, which would occupy about 6,241 square feet of lake bed (Table 6.11-4). This is similar to Option L, but less than Option K.

Option A Suboptions

- Adding the Lake Washington Boulevard ramps would increase the number of construction support piles by 55 and the amount of lake bed disturbed by 170 square feet.
- Adding an eastbound HOV direct-access ramp or changing the profile of Option A to a constant slope in the western approach would not change the construction effects on fish and aquatic resources.

Option K

In addition to the construction work bridges, Option K would include a 60-foot-wide temporary detour bridge between Foster Island and the eastern shoreline of the Arboretum to bypass traffic around SPUI construction. This temporary detour bridge would be supported by hollow steel piles, similar to the construction of the construction bridges. This over-water structure would be in place for approximately 4 years. The temporary detour and work bridges would require approximately more temporary piles than the other options (Table 6.11-4), occupying approximately 8,786 square feet of lakebed.

Option K would include substantially greater in-water and over-water work compared to the No Build Alternative and Option A or L. The primary differences in potential effects on fish and aquatic habitat in Option K include the number of pilings needed for in-water and nearshore work bridge and falsework, the number of permanent in-water piers constructed, and the amount of riparian and nearshore areas disturbed.

The construction of Option K would result in 8.5 acres of shading in the west approach area, which is more shading than the other options (see Exhibits 3-9 and 3-12). While the tunnels would result in less overwater and riparian construction at the Montlake Cut compared to Options A or L, the construction process would be substantially more complex and extensive. This would increase the potential for inadvertent effects on fish and aquatic

resources in the Montlake and Union Bay areas should construction BMPs fail.

Option L

The amount of shade and fill from constructing the construction bridges would be slightly less under Option L than the other two options (see Table 6.11-3).

Construction of Option L would require an estimated 1,984 temporary piles to support the work bridges through the west approach area, which is approximately the same as Option A but less than Option K. The amount of area occupied by these temporary piles is also very similar to Option A (see Table 6.11-4).

Lake Washington Area

The floating portion of the Evergreen Point Bridge would be the same for all options and suboptions. It would be built over deep open-water habitat where bridge columns are not feasible, between 160 and 190 feet north of the existing bridge. Rows of three 10-foot-tall concrete columns would support the roadway above the pontoons. The new bridge would be approximately 22 feet higher than and approximately twice as wide as the existing bridge.

Construction of the new floating bridge would occur north of the existing bridge to maintain traffic flow. Construction on the lake would take place from barges and boats. Pontoon installation would begin by connecting the longitudinal pontoons in pairs (see Chapter 3), and then continue by connecting the supplemental stability (flanker) pontoons to the north and south sides of the longitudinal pontoons. The superstructure for the 6-lane configuration would then be constructed on the longitudinal pontoons, and the structure would be permanently anchored into place. Once traffic had been shifted to the new floating bridge, the existing floating bridge would be demolished. However, there would be a period (12 to 16 months) when two bridge structures would be floating in Lake Washington. The increased structures, as well as the barges and equipment used during construction, would have more intensive effects on fish in the area than the completed bridge would have during operation (see the Construction Techniques and Activities Discipline Report in Attachment 7).

Approximately 54 anchors would be used to secure the new bridge in place. The two main anchor types are: (1) gravity anchors for harder lakebed materials and sloped areas (near the shores), and (2) fluke anchors for soft bottom sediments and flat areas (middle of the lake). Both types of anchors would be connected to the floating pontoons with steel cables.

The installation of new bridge anchors could disrupt lake bed sediments and the organisms living in them. These sediments and organisms would be displaced and the organisms might die or disperse to adjacent areas.

However, these effects would be localized and short-term. Water quality in the immediate vicinity of the in-water construction activities could become turbid, although such turbidity would probably not reduce lake productivity or directly harm fish and invertebrates.

The installation of the fluke anchors would likely result in greater turbidity levels than the gravity anchors. However, the expected low currents in the deep portions of the lake would limit the distribution of the turbidity plume and minimize potential effects on fish and other aquatic resources.

Temporary anchors would be used to hold the pontoons in place before they are finally positioned along the new bridge alignment. These temporary anchors are not expected to substantially affect the lakebed sediments, although the placement could result in the loss of aquatic organisms living on or in the sediments.

East Approach Area

Construction of the east approach would take place from work bridges and barges. The westbound (north) side of the structure would be constructed first. Cofferdams would be installed, and bridge substructure and superstructure would be built as previously described for the over-water structures. The construction process would require construction bridges and falsework.

The construction process would require work bridges and falsework. Approximately 0.3 acre of open-water habitat would be shaded during construction from construction work bridges (see Table 6.11-3). The work bridges and falsework would require hollow steel piles, which would occupy approximately 520 square feet of lake bed. This could result in the loss of potential sockeye salmon spawning habitat during the construction period if the support piers were to be installed in preferred spawning habitat. In-water construction activities would occur during approved in-water construction windows, which would minimize the effects on sockeye spawning. As noted in Chapters 4 and 5, sockeye use has not been documented in this area since the 1970s.

Bridge Maintenance Facility

The Lake Washington area would also include construction of a bridge maintenance facility under the proposed east approach. This facility would consist of an upland facility constructed in the hillside under the east approach, as well as a pier and berth extending several hundred feet offshore for a maintenance vessel.

The new bridge maintenance facility would be built at the same time as the east approach. Permanent and temporary access roads, retaining walls, and the dock substructure would be constructed while the westbound (north) half of the east approach is being built. Construction of the bridge maintenance facility would not require any traffic revisions. Construction

activities occurring at this stage would include excavation and embankment work, retaining wall construction, and roadway paving. Appropriate sediment control BMPs would be implemented to prevent the discharge of sediment from the disturbed construction areas into Lake Washington.

How would project construction affect federally and state listed fish species?

SR 520 Corridor

The above sections described the potential construction effects on fish resources, including habitat of 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, current analysis indicates that the project is not expected to negatively affect overall salmonid populations or ESUs in the watershed. There would be no substantial differences among the design options regarding the effects of construction on ESA-listed fish species.

There are no state-listed species in the SR 520 Corridor.

Effects of Suboptions

- Adding the suboptions to Option A, K, or L would result in no measurable difference to the effects on ESA-listed fish species as described above.

Pontoon Construction and Transport

As discussed in Chapter 4, bull trout and green sturgeon occur in the Grays Harbor area. Construction of the supplemental stability pontoons is not expected to result in adverse effects on these species, as only limited openings of the casting basin gates would occur to release the pontoons into open water. Openings would occur on high tides, reducing the potential for effects on nearshore habitat, and measures would be in place to minimize any fish stranding in the casting basin. Key habitat elements for these species are generally close to shore and well away from the shipping lanes where pontoon transport would occur. There are no state-listed species in the Grays Harbor area.

How would construction of the project affect wildlife and habitat?

All the 6-Lane Alternative options could affect wildlife by removing vegetation and wildlife habitat, increasing shading, and adding noise disturbance during construction. Lighting associated with nighttime highway construction could also disturb wildlife.

KEY POINT

Wildlife Habitat

All of the options would affect wildlife by 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 during construction.

For all three options, most temporary vegetation clearing for construction would occur in the west approach area, and Urban Matrix would be the most commonly affected habitat type (Table 6.11-5). Option K would result in more clearing for construction than the other options. Construction work bridges would also result in shading and Option K would have the most shading, primarily because of the construction detour bridge (Table 6.11-6).

Table 6.11-5. Vegetation Removal for Construction by Geographic Area (acres)

	I-5 Area	Portage Bay Area	Montlake Area	West Approach Area	Floating Bridge Area	Total Effect
Option A	2.9	0.8	0.9	6.4[a]	1.4	12.4
Option K	2.9	1.3	4.7	4.5	1.4	14.9
Option L	2.9	1.3	3.2[b]	5.1	1.4	14.0

[a]Adding the Lake Washington Boulevard ramps to Option A would result in an additional 0.5 acre of vegetation removal in the west approach area during construction.
[b]Adding northbound capacity on Montlake Boulevard to Option L would result in an additional 0.2 acre of vegetation removal in the Montlake area.

Table 6.11-6. Shading from Construction by Cover and Habitat Type (acres)

Area, Cover Type, and Habitat Type	Option A	Option K	Option L
Parks and Other Protected Areas	0.8[a]	2.4	1.2
Open Water	5.2	5.6	4.7
Urban Matrix	0.4	0.6	0.5
Total	6.4	8.7	6.6

[a]Adding the Lake Washington Boulevard ramps to Option A would result in an additional 0.5 acre of shading from construction.

Similar levels and durations of noise from construction activities under all options could temporarily affect bird species, including nesting and foraging waterfowl and bald eagles near the Arboretum.

Noise disturbance from construction activities could occur over almost 7 years for Options A and L and for 7.5 years for Option K. If the project is developed in phases, however, these periods would be drawn out over a longer time. Noise and associated construction activity can disturb wildlife by causing stress and altering behavior patterns and, therefore, interfering with activities such as reproduction and feeding. The degree of disturbance would depend on noise level, timing, and duration of construction activities, as well as the sensitivity of the individual animals. In general, most wildlife species found in areas adjacent to the project site are adapted to urban conditions and highway noise. However, loud construction activities could displace some animals or discourage them from using adjacent habitats. In

extreme cases, birds could abandon their nests in response to noise disturbance.

Seattle Project Area

The average noise levels near wildlife habitat along SR 520 (within 100 feet) would rise from 60 to the low 70s in decibels (depending on the location), potentially reaching a maximum of 94 dB during general construction. Noise levels would decrease with distance from the construction area. In most cases, noise levels at distances of 750 to 1,000 feet from areas of active construction would be similar to existing noise levels.

Pile-driving in the Portage Bay and the Washington Park Arboretum areas is anticipated to raise noise levels to a maximum of 105 dB 50 feet from the pile-driver. Noise levels would decrease with distance from pile-driving. At 500 feet, anticipated noise levels from the pile-driver would range from approximately 80 to 95 dB; at 1,000 feet, noise levels would range from approximately 72 to 92 dB. See Section 6.7 and the Noise Discipline Report (Attachment 7), for more details on construction noise. Noise from construction could cause wildlife to avoid this area during construction. In addition, pile-driving could increase noise in an area that waterfowl and bald eagles use for foraging during the day. This could displace bald eagles and waterfowl during foraging.

General construction noise levels would be similar between the options; any difference in noise level would be small and localized. Option K may have more noise associated with general construction than Options A or L because of the construction of the detour bridge over Union Bay to divert mainline traffic.

Effects of Suboptions

- Adding the Lake Washington Boulevard ramps to Option A would remove an additional 0.5 acre of vegetation and shade an additional 0.2 acre of habitat during construction compared to Option A.
- Adding the eastbound HOV direct-access ramp and the constant-slope profile in the west approach area would result in no measurable differences from Option A.
- Adding the eastbound off-ramp to Montlake Boulevard under Option K would result in no additional clearing or shading of vegetation and no additional changes to wildlife effects from those described for Option K because the ramp would be located within the right-of-way of the existing interchange.
- Adding northbound capacity on Montlake Boulevard to Option L would remove an additional 0.2 acre of habitat (wetland and wetland buffer area). Adding the left-turn lane from Lake Washington Boulevard to the SPUI south ramp would not affect habitat.

Lake Washington and Eastside Transition Area

Noise in the Lake Washington and Eastside Transition area would consist of general construction noise as described above for the Seattle area.

The bridge maintenance facility would be constructed from the eastern shoreline and a small area of shoreline habitat would be cleared during construction. Noise from construction could cause wildlife to avoid this area during construction.

There would be no substantial differences among the options regarding effects of construction activities on any federally listed species or species of concern. Sedimentation and spills of toxic substances could have adverse effects on wildlife that forage near the floating bridge. Wildlife species may avoid such areas if spills occur.

How would project construction affect federally and state listed wildlife species?

SR 520 Corridor

Construction of the project would have no effects on wildlife species protected under ESA or state lists, because none occur in along the SR 520 corridor. Bald eagles, which are protected by the Bald and Golden Eagle Protection Act, may be affected by construction activities as discussed above.

Pontoon Construction and Transport

Several federally protected wildlife species may occur in marine waters along the pontoon transport route (Table 4.11-2). Key habitats for many of these species are generally close to shore and well away from the shipping lanes where pontoon transport would occur.

Some individuals may use areas farther offshore, primarily for foraging. The transport of pontoons would not represent a substantial increase over the number of ships (potentially several thousand per year) that travel through the Strait of Juan de Fuca and the outer coast. Increased ship traffic associated with pontoon transport would not be expected to result in a noticeable increase in the amount of noise and disturbance to these species. The risk of collisions with any of these species would be negligible. All the ESA-listed birds and marine mammals can fly or swim quickly away from any oncoming vessels except leatherback sea turtles, which are slow swimmers. Given the rarity of this species in Washington waters, the likelihood of a leatherback sea turtle encounter is low.

Pontoon transport is not expected to result in effects on critical habitat for southern resident killer whales. As noted above, the vessel traffic associated with pontoon transport is minor in comparison to overall shipping traffic in the whales' habitat area.

No state-listed wildlife or marine mammals are expected to occur in the pontoon construction and transport area.

How can the project minimize negative effects during construction?

Standard over-water and in-water construction and demolition BMPs would be implemented in accordance with environmental regulatory permit requirements. Specific in-water construction time periods would also be established through the project permitting process to minimize potential effects of pile-driving and other in-water construction activities on salmonid species.

During column and bridge construction, contractors would use BMPs (e.g., cofferdams and construction bridges) to avoid unintentional effects on habitat and water quality. Cofferdams or other appropriate measures would be used to isolate work areas from open-water areas, particularly for concrete pouring activities, and work bridges would be used to minimize the use of barges in shallow water areas. Bibs would be used to contain falling debris during construction of the new bridge decking and demolition of the existing decking. As noted above, temporary erosion and sediment control measures and a stormwater management and pollution prevention plan would be developed and implemented.

Appropriate BMPs and sound attenuation methods will be developed in coordination with the regulatory agencies and environmental permitting processes, and implemented to minimize potential effects of pile-driving activities.

Other BMPs could include:

- Minimizing any spillage of concrete or other construction material into the water
- Minimizing lighting effects from direct lighting entering Lake Washington from construction activities by adjusting the angle of the lights and/or using bulbs in a non-white light spectrum
- Operating construction equipment from work bridges and barges where possible to minimize ground disturbance when working in or near sensitive areas
- Restoring cleared areas to preconstruction grades and replanting the areas with appropriate native herbaceous and woody species

What mitigation is proposed for effects that are not avoidable?

Areas affected by construction of the SR 520, I-5 to Medina project would require mitigation; however, specific ratios have not yet been determined. As the design advances and effects from construction are better

understood, WSDOT will define appropriate mitigation measures in consultation with federal and state agencies and local agencies. WSDOT anticipates that mitigation measures would include restoration of the temporarily affected areas, and any additional mitigation would consider the time needed to restore the impaired functions. Measures may include:

- Replanting temporarily affected wetlands and riparian habitat with native vegetation
- Planting native shade-tolerant vegetation in areas under the elevated roadway and ramps, where feasible and practical

6.12 Geology and Soils

Construction of the 6-Lane Alternative would consider a number of potential geologic hazards along the corridor during design. These include areas susceptible to erosion, the location of steep-slope and landslide hazard areas, soil conditions, and seismic risk. Corridor topography would also be affected to varying degrees, depending on the option. This chapter discusses potential construction effects of the 6-lane Alternative design options on geologic and soil conditions along the SR 520 corridor.

What are the effects on geology and soils during construction?

Earthwork Quantities

Construction of the SR 520 roadway would involve topographic grade changes that require cuts and fills, and/or installation of bridge and retaining wall structures. With the exception of the depressed SPUI in Option K, the topographic changes to the corridor would be relatively small since the widened roadway would follow the same corridor as the existing roadway. In addition, the footprint would be minimized by using walls to retain most fills and cuts.

Option K would involve substantially greater amounts of excavation than the other design options for construction of a depressed SPUI and tunnel under the Montlake Cut. The footprint of SR 520 would be minimized to the extent possible for each option by using retaining walls to contain and support areas where earthwork occurs. Earthwork quantities (cut and fill volumes) provide a relative measure of the amount of topographic change. Table 6.12-1 identifies the total estimated excavation volumes and new material for construction elements along the corridor for each option. The total estimated excavation would be substantially greater with Option K, but the number of walls and area of new bridges would be similar to the other options.

KEY POINT

Geology and Soils

All options would require excavation and grading for cuts and fills, and/or installation of bridge and retaining wall structures. Option K would require substantially more cubic yards of excavation and fill material than Options A and L, and the sequential excavation method would require ground freezing, which involves some risk of freeze pipe leakage or rupture into the surrounding soil.

Table 6.12-1. Estimated Excavation and Fill Quantities (cubic yards)

Project Effect	Project Totals		
	Option A	Option K	Option L
Total estimated excavation volume[a]	340,000	1,300,000	450,000
Total Import fill (total volume of embankment, cy)[a]	86,000	320,000	52,000

[a] Total excavation is the sum of estimated roadway excavation quantities and structure excavation quantities. Quantities for suboptions would not vary measurably from these totals.
Source: HDR Inc. et al. (2009a) and Geology and WSDOT et al. (2009).

Most of the native materials that would be excavated along the project alignment would contain too much silt and clay to be reusable. It is assumed that the large majority of material used for construction would be imported aggregate.

Erosion and Sedimentation

Under all options, construction of the 6-Lane Alternative would include the risk of erosion from exposed soils, landslides during slope excavation, and ground settlement in liquefaction zones. Clearing protective vegetation, fill placement, grading, and spoils removal or stockpiling during construction would allow rainfall and runoff to erode soil particles. TESC measures would be employed to prevent erosion from affecting nearby water bodies. Any contaminated soils encountered would require special handling, transport, and disposal at offsite locations.

Construction Dewatering

Many excavations for bridge and retaining wall footings would require dewatering. Dewatering of excavations located below the groundwater table can produce quantities of sediment-laden water. Water in contact with concrete curing adds to the risk of water quality contamination. Dewatering could potentially result in the settlement of nearby structures if proper considerations are not given to the effects of potential changes in the water table, which is near the surface in many areas including the Arboretum. Roadway design and construction methods would take the water table into account to avoid the potential for such effects. Any contaminated groundwater would be treated prior to disposal.

The large excavations for the interchange and cut-and-cover tunnel sections would require disposal of large volumes of groundwater and also increase the risk of contamination or settlement of adjacent soils. Deep pile walls would be required, and alignment problems or unanticipated obstructions could cause leaks that would be much more difficult to mitigate than at shallower depths.

Geologic Hazards

In general, areas mapped as seismic hazards associated with liquefaction also coincide with areas of settlement hazard. Areas underlain by loose, compressible sediments, particularly peat and lake deposits in Lake Washington and Union Bay could also be subject to ground settlement. These soft soils would require the use of special construction procedures; for example, pile supports would be used in many places during construction. Bridge structures would be designed to current seismic standards.

The SEM requires that the ground be reasonably stable for tunneling. Dewatering of the extensive water-bearing sand layers and lenses anticipated would not be possible. Ground freezing appears to be the most reasonable ground stabilization alternative. Ground freezing on a curved alignment approximately 760 feet long would be difficult and would involve horizontal directional drilling methods to drill the holes for individual freeze pipes, installing the freeze pipes, waiting for ground freezing to occur, excavating the tunnel bore, and installing tunnel lining. These activities are estimated to take up to 2.5 years. In addition to the conventional disturbance of construction and fuel usage by heavy equipment, operation of the freezing system would be very energy-intensive and involve some risk of freeze pipe leakage or rupture into the surrounding soil.

Effects of Suboptions

- Adding the potential suboptions to Option A or K would result in no measurable difference in the effects described above.
- Adding northbound capacity on Montlake Boulevard to Option L may require preloading, construction of reinforced embankments, or other measures to mitigate against long-term settlement and issues associated with the Montlake Landfill. All these measures would be complicated by utility relocation issues and maintaining access to the existing parking areas and playfields. In addition, hazardous materials or contaminated groundwater could be encountered during construction in the landfill area (see Section 6.13, Hazardous Materials, below). Adding left-turn access from Lake Washington Boulevard onto the SPUI south ramp would result in no difference to the geology and soils effects.

How would the project minimize negative effects during construction?

Erosion control would be achieved using best management practices for erosion control and a monitoring plan to ensure continued mitigation throughout construction. BMPs could include the following:

- Maintaining vegetative growth and providing adequate surface water runoff systems

- Using quarry spalls and, possibly, truck washes at construction vehicle exits from the construction site
- Regularly sweeping and washing adjacent roadways
- Constructing silt fences downslope of all exposed soil
- Using quarry spall lined temporary ditches, with periodic straw bales or other sediment catchment dams
- Providing temporary covers over soil stockpiles and exposed soil
- Using temporary erosion-control blankets and mulching to minimize erosion prior to vegetation establishment
- Constructing temporary sedimentation ponds for removal of settleable solids prior to discharge
- Limiting the area exposed to runoff at any given time
- Frequently watering exposed surface soils to minimize visible dust

Where construction dewatering could result in settlement that might damage adjacent facilities, mitigation could include the following:

- Reinjecting the pumped groundwater between the dewatering wells and the affected facility
- Using construction methods that do not require dewatering

6.13 Hazardous Materials

Hazardous materials vary in the degree of their potential to affect a roadway project during construction. Some of the variables include the types of hazardous materials present at a given site, the distance of the site from the roadway footprint, and whether contamination is contained or has the potential to spread into the surrounding environment.

How would construction of the project affect hazardous materials?

Construction effects of the 6-Lane Alternative could include encountering contaminated soil, sediment, and groundwater; releasing hazardous materials used at construction sites; generating hazardous building materials through demolition; encountering underground storage tanks (USTs) or leaking underground storage tanks (LUSTs); creating accidental spills; and addressing worker safety and public health issues.

Construction of the 6-Lane Alternative would affect properties that likely contain some hazardous materials and waste. A primary goal in preventing effects from hazardous materials would be to prevent contaminated material or groundwater from being released or spreading into the surrounding environment. Demolition of older buildings, such as MOHAI, could disturb hazardous materials like asbestos, lead-based paint, and PCBs,

all of which were commonly used prior to the 1970s. Maintaining public and worker safety would be a top priority.

Table 6.13-1 shows which hazardous material sites could affect, or be affected by, project construction. All potentially contaminated sites would be managed using standard hazardous materials mitigation measures, which address procedures, investigations, and mitigation for construction activities such as demolition, decommissioning USTs, handling and disposing of contaminated soils and water, spill prevention, and worker safety and public health. These are included in the Hazardous Materials Discipline Report (Attachment 7). Three potentially contaminated areas, including the Montlake Landfill, the Miller Street Landfill, and the sediments in Lake Washington, Union Bay, and Portage Bay, are discussed below in more detail because they could pose unique concerns.

KEY POINT

Hazardous Materials

All options could encounter contaminated soil, sediment, and groundwater; create accidental spills and release hazardous materials; demolish structures that contain hazardous materials; and encounter underground storage tanks.

Table 6.13-1. Hazardous Material Sites Potentially Affected by Construction

Site Name[a]	Potential to Affect Project
Shell Oil Products	Contaminated groundwater could affect Option L.
Village Autocare	Contaminated groundwater could affect Option L.
Montlake Landfill	Construction of Option K would occur within 1,000 feet of the landfill boundary requiring methane gas mitigation. Adding the suboptions to Option L would result in construction on Montlake Boulevard north of the Montlake Cut. This construction would occur within 1,000 feet of the landfill boundary requiring methane gas mitigation.
NOAA Northwest Fisheries Science Center	Contaminated soil and groundwater could affect all options.
Montlake Texaco	Contaminated soil and groundwater could affect all options.
Seattle Fire Station 22	Contamination, if present, could affect all options.
Exxon Mobil	Contaminated groundwater could affect construction of Option A.
Circle K Station #1461	Contaminated groundwater could affect construction of Option A.
Miller Street Landfill	Construction of all options would occur within the former Miller Street Landfill.
Lake Washington, Union Bay, and Portage Bay	Contaminated sediments in these water bodies could affect all options.

[a]Site locations are shown on Exhibit 4.13-1.

Note: Adding the potential suboptions to Option A, K, or L would result in no measurable difference in the effects described above, except as described for the Montlake Landfill.

Montlake Landfill

The Montlake Landfill could be affected under Options K and L, in addition to the other sites discussed above. It is estimated that the Montlake Landfill is bounded by Montlake Boulevard to the west, NE 45th Street to the north, Mary Gates Memorial Drive NE to the east, and

Wahkiakum Lane and Union Bay to the south (University of Washington Montlake Landfill Oversight Committee 2009).

Under Option K, a tunnel would be constructed under the Montlake Cut to move traffic to Montlake Boulevard NE and NE Pacific Street. According to the Montlake Landfill Project Guide (University of Washington Montlake Landfill Oversight Committee 2009), new projects within 1,000 feet of the landfill boundary, would need methane gas mitigation or would need to demonstrate that the project does not require a methane mitigation system. The project would comply with applicable regulations, guides, and management plans.

Effects of Suboptions

- Adding the suboptions to Option A or K would result in no measurable difference to the effects described above.
- Adding northbound capacity on Montlake Boulevard to Option L could uncover hazardous landfill material at the Montlake Landfill. In addition, landfill debris is not a suitable base material for any temporary construction staging area or new permanent facilities because of settlement concerns. The debris would have to be removed, tested, and disposed of at a permitted landfill facility. Construction would occur within 1,000 feet of the landfill boundary, requiring methane gas mitigation. Contaminated groundwater may also be encountered during construction because the water table is less than 3 feet below the surface in some areas.

Miller Street Landfill

Methane gas is not expected to be a significant issue at the Miller Street Landfill during construction based on the age of the landfill site. A petroleum odor was identified during a geoarchaeological study in the landfill area and samples were collected, but the material was determined to be non-hazardous (Blukis Onat and Kiers 2007). Overall, the risk is low that hazardous materials may be encountered during construction because the site was formerly a domestic landfill.

Sediments in Lake Washington, Union Bay, and Portage Bay

Existing sediment data for Lake Washington and Portage Bay suggest that there are relatively low concentrations of pollutants. Lake Union sediment contaminant concentrations are slightly higher. Because the existing sediment quality data are limited, the risk of encountering contaminated sediments during construction is unknown.

Sediment would be removed during excavation for bridge column footings. Contaminated sediment, if found, would impose limits on reuse and disposal options. Approximately 85,000 cubic yards of in-water sediment

would be removed under Option A, approximately 101,000 cubic yards under Option K, and approximately 85,400 cubic yards under Option L.

The estimated volume of 101,000 cubic yards under Option K would not include the soil generated as part of the sequential excavation method tunnels under Montlake Cut. Soil generated as part of the SEM tunnels excavation would not be expected to be contaminated because these are native soils, and it is assumed they have not been affected by development.

Hazardous Materials Spills

Other potential short-term construction effects that may occur include spills of hazardous materials (such as oil, gasoline, and hydraulic fluid), chemical contaminants, or other materials, such as concrete-laden water. This effect is of particular concern for demolition or construction activities over water.

Control of hazardous materials is a standard provision in construction contracts and permits and would be addressed with best management practices. WSDOT would be required to submit a spill prevention, control, and countermeasures plan before starting work.

How could the project mitigate negative effects during construction?

Environmental regulations require that project owners use appropriate techniques to manage contaminated soil and groundwater, strictly manage and control hazardous wastes, and adhere to established criteria for transporting hazardous substances. Other measures WSDOT would use to minimize the potential for contaminant release during construction include:

- Conducting assessments of sites where contamination may be present to identify the presence and extent of any contaminants.
- Locating underground storage tanks and fuel lines before construction to reduce the potential for breakage and resulting spills.
- Surveying structures that would be demolished to determine whether they contain hazardous building materials like asbestos, lead-based paint, and PCBs.
- Specifying construction techniques that minimize disturbance to areas where contamination may exist, and phasing construction activities to follow cleanup activities whenever possible.
- Complying with Section 620.08 of WSDOT's Environmental Procedures Manual (WSDOT 2008e), which provides standard protocols for dealing with hazardous materials during construction.
- Preparing a comprehensive contingency and hazardous substance management plan and a worker health and safety plan to reduce potential risks to human health.

- Preparing an SPCC plan and a SWPPP to prevent the release of pollution and hazardous substances to the environment.

6.14 Navigation

Construction of the 6-Lane Alternative would affect navigation in the study area. All three options would use construction bridges in Portage Bay and in the west approach area that would limit recreational use of this part of the study area during the multi-year construction periods.

How would construction of the project affect navigable waterways?

Construction work bridges in the Portage Bay and Arboretum shoreline areas would prohibit the use of recreational vessels such as canoes or kayaks in these areas. The west approach work bridges would extend from the east shore of Montlake, across the water to Foster Island, then east to a line that is parallel to approximately 41st Street NE. Vessels would still have access to the docks on the north shore of Madison Park.

Montlake Cut

Installation of the bascule bridge components spanning the Montlake Cut would require complete closure of that portion of the Lake Washington Ship Canal for two 24-hour periods and two weekends, for a total of 6 days of closure spread over a period of at least 9 days. During the closures, barges would be used to install the bridge components, which might require use of barge/tug combinations to hold the barges in place during construction. These combinations would be necessary in cases where barges cannot anchor in the Montlake Cut due to concrete placement at the edges of the Montlake Cut. After the overwater structures are installed, the concrete deck would be poured and cured on a level surface. Curing would require a 3-week period during which the bascule bridge would not be able to be opened and would therefore restrict passage to vessels with a vertical clearance of less than 46 feet.

Evergreen Point Bridge Navigation Channels

The west and east navigation channels of the Evergreen Point Bridge would have lower clearances or would be closed during certain periods. Each navigation channel would likely be closed one to several days during placement of the new transition spans. To the maximum extent feasible WSDOT would leave at least one of the two navigational channels open at all times. The existing midspan drawbridge on the Evergreen Point Bridge would not be usable once the final pontoons for the new bridge were floated and anchored into place. Temporary delays to vessels entering or exiting the Lake Washington Ship Canal may be experienced during transport of pontoons to Lake Washington.

KEY POINT

Navigation

The west and east navigation channels of the Evergreen Point Bridge would have lower clearances at different times during construction. Each navigation channel would likely be closed three times for 24 hours during placement of the new transition spans and removal of the existing transition spans. During these closures there would be other openings of varying heights available.

Options A and L would require complete closure of the Montlake Cut for a total of 6 days of closure spread over a period of at least 9 days for installation of the new

Effects of Suboptions

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

How would the project minimize negative effects during construction?

Construction of the new floating bridge would be staged so that the west and east navigation channels would not be closed on the same days. A "Local Notice to Mariners" would be distributed electronically by the Coast Guard to alert local commercial and recreational boating communities. The notice would allow all potentially affected vessels time to relocate temporarily to prevent their being blocked during the replacement bridge construction period.

6.15 Pontoon Production and Transport

As previously discussed, the SR 520, I-5 to Medina project would replace the Evergreen Point Bridge as a 6-lane bridge with four general-purpose lanes, two HOV lanes, and wider shoulders. The number of pontoons required for this design includes 21 longitudinal pontoons, 2 cross pontoons, and 54 supplemental stability pontoons. If the Evergreen Point Bridge does not suffer catastrophic failure prior to reconstruction, the SR 520, I-5 to Medina project would use the 33 pontoons built and stored as part of the Pontoon Construction Project, and construct an additional 44 supplemental stability pontoons to satisfy the bridge design requirements. Pontoon types, construction activities, construction sequencing, and towing are discussed in Chapter 3 of this SDEIS. The following sections discuss the effects anticipated from pontoon construction and transport.

What effects would pontoon transport have on the environment?

One of the first construction activities to replace the floating portion of the Evergreen Point Bridge would be to transport the longitudinal and cross pontoons to Lake Washington. Stored pontoons would be towed in established tow lanes. For potential Grays Harbor sites, towing would follow the coast, pass through the Strait of Juan de Fuca, and pass through Puget Sound (see Exhibit 3-18). Once in Puget Sound, pontoons built at either site would then be towed to the Ballard Locks and into Lake Washington. Pontoons stored at CTC would be towed through Puget Sound to the Ballard locks, and into Lake Washington.

The stored pontoons would provide a hard structure in an aquatic environment that could serve as habitat for invertebrates and fish. WSDOT would monitor the pontoons for aquatic species growth, particularly invasive species. If necessary, WSDOT would clean the pontoons prior to

towing to prevent the transport of invasive species. No substantial aquatic species growth would likely occur during towing, and any incidental fouling organisms would die and decompose once the pontoons are towed in the freshwater lake environment.

Tugboat operations associated with pontoon transport have the potential to affect aquatic habitat. Pontoons would be towed from the casting basin to the launch channels and out into open water using tug boats. Short-term disturbances to soft sediment and increases in turbidity caused by propeller wash from tug boats may occur at that time. Tug propeller wash would be directed either toward the launch channel or the existing navigation channel.

If a new facility at Grays Harbor is used, it may require maintenance activities in the launch channel that would be used to float pontoons out of the casting basin and into open water. Underwater currents and other natural processes would deposit soil in the dredged portion of the launch channel and occasionally need to be removed by dredging. The dredged materials from the launch channel would be removed to an approved disposal site. Launch channel maintenance dredging would be the only activity that affects geology and soils during pontoon construction in Grays Harbor. If dredging is required, WSDOT would obtain all necessary permits and approvals, and employ all BMPs needed to minimize effects on the aquatic environment.

Towing activities could temporarily disturb marine wildlife from noise and the physical movement of towing pontoons. However, if the Grays Harbor site is used, the number of pontoon towing trips would not add substantially to the number of ships (potentially several thousand per year) that travel up the coast today. The tow trips for transporting the pontoons would not be expected to result in a noticeable increase in the amount of in-water noise disturbance.

In Puget Sound, the Coast Guard regulates vessel traffic, monitoring and directing vessel movements to maintain safety and to minimize shipping interruptions and delays. It is unlikely that transport of pontoons to or through Puget Sound would result in any substantial interruption of vessel movement or frequency.

Approximately 11 longitudinal pontoons would be towed first to an outfitting location within Puget Sound prior to transport to Lake Washington. Outfitting would take place at established industrial port locations typically used for operations such as large marine vessel moorage and repair. Pontoons would be moored at these locations in order to construct bridge columns and bridge superstructure on the surface, which could take up to 4 months to complete. Once complete, the pontoons would be towed through Puget Sound to the Ballard Locks, through the Lake Washington Ship Canal, and out to Lake Washington for immediate

inclusion in the new floating bridge alignment. No additional pontoon storage or moorage is anticipated for the SR 520, I-5 to Medina project.

Table 6.15-1 shows the estimated diesel fuel consumption and energy use required to transport the pontoons from their construction and moorage locations in Grays Harbor and Puget Sound to the project site. For this analysis, it was assumed that 56 pontoons would be towed one at a time by one tug from Grays Harbor to Lake Washington and 21 pontoons would be towed one at a time by one tug from their location in Puget Sound to the floating bridge construction site. An additional tug would be required to navigate the pontoons through the Ballard Locks and Lake Washington Ship Canal.

Table 6.15-1. Estimated Diesel Fuel Consumption and Energy Use during Transport of Pontoons

Route	Number of Trips	Estimated Miles per Trip	Estimated Total Miles	Estimated Avg. mph	Estimated Operating Hours	Diesel Fuel Consumption[a] (gallons)	MBtu[b]
Grays Harbor[c] to SR 520	56	254	14,224	3	4741	711,150	99,000
Puget Sound to SR 520	21	35	735	3	245	36,750	5,000
Additional Tug for Locks	77	10	770	2	385	57,750	8,000
Total	154		15,729		5,371	805,650	112,000

[a] Fuel consumption of 150 gallons per hour based on delivery tow estimate for SR 520 pontoon tow (WSDOT 2005).
[b] Conversion rate: One gallon of diesel = 139,000 Btu.
[c] If Grays Harbor site is constructed.

The estimated energy consumed during the construction of the 44 supplemental stability pontoons is approximately 1.5 MBtu, which is 54 percent of the total energy needed to construct the floating bridge area of the SR 520, I-5 to Medina project.

Several federally protected wildlife species may occur in marine waters along the pontoon transport route (see Table 4.11-2). Key habitat elements for many of these species are generally close to shore and well away from the shipping lanes where pontoon transport would occur.

Some individuals may use areas farther offshore, primarily for foraging. The transport of pontoons would not represent a substantial increase over the number of ships (potentially several thousand per year) that travel through the Strait of Juan de Fuca and the outer coast. Increased ship traffic associated with pontoon transport would not be expected to result in a noticeable increase in the amount of noise and disturbance to these species. The risk of collisions with any of these species would be negligible. All the ESA-listed birds and marine mammals can fly or swim quickly away from any oncoming vessels except leatherback sea turtles, which are slow

swimmers. Given the rare occurrence of this species in Washington waters, the likelihood of a leatherback sea turtle encounter is low.

Pontoon transport is not expected to result in effects on critical habitat for southern resident killer whales. As noted above, the vessel traffic associated with pontoon transport is minor in comparison to overall shipping traffic in the whales' habitat area.

Pontoon transport scheduling would be coordinated with the Seattle Yacht Club so that towing of the pontoons does not interfere with the traditional Opening Day ceremonies through the Montlake Cut or other important social maritime activities associated with the Seattle Yacht Club in the cut or in Portage Bay.

Overall, no effects on the human or natural environments are expected from transporting pontoons from Grays Harbor and Puget Sound to Lake Washington.

What effects would pontoon production have on the environment?

Some of the 44 supplemental stability pontoons would be constructed at the CTC casting basin facility located on the Blair Waterway in Tacoma. This facility is within an approximately 3-square-mile area of land zoned for industrial use, and is surrounded on all sides by commercial, industrial, and shipping facilities. CTC has well-established haul routes to main highways and heavy truck traffic is typical at this location due to the shipping facilities. The nearest noise-sensitive properties are a group of single-family residences approximately 1.25 miles from the site.

The remaining supplemental stability pontoons needed could be constructed at the potential Grays Harbor casting basin facility and at CTC. The potential Grays Harbor facility is located in Aberdeen in an established industrial area. Land use near the facility is primarily commercial and industrial, and construction of the pontoons would be consistent with ongoing activities at this location. Noise-sensitive properties located within 500 feet of the site are well shielded from the casting basin by existing commercial structures. Noise levels at these properties during operation of the casting basin are expected to correspond to those of a typical office environment.

Pontoon construction may affect water quality. Pontoon construction at both CTC and Grays Harbor would require work areas be thoroughly cleaned and pressure washed after each set of pontoons is complete. Wash water would be collected and treated by facility water quality treatment systems before being discharged to receiving waters. All water collected on the site would be handled and treated in accordance with state water quality requirements.

Additional potential effects on water quality could include the spill of hazardous materials (for example, oil and gasoline), chemical contaminants, nutrients, or other materials into waters in the casting basin vicinity. Control of hazardous materials is a standard provision in construction contracts and permits and would be addressed with BMPs. WSDOT would require a spill prevention and response plan be in place prior to commencing operations. Also, if an oil or contaminant spill were to occur from the tugboat during removal and transport of the pontoons, U.S. Coast Guard regulations would be implemented.

Air quality effects could occur during pontoon construction activities. Onsite operation of heavy-duty construction equipment would generate exhaust emissions containing pollutants such as CO, NO_X, VOCs, SO_2, PM_{10}, and $PM_{2.5}$. An onsite concrete batch plant would produce PM_{10} and $PM_{2.5}$ emissions. Offsite vehicle trips made by employees and supply trucks to and from the sites would generate additional vehicle exhaust emissions. Tugboats would generate exhaust emissions during pontoon transport similar to that of other heavy-duty diesel equipment. When a design option is selected and if construction lasts for 5 or more years, a quantitative emissions analysis from pontoon production and transport would be included in the construction emissions analysis in the Final EIS.

As discussed in Chapter 4, bull trout and green sturgeon occur in the Grays Harbor area. Construction of the supplemental stability pontoons is not expected to result in adverse effects on these species, as only limited openings of the casting basin gates would occur to release the pontoons into open water. Openings would occur on high tides, reducing the potential for effects on nearshore habitat, and measures would be in place to minimize any fish stranding in the casting basin. Key habitat elements for these species are generally close to shore and well away from the shipping lanes where pontoon transport would occur.

WSDOT's continued use of these sites to construct pontoons for the new 6-lane floating bridge is not expected to alter the character of the human or natural environment because the activities would be consistent with ongoing activities at these locations.

6.16 Summary of Effects During Construction

Table 6.16-1 summarizes the construction effects of the 6-Lane Alternative options on each element of the environment. Additional effects resulting from the suboptions are shown in italics. Effects from adding the suboptions to each option are noted only where they would result in a measurable difference to the effects described. Table 6.16-2 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 6.12-2.

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
Transportation	All options would have similar construction effects on transportation through most of the project area, with differences in the vicinity of the Montlake Boulevard interchange. Options K and L would result in more effects than Option A because of the amount of truck traffic required for construction of the new SPUI and the traffic effects during the closure of NE Pacific Street.		
Road Closures and Detours	All options would close the Lake Washington Boulevard ramps for some period of time during construction. The ramp closures would mostly affect local street operations and are not expected to have a substantial effect on SR 520 operations. Traffic that currently uses the Lake Washington Boulevard ramps would be detoured to use the ramps at Montlake Boulevard. A number of improvements would be made to the ramps at Montlake Boulevard in order to accommodate the detour traffic. All options would close Delmar Drive East for 9 months to accommodate construction on SR 520 beneath the bridge, as well as construction of the 10th Avenue East/Delmar Drive East lid. Traffic would be detoured to 10th Avenue NE.		
		Options K and L would close NE Pacific Street for 9 to 12 months. During this closure, detour traffic would use the Montlake Boulevard NE/ NE Pacific Place intersection (600 feet to the north) to make any turning movements. Several improvements would be made to the intersection to accommodate the additional detour traffic. Even with these improvements the intersection would operate at LOS F.	
Haul Routes	All options would require construction-related truck traffic on local streets. Most of the trips would use Montlake Boulevard to access SR 520. Construction-related truck traffic on SR 520 and the Montlake ramps would range from 11 to 19 vehicles per hour and would not have substantial effects on any one segment or ramp analyzed. Other arterials would be affected, and the estimated number of truck trips along these arterials would be relatively low compared to overall arterial volumes. The exception would be East Shelby Street and East Hamlin Street, which are residential streets in Montlake that may need to be used to access construction occurring near MOHAI.		
		Options K and L would use East Shelby Street and East Hamlin Street as haul routes during construction. During peak construction periods there could be as many as 5 to 20 trucks per hour, depending on which option is selected.	
Parking	All options would use the MOHAI parking lot for construction staging and would remove the 5 on-street parking spaces on 24th Avenue East. Museum operations would not be affected because operations would be moved prior to the start of construction. All options along with construction of the Sound Transit North Link UW Station would affect available parking in the UW E-11 and E-12 lots.		
	Option A would remove 54 spaces at the UW E-11 and E-12 lots.	Option K would remove 549 spaces at the UW E-11 and E-12 lots.	Option L would remove 211 spaces at the UW E-11 and E-12 lots.
Pedestrian and Bicycles	All options would close the 24th Avenue East bridge and the Bill Dawson Trail for most of the construction duration, leaving only Montlake Boulevard open to pedestrian and bicycle traffic. Bicycle and pedestrian access may be restricted to one side of Montlake Boulevard.		
Transit	All options would permanently close the Montlake Freeway Transit Station, relocate transit stops on Montlake Boulevard, and temporarily close the Evergreen Point Road Transit Station for 4 to 6 months.		
		Options K and L would temporarily relocate several transit stops on NE Pacific Street and Montlake Boulevard.	

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
Mitigation	Because final construction staging and schedules have not yet been determined, WSDOT will continue to coordinate with local and regional transit agencies regarding future transit service effects All options would include staging plans with specific restrictions on construction methods and prescribed work times for construction to avoid peak travel periods. Various work zone management techniques may be implemented including traveler information systems, incident management systems, active traffic management, construction worker shuttle service, special event strategies, and transportation demand management. All options would include temporary capacity improvements at the Montlake Boulevard interchange to accommodate changes in traffic patterns during construction.		
		Options K and L would include temporary changes to the Montlake Boulevard/NE Pacific Place intersection to accommodate traffic during the closure of NE Pacific Street.	
		WSDOT will coordinate with the UW regarding the reduced parking availability at Husky Stadium. Specific mitigation has not been determined at this time.	
Land Use and Economic Activity	Construction would occur within existing WSDOT right-of-way, adjacent to SR 520, to the extent possible. However, in some places within the project area, land now used for other purposes would be used for construction purposes. The boat slips on the south side of the Queen City Yacht Club and at the Bayshore Condominiums would be removed to accommodate construction of the Portage Bay Bridge. These moorages would be replaced in after construction was completed.		
		Options K and L would relocate the UW's WAC throughout the construction duration.	
	The loss of parking near Husky Stadium could inconvenience UW Medical Center employees, event attendees, and campus visitors.		
	The positive effects of construction-related jobs, spending (e.g., project spending and spending by construction workers), and resulting sales tax revenues would be widely dispersed through the local and regional economies.		
Mitigation	WSDOT will coordinate with business owners for alternative access and appropriate signage. The temporary loss of boat moorage at Queen City Yacht Club and the Bayshore Condominiums would be mitigated through relocation or other options to be identified. WSDOT would coordinate with the UW on the temporary relocation of functions of the WAC (Options K and L) and reduced parking availability and associated revenues at Husky Stadium lots (all options). Specific mitigation measures have not been determined at this time.		
Social Elements	All options would affect adjacent neighborhoods during construction. These neighborhoods could experience negative effects from detours, haul truck traffic, relocated bus stops, and utility service disruptions. Construction would also increase noise, dust, and visual clutter in residential, business, and park areas adjacent to construction zones. These effects could reduce residents' quality of life and limit connections to community resources, patronage at neighborhood businesses, or use of recreational amenities. Partial closures of sidewalks, bicycle paths/routes, trails, and park areas could discourage neighborhood activity and use of community resources. All options would have similar effects except in the Montlake and UW south campus areas, where the scale and intensity of construction would differ. The scale and intensity of construction-related effects within these areas would be greatest with Option K.		
	Construction would occur over a period of slightly less than 7 years.	Construction would occur over a 7½-year period.	Construction would occur over a period of less than 7 years.

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
		Effects on the University District and Montlake neighborhoods would be similar for Options K and L. Construction effects would include longer and more intense construction effects of noise, dust, vibration, construction traffic and visual changes due to construction of the tunnel (Option K) or new bascule bridge and SPUI ramps (Option L). Construction in this area would last 6½ years with Option K and 5 years with Option L.	
		Closure of NE Pacific Street associated with Options K and L could affect response times and emergency accesses to UW Medical Center.	
Environmental Justice	All options would result in disproportionately high and adverse effects on the usual and accustomed fishing areas of the Muckleshoot Tribe during construction. Overwater and in-water construction would affect tribal fishing opportunities and fish habitat, although the risk of harming fish is lower for Options A and L compared to Option K.		
Mitigation	WSDOT will continue to work with the project area neighborhoods to keep residents informed of project changes, and to develop neighborhood-specific measures to address anticipated construction effects. WSDOT is coordinating with the Muckleshoot Tribe to identify important access points to usual and accustomed fishing areas where proposed structures would be built. There would be additional coordination to avoid construction conflicts with tribal fishers harvesting salmon in Portage Bay, Union Bay, and Lake Washington. WSDOT will work with utility service providers to prepare a consolidated utility engineering plan consisting of key elements such as existing locations, potential temporary locations, and potential new locations for utilities; to prepare sequenced and coordinated schedules for utility work; and to develop detailed descriptions of any service disruptions. WSDOT will work with affected communities to provide advance notice of any service disruptions.		
Recreation	All options would affect adjacent parks during construction. These parks could experience negative effects from property acquisitions, construction-related truck traffic, and construction noise and visual clutter. All options include a proposed haul route adjacent to Roanoke Park, and construction effects would last approximately 2 years. All options would affect East Montlake Park, McCurdy Park, and the University of Washington recreation facilities. The scale and intensity of construction near these parks would vary among the options, with increased noise, dust, and traffic in around the park areas. All options would permanently close McCurdy Park and a portion of East Montlake Park. All options would also use a portion of the UW campus for construction and staging.		

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
	Option A would result in 5.1 acres of construction effects on area parks. This option would temporarily close over 60 percent of East Montlake Park. Construction effects are likely to last for 24 to 30 months. Approximately 1.1 acres of UW Open Space would be used for construction staging. Construction of the new bascule bridge would mainly affect access to the UW Open Space. Construction effects are likely to last 36 to 42 months.	Option K would result in 7.0 acres of construction effects on area parks. This option would temporarily close over 80 percent of East Montlake Park. Construction effects are likely to last for 54 to 60 months. Approximately 0.5 acre of UW Open Space would be used for construction staging. Construction of the tunnel would substantially affect access and parking on the UW campus, and the WAC would be dismantled and its functions temporarily relocated during tunnel construction. The WAC would be restored in its original location upon completion of construction. Construction effects are likely to last 48 months.	Option L would result in 6.3 acres of construction effects on area parks. This option would temporarily close over 80 percent of East Montlake Park. Construction effects are likely to last for 27 to 36 months. Approximately 0.9 acre of UW Open Space would be used for construction staging. Construction of the bascule bridge span, support columns, and ramps would affect access and parking on the UW campus, and cause periodic closure of the trails, the Canoe House, and the WAC. Construction effects are likely to last 36 months.
	All options would require periodic closure and detours of the Ship Canal Waterside Trail, trail access from Montlake Boulevard, trail access in East Montlake Park, and the Arboretum Waterfront Trail. The kayak and canoe launch point at East Montlake Park would also be periodically inaccessible.		
Suboptions	*Adding the Lake Washington Boulevard ramps and eastbound HOV direct-access ramp to Option A would temporarily affect an additional 0.1 acre of East Montlake Park and 0.3 acre of the Arboretum during construction.*		
Mitigation	Best management practices would be implemented to protect recreational resources from construction-related effects such as dust, vibration, glare, and accidental damage from construction equipment. Detour routes and traffic control measures would be implemented to provide access to University of Washington recreational activities. Construction closures would be timed to minimize effects during major events. WSDOT, the City of Seattle, the University of Washington, and appropriate regulatory agencies would evaluate how best to protect specimen trees and important vegetation in the Arboretum.		

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
Visual Quality	All options involve large-scale construction activities using heavy equipment. Vegetation removal would occur along the corridor and mature roadside trees and shrubs along both sides of SR 520 would be affected. Views from homes currently screened by these trees would then overlook ongoing construction. Construction equipment and activities would be visible from homes along roadways and surface streets. Construction activities would also be highly visible from the Seattle Yacht Club, the Montlake Cut, Montlake Boulevard, and UW southeast campus. All in-water and upland activities associated with replacing the Portage Bay Bridge would result in substantial degradation of visual character and quality of the south part of Portage Bay. The viewers most affected would be motorists crossing the bridge, residents on houseboats near the bridge ends, park users at Montlake Playfield, and boaters at the Queen City and Seattle yacht clubs. All options would require some construction north of the Montlake Cut and would require removing specimen quality conifers in the UW Open Space. All options would require a considerable amount of earthwork for widening SR 520 and grading for the stormwater ponds, which would affect residences in the Shelby-Hamlin area and users of the Arboretum and Ship Canal waterfront trails. Construction work bridges would also clutter views, especially for boaters in the Montlake Cut and SR 520 motorists, both of whom would be sensitive to visual quality. All options include work bridges that would be highly visible at breaks in the tree line in the Arboretum. Barges and tall cranes would stand out and further diminish visual character and quality. Temporary changes to visual character and quality would be high for views from or near the west approach bridges and from Husky Stadium, where Foster Island and the Arboretum ramps are visible from seats in the northeast corner of the stadium.		
	Option A would construct a new bascule bridge across the Montlake Cut. Construction would require the removal of a band of mature, dense woods along the cut, which would diminish views. The removal of two single-family homes and vegetation would also eliminate a buffer for nearby homes. The greatest effect on views and visual quality would be due to reconstruction of the Montlake interchange adjacent to the NOAA campus and to homes along Lake Washington Boulevard. Construction in the Montlake area would last 4 years.	Option K would require extensive excavation for construction of the tunnel, SPUI, and tunnel entrances in East Montlake Park and in the south parking lot of Husky Stadium. The greatest effect on views would be from the extreme change in landform and the construction of ventilation towers for the tunnels. A temporary detour bridge south of the existing west approach would add to the clutter. This high level of degradation of visual quality and character from demolition and construction could last up to 7 years in this area.	Option L would require excavation for the construction of the elevated SPUI, the depressed main line under the SPUI, and the new bascule bridge over the east end of the Montlake Cut and associated approaches. Very high levels of change would occur at the east end of the Montlake Cut, the east Shelby-Hamlin neighborhood, and East Montlake Park area. This high level of degradation of visual quality and character from demolition and construction in this area could last up to 5 to 6 years.

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
Suboptions	*Adding the Lake Washington Boulevard ramps to Option A would remove mature poplars and other specimen trees to the east of Lake Washington Boulevard East.*		*Adding northbound capacity on Montlake Boulevard would create additional construction views along Montlake Boulevard north of Pacific Street.*
Mitigation	Per the WSDOT Roadside Classification Plan, all options would landscape areas within the right-of-way and construction easements with vegetation similar to the vegetation removed, especially along Lake Washington Boulevard, Montlake Boulevard, and through the Washington Park Arboretum. Areas disturbed during construction would be revegetated where natural habitat, vegetation, or neighborhood tree screens were removed. These places are under Portage Bay Bridge in Roanoke Park and through Montlake, in particular at the NOAA Northwest Fisheries Science Center, East Montlake Park, Foster Island, and the Arboretum. The MOHAI site and the remaining portion of East Montlake Park would be redesigned in cooperation with the Seattle Parks Department. Foster Island would require restoration including shoreline and buffer restoration (mitigation would be extensive under Option K due to the footprint required for the land bridge and associated earthen berm). Union Bay would also require revegetation for the areas where the R.H. Thomson Expressway ramps were removed.		
Cultural Resources	The construction work bridges and barges used for demolition and construction of the Portage Bay Bridge may also introduce new visual effects, especially to the Kelley House, because one of the work bridges is planned to be at the current location of the Portage Bayshore Condominium docks next door. Upon completion, the work bridges would be removed and the condominium docks would be replaced. Temporary construction supports and barges used for in-water activities may occasionally interfere with the Seattle Yacht Club's marine activities in the Montlake Cut. In-water construction activities are allowed only from October 1 through April 15, so most marine activities in the cut from mid-April to the end of September would be unaffected. Historic properties in this area would experience effects from construction. All of the options would affect the Montlake Historic District with increased noise, fugitive dust, glare from lights for nighttime construction, and possibly vibration from demolition and construction. Particularly affected would be portions of the historic district in the Shelby-Hamlin area east of Montlake Boulevard, which would be affected by construction in East Montlake and McCurdy Parks and truck traffic on Shelby and Hamlin Streets. The specific effects on historic properties that may result from construction will be fully analyzed once the details of construction are further developed and more information on the potential effects is available. The Foster Island presumed TCP would experience dust and construction-related noise and vibration under all options. Construction of all options would include construction work bridges on Foster Island that would be removed and construction easement property would be returned to park use after construction was completed. During construction, access to the north part of the island would be restricted, but access to this area is not as important for traditional cultural activities. For options A and L, the majority of effects would be north of the existing SR 520 alignment and would not interfere with any ongoing cultural activities that may occur on the southern part of Foster Island, and would involve little or no ground disturbance within the known historic land area of the south island. However, because of land bridge construction south of the existing alignment, Option K would have the potential to interfere with cultural activities that may occur on the southern part of Foster Island. The degree of construction disturbance could be determined to be an adverse effect on the presumed TCP. Once the final alignment is determined, additional investigation will be done to determine the formal boundaries of the presumed TCP. Once specific construction effects are more clearly identified, Foster Island can be re-evaluated for potential adverse effects from construction activities.		

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
Suboptions			*Adding northbound capacity on Montlake Boulevard would reconstruct three existing NRHP-eligible pedestrian bridges over Montlake Boulevard, constituting an adverse effect. Construction activities could affect adjacent historic properties, including Graves Hall, Bloedel Hall, Winkenwerder Forest Sciences Laboratory, Hewitt Wilson Ceramics Laboratory, Wilcox Hall, More Hall, the University of Washington Club, and McMahon Hall; however, effects would not be adverse.*
Mitigation	All options would monitor and ensure compliance with the local noise regulations for construction and equipment operations. The facades of affected historic buildings could be protected from the accumulation of excessive dirt and dust during construction, and/or they would be cleaned in an appropriate manner at the conclusion of construction. WSDOT would consult with the SHPO and/or the Seattle Historic Preservation Officer before implementing any protection or cleaning methods. All options would locate any construction sheds, barricades, or material storage away from historic properties, and would avoid obscuring the views of historic properties. Access to historic properties would also be maintained except for unavoidable short periods during construction. Under all options, to reduce or mitigate potential effects on the Foster Island presumed TCP, project engineers may be able to refine the bridge alignment to maximize geographical avoidance of the more significant portion of the island, which is south of the gap between the two historic islands and the existing SR 520 alignment. If a significant archaeological site were present on Foster Island, potential adverse effects could be avoided or greatly minimized by using sophisticated remote sensing techniques (such as ground-penetrating radar) to identify subsurface cultural features. If successful, such techniques could help WSDOT reduce the amount of excavation necessary in areas with known resources to avoid or minimize potential adverse effects on archaeological properties. Consultation between WSDOT, FHWA, the SHPO, and interested tribes would be necessary to identify mitigation for any potential adverse effect on Foster Island.		

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
		Every effort would be made to keep the Canoe House accessible and functioning during and after construction of the tunnel in Option K or the new bascule bridge in Option L. Every precaution would be taken to ensure that the Canoe House is not affected during construction of the tunnel or bridge by vibrations, excavations, or heavy equipment. No construction staging or storage should occur on the Canoe House property. Construction access to and from the construction zone could be provided along Montlake Boulevard westbound off-ramp to reduce the volume of construction trucks using the residential streets of East Shelby, East Hamlin, and East Park Drive East.	
Noise	During construction, people living and working near construction areas would be affected by noise from a variety of activities and equipment. Construction phases that include preparing for new structure construction, roadway paving, and structure demolition would result in noise levels ranging from 83 to 94 dB at 50 feet from the construction site. Pile-driving would be the loudest single source of noise during construction preparation. The equipment would include vibratory and impact equipment that can produce short-term noise levels of 99 to 105 dB at 50 feet. Noise levels can vary depending on the distance, topographic conditions between the pile-driving location and receiver, frequency of pile-driving, and the number of pile-drivers operating at one time. The loudest construction-related noise activities are pile-driving and demolition of existing structures. Typical construction equipment is expected to have a range of 62 to 105 dB maximum noise level 50 feet from the source. Major non-impact noise-producing equipment includes concrete pumps, cranes, excavators, haul trucks, loaders, and tractor trailers; maximum noise levels could reach up to 92 dB at the nearest residences (50 to 100 feet). State regulations restrict noise from construction activities by imposing noise limits based on the type of activity, time of day, and property type with less noise allowed for residential than for commercial and industrial receivers. Vibration from general construction can affect receivers that use vibration-sensitive equipment such as medical or scientific equipment. The only such known receiver located close to construction activities is the NOAA Northwest Fisheries Science Center, which uses floating electron microscopes in its research. Major vibration-producing activities would occur primarily during demolition and preparation for the new bridges. While pile-driving or vibratory sheet installation may occur within 50 to 100 feet of sensitive receivers, it is unlikely that vibration levels would exceed 0.5 inch per second at distances greater than 100 feet from the construction sites.		
Mitigation	WSDOT would follow state noise control regulations and other methods of mitigating noise such as limiting construction hours within 500 feet of any occupied dwelling to minimize effects on receivers. Several construction noise and vibration abatement methods – including operational methods, equipment choice, or acoustical treatments – could be implemented to limit the effects of construction. The methods used might vary in the project corridor depending on construction criteria.		

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
Air Quality	Soil-disturbing activities, diesel equipment, traffic congestion, and paving with asphalt would generate emissions that may temporarily affect air quality in the vicinity of the construction activity. Engine and motor vehicle exhaust would result in emissions of VOCs, NO_x, particulate matter (PM_{10}, $PM_{2.5}$), and air toxics. Air quality will be most affected in areas close to the active construction sites. Depending on the option selected, the project could take up to 7-1/2 years to build, which will require the project to be evaluated for conformity with the State Implementation Plan for carbon monoxide emissions. The detailed construction emissions analysis will be completed after the preferred alternative is identified, and the analysis included in the Final EIS.		
Mitigation	WSDOT would comply with procedures outlined in the MOA between WSDOT and the PSCAA for controlling fugitive dust. WSDOT encourages contractors to reduce idling time of equipment and vehicles and to use newer construction equipment and equipment with add-on emission controls.		
Energy and Greenhouse Gases	Onsite construction energy requirements for Option A would be 15,006,000 MBtu and pontoon transport would be 108,000 MBtu.	Option K has the largest onsite construction energy consumption estimate of 34,299,000 MBtu, which is about double of Options A and L. Energy required for pontoon transport would be the same as Option A.	Onsite energy consumption estimate is 18,780,000 MBtu. Energy required for pontoon transport would be the same as Option A.
	During construction, the primary source of GHG emissions would be fuel combustion with the GHG emissions being proportional to the amount of energy used and also expressed in project costs. Unintentionally released fugitive gases, such as coolant leaking from air conditioners, is not included in the analysis. The analysis assumes diesel fuel only (no electricity or gasoline) to be conservative and is intended to show relative differences between the options.		
	Option A would have the lowest level of construction GHG emissions.	Option K has the highest GHG emissions potential at roughly double that of Option A.	Option L would produce approximately 20 percent more emissions than Option A, but less than Option K.
Mitigation	Measures to conserve energy could include limiting idling equipment; encouraging carpooling of construction workers, and locating staging and material transfer areas near work sites.		
Water Resources	The primary concern for water quality during construction is increased turbidity in water bodies. From the land-based activities the most likely source would be from construction-exposed soils eroding during rainstorms and flowing into nearby water bodies. For water-based activities the most likely source would be from direct disturbance of sediments through activities such as pile-driving, column construction, and anchor placement. Another potential risk is spills of pollutants such as fuel and lubricants. Construction of roadways and bridges may temporarily alter the flow of groundwater but the effects are typically minimal and temporary.		
	The need for dewatering is expected to be fairly minor.	This option would require substantial excavations for the depressed SPUI with much of it likely to be below the water table. This would require substantial dewatering and the disposal of a large volume of water.	The need for dewatering is expected to be fairly minor.

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
Mitigation	WSDOT would avoid or minimize adverse effects on surface water bodies during construction by implementing water quality pollution control measures outlined in the required TESC and SPCC plans and by following permit conditions. Potential sedimentation effects during construction would be avoided through the use of appropriate construction BMPs. Erosion and sediment control measures could include mulching, matting, and netting; filter fabric fencing; quarry rock entrance mats; sediment traps and ponds; surface water interceptor swales and ditches; and placing construction material stockpiles away from streams. A TESC plan would be prepared and implemented to minimize and control pollution and erosion from stormwater. Erosion and sediment control BMPs would be properly implemented, monitored, and maintained during construction.		
Ecosystems	All of the options would create larger areas with reduced fish habitat functions, primarily due to increased shading by the work bridges and barges. All options would result in the same area of temporary overwater structure in the Portage Bay area (3 acres). Although 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. All of the options would result in noise from construction activities that could affect wildlife species, and could temporarily displace state and federally-listed and priority bird species. Construction activities could affect wildlife by removing vegetation and wildlife habitat and increasing shading through the use of work bridges. Although, habitat quality is generally low for the Urban Matrix cover type, some 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 during construction.		
Wetlands	All options include construction work bridges, work platforms, staging areas, and construction access roads that would have transient effects on wetlands due to vegetation clearing or shading during the 5- to 7-year construction period. In general, Option K would have more effects on wetlands from construction than Options A and L. Option K would also result in more wetland buffer being filled and shaded during construction.		
	Option A would fill 0.6 acre of wetland and 2.8 acres of wetland buffer. Option A would shade 6.4 acres of wetland and 0.2 acre of wetland buffer.	Option K would fill 1.1 acres of wetland and 3.2 acres of wetland buffer. Option K would shade 8.1 acres of wetland and 0.6 acre of wetland buffer.	Option L would fill 0.5 acre of wetland and 2.8 acres of wetland buffer. Option L would shade 6.4 acres of wetland and 0.2 acre of wetland buffer.
Suboptions	*Adding the Lake Washington Boulevard ramps to Option A would clear an additional 0.1 acre of wetland and 0.4 acre of buffer and shade an additional 0.4 acre of wetland.*	*Adding the eastbound off-ramp to Montlake Boulevard to Option K would affect less than 0.1 acre of additional wetland.*	*Adding northbound capacity on Montlake Boulevard to Option L would affect an additional 0.1 acre of wetland.*
Pile-Driving and Loss of Substrate	All options would require substantial in-water pile-driving to construct construction work bridges in shallow-water areas that cannot be accessed by barge. The underwater sound levels generated during pile-driving activities can disturb or alter the natural behavior and habitat of fish and other aquatic species and in some instances cause injury or mortality. Option K would require considerably more in-water and over-water construction in the Montlake and west approach areas compared to Options A and L. The depressed SPUI would be constructed below the high-water elevation of the lake. The loss of 2.7 acres of aquatic habitat is considered permanent, so it is not included in the construction effects quantities. All options would result in the loss of lake bottom substrate that supports aquatic vegetation as a result of work bridges. In addition to the work bridges, in-water construction would also include installing temporary cofferdams.		

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
	Option A would require 2,893 piles and affect approximately 9,090 square feet of substrate.	Option K would require 3,660 piles and affect approximately 11,500 square feet of substrate.	Option L would require 2,853 piles and affect approximately 8,960 square feet of substrate.
Suboptions	*Adding the Lake Washington Boulevard ramps to Option A would require an additional 55 temporary support piles and affect an additional 170 square feet of substrate.*	*Adding the eastbound off-ramp to Montlake Boulevard to Option K would require 3 additional in-water piles.*	
Shading of Aquatic Habitat	All options would increase shading from the work bridges and could reduce the distribution, density, and/or growth rate of aquatic vegetation in the shadow of these structures.		
	Option A would shade 10.9 acres of aquatic habitat.	Option K would shade 11.8 acres of aquatic habitat.	Option L would shade 10.3 acres of aquatic habitat.
Suboptions	*Adding the Lake Washington Boulevard ramps to Option A would shade an additional area totaling less than 0.1 acre.*	*Adding the eastbound off-ramp to Montlake Boulevard to Option K would shade an additional area totaling less than 0.1 acre.*	
Loss of Wildlife Habitat	For all three options, most vegetation clearing for construction would occur in the west approach area, and Urban Matrix would be the most commonly affected habitat type. Option K would result in more clearing for construction than the other options.		
	Option A would remove 12.4 acres of wildlife habitat, composed of mostly the Urban Matrix cover type.	Option K would remove 14.9 acres of wildlife habitat, composed of mostly the Urban Matrix cover type in the Montlake and west approach areas.	Option L would remove 14.0 acres of wildlife habitat composed of mostly the Urban Matrix cover type.
Suboptions	*Adding the Lake Washington Boulevard ramps to Option A would remove an additional 0.5 acre of habitat, mostly in the Parks and Other Protected areas cover type.*		*Adding the northbound capacity on Montlake Boulevard to Option L would remove an additional 0.2 acre of habitat, mostly in the Parks and Other Protected areas cover type.*

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
Mitigation	All options would implement standard overwater and in-water construction and demolition BMPs in accordance with environmental regulatory permit requirements. Specific in-water construction time periods would also be established through the project permitting process to minimize potential effects of pile-driving and other in-water construction activities on aquatic species. During column and bridge construction, contractors would use BMPs (e.g., cofferdams and construction work bridges) to avoid unintentional effects on habitat and water quality. Cofferdams or other appropriate measures would be used to isolate work areas from open-water areas, particularly for concrete pouring activities, and work bridges would be used to minimize the use of barges in shallow water areas. Bibs would be used to contain falling debris during construction of the new bridge decking and demolition of the existing decking. As noted above, temporary erosion and sediment control measures and a stormwater management and pollution prevention plan would be developed and implemented. Appropriate BMPs and sound attenuation methods will be developed in coordination with the regulatory agencies and environmental permitting processes, and implemented to minimize potential effects of pile-driving activities.		
Geology and Soils	All options would require excavation and grading for cuts and fills, and/or installation of bridge and retaining wall structures. Other than the depressed SPUI and tunnel for Option K, the topographic changes within the corridor would be minor. Dewatering may be required in excavations. Water quality issues could arise from needing to discharge large quantities of sediment-laden water. Dewatering may result in settlement of nearby structures if the water table level is not taken into consideration. The groundwater level is near the surface in many areas including the Arboretum.		
	Option A would result in an estimated 340,000 cubic yards (cy) of excavation and 86,000 cy fill material. The overall constructability risk based on geologic criteria for this option is a low to moderate risk.	Option K would result in an estimated 1,300,000 cy of excavation and 320,000 cy of fill material. Deep pile walls would be required for the depressed SPUI and risks from leaks and contamination or settlement of adjacent soils would be greater than the other options. The overall constructability risk based on geologic criteria for this option is moderate to high risk.	Option L would result in an estimated 450,000 cy excavation and 52,000 cy of fill material. The overall constructability risk based on geologic criteria for this option is moderate risk.
Suboptions			*Adding northbound capacity on Montlake Boulevard to Option L may require preloading, construction of reinforced embankments, or other measures to mitigate against long-term settlement and issues associated with the Montlake Landfill.*

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
Sequential Excavation Method		The sequential excavation method would require ground freezing, which involves directional drilling ahead of excavation for individual freeze pipes. This method involves some risk of freeze pipe leakage or rupture into the surrounding soil.	
Mitigation	All options would implement BMPs to prevent erosion including minimizing loss of vegetation; using erosion-control blankets and mulching; street sweeping; use of construction exits that minimize mud tracking; constructing temporary sedimentation ponds; and limiting the area exposed to runoff at any given time Construction techniques will be used to prevent adverse effects on slope and ground stability. For dewatering this may include reinjecting the pumped groundwater between the dewatering wells and the affected facility or using construction methods that do not require dewatering. Effects from ground vibrations could be mitigated by using drilled piles or shafts instead of pile-driving; switching to a different hammer or pre-boring holes before pile-driving; and using cofferdams (for sound attenuation and sedimentation control) or bubble curtains (for sound attenuation) within water bodies.		
Hazardous Materials	All options could encounter contaminated soil, sediment, and groundwater; create accidental spills and release hazardous materials; demolish structures that contain hazardous materials; and encounter underground storage tanks. All options would affect the following sites: NOAA Northwest Fisheries Center, Montlake 76 station, Seattle Fire Station 22, Miller Street Landfill, and sediments in Lake Washington, Union Bay, and Portage Bay		
	Option A would also affect the Exxon Mobil and Circle K stations.	Option K may also affect the Montlake Landfill through construction activities occurring within 1000 feet of this site.	Option L would also affect the Shell Oil Products station and Village Autocare.
Suboptions			*Adding northbound capacity on Montlake Boulevard to Option L may also affect the Montlake Landfill.*
Mitigation	WSDOT would conduct an assessment of sites where contamination may be present to identify the nature and extent of any contaminants. In addition, structures to be demolished would be surveyed to determine whether they contain hazardous building materials like asbestos, lead-based paint, and PCBs. All options would also include a comprehensive contingency and hazardous substance management plan and a worker health and safety plan to reduce potential risks to human health. An SPCC plan and a SWPPP would be prepared to prevent the release of pollution and hazardous substances to the environment.		

Table 6.16-1. Summary Comparison of Construction Effects of 6-Lane Alternative Options

Element of the Environment	Option A	Option K	Option L
Navigation	All options would construct work bridges on both sides of the Portage Bay Bridge and would prohibit the use of recreational vessels such as canoes or kayaks in these areas during construction. All options would construct work bridges from the east shore of Montlake, across the water to Foster Island, then east of Foster Island for work on the new west approach structures. The use of recreational vessels such as canoes or kayaks would be prohibited around work bridges during construction. Vessels would have water access within the Arboretum, and on the northern shore of Madison Park. The west and east navigation channels of the Evergreen Point Bridge would have lower clearances at different times during construction. Each navigation channel would likely be closed three times for 24 hours during placement of the new transition spans and removal of the existing transition spans. During these closures there would be other openings of varying heights available. The Evergreen Point Bridge drawspan would be permanently blocked once the new pontoons were floated into place. Adding the suboptions to Options A, K, and L would result in no measurable difference in these effects.		
	Option A would require complete closure of the Montlake Cut for two 24-hour periods and two full weekends (total of 6 days) for installation of the bascule bridge.		Option L would require complete closure of the Montlake Cut for two 24-hour periods and two weekends (total of 6 days) for installation of the bascule bridge.
Mitigation	Construction of the new floating bridge would be staged so that the west and east navigation channels would not be closed on the same days. A “Local Notice to Mariners” would be distributed electronically by the Coast Guard to alert local commercial and recreational boating communities of all construction related closures in Lake Washington and the Montlake Cut. The notice would allow all potentially affected vessels time to relocate temporarily to prevent being blocked during the bridge construction period.		

Note: Suboption effects are shown in italics.

Table 6.16-2. Quantitative Effects Summary

Element	Type of Effect	Construction Effects		
		Option A	Option K	Option L
6.1 Transportation		Please see qualitative effects summary in Table 6.16-1.		
6.2 Land Use and Economics	Number of jobs during peak year construction	7,683	12,620	9,526
6.3 Social Elements		Please see qualitative effects summary in Table 6.16-1.		
6.4 Recreation	Parks effects (acres)	5.1 (0.4)	7.0	6.3
6.5 Visual Quality		Please see qualitative effects summary in Table 6.16-1.		
6.6 Cultural Resources				
6.7 Noise				
6.8 Air Quality				
6.9 Energy and Greenhouse Gases	GHG Emissions (MT CO2e, in millions)	1,116,000	2,541,000	1,395,000
6.10 Water Resources		Please see qualitative effects summary in Table 6.16-1.		
6.11 Ecosystems	Wetland fill (acres)	0.6 (0.1)	1.1 (<0.1)	0.5
	Wetland buffer fill (acres)	2.8 (0.4)	3.2	2.8
	Wetland shading (acres)	6.4 (0.4)	8.1	6.4
	Wetland buffer shading (acres)	0.2	0.6	0.2
	Lakebed substrate (sq ft)	9,099 (170)	11,500	8,964
	Vegetation removal (acres)	12.4 (0.5)	14.9 (0.2)	14.0
	Overwater structures (acres)	10.9 (0.1)	11.8 (0.1)	10.3
6.12 Geology and Soils	Excavation volume (cy)	340,000	1,300,000	450,000
	Import fill volume (cy)	86,000	320,000	52,000
6.13 Hazardous Materials	Number of known hazardous materials sites likely encountered during construction[a]	6	5	7
6.14 Navigation	Montlake Cut closure duration	Approximately 6 days	No closure anticipated	Approximately 6 days

[a] Site count does not include lake bed sediments encountered in Portage Bay, Union Bay, and Lake Washington.
Note: Additional effects resulting from the suboptions are shown in parentheses.

6.17 Phased Implementation Scenario

How would phased implementation affect project construction?

As discussed in Chapter 2, there is a possibility that WSDOT would construct the project in phases over time. If the project is phased, WSDOT would first complete one or more of those project components that are vulnerable to windstorms and earthquakes. These components include the following:

- The floating portion of the Evergreen Point Bridge, which is vulnerable to windstorms
- The Portage Bay Bridge, which is vulnerable to earthquakes
- The west approach of the Evergreen Point Bridge, which is vulnerable to earthquakes

The Phased Implementation scenario would provide new structures to replace the vulnerable bridges in the SR 520 corridor, as well as transitional sections to connect the new bridges to existing facilities. Exhibit 2-22 in Chapter 2 shows how the new bridge structures would tie in to the existing interchanges and roadway. The Phased Implementation scenario would include stormwater treatment facilities, noise mitigation, and the width needed for the regional bicycle/pedestrian path. The regional path would not be fully operational until the entire 6-lane corridor is complete.

Under the Phased Implementation scenario, corridor improvements in the I-5 and Montlake areas would be completed during later phases, after the vulnerable structures have been replaced. Lids at I-5, 10th Avenue East and Delmar Drive East, and Montlake Boulevard would be deferred until a subsequent phase.

The time frame for the Phased Implementation scenario depends upon WSDOT's ability to fund full construction of the SR 520 corridor. Potential construction effects would differ from those of the 6-Lane Alternative for several reasons. Construction activities would occur twice in the transition areas between project phases, lengthening the construction durations for some project elements. The overall timeframe would also increase over those currently assumed for constructing the 6-Lane Alternative (slightly less than 7 years for Options A and L and up to 7-1/2 years for Option K). At the same time, constructing the project in phases would reduce the magnitude and intensity of many construction-related effects along the corridor. WSDOT would develop and implement all mitigation needed to satisfy regulatory requirements. Mitigation measures identified previously in this chapter would apply to the Phased Implementation scenario.

Transportation

Capacity improvements to handle the traffic demand at the Montlake interchange would be needed. Interim eastbound and westbound off-ramps to Montlake Boulevard could be constructed; these ramps would be removed if a SPUI is constructed to replace the Montlake interchange. Alternatively, interim connections to the existing Lake Washington Boulevard ramps could also be constructed. These could include a new flyover ramp from the new west approach bridge to the existing westbound Lake Washington Boulevard off-ramp and a connection from the existing eastbound on-ramp from Lake Washington Boulevard to the new west approach bridge. The ramps could remain in operation until full buildout of the 6-Lane Alternative and would be removed and/or replaced in a later phase, depending on the Montlake interchange option constructed.

The Phased Implementation scenario would result in less construction-related congestion and fewer numbers of haul truck trips along proposed haul routes (Exhibit 3-2) compared to full build of the 6-Lane Alternative, which assumes that construction would occur concurrently in multiple locations along the corridor for up to 10 hours each day. Trips associated with 6-Lane Alternative improvements at the I-5 and Montlake interchanges (Table 6.1-3) would be deferred until a later phase, easing the magnitude of transportation-related construction effects on local and regional roads and spreading it over a longer duration of time.

Construction-related effects on transit would be similar to those described for the 6-Lane Alternative for the SR 520 main line. The Montlake Freeway Transit Station would be closed for construction of the west approach and interim connections to Montlake Boulevard. Relocations and/or closures of other transit stops on Montlake Boulevard and NE Pacific Street would be deferred until a later phase. See Section 5.16 for a discussion of operational effects on transit associated with the Phased Implementation scenario.

Construction effects on bicycle and pedestrian travel at the Delmar Drive East bridge crossing, Montlake area, Foster Island, and the Arboretum would be the same as described for the 6-Lane Alternative. Effects in the NE Pacific Street area would be deferred until a later phase. Parking areas at Bagley Viewpoint and MOHAI would be closed for construction of the Phased Implementation scenario; however the lots at Husky Stadium would remain open.

Land Use and Economic Activity

Land Use

Construction-related effects on land uses in the Portage Bay area and the east and west approaches to the Evergreen Point Bridge would be the same as described for the 6-Lane Alternative and would include increases in noise, dust, and truck traffic to neighborhoods and park areas (see

discussion in Section 6.3, Social Elements, and Section 6.4, Recreation). Although corridor improvements to the I-5 and Montlake interchange areas would not occur during the Phased Implementation scenario, effects on land uses in this area could occur from right-of-way purchase, use of staging areas identified in these areas, construction of interim connections in the Montlake Interchange area, and implementation of detour routes. Land use effects on the University of Washington campus, including relocation of the University of Washington's Waterfront Activities Center, would be deferred until a later phase (see also Section 5.16, Land Use).

Economic Activity

Construction-related effects on local businesses under the Phased Implementation scenario would be similar to but not as severe as those described for the 6-Lane Alternative. Project phasing would defer some of the effects on businesses in the I-5 and Montlake interchange areas and on the University of Washington and Husky Stadium. However, local businesses served by routes that include Delmar Drive East, 24th Avenue East, and the Lake Washington Boulevard ramps (located in the transition areas between phases) could affected by reduced access and road closures on these roads during the initial phase of construction and during subsequent phases to complete the corridor.

Direct, indirect, and induced jobs estimated for the 6-lane Alternative would be spread over a longer duration and construction-related spending would occur at a lower magnitude of scale and over a longer period of time than if the corridor were constructed within the single 5- to 7-year timeframe estimated for full build of the 6-Lane Alternative.

Social Elements

Neighborhoods, Public Service Providers, and Utilities

The Phased Implementation scenario would defer construction of the I-5 and Montlake interchange improvements to a later phase, which would reduce the magnitude of construction effects described for the 6-Lane Alternative from detour routes, haul truck traffic, relocated bus stops, and increases in noise, dust, and visual clutter on adjacent neighborhoods. The Eastlake, North Capitol Hill, Portage Bay/Roanoke, Montlake, University District, and Madison Park neighborhoods would benefit from a reduced level of construction effects associated with the Phased Implementation scenario. However, the Montlake, Portage Bay/Roanoke, and North Capitol Hill neighborhoods in particular would experience construction effects more than once and for a longer number of overall years; the overall time frame would be contingent on funding for the 6-Lane Alternative. Types of effects by neighborhood would be similar to those described for the 6-Lane Alternative.

Noise mitigation would be constructed for the phased project components. Lids would be deferred until a subsequent phase when the I-5 interchange area improvements and the Montlake interchange are constructed. The regional bicycle/pedestrian path would also not be fully operational until the entire 6-lane corridor is complete. This would delay the benefits of improved connectivity between neighborhoods, their business districts, and community resources.

Types of construction effects on fire, emergency medical, and police under the Phased Implementation scenario would be the same as described for the 6-Lane Alternative. Response times could be affected by detour routes and increased congestion along the corridor during construction of the Evergreen Point Bridge and approaches and Portage Bay Bridge. However, because the full corridor would not be under construction during a single time period, these effects would be of a lower magnitude. As described in the Transportation section above, interim improvements would be made in the Montlake interchange area to accommodate traffic flow to the University District and neighborhoods south of the interchange. The majority of construction effects on the University Medical Center would be deferred until construction of the Montlake interchange, the Montlake Cut crossing, and the Montlake Boulevard/Pacific Street intersection.

Utility relocations required for replacement of the vulnerable structures would occur concurrent with construction of those corridor elements and would be the same as described for the 6-Lane Alternative. Several major utility lines (water and wastewater) are located in the Montlake interchange area. Before construction, coordination with utility providers would occur to minimize the potential for having to affect facilities more than once.

Effects on Low-income, Minority, and LEP Residents

Construction would affect low-income, minority, and LEP residents of neighborhoods affected by the Phased Implementation scenario in the same way that it would affect other residents.

Effects on usual and accustomed tribal fishing areas would also be the same as described for the 6-Lane Alternative for replacement of the Evergreen Point Bridge and Portage Bay Bridge. Construction effects in the west approach area, including Union Bay, would occur more than once as improvements to the Montlake interchange area would occur in a later phase. Therefore, the construction activities would extend over more than one construction season, prolonging effects on usual and accustomed fishing areas of Native American tribes. Stormwater treatment facilities would be constructed to accommodate a 6-lane corridor and any interim improvements in the transition areas as part of the Phased Implementation scenario.

Recreation

Under the Phased Implementation scenario, construction effects on park and recreation resources located in the Portage Bay and west approach areas, as well as recreation activity on Lake Washington, would be the same as described for the 6-Lane Alternative.

Benefits to recreation from lids would be deferred until a subsequent phase when the I-5 interchange area improvements and the Montlake interchange are constructed. Also, the new bridge structures would include the width needed for the 14-foot bicycle/pedestrian path, but the path would not be fully operational until the entire 6-lane corridor is complete.

Project phasing would sequence the effects on park and recreation resources and defer effects on the University of Washington campus and parks in the vicinity of the I-5 interchange until later phases. However, the Washington Park Arboretum would experience effects during construction of the west approach and again during construction of the Montlake interchange (under all options). The specific effects from phasing are unknown at this time.

Visual Quality

Construction effects from the Phased Implementation scenario would be the same as those described for the portions of the SR 520 corridor within the Roanoke, Portage Bay, west approach, Lake Washington, and Eastside transition area landscape units (Section 6.3). The majority of construction effects identified for the Montlake Landscape Unit would be deferred until later phases.

Cultural Resources

Overall, the type and timing of effects on historic properties along the corridor would be tied to the sequencing of project construction. Phased implementation would construct the vulnerable bridge structures first. The Evergreen Point Bridge, which has been determined eligible for the NRHP, would be demolished. Mitigation would be the same as described for the 6-Lane Alternative.

Historic properties and resources within the Portage Bay and west approach areas, including Foster Island, would experience the same effects as described for the 6-Lane Alternative; however, negative effects on Foster Island would be experienced more than once if interim connections to Lake Washington Boulevard ramps are constructed, as these would be demolished in later phases. Types of effects would include noise, dust, glare, and possibly vibration. Effects on tribal fishing from the Phased Implementation scenario are described in the evaluation of effects on low-income and minority populations, above.

Noise and Vibration

The loudest noise source during construction activities would be from pile-driving equipment; the majority of pile-driving would occur during replacement of the vulnerable bridge structures. Most demolition would also take place during this time. Noise levels from pile-driving and vibration effects would be the same as described for the 6-Lane Alternative. Noise mitigation, such as noise walls (as approved by affected neighborhoods), would be constructed in conjunction with the completion of corridor improvements (see Section 5.7, Noise), helping to reduce noise levels for adjacent neighborhoods concurrent with project phasing.

Air Quality

Air quality emissions from construction activities would be spread over a longer duration if the project was constructed in phases. However, additional mobilization and demolition in the transition areas would be required and would extend the overall time period that neighborhoods and park areas could experience negative air quality effects, such as fugitive dust and exhaust emissions.

Energy and Greenhouse Gas Emissions

Table 6.17-1 identifies the amounts of energy that would be consumed to construct the project elements included in the Phased Implementation scenario and represents a subset of the total energy that would be consumed to build the 6-Lane Alternative.

Table 6.17-1. Energy Consumption (in MBtu[a]) during Construction, Phased Implementation Scenario

Option	Portage Bay Area	West Approach Area	Floating Bridge Area	Eastside Transition Area	Total
Option A	1,871,000	2,880,000	2,890,000	698,000	8,339,000
Option K	1,633,000	3,793,000	2,890,000	698,000	9,014,000
Option L	1,639,000	3,950,000	2,890,000	698,000	9,177,000

[a] A 60 percent risk cost was used to estimate construction energy consumption.

Phasing construction of the 6-Lane Alternative would defer improvements at the I-5 and Montlake interchanges. Because energy needed for the project is calculated as a function of project costs, it is likely that project phasing would ultimately result in cost escalations and associated increases in energy consumption, as compared to estimates provided for the 6-Lane Alternative. Some additional energy would be consumed and greenhouse gases emitted for additional mobilization and demolition efforts in the transition areas. However, building the 6-Lane Alternative in phases would spread the demand for energy and the greenhouse gas emissions over a longer period of time.

Water Resources

Replacing the vulnerable structures under the Phased Implementation scenario would include much of the in-water work needed for the 6-Lane Alternative. Construction effects on water resources would be similar to those described for the 6-Lane Alternative. Additional construction seasons for subsequent phases of construction would be required in Union Bay to remove or replace the Lake Washington Boulevard ramps (depending on the option) and to add the SPUI structures (for either Option K or L). This would increase the overall duration of construction effects on Union Bay.

Stormwater treatment facilities would be constructed to accommodate a 6-lane corridor and any interim improvements in the transition areas as part of the Phased Implementation scenario.

Ecosystems

Wetlands

Construction-related effects on wetlands and buffers would occur under the Phased Implementation scenario in the Portage Bay and west approach areas (see Exhibit 6.11-1 and Tables 6.11-1 and 6.11-2). There are no wetlands in the I-5 area or immediately adjacent to the Montlake interchange. The amount of permanent wetland and buffer affects associated with replacement of the vulnerable structures would be similar to these same elements of the 6-Lane Alternative. However, wetlands located in transition areas between project phases would be affected more than once. Wetlands in the Arboretum would be affected to the greatest extent if interim connections to the existing Lake Washington Boulevard ramps were constructed for Phased Implementation and then subsequently removed to facilitate the new Lake Washington Boulevard ramps that may be constructed under Option A. WSDOT would develop and implement all mitigation needed to satisfy regulatory requirements.

Fish

Fish resources, including endangered species, would experience greater overall effects under the Phased Implementation scenario because of the need for additional construction seasons to complete the new interchanges in the Montlake area. The effects would be greatest under Options K and L because of the need for in-water construction of the new SPUI ramps.

Option K would require construction of a work bridge to detour mainline traffic around the excavation while the ramps and tunnel were being built. At the same time, the aquatic fill for the SPUI approach would be constructed east of the Montlake shoreline. The phased approach would considerably lengthen the total in-water work time in Union Bay (the time during which work bridges, detour bridges, and other in-water construction elements would be present) under Option K compared to Options A and L.

Wildlife and Wildlife Habitat

Types of effects on wildlife and wildlife habitat would be the same as described for the 6-Lane Alternative. Phased construction would spread out the duration of disturbance to wildlife from noise as well as from vegetation clearing over time. Transition areas between phases would be affected more than once.

Geology and Soils

Types of construction effects on geology and soils associated with the Phased Implementation scenario would be similar to those described for the 6-Lane Alternative. Excavation quantities associated with construction activities in the I-5 and Montlake interchange areas (depending on the option) would be lower by approximately 180,000 and 650,000 cubic yards. The magnitude of construction activity with the potential to result in erosion, sedimentation, or water quality contamination effects on adjacent water bodies would be lower than if the full corridor was under construction during concurrent time periods. However, additional risks of construction-related effects would occur from areas that are affected more than once.

Hazardous Materials

Replacement of the vulnerable structures would not affect identified hazardous materials sites located in the vicinity of the I-5 interchange, Montlake interchange, and north of the Montlake Cut, including the Seattle Fire Station 22, Montlake Landfill, and Montlake 76 gas service station (see Exhibit 4.13-1). However, effects on the Miller Street Landfill and from encountering contaminated sediments would still be a possibility. Types of effects would be similar to the effects described for the 6-Lane Alternative. The NOAA Northwest Fisheries Science Center could also be affected by replacement of the Portage Bay Bridge, but to a lesser degree than under full build of the 6-Lane Alternative.

In the transition areas between project phases, the risk of hazardous materials spills or of encountering contaminated sediments would be greater because construction in these areas would occur more than once.

Potential locations for production of supplemental stability pontoons (SSPs)

Navigable Waterways

Construction effects on navigable waterways and navigation channels from replacement of the Evergreen Point Bridge, Portage Bay Bridge, and west approach would be the same as for the 6-Lane Alternative as these project components correspond to the areas where navigability would be affected. Navigability effects associated with a new bascule bridge across the Montlake Cut would be deferred until the Montlake interchange is constructed.