

5.0 Construction

5.1 Construction Approach

This section provides an overview of potential construction activities and timing. Major activities would include:

- *Civil construction*: utility relocation, foundation and column placement, guideway construction, and track work, followed by construction of other facilities such as stations, park-and-ride lots and structures, and ancillary facilities.
- *Systems installation*: installation of the electrical system that powers the trains.
- *Testing and startup activities*: communications, safety, and emergency systems tested and certified before beginning revenue operations.

Activity would be most intense during civil construction, which would take between 1 and 4 years in any given portion of the corridor.

The following sections describe the methods for each major construction component. Several sections quantitatively compare the impacts of the Preferred Alternative against a low-cost project and a high-cost project, using a conceptual design level construction cost estimate. Low- and high-cost projects are as follows:

- **Low-cost project**: Preferred Alternative with the Kent/Des Moines At-Grade Station Option, S 272nd Star Lake Elevated Station Option, and the Federal Way I-5 Station Option
- **High-cost project**: SR 99 Alternative with the potential additional S 216th West Station Option, the Kent/Des Moines HC Campus Station Option, and the potential additional S 260th East Station Option

Many impacts are discussed qualitatively because the specific approach to construction will be refined as Sound Transit obtains additional information on site conditions and makes decisions related to construction contracting methods. It is expected that the project would be constructed in at least two phases, with the first phase

The major civil construction activities that could cause environmental impacts and community disruption include:

- Demolition (buildings, pavement) and debris removal
- Clearing and vegetation removal
- Fill and excavation
- Utility extensions, relocations, or disruptions
- Drainage changes
- Staging area use
- Construction activity in or near a wetland or water body
- Elevated structure construction
- Retaining wall construction
- Pile-driving or auguring piles
- Blasting (not likely)
- Temporary partial or total road or lane closures and detour routes
- Temporary, partial, or limited access
- Building temporary vehicular and pedestrian detour routes
- Delivery of materials and equipment

being Angle Lake to Kent/Des Moines, and the additional phase constructing from Kent/Des Moines to S 272nd Street and the Federal Way Transit Center. As described in Chapter 2, if the ST3 package is approved by voters, the schedule will be revisited.

Site-specific conditions, permit requirements, and market conditions at the time of construction, among other factors, affect how a project is built. Sound Transit will coordinate with each jurisdiction on land use approvals, right-of-way use and land disturbance permits, and other permits required for construction.

Although the SR 509 Extension Project could be under construction concurrently with the FWLE, this chapter only analyzes FWLE project impacts. Potential combined impacts of both projects being constructed at the same time are discussed in Chapter 6, Cumulative Impacts.

5.1.1 Types of Construction

5.1.1.1 Elevated Light Rail Construction

Construction of elevated guideway would involve the following:

- Demolition of existing structures
- Clearing and grading
- Relocating utilities
- Preparing construction access
- Building a temporary construction road where access is not available from existing roads
- Temporarily closing some traffic lanes and detouring traffic when working within existing street right-of-way
- Constructing the guideway structure

Construction would begin with preparation work to build foundations such as shallow spread footings, deep-driven or augered piles, or drilled shafts. Concrete columns would then be constructed. The elevated superstructure could be steel, cast-in-place concrete, pre-cast concrete, or segmental concrete. Sound Transit would primarily use segmental construction for elevated guideways, where the segmental box girders are typically poured offsite and trucked to the project location to be placed by crane.



Columns Under Construction for the Central Link Project in Seattle

False-work could be required in places where cast-in place concrete is used to support the superstructure while the concrete is poured and the cast concrete gains enough strength to support itself, or while the steel beams are joined through welding or bolting. It would require temporary traffic detours until a sufficient portion of the elevated structure is complete. Some other construction activities would also require short-term partial or full street closures, as described in Section 5.2.1.

False-work

False-work is temporary support structures used during construction of a structure not yet able to support itself.



Construction of Elevated Guideway Showing False-Work

5.1.1.2 At-Grade Light Rail Construction

Construction methods and impacts for at-grade guideways would be similar to typical road construction, as follows:

- Demolishing existing structures in the project footprint and relocating conflicting utilities
- Performing shallow excavations to construct the subgrade, track, and station platform slabs
- Building a temporary construction road where access is not available from existing roads
- Installing drainage structures and below-grade light rail infrastructure

Construction Footprint

The construction footprint used in analyzing impacts includes areas beyond the permanent footprint needed for construction access or staging. It does not include all temporary construction easements.

5.1.1.3 Trench and Retained Fill Light Rail Construction

Trench and retained-fill guideway construction would be similar to at-grade guideways, but may be more intensive and of longer duration because of required retaining walls. Trench construction would involve excavating trenches and building retaining walls. Dewatering may be necessary in places. Retained fills would require building retaining walls and placing fill.

Sound Transit would use soil nail, soldier pile, and secant pile retaining walls. Soil nail walls would be most often used because they are the most cost-effective and have the shortest construction time. Soldier piles walls are also cost and time efficient for shallower excavations up to 10 feet. Secant pile walls would be used in deeper excavations and where groundwater is present. The type of wall to be used would depend on depth of the trench and site conditions.

Construction under roads would use cut-and-cover construction methods, typically with metal plates over the trench to maintain traffic flow.

Construction staging areas are needed before, during, and for a short time after construction work, for the following:

- Construction
- Equipment storage
- Construction materials delivery and storage
- Demolition or spoils handling
- Contractor trailers
- Access roads
- Construction crew parking

All profiles would have construction staging areas along the alignments. Contractors would use the property in which the facility is being constructed, property that Sound Transit acquired for right-of-way, or other properties as negotiated by the contractor.

Following construction, staging sites may be used for the project or redeveloped by others consistent with the current zoning.

In undeveloped areas, 50- to 100-foot-wide construction areas could be necessary to maneuver equipment and materials along the corridor. Sometimes the project could use areas acquired for project right-of-way, but other times it would require temporary construction easements from adjacent properties. Following construction, these areas would be restored to preconstruction conditions.

Construction might require temporary road closures. Where this would occur, traffic would be rerouted to maintain access to businesses and residences. Traffic closures or detours would require approval by local jurisdictions and/or Washington State Department of Transportation (WSDOT).

5.1.2 Construction Plan

Sound Transit generally builds light rail projects in 1/3 to 1/2 mile-long segments. Within each segment, a project proceeds according to type of construction (e.g., foundations, columns, at-grade guideway, elevated guideway, retained-cut/fill

Retaining Wall Types

Soil Nail: A type of excavation using grout tension-resisting elements (nails) designed for permanent support. This method enables construction to occur from the existing ground surface down to the desired excavation depth. Typically 3 to 6 feet of soil is excavated from the ground surface and nearly horizontal holes are drilled into the exposed face at 3 to 6 feet on center. The tension-resisting steel is inserted and grouted. A drainage system is installed on the exposed face and reinforced shotcrete is applied. This procedure continues to the desired depth of excavation.

Secant pile: A type of wall formed by constructing intersecting reinforced concrete piles. The holes for the piles are either drilled or augered and then reinforced with either rebar or steel beams. Primary piles are installed first and then secondary piles are constructed in between when the primary piles have gained sufficient strength. The piles overlap by about 3 inches.

Soldier pile and lagging: Soldier piles and lagging uses vertical steel piles with horizontal lagging. Typically, H-piles are drilled or driven at regular intervals along the planned excavation perimeter. The lagging material can be timber, steel, or precast concrete is inserted between the H-piles. The lagging effectively resists the load of the retained soil and transfers it to the piles.



Staging Area Adjacent to New Guideway Under Construction

sections, station platforms, park-and-ride facilities). Where appropriate, the contractor would work in more than one segment at a time.

Sound Transit would develop a construction plan during final design to establish the various construction phases and construction contracts, their estimated schedules and durations, and appropriate sequencing. Where possible, Sound Transit would coordinate construction activities with other capital improvement projects being carried out by or permitted by WSDOT or local jurisdictions, to help minimize construction impacts. This could include coordinating construction activities with WSDOT for the SR 509 Extension Project.

Most construction would occur between 7 a.m. and 10 p.m. in a 5- to 6-day workweek. Where street or freeway detours are involved and/or daytime construction periods need to be abbreviated to reduce impacts, work may require additional shifts or weekend, nighttime, or 24-hour construction.

Truck hauling would require loading areas, staging space for trucks awaiting loading, and provisions to prevent tracking soil on public streets. Truck haul routes would require approval by local jurisdictions. Truck hauling activities may be required in off-peak periods or weekends to avoid peak traffic periods or to minimize potential noise impacts.

An example of construction steps and durations for each alternative is provided below. It assumes 1/2-mile segments of guideway construction. An overview of station construction is provided after the discussion of alternatives.

5.1.2.1 Preferred Alternative

The Preferred Alternative would include elevated, at-grade, and trench profiles in and outside of the WSDOT right-of-way. Light rail under S 216th Street and S 317th Street would use cut-and-cover construction to maintain some surface traffic during trench construction. The roadway would be reconstructed to restore its existing configuration.

The profile within the I-5 right-of-way would be primarily at-grade with existing topography (Exhibit 5-1), except for road crossings. Work would begin with site preparation, including clearing of vegetation and construction of access points and roadways. Grading would occur as necessary to create a level surface for the track

ballast, with retaining walls constructed where necessary for retained fills. Major utility relocations would be limited for the Preferred Alternative and are described in Section 5.2.16.

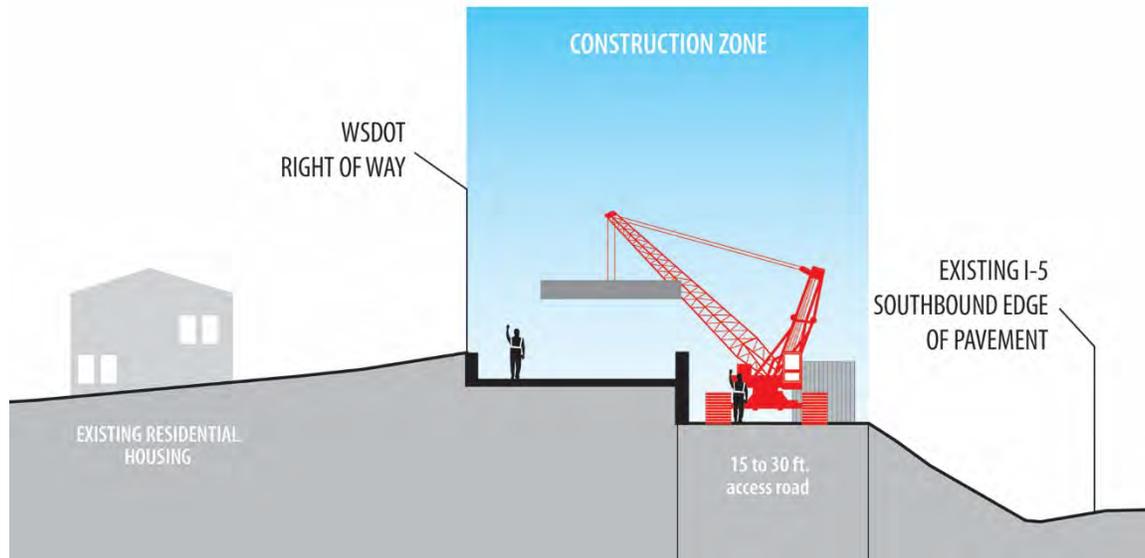


EXHIBIT 5-1
I-5 Construction (Typical Cross-Section)

For elevated structures, Sound Transit would build columns and then place the guideway on and between the columns, with each step taking 6 to 8 months in a given location.

Regardless of profile, the final construction step is track and systems installation. Much of this work would be completed from the side of the guideway or on the guideway.

Construction across SR 99 and the future SR 509 would require an approximately 900-foot-long bridge structure. The bridge would have two columns in the middle of SR 99, one of which would be a straddle bent over the northbound lanes. There would also be a column in the future median of SR 509. This crossing could take up to 9 months to build, and could be done before or concurrent with guideway sections to the north or south.

The crossing under S 216th Street would involve construction of a trench box structure under an I-5 overpass. To construct the trench box, temporary shoring walls would be installed across S 216th Street to support the excavation and provide a temporary span for S 216th Street. When these are in place, construction of the trench box would be staged below the overpass and on either side of S 216th Street. After the trench box is constructed, the walls and temporary span

would be removed and the roadway restored. A similar process would be followed where the light rail would travel under S 272nd Street and under S 317th Street.

Sound Transit would build the elevated guideway next to the McSorley Creek Wetlands from a temporary work trestle supported by steel pilings driven by pile hammers. Once construction in this area is complete, the trestle would be removed.

The Landfill Median Alignment Option would include straddle bents requiring columns on the west side and median of I-5, beams across southbound travel lanes, and a temporary shoring tower in the median. Building it would require either closing one or two lanes of I-5 for 6 to 8 weeks, restriping the mainline lanes around the construction area, or overnight closures for up to 4 months. A 15- to 30-foot-wide construction access road built within the median for this option may require grading of the median. The median would be used to store construction equipment. Column and guideway construction in the median would take approximately 6 months. Construction access points, closures, and changes in I-5 operations would require approval from WSDOT and the Federal Highway Administration (FHWA).

The S 320th Park-and-Ride Station Option would require demolition and reconstruction of the southbound on- and off-ramps at S 320th Street, where the alignment would go under the ramps. Sound Transit could use sequential excavation method (SEM) mining to cross under S 320th Street itself and avoid this type of roadway disturbance.

5.1.2.2 SR 99 Alternative

Construction in the Median of SR 99

Where the SR 99 Alternative is in the roadway median, primary civil construction would occur in five phases: utility relocation, street reconstruction, foundation and column construction, guideway placement, and track and systems installation.

Utility relocation for guideway conflicts with above- or below-ground utilities (see Section 5.2.16) would last approximately 6 months for each 1/2-mile section of SR 99. It could overlap with street reconstruction in some areas.

Street reconstruction would involve widening the existing SR 99 roadway on one or both sides to allow space in the median for

Construction Affecting I-5

Construction access points, closures, and changes in I-5 operations would require approval from WSDOT and the Federal Highway Administration (FHWA).

Sequential Excavation Method

With SEM, the tunnel is dug out in small sections or bites using an excavator and cutting equipment. As soon as soil is removed, pressurized concrete called shotcrete is sprayed on the tunnel's sides, ceiling and floor. Lattice girders provide additional structural support for the tunnel.

column construction. The area needed for road widening would be cleared, and the existing street infrastructure (sidewalks, curbs, gutters, and pavement) removed and rebuilt. Lanes would be restriped in their new configuration and the widened median area prepared for light rail construction. This phase would also last approximately 6 months per 1/2-mile section.

The foundation and column construction, guideway placement, and track and systems installation would proceed as described in Section 5.1.1.1.

Exhibits 5-2 and 5-3 show that work in the median for Phases 2 through 4 would close the adjacent northbound and southbound lanes. Existing business access and transit (BAT) lanes would be converted to general purpose lanes.

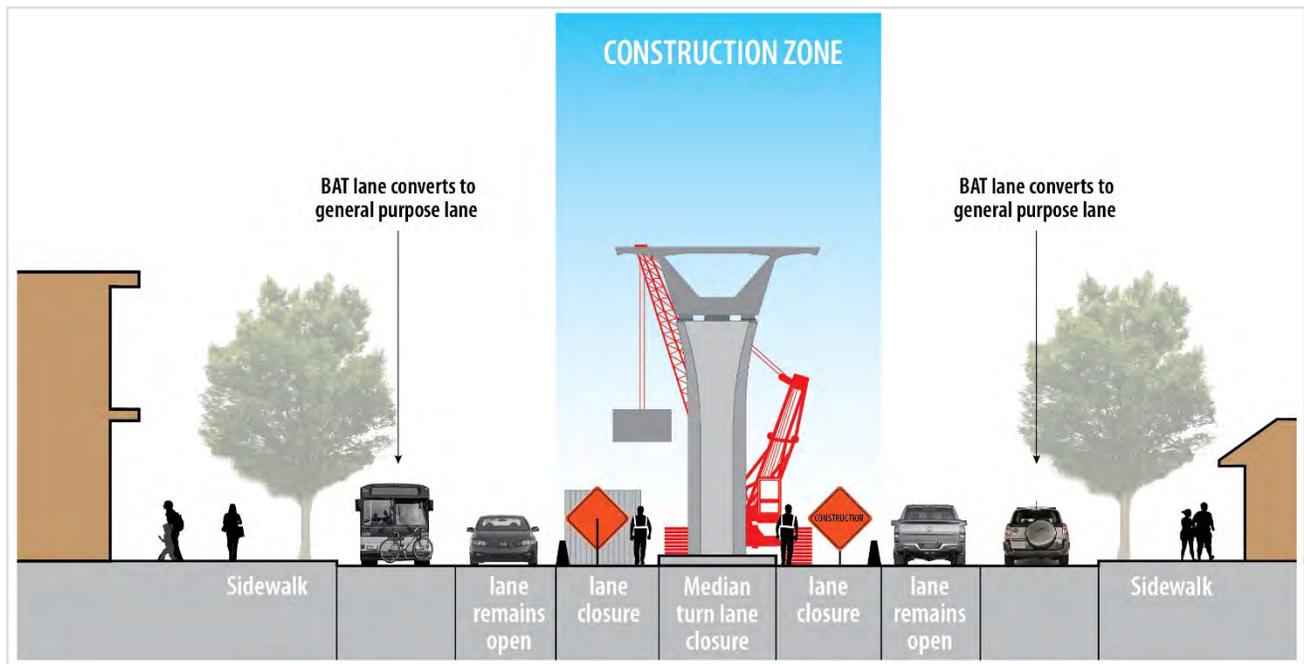


EXHIBIT 5-2
Construction of Elevated Guideway in SR 99 Median (Typical Cross-Section)

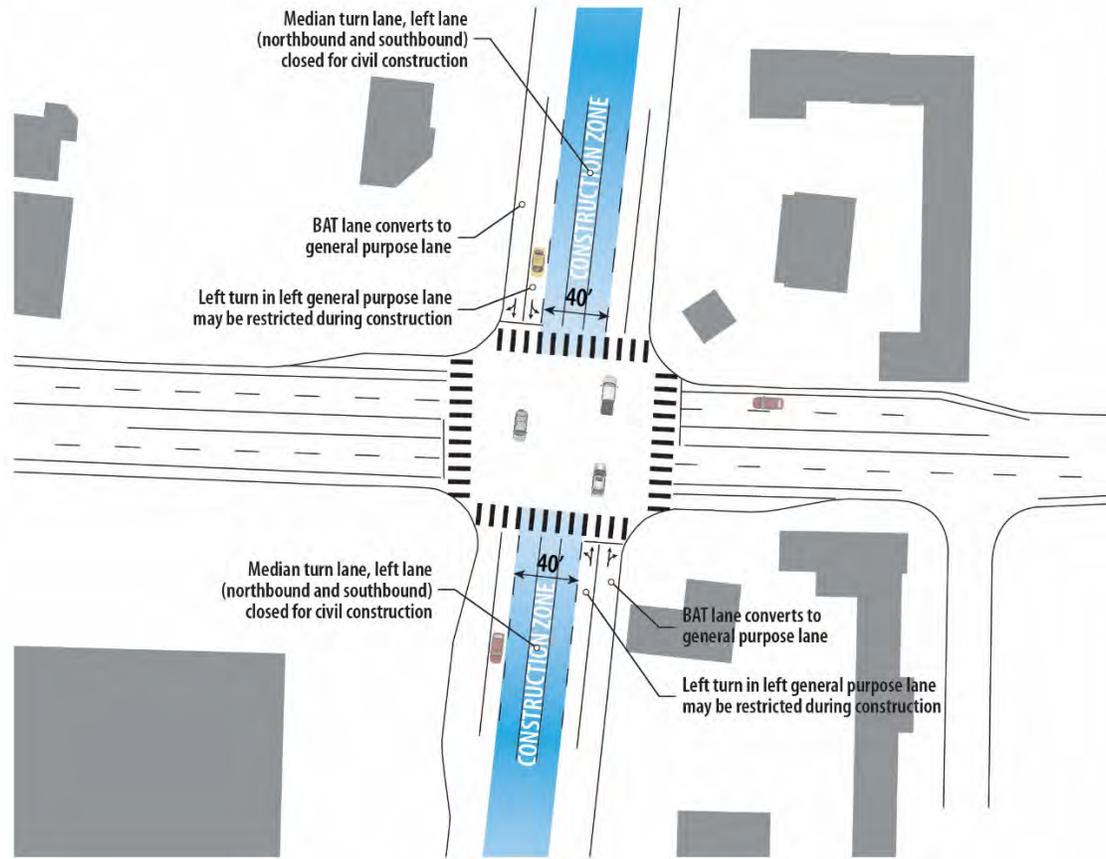


EXHIBIT 5-3
Construction of Elevated Guideway in SR 99 Median (Typical Plan View)

Construction on the Side of SR 99

Areas where the light rail would be on the side of SR 99 (elevated or in a trench) would generally not need roadway reconstruction, and would have fewer utility relocations.

Column and guideway construction for elevated profiles alongside of SR 99 would be the same as when in the median, although only the adjacent BAT lane would be closed (Exhibit 5-4). For trenched areas on the side of SR 99, excavation and retaining wall construction would replace the column and guideway construction phases (Exhibit 5-5). Commercial driveway access would be maintained during business hours, although periodic short-term closures might be necessary. Residential driveway access would also be maintained, except for periodic short-term closures. Trenching would take approximately 6 to 9 months to complete per 1/2 mile. Depending on the station option, there could be 1/4 to 1-1/2 miles of trenching.

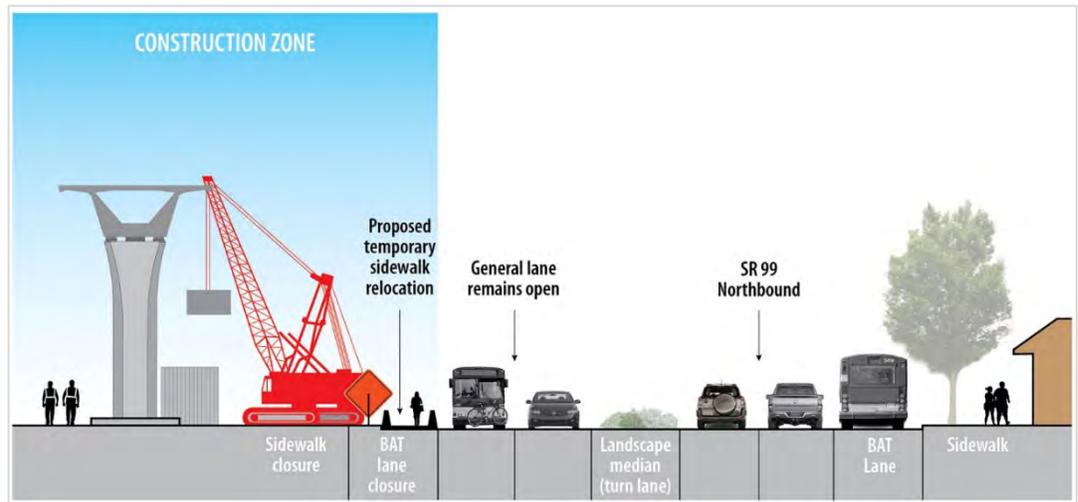


EXHIBIT 5-4
Construction of Elevated Guideway on Side of SR 99

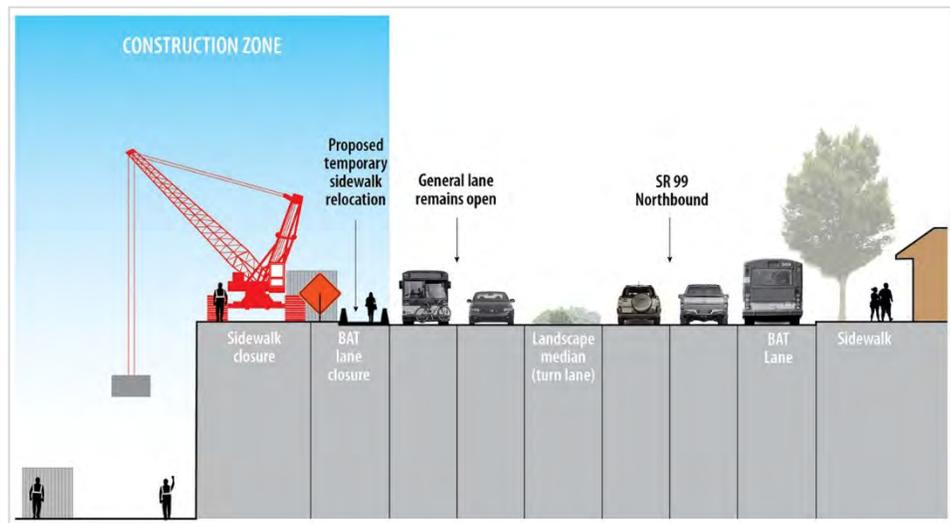


EXHIBIT 5-5
Construction of Trench Guideway on Side of SR 99

5.1.2.3 SR 99 to I-5 Alternative

Construction methods for the SR 99 to I-5 Alternative would be the same as for the SR 99 Alternative north of Kent-Des Moines Road and similar to the Preferred Alternative south of S 240th Street. This alternative would also require a trench under S 272nd Street and the Mark Twain Elementary School playfield. Construction under S 272nd Street and S 317th Street would be the same as described for the Preferred Alternative. Between Kent-Des Moines Road and S 240th Street, the profile would be elevated primarily on private property but may require some roadway reconstruction and utility relocations.

5.1.2.4 I-5 to SR 99 Alternative

Construction methods for the I-5 to SR 99 Alternative would be the same as for the Preferred Alternative north of Kent-Des Moines Road and for the SR 99 Alternative south of S 240th Street. Between Kent-Des Moines Road and S 240th Street, the profile would be elevated primarily on private property but may require some roadway reconstruction and utility relocations.

5.1.2.5 Stations

The Kent/Des Moines, S 272nd, and Federal Way City Center stations would need approximately 8- to 10-acre construction staging areas. Potential additional stations at S 216th Street and S 260th Street would have 4- to 6-acre footprints with no parking areas and therefore less construction. Station construction would be similar to that for the guideway in terms of sequencing (e.g., utility relocations, site preparation, and column construction for elevated stations) or trench construction (for trenched stations). The station structure itself would be completed first, followed by parking lots and/or garages, bus circulation areas, internal circulation facilities (stairways, escalators, and elevators), and other ancillary facilities, such as the traction power substations (TPSSs), storage buildings, and payment kiosks. Center-platform trench stations are wider than the guideway and require more excavation.

Stations would not be in roadways or require roadway reconstruction, except for the Kent/Des Moines SR 99 Median Station Option for the SR 99 Alternative. They may include new access roads on currently private property. Construction of the SR 99 Median Station Option would detour northbound traffic to 30th Avenue S; once work in the median is completed, the northbound lanes would be shifted back. Station construction generally lasts 2 to 3 years for all phases at each station area.

5.2 Construction Impacts and Potential Mitigation Measures

5.2.1 Transportation

This section summarizes potential construction impacts and mitigation measures for impacts on regional and local roadway operations (including transit and freight), safety, parking, and non-motorized facilities. Impacts typically stem from road and lane closures, staging areas and haul routes, and traffic detours. The discussion of impacts below is grouped according to these activities.

It is likely that the SR 509 Extension construction period will overlap for a portion of the FWLE construction period (see Exhibit 2-26). While some construction activities for both the FWLE and WSDOT's SR 509 Extension may occur simultaneously, it is assumed the peak FWLE construction would occur prior to SR 509 construction. Although the SR 509 Extension could be under construction concurrently with the FWLE, this chapter only analyzes FWLE project construction impacts. Potential combined impacts of both projects being constructed at the same time are discussed in Chapter 6, Cumulative Impacts.

Additional details are included in Appendix G1, Transportation Technical Report.

5.2.1.1 Construction Impacts

Impacts Common to All Alternatives

Road and Lane Closures

Appendix G to the Transportation Technical Report (Appendix G1 to this Final EIS) shows the potential road and lane closures assumed for the construction traffic analysis. Construction for each alternative would require local road and lane closures that could also affect sidewalks and property access. Streets that intersect the alternatives would require full and/or partial closures for short durations to construct the guideway over or under the road. Sound Transit would prepare traffic control plans during final design to explain how it would maintain all modes of transportation and address pedestrian access and safety. Plans would need approval from WSDOT and the local jurisdictions and would conform to their requirements and the *Manual on Uniform Traffic Control Devices for Streets and Highways* (FHWA, 2009). Sound Transit would also coordinate with WSDOT and local agencies to disseminate construction closure information to the public.

All alternatives except for the SR 99 Alternative would require I-5 lane closures.

Road, lane, and sidewalk closures would require bus stop relocations and/or bus detours during construction. Sound Transit would maintain access to existing bus stops to the extent feasible and coordinate with other transit providers to minimize impacts and disruptions. Information (e.g., rider alerts) would be posted at transit stops before construction at these locations.

Sidewalk closures would affect pedestrians and bicyclists. Sound Transit would provide detours within construction areas, such as protected walkways, and notify the public as appropriate.

Commercial driveway access would be maintained during business hours, although periodic short-term closures might be necessary.

Construction Staging and Haul Routes

Appendix G to the Transportation Technical Report (Appendix G1 to this Final EIS) shows preliminary staging areas and truck haul routes for each FWLE alternative and option. Most truck trips would occur during earthwork operations and during concrete delivery for both the guideway and station construction. These periods would require up to 15 trucks per hour for the concrete delivery, or between approximately 80 and 240 trips per day. Earthwork activities would require a similar level of truck activity hauling material during excavation.

Construction trucks would use SR 99, Military Road, I-5 (via on and off ramps), and, if required, local roadways to access the construction areas. They would use I-5 to get to and from other locations. There would be no direct access to the construction sites via the I-5 mainline except for the construction of the S 216th Street temporary bridge abutment for the Preferred Alternative, overhead electrical wire relocations that cross I-5, sporadic construction vehicle access (such as for material deliveries), and for the I-5 Landfill Median Alignment Option between S 240th Street and S 259th Place. Tree removal along I-5 would likely require periodic closures of up to one lane to safely conduct this work.

Sound Transit might temporarily close Star Lake Park-and-Ride, Redondo Heights Park-and-Ride, and the S 320th Street Park-and-Ride. It would cooperate with WSDOT and other transit agencies to minimize closures and disruptions to service and to identify alternate parking locations.

Construction workers would park within the construction area or on local streets and arterials with unrestricted parking. Construction workers parking near designated construction staging areas could affect the nearby parking supply during heavy construction periods. Contractors are responsible for providing parking for construction workers where necessary. On-street parking on 21st Avenue S next to the Preferred Federal Way Transit Center Station staging area would be removed during construction for up to 30 months. The Federal

Way I-5 and S 320th Park-and-Ride station options would avoid this impact. The SR 99 Alternative Kent/Des Moines HC Campus Station Option would remove some Highline College parking for staging, but replacement parking would be provided by Sound Transit prior to construction.

Detours

Conceptual detour routes are shown in Appendix G of the Transportation Technical Report (Appendix G1). Detours would cause additional traffic volumes on detour routes, which could increase traffic delay.

Preferred Alternative Road and Lane Closures

The Preferred Alternative would require periodic weekend and nighttime local road and lane closures to construct the guideway at the following roads:

- I-5
- SR 99
- S 216th Street
- Kent-Des Moines Road
- 30th Avenue S (two locations)
- S 240th Street
- S 260th Street
- S 272nd Street
- I-5 SB Off-Ramp at S272nd Street
- Military Road S (two locations)
- S 288th Street
- 28th Avenue S
- S 317th Street
- 23rd Avenue S
- S 320th Street
- I-5 SB On and Off-Ramps at S 320th

Sound Transit would keep all traffic lanes open as much as possible during peak traffic periods. In general, temporary road closures for guideway construction could affect bike and pedestrian travel and result in rerouted bus routes and temporarily closed or relocated bus stops. Transit service and non-motorized facilities would be maintained as much as possible. For all analyses, the SR 509 Extension is not assumed to be under construction or built by the time FWLE is under construction.

I-5 Lane Closures

Construction of the Preferred Alternative would have limited short-term impacts on highway operations on the I-5 mainline or shoulders. Most construction activities would occur west of the I-5 mainline, except during construction under the S 216th Street bridge over I-5, overhead electrical wire relocations that cross I-5, and during tree removal. At the S 216th Street bridge undercrossing, access would be

required day and night from southbound I-5 and would involve use of the outside shoulder and possibly one outside general-purpose lane. Relocating electrical lines would require short-term full or directional closure of the mainline. Tree removal along I-5 would occur during the day to maintain public safety. Tree removal could require periodic closure of the shoulder and potentially one lane for limited distances. Access directly from I-5 mainline for these activities would be coordinated with and approved by WSDOT.

I-5 Ramp Closures

Short-term ramp closures would be needed at three locations. Kent-Des Moines Road, west of the I-5 southbound ramps, would need to be closed for the elevated guideway construction during nights and weekends. This would restrict southbound right turns at the southbound ramp terminal intersection and close the I-5 northbound off-ramp to westbound Kent-Des Moines Road. The S 317th Street high-occupancy vehicle (HOV)/bus access ramp would be closed for periods during construction under the S 317th Street/28th Avenue S roundabout. The I-5 southbound on- and off-ramps at S 320th Street would require night and/or weekend closures for the construction of stormwater pipes under the ramps.

SR 99 Lane Closures

Construction of the Preferred Alternative guideway over SR 99 near S 208th Street would require lane reductions and nighttime or weekend closures of SR 99 periodically for about 3 months. Because one northbound and one southbound lane adjacent to the median would be closed while constructing a column in the median, the southbound SR 99 HOV lane in this area would be converted to general-purpose traffic. Nighttime closures of all northbound lanes or southbound lanes (at different times) would be required during construction of the guideway over the lanes, detouring RapidRide A Line and temporarily relocating stops at the SR 99 and S 208th Street intersection. The lane closure could cause longer travel times in this area for all traffic.

Construction-area SR 99 lane closures would temporarily affect freight mobility. Even during lane closures on SR 99, freight would continue to travel on SR 99 or on other designated freight corridors. Potential temporary closures of business driveways could also affect freight deliveries. If driveway closures are required, Sound Transit

would maintain access to these properties to the extent possible and Sound Transit would try to schedule the closures outside of business hours.

Local Roadway Lane Closures

Longer-duration lane closures would occur where the light rail would go over (or under) S 208th Street, S 216th Street (under), Kent-Des Moines Road, 30th Avenue S (two locations), S 240th Street, S 259th Street, S 272nd Street, Military Road (two locations), S 288th Street, S 317th Street (under), 23rd Avenue S, and S 320th Street. Where the guideway would cross over roadways, full road closures would be required for part of the construction period, except for S 208th and S 240th Streets where traffic could be shifted around the work areas. For the two locations where the guideway is proposed to be under the roadways (S 216th Street and S 272nd Street), construction would be phased/sequenced to maintain traffic.

Sound Transit would reconstruct the existing roundabout at the intersection of S 317th Street and 28th Avenue S in Federal Way where the guideway crosses under the intersection. The existing roundabout would be converted to a stop-controlled intersection for about 18 months, which would likely increase vehicle delay. However, because of the intersection's low traffic volumes, conversion would not result in impacts on the I-5/317th direct-access ramps or the I-5 mainline. It would temporarily increase the potential for crashes, from three crashes over 5 years to five crashes over 5 years. This construction would affect bus service at the 28th Avenue S and S 317th Street intersection and increase bus travel times. After construction, the roundabout would revert to existing operations.

Guideway construction near I-5 interchanges (Kent-Des Moines Road and S 272nd Street) would require periodic nighttime and weekend closures of Kent-Des Moines Road and S 272nd Street. Traffic detours to other arterials or interchanges could increase or decrease volumes on the I-5 mainline. Near these two interchanges, I-5 northbound would be over capacity during weekend closures. At the S 272nd southbound off-ramp, the channelization at the ramp terminal could be modified from a left-turn lane, left-through shared lane, and right-turn lane, to a left-through lane and a right-turn lane for up to 4 months.

Intersection Type Safety

The *Highway Safety Manual* (American Association of State Highway and Transportation Officials, 2014) suggests that converting a roundabout to a stop-controlled intersection could increase the potential for crashes by up to 65 percent.

Construction Staging and Haul Routes

The construction area for the Preferred Alternative would be near the I-5 pavement edge in several locations. During construction, the highway clear zone would be reduced or eliminated along most of I-5 southbound through the study area. It would be entirely eliminated south of Kent-Des Moines Road. Where the light rail alignment parallels the I-5 mainline, from approximately S 211th Street to S 317th Street, a temporary construction barrier would be placed near the southbound I-5 edge of pavement (where barriers are not already present) to separate the construction activity from traffic on I-5 for the full guideway construction duration (1 to 4 years). An increase of up to three crashes per construction year could be expected (most, likely property damage only), based on the severity distribution of the existing crash history.

Construction truck traffic would use I-5, SR 99, and local streets and arterials for haul routes. Truck access to the construction areas would be west of the guideway using a temporary construction road adjacent to the guideway accessed via arterials, local streets, and I-5 interchange ramps. Except for the construction area under the S 216th Street bridge over I-5 and special construction vehicle access (such as material deliveries) that would occur sporadically during construction, there would be no direct access to the construction areas from the I-5 mainline. Additional truck traffic could cause a small increase in delay where ramps intersect local roads.

The staging area for the S 272nd Star Lake Station at the Star Lake Park-and-Ride lot would temporarily relocate transit service, possibly to the Redondo Heights Park-and-Ride and/or the Kent-Des Moines Park-and-Ride. The existing Star Lake Park-and-Ride is currently 52 percent utilized, with approximately 285 of the 540 parking stalls being occupied during weekdays. If bus service were rerouted to the Redondo Heights Park-and-Ride, this location (with approximately 640 spaces) could accommodate the displaced riders because it is currently 9 percent utilized. Riders would have longer travel times on the rerouted buses. This closure would also change traffic circulation patterns along S 272nd Street. With the additional vehicle trips from riders relocating to the Redondo Heights Park-and-Ride, some intersections along SR 99 and S 272nd Street could have additional congestion, but impacts to I-5 would not be expected.

Construction of the Federal Way Transit Center Station is not expected to disrupt access to the existing Federal Way Transit Center for most of the construction period other than for the construction of the roundabout at 23rd Avenue S and S 317th Street. Construction phasing could, however, require relocating the transit center temporarily within the station staging area. Transit service would be rerouted to the temporary or new bus circulation areas at the station after they are complete to avoid interruptions in service. The existing on-street parking along 21st Avenue S would be removed during construction at the Federal Way Transit Center for up to 30 months. Additional construction activities, including constructing the new 400-stall parking garage and the proposed roundabout at 23rd Avenue S and S 317th Street, would continue for up to a year and could affect transit operations at the new transit facility.

If the SR 509 Extension were built before the FWLE south of Kent-Des Moines Road, the light rail construction south of Kent/Des Moines Station would be adjacent to the planned I-5 pavement edge in two places—in the Midway Landfill between S 246th and S 252nd streets, and next to the McSorley Creek Wetlands near S 272nd Street. There would be no direct construction impact on the I-5 mainline travel lanes, but these areas would require short-term I-5 shoulder reductions, which could reduce vehicle speeds through the construction areas.

Detours

Sound Transit evaluated the proposed detour routes to determine if those roads would be able to accommodate increased volumes. 2021 was used as the analysis year because it is expected to be the peak year for heavy civil construction.

Detour routes would use arterials and avoid local and collector streets to discourage traffic through neighborhoods. Because of the limited number of crossings over I-5, many detour routes could be circuitous. With some road closures (e.g., S 272nd Street, S 288th Street, and Military Road near S 304th Street), local and collector streets could provide a more direct route than the signed detour routes and drivers may choose to use alternate routes other than the proposed detour routes. Sound Transit would work with the local jurisdictions to minimize these potential impacts. Detour routes would ultimately be determined during the final design phase and in coordination with the contractor and relevant jurisdictions.

The following roads are proposed as potential detour routes:

- I-5 mainline and ramps
- SR 99
- Military Road S
- 23rd Avenue S
- 28th Avenue S/24th Avenue S
- 51st Avenue S
- 55th Avenue S
- S 200th Street
- S 216th Street
- Kent-Des Moines Road
- S 240th Street
- S 272nd Street
- S Star Lake Road
- S 304th Street
- S 320th Street
- S 324th Street
- S 288th Street
- S 312th Street
- S 316th Street
- S 321st Street

Most roads on detour routes would operate under capacity during temporary night or weekend road closures, with a few exceptions:

- The closure of SR 99 north of S 208th Street during weekends could cause S 216th Street to operate over capacity for peak periods.
- A weekend closure of Kent-Des Moines Road could result in Military Road S and I-5 ramps at S 200th St and Kent-Des Moines Road and S 272nd Street operating over capacity.
- The closure of S 260th Street could result in Military Road S operating over capacity during the weekend.
- The closure of Military Road S (north crossing) during weekends could cause traffic on S Star Lake Road to be over capacity during some of the closure period.
- Weekend closure of S 288th Street could cause traffic on Military Road S, 51st Avenue S, and 55th Avenue S to be over capacity during certain periods of the closure.
- The closure of S 320th Street during weekends could cause congestion on 23rd Avenue S and S 324th Street during periods of the closure.

Detour plans for freight would be similar to those for the general traffic and would only be on arterial streets.

Station and Alignment Options

There would be no changes in impacts on I-5, local streets and arterials, transit, safety, parking, or non-motorized facilities for the **Kent/Des Moines I-5 Station Option**. The **Kent/Des Moines At-Grade**

Station Option would have fewer impacts on non-motorized facilities than the Preferred Kent/Des Moines Station because no improvements would occur along S 236th Street and 30th Avenue S with this station option. During construction of the future S 242nd Street with the At-Grade Station Option, minor non-motorized impacts may occur in the area.

Construction of the **Landfill Median Alignment Option** over the southbound lanes of I-5 would have impacts on traffic operations during installation of the guideway bridge girders. If cast-in-place construction is used, it could require a shoring tower within the southbound I-5 mainline to support the straddle bents. To maintain safe operations of I-5, Sound Transit would coordinate with WSDOT to either close one or two lanes for about 2 months or restripe the southbound I-5 mainline travel lanes around the shoring tower. This would slightly reduce capacity on I-5 southbound.

Using precast cap beams across southbound I-5 would avoid the need for shoring towers with this option, but would require multiple overnight and/or weekend closures. These closures would then require vehicles and transit to use a detour route, resulting in longer automobile and transit travel times. Increased congestion on I-5 or along detour routes could also cause short-term travel impacts on freight movement. The likely detour route would be the Kent/Des Moines interchange to SR 99 and/or Military Road, with traffic rerouted back to I-5 at S 272nd Street. These detour routes have lower traffic volumes during weekday off-peak periods and weekends and would have capacity to accommodate some traffic from I-5.

With this option, approximately 1,100 feet of safety barriers would be required along the southbound I-5 outside shoulder for guideway transitions to and from the I-5 median in order to shield the guideway. Based on a safety analysis using the *Highway Safety Manual*, adding a barrier (like the guardrail) through the median section of both directions of I-5 and along the southbound I-5 outside shoulder could result in an increase of up to two crashes per year.

Vertical clearance during construction would be maintained on I-5. Construction vehicle access to the median construction area would be provided from either northbound or southbound I-5 mainline. No construction worker parking would be allowed in the I-5 median. This option would not change impacts on arterials and local roadways, parking, or non-motorized facilities.

The **S 272nd Star Lake Elevated Station Option** would reduce disturbance to S 272nd Street and the duration of lane and ramp closures for this road because the light rail would be constructed over the roadway instead of under. Some road closures would still be needed while constructing the guideway across S 272nd Street, similar to other elevated road crossings with the Preferred Alternative. This option would not change the impacts on transit, parking, and non-motorized facilities from the Preferred S 272nd Star Lake Station.

The **S 317th Elevated Alignment Option** would avoid reconstruction of the roundabout at S 317th Street and 28th Avenue S, reducing impacts at this location. Some road closures would still be needed while constructing the guideway across the roundabout, similar to other elevated road crossings with the Preferred Alternative, which would still affect transit but not to the same extent. This option would not change impacts on parking or non-motorized facilities.

The **Federal Way I-5 Station Option** would not have any additional impacts on I-5, but would require the temporary removal of the S 317th Street and 28th Avenue S roundabout during construction. Vehicles and transit would be rerouted to either S 312th Street or S 320th Street because of the phased long-term (12- to 18-month) temporary closure of both 28th Avenue S and S 317th Street. This option would increase automobile and transit travel times, but avoid impacts to non-motorized facilities at 23rd Avenue S. Parking along 21st Avenue S would not be removed with this option.

Guideway construction for the **Federal Way S 320th Street Park-and-Ride Station Option** would require night and weekend closures of the I-5 southbound ramps at S 320th Street. These closures would require rerouting or rescheduling of freight trips during these periods. The southbound off-ramp right-turn pocket would be shortened by approximately 250 feet for a substantial portion of the construction period, with no likely traffic backups onto the I-5 mainline. The off-ramp would be restored to existing conditions after construction is complete. This option would require the temporary closure of the S 320th Park-and-Ride; transit service would be rerouted to other transit centers, such as the Federal Way Transit Center. This could increase bus travel times. Local arterial and street impacts would be less than with the Preferred Alternative, as guideway construction would not impact 23rd Avenue S and 28th Avenue S.

The existing S 320th Park-and-Ride is currently under capacity, with almost 400 of the 877 parking stalls (45 percent) occupied on weekdays. The park-and-ride would be partially or fully closed during the construction period for this station option. Displaced bus riders would need to use the currently at-capacity Federal Way Transit Center, or other under-capacity facilities, such as the Star Lake Park-and-Ride. Parking along 21st Avenue S would not be removed with this option.

Minimal non-motorized impacts are expected during the construction of improvements at the 25th Avenue S/S 322nd Street intersection with this option. This option would avoid impacts to non-motorized facilities at 23rd Avenue S.

SR 99 Alternative

Road and Lane Closures

SR 99 Closures

Construction in the SR 99 median would require closure of adjacent travel lanes. During peak hours, one travel lane directly adjacent to the construction area would likely be closed in each direction, causing temporary impacts on traffic operations. Sound Transit would convert the existing HOV lanes within the construction area to open access for all traffic. Some traffic might divert to parallel roads, including I-5, 28th/24th Avenue S, Military Road, and 16th Avenue S. During peak periods, many intersections along SR 99 currently operate at or near capacity. Reductions in capacity would increase congestion and travel time through the construction area.

Two of three lanes in each direction would be closed during off-peak periods and overnight on both weekdays and weekends. An increase in construction trucks could slightly increase delays at intersections near work areas.

To install box girders where the guideway transitions to and from the median, Sound Transit could close or realign SR 99 lanes in one direction, likely during nights or over a weekend. After girder installation, at least two of three lanes of traffic in each direction would be open during peak periods for the remaining civil construction period. SR 99's vertical clearance for vehicles would not change during construction.

The reduced number of lanes and use of the existing HOV lane for all vehicles would decrease road capacity, increase delays, and affect bus

operations on SR 99. Buses would have increased travel times and be less reliable. Increased congestion may cause temporary service disruptions, in particular northbound during the morning weekday commute and southbound during the evening weekday commute. Some bus routes may require rerouting when left-turn restrictions are in place at intersections or when side streets are closed.

Local Roadway Closures

Guideways would be built over roadways at all of the arterial and local streets that intersect with SR 99 between S 200th Street and S 316th Street, including:

- S 208th Street
- S 216th Street
- Kent-Des Moines Road
- S 240th Street
- S 259th Street
- S 272nd Street
- S 288th Street
- S 304th Street
- S 312th Street
- S 316th Street

Cross-street roadway and lane closures would likely occur overnight or over weekends, with detours to maintain access. The limited number of detour routes along the corridor would affect traffic, bus transit, bicyclists, and pedestrians. Access modifications (such as right-in, right-out only) would also occur on these roadways within the construction areas. These changes could reduce some vehicle conflicts at these locations.

For roads with two or more lanes in each direction, at least one lane in each direction would be kept open. Roads with one lane in each direction, such as S 220th Street and S 224th Street, may be closed for a portion of the construction period and vehicles rerouted to a nearby road. Drivers on these roads would likely have increased delays.

There would be some impacts on non-motorized travel (pedestrians and bicyclists) while constructing the elevated guideway along SR 99. Wherever feasible, sidewalks would remain open in the construction areas, with protected sidewalks next to the construction area when detour routes are not feasible. Short sections of sidewalks may require closure during construction on or adjacent to the roadway and would require pedestrians to detour to the closest signalized crossing of SR 99. Due to the width of SR 99 and the spacing of these crossings, detours for pedestrians could involve noticeable delays. Crosswalks at signalized intersections would remain open except

when SR 99 or side streets are temporarily closed. Bicycle routes and lanes adjacent to the construction areas, such as those along 216th Street, may be temporarily removed during construction.

Construction in the area of the midblock pedestrian crossing north of Kent-Des Moines Road would require its closure. Near the Kent/Des Moines Station area, S 236th Street (built before station construction) would provide an additional SR 99 pedestrian crossing to minimize pedestrian impacts near the Highline College campus if sidewalks are temporarily closed. A new protected pedestrian pathway along S 236th Street or S 240th Street would provide access between the Highline College campus and SR 99.

There is no on-street parking allowed along the length of SR 99. Available on-street parking is generally in neighborhoods east and west of SR 99 and would not likely be affected by construction activity.

Construction Staging and Haul Routes

Left-turning vehicles from SR 99 at signalized intersections within active construction areas would be restricted and rerouted to nearby intersections where left turns and U-turns are possible. There would be no midblock left turns or U-turns within the construction area.

S 272nd Redondo Station construction would disrupt bus service and require partial or full temporary closure of the Redondo Heights Park-and-Ride. This facility is currently underused, with less than 10 percent (approximately 60 of 697 spaces) being used. Bus routes serving this transit center could be relocated to the under capacity (approximately 240 of 540 spaces available) Star Lake Park-and-Ride for the duration. This closure would also change traffic circulation patterns around S 272nd Street. Vehicle trips would relocate to the Star Lake Park-and-Ride, and some intersections along SR 99 and S 272nd Street could have additional congestion. This staging area may require sidewalk closures on the east side of SR 99, or construction of a protected sidewalk next to the station. Sidewalks would remain open at the two signalized intersections on SR 99 adjacent to the staging area, S 272nd Street and S 276th Street.

Bus service at the existing Federal Way Transit Center is not expected to be disrupted with the construction of the station there. The staging area may cause local street closures or longer access modifications. Sidewalk closures or protection would be needed along short portions of Pete Von Reichbauer Way S, 21st Avenue S, and 23rd Avenue S.

Detours

If portions of SR 99 are temporarily closed for nights and/or weekends, traffic detour routes north of Kent-Des Moines Road could include 24th Avenue S, 30th Avenue S, and Military Road. South of Kent-Des Moines Road, 16th Avenue S could also serve as a detour route. During weekday off-peak periods and weekends, traffic volumes are generally lower than during peak commute periods, and detour routes would have capacity to handle increased traffic from SR 99. Traffic diverted from SR 99 may use these roads, even without road closures.

Detour routes would change the traffic circulation, increasing the potential for driver confusion and crashes. The project's traffic control plan would address strategic sequencing or construction phasing to minimize the potential safety impacts.

Station Options

There would be no additional safety or parking impacts with any of the station options.

Property access impacts would be similar for most station options, except for the **Kent/Des Moines HC Campus Station Option from S 216th West Station Option**. Construction of this option would require trenching adjacent to properties and the use of temporary plates over the guideway to maintain property access. Placement of plates might require night and weekend closures. If alternative access to a property is not available, Sound Transit would review the specific construction activity to determine timing. Highline College access from SR 99 would be either via S 240th Street or the planned S 236th Street extension.

The **Kent/Des Moines HC Campus Station Option** would remove some Highline College student parking from a fully utilized Highline College parking lot. Sound Transit would provide permanent replacement parking for Highline College prior to station construction.

The **Kent/Des Moines SR 99 Median Station Option** would require complete reconstruction of SR 99 to widen the roadway for the median station, with the following results:

- The currently low-volume 30th Avenue S would be a detour route for northbound SR 99 traffic. Traffic would flow from SR 99 to 30th Avenue S via S 240th Street.

- S 236th Street between SR 99 and 30th Avenue S would be constructed and completed prior to closing northbound SR 99, and traffic would reroute back onto SR 99 via this new road.
- Some of the SR 99 northbound traffic would likely continue north on 30th Avenue S to eastbound Kent-Des Moines Road and I-5.

During peak periods, traffic volumes on this detour route could increase by over 1,000 vehicles per hour, causing congestion and longer transit times. Drivers could potentially avoid this area by using other roads, increasing congestion on those streets as well. Sidewalks would likely be closed on one side of SR 99 during construction.

The **S 272nd Redondo Trench Station Option** would cross under SR 99 south of S 279th Street. Maintaining two lanes of traffic in each direction on SR 99 during peak periods would require staged construction. Sound Transit would temporarily narrow lanes and the median to shift traffic through the construction area. This option would likely require the removal of one westbound left-turn lane at the intersection of SR 99 and S 272nd Street during construction. Reduced capacity would increase congestion and delays at this intersection. This option would have similar property access impacts as described for the Kent/Des Moines HC Campus Station Option from S 216th West Station Option.

The **Federal Way SR 99 Station Option** would not impact the sidewalks on Pete Von Reichbauer Way S, 21st Avenue S, and 23rd Avenue S.

SR 99 to I-5 Alternative

North of Kent-Des Moines Road, where the SR 99 to I-5 Alternative would be on SR 99, impacts would be similar to those for the SR 99 Alternative. South of S 240th Street, where the alternative would be within the I-5 right-of-way, impacts would be similar to those for the Preferred Alternative, including for the Landfill Median Alignment Option. This alternative does not include the new roundabout at 23rd Avenue S and S 317th Street because this station would use the existing transit center bus circulation area and no change in bus access would be necessary. There would be no additional impacts on regional facilities, transit, safety, parking, or non-motorized facilities between Kent-Des Moines Road and 240th Street where the alternative transitions from SR 99 to I-5.

Between Kent-Des Moines Road and S 240th Street, construction would have impacts on 30th Avenue S and would likely require its temporary closure north of the proposed S 236th Street. Traffic would likely detour to SR 99, with local property access maintained.

I-5 to SR 99 Alternative

North of Kent-Des Moines Road, impacts would be similar to those for the Preferred Alternative. South of S 240th Street, impacts would be similar to those for the SR 99 Alternative. There would be no additional impacts on regional facilities, transit, safety, parking, or non-motorized facilities between Kent-Des Moines Road and S 240th Street where the alternative transitions from SR 99 to I-5.

Between Kent-Des Moines Road and S 240th Street, construction would have impacts on 30th Avenue S and would likely require its temporary closure north of the proposed S 236th Street, with local property access maintained and traffic detoured to SR 99.

5.2.1.2 Potential Mitigation Measures

No mitigation measures are necessary for regional facilities or non-motorized facilities. Potential minimization measures for construction traffic impacts could include the following practices:

- Conform to the *Manual on Uniform Traffic Control Devices* (FHWA, 2009) and jurisdictional agency requirements for all maintenance of traffic plans.
- Install advance warning signs and highly-visible construction barriers and use flaggers where needed.
- Consider a variety of traffic and travel demand management strategies.
- Clearly sign and provide reasonable detour routes when cross streets are closed for elevated guideway and trench construction. The contractor would be required to keep nearby parallel facilities open to facilitate access and mobility.
- Use lighted or reflective signage to direct drivers to truck haul routes to ensure visibility during nighttime work hours. Use special lighting for work zones and travel lanes, where required.
- Communicate public information through tools such as print, radio, posted signs, websites, and email to provide information regarding street closures, hours of construction, business access, and parking impacts. Sound Transit would provide this plan.

- Coordinate access closures with affected businesses and residents. The contractor would be required to perform this task in coordination with Sound Transit staff. If access closures are required, property access to residences and businesses would be maintained to the extent possible. If access to the property cannot be maintained, the specific construction activity would be reviewed to determine if it could occur during non-business hours, or if the parking and users of this access (for example, deliveries) could be accommodated at an alternative location.
- Post advance notice signs prior to construction in areas where construction activities would affect access to surrounding businesses.
- Provide regular updates to schools, emergency service providers, local agencies, solid waste utilities, and postal services, and assist public school officials in providing advance and ongoing notice to students and parents concerning construction activity near schools.
- Schedule traffic lane closures and high volumes of construction truck traffic during off-peak hours to minimize delays, where practical.
- Cover potholes and open trenches, where possible, and use protective barriers to protect drivers from open trenches.
- For the Kent/Des Moines SR 99 Median Station Option, improve 30th Avenue S and S 236th Street prior to the station construction to accommodate increased traffic from SR 99 when lanes are closed.
- For FWLE alternatives near I-5, place a temporary construction barrier near the southbound I-5 edge of pavement where barriers are not already present to separate construction activity from I-5 mainline traffic.
- To minimize potential freight impacts, coordinate with affected businesses throughout the construction period to notify them of lane and access closures and maintain business access as much as possible.
- For any construction activities that might have impacts on I-5, provide construction information to WSDOT for use in the state's freight notification system. Sound Transit would provide information in the format required by WSDOT.

With these minimization measures, no additional mitigation is expected to be needed for traffic impacts.

Depending on the alternative and station options, the existing Star Lake, Redondo Heights, or S 320th Street park-and-ride lots could be partially or fully closed. Measures to mitigate the closure of these park-and-rides could include the following:

- Route transit riders that use these locations to available spaces at other nearby park-and-ride lots.
- Consider service increases or other measures to encourage transit trips that do not require automobile access.
- Lease parking lots and/or new parking areas within the vicinity of the closed park-and-ride lots.
- Provide temporary transit service at a nearby off-street location.

5.2.2 Acquisitions, Displacements, and Relocations

5.2.2.1 Construction Impacts

Property impacts during construction would include staging area acquisition and temporary construction easements. Staging areas would be in areas of permanent right-of-way where possible, reducing the need for additional acquisitions. Staging for the Preferred Alternative would occur along the alignment in the I-5 right-of-way and on private property obtained for stations or ancillary facilities, such as TPSSs or stormwater detention ponds. Staging in more heavily developed areas, primarily along SR 99, may require additional property acquisition. The staging areas identified in this Final EIS are preliminary and would be refined during final design. The contractor might also lease or make arrangements for additional staging areas if needed.

Construction would also require temporary easements on some adjacent properties. Sound Transit would return the land in these easements to preconstruction conditions.

5.2.2.2 Potential Mitigation Measures

Mitigation for temporary property acquisition would be the same as in Section 4.1.7.

5.2.3 Land Use

5.2.3.1 Construction Impacts

Potential impacts on the existing land use include temporary impacts from construction easements and staging areas, and noise, air emissions, visual changes, and traffic congestion. Some businesses

may experience hardship during construction. These impacts would not affect land use type unless the property became vacant. Proximity and construction impacts were determined based on the findings of other environmental elements in this chapter.

5.2.3.2 Potential Mitigation Measures

Although Sound Transit cannot minimize all disturbances to adjacent land uses during construction, impacts are not expected to cause substantial changes in land use. No mitigation related to land use would be required.

5.2.4 Economics

The section addresses the positive one-time economic impacts related to construction:

- Influx of money into the economy from construction jobs
- Purchasing of local goods and services for construction
- Money spent by construction crews in the community where construction occurs

This section also considers the potential negative economic impact of construction on local businesses.

5.2.4.1 Potential Positive Economic Impacts from Construction

Construction labor and materials for improvements would be subject to retail sales tax. Revenue from local sales tax on construction accrues to local jurisdictions based on the location of the activity. Retail sales tax in the project corridor would be 9.5 percent, with the city component—SeaTac, Des Moines, Kent, or Federal Way—at approximately 0.85 percent. King County would receive 0.15 percent on all taxable activities.

Based on the current conceptual design, the Preferred Alternative construction is estimated to cost \$922 million in 2016 dollars. Other alternatives would cost between \$806 million and \$1.38 billion.

While not all construction costs would be subject to retail sales tax, statewide experience shows that about 90 percent of project costs would be. Approximately \$182 to \$311 million a year in construction spending would generate tax revenue for the affected cities combined. This would represent 4 to 6 percent of the combined cities' 2015 taxable retail sales reported by the Washington State

Department of Revenue. It would generate approximately \$1.5 to \$2.6 million in additional sales tax revenue per year across all cities.

The multiplier tables in the Washington State Input-Output economic model estimate that \$1 million of highway construction activity will generate 12 jobs. Table 5-1 shows direct jobs generated over the life of the Preferred Alternative and the high and low cost estimates. The majority of the activity would occur within the Puget Sound Region.

TABLE 5-1

Direct Expenditures and Total Employment Statewide from FWLE Construction

Cost Estimates and Employment	Project Construction
Preferred Alternative	
Direct Expenditures ^a	\$922,154,401
Total Employment (Direct and Indirect)	8,996
Annual Employment (Direct and Indirect)	2,249
High-cost Estimate^b	
Direct Expenditures ^a	\$1,381,980,934
Total Employment (Direct and Indirect)	13,482
Annual Employment (Direct and Indirect)	3,370
Low-cost Estimate^c	
Direct Expenditures ^a	\$806,885,101
Total Employment (Direct and Indirect)	7,872
Annual Employment (Direct and Indirect)	1,967

^a Does not include right-of-way or engineering costs; does include contingency costs. Cost estimates in \$2016, based on Preliminary Engineering Pre-Final Cost Estimate (August 2016).

^b High-cost alternative is the SR 99 Alternative with the potential additional S 216th West Station Option, Kent/Des Moines HC Campus Station Option, and potential additional S 260th East Station Option.

^c Low-cost alternative is the Preferred Alternative with the Kent/Des Moines At-Grade Station Option, S 272nd Star Lake Elevated Station Option, and the Federal Way I-5 Station Option.

A job created by a transportation investment might not be a *new* job to the region. If construction funds entered the regional economy through other channels (for example, through different transportation investments or if they were spent by households or businesses) the effects of that money could be similar to the job-creating effects of project construction. However, investments in major construction projects have higher local multipliers than in other sectors. Because of the higher multiplier, construction-related investments can benefit the region more than other types of investments, which may generate more lower-wage jobs or jobs out of the region.

The net job-creation effects of the FWLE depend on the portion of the investment dollars that might be diverted away from the Puget Sound economy if the project is not built. There would likely be no adverse effects to construction-related employment as a result of the FWLE and there may be some positive employment effects.

5.2.4.2 Potential Negative Economic Impacts from Construction

Construction activity could also negatively affect businesses along the FWLE, reducing sales through changes in traffic, access, parking, visibility, dust, and noise. Patrons might avoid construction areas or have greater difficulty accessing retail businesses nearby. These direct impacts on retail businesses would decrease sales tax revenues to local jurisdictions. The extent and duration of the interference, the location of competitors, and the type of affected business would influence the magnitude of economic effects on local businesses. Alternative-specific impacts are described below.

Preferred Alternative

The Preferred Alternative could affect approximately 60 businesses (mostly retail), primarily in the Kent/Des Moines and Federal Way Transit Center station areas from changes in local traffic patterns. The Kent/Des Moines station options would be closer to I-5 and reduce business impacts along SR 99. The Kent/Des Moines At-Grade Station Option would not add a new intersection at S 236th Street, avoiding the disruption to SR 99 that would occur with other Kent/Des Moines station options. The Federal Way City Center station options would reduce business impacts by staying closer to I-5 and farther away from the city center. They would not cross over 23rd Avenue S or construct a roundabout at 23rd Avenue S and S 217th Street, which would reduce circulation impacts in the city center.

SR 99 Alternative

Construction along SR 99 may require lane closures and temporary left-turn restrictions impacting local and business traffic. It would also have access and noise impacts on nearby businesses, particularly near staging areas. Construction could affect approximately 350 businesses: 300 retail, 40 office, and 10 industrial. Challenges in opening new businesses during construction along SR 99 could delay potential development or redevelopment of adjacent commercial parcels. Station options on the side of SR 99 would generally have similar or fewer impacts. The **Kent/Des Moines SR 99 Median Station**

Option and the **Federal Way SR 99 Station Option** would slightly increase potential impacts.

SR 99 to I-5 Alternative

The SR 99 to I-5 Alternative would impact approximately 120 businesses: about 100 retail, the rest mostly office. Construction along SR 99 would require lane closures and turn restrictions, limiting access and affecting local traffic patterns, particularly in the Kent/Des Moines area.

I-5 to SR 99 Alternative

The I-5 to SR 99 Alternative would affect approximately 280 businesses: about 240 retail, the rest mostly office. Construction along SR 99 would close lanes and restrict turns, limiting access and affecting local traffic patterns, particularly in the Kent/Des Moines area.

5.2.4.3 Potential Mitigation Measures

Sound Transit would develop a construction mitigation plan to address the needs of businesses in the study area, and would dedicate staff to work with the affected businesses. Actions in the plan could include the following:

Actions in the plan could include the following:

- Provide 24-hour construction telephone hotline.
- Provide business cleaning services on a case-by-case basis.
- Provide detour, open-for-business, and other signage as appropriate.
- Establish effective communications with the public through meetings and construction updates, alerts, and schedules.
- Implement promotion and marketing measures to help affected business districts maintain their customer base.
- Maintain access to each business as much as possible and coordinate with businesses during times of limited access.



Open For Business Signage

- Provide a community ombudsman to investigate and address complaints.

5.2.5 Social, Community, and Neighborhoods

5.2.5.1 Construction Impacts

The following construction activities would temporarily affect neighborhood quality in nearby areas:

- Presence and movement of equipment and materials
- Clearing and exposure of soils
- Introduction of lights for nighttime work
- Storage of construction materials
- General visual changes in the viewed landscape during the period of building the project

Temporary increases in noise, dust, and traffic congestion would occur along the corridor and at staging areas. Adjacent neighborhoods may experience increased difficulty accessing residential, commercial, and office properties because of road or lane closures. These closures could cause detours and cut-through traffic in neighborhoods. All alternatives along I-5 would have limited access points along I-5 from outside of the right-of-way. Access could be at the following locations:

- S 208th Street
- S 216th Street
- S 219th Street
- S 220th Street
- S 221st Street
- S 224th Street
- S 231st Street
- S 240th Street
- S 252nd Ct
- S 252nd Street
- S 259th Place
- Approximately S 265th Street (north of Star Lake Park-and-Ride)
- S Star Lake Road
- Military Road S (near Star Lake Road)
- S 284th Street
- Approximately S 299th Street (at Federal Way Church of Christ)
- Military Road (near S 304th Street)
- S 304th Street
- S 311th Street
- S 312th Street
- 28th Avenue S near S 317th Street

Access for alternatives along SR 99 would generally be from SR 99 or where options would use properties along SR 99. The SR 99 Alternative, Kent/Des Moines HC Campus Station Option, and S 272nd Redondo Trench Station Option may require access from adjacent neighborhood streets. Sound Transit would limit access at these points to light trucks and vehicles during daytime hours to minimize impacts on neighborhoods. Sound Transit would also minimize construction-related parking in neighborhoods.

Sound Transit would coordinate all access with WSDOT and the local jurisdiction, and obtain the appropriate permits for use of local roadways.

Construction would also require earthmoving for the trench profiles. Section 5.2.1.1 discusses the average number of truck trips. Haul trucks would access construction sites from existing interchanges at SR 99 and I-5.

Residents and businesses in the immediate construction area could experience impacts affecting neighborhood. Sound Transit would strive to maintain property access and prevent barriers to social interaction. Because the FWLE primarily follows major transportation corridors, short-term effects on pedestrian and vehicular circulation would not prevent movement within neighborhoods and would not cause a barrier to interaction. Noise, dust, and congestion may affect the use of some community resources. To some extent, the quality of the neighborhood's edges would be reduced temporarily.

There would be short-term impacts on some public recreation facilities (see Section 5.2.18, Parks and Recreational Resources). These temporary impacts would primarily be felt by those near the facilities.

5.2.5.2 Potential Mitigation Measures

The following parts of Section 5.2 provide details on potential mitigation measures for community resources and neighborhoods during construction: Transportation; Acquisitions, Displacements, and Relocations; Land Use; Economics; Visual and Aesthetics; Air Quality; Noise and Vibration; and Parks and Recreational Resources.

5.2.6 Visual and Aesthetics

5.2.6.1 Construction Impacts

FWLE construction would temporarily change the visual environment through removal and demolition of buildings, paved areas, and vegetation. Other possible impacts include the following:

- Staging and storing of material and equipment
- Equipment use (and the resulting noise, light, and potential glare)
- Detours
- Delivery of construction materials
- Debris removal

Some of these activities would occur near sensitive viewers.

Project staging near residential areas along I-5 would include:

- Between S 208th Street and S 216th Street
- Kent/Des Moines Station Area
- S 272nd Station Area
- Directly north of S 288th Street

Development along SR 99 is primarily commercial in the project corridor, so there would be limited staging in residential areas (primarily at the Kent/Des Moines Station and S 272nd Redondo Station).

5.2.6.2 Potential Mitigation Measures

Sound Transit would provide visual screening such as solid barriers for station construction and staging areas adjacent to residential areas, if required by local jurisdictions. When possible, Sound Transit would preserve existing vegetation to assist in screening views. Sound Transit would decide whether to revegetate disturbed areas following construction based on future land use.

Workers would shield nighttime construction lighting and direct it downward to avoid light spillover onto adjacent sensitive uses. Sound Transit would comply with local jurisdictional construction measures for controlling light.

5.2.7 Air Quality and Greenhouse Gases

5.2.7.1 Construction Impacts

Temporary air quality impacts would include the release of particulate emissions (airborne dust) from site preparation, fill operations, and roadway improvements (i.e., clearing, cut-and-fill

activities, grading, removing or improving existing roadways, and paving roadway surfaces).

Construction equipment produces carbon monoxide (CO), particulate matter (PM), nitrogen oxide (NO_x), and volatile organic compound (VOC) emissions.

Site preparation would have the greatest impacts on air quality because most engine emissions and airborne dust are associated with the excavation, handling, and transport of soils to and from the site. If not properly controlled, these activities would temporarily generate particulate matter less than 10 microns in diameter (PM₁₀), particulate matter less than 2.5 microns in diameter (PM_{2.5}), and small amounts of CO, sulfur dioxide (SO₂), NO_x, and VOCs. Sources of fugitive dust would include disturbed soils at the construction site and trucks carrying uncovered loads of soils. Unless properly controlled, vehicles leaving the site could deposit mud on local streets, causing airborne dust after it dries. PM₁₀ and PM_{2.5} emissions would vary, depending on construction activities and local weather conditions as well as soil moisture, silt content of soil, wind speed, and the amount of equipment operation. Larger dust particles would settle near the source, while fine particles would be dispersed over greater distances.

Fossil-fuel-powered heavy trucks and construction equipment would generate CO, SO₂, NO_x, and VOCs in exhaust. If construction traffic reduced the speed of hauling trucks and other vehicles in the area, CO emissions from traffic would temporarily increase near the construction site. Some phases of construction, particularly asphalt paving, would cause short-term odors from VOCs near paving sites. These would quickly disperse below detectable thresholds as distance increases.

Greenhouse gas (GHG) emissions associated with the construction phase of the FWLE are expected to be consistent with other projects of this scale. In large-scale construction projects, the major sources of GHG emissions are fossil-fueled construction equipment (mobile and stationary). It was conservatively assumed that all fossil fuel used during construction would be diesel. The carbon dioxide equivalent (CO_{2e}) factor for diesel used in the analysis is from The Climate Registry General Reporting Protocol (The Climate Registry, 2016).

The amount of GHG emissions produced by fossil-fueled construction equipment is directly proportional to the quantity of fuel used. Construction fuel consumption is based on recent experience in building light rail in the Seattle region and provides an order-of-magnitude estimate of GHG emissions. The estimate includes the following factors:

- Transportation of construction materials, waste, and fill material
- Equipment used during construction site preparation
- Construction of the rail track and guideway, rail stations, and associated park-and-rides

This method accounts for differences between alternatives, because it estimates fuel used in building different types of structures, such as at-grade, elevated, or retained-cut guideways, on a per-mile basis; specific station design; and parking structures of different sizes.

Table 5-2 compares the total CO₂e emissions for the overall low- and high-cost project scenarios and the Preferred Alternative.

TABLE 5-2

CO₂e Emissions for Construction of Full-Length Project

Alternative	Tons of CO ₂ e
Preferred Alternative	42,667
High-cost Alternative ^a	50,871
Low-cost Alternative ^b	40,594
Potential difference in CO ₂ e	10,277

^a High-cost alternative is the SR 99 Alternative with the potential additional S 216th West Station Option, Kent/Des Moines HC Campus Station Option, and potential additional S 260th East Station Option.

^b Low-cost alternative is the Preferred Alternative with the Kent/Des Moines At-Grade Station Option and the Federal Way I-5 Station Option.

For each alternative, the GHG emission numbers were translated in terms of typical passenger vehicles by using the U.S. Environmental Protection Agency's (EPA) Greenhouse Gas Equivalency calculator (EPA, 2014). Emissions from construction of the low-cost alternative would be equivalent to adding 8,575 typical passenger vehicles to the road annually during construction; the Preferred Alternative would be equivalent to adding 9,013 typical passenger vehicles annually, and the high-cost alternative would be the equivalent of adding 10,746 typical passenger vehicles annually.

The Puget Sound Clean Air Agency (PSCAA) regulates particulate emissions (in the form of fugitive dust) in the Puget Sound Region. To comply with PSCAA policy on preventing air quality degradation, the following best management practices (BMPs) may be used in accordance with standard practice to control emissions of PM₁₀, PM_{2.5}, CO, and NO_x during construction:

- Spray exposed soil with a dust-control agent to reduce emission and deposition of particulate matter.
- Cover all transported loads of soil and wet materials before transport, or provide adequate freeboard (i.e., space from the top of the material to the top of the truck) to reduce emission and deposition of particulate matter during transport.
- Provide wheel washes to reduce dust and mud carried offsite by vehicles and decrease particulate matter on area roadways.
- Remove the dust and mud that are deposited on paved public roads.
- Route and schedule high volumes of construction traffic to reduce congestion during peak travel periods and reduce emissions of CO, NO_x, and CO_{2e}, where feasible.
- Require appropriate emission-control devices on all construction equipment powered by gasoline or diesel fuel to reduce CO and NO_x emissions in exhaust.
- Use well-maintained equipment to reduce CO and NO_x emissions.
- Cover, install mulch, or plant vegetation as soon as practical after grading to reduce windblown particulates.

Several of these measures would also reduce GHG emissions and mobile source air toxics. Other readily available measures could also be used, including:

- Encourage contractors to employ emissions reduction technologies and practices for both on-road and off-road equipment/vehicles (e.g., retrofit equipment with diesel control technology and/or use ultra-low-sulfur diesel).
- Implement a construction truck idling restriction (e.g., no longer than 5 minutes).

- Locate construction equipment and truck staging zones away from sensitive receptors as much as practical and in consideration of other factors such as noise.

Emissions of CO, NO_x, and VOCs are best controlled through use and proper maintenance of newer construction equipment. Use of low-sulfur diesel fuel controls emissions of SO₂. SO₂ and NO_x emissions are considered precursors to PM_{2.5} emissions; reductions in SO₂ and NO_x reduce PM_{2.5} emissions. All construction activities would comply with local regulations governing air quality, including those for controlling fugitive dust during construction.

5.2.7.2 Potential Mitigation Measures

Through compliance with applicable construction permits and the incorporated BMPs, none of the build alternatives would adversely affect air quality during construction and no mitigation would be needed.

5.2.8 Noise and Vibration

Noise and vibration impacts during construction would be similar in type for all alternatives because construction equipment would be similar, but would vary in degree depending on the proximity of sensitive receivers to the activity. Impacts are not quantified in this analysis because it will be up to the contractor how and when a specific piece of equipment is used in a given location. This section provides a general understanding of average and worst-case noise levels from construction.

5.2.8.1 Noise

Construction Impacts

State and local ordinances regulate construction noise, and the contractor would adhere to these regulations and exclusions, as follows:

- SeaTac: Construction activities are exempt from the maximum permissible environmental noise level requirements between 7:00 a.m. and 10:00 p.m. on weekdays and 9:00 a.m. and 8:00 p.m. on weekends. Construction noise is prohibited between 10:00 p.m. and 7:00 a.m. on weekdays and 10:00 p.m. and 9:00 a.m. on weekends. A noise variance would be needed for any nighttime construction.
- Des Moines and Kent: Construction activities are exempt from the maximum permissible environmental noise level requirements

between 7:00 a.m. and 10:00 p.m. on weekdays and 9:00 a.m. and 10:00 p.m. on weekends. Nighttime construction is allowed if it meets nighttime noise criteria.

- **Federal Way:** Sounds originating from construction sites and activities are exempt from noise regulations between 7:00 a.m. and 8:00 p.m. on weekdays and 9:00 a.m. and 8:00 p.m. on weekends. Nighttime construction is allowed if it meets nighttime noise criteria.

Table 5-3 shows exemptions for short-term noise exceedance in the cities of Des Moines, Kent, and Federal Way, based on the minutes per hour that the noise limit is exceeded. The City of SeaTac does not have an exemption for short-term exceedances.

TABLE 5-3
Washington State Short-Term Noise Exceedance Exemptions

Maximum Minutes per Hour	Adjustment to Allowable Sound Level
15	+5 dBA
5	+10 dBA
1.5	+15 dBA

Source: Washington Administrative Code Chapter 173-60-040.
dBA = A-weighted decibels

Nighttime construction would require a noise variance from the local jurisdiction. Noise variances typically limit noise levels and construction times depending on the land use in the area and type of construction.

FWLE would require several construction phases (see Section 5.1). Table 5-4 shows worst-case noise levels for civil construction phases measured at a distance of 50 feet from the construction site. This estimate uses reference noise levels from typical construction equipment and accounts for the amount of time that the equipment is in operation. The actual noise levels expected during construction would generally be lower because those shown in the table are combined noise levels for all equipment. It is unlikely all equipment would be running at once at a given site. Elevated profiles (e.g., at the work trestle next to the McSorley Creek wetlands for the Preferred Alternative and SR 99 to I-5 Alternative) and trench profiles might require pile installation. Workers would install piles using a standard pile-driver, which produces an impact noise up to 105 dBA.

TABLE 5-4

Maximum Noise Levels for Typical Construction Phases at 50 Feet from the Work Site

Scenario ^a	Equipment ^b	Lm ^c (dBA)	Leq ^d (dBA)
Demolition, site preparation, and utility relocation	Air compressors, backhoe, concrete pumps, crane, excavator, forklifts, haul trucks, loader, pumps, power plants, service trucks, tractor trailers, utility trucks, vibratory equipment	94	87
Structure construction, track installation, and paving	Air compressors, backhoe, cement mixers, concrete pumps, crane, forklifts, haul trucks, loader, pavers, pumps, power plants, service trucks, tractor trailers, utility trucks, vibratory equipment, welders	94	88
Miscellaneous activities	Air compressors, backhoe, crane, forklifts, haul trucks, loader, pumps, service trucks, tractor trailers, utility trucks, welders	91	83

Note: Combined worst-case noise levels for all equipment at a distance of 50 feet from work site.

^a Operational conditions under which the noise levels are projected.

^b Normal equipment in operation under the given scenario.

^c Lm is an average maximum noise emission for the construction equipment under the given scenario.

^d Leq is an energy average noise emission for construction equipment operating under the given scenario.

If pile-driving occurs near residential areas, alternate methods for pile installation would be considered, such as using an auger instead of a pile-driver.

Deep retained cuts and the cut-and-cover trenches, including at Mark Twain Elementary School for the Preferred Alternative and the SR 99 to I-5 Alternative, would require major construction activities. The loudest noise sources during such construction include excavators, cement-mixers, concrete pumps, cranes, pavers, haul trucks, and tractor-trailers. Maximum noise levels would range from 82 to 94 dBA at distances of approximately 50 feet.

For trench and elevated profiles, construction activities would be approximately 175 feet from the nearest classroom at Mark Twain Elementary. Major construction activities at the school for the S 272nd Star Lake Elevated Station Option would include construction of a retaining wall and installation of fill for the trackway. Noise levels could reach 82 to 88 dBA at approximately 50 feet from the activity for short periods during intense construction activity.

Because of the distance between the alternative and the Truman High School buildings (over 400 feet) and existing noise levels, construction noise is not expected to disrupt interior school activities and would have a minimal effect on exterior activities.

Construction noise would meet the local noise-control regulations. Sound Transit would control nighttime construction noise levels by applying noise level limits established through the variance process, and would use noise-control measures where necessary. The

contractor would have the flexibility of either prohibiting certain noise-generating activities during nighttime hours or providing additional noise-control measures to meet these noise limits. Noise-control for nighttime or daytime work may include the following measures, as necessary, to meet required noise limits:

- Install construction site sound walls by noise-sensitive receivers.
- During nighttime work, use smart backup alarms that automatically adjust or lower the alarm level or tone based on the background noise level, or switch off back-up alarms and replace with spotters.
- Use low-noise emission equipment.
- Implement noise-deadening measures for truck loading and operations.
- Conduct monitoring and maintenance of equipment to meet noise limits.
- Use lined or covered storage bins, conveyors, and chutes with sound-deadening material.
- Use acoustic enclosures, shields, or shrouds for equipment and facilities.
- Install high-grade engine exhaust silencers and engine-casing sound insulation.
- Prohibit nighttime aboveground jack-hammering and impact pile-driving.
- Minimize the use of generators or use whisper-quiet generators to power equipment.
- Limit use of public address systems.
- Use movable noise barriers at the source of the construction noise.
- Limit or avoid noisy activities during nighttime hours.

For impact pile-driving, mitigation measures would focus on limiting the time of day the activity can occur.

Potential Mitigation Measures

Through compliance with applicable construction permits and the incorporated BMPs, no mitigation for noise impacts would be needed.

5.2.8.2 Vibration

Construction Impacts

Vibration levels depend on the construction equipment and methods.

The major sources of construction vibration include impact pile-driving, augered pile construction, and vibratory roller-compacting.

Construction has the potential to affect vibration-sensitive equipment, produce rumbling or groundborne noise, and cause damage to buildings. In general, construction vibrations are assessed where prolonged annoyance or damage could be expected.

In most cases, the main concern is potential damage to structures.

Most construction processes do not generate strong enough vibrations to damage buildings and other structures. The criteria thresholds for building damage are 1 to 2 orders of magnitude higher than the criteria for annoyance. Because construction is a short-term, temporary impact, the potential for structural damage is considered more critical than the potential for annoyance.

The only project activity with potential to damage buildings is impact pile-driving within 25 feet of structures. Based on the current design, there are no sensitive buildings close enough to the alignments to require special pile-driving techniques. If pile-driving were to be proposed near sensitive buildings, alternate methods for pile installation would be considered, including sonic pile-driving and augered or drilled pile construction. Table 5-5 shows the typical distances at which groundborne vibration annoyance would occur for single-family residences and large masonry buildings. Vibration impacts would only occur where pile-driving and vibratory roller-compacting take place. At all other locations, the vibration generated by construction activity would be minimal. Most activities would be far enough away from any buildings that there would be no impacts. Because of the distances of the Preferred Alternative, the SR 99 to I-5 Alternative, the S 272nd Star Lake Elevated Station Option, and the S 317th Elevated Alignment Option from Mark Twain Elementary School and Truman High School, there would be no construction vibration impacts on these facilities.

Measures to minimize short-term annoyance from construction groundborne vibration and noise include use of alternate methods with less vibration, such as auger-cast piles or drilled shafts in place of driven piles, or use of static roller-compactors rather than vibratory roller-compactors.

TABLE 5-5

Typical Distances from Sources to Vibration Impact

Construction Equipment	Distance to Vibration impact (Annoyance)
Vibratory Roller-Compactor	Large masonry building: 18 feet
	Single-family residences: 36 feet
Impact Pile-Driving	Large masonry building: 70 feet
	Single-family residences: 150 feet

Activities with potential for short-term annoyance could also be restricted to shorter periods and daytime hours, when vibrations and noise are less noticeable. For more detailed information on construction-related vibration, see Appendix G3, Noise and Vibration Technical Report.

Potential Mitigation Measures

Through compliance with applicable construction permits and the incorporated BMPs, no mitigation would be needed.

5.2.9 Water Resources**5.2.9.1 Construction Impacts**

Construction-related impacts to water resources would be similar for all build alternatives because construction equipment and techniques would be similar. Alternatives with more at-grade or trench portions, such as the Preferred Alternative or station options on SR 99 with trenches, would disturb more ground area and require more water pollution protective measures. The following activities could affect water resources:

- **Earthwork, stockpiling, and material transport:** Soil exposed in sloped excavations or fills is especially susceptible to local erosion until vegetation is established. Wind can erode dry, exposed soil. Water or wind can carry loose soil into adjacent stormwater drains and streams. Construction vehicle tires can carry soil onto roadways, where the soil could wash into ditches or streams during storms.
- **Concrete work and paving:** Runoff that comes in contact with process water or slurry from concrete work or curing concrete can increase the pH in surface water to levels harmful to fish and wildlife.
- **Storm drainage utility work:** Changes to municipal systems can cause water quality problems or flooding during construction.

- **Over-water work:** Construction at stream crossings can pose a direct risk to water quality from pollutant spills, sediment transport, and/or wind deposition of stockpiled materials.
- **Construction machinery:** Equipment leaks or spills can affect water quality in nearby water resources. Construction-related pollutants can increase turbidity and affect other water quality parameters, such as oils and grease, pH levels, and/or the amount of available oxygen in the water.

Steep slopes and proximity to a stream would make the stream particularly vulnerable to erosion and sedimentation at the following locations:

- The portion of Bingaman Creek that parallels the Preferred Alternative for about 1,015 feet north and south of S 288th Street
- The ravine crossing of upper Massey Creek for the Kent/Des Moines HC Campus Station Option for the SR 99 Alternative
- Upper Redondo Creek crossed by the S 272nd Redondo Trench Station Option for the SR 99 Alternative and I-5 to SR 99 Alternative

Sound Transit would develop and implement a Construction Stormwater Pollution Prevention Plan (SWPPP), with the following plans (for further details, see Appendix D4.8):

- Temporary Erosion and Sediment Control Plan
- Spill Prevention, Control, and Countermeasures Plan
- Concrete Containment and Disposal Plan
- Dewatering Plan
- Fugitive Dust Plan

Sound Transit would use a variety of BMPs to avoid or minimize erosion and other water quality impacts during construction. BMPs could include stabilized construction site entrances, silt fencing, and the mulching or covering of stockpiles and other disturbed sites.

To avoid potential adverse impacts on streams, construction in stream channels or buffers would occur in the dry season to the extent feasible. Depending on the length of construction near streams, it may be necessary to temporarily pipe streams during construction.

Standard BMPs such as construction limit fencing and mulching or other temporary covering of exposed soils would reduce the possibility of excessive erosion during construction. For any areas with slopes steeper than 3:1 (horizontal: vertical), workers would place erosion blankets over reseeded areas at the conclusion of construction. Additional discussion of stream impacts and stream protection measures is included in Section 5.2.11, Ecosystems.

Several of the design options would be in designated wellhead protection zones (see Appendix D4.8). During construction, the contractor may store or transfer (e.g., by refueling) hazardous materials within a wellhead protection zone. The City of Federal Way is the only city in the corridor with wellhead protection code requirements. Consistent with the City of Federal Way's Wellhead Protection Ordinance, standard construction BMPs would be carried out: refueling at a sufficient distance from water bodies, cleaning up spills promptly, and maintaining cleanup equipment and materials onsite. Any hazardous materials storage areas must also provide double containment to prevent spills of stored hazardous materials from reaching soils or waterways. These measures help protect groundwater quality in wellhead protection zones during construction.

The Preferred Alternative (with the exception of the Landfill Median Alignment Option) would cross the eastern edge of the Midway Landfill on an elevated guideway or at-grade. Additional information on potential impacts on groundwater are discussed in Section 5.2.13, Hazardous Materials.

Portions of the alternatives and options, such as at Mark Twain Elementary School, include 20- to 40-foot-deep trenches. Sound Transit would construct the trenches with solid concrete sides and bottoms designed to permanently maintain their integrity. Dewatering could temporarily depress groundwater levels during the trench construction, but they would recover close to pre-project levels following construction.

Sound Transit would comply with the following to control the risk of construction-related impacts on water resources:

- National Pollutant Discharge Elimination System Construction Stormwater General Permit process (including development of a stormwater pollution prevention plan [SWPPP])

- Washington Department of Fish and Wildlife Hydraulic Project Approval (if required)
- U.S. Army Corps of Engineers Section 404 permit (if required)

A full list of potential stormwater BMPs is provided in Appendix D4.8.

Water discharged from dewatering activities would be settled to reduce sediments before release, or discharged to a sanitary sewer if permission can be secured from the local sewer utility.

5.2.9.2 Potential Mitigation Measures

Through compliance with applicable construction permits and the incorporated BMPs, none of the build alternatives would adversely affect water resources during construction and no mitigation would be needed.

5.2.10 Ecosystems

Table 5-6 summarizes the estimated temporary construction impacts on ecosystem resources. Sound Transit would use appropriate construction BMPs that apply to work in or around sensitive areas and comply with applicable federal, state, and local requirements during construction. A list of potential BMPs that could be used to protect wetlands, streams, and habitat is provided in Appendix G2, Ecosystems Technical Report.

TABLE 5-6

Summary of Temporary Construction Impacts on Ecosystem Resources by FWLE Alternative (Range with Options)

Alternative	Wetlands		Streams	
	Wetland Area (acres)	Wetland Buffer Area (acres)	Stream Length (linear feet) ^a	Stream Buffer Area (acres) ^a
Preferred Alternative	0.8 (0.8-0.9)	4.0 (4.0-4.3)	0 (0-0) ^b	0.8 (0.8-0.8)
SR 99 Alternative	<0.1 (<0.1-0.4)	0.2 (0.2-0.5)	0 (0-490)	<0.1 (<0.1-0.2)
SR 99 to I-5 Alternative	0.6 (0.6-0.6)	5.3 (5.3-5.3)	0 (0-0) ^b	1.0 (1.0-1.0)
I-5 to SR 99 Alternative	<0.1 (<0.1-0.3)	0.3 (0.3-0.5)	0 (0-490)	<0.1 (<0.1-0.2)

^a Work over Redondo Creek and McSorley Creek would require temporary piping of open stream segments to protect stream from temporary construction impacts. The Ecosystem Technical Report provides additional detail (see Appendix G2).

^b Impacts on Bingaman Creek are included in the permanent operational impacts discussed in Section 4.9.

5.2.10.1 Wetlands Impacts

Temporarily clearing the construction footprint of vegetation and performing earthwork may temporarily decrease or alter wetland type, area, or function, including soil, hydrology, and vegetation. Dewatering activities for trench and retained-fill construction might temporarily alter groundwater discharge to wetlands.

Wetland and wetland buffer functions could also be affected by soil compaction, accidental spills of hazardous substances, or other human-caused disturbances, sedimentation, and introduction of invasive species. Temporary impacts may cause a change in wetland functions that extends over a period of years due to the time required to reestablish hydrology, soils, and woody vegetation to preconstruction conditions. All temporarily impacted areas would be restored in accordance with permit requirements.

For the **Preferred Alternative**, construction in the McSorley Creek wetland would be conducted from a work trestle to minimize impacts, as described in Section 5.1. The **Landfill Median Alignment Option** would slightly increase wetland buffers impacts at Wetland 20-2, south of S 240th Street.

The **SR 99 Alternative** would have fewer wetland and buffer impacts during construction than the Preferred Alternative. The **Kent/Des Moines HC Campus Station Option**, the **Kent/Des Moines HC from S 216th West Station Option**, the **S 260th potential additional station options**, and the **S 272nd Redondo Trench Station Option** would all increase impacts. Construction of the S 272nd Redondo Trench Station Option might require direct dewatering in small portions of the McSorley Creek Wetland adjoining the east side of SR 99. Dewatering would be localized, and drawdown of groundwater would be temporary (less than one growing season). Groundwater levels in the McSorley Creek Wetland would recover within days.

The **SR 99 to I-5** and **I-5 to SR 99 alternatives** would have fewer temporary impacts on wetlands than the Preferred Alternative, while the SR 99 to I-5 Alternative would have more impacts on wetland buffers.

5.2.10.2 Streams Impacts

Table 5-6 summarizes construction impacts on streams and their buffers. The FWLE would cross streams on elevated structure. Except for Bingaman Creek under the Preferred Alternative, construction activities would be outside the stream channel itself, avoiding in-

water work to the extent feasible. To minimize water quality impacts, creeks could be temporarily placed in culverts or pipe bypasses during construction over or near them. Work over or in any water bodies would require the following:

- Hydraulic Project Approval from Washington Department of Fish and Wildlife
- In-water work only during permitted work windows, when fish and water quality would be minimally affected
- Design and construction methods that comply with Washington Administrative Code 220-660 regarding fish passage, if temporary culverts need to be installed or extended on fish-bearing streams

Post-construction, Sound Transit would remove temporary culverts or bypasses and restore the stream.

Removing vegetation along stream banks during construction could increase the erosion hazard for the stream bank and reduce potential large woody debris recruitment until vegetation was reestablished. Post-construction, Sound Transit would regenerate native vegetation and add large woody debris to restore stream habitat. Construction earthwork and equipment could introduce sediment or contaminants (e.g., fuel or hydraulic fluids) to streams that could be carried downstream. Sound Transit would develop and implement an SWPPP to manage turbidity plumes and pollutants from equipment and runoff (see Section 5.2.9, Water Resources).

Work conditions and activities would comply with applicable species and habitat protection laws, regulations, and permits. The delivery of construction-related sediment or contaminants to streams would be avoided or minimized by implementing construction BMPs (see Appendix D4.8, Water Resources).

The **Preferred Alternative** would temporarily impact approximately 0.8 acre of Bingaman Creek stream buffer that includes a forested riparian corridor. Tree removal would reduce shading of the stream until vegetation is reestablished. Sections 4.8 and 4.9 describe the permanent impacts on the stream from realigning the stream channel.

The **SR 99 Alternative** would temporarily impact less than 0.1 acre of stream buffers at McSorley and Redondo creeks. The Kent/Des Moines HC Campus Station Option, the S 260th potential additional

station options, and the S 272nd Redondo Trench Station Option would be on the side of SR 99 and cross over Massey, McSorley and Redondo creeks, increasing temporary impacts on these streams and stream buffers. Direct construction effects on streams are not expected unless the contractor uses temporary culverts or pipe bypasses. The small resident fish species that may inhabit these streams might be affected by riparian clearing.

Construction activities for the **SR 99 to I-5 Alternative** would have slightly greater stream buffer impacts than the Preferred Alternative due to minor differences in the guideway design in this area. The station options for this alternative would not change these impacts.

Construction activities for the **I-5 to SR 99 Alternative** would temporarily impact less than 0.1 acre of the McSorley and Redondo creek stream buffers. No impacts to streams are expected unless temporary culverts are used. The S 260th potential additional station options and the S 272nd Redondo Trench Station Option alongside SR 99, directly over McSorley and Redondo creeks, would increase temporary impacts at the creeks.

5.2.10.3 Vegetation and Wildlife Impacts

The FWLE would have temporary impacts on areas of forested vegetation that provide wildlife habitat. These areas would be replanted with native vegetation after construction but might not be the same type of vegetation as currently exists. It may take several years for the forested vegetation communities to return to their preconstruction habitat function. Sound Transit would implement measures to avoid or minimize effects on wetland and upland vegetation and wildlife resources. Potential strategies include minimizing vegetation clearing, preparing a Revegetation Plan, and restoring temporarily affected areas.

Construction noise, vibration, dust, dirt, light, and clearing and grubbing along the alignment could affect nearby wildlife species. There would be a low risk of disturbance to wildlife from equipment accessing construction sites, noise, and light because the resident wildlife are probably acclimated to high noise levels and low habitat value. Clearing vegetation for construction could affect bird nesting sites.

Vegetation clearing would also increase the risk of introducing or contributing to the spread of noxious or invasive weed species. Sound

Transit would minimize this risk by restoring temporarily disturbed areas.

5.2.10.4 Potential Mitigation Measures

Sound Transit plans to mitigate temporary impacts on wetlands and wetland buffers by replacing resources through the King County in-lieu fee program. Sound Transit could also use one or more of the following methods, if available:

- Approved wetland mitigation banks
- Advance offsite compensatory mitigation
- Project-specific mitigation developed by Sound Transit and approved by appropriate regulatory agencies

Compensatory mitigation would be implemented in accordance with applicable federal, state, and local requirements and guidelines. To the extent feasible, mitigation sites would be identified close to impacts and compensate for lost values in-kind.

Sound Transit would mitigate for impacts on upland vegetation using applicable guidance from WSDOT and local jurisdiction regulations. Vegetation losses due to construction outside the long-term footprint would be temporary, as construction would be followed by site restoration and vegetation reestablishment. Vegetation plantings and restoration would only include native species.

To comply with the Migratory Bird Treaty Act (MBTA), Sound Transit would restrict clearing activities to outside the active bird nesting period, to the extent possible. If avoidance scheduling is infeasible, Sound Transit would work with staff at the U.S. Department of Agriculture to conduct preconstruction surveys to determine the presence or absence of nesting migratory birds in the corridor and assist Sound Transit in complying with the MBTA.

5.2.11 Energy Impacts

5.2.11.1 Construction Impacts

Construction materials produced and transported to the site and the operation and maintenance of construction equipment will consume energy. The California Department of Transportation (CALTRANS) 1983 *Energy and Transportation Systems* energy consumption factors for different light rail transit facilities are widely used in today's industry. Sound Transit estimated energy consumed and construction-related impacts by applying the following energy consumption factors to the total construction cost of the FWLE:

- Track work: 4,555 Btu per 2016 dollar
- Structures: 4,555 Btu per 2016 dollar
- Electric substations: 7,001 Btu per 2016 dollar
- Signaling: 1,916 Btu per 2016 dollar
- Stations, stops, and terminals: 4,555 Btu per 2016 dollar
- Parking: 5,602 Btu per 2016 dollar

To account for the change in construction costs since the CALTRANS report was developed (using 1973 construction dollars), Sound Transit used the California Construction Cost Index to adjust the factors to 2016 dollars. The cost estimate for the analysis included only direct construction costs to calculate energy consumption, not engineering or right-of-way costs.

Table 5-7 shows the estimated energy that would be consumed during construction for the low- and high-cost alternatives.

TABLE 5-7
Projected Energy Consumption During Construction

Alternative	Total Construction Cost ^a (millions)	Energy Consumption (MMBtu)
Preferred Alternative	\$765.7	3,007,000
High-cost Alternative ^b	\$1,106.9	4,769,000
Low-cost Alternative ^c	\$670.0	2,631,000

^a Uses Preliminary Engineering Pre-Final Cost Estimate (August 2016) Does not include right-of-way, engineering, or contingency costs.

^b High-cost alternative is the SR 99 Alternative with the potential additional S 216th West Station Option, Kent/Des Moines HC Campus Station Option, and potential additional S 260th East Station Option.

^c Low-cost alternative is the Preferred Alternative with the Kent/Des Moines At-Grade Station Option, S 272nd Star Lake Elevated Station Option, and the Federal Way I-5 Station Option.

The high-cost alternative is estimated to consume approximately 180 percent as much energy as the low-cost alternative. No energy would be consumed with the No Build Alternative because there would be no construction activities. The average residential home in Washington state consumed approximately 41 MMBtu per year in 2014 (Energy Information Administration, 2015). Assuming a 4-year construction period, the average annual energy consumed by the construction of the project would provide the energy needs for approximately 16,000 to 29,000 residential homes.

Sound Transit's commitment to sustainability practices includes conserving energy during construction. It would work with the contractor on measures that may include conserving fuel, providing for predemolition extraction of recyclable materials, and reducing traffic for detours.

5.2.11.2 Potential Mitigation Measures

Because there would be no adverse impacts on energy use, no mitigation is required.

5.2.12 Geology and Soils

5.2.12.1 Construction Impacts

Construction activities can cause short-term impacts on geology and soils related to erosion hazards, slope instability and excavations, settlements from new earth loads, construction-induced vibration, and dewatering. Unmanaged construction impacts could become long-term problems. This section describes those impacts and discusses seismic ground shaking/liquefaction due to earthquakes and the challenges of crossing the Midway Landfill.

Erosion Hazards

The following potential construction activities could expose soil to rainfall and potential erosion:

- Clearing of vegetation
- Excavation and grading
- Spoils removal and stockpiling
- Fill placement

The severity of potential erosion depends on the quantity of vegetation removed, slope inclination, soil type, volume and configuration of soils stockpiles, and rainfall intensity. The Preferred Alternative would have the most vegetation removal and erosion potential.

The following BMPs could reduce erosion hazards:

- Maintaining vegetative growth
- Providing surface water runoff systems
- Installing silt fences or straw wattles downslope of exposed soil and covering exposed soil with straw, mulch, or plastic sheeting
- Installing temporary erosion-control blankets and mulching to minimize erosion prior to vegetation reestablishment

Slope Instability and Excavations

Temporary and permanent retaining walls for grade separation, cut slopes, or placement of earth embankment fills could increase the potential for slope instability during construction, particularly in steep slope areas along SR 99 and I-5.

Sound Transit could provide adequate stability for slopes and retaining structures using cast-in-place concrete cantilever walls, mechanically stabilized earth walls, soil-nail walls, or soldier-pile walls. Drainage would control seepage in shallow or perched groundwater intersected by cut slopes or other excavations (including belowground sections of the alignment in trenches) and prevent it from contributing to surface soil sloughing or slope instability.

Sound Transit would remove and appropriately dispose of excavated soil that cannot be used as structural or landscape fill. Table 5-8 summarizes the estimated earthwork quantities for excavation (cut) and fill placement activities. These estimates include all excavation, not just unsuitable soils and provide a range of potential volumes; station or alignment options could increase or decrease the amount. The Preferred Alternative would have the most earthwork.

TABLE 5-8
Estimated Earthwork Quantities (cubic yards)

Alternative	Cut	Fill
Preferred	450,000	120,000
SR 99	50,000	10,000
SR 99 to I-5	350,000	70,000
I-5 to SR 99	100,000	15,000

Settlements from New Earth or Facility Loads

Construction earth loads would result from temporary stockpiling, with low potential for settlement. Sound Transit would identify areas where soft soils could settle and avoid these areas, or take protective measures against settlement such as improving the soils.

Seismic Ground Shaking/Liquefaction

Earthquakes during construction could cause slope failure, liquefaction, or ground settlement, damaging facilities under construction and delaying the project schedule because of repairs. The probability of a strong earthquake occurring is very low.

Dewatering

Substantial dewatering of groundwater during construction is not expected because most construction is above the water table. Sound Transit would have to remove soft material below the water table to create a stable base for the track or transit facility in wetland areas. Deep foundations would extend below the groundwater table, but they would not require dewatering.

The design process would consider the potential for dewatering-induced settlement on nearby structures. To help minimize soil settlement, Sound Transit would use localized dewatering and groundwater injection methods, and sheet-pile walls for horizontal groundwater containment. Nearby structures would be underpinned if necessary. Sound Transit would also perform engineering studies to quantify the effects of dewatering, during final design or as an early phase of construction. Dewatering tests implemented early would minimize the risks of settlement.

Midway Landfill

The Preferred and SR 99 to I-5 alternatives would travel along the eastern edge of the Midway Landfill. The profile could be elevated or at-grade across the landfill. If at-grade methods are used, settlement considerations would likely require construction of deep foundations, ground improvement, or removal and replacement of landfill materials.

5.2.12.2 Potential Mitigation Measures

With appropriate use of engineering design standards and BMPs, geological and soils construction impacts are not expected.

5.2.13 Hazardous Materials

5.2.13.1 Construction Impacts

Impacts Common to All Alternatives

Potential hazardous materials impacts during construction could result from:

- Existing soil or groundwater contamination found on or adjacent to contaminated sites
- Containers holding hazardous materials
 - Aboveground storage tanks (ASTs) and underground storage tanks (USTs), which typically contain petroleum products
 - Pole-mounted transformers, which might contain polychlorinated biphenyl (PCB)-contaminated transformer oil

Possible impacts from encountering contamination or hazardous materials containers include the following:

- Release of contaminants to soil, groundwater, and surface water from activities such as grading near contaminated materials.
- More direct exposure to the public.
- Spread of contamination.

- Generation of large quantities of contaminated water from dewatering requiring treatment and disposal.
- Cleanup of contamination that otherwise would remain in place and potentially migrate.
- Cleanup of contamination earlier than otherwise would occur.
- Removal of existing sources, such as USTs and ASTs, before they cause releases.

Asbestos or lead could be released while demolishing, removing, and disposing of structures. Heavy equipment lubricants and fuels could be released accidentally. These common hazards are particularly acute for construction over water or in areas where stormwater runs off into water bodies. Uncontained spills of any size could harm water quality, vegetation, and wildlife in the immediate area and downstream; large spills could require emergency response.

Sound Transit would adhere to applicable regulations regarding hazardous materials handling and spill response during construction. BMPs would include requiring contractors to prepare the following plans, as necessary:

- Project-specific and site-specific hazardous material management plans
- Construction SWPPP
- Health and safety plans
- Spill prevention, control, and countermeasure plans
- Contaminated media management plans
- Lead and asbestos abatement programs

Section 4.12, Hazardous Materials, describes high-risk sites in the construction footprint. Sound Transit would clean up subsurface contamination at these sites in accordance with Washington State Department of Ecology (Ecology) requirements prior to installing any underground facilities during. Sound Transit would identify and assess the specific construction impacts on any affected hazardous materials sites during a detailed evaluation of site-specific conditions.

All FWLE alternatives and options pass through the ASARCO smelter plume, where surface soils are likely contaminated and which Ecology

Asbestos and Lead

Asbestos (commonly used in construction because of its insulation, fireproofing, and soundproofing qualities) causes cancer and other respiratory problems; asbestos is most dangerous when crushed, broken, or otherwise disturbed so that fibers are released to the air and inhaled.

Lead is often found in lead pipes, copper pipes with lead solder, and interior and exterior painted wood, siding, window frames, and plaster, and could cause lead poisoning if handled inappropriately and inhaled or ingested during demolition.

requires be cleaned up during site development. Ground disturbance during construction may release contaminated dust particles that could affect workers. Ecology recommends sampling to determine the horizontal and vertical extent of soil contamination, and provides guidance on types of remediation, including excavation, mixing with clean soils, capping in place, or consolidation and capping as remedial alternatives. Permits are not required for this activity; however, Sound Transit would need to enter the Voluntary Cleanup Program to receive a No Further Action determination from Ecology (Ecology, 2012). Contractor-prepared plans would establish the procedures for safely managing ASARCO-plume-contaminated soils.

Potential impacts unique to the Preferred Alternative and SR 99 to I-5 Alternative are described below. There would be no additional impacts with the SR 99 or I-5 to SR 99 alternatives.

Preferred Alternative and SR 99 to I-5 Alternative

The Preferred Alternative and the SR 99 to I-5 Alternative would cross the eastern edge of the Midway Landfill in WSDOT right-of-way. An elevated crossing would require removal of a portion of the landfill cover, drilling of up to 10-foot-diameter shafts for the guideway columns, removal of waste material, and replacement of the landfill cover around the shafts. An at-grade crossing would require removal of a portion of the cover, compaction of waste materials in place or removal of waste along the length of the landfill, replacement of the cover over the compacted waste, and placement of base material for the tracks at ground level. The overhead catenary system poles would be placed on small drilled shafts for support. Both options would require regulatory approval from the EPA and Ecology. Based on geotechnical borings completed for the project, waste is expected to be classified as municipal solid waste and would not require special disposal.

At-grade guideway construction would temporarily disturb the landfill cover, the landfill gas collection systems, and groundwater from disturbance of waste below the cap. Elevated guideway construction would also temporarily disturb the landfill cover, but over a smaller area. Environmental monitoring would take place to ensure worker and public health and safety while the landfill cap is open.

Sound Transit would continue coordinating with EPA and Ecology because Midway Landfill is a Superfund site. Prior to construction at the landfill, EPA will need to evaluate Sound Transit's design and

construction plans to determine whether the FWLE is consistent with the remedial action that has been implemented at the landfill and what documentation is needed related to the remedy as described in the Midway Landfill Record of Decision under CERCLA (EPA, 2000).

5.2.13.2 Potential Mitigation Measures

With implementation of BMPs described in Section 5.2.13.1, no adverse impacts are anticipated and no mitigation is needed.

Crossing Midway Landfill would require excavation and disposal of waste from under the landfill cap. This would be managed in accordance with the applicable state and federal regulations, and standard BMPs for excavation would be implemented. Prior to construction, Sound Transit and FTA would coordinate with EPA and Ecology to obtain approval to temporarily disturb the landfill cap.

5.2.14 Electromagnetic Fields

5.2.14.1 Construction Impacts

There is no potential for construction impacts from electromagnetic fields because there are no sensitive equipment or facilities in the project study area.

5.2.14.2 Potential Mitigation Measures

Because there were no impacts related to electromagnetic fields identified, no mitigation is required.

5.2.15 Public Services, Safety, and Security

5.2.15.1 Construction Impacts

Construction would increase congestion along adjacent roadways, which could temporarily affect access and response times for public service providers (i.e., fire and emergency medical, police, and solid waste and recycling vehicles). This could also affect vehicle and school bus access and timing, including for Mark Twain Elementary School and Truman High School. Access to all schools would be maintained during all hours of operation. Sound Transit would maintain access during established periods or keep one lane of traffic open (especially on main arterials) and, whenever possible, accommodate access during peak travel hours (see Section 5.2.1). Traffic control plans would be reviewed and approved by applicable agencies before implementation.

Sound Transit would establish a Fire/Life Safety Committee as part of the project's safety and security management plan and would work with it and other safety and security specialists to address public

safety issues. Sound Transit would also coordinate with solid waste and recycling companies and schools if any rerouting of collection or school bus routes is needed. Postal collection and delivery and solid waste and recycling collection would be maintained at all addresses. Water-main relocation could affect access to and use of fire hydrants and would be coordinated with the local fire districts.

The Preferred Alternative would have fewer construction impacts on public services because it would avoid many roadways. Alignments in the I-5 corridor would be west of the southbound travel lanes near the edge of the right-of-way, minimizing impacts on public services vehicles that travel along I-5. Impacts would also be fewer for the SR 99 to I-5 and I-5 to SR 99 alternatives where they are next to I-5.

The Preferred Alternative and SR 99 to I-5 Alternative would cross under the playfield and bus loop at Mark Twain Elementary School in a lidded trench. Approximately 0.3 acre of the playfield would be unavailable for use with the Preferred Alternative and 0.9 acre would be unavailable with the SR 99 to I-5 Alternative for approximately 24 to 36 months. During this period, heavy civil construction would occur for approximately 12 months. The S 272nd Star Lake Elevated Station Option would also cross the playfield edge on retained fill, making 0.3 acre unavailable for use for approximately 24 to 36 months (including the 0.1 acre of permanent impact). This option would require distinct periods of active construction lasting 2 to 3 months at a time at the school. Barriers would be installed around the construction area for safety and to limit noise and dust outside of the construction area. The BMPs described in Section 5.2.13, Hazardous Materials, would be implemented to prevent potential hazardous material impacts during construction. Under either option, the remainder of the field could remain open for school and public use during construction and the current playground adjacent to the playfield would not be affected. The eastern end of the bus loop would be unavailable during construction. Sound Transit would reconfigure the bus loop allowing for continued vehicle circulation during construction. However, the bus loop would be closed for a period while it is reconfigured. Sound Transit would coordinate with Federal Way Public Schools to ensure vehicles could operate safely during construction.

Sound Transit would restore the playfield and bus loop to existing conditions in the construction area, allowing continued field use and

school bus circulation. There would be no construction access through the school property.

There would not be any construction access through the Mark Twain Elementary School property, and access from S Star Lake Road to the school would be maintained. There would be temporary closures (as described in Section 5.2.1.1), detours, and construction access on roads in the vicinity of Mark Twain Elementary and Truman High School such as S 272nd Street, Military Road S, and 28th Avenue S that could increase congestion near the schools. This congestion could affect school bus timing. Sound Transit would coordinate with Federal Way Public Schools if rerouting of school bus routes is needed.

5.2.15.2 Potential Mitigation Measures

For the Preferred and SR 99 to I-5 alternatives, Sound Transit would continue to coordinate with Federal Way Public Schools regarding construction at Mark Twain Elementary to ensure school buses could operate safely during construction and that there is safe pedestrian access. Sound Transit would restore temporarily impacted portions of the Mark Twain Elementary School field to pre-project conditions after construction in cooperation with the school district.

5.2.16 Utilities

5.2.16.1 Construction Impacts

Sound Transit inventoried major utilities in the study area to identify potential conflicts that may require utility relocation and to understand the degree of utility impacts. Minor utilities were not inventoried. Utilities affected by all alternatives include stormwater and sanitary sewers, aboveground electric lines, and underground water and natural gas mains. No telephone or fiber optic duct banks were identified.

Sound Transit identified utility conflicts to:

- Plan for relocating the utilities during construction to remove possible conflicts
- Prevent disturbing the route during future maintenance of underground utilities
- Keep the FWLE profile, whether underground, surface, or elevated, above the minimum required distance from all utilities
- Account for the relocation costs

Major Utilities

Major utilities were defined as follows:

- Water mains of 16-inch diameter or greater
- Sanitary sewer force mains and gravity sewers of 16-inch diameter or greater
- Stormwater drains of 36-inch diameter or greater
- 115-kilovolt (kV) and greater electrical transmission lines
- High-pressure and intermediate-pressure gas lines with a 6-inch diameter or greater
- Telephone and fiber-optic duct banks with three or more conduits
- Petroleum product pipelines

Construction impacts may require the following:

- Relocating utility poles supporting overhead lines
- Constructing new distribution lines to provide power to electric substations
- Relocating underground utilities under the guideway and station areas
- Inspecting, repairing, and encasing underground utilities at track crossings

Aboveground utilities on poles could be relocated to taller or different types of poles. The FWLE could affect maintenance activities and access to underground utilities such as sewer holes or vaults requiring relocation of access points. Relocating water mains could also affect access to and use of fire hydrants; Sound Transit might consider establishing a parallel water main to avoid utility lines crossing under the guideway.

Grading and excavation might affect underground utilities, depending on the utilities' depth and material composition. Most underground utilities crossed by the alternatives are within approximately 6 feet of the surface and might be impacted by the weight of light rail vehicles. Sound Transit would relocate or protect underground utilities during construction to minimize potential impacts.

Trench construction would impact the most underground utilities, followed by at-grade construction. These types of construction would relocate more underground pipes and aboveground utility poles than elevated alignments. In most cases where an at-grade profile would cross an underground utility, a split casing could be installed. Sound Transit and utility providers would move underground utilities that are in public road rights-of-way and adjacent to or under the FWLE to a different location in the right-of-way.

Where feasible, columns for elevated guideways would avoid impacts on underground utilities. Conflicts with overhead electric lines could occur where the elevated guideway passes directly underneath the lines. This would require raising the lines to be a minimum of 35 feet from the top of rail for 115-kV lines and 37 feet for 230-kV lines.

Split Casing

A steel pipe that serves as a casing around the utility line or pipe, allowing the utility company to remove or install utilities at that location in the future without disturbing the light rail facilities above.

Temporary connections to utility customers would typically be established before relocations to minimize service disruptions. However, inadvertent damage to underground utilities could occur if utility locations are uncertain or misidentified. Efforts to minimize impacts would include potholing and preconstruction surveys to identify utility locations, and communication with customers to inform them of planned or potential service disruptions.

Sound Transit would coordinate with utility providers to establish replacement procedures and facility design standards as applicable. The comprehensive plans of SeaTac, Des Moines, and Federal Way require that existing overhead utilities (power and communications) requiring relocation be placed underground when possible. The City of Kent encourages the undergrounding of new electrical distribution lines. The policies would not apply to 115-kV or other high-voltage transmission lines.

Some utility service providers might consider impacts substantial in terms of relocation costs incurred, staff time and resources, and temporary loss of access to utilities. Sound Transit would evaluate relocation approaches and associated costs on a case-by-case basis. In general, it would evaluate the terms of a private utility's franchise agreement to determine the rights of the private utility within the public right-of-way and the responsibility for relocation costs. Sound Transit would seek to establish formal agreements for public utilities, with relocation costs allocated pursuant to local ordinances or codes. Most utilities in the I-5 right-of-way are franchise holders who must relocate their utilities at WSDOT's request, at their own expense. If an alternative using WSDOT right-of-way is advanced, Sound Transit would work with WSDOT and the affected utilities on relocation issues consistent with Sound Transit's relocation policies and applicable laws, including city codes and charter provisions.

Table 5-9 summarizes the major utility conflicts, expected length of relocation, and number of crossings where the length has not yet been determined. Actual relocation lengths of crossings would be determined during final design. Many underground intersecting utilities would require only a split casing.

Utilities in WSDOT Right-of-Way

Utilities in the WSDOT right-of-way are franchise holders that have agreements with WSDOT for use of public right-of-way.

TABLE 5-9

Major Utility Conflict Summary - Approximate Length of Relocations and Number of Crossings

Alternative		Power Line	Water Line	Sanitary Sewer Line	Gas Line	Stormwater Drainage
Preferred Alternative		600 feet 8 crossings	1,200 feet, 1 crossing	--	600 feet, 2 crossings	--
Kent/Des Moines Station Options	Kent/Des Moines At-Grade Station	-200 feet	--	--	--	--
	Kent/Des Moines I-5 Station	-200 feet	--	--	--	--
Landfill Median Alignment Option		--	--	--	--	--
Federal Way City Center Station Options	Federal Way I-5 Station	--	--	--	--	--
	Federal Way S 320th Park-and-Ride Station	--	--	--	--	--
SR 99 Alternative		1,400 feet 5 crossings	1 crossing	3 crossings	500 feet	300 feet
S 216th Station Options	S 216th West Station	- 450 feet	--	--	--	--
	S 216th East Station	+ 3 crossings	+ 1 crossing	--	--	--
Kent/Des Moines Station Options	Kent/Des Moines HC Campus Station	--	--	--	--	--
	Kent/Des Moines HC Campus Station from S 216th West	--	--	--	--	+ 3 crossings
	Kent/Des Moines SR 99 Median Station	--	--	--	--	--
	Kent/Des Moines East Station	+ 500 feet	--	+400 feet	--	+1 crossing
S 260th Station Options	S 260th West Station	-400 feet +2 crossings	--	+200 feet +2 crossings	--	+1 crossing
	S 260th East Station	+300 feet + 1 crossing	--	+ 500 feet	--	--
S 272nd Redondo Trench Station		+1,800 feet -1 crossing	--	+700 feet +1 crossing	+ 1 crossing	-300 feet
Federal Way SR 99 Station Option		+100 feet	--	--	--	--
SR 99 to I-5 Alternative		400 feet 5 crossings	No conflicts	2 crossings	--	300 feet 1 crossing
S 216th Station Options	S 216th West Station	- 450 feet	--	--	--	--
	S 216th East Station	+ 3 crossings	+ 1 crossing	--	--	--
Landfill Median Alignment Option		--	--	--	--	--
Federal Way City Center Station Options	Federal Way I-5 Station	--	--	--	--	-100 feet
	Federal Way S 320th Park-and-Ride Station	--	--	--	--	-100 feet

TABLE 5-9

Major Utility Conflict Summary - Approximate Length of Relocations and Number of Crossings

Alternative		Power Line	Water Line	Sanitary Sewer Line	Gas Line	Stormwater Drainage
I-5 to SR 99 Alternative		1,500 feet 4 crossings	1,200 feet 1 crossing	100 feet 3 crossings	400 feet 1 crossing	300 feet
S 260th Station Options	S 260th West Station	-400 feet +2 crossings	--	+200 feet +2 crossings	--	+1 crossing
	S 260th East Station	+300 feet + 1 crossing	--	+ 500 feet	--	--
S 272nd Redondo Trench Station Option		+1,800 feet -1 crossing	--	+700 feet +1 crossing	+ 1 crossing	-300 feet
Federal Way SR 99 Station Option		+100 feet	--	--	--	--

Notes:

Relocation lengths and crossings listed for station and alignment options are *in addition* to the alternative (shown in **bold**).

As-built utility data were used to determine impacts of major utilities; some segments in as-built data might not represent full segment and will be finalized with field check.

Length of relocations is rounded to the nearest hundred feet.

Preferred Alternative

The Preferred Alternative would have the most impacts on storm drainage utilities. It would impact one of four Highline Water District tanks on a property north of S 216th Street. Sound Transit would coordinate with the water district to relocate the water tank, maintaining the current capacity.

This alternative would also be adjacent to a Puget Sound Energy substation at S 221st Street. Sound Transit would coordinate with Puget Sound Energy to comply with the minimum distance from the electrical facilities, or relocate them. The Preferred Alternative would also require relocation of overhead electric lines that cross I-5 at various locations.

Crossing under S 272nd Street would require maintaining the 10-inch gas line in S 272nd Street in place during construction.

The Kent/Des Moines station options would not cross over 30th Avenue S and would therefore avoid two of the power line crossings in the Midway subarea. The Federal Way I-5 Station Option would avoid one stormwater main crossing because it would not cross S 320th Street.

Construction of the S 320th Park-and-Ride Station Option would be under 512-kV power lines operated by Bonneville Power Administration, but would not affect their operation.

SR 99 Alternative

Most utility conflicts for the SR 99 Alternative would be to power lines. The Kent/Des Moines HC Campus Station Option would affect a stormwater surge tank in the east parking lot, which could be relocated within the lot.

Crossing under S 272nd Street for the S 272nd Redondo Trench Station Option would require maintaining the existing 10-inch gas line in S 272nd Street in place during construction. The S 272nd Redondo Trench Station Option would move the 115-kV overhead transmission lines north of Dash Point Road. Based on coordination with Puget Sound Energy and the City of Federal Way, they could be relocated to the west side of SR 99. Sound Transit would determine the final location and configuration through further coordination with these entities.

SR 99 to I-5 Alternative

The greatest utility conflicts for the SR 99 to I-5 Alternative would be to power lines. The Kent/Des Moines 30th Avenue East Station would displace the administrative offices of the Highline Water District at 23828 30th Avenue S, Kent. This property also includes maintenance facilities for the water district. Sound Transit would coordinate with the water district to relocate these offices in their service area.

I-5 to SR 99 Alternative

The greatest utility conflicts for the I-5 to SR 99 Alternative would be to power lines. All station options would increase the number of utility conflicts, with the S 272nd Redondo Trench Station Option having the greatest increase in conflicts.

5.2.16.2 Potential Mitigation Measures

Through preconstruction measures and coordination with utility providers, no adverse impacts on utilities are expected during construction and no mitigation would be needed.

5.2.17 Historic and Archaeological Resources**5.2.17.1 Construction Impacts**

There are no known National Register of Historic Places (NRHP)-eligible archaeological sites in the Area of Potential Effects (APE). Most of the APE has a low to moderate sensitivity for archaeological resources and areas with higher sensitivity have experienced previous disturbance. It is possible that unknown archaeological sites exist beneath the ground surface in areas where ground disturbance would occur.

Only the Kent/Des Moines HC Campus Station Option to the SR 99 Alternative would have the potential to affect historic resources during construction. The station would be in open trench on the eastern edge of Highline College's east parking lot. The station plaza would be approximately 206 feet from the nearest NRHP-eligible building at the college. There would be no adverse effect to the NRHP eligible buildings during construction because no vibration impacts are anticipated, visual and noise impacts would be minor, and access to the historic Highline College buildings would be maintained.

The SR 99 and I-5 to SR 99 alternatives would be approximately 100 feet from the NRHP-eligible US Bank building. The closest improvement would be road widening, which would not impact the building. The Federal Way I-5 Station Option for the Preferred Alternative and the SR 99 to I-5 Alternative would be approximately 400 feet from the NRHP-eligible Calvary Lutheran Church. There would be no construction impacts on the building because of the distance between it and the alignment.

5.2.17.2 Potential Mitigation Measures

For the Preferred Alternative, Sound Transit would develop and implement an Inadvertent Discovery Plan (IDP) to minimize the risk of damage to currently unknown archaeological resources. FTA and Sound Transit would coordinate with the State Historic Preservation Office and tribes to review the plan, which would include procedures to be followed if human remains or cultural artifacts were discovered during construction. Archaeologists would conduct training for contractors to help them identify potential cultural resources during construction, including protocols to implement if something is discovered.

If the SR 99, I-5 to SR 99, or SR 99 to I-5 alternative was selected to be built, Sound Transit would also develop an Archaeological Monitoring and Treatment Plan (ARMTP). The ARMTP would describe the high-probability areas where Sound Transit would complete archaeological monitoring during construction and/or preconstruction surveys. Because there would not be adverse construction effects on the NRHP-eligible Highline College campus buildings, U.S. Bank building, or the Calvary Lutheran Church, no mitigation is required.

5.2.18 Parkland and Open Space

5.2.18.1 Construction Impacts

The Preferred Alternative would not impact any parks during construction.

The Federal Way SR 99 Station Option for the SR 99 and I-5 to SR 99 alternatives would require a transit-only roadway along the southern edge of Federal Way Town Square Park, causing temporary impacts and closure of less than 0.1 acre of the park for approximately 6 to 12 months. Noise, dust, and visual impacts from construction activities would be disruptive to park users. A portion of the parking lot, stormwater retention pond, path, and a small portion of the open lawn, and landscaping would be temporarily closed to park users, but vegetation and parking uses would be restored after the roadway is completed. Sound Transit would permanently relocate the impacted portion of the path and the retention pond prior to construction to avoid disruption of these facilities, which may require short-term closure of the path. Four parking spaces would also be temporarily affected temporarily.

Section 5.2.15 shows that the Preferred Alternative, the S 272nd Star Lake Elevated Station Option and SR 99 to I-5 Alternative would require construction on 0.3 to 0.9 acre of the playfield at Mark Twain Elementary School. This part of the field would not be available for public recreational use. The school district would need to program youth league softball and soccer practices at other district-owned facilities during construction. All alternatives would also have a small (less than 0.1- to 0.8-acre) temporary construction impact to open space areas, including RCAs.

No planned (future) parks or trails in the study area are anticipated to be operational during construction, so no impacts are anticipated.

5.2.18.2 Potential Mitigation Measures

Sound Transit would restore temporarily impacted portions of Town Square Park and the Mark Twain Elementary School field to pre-project conditions after construction in cooperation with the resource owner. This would include landscaping, paths, and any built features. Mitigation for permanent impacts from the S 272nd Star Lake Elevated Station Option are described in Section 4.17, Parkland and Open Space. Temporary replacement parking for parking lost at the Town Square Park could be provided if necessary.

6.0 Cumulative Impacts

6.1 Introduction

Cumulative impacts analysis evaluates a proposed project and its alternatives broadly. It includes potential interactions with impacts from past, present-day, and planned actions. This assessment can reveal environmental consequences not apparent when the project is evaluated in isolation.

Analysis of cumulative impacts has influenced all components of the FWLE environmental review process including scoping, describing the affected environment, developing the alternatives, and evaluating environmental impacts. Example information sources include:

- Adopted transportation plans, land use plans, and neighborhood plans from King County and the cities of SeaTac, Des Moines, Kent, and Federal Way
- Lists of known major public and private land use proposals in King County and the cities of SeaTac, Des Moines, Kent, and Federal Way
- Information provided by Washington State Department of Transportation (WSDOT), King County Metro Transit, and Pierce Transit on planned transportation projects and developments
- Puget Sound Regional Council data on population and employment growth projections, travel forecasts, and land use projections
- Information provided by other organizations and the public on planned private projects, community values, and concerns

This information helped identify past and ongoing development trends, prepare growth projections, characterize reasonably foreseeable future actions, and identify and evaluate expected cumulative impacts to which the FWLE could contribute.

Appendix D6 provides more information on the reasonably foreseeable future actions considered in this analysis.

Cumulative Impacts

Cumulative impacts on the environment result “from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.”

-- 40 Code of Federal Regulations 1508.7

Guidance for Cumulative Impacts Analysis

This cumulative impact assessment used guidance from the following documents:

- Considering Cumulative Effects Under NEPA (Council on Environmental Quality [CEQ], 1997)
- Consideration of Cumulative Impacts in EPA Review of NEPA Documents (U.S. Environmental Protection Agency, 1999)
- Interim Guidance: Questions and Answers Regarding Indirect and Cumulative Impact Considerations in the NEPA Process (Federal Highway Administration [FHWA], 2003)
- Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (CEQ, 2005)
- Executive Order 13274, “Indirect and Cumulative Effects Work Group Draft Baseline Report” (ICF Consulting, 2005)
- Indirect and Cumulative Impact Analysis (National Cooperative Highway Research Program, 2006)

6.2 Temporal and Geographic Boundaries of Cumulative Analysis

This analysis considers the following actions:

- Past actions - nonnative settlements dating back to the 1800s and continuing trends in development patterns up to the present
- Present actions - projects by local, state, or federal agencies just completed or under construction
- Reasonably foreseeable future actions - those that have obtained some local, state, or federal government approval and could be under construction at any time between the present and FWLE design year (2035)

In general, the cumulative analysis study area combines those for transportation facilities (see Chapter 3), environmental resources (see Chapter 4), and construction impacts (see Chapter 5).

Exceptions include the following:

- Ecosystem-related resources require broader study areas to capture how effects from reasonably foreseeable future projects may interact to affect the function of larger ecosystem networks. Sound Transit established the study area for ecosystem resources (streams, wildlife, and wetlands) based on regulatory requirements or up to 200 feet around the project alternatives, whichever was greater. Sound Transit also evaluated wildlife corridors for avian species and other migratory animals or animals with large foraging areas, and fish habitat at the watershed level for impacts on stream quality.
- The Puget Sound Region study area applies to resources such as transportation, air quality (and greenhouse gases), energy, and, to some degree, the economy. Although greenhouse gases are studied at the regional level, it is acknowledged that the effects are felt on the global level.
- Socioeconomic resources that may experience a range of cumulative impacts from new infrastructure projects, such as land use, economics, neighborhoods, public services, visual resources, and parks, were generally analyzed within 1/2 to 1 mile of the project alternatives.
- For built environment resources (property acquisitions, hazardous materials, geology, electromagnetic fields, utilities, historic and

Design Year 2035

The year for which ridership forecasts and volumes are estimated to determine the design features required for the proposed FWLE improvements.

archaeological resources, and noise and vibration), the study area is approximately 1/4 mile or less around project alternatives.

6.3 Past and Present Actions

Since the mid-19th century, impacts from past actions have shaped and continue to shape how the Seattle, southwest King County, Tacoma, and northwest Pierce County areas change in response to activities and trends. Over time, Seattle and Tacoma have become increasingly urban, with suburban population growth spreading to surrounding areas, including the cities in the FWLE study area.

The original Highway 1, built in 1913, was the first piece of Washington's interstate transportation network. Highway 1, or the Pacific Highway, later became SR 99. By 1923, 700 miles of two-lane highway connected Vancouver, British Columbia, to Seattle and south to the Oregon-California border. Improvements to the highway began just after its 1924 completion, including a new four-lane route farther west connecting Seattle and Tacoma more directly. In the following decades, businesses grew rapidly along SR 99 and a new auto-oriented roadside culture appeared, with associated motels, restaurants, and rest stops. Increased automobile ownership changed perceptions about distance, and encouraged the growth of suburban towns and cities (such as SeaTac, Des Moines, Kent, and Federal Way).

The first segment of I-5 in Washington formally opened in Tacoma in 1960, and the final freeway section from Everett to Tacoma was completed in 1967. The construction of Seattle-Tacoma International (Sea-Tac) Airport and the adjacent I-5 freeway influenced much of the development in the nearby SR 99 corridor, with most development occurring from the 1950s to 1970s. Past development adjacent to both I-5 and SR 99 in the FWLE study area has been predominantly commercial and residential, with some office, mixed use, and institutional uses. In recent years, regional and local planning efforts emphasized an integrated, long-range growth-management, economic, and transportation strategy based on a vision of high-density, urbanized centers linked by a high-quality, multimodal transportation system that includes light rail.

This section presents the environmental effects of past and ongoing actions in relation to the natural and built environments.

6.3.1 Natural Environment

Most of the study area is urbanized. All of the stream basins in the study area are highly urbanized and exhibit high stream flows (peak flows) during storm events, typical of developed basins. Urbanization has also changed base flow and increased seasonal flow fluctuations from predevelopment conditions.

Past development filled and developed wetland areas. The wetlands present in the FWLE corridor are fragments of larger historical wetland systems or are wetlands recently formed from changes in land use and surface water drainage patterns. The McSorley Creek Wetland is the only undisturbed wetland in the study area larger than 5 acres.

Most of the corridor's vegetation reflects landscaping practices for urban and suburban areas, with remnant tree canopy retained for shade or aesthetics. The largest remnant of native forest in the study area is in the McSorley Creek riparian corridor to the west of SR 99.

The Puget Sound Region is seismically active. Numerous earthquakes have occurred in the past, and future earthquakes are likely. The topography along the entire project corridor was substantially modified with engineered cuts and fills during I-5 and SR 99 construction.

6.3.2 Built Environment

The I-5 study area is primarily residential, with limited commercial development except near the Kent-Des Moines Road and S 320th Street interchanges. The residential neighborhoods west of I-5 tend to consist of older, established single-family housing that developed from the 1950s to 1970s as suburbs for workers in Seattle or Tacoma mixed with some newer single-family and multi-family housing developments, including mobile home parks. The area east of I-5 is primarily single-family residential developments.

The study area for SR 99 includes a mix of commercial and residential uses. SR 99 was the first road linking the region's primary economic centers of Seattle and Tacoma. Residential uses close to SR 99 are primarily multi-family.

In recent years, the study area population has become ethnically and linguistically diverse. Immigrant groups are attracted to the affordable housing and jobs in the area, many associated with the airport. The study area includes substantial Korean, Somali, and

Hispanic populations. Community resources and businesses that provide services and goods to these populations have become more common. In addition to being ethnically diverse, the study area also has low-income populations. As shown in Table 6-1, the median income in the corridor is lower than the median income in King County, and the percentage of people with a low income is also higher than that in King County as a whole.

TABLE 6-1
FWLE Corridor Population Characteristics

	I-5 Corridor	SR 99 Corridor	King County
Minority (%)	58	61	37
Low-Income (%)	21	21	12
Median Household Income	\$53,862	\$48,236	\$73,035
Households with No Vehicle (%)	9	12	10
Households with Limited English Proficiency (%)	19	20	11

Source: U.S. Census Bureau, 2015.

The wide variety of land use types found along the SR 99 corridor, its large-scale commercial/manufacturing and storage buildings, and associated parking areas have caused primarily auto-oriented development patterns and low visual quality. Over the past several years, each city has made improvements to SR 99 by adding landscaped medians, sidewalks and street trees. Changes in building codes also now encourage or require landscaping on adjacent properties. Development along I-5 has remained primarily residential, and mature vegetation has been retained as a barrier between neighborhoods and the freeway.

6.4 Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions are future projects that could add to or otherwise influence the nature of FWLE impacts when combined with past and present actions. They are:

- Not speculative
- Relevant regardless of the agency, organization, or person serving as their proponent (CEQ, 1997)
- Likely to occur in the reasonably foreseeable future, because they meet one or more of the following criteria:

- Funded, approved, or under consideration for regulatory permitting
- The subject of an environmental review process under the National Environmental Policy Act (NEPA) or the State Environmental Policy Act
- Part of an officially adopted planning document or publicly available development plan

Exhibits 6-1 and 6-2 show the approximate locations of reasonably foreseeable regional transportation projects. Exhibits 6-3 and 6-4 show known public and private developments that were planned or constructed at the time of the Final EIS. Appendix D6 briefly describes the actions shown on these exhibits. It also summarizes impacts identified during the environmental review process for each project.

6.5 Cumulative Impact Assessment

Sound Transit analyzed two kinds of cumulative impacts:

- Long-term (during project operation) – could be adverse and/or beneficial, if impacts of the FWLE add to or interact with long-term impacts of other past actions, present actions, and reasonably foreseeable future actions
- Short-term (during construction) – potentially adverse, if the impacts from other projects under construction at the same time worsen the intensity or duration of FWLE construction impacts

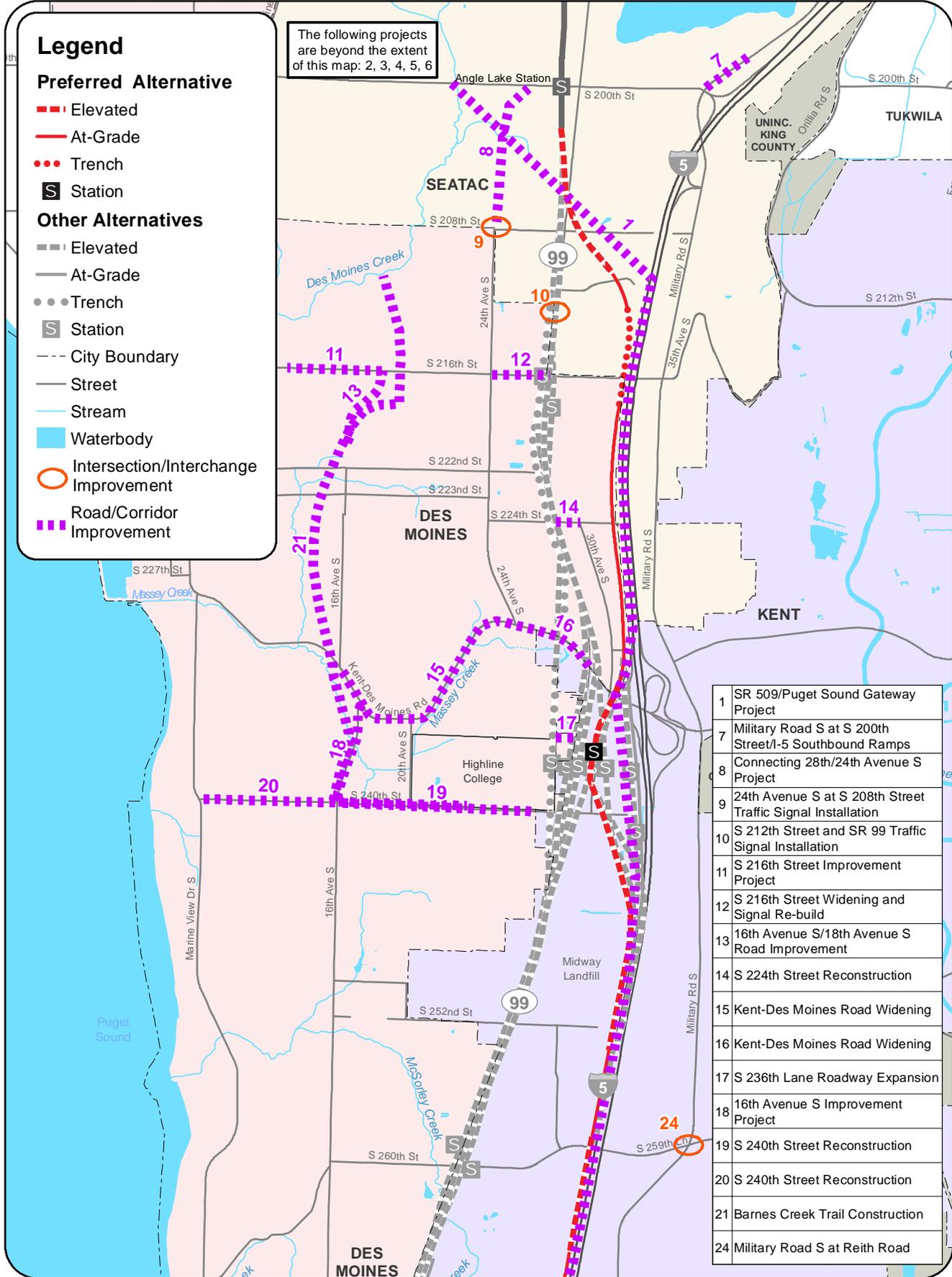
The following sections discuss expected cumulative impacts of project operation and construction, focusing on specific elements of the environment.

The FWLE would shift some vehicle trips to light rail, reducing the demand on local roads and highways. This would improve air quality and reduce energy consumption compared to the No Build Alternative.

Analyses of transportation, economics, air quality, and energy inherently include the impacts of other projects or processes. These analyses in Chapters 3 and 4 generally account for cumulative impacts already, so these four elements are discussed only briefly below.

Direct and Indirect Impacts

Chapters 3, 4, and 5 discuss the direct and indirect impacts of the project alternatives that could contribute to future cumulative impacts.



The following projects are beyond the extent of this map: 2, 3, 4, 5, 6

Legend

Preferred Alternative

- Elevated
- At-Grade
- Trench
- Station

Other Alternatives

- Elevated
- At-Grade
- Trench
- Station
- - - City Boundary
- Street
- Stream
- Waterbody
- Intersection/Interchange Improvement
- Road/Corridor Improvement

1	SR 509/Puget Sound Gateway Project
7	Military Road S at S 200th Street/I-5 Southbound Ramps
8	Connecting 28th/24th Avenue S Project
9	24th Avenue S at S 208th Street Traffic Signal Installation
10	S 212th Street and SR 99 Traffic Signal Installation
11	S 216th Street Improvement Project
12	S 216th Street Widening and Signal Re-build
13	16th Avenue S/18th Avenue S Road Improvement
14	S 224th Street Reconstruction
15	Kent-Des Moines Road Widening
16	Kent-Des Moines Road Widening
17	S 236th Lane Roadway Expansion
18	16th Avenue S Improvement Project
19	S 240th Street Reconstruction
20	S 240th Street Reconstruction
21	Barnes Creek Trail Construction
24	Military Road S at Reith Road

Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2015).

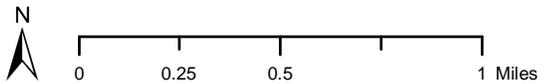
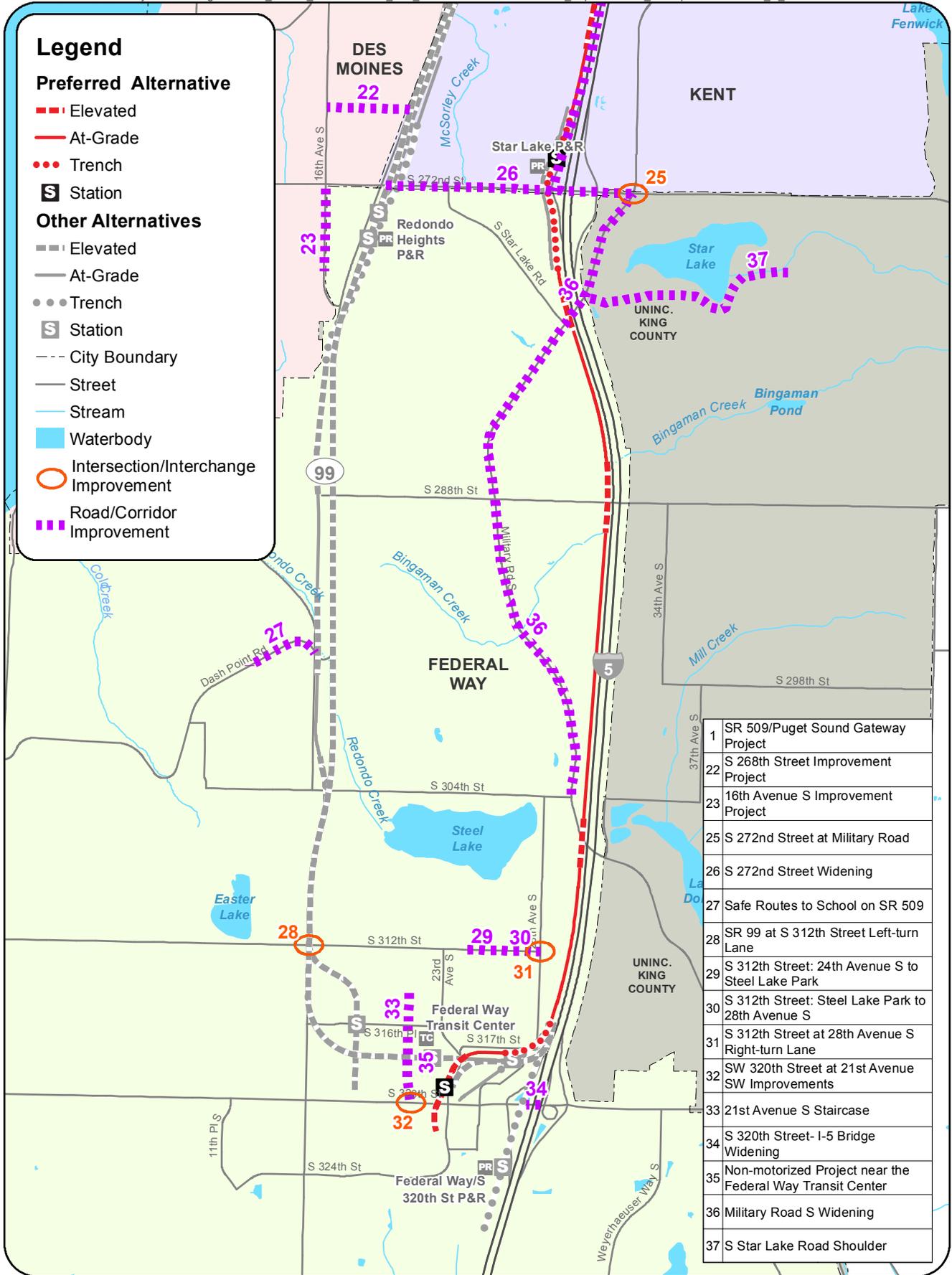


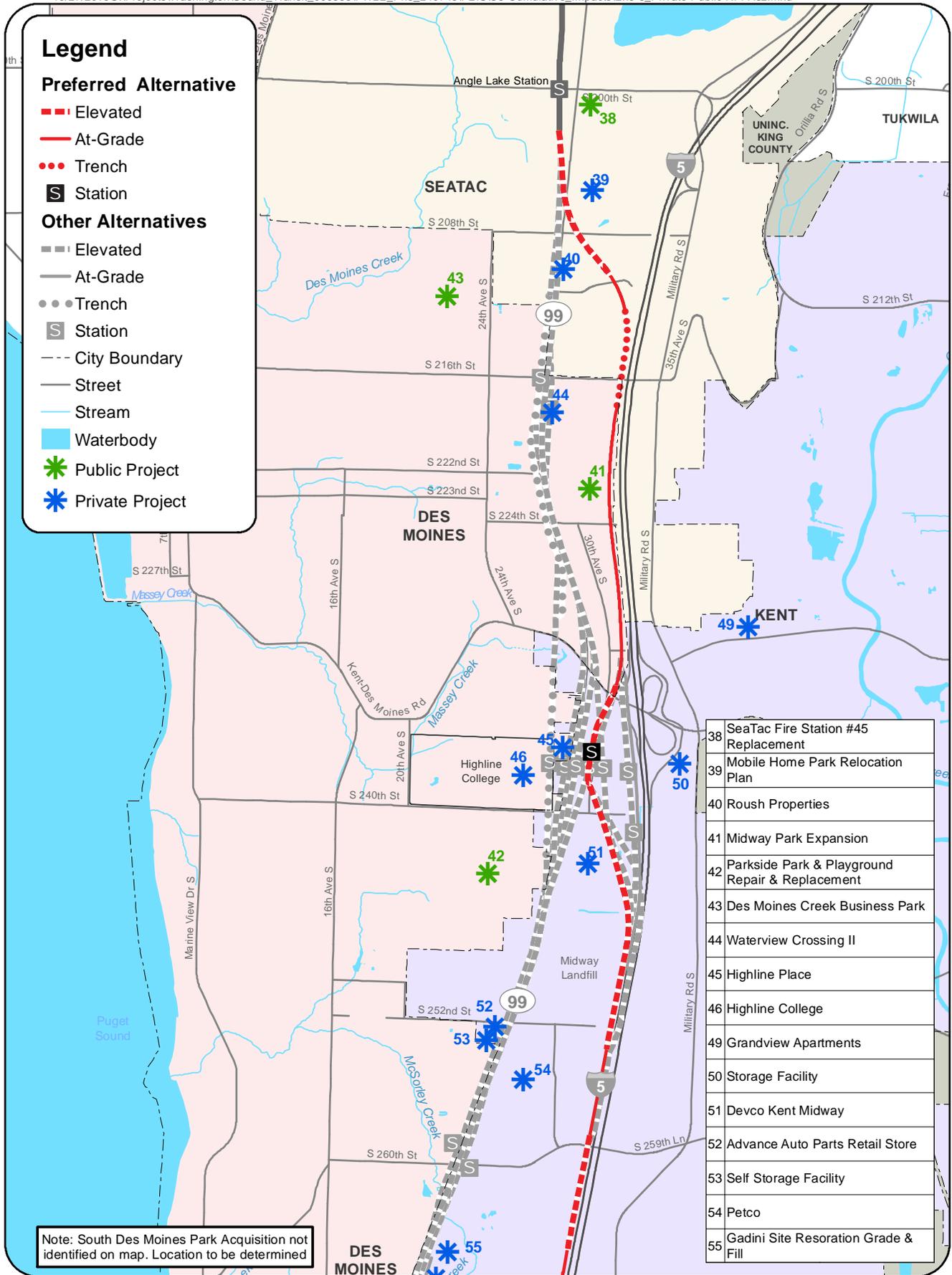
EXHIBIT 6-1
 Planned Transportation Projects
 Northern Extent
 Federal Way Link Extension

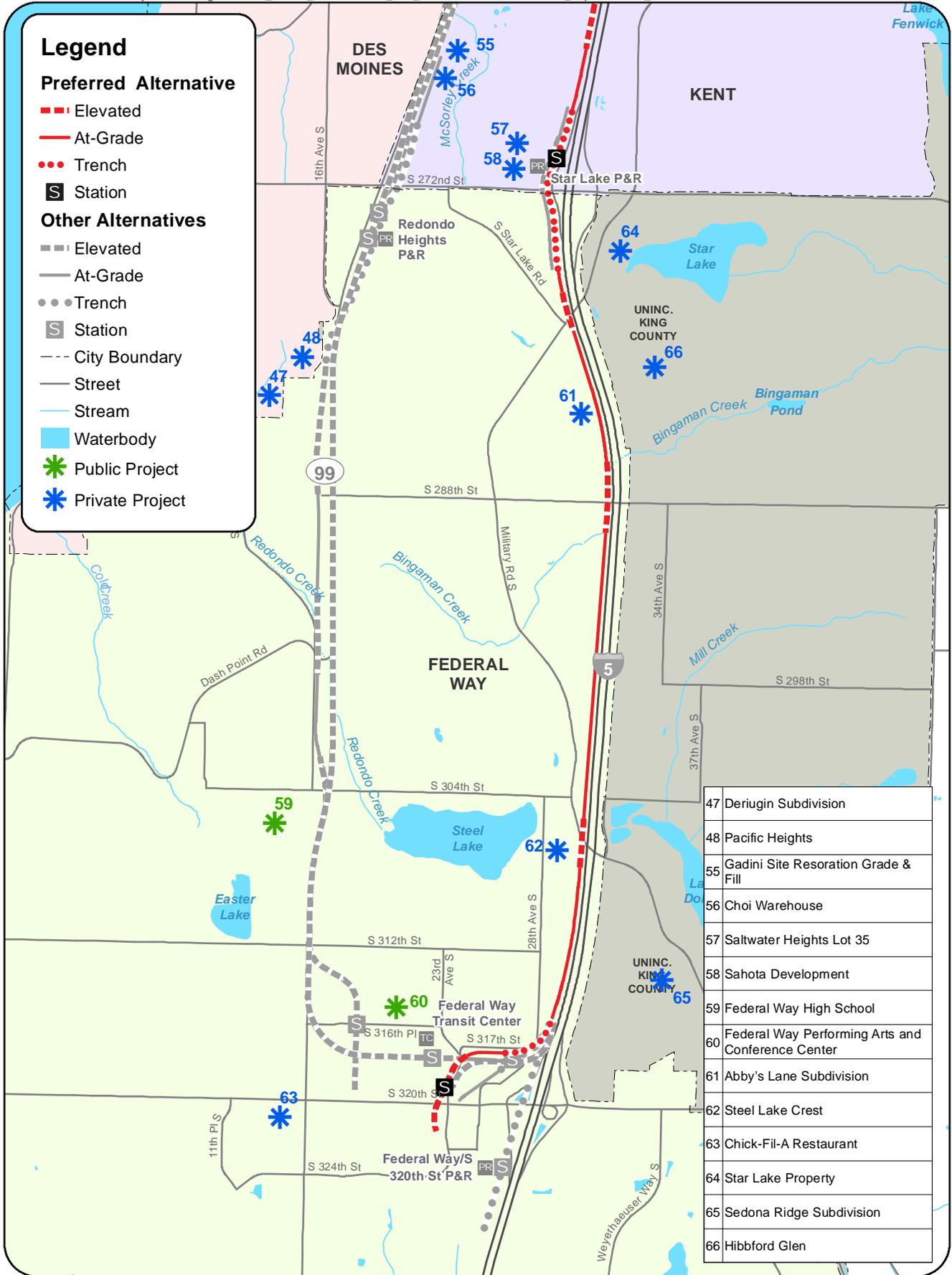


Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2015).



EXHIBIT 6-2
Planned Transportation Projects
Southern Extent
Federal Way Link Extension





Legend

Preferred Alternative

- Elevated
- At-Grade
- Trench
- S Station

Other Alternatives

- Elevated
- At-Grade
- Trench
- S Station
- City Boundary
- Street
- Stream
- Waterbody
- * Public Project
- * Private Project

47	Deriugin Subdivision
48	Pacific Heights
55	Gadini Site Resoration Grade & Fill
56	Choi Warehouse
57	Saltwater Heights Lot 35
58	Sahota Development
59	Federal Way High School
60	Federal Way Performing Arts and Conference Center
61	Abby's Lane Subdivision
62	Steel Lake Crest
63	Chick-Fil-A Restaurant
64	Star Lake Property
65	Sedona Ridge Subdivision
66	Hibbford Glen

Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2015).



EXHIBIT 6-4
Private and Public Planned Projects
Southern Extent
Federal Way Link Extension

The SR 509 Corridor Completion Project (SR 509 Extension Project) might substantially change some of the impacts for some FWLE alternatives. As described in Chapter 2, the SR 509 Extension received a Record of Decision in 2003, and it is funded through the “Connecting Washington” transportation bill passed in 2015. As approved in 2003, the project was included in the No Build Alternative for the Final EIS analysis and thus is accounted for in the analysis in Chapters 3 through 5. However, WSDOT is revising the project as part of the Puget Sound Gateway Program. Changes in design of the SR 509 Extension could increase or decrease FWLE’s permanent impacts. Construction of the FWLE to Kent/Des Moines is scheduled to be complete by 2023, and it is likely that the SR 509 Extension construction period will overlap, creating cumulative construction impacts that could be adverse (longer road closures, for instance) or positive (shared construction staging areas, for instance). Because the construction schedule for the rest of the FWLE is currently unknown, construction of portions of the SR 509 Extension south of Kent-Des Moines Road might be before, concurrent with, or after the FWLE.

SR 509 Extension Project

This project proposed by WSDOT would include extending the SR 509 freeway from South 188th Street/12th Place South to a connection with I-5 near South 210th Street; improving I-5 between South 210th and South 320th streets; improving southern access to and from Sea-Tac Airport by a new roadway; and improving related local traffic circulation patterns.

6.5.1 Transportation

6.5.1.1 Operation

The transportation impacts discussed in Section 3.5 were based on traffic and ridership modeling that incorporates past, present, and funded future actions, as well as projected growth that includes development in the region. Other planned, but not funded, regional and local transportation projects and development projects could affect transit ridership and travel patterns within the project area, including traffic operations near the proposed stations. This could include possible transit-oriented development (TOD) in station areas, which would likely increase the numbers of people walking or biking to stations.

The most substantial potential transportation improvement near the FWLE is the SR 509 Extension. Cumulative effects of building and operating both projects relate to overall transportation capacity, highway operations, and safety. These impacts are covered in Section 3.5, Environmental Impacts, in Chapter 3, Transportation Environment and Consequences, and are discussed below.

The SR 509 Extension proposes closing S 208th Street east of SR 99 and extending S 211th Street east to 32nd Lane S to maintain neighborhood access to SR 99. Associated roadway improvements in this area would need to be redesigned to maintain neighborhood access and maintain a grade-separated light rail guideway in this area for the Preferred Alternative or I-5 to SR 99 Alternative. Sound Transit would coordinate with WSDOT and SeaTac on the S 211th Street redesign.

6.5.1.2 Construction

Simultaneous construction of the FWLE and the SR 509 Extension would increase truck trips and the number and duration of road closures, which could increase congestion. Sound Transit and WSDOT would time road closures to minimize traffic impacts. Current project construction schedules (see Exhibit 2-27 in Chapter 2) have the FWLE beginning construction about 2 years before the SR 509 Extension, but some construction would overlap. As project designs advance, Sound Transit and WSDOT would coordinate to minimize impacts.

6.5.2 Acquisitions, Displacements, and Relocations

The Preferred Alternative and the SR 509 Extension would require several property acquisitions and residential displacements north of S 240th Street. Once WSDOT determines the right-of-way needs of the SR 509 Extension, Sound Transit would work with it to identify properties needed for both projects and coordinate on paying fair market value to owners and providing relocation assistance to tenants.

Land use plans for the Pacific Ridge neighborhood and Midway Subarea include redeveloping the area north of S 240th Street to higher densities. This would increase housing opportunities for residents displaced by either project. The Waterview Crossing project in Pacific Ridge will displace 110 mobile homes in 2016, but will provide 324 new multi-family residential units. In addition, high-density TOD could occur after construction of the FWLE near the Kent/Des Moines Station, close to where these impacts would occur. This type of development/redevelopment could provide housing opportunities within the study area.

Even without the forecast increase in development, however, there are relocation opportunities in the FWLE study area for most displaced parties. An adverse cumulative impact from property

Highway Design Deviations

Based on the conceptual design, design deviations could be required by WSDOT for the Preferred Alternative in two locations:

1. Where the Preferred Alternative crosses the future SR 509 Extension. Future changes to the SR 509 design might eliminate the need for this deviation.
2. Where the Landfill Median Alignment Option would be in the I-5 median, if the median is developed as toll lanes in the future.

If a design deviation is needed in either of these locations, Sound Transit would coordinate with and seek approval from WSDOT and/or FHWA.

acquisition is not expected because more residential and employment opportunities are expected to be created than lost by projects in the area.

6.5.3 Land Use

The FWLE, in conjunction with other land use actions by local governments, could result in beneficial cumulative impacts on land use conditions. The FWLE would provide new or improved access that could encourage private development by making properties more attractive to developers. Other planned transportation and public works projects, such as better transit, roadway improvements (including the SR 509 Extension), and bicycle lanes, would cumulatively help achieve higher densities and support mixed-use TOD. This would indirectly affect land use, as described below, and the economy, as described in Section 6.5.4, Economics.

The FWLE in combination with other transportation projects could encourage and accelerate change in land use to high-density, mixed-use TOD where planned near light rail stations. Land use changes would be greatest near stations because of increased transit accessibility and pedestrian activity, attracting businesses and residents. These changes would be consistent with and advance applicable regional and local plans, policies, and development ordinances. Any changes to development regulations would be the responsibility of local governments and entirely within their control.

Changes in the transportation systems from the FWLE and other planned projects would also directly influence changes in land use through acquisition.

6.5.4 Economics

The FWLE, along with other development projects, would influence long-term development and economic conditions in the area through acquisition and displacement. None of the reasonably foreseeable future projects are expected to displace businesses, so no cumulative impact related to business displacements is expected. If WSDOT acquires properties for the SR 509 Extension that are also needed for FWLE, WSDOT would convert them to a public, tax-exempt transportation use, reducing the FWLE property tax impacts.

The SR 509 Extension would create an alternate north-south travel route to I-5 and would improve traffic and freight mobility through south King County. The SR 509 Extension and the increased transit

accessibility and pedestrian activity from the FWLE and other projects described in Section 6.5.3, Land Use, would cumulatively improve travel through the area. This would likely foster additional business activity in the area and lead to additional economic growth. Planned private development projects could also add jobs to the local economy, and denser, more diverse development could increase property and sales tax revenue for local jurisdictions. The private development encouraged by the FWLE and other reasonably foreseeable future action projects could increase property tax and sales tax revenues for local jurisdictions.

Simultaneous construction of the FWLE and other reasonably foreseeable future actions could cause the following temporary adverse cumulative impacts on adjacent businesses:

- Potential increases in noise and dust
- Traffic congestion
- Visual intrusion
- Increased difficulty in accessing properties

Visitors might avoid areas of intense construction, resulting in a temporary adverse economic impact on local businesses but no long-term adverse economic cumulative impact. In addition, the intervals of time between the reasonably foreseeable future action projects might lessen the potential cumulative impacts from multiple construction actions.

Overall, the FWLE and other reasonably foreseeable future actions in the project vicinity have the potential to support economic growth and provide a beneficial cumulative economic impact.

6.5.5 Social Impacts, Community Facilities, and Neighborhoods

Past actions, including transportation projects and land use plans, have influenced the shape and nature of neighborhoods in the study area. Many of these neighborhoods (particularly near stations) could experience increased vitality in terms of improved access, residential infill, growth in employment base, and greater patronage of local businesses as described in Sections 6.5.3 and 6.5.4 as a result of the FWLE and other future projects including transportation projects, private development, and land use changes.

Future private development could increase property values and taxes, as noted in Section 6.5.4, which could reduce affordable housing

opportunities in the neighborhoods. As discussed in Section 6.5.1, Transportation, several future projects would create more residences than the FWLE displaces. Affordable housing goals and policies of local jurisdictions and Sound Transit would encourage affordable housing options. Other than the FWLE, no reasonably foreseeable future actions would impact any community facilities.

If the FWLE and SR 509 Extension were constructed at similar times, they could inconvenience residents and businesses due to cumulative increases in congestion, noise, and construction durations. However, the FWLE, SR 509 Extension, and other reasonably foreseeable future actions would implement minimization measures that would reduce cumulative construction impacts on neighborhoods or community facilities.

6.5.6 Visual and Aesthetic Resources

The construction of I-5 in the 1960s was a major change to the visual environment in the project corridor, particularly in the neighborhoods north of Kent-Des Moines Road and between the Midway Landfill and S 259th Place. The freeway and corresponding development along SR 99 in recent decades also changed other more natural or rural landscapes. The addition of light rail to the project corridor would increase the size and visual prominence of these linear transportation corridors.

The cumulative visual change from reasonably foreseeable future actions and the FWLE would likely reflect changes in development density, primarily in the Kent/Des Moines and Federal Way Transit Center station areas, and more pedestrian-oriented activity than with existing or no-build conditions. Increased density would likely mean higher structures primarily near stations, making these areas visually more urban and light rail less prominent because background views would be of more diverse urban forms. Denser development in other areas, such as the Waterview Crossing development near S 216th Street, would make the SR 99, the SR 99 to I-5, and I-5 to SR 99 alternatives less prominent where they travel on SR 99. The cumulative effect of denser development could help reduce regional impacts on the visual environment from low-density development (e.g., loss of open space, reduction in vegetated areas, and expansion of paved areas).

The removal of trees in the I-5 right-of-way for the Preferred and SR 99 to I-5 alternatives would contribute to a cumulative loss of

vegetation that provides a visual buffer between residential areas and the freeway. Other projects in the corridor that could contribute to this impact include private residential developments planned adjacent to the right-of-way and the SR 509 Extension. Additionally, after the trees are removed, less scenic elements such as the guideway, freeway, and SR 509 would be visible. WSDOT and the cities all require mitigation for tree removal; the specific requirements depend on the size and number of the trees removed. Because trees lost on these properties may or may not be mitigated in the same area, some of the visual impacts of tree removal may be permanent.

If constructed at the same time as other reasonably foreseeable future actions, such as the SR 509 Extension, viewers could experience more visual impacts during construction. This would increase the overall impacts on the surrounding visual environment.

6.5.7 Air Quality and Greenhouse Gases

The impact analysis for air quality in Section 4.6 is based on forecasts that include reasonably foreseeable transportation projects. Therefore, it fully encompasses the cumulative effects that would occur regionally and locally.

The FWLE, alone and as part of ST2 and ST3, would reduce automobile vehicle miles traveled and vehicle emissions in the Puget Sound Region. Its operation may affect traffic patterns near proposed transit stations, but, in conjunction with increased traffic from other projects in the area, this would not cause any exceedances of the National Ambient Air Quality Standards (NAAQS). The FWLE and reasonably foreseeable future actions would temporarily increase air pollutants and greenhouse gas emissions during construction. However, construction emissions would not exceed the NAAQS, and mitigation measures and best practices would minimize air quality impacts.

Regional, state, and federal governments are adopting new regulations that will require reductions in greenhouse gas emissions, further enhancing the cumulative air quality benefits of the FWLE and other foreseeable future actions.

6.5.8 Noise and Vibration

The Federal Transit Administration methodology for noise and

ST2 and GHG Emissions

The FWLE is part of the ST2 Plan (Sound Transit, 2008a), which extends light rail north, south, and east of the Central Link Initial Segment in Seattle and makes other transit improvements throughout central Puget Sound. In 2008, Sound Transit analyzed the cumulative impacts of the ST2 Plan's greenhouse gas emissions. The ST2 Plan is projected to reduce overall regional carbon dioxide equivalent (CO_{2e}) compared to the No Build Alternative by approximately 99,552 metric tonnes annually (using current electric power fuel mix assumptions). Under the possible scenario of using non-carbon energy sources, the reduction could be as much as 178,334 metric tonnes—the equivalent of 414,731 barrels of oil a year, 931 railcars of coal a year, or preserving 1,244 acres of forest from deforestation (Sound Transit, 2008b). With ST3 there would be additional GHG emissions savings.

vibration analysis identifies noise impacts and mitigation in the context of cumulative noise exposure at noise-sensitive properties. It is based on existing noise levels in combination with new noise generated by the project. Direct impacts identified for noise are cumulative in nature. For both the SR 99 and I-5 corridors, motor vehicles are the dominant noise source. Aircraft noise from Sea-Tac Airport also affects some of the project area. The SR 509 Extension would also contribute to future noise and vibration in the project area.

The overall day-night average sound level along the FWLE corridor, when the FWLE is combined with other future projects, would not vary more than 3 decibels (dBA) from the noise levels reported in Section 4.7. Three dBA is the minimum noise change that is discernible to the average person.

During construction, cumulative noise impacts could occur, most likely north of Kent-Des Moines Road, where the FWLE and SR 509 Extension construction could occur concurrently. As described in Section 6.5.1.2, Sound Transit would coordinate with WSDOT to combine construction activities to reduce the duration and intensity of impacts.

Although Sound Transit will mitigate project noise impacts, light rail would still create a new noise source and would contribute to cumulative noise in the project corridor. In addition, the indirect impact of FWLE attracting more development around stations would likely cause more intense urban activities in some station areas, adding cumulative noise to the surroundings.

Light rail vibration might occur concurrently with vibration from heavy trucks on rough roads and local construction activities. Cumulative vibration levels in most areas are not expected to differ from existing vibration levels. Exceptions to this would include areas with extremely rough roadways with potholes or cracks that increase vibration levels from passing trucks and other heavy vehicles, and areas near active construction sites where equipment causes short-term increases in vibration levels. In these areas, vibration could increase from construction equipment for multiple projects such as the FWLE and the SR 509 Extension. Long-term vibration impacts from the FWLE would be mitigated, and no cumulative vibration impacts are predicted.

6.5.9 Water Resources

Over time, new development and redevelopment are expected to bring many existing pollution-generating surfaces up to current standards for runoff control and stormwater quality treatment. Small improvements in stormwater runoff control and water quality would occur over time, with or without the FWLE. This should result in modest improvement in the hydrology and water quality of the streams within the project corridor. No cumulative adverse impact on water resources from the FWLE is expected.

6.5.10 Ecosystems

Past actions have greatly changed the ecological landscape in the study area and vicinity, and presently occurring and reasonably foreseeable future actions could contribute to additional cumulative impacts. However, because individual project impacts are likely to be limited, the potential for negative cumulative impacts on ecosystems would be low.

Past urbanization, including residential development and construction of I-5, have degraded Bingaman Creek; the FWLE would worsen past impacts. The Preferred Alternative would be on columns next to Bingaman Creek both north and south of S 288th Street, and the creek would be realigned next to or in between the columns. The SR 99 to I-5 Alternative would relocate the creek north of S 288th Street and pipe the stream under the guideway south of S 288th Street. If this alternative were identified as the project to be built, the alignment in this area could be redesigned similar to the Preferred Alternative to reduce impacts on the stream. Previous projects in this area have channelized this stream and degraded the habitat quality. South of S 288th Street, the stream would be adversely impacted but would likely be mitigated offsite. North of S 288th Street, impacts could be potentially mitigated onsite or offsite based on agency coordination and permit requirements. Sound Transit would design the FWLE to accommodate the removal of existing fish barriers in the future by WSDOT or other parties. Offsite mitigation for the FWLE, along with other Sound Transit mitigation proposed for Sounder commuter rail improvements in the Green River Valley, would cumulatively benefit fish habitat and passage in the creek east of I-5.

The following proposed site development projects could affect ecosystem resources in the study area that, when combined with the effects of the FWLE, might result in cumulative effects:

- Several commercial and residential projects surrounding the McSorley Creek Wetland and McSorley Creek in the city of Kent
- New subdivision adjoining Steel Lake at the headwaters of Redondo Creek

Although most of these projects are on developed or partially developed parcels, impacts could include minor loss or degradation of vegetation, wildlife habitat, streams, wetlands, and associated buffer areas. These impacts would be short-term (e.g., temporary disturbance during construction) and long-term (e.g., conversion of vegetated areas to impervious surface). Permit restrictions would limit the extent of the future projects' adverse effects on aquatic species, aquatic habitat, vegetation, wildlife, or wetlands.

Remnant patches of forest habitat in the greater project area would be subject to cumulative impacts due to tree removals in the I-5 corridor with the Preferred Alternative or the SR 99 to I-5 Alternative, the SR 509 Extension, and other development projects proposed on undeveloped properties, as well as the removal of trees that are obstructions at Sea-Tac Airport by the Port of Seattle. Cumulative effects on forested habitat include habitat loss and disturbance to wildlife. All project alternatives are near existing highways and urban developed areas and, due to past development, have lower habitat value than less disturbed, more rural areas. However, remnant patches of natural vegetation can provide wildlife refuge and/or corridors that connect larger undisturbed areas and are important for animals and birds transiting through urban areas. As described in Section 6.5.6, WSDOT and the cities all require mitigation for tree removal; the specific requirements depend on the size and number of the trees removed. Because trees lost on these properties may or may not be mitigated in the same area, there could be permanent impacts from tree removal in specific locations. However, the mitigation might benefit other forest habitat in the study area depending on where it occurs and if there are other projects requiring similar mitigation in the same area.

Any project or land use action would be subject to regulatory review and permitting under federal, state, and/or local regulations. These processes would require measures to avoid or minimize the impacts on ecosystem resources. Such processes would also provide compensatory mitigation for any unavoidable impacts on streams,

stream buffers, wetlands, or wetland buffers as discussed in Section 4.9, Ecosystems.

6.5.11 Energy Impacts

Given the regional scale of the energy analysis and the scope of the travel demand model used for the analysis, the Section 4.10 analysis accounts for the cumulative impacts of the proposed project. The cumulative energy impacts of the FWLE in conjunction with other reasonably foreseeable future actions would be negligible.

6.5.12 Geology and Soils

Analysis shows no cumulative impacts on geology from the FWLE in conjunction with other reasonably foreseeable future actions, either in operation or construction. Existing urban development has already substantially altered geologic surface conditions throughout the study area. Continued development from reasonably foreseeable future actions could increase infrastructure placed in localized geologically sensitive areas (e.g., steep slopes or seismic hazard areas). However, all projects must be constructed in accordance with state and local laws that require design and construction to meet seismic standards.

6.5.13 Hazardous Materials

Hazardous materials impacts are managed through cleanup and disposal. Federal environmental regulations have resulted in the identification and cleanup of past hazardous materials sites, and in fewer hazardous materials spills and releases. Because encountered hazardous materials must be cleaned up or remediated during project development, future development projects, with or without the FWLE, would accelerate the cleanup of existing contaminated sites in the study area.

6.5.14 Electromagnetic Fields

As described in Section 4.13.4.2, the FWLE would not result in electromagnetic interference (EMI) that causes sensitive electronic equipment to malfunction. There are also no areas where the project's EMI would combine with past, present, or reasonably foreseeable future actions to result in human health effects or disturbance to sensitive equipment.

6.5.15 Public Services, Safety, and Security

Under all FWLE alternatives, planned growth in population, employment, and general urban activity in the study area would increase demand on public services, including emergency and public

safety services. However, the project's contribution to the cumulative increase in demand would be minor.

6.5.16 Utilities

Light rail service could encourage development of property in and around the project area, which could increase demand for utility services. However, local governments and public utilities have already accounted for this planned growth in adopted local land use plans. Any development near the project would be no more intense than what is allowed in the adopted land use plans and development regulations of the local governments. Therefore, the cumulative impacts on utilities would not be greater with or without the FWLE.

6.5.17 Historic and Archaeological Resources

The FWLE would not have an adverse effect on any National Register of Historic Places eligible resources, and as such would not contribute to a cumulative effect.

6.5.18 Parks and Recreational Resources

The FWLE would not contribute to any permanent cumulative impacts on parks or recreational resources. Section 4.17.3 shows that the Federal Way SR 99 Station Option to the SR 99 and I-5 to SR 99 alternatives would use 0.7 acre of Federal Way Town Square Park for a new transit-only roadway. All adverse effects on the park would be mitigated. The FWLE would impact the playfield at Mark Twain Elementary School in Federal Way, primarily during construction. For the Preferred Alternative, the playfield would be restored to existing conditions following construction where it is not permanently affected, and the permanent effects would not be material. For the S 272nd Star Lake Elevated Station Option, there would be permanent loss of 0.1 acre of the school playfield.

The FWLE could potentially contribute to cumulative impacts on parks or recreational resources if construction periods of other foreseeable projects overlap. However, no other projects have been identified in the FWLE corridor that would also temporarily impact parks, making temporary cumulative impacts on parks and recreational resources unlikely.

6.6 Potential Mitigation Measures for Cumulative Impacts

The FWLE operations could contribute to cumulative impacts on transportation, visual quality, noise, and ecosystems. Chapters 3 and

4 discuss avoidance, minimization, and mitigation measures for operational impacts on these resources, which, except for some visual impacts, could be fully mitigated. However, most cumulative impacts due to the FWLE and concurrent projects would occur during construction rather than operation. Individual projects would be responsible for mitigation and meeting regulatory requirements relating to direct impacts on resources such as ecosystems, water resources, hazardous materials, and historic and archaeological resources.

Sound Transit would coordinate as necessary with projects that would be under construction at the same time as the FWLE to minimize the potential cumulative effects of overlapping construction periods within the same area. Such coordination would reduce cumulative construction impacts related to transportation, reduced access, increased dust and noise affecting businesses and residences, and visual resources.

7.0 Environmental Justice

7.1 Summary

Based upon information presented in other sections of this Final EIS, the FWLE would not result in disproportionately high and adverse effects on minority and low-income populations. The FWLE would result in benefits to these populations in the FWLE corridor such as improved access to transit and employment, improved transit reliability, extended transit service hours, and increased mobility in the FWLE corridor and to other regional centers.

In addition, in station areas where cities have planned for increased densities, the project could indirectly result in more access to services from more intensive land uses and economic development, improving neighborhood quality and providing new employment opportunities. New development and redevelopment in the station areas could result in higher property values, taxes, and rents, which could have a negative impact on residents, especially those who rent. However, goals and policies have been adopted by jurisdictions along the FWLE corridor and Sound Transit related to affordable housing options.

Executive Order 12898

Executive Order 12898 provides that “each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.” The executive order addresses the importance of public participation in the project review process.

7.2 Introduction and Regulatory Framework

The environmental justice analysis in this chapter describes (1) the evaluation of whether the FWLE would result in disproportionately high and adverse effects on minority and low-income populations and (2) Sound Transit’s engagement with minority and low-income populations, encouraging their active participation in the planning process. Sound Transit prepared the analysis in compliance with the following:

- Presidential Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, dated February 11, 1994

DOT Order 5610.2(a)

Subsection 5(b)(1) requires agencies to take two actions:

- Explicitly consider human health and environmental effects related to transportation projects that may have disproportionately high and adverse effects on minority or low-income populations
- Implement procedures to provide “meaningful opportunities for public involvement” by members of minority or low-income populations during project planning and development

- U.S. Department of Transportation (DOT) Order to Address Environmental Justice in Minority Populations and Low-Income Populations (DOT Order 5610.2(a))
- EO 13166, Improving Access to Services for Persons with Limited English Proficiency, which directs agencies to ensure limited-English-proficiency (LEP) populations have fair and equal access to services

DOT Order 5610.2(a) establishes the procedures to use to comply with EO 12898 to avoid disproportionately high and adverse effects on minority and low-income populations. The order further provides that “In making determinations regarding disproportionately high and adverse effects on minority and low-income populations, mitigation and enhancement measures that will be taken and all offsetting benefits to the affected minority and low-income populations may be taken into account, as well as the design, comparative impacts, and the relevant number of similar existing system elements in non-minority and non-low-income areas” (DOT Order 5610.2 §8(b)).

7.3 Methodology and Approach

Sound Transit completed the FWLE environmental justice analysis using guidance from the Sound Transit/Washington State Department of Transportation (WSDOT) Re-Alignment Issue Paper No. 36: Implementing Environmental Justice Pursuant to Executive Order 12898 and the Department of Transportation Order (Sound Transit, 2001), and the 2012 FTA circular *Environmental Justice Policy Guidance for Federal Transit Administration Recipients* (Circular FTA C4703.1). The FTA guidance provides recommendations to transportation organizations at state and local levels on the following:

- Engaging environmental justice populations in the public transportation decision-making process
- Determining whether environmental justice populations would be subjected to disproportionately high and adverse human health or environmental effects because of a transportation plan, project, or activity

DOT Order Definitions

The DOT order includes the following definitions:

1. **Disproportionately high and adverse effect** on minority and low-income populations means an adverse effect that: is predominately borne by a minority population and/or a low-income population, or would be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that would be suffered by the non-minority population and/or non-low-income population (DOT Order 5610.2, § Appendix 1(g)).
2. **A minority** is a person identified as:
 - Black (a person having origins in any of the black racial groups of Africa)
 - Hispanic (a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race)
 - Asian American (a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands)
 - American Indian or Alaskan Native (a person having origins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition) (DOT Order 5610.2, § Appendix 1(c))
3. **A low-income person** is identified as a person whose median household income is at or below the Department of Health and Human Services poverty guidelines (DOT Order 5610.2, § Appendix 1(b)).

- Avoiding, minimizing, or mitigating these effects

This environmental justice analysis describes the demographics of the FWLE study area using the most recent U.S. Census American Community Survey (ACS) data (U.S. Census, 2015). The analysis looked at minority populations and low-income populations at the census block group level using 2010 to 2014 ACS data. Sound Transit also collected demographic data for foreign-born and LEP populations and transit-dependent households, and used elementary school data as another source of information. Finally, Sound Transit conducted a series of interviews with social service providers to better understand populations in the study area. These interviews also informed the outreach strategy to engage traditionally hard-to-reach populations.

The analysis also provides information on Sound Transit's efforts to involve minority and low-income populations in the FWLE planning process. In assessing whether the FWLE would result in disproportionately high and adverse effects on these populations, the analysis considers potential mitigation and enhancement measures and benefits of the project. The analysis of potential disproportionately high and adverse effects is based on the information in this Final EIS, including the technical appendices and reports.

7.4 Study Area Demographics

Community resources and businesses in the study area that provide services to minority and low-income populations include ethnic grocery and retail stores, religious facilities, and affordable housing. Information on neighborhoods within the study area is available in Section 4.4, Social Impacts, Community Facilities, and Neighborhoods.

For those elementary schools that draw students from the study area, student demographic data were collected from the Washington State Report Card website for the 2014-15 school year (Office of the Superintendent of Public Instruction, 2015). The analysis used elementary school data because the attendance boundaries are more representative of the study area. They encompass smaller areas than middle or high school attendance boundaries, which have more students living outside of the study areas. Students within the study area attended schools in the Highline

Study Area

The study area for the environmental justice analysis is the area within 1/2 mile of SR 99 and I-5 in the FWLE corridor. This study area reflects the impact assessment described in Chapters 3 and 4 and represents the geographic area most likely to receive the greatest impacts, both positive and negative, because of the FWLE. This study area is appropriate because it identifies potentially affected populations or community resources that would be impacted most directly. Such impacts include acquisitions and displacements for residents, businesses, and community facilities; noise; traffic; visual quality; and construction.

The 1/2-mile study area also represents the distance within which residents and workers could easily access the proposed station and the area where nearby residents and communities would be most likely to experience improved access to transit. The environmental justice analysis compares the demographics in the project study area to the Sound Transit District as a whole to understand how the distribution and concentration of minority and low-income populations that could be affected by the project relate to the broader geographic area where Sound Transit provides services.

School District (cities of SeaTac and Des Moines), Kent School District (City of Kent), or Federal Way School District (cities of Kent, Auburn, and Federal Way).

Not every family has children in school, and the Report Card demographic information also contains data on students who may live outside of the study area. Because of this, the school data do not provide a direct comparison with the census data, but can add to the understanding of the study area's demographics.

Exhibits 7-1 through 7-4 illustrate the minority and low-income percentages in the study area using the latest ACS data.

7.4.1 Minority Populations

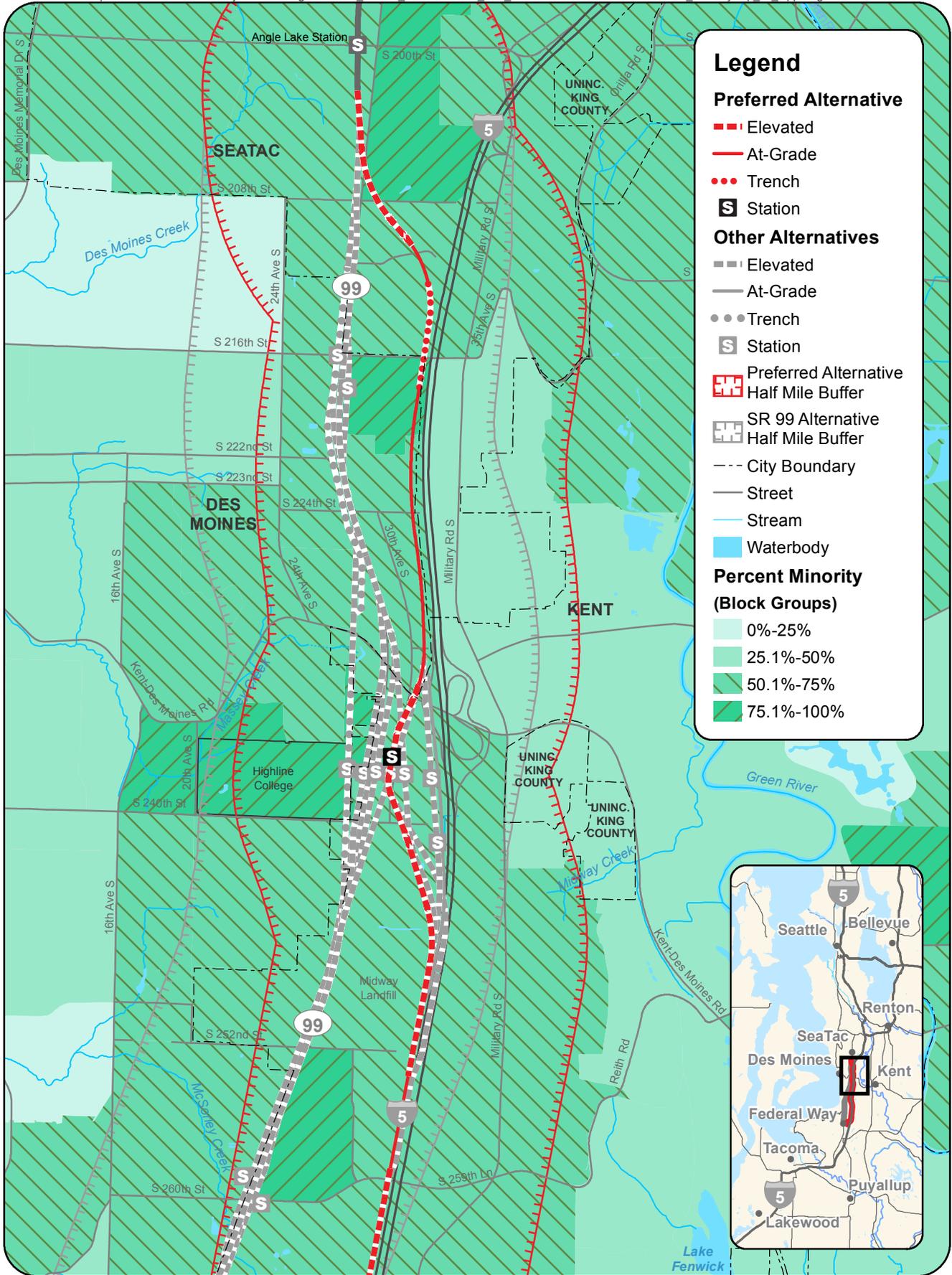
As shown in Exhibits 7-1 and 7-2, the area between I-5 and SR 99 has higher minority population concentrations compared to the areas east of I-5 and west of SR 99. Minority population concentrations in this area are between 50 and 75 percent, although there are some block groups with concentrations that exceed 75 percent. Outside of this area, minority population concentrations are under 50 percent. The overall minority concentration in the study area is over 58 percent, which is higher than the cities in the study area except SeaTac and higher than the Sound Transit district-wide minority population of 31 percent. The predominant minority concentrations are Hispanic or Latino (22 percent), Asian (15 percent), and African-American (13 percent).

The study area also has higher concentrations of LEP households, with about 19 percent within 1/2 mile of I-5 and 20 percent within 1/2 mile of SR 99. These concentrations are higher than all cities in the study area except the city of SeaTac. The Sound Transit district LEP concentration is about 5 percent. The predominant foreign languages spoken in the study area are Spanish, Russian, Korean, Vietnamese, and Tagalog. Information about LEP populations helped inform the outreach strategy targeted for environmental justice populations.

Table 7-1 provides additional information about minority populations in the study area.

The Sound Transit District

Sound Transit's taxing district includes the most populated areas of King, Pierce, and Snohomish counties. The district generally follows the urban growth boundaries created by each county in accordance with the state Growth Management Act and electoral precincts as established in 1996. For more information and a district map see <http://www.soundtransit.org/About-Sound-Transit/Taxing-district>.



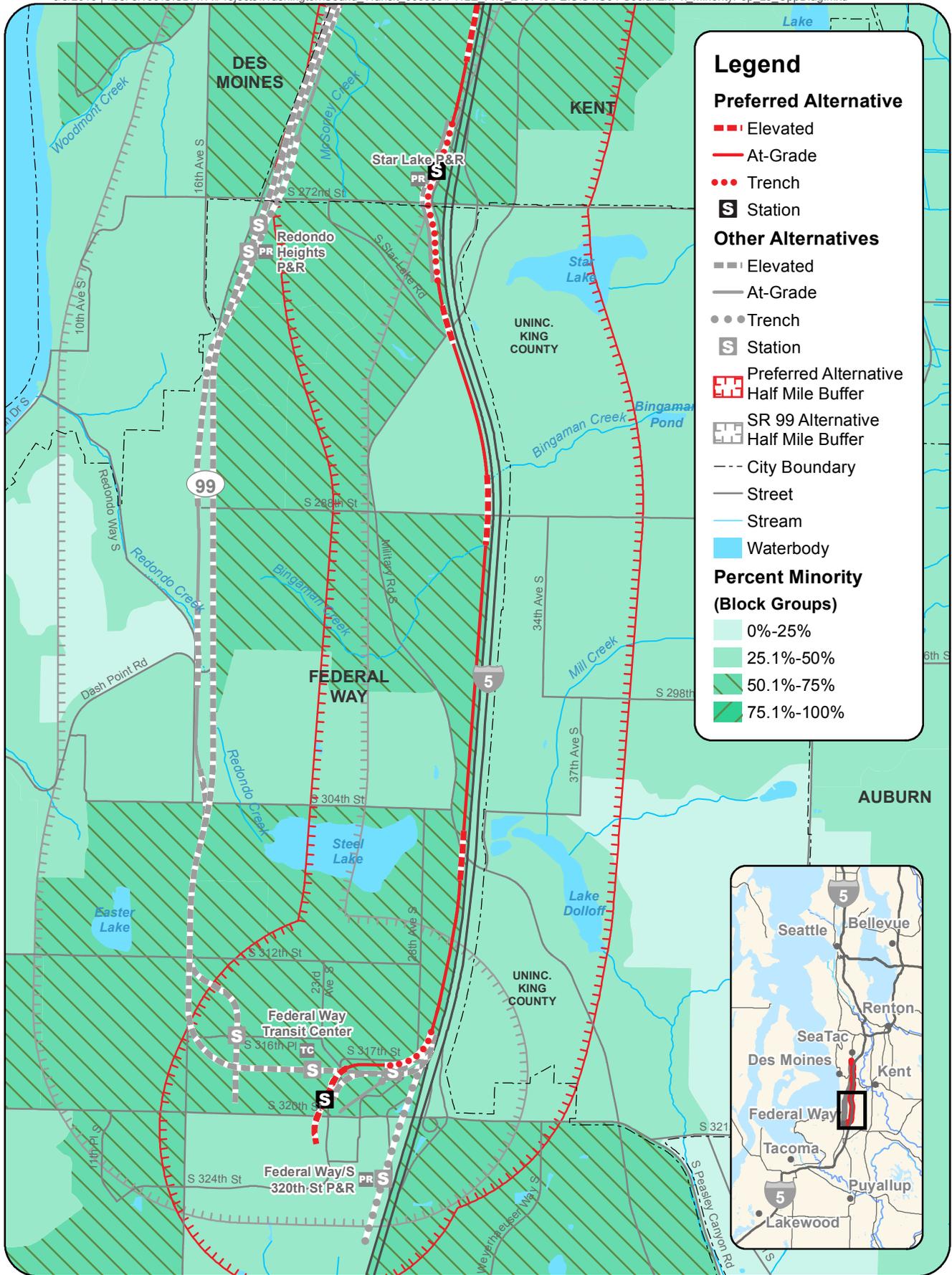
Data Sources: BOC (2014), King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2015).

EXHIBIT 7-1

Minority Population within Census Block (North)

Federal Way Link Extension





Legend

Preferred Alternative

- Elevated
- At-Grade
- Trench
- Station

Other Alternatives

- Elevated
- At-Grade
- Trench
- Station
- Preferred Alternative Half Mile Buffer
- SR 99 Alternative Half Mile Buffer
- - - City Boundary
- Street
- Stream
- Waterbody

Percent Minority (Block Groups)

- 0%-25%
- 25.1%-50%
- 50.1%-75%
- 75.1%-100%

Data Sources: BOC (2014), King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2015).

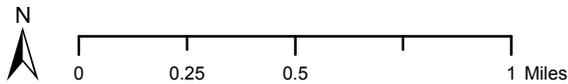
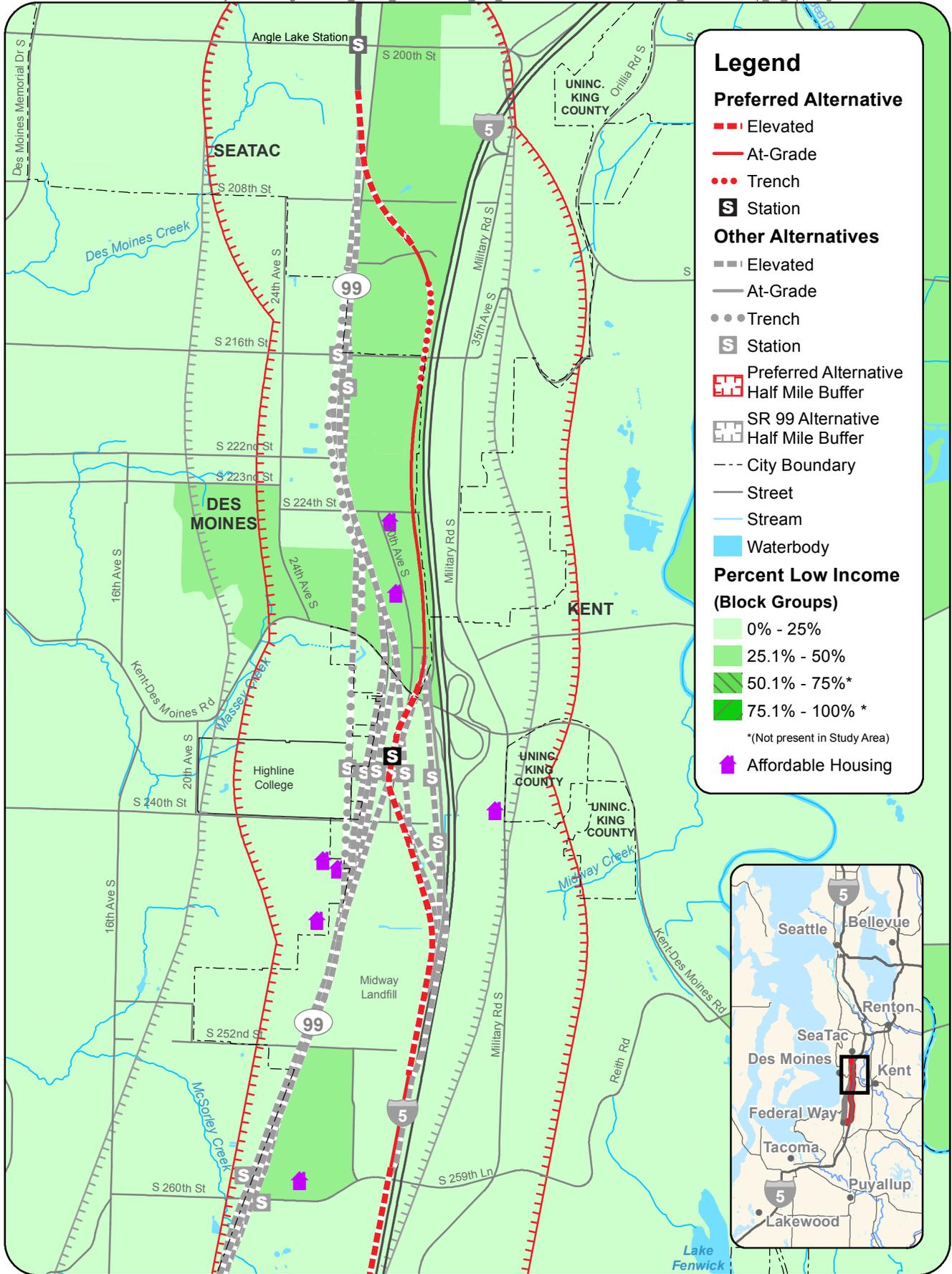


EXHIBIT 7-2
 Minority Population within Census Block
 (South)

Federal Way Link Extension

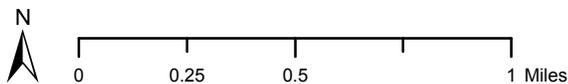


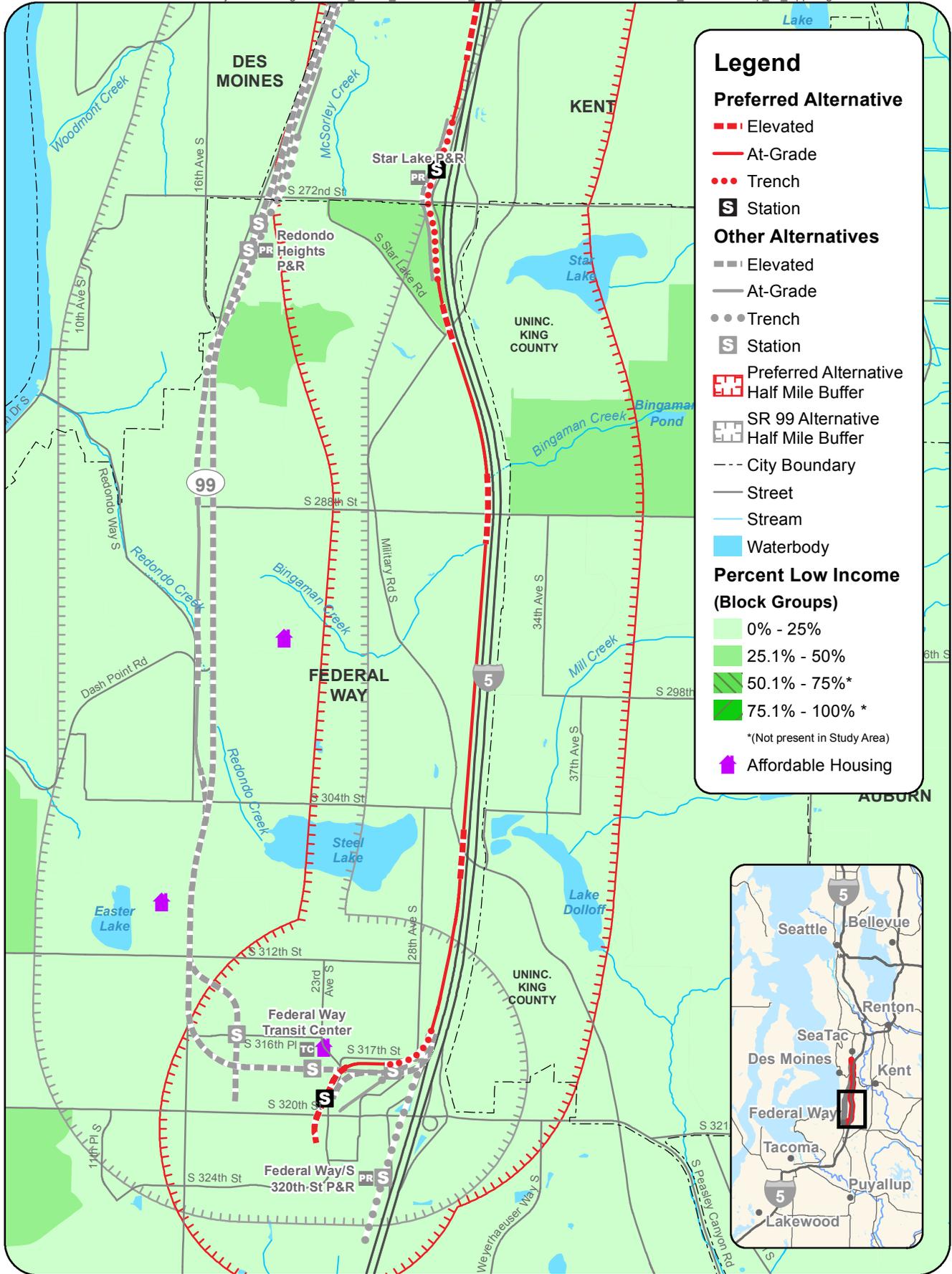
Data Sources: BOC (2014), King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2015).

EXHIBIT 7-3

Low Income Population within Census Block Group (North)

Federal Way Link Extension





Legend

Preferred Alternative

- Elevated
- At-Grade
- Trench
- S Station

Other Alternatives

- - - Elevated
- - - At-Grade
- Trench
- S Station
- ▣ Preferred Alternative Half Mile Buffer
- ▣ SR 99 Alternative Half Mile Buffer
- - - City Boundary
- Street
- Stream
- Waterbody

Percent Low Income (Block Groups)

- 0% - 25%
- 25.1% - 50%
- 50.1% - 75%*
- 75.1% - 100%*

* (Not present in Study Area)

🏠 Affordable Housing

Data Sources: BOC (2014), King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2015).

EXHIBIT 7-4

Low Income Population within Census Block Group (South)

Federal Way Link Extension

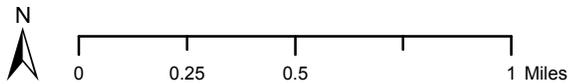


TABLE 7-1
Population Characteristics

	I-5 Corridor	SR 99 Corridor	SeaTac	Des Moines	Kent	Federal Way	King County
Total Population	63,717	54,330	27,606	30,403	122,620	91,676	2,008,997
Population under 18 (%)	24	24	21	21	26	24	21
Population over 65 (%)	10	11	11	15	9	12	12
Minority (%)	58	61	65	46	52	50	37
Low-Income (%)	21	21	23	14	17	16	12
Median Household Income	\$53,862	\$48,236	\$45,573	\$58,308	\$57,490	\$54,186	\$73,035
Households with No Vehicle (%)	9	12	9	7	8	9	10
Households with Limited English Proficiency (%)	19	20	23	16	18	15	11

Source: U.S. Census Bureau, 2015.

Much of the study area's foreign-born population is minority; people from Mexico, the Philippines, Korea, Vietnam, India, Ethiopia, and Kenya account for approximately 55 percent of the foreign-born population, with Mexico being the highest at approximately 21 percent.

Elementary school data are characterized by race and/or ethnicity and may differ from census data. Still, these data, which were used as a secondary data source, are a potential indicator of changing demographics. About 79 percent of students were minority in 2014-15, and about 32 percent of students were English language learners. These are students who live in homes where another language is the primary language spoken, or who learned another language before English.

7.4.2 Low-Income Populations

Similar to the minority population, the low-income population concentration in the area between I-5 and SR 99 is higher than areas farther west or east, as shown in Exhibits 7-3 and 7-4. Much of the study area east of I-5 and west of SR 99 has low-income concentrations less than 12.5 percent and all areas of the corridor have concentrations less than 50 percent. Overall, low-income concentrations average approximately 21 percent within 1/2 mile of I-5 and SR 99. These concentrations are higher than those within the cities in the study area except the city of SeaTac and higher than the 12 percent low-income population in the Sound Transit district.

Exhibits 7-3 and 7-4 also show the study area's affordable housing (subsidized by the U.S. Department of Housing and Urban Development or the King County Housing Authority). Additional developments in the area may provide below-market-rate housing. Many housing providers in the study area (single-family and multi-family) accept residents participating in the King County Section 8 Voucher Program, which is limited to families with income at or below 80 percent of the area's median income. Although the low-income population concentrations are higher in the FWLE study area than the cities as a whole, the median household income is similar to the cities in the study area.

Households without a vehicle are often transit-dependent and this can be an indicator of low-income populations. The concentration of households with no vehicle for the I-5 and SR 99 corridors is 12 and 9 percent, respectively, similar to the study area cities.

The elementary school data on free-lunch program participation give another view of the area's low-income population. Eligibility for the program is based on the federal poverty guidelines issued by the Department of Health and Human Services. About 70 percent of the students who attend elementary schools in the study area participate in the program.

7.5 Outreach to Minority and Low-Income Populations

Sound Transit provided engagement opportunities for minority and low-income populations early and often in the planning and development process. The following sections describe these efforts. For additional information on public involvement and agency coordination, refer to Appendix B.

7.5.1 Stakeholder Outreach

At the beginning of project development, Sound Transit conducted stakeholder interviews to better understand the nature and extent of the minority and low-income populations in the study area. Sound Transit interviewed many local community organizations, jurisdictions, and social services providers, including:

- Korean Women's Association
- International Rescue Committee

Outreach Strategies

Sound Transit is using the following strategies to engage minority and low-income populations:

- Advertisements with translated statements in Korean, Russian, Somali, Spanish, Tagalog, and Vietnamese, with a phone number for non-English-speaking community members to access interpretation services and get more information
- Meetings in transit-accessible facilities
- Meetings in the evening to accommodate daytime and graveyard shift workers
- Production of a Somali-language video that appears on the SomTV website and Facebook page, YouTube, and the Sound Transit website
- Partnering with community organizations to organize outreach events in the community and distribute project information through existing communication channels
- Hosting neighborhood drop-in sessions at familiar, trusted community gathering places, such as community centers and local houses of worship
- Providing neighborhood briefings at individual homes to connect with people who may not feel comfortable attending public open houses

- Angle Lake Family Resource Center
- Kent Youth and Family Services
- United Way of King County
- Des Moines Food Bank
- South King County Council of Human Services
- Cities of Des Moines, SeaTac, and Federal Way

7.5.2 Scoping Meetings

Sound Transit conducted two scoping periods for the FWLE:

- Early scoping, to solicit input on the project purpose and need, transit modes, and alignment alternatives to be studied during the alternatives analysis phase
- National and State Environmental Policy Act scoping, to request public review and comment on the purpose and need, the range of alternatives to be evaluated, and the environmental issues of concern to be analyzed

Each scoping period included public meetings held in the FWLE corridor. Sound Transit summarized the scoping process and comments in two summary reports, which are included in Appendix C of this Final EIS.

Scoping meetings provided an early opportunity for the public to learn about the project and provide comments. Advertisements for the meetings included a postcard mailed to approximately 24,900 residences and businesses within the 1/2-mile study area, print and online advertising, a media advisory, posters at community gathering places, and notifications on the Sound Transit FWLE website. To reach minority populations, advertisements were placed in area newspapers and newsletters in Korean (*Korea Daily*), Russian (*Russian World*), Spanish (*El Mundo, La Raza*), and Vietnamese (*Phuong Dong Times, Ngoui Viet Tay Bac*).

Sound Transit contacted tribes (both federally and non-federally recognized) during scoping and invited them to become participating agencies. The federally recognized tribes included the Confederated Tribes and Bands of the Yakama Nation, Muckleshoot Indian Tribe, Puyallup Tribe of Indians, Snoqualmie Indian Tribe, Stillaguamish Tribe of Indians, and Suquamish Tribe. Thus far, Sound Transit has met with the Muckleshoot Indian Tribe and the Stillaguamish Tribe of Indians; representatives from the Puyallup Tribe of Indians attended

the agency early scoping meeting. Sound Transit also contacted the Duwamish and Snohomish tribal organizations.

7.5.3 Targeted Outreach Events

Sound Transit held a number of outreach events to increase awareness about the FWLE and provide opportunities for all populations to be involved in the decision-making process. All notices for outreach events included translated language blocks (in Spanish, Chinese, Vietnamese, Korean, Somali, Tagalog, and Russian) stating “To speak with Sound Transit about the proposed Link light rail mass transit project in South King County, call 1-800-823-9230 during regular business hours.” Sound Transit staff contacted by a non-English-speaking member of the public have available an immediate phone translation service that provides over-the-phone interpretation in 150 languages, 24 hours a day and 7 days a week.

Sound Transit representatives have attended farmers markets in Des Moines and Federal Way, and neighborhood drop-in sessions at study area food banks, activity centers, community centers, libraries, and local businesses. Specific events targeted to minority and low-income populations through the EIS process have included the following:

- Open houses – Two held at the Federal Way Transit Center, to better reach transit-dependent populations
- Tabling events – Forty-nine held to date at various locations in the study area, including libraries, community centers, the Des Moines Food Bank, The Market at La Plaza, transit centers along the corridor, and Highline College
- Neighborhood briefings – Ten held in neighborhoods adjacent to the potential station locations and project alternatives

The events were held at various times during the day to accommodate area residents’ schedules. Representatives provided information on the project, answered questions, and encouraged residents to sign up for the project e-mail mailing list. In addition, Sound Transit outreach staff regularly provide project updates to social service organizations, including King County Mobility Coalition and the South King County Human Services Council.

During these events, Sound Transit learned that communities in the study area are culturally diverse with large foreign-born populations. Depending on the location, some of these ethnic groups are tightly knit while others are not. Highline College is one of the most diverse

educational institutions in the state. Residential areas closest to the alignments along I-5 and SR 99 include low-income populations.

Sound Transit outreach staff also held meetings and briefings with potentially affected property owners, neighborhoods, and others to provide information and answer questions. These meetings and briefings included minority and low-income people who live on or own property that could be affected by the FWLE.

During the outreach events, comments heard most often from the public included the following:

- Support for the project, including a desire to see it completed sooner
- Concerns about noise and vibration impacts
- General questions on the project (i.e., station locations, cost to ride, and when service starts)
- Parking concerns; people see parking as needed and want it included
- Project funding, including questions as to why the project is not fully funded
- Changes to the existing bus service as a result of new light rail service
- Concerns about cuts in transit service from budget cuts
- Property impacts and whether their property will be affected or acquired, including when Sound Transit would start to inform property owners about acquisition activities
- Concerns about impacts on businesses along SR 99 during construction
- Concerns about potential indirect effects from gentrification

During these meetings and briefings Sound Transit also provided information on how impacts could be mitigated and information on the relocation process for those that own and rent affected property.

7.5.4 Targeted Outreach for Draft EIS Release

Before publishing the Draft EIS, Sound Transit conducted the following targeted outreach activities:

- Hosted a transportation fair at Highline College to inform students and staff about FWLE
- Conducted over 200 one-on-one property owner and tenant meetings (with interpretation upon request), including briefings with residents of three mobile home parks and at one religious institution.
- Distributed fliers to tenants in apartments and mobile home parks potentially affected by the project
- Translated project fact sheets into the key languages for translation identified in the Public Involvement Plan, including Korean, Russian, Spanish, and Vietnamese
- Conducted additional outreach to community groups and organizations that provide services to minority and low-income populations in the project vicinity

Sound Transit published a public notice along with a request for comments on the Draft EIS, and a notice of public hearings and opportunities for comment. It also mailed a project update to approximately 25,000 households and businesses in the project corridor. The newsletter included content in Korean, Russian, Spanish, and Vietnamese. Throughout the Draft EIS phase, Sound Transit hosted public open houses/public hearings (with translation available), attended community events, and held briefings for community organizations including those that serve minority and low-income populations.

7.5.5 Targeted Outreach for Final EIS Release

The release of the Final EIS included the following forms of outreach:

- Public notice in local and online newspapers
- E-mail notification to the individuals in the project database
- Announcements to those within 1/2 mile of the proposed alternatives
- Notice on the project website

Sound Transit performed outreach to ensure that community members and organizations were aware of the Final EIS and to give them a chance to discuss it with project team members. The Final EIS was circulated as required under the National Environmental Policy

Act and the State Environmental Policy Act, and includes the responses to comments made on the Draft EIS.

To inform minority and low-income populations of the availability of the Final EIS, Sound Transit used many of the same methods as on the Draft EIS, including translated fact sheets, the project website, and notices to community groups and organizations. In addition, Sound Transit staff performed targeted outreach to businesses that serve the minority populations through one-on-one meetings.

7.5.6 Community Engagement and Feedback

After the Draft EIS was published, there was considerable feedback about which alternative would best serve the communities in the FWLE corridor. This is summarized in Chapter 9, Comment Summary. A key issue related to the location of the Kent/Des Moines Station and how it would serve the Highline College campus and surrounding neighborhood. Advocacy groups such as OneAmerica, which advocates for immigrant rights, and the Highline College community (students, faculty, and administration) stated that safe, convenient access to the campus was of utmost importance. The station's location was characterized as a social equity issue and that the FWLE project is an opportunity to improve the lives of economically disadvantaged members of the community in South King County. There was concern by these stakeholders that choosing an alternative along I-5 would place the station too far from the campus and forfeit an opportunity to improve the neighborhood near the station. As described in Chapter 2 (Section 2.1), the Sound Transit Board identified the I-5 Alternative as the Preferred Alternative, with a station located near SR 99 and the college campus. It also directed Sound Transit staff to convene a series of stakeholder workshops to optimize the station location and configuration, to facilitate access to Highline College and enhance future transit-oriented development (TOD) potential in the area surrounding the station. Stakeholder participants included Highline College staff and student representatives, the cities of Kent and Des Moines, King County Metro, advocacy groups such as OneAmerica, Futurewise, and Transportation Choices, and others. After four workshops in the fall of 2015, the stakeholders reached consensus around how the station should optimize access for all modes (pedestrians, buses, autos), create a safe pedestrian environment, and create near- and long-term development opportunities. Support for the outcome of this process

was communicated to the Sound Transit Board by stakeholder participants during the Board's October 22, 2015, meeting.

Also, since publishing the Draft EIS, Sound Transit has held several meetings in neighborhoods (in homes and common spaces) that the Preferred Alternative would affect. Questions and discussions have focused on Sound Transit's acquisition and displacement policies, including relocation assistance. Residents have also asked about the project's potential traffic, noise, and visual impacts and mitigation. Residents have raised concerns about construction impacts, including traffic, detours and haul routes.

7.6 Project Impacts and Potential Mitigation

DOT Order 5610.2(a) requires agencies to explicitly consider human health and environmental effects related to transportation projects that may have a disproportionately high and adverse effect on minority or low-income populations. Table 7-2 summarizes impacts identified for all elements of the environment analyzed for the Final EIS. It summarizes direct effects from construction and operation of FWLE as well as indirect and cumulative effects (such as potential for redevelopment near station areas). Because of the project-area demographics, there will be impacts on minority and low-income populations regardless of which alternative is selected. Table 7-2 also addresses (1) elements of the environment where project impacts would accrue to a different degree for minority and low-income populations and (2) potential mitigation to reduce or eliminate the impacts. Mitigation measures are designed to effectively minimize or eliminate unavoidable adverse impacts and would be implemented similarly for all persons affected by the project. That is, the type, level, and quality of mitigation is uniformly proposed for all affected persons.

The No Build Alternative includes the SR 509 Extension Project, which would displace residences and businesses, increase noise, and have visual impacts. The No Build Alternative would not have any of the impacts described in this table, but it would have congestion and mobility impacts as the area continues to grow.

TABLE 7-2

Summary of FWLE Potential Impacts and Mitigation

Type of Impact	Impact Summary for Build Alternatives	Mitigation Summary
Transportation	<ul style="list-style-type: none"> Impacts to access and circulation are expected at 9 or 10 intersections near stations, and could be mitigated. All alternatives would displace parking, including off-street parking associated with businesses. It would provide parking at most stations, except the potential additional stations at S 216th Street and S 260th Street. Hide-and-ride parking could occur near the S 216th, S 260th, and Federal Way City Center stations. 	<ul style="list-style-type: none"> Sound Transit would add or extend turn lanes to accommodate increased traffic. Sound Transit would provide businesses with replacement parking or compensate them for the lost parking. Parking management programs would be introduced where needed.
Acquisitions, Displacements, and Relocations	<ul style="list-style-type: none"> The Preferred Alternative would displace the most residences (141 to 260), primarily in the Pacific Ridge and Midway neighborhoods. Both neighborhoods have high concentrations of minority populations (over 50 percent). Pacific Ridge also has high concentrations of low-income populations (over 50 percent). The SR 99 Alternative would displace the fewest residences (36 to 108) and they would be primarily in the Midway neighborhood. The Preferred Alternative would displace the fewest businesses (7 to 42). The SR 99 Alternative would displace the most businesses (80 to 146), affecting mostly retail properties in station areas. Some displaced businesses provide services considered important to minority and/or low-income populations (e.g., an ethnic grocery store). These services are also provided by other businesses in the study area that would not be displaced or could be relocated. 	<ul style="list-style-type: none"> Displaced residents and businesses would receive compensation and relocation assistance in accordance with Sound Transit's adopted real estate property acquisition and relocation policy, procedures, and guidelines (Sound Transit, 2014a, 2014b). These policies and procedures comply with the federal Uniform Relocation Act and the State of Washington's relocation and property acquisition requirements, and in some cases provide services above the minimum requirements of federal and state law. Potential residential relocation assistance includes a variety of advisory services, moving expenses, rent supplements, and/or down payment assistance. There are opportunities for relocation of residents and businesses in the FWLE vicinity, including for the residents of impacted mobile home parks. Sound Transit would work with affected residences to try to keep them in the same general area. This includes identifying replacement housing that considers such factors as proximity to commercial and community facilities, schools (if applicable), an individual's place of employment, and accessibility to transit if they are transit-dependent.
Land Use	<ul style="list-style-type: none"> Most land acquired would be converted to a transportation-related use. Some property acquired for construction staging could be redeveloped consistent with existing zoning. All FWLE alternatives would be consistent with regional and local plans and policies. Indirect land use effects include potential for redevelopment or transit-oriented development (TOD), particularly around station areas. Such developments can increase availability and density of housing options near high-capacity 	<ul style="list-style-type: none"> No mitigation is required or proposed.

TABLE 7-2

Summary of FWLE Potential Impacts and Mitigation

Type of Impact	Impact Summary for Build Alternatives	Mitigation Summary
	transit services and may include affordable housing units.	
Economics	<ul style="list-style-type: none"> • The Preferred Alternative would displace the fewest businesses (7 to 42) and employees (10-370). The SR 99 Alternative would displace the most businesses (80 to 146) and employees (480 to 1,040). Displaced businesses could be relocated in the area. • With all FWLE build alternatives, there would be a temporary reduction in tax revenues due to property acquisitions and conversions of land. Redevelopment is expected to offset the initial loss, and the economic benefits from new development and redevelopment could result in additional tax revenues and business and employment growth. The increased tax revenues could fund improved city services, including those used by minority and low-income populations in the study area. • New development and redevelopment in the station areas could increase property values, taxes, and rents, which could negatively impact residents, especially those who rent. 	<ul style="list-style-type: none"> • Displaced businesses would receive compensation and relocation assistance in accordance with the provisions of Sound Transit's adopted real estate property acquisition and relocation policy, procedures, and guidelines (Sound Transit, 2014b).
Social, Neighborhoods, Community	<ul style="list-style-type: none"> • The Kent/Des Moines HC Campus Station Option and the S 260th West Station Option associated with the SR 99 Alternative would both displace a community medical and dental clinic that serves minority and low-income populations. • The Kent/Des Moines HC from S 216th W Station Option and the S 260th West Station Option associated with the SR 99 Alternative would each displace two religious institutions. No adverse impacts on minority populations or low-income populations are anticipated because it is expected these churches could relocate in the project vicinity. • New development and redevelopment in the station areas could result in higher property values, taxes and rents, which could negatively impact residents, especially those who rent. Jurisdictions along the FWLE corridor have adopted goals and polices in their comprehensive plans related to affordable housing options and Sound Transit's Transit-Oriented Development Policy includes goals for providing affordable housing in station areas. The Puget Sound Regional Council Growing Transit Communities program established a number of strategies related to affordable housing. 	<ul style="list-style-type: none"> • Mitigation for displacements is described above for Acquisitions, Displacements, and Relocations.

TABLE 7-2

Summary of FWLE Potential Impacts and Mitigation

Type of Impact	Impact Summary for Build Alternatives	Mitigation Summary
Visual and Aesthetic Resources	<ul style="list-style-type: none"> The FWLE would lower the visual quality for some sensitive viewers in the vicinity primarily from vegetation removal and introduction of elevated light rail structure. Impacts would affect all populations similarly and about half of the impacts are anticipated north of Kent Des Moines Road. Number of residences affected would be reduced by implementing landscaping and other design elements. 	<ul style="list-style-type: none"> Where possible, Sound Transit would preserve existing vegetation, provide replacement landscaping that would mitigate impacts after 5 to 10 years, and include new landscaping to soften the appearance of project facilities. FWLE project elements near sensitive viewing areas could be designed to minimize visual effects and include visually interesting elements.
Air Quality	<ul style="list-style-type: none"> No new violations of federal air quality standards would occur. Greenhouse gas emissions with the build alternatives would be less than under the No Build Alternative resulting in beneficial effects for all populations. 	<ul style="list-style-type: none"> No mitigation is required.
Noise and Vibration	<ul style="list-style-type: none"> The Preferred Alternative would have the second most vibration impacts but the fewest noise impacts. The SR 99 Alternative would have the most noise impacts but fewest vibration impacts. 	<ul style="list-style-type: none"> Sound Transit would mitigate all noise and vibration impacts with sound walls, special track work, or other measures. Most noise impacts could be mitigated with sound walls, although in areas where this would not lower noise levels below the FTA criteria, residential insulation (RSIP) would be considered. Based on the current design, all noise impacts to mobile homes are expected to be mitigated with sound walls. As design progresses, it may be determined that some noise impacts to mobile homes cannot be mitigated with sound walls. If this occurs, these mobile homes would likely be acquired as RSIP would not be effective on most mobile homes.
Water Resources	<ul style="list-style-type: none"> The Preferred Alternative would increase impervious surface by about 75 percent. Other alternatives would increase impervious surfaces by between 14 percent (SR 99 Alternative) and 80 percent (SR 99 to I-5 Alternative). 	<ul style="list-style-type: none"> Stormwater would be managed according to applicable regulatory requirements.
Ecosystems	<ul style="list-style-type: none"> The Preferred and SR 99 to I-5 alternatives would have the most wetland impacts and require realigning Bingaman Creek around the columns of the elevated guideway. These alternatives would also have the greatest impacts on forested habitat which would be primarily along the I-5 corridor. Ecosystem impacts would be limited with the SR 99 and I-5 to SR 99 alternatives. None of the build alternatives would adversely effect threatened or endangered species. 	<ul style="list-style-type: none"> Where impacts cannot be avoided, compensatory mitigation would be implemented to achieve no net loss of ecosystem function and acreage.
Energy	<ul style="list-style-type: none"> Operation of FWLE would slightly reduce passenger and transit vehicle miles traveled as people shift to the light rail system. Overall, FWLE 	<ul style="list-style-type: none"> None required.

TABLE 7-2

Summary of FWLE Potential Impacts and Mitigation

Type of Impact	Impact Summary for Build Alternatives	Mitigation Summary
	operation is projected to result in 0.1 percent less energy use than the No Build Alternative.	
Geology and Soils	<ul style="list-style-type: none"> The FWLE Alternatives would travel through geologic hazard areas such as erosion, steep slopes, landslides, and seismic hazards. These hazards are not extensive for any alternative and would be addressed through typical design efforts. 	<ul style="list-style-type: none"> Risks would be avoided or minimized using engineering design standards and BMPs.
Hazardous Materials	<ul style="list-style-type: none"> All build alternatives would have the potential to encounter hazardous material sites considered to be high-risk. The Preferred Alternative would have the lowest number of sites within or adjacent to the project footprint and the SR 99 Alternative would have the highest. The likelihood of impacts from operations and maintenance activities is low as electric trains carry no fuel. The Preferred Alternative and SR 99 to I-5 Alternative would cross the Midway Landfill, a contained hazardous materials site. Based on information gathered and design analysis conducted to date, hazardous materials have not been identified in the part of the landfill where these alternatives would be constructed. However, there is the potential to encounter them given the nature of the landfill materials. 	<ul style="list-style-type: none"> Hazardous waste would be managed and contaminated sites cleaned up or contained.
Electromagnetic Fields	<ul style="list-style-type: none"> No adverse effects would occur because no sensitive equipment has been identified in the study area and electromagnetic fields would comply with guidelines for human health. 	<ul style="list-style-type: none"> None required.
Public Services	<ul style="list-style-type: none"> All build alternatives would be grade-separated with no changes in access and no affect on public service vehicle travel or response times. The alternatives are not expected to result in any negative impacts on overall crime rates in the surrounding neighborhoods. During the preliminary design phase, Sound Transit would conduct a threat and vulnerability assessment and incorporate measures to address risks, using “crime prevention through environmental design” principles. The Fire/Life Safety Committee and other Sound Transit safety and security specialists would continue to address safety and security issues throughout design, construction, and operation. The S 272nd Star Lake Elevated Station Option would acquire a portion of the Mark Twain Elementary School’s playfield, but would not affect school operation. The Kent/Des Moines SR 99 East Station Option associated with the SR 99 Alternative would 	<ul style="list-style-type: none"> Displaced public services would be relocated in accordance with the Uniform Relocation Assistance and Real Property Acquisitions Policies Act of 1970 and the Sound Transit Real Estate Property Acquisition and Relocation Policy, Procedures and Guidelines.

TABLE 7-2

Summary of FWLE Potential Impacts and Mitigation

Type of Impact	Impact Summary for Build Alternatives	Mitigation Summary
	acquire the U.S. Post Office in the Midway area of Kent. There are opportunities for it to be relocated in the same area.	
Utilities	<ul style="list-style-type: none"> No long-term impacts on utility providers (electricity, natural gas, water, wastewater, telecommunications, etc.) are expected with any of the FWLE alternatives. 	<ul style="list-style-type: none"> None required.
Historic and Archaeological	<ul style="list-style-type: none"> No archaeological resources were identified in the FWLE corridors. There are historic buildings determined eligible for the National Register of Historic Places, but none of the FWLE alternatives would adversely affect them. 	<ul style="list-style-type: none"> No mitigation is required. Sound Transit would develop and implement an Inadvertent Discovery Plan (IDP) to minimize the risk of damage to currently unknown archaeological resources.
Parkland and Open Space	<ul style="list-style-type: none"> The Federal Way SR 99 Station Option associated with the SR 99 and I-5 to SR 99 alternatives would acquire a portion of the Federal Way Town Square Park property. The area affected includes parking stalls, a path, a bioretention pond, and landscaping. The S 272nd Star Lake Elevated Station Option would permanently acquire 0.1 acre of the playfield at Mark Twain Elementary School. 	<ul style="list-style-type: none"> Potential mitigation measures include providing replacement lands or financial compensation, where appropriate.
Construction ^a	<p>Construction impacts generally occurring under all build alternatives include:</p> <ul style="list-style-type: none"> Temporary lane closures and traffic detours, and a loss of parking at the Star Lake, Redondo Heights, and S 320th Street park-and-ride lots. Increased truck traffic could temporarily negatively affect residents, businesses, and public service providers. Some construction staging areas might be needed outside of the permanent FWLE right-of-way. Temporary construction-related impacts on nearby land uses could include increases in noise levels, dust, traffic congestion, and access difficulty. Construction of the FWLE would provide economic benefits by creating new jobs and revenue. Construction could also affect businesses from temporary changes in access, circulation, and parking, with greatest impacts associated with SR 99 Alternative because of the number of adjacent businesses. Access and response times for public service providers (fire and emergency medical, police, school buses, King County Metro buses, and solid waste and recycling vehicles) could be affected. 	<p>The following summarizes the potential mitigation measures that could be implemented during construction:</p> <ul style="list-style-type: none"> Sound Transit would work with WSDOT to develop a written plan to coordinate construction activities on I-5 and/or SR 99. Replacement parking would be identified to address the loss of parking at existing park-and-ride lots. Haul routes would be developed as approved by local jurisdictions to avoid residential neighborhoods to the extent possible. Property access would be maintained as much as possible. Detour signage would be provided where needed. Sound Transit would work with businesses to develop impact minimization efforts during construction. To reduce construction air quality impacts, BMPs would be implemented, including limiting construction truck idling, use of wheel washes, and spraying exposed soils. Sound Transit would coordinate with public service providers to maintain reliable access and alternative plans or routes to minimize delays. Access for fire and emergency medical would be maintained at all times, which would

TABLE 7-2

Summary of FWLE Potential Impacts and Mitigation

Type of Impact	Impact Summary for Build Alternatives	Mitigation Summary
	<ul style="list-style-type: none"> • Temporary visual quality impacts would result from vegetation removal and demolition of structures. • Construction could cause possible service interruptions during utility relocations. • Construction of the lidded trench associated with Preferred and SR 99 to I-5 alternatives would temporarily close all or a portion of the playfield and the existing school bus loop driveway at Mark Twain Elementary School. • Construction of Federal Way SR 99 Station Option with SR 99 and I-5 to SR 99 alternatives would temporarily affect Federal Way Town Square Park. • Park users at Federal Way Town Square Park and the Mark Twain Elementary School playfields could experience increased noise, dust, and temporary access restrictions where alternatives are adjacent to or on park property. • Cumulative traffic impacts could change if the FWLE and SR 509 Extension Project were constructed at same time. • Additional temporary barriers would be needed along I-5 with the Preferred or SR 99 to I-5 alternatives if the SR 509 Extension Project were constructed first or concurrently. 	<p>minimize impacts on response and travel times within the corridor.</p> <ul style="list-style-type: none"> • Temporarily disturbed park areas would be restored after construction. At the Federal Way Town Square Park, temporary replacement parking could be provided. • Potential construction period mitigation measures for Mark Twain Elementary School could include providing financial compensation and/or identification of temporary replacement facilities. Alternative school bus circulation would be provided during construction periods that coincide with the school year. • Noise-control measures would be implemented for nighttime and daytime work and could include construction site sound walls, use of movable noise barriers, and limiting or avoiding certain noisy activities during nighttime hours. • Any temporary property use during construction would be compensated according to the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Code of Federal Regulations Title 49, Part 24), the State of Washington's relocation and property acquisition regulations (Revised Code), and Sound Transit policies.

^a Construction-related impacts are temporary.

Table 7-2 shows that many elements of the environment have no adverse impacts or only minor effects that would be mitigated. These elements (listed on Table 7-3) are not further analyzed in the environmental justice analysis.

However, property acquisitions and displacements could affect minority and low-income populations differently and could also have economic and social impacts. Construction impacts also could impact minority and low-income populations, primarily as economic impacts on minority-owned businesses. These elements are described further, with additional discussion of potential mitigation measures.

TABLE 7-3

Elements of the Environment Not Further Analyzed

Element of the Environment	Minor Effects or No Adverse Impacts	Impacts Mitigated
Transportation		X
Land use	X	
Air quality	X	
Energy	X	
Geology and soils	X	
Hazardous materials	X	
Electromagnetic fields	X	
Public services	X	
Utilities	X	
Historic and archaeological resources	X	
Visual and aesthetic resources		X
Noise and vibration		X
Water resources		X
Ecosystems		X
Parkland and open space		X

7.6.1 Acquisitions and Displacements

The primary difference between the alternatives is the number of residential and business displacements. The Preferred Alternative would have the most potential residential displacements and the SR 99 Alternative would have the most potential business displacements. Residential displacements include single-family and multi-family dwellings (buildings or complexes ranging from 4 to over 70 units) and mobile home parks with between 18 and 34 units each. Residential displacements with the Preferred Alternative occur in an area with high concentrations of both minority and low-income populations (both over 50 percent). Residential displacements with the SR 99 Alternative are lower, but would also occur in areas with relatively high concentrations of minority populations (over 50 percent). The S 216th East Station Option associated with the SR 99 Alternative and SR 99 to I-5 Alternative would displace a mobile home park, but that park is anticipated to be redeveloped as the Waterview Crossing mixed-use project before the FWLE begins construction. See further discussion in Chapter 6, Cumulative Impacts. While the Preferred Alternative has a greater number of residential displacements, the minority population potentially affected would be similar to those that would be displaced by the SR 99 Alternative.

Potential impacts on low-income populations would be greater with the Preferred Alternative.

For all alternatives, the majority of displaced businesses are in the following categories:

- Automotive (gas stations, tire shops, auto parts)
- Retail/service (coffee, nail salons, cleaners, groceries)
- Restaurant related

Businesses include both large chains and small, local businesses. Some displaced businesses (including ethnic grocery stores) tend to serve mostly minority populations, but there are other businesses that provide similar services in the study area and along the SR 99 corridor. The proximity of similar businesses would reduce the impact on the community of these displacements because patrons would not have to travel out of the area to obtain the same goods and services. As with residential displacements, there are opportunities for businesses to relocate in the surrounding area. Sound Transit has conducted outreach to those affected as noted in Sections 7.5.4 and 7.5.5.

Business and residential property owners and tenants affected by property acquisitions will be treated fairly and equitably. In all cases, Sound Transit would work with those affected to try to keep them in the same area to minimize impacts. For all residential relocations, Sound Transit is obligated to find and make available comparable housing before any resident is required to move, regardless of whether that person owns or rents their home. In working with residents that would be displaced by the project, Sound Transit will identify replacement housing options that consider such factors as proximity to commercial and community facilities, schools (if applicable), an individual's place of employment, and accessibility to transit if the residents are transit-dependent. Tenants of rented property may be eligible for a rent supplement for up to 42 months if comparable decent, safe, and sanitary replacement housing is more than their current rent.

Mobile home residents are eligible for the same acquisition and relocation benefits as other residential properties. Where residents own their mobile home but rent or lease space in a mobile home park, the residents would receive rental relocation assistance and their mobile home would be either purchased or relocated. If the

mobile home could not be relocated because of its age or condition, the owner would receive rental relocation assistance and would also be compensated for the mobile home. The owner could then use this payment to buy another mobile home or other real estate (for example, as a down payment for a single-family home or condominium). Mobile home residents who rent both the space in a mobile home park and the mobile home unit would be eligible for rental relocation assistance, similar to someone renting an apartment or house. Residents who own land with a mobile home would receive payment for the land in addition to payment for the mobile home, as with other residential land acquisition.

In all cases of residential relocations, a Sound Transit relocation agent would interview affected individuals to:

- Determine any special needs and requirements.
- Explain the relocation process, entitlements and payments.
- Offer relocation advisory assistance.
- Offer transportation if necessary.
- Assure the availability of at least one comparable property in advance of displacement.
- Provide referrals to comparable properties.
- Inform them of the amount of the maximum replacement housing entitlement and the basis for the determination in writing 90 days or more before the required vacate date.
- Inspect replacement houses for decent, safe, and sanitary acceptability.
- Supply information on other federal, state, and local programs offering assistance to displaced persons.
- Minimize hardship to persons adjusting to relocation by providing reimbursement of counseling services and advice as to other sources of assistance that may be available.
- Advise obtaining a professional home inspection when purchasing a replacement dwelling.

The No Build Alternative would also result in residential displacements in the Pacific Ridge neighborhood from the SR 509 Extension Project. Approximately half of the residential

displacements from the Preferred Alternative and I-5 to SR 99 Alternative would occur with the SR 509 Extension Project under the No Build.

7.6.2 Economics

In addition to the construction-period economic effects described in Section 7.6.4, there is potential for long-term, indirect economic effects of the FWLE as land redevelops in the study area consistent with local jurisdictions' land use plans and policies. New development and redevelopment in the station areas could result in (1) increased property taxes, which could affect low-income property owners, or (2) increased rent, potentially requiring owners or tenants to relocate if affordable housing options are not available. Section 7.6.3 discusses goals and strategies in place to address the need to maintain affordable housing in the study area. Redevelopment in station areas would include new employment opportunities for those station areas where TOD has been targeted. This includes the Midway subarea, where a subarea plan has been adopted and land use regulations allow for greater density and mixed commercial and residential developments.

Project alternatives would remove off-street parking from businesses (especially the SR 99 Alternative and I-5 to SR 99 Alternative), including businesses that provide goods and services to minority and low-income populations. This could hurt these businesses. The viability of each business is considered when determining the type of property acquisition (full or partial). While Sound Transit staff can help individual businesses to identify potential relocation sites, it is up to each business to decide if they want to relocate and where they relocate.

The No Build Alternative would also result in business displacements in the FWLE area from the SR 509 Extension Project. These displacements would generally occur north of S 208th Street where the SR 509 alignment would connect to the I-5 corridor. Without the FWLE, any planned growth may happen slower and increases in congestion could negatively affect access to businesses.

7.6.3 Social Impacts, Community Facilities, Neighborhoods

Section 7.6.2, Economics, notes that new development and redevelopment in the station areas could result in higher property values, taxes, and rents, which could have a negative impact on

residents, especially those who rent. Jurisdictions along the FWLE corridor have adopted goals and policies in their comprehensive plans related to housing affordability such as designating areas for affordable housing opportunities and providing incentives and programs to developers to construct affordable housing. In addition, Puget Sound Regional Council's Growing Transit Communities policy contains several affordable-housing strategies. These plans and policies provide a basis for focusing public resources and properties on advancing equitable development goals.

Sound Transit's Transit-Oriented Development Policy (Sound Transit, 2012) includes goals for providing affordable housing in station areas. Recent state legislation authorizing Sound Transit to seek funding for Sound Transit 3 (ST3) creates additional requirements intended to maximize opportunities for affordable housing. It requires Sound Transit to offer properties considered suitable for housing first to a defined class of qualified entities, including cities, housing authorities, and nonprofit housing developers. Because the requirement is contingent on the successful passage of the ST3 ballot measure, the Sound Transit Board of Directors will determine how it will implement the law in late 2016 or early 2017. It is anticipated that this will require amendments to the TOD and Surplus Property Disposition policies, as well as adoption of detailed administrative procedures. Many of the future TOD parcels in FWLE station areas will likely need to be evaluated for suitability for housing; affordable housing may be a substantial programmatic element in all station areas.

Most residential displacements for all alternatives are in the Pacific Ridge and Midway neighborhoods, which have large concentrations of minority populations and (to a lesser degree) low-income populations.

All Kent/Des Moines stations and station options except the Kent/Des Moines At-Grade Station Option for the Preferred Alternative and the SR 99 Median Station Option for the SR 99 Alternative would displace residential developments where minority population concentrations are over 50 percent and low-income population concentrations are under 25 percent. Changes in displacements for other station options would have less effect on low-income populations.

Sea Mar Community Health Center's Des Moines Medical and Dental Clinic would be displaced by the Kent/Des Moines HC Campus Station

Option and the S 260th West Station Option associated with the SR 99 Alternative. The clinic is a neighborhood resource that provides medical and dental care services to low-income and minority populations (mainly Hispanic).

Other community resources displaced include the Citadel Church and Open Door Baptist Church, affected by the Kent/Des Moines HC Campus Station Option from the S 216th West Station Option, and the Seattle Full Gospel Church and Iglesia Cristiana Pentecostes Filidelphia, affected by the S 260th West Station Option associated with the SR 99 Alternative. Three of these churches serve predominantly minority populations: Citadel Church (African-American), Seattle Full Gospel Church (Korean), and Iglesia Cristiana Pentecostes Filidelphia (Hispanic). As described in Section 7.6.1, Sound Transit would implement measures to address displacements.

The No Build Alternative would also result in residential displacements in the Pacific Ridge neighborhood from the SR 509 Extension Project. These displacements would have a similar effect as the Preferred Alternative or I-5 to SR 99 Alternative.

7.6.4 Construction

The most intensive FWLE civil construction would last from 1 to 4 years in any one location, with the greatest effects earlier in construction. A Construction Plan would establish construction phases, estimated durations, and appropriate sequencing. The SR 99 Alternative, SR 99 to I-5 Alternative, and I-5 to SR 99 Alternative would have greater construction impacts on businesses and residents than the Preferred Alternative. All of those alternatives would require lane closures on SR 99 and temporary driveway closures. Lane closures would affect transit travel times and require relocation of bus stops on SR 99. Transit-dependent people would have to spend more time traveling to and from their destinations.

Sound Transit would maintain access to properties during construction, or provide alternative access. If alternative access to a business is not available, the specific construction activity would be reviewed to determine if it could occur during non-business hours. Sound Transit's project-specific Business Relations Program helps minimize construction impacts on businesses. For all projects, the program includes general goals such as educating and informing businesses of construction-related impacts, easing physical impacts of construction on businesses, creating awareness that businesses are

open, and connecting businesses to partner tools and business resources. Strategies to meet those goals are selected based on the types of businesses in the area and the unique project environment. Sound Transit has developed a business outreach plan to connect with businesses as well as social services that provide services to minority and low-income populations.

For alternatives along I-5, construction activities would primarily be within the WSDOT right-of-way. With the exception of the Landfill Median Alignment Option, construction activities would therefore not impact the I-5 mainline. The Landfill Median Alignment Option would require some lane closures and work in the median, which would affect traffic on I-5. Given the lack of commercial development along the Preferred Alternative, these alternatives would have fewer business-related impacts. Chapter 5, Construction, provides additional information on construction impacts.

The No Build Alternative includes construction of the SR 509 Extension Project, which would have similar impacts as the Preferred Alternative, the SR 99 to I-5 Alternative and I-5 and SR 99 Alternative when they are in or adjacent to WSDOT right-of-way.

7.6.5 Cumulative Impacts

Cumulative impacts are described in Chapter 6 of this Final EIS. Past, present, and reasonably foreseeable actions could effect minority and low-income populations in the FWLE project area. Noteworthy effects include the housing availability and affordability in the project area, economic growth and employment opportunities, and extended or overlapping construction-related impacts from multiple projects being built simultaneously.

Both transportation and private development projects affect housing stock in the project area. Since 2003, WSDOT has acquired property and relocated residents for the SR 509 Extension. About half (approximately 100) of the residential acquisitions for the FWLE Preferred Alternative would also be needed for the SR 509 Extension if it were built before the FWLE. Sound Transit and WSDOT would work together to develop a coordinated property acquisition plan for both projects.

Land use plans for the Pacific Ridge neighborhood and Midway Subarea include redeveloping the area north of S 240th Street to higher densities. Some private development projects would displace

existing residents, but would also increase housing opportunities in the area. For example, the Waterview Crossing project in Pacific Ridge will displace 110 mobile homes in 2016, but will provide 324 new multi-family residential units. Another redevelopment project in SeaTac will close a 69-unit mobile home park for redevelopment. Two other projects in Kent (the Grandview Apartments and the Devco Midway project) will create over 500 residential units; both are affordable housing projects. A complete list of reasonably foreseeable development projects in the area is in Appendix D.6 of this Final EIS.

Future private development could increase property values, which could reduce affordable housing opportunities over time in the project area. It could also add jobs to the local economy, and denser, more diverse development could increase property and sales tax revenue for local jurisdictions. On balance, the FWLE's impact on housing availability and tax revenues is likely to be lessened by the anticipated impacts of other reasonably foreseeable residential and commercial projects in the area. Additionally, the FWLE, when combined with other reasonably foreseeable future actions in the project vicinity, would have more potential to support economic growth and would provide a beneficial cumulative economic impact.

Simultaneous construction of the FWLE and other reasonably foreseeable future actions, including the SR 509 Extension, could cause temporary adverse cumulative impacts on adjacent businesses and residents, such as:

- Potential increases in noise and dust
- Traffic congestion
- Visual intrusion
- Increased difficulty in accessing properties

Projects constructed at similar times could inconvenience residents and businesses due to cumulative increases in these effects and construction durations.

7.7 Project Benefits

Under DOT Order 5610.2(a), the benefits of a proposed transportation project should be taken into account when determining whether disproportionately high and adverse effects on minority and low-income populations would occur. As described in sections 7.7.1 and 7.7.2, the FWLE would provide a number of benefits to all populations within the study area.

While all populations in the FWLE service area would realize these benefits, studies have shown that they can often accrue to a higher degree for minority and low-income populations. These benefits would not occur with the No Build Alternative. In addition to not receiving the benefits of the FWLE, it is anticipated that transportation delays would continue to worsen as population growth continues in the urban centers.

7.7.1 Improved Access to Transit and Employment

Access to transit would improve for all populations within the service area, especially people living and working within 1/2 mile of the stations (people generally walk up to 1/2 mile to access transit). The extended transit service hours (about 20 hours per day) would also improve access to transit for all populations within the service area because of the longer service period.

As discussed in Section 4.4, Social Impacts, Community Facilities, and Neighborhoods, the minority population ranges from 55 to 62 percent and the low-income population ranges from 9 to 21 percent within 1/2 mile of station areas (Table 7-4). Although all station areas have high concentrations of minority and low-income populations, the Kent/Des Moines Station area and the area at the potential additional station at S 216th Street have higher low-income and minority populations that would receive improved access. Approximately 9 to 12 percent of the households in the FWLE project area rely on transit as they do not have a vehicle.

The minority and low-income populations that would receive the transit benefits of the project are similar for all build alternatives. Some alternatives could include more stations than other alternatives, so more people would benefit from improved transit access.

Users of the FWLE could travel longer distances with fewer transfers, saving time and possibly allowing new employment opportunities that were previously considered too time-consuming or difficult to reach. The FWLE would improve transit travel time by 26 minutes between Federal Way and Sea-Tac Airport, which is a large employment center in South King County. This benefit is particularly important for the transit-dependent populations for whom the bus provides extended travel times or circuitous routes that do not serve their destinations well.

TABLE 7-4

Access to Light Rail Stations for Minority and Low-Income Populations within 1/2 Mile

Project Alternative Stations	Total Population	Minority Population	2010-2014 Population for Whom Poverty Determined	2010-2014 Low-Income Population
Preferred Alternative				
Kent/Des Moines Station	12,708	7,843 (62%)	12,503	1,921 (15%)
S 272nd Star Lake Station ^a	10,969	6,221 (57%)	10,700	989 (9%)
Federal Way Transit Center Station	11,839	6,779 (57%)	11,859	1,943 (16%)
Preferred Alternative Station Options				
Kent/Des Moines Station Options ^b	13,693	8,423 (62%)	13,621	2,079 (15%)
Federal Way I-5 Station Option	8,809	4,928 (56%)	8,809	1,595 (18%)
Federal Way S 320th Park-and-Ride Station Option	11,071	6,190 (56%)	11,007	2,110 (19%)
SR 99 Alternative				
Kent/Des Moines SR 99 West Station ^c	12,708	7,843 (62%)	12,503	1,921 (15%)
S 272nd Redondo Station ^d	12,156	7,216 (59%)	11,897	1,556 (13%)
Federal Way Transit Center Station	11,859	6,779 (57%)	11,859	1,943 (16%)
SR 99 Alternative Station Options				
S 216th Stations	12,273	6,804 (55%)	11,150	2,311 (21%)
S 260th Stations	13,965	8,547 (61%)	13,829	1,821 (13%)
Federal Way SR 99 Station	9,654	5,779 (60%)	9,546	1,427 (15%)
SR 99 to I-5 Alternative				
Kent/Des Moines 30th Avenue East Station	13,825	8,423 (61%)	13,621	2,079 (15%)
S 272nd Star Lake Station	10,969	6,221 (57%)	10,700	989 (9%)
Federal Way Transit Center Station ^e	11,859	6,779 (57%)	11,859	1,943 (16%)
SR 99 to I-5 Alternative Station Option				
S 216th Stations	12,273	6,804 (55%)	11,150	2,311 (21%)
I-5 to SR 99 Alternative				
Kent/Des Moines 30th Avenue West Station	13,825	8,423 (61%)	13,621	2,079 (15%)
S 272nd Redondo Station	10,897	6,397 (59%)	10,638	1,258 (12%)
Federal Way Transit Center Station	11,859	6,779 (57%)	11,859	1,943 (16%)
I-5 to SR 99 Alternative Station Options				
S 260th Stations	13,965	8,547 (61%)	13,829	1,821 (13%)
Federal Way SR 99 Station	9,654	5,779 (60%)	9,546	1,427 (15%)

^a Includes the S 272nd Star Lake Elevated Station Option.

^b Includes all Kent/Des Moines Station options for the Preferred Alternative.

^c Includes all Kent/Des Moines Station options for SR 99 Alternative.

^d Includes S 272nd Redondo Trench Station Option.

^e Includes Federal Way I-5 Station Option.

Source: U.S. Census Bureau, 2015.

The FWLE would also provide more frequent service (including during non-peak hours) to other regional employment centers such as Seattle, Bellevue, Redmond, and Lynnwood. The Midway Subarea and Federal Way City Center are planned for higher-density mixed use, and all alternatives include stations in these areas. Therefore, access to job opportunities is expected to be similar for transit riders with all alternatives.

A number of studies have shown that minority and low-income populations tend to make greater use of transit service than other groups. As noted in Chapter 1, the project is needed to expand regular, reliable, off-peak transit service for workers in retail and manufacturing, as well as students. For those reliant on private transportation, costs continue to rise for fuel, tolls, and paid parking. Transit service improvements are therefore generally more important to these populations than to others. Data from Sound Transit (2015) showed that there are higher concentrations of minority and low-income populations within the Sound Transit District who have access to and use Sound Transit than other groups. Data from the American Public Transportation Association (2008) indicate that in 2007 approximately 60 percent of all transit passengers in the United States were minority. Data from a 2006 report (Center for Housing Policy, 2006) illustrated that families with household incomes between \$20,000 and \$50,000 have transportation costs as high as or higher than housing. This is true in the Seattle area, where 31 percent of income was spent on housing and 30 percent on transportation. This is primarily a result of families moving farther away from cities to find affordable housing, where transit options are often more limited. While the FWLE may result in increases in property taxes and rents around stations, negatively affecting some low-income populations, improved access to transit would allow residents to reduce transportation costs, potentially offsetting increased housing costs. Increased transit access and new development could also improve overall neighborhood quality. Stations could provide improved neighborhood cohesion by providing new opportunities to interact.

7.7.2 Transit Reliability

The FWLE would also increase transit reliability for populations that depend on transit to access employment, education, child care, health care, and other services. Bus service can be affected by increasing congestion even when using high-occupancy vehicle lanes.

Because the FWLE would operate in an exclusive right-of-way and have no at-grade vehicle crossings, it would provide better on-time performance for riders compared to the bus. The FWLE would also improve transit travel times, reliability, and frequency to and from regional centers such as Downtown Seattle, Downtown Bellevue, the University of Washington, Northgate, Lynnwood Transit Center, and Overlake to Federal Way. Improvements in transit travel times would range from 2 to 26 minutes; for most trips, a transfer would not be required. The greatest transit travel time savings would occur between Sea-Tac Airport and Federal Way Transit Center.

Section 7.7.1 shows that these benefits are particularly important to low-income populations and minority populations, who tend to make greater use of transit than other groups. The FWLE would not negatively affect local bus service. As described in Chapter 3, Transportation Environment and Consequences, all but two transit routes are assumed to provide service in 2035. Other routes could be modified to provide more frequent service to better serve the study area and provide direct connections to light rail stations.

7.8 Conclusion

When making an Environmental Justice determination, FTA must consider the impacts of a project and who may be affected, then consider the mitigation proposed for these impacts, and finally consider any offsetting benefits to minority and low-income populations.

The environmental justice study area for the project was defined to identify populations that would be directly affected by the project alternatives. The study area captures populations that would experience both direct and indirect impacts, as well as benefits the project would provide. These populations are predominantly minority, and in some places are predominantly low-income. Concentrations of minority and low-income populations in the study area are higher than the Sound Transit taxing district as a whole. The FWLE would travel along existing transportation corridors, minimizing impacts on all populations. Most project impacts would be limited in scope, with adverse impacts mitigated by effective mitigation measures. Complete information on the project impacts and mitigation is provided in Chapters 3 through 6. Both negative and positive effects would occur for minority and low-income

populations; they would not differ substantially among the build alternatives.

The FWLE would benefit all populations in the study area by providing improved access to transit and employment and improved transit reliability, including extended transit service hours, and mobility in the FWLE corridor and to other regional centers.

Based on the analysis in the Final EIS, the FWLE is not expected to have disproportionately high and adverse effects on minority and low-income populations. FTA expects to make a final environmental justice determination for the project in its Record of Decision. That determination will consider public and agency comments received on the Draft and Final EIS; evaluation of the Preferred Alternative; additional outreach to environmental justice populations potentially affected by the Preferred Alternative, and the analysis contained in this Final EIS.

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8.0 Alternatives Evaluation

This chapter evaluates how the FWLE alternatives would meet the project Purpose and Need, and summarizes the benefits and impacts of each alternative. The FWLE is one of several light rail extensions to Sound Transit’s Link system that are in the planning, design, or construction phases. The collective system benefits would be greater than those of the individual projects; several of these system-wide benefits are described in Section 8.1.

8.1 Meeting the Purpose and Need for FWLE

The purpose of the FWLE is to extend the Sound Transit Link light rail system south from the city of SeaTac to the cities of Des Moines, Kent, and Federal Way in King County. As described in Chapter 1, Purpose and Need for Federal Way Link Extension, the project will:

- Provide a rapid, reliable, accessible, and efficient alternative for travel to and from the corridor and other urban growth and activity centers in the region with sufficient capacity to meet projected demand.
- Expand mobility by improving connections to the regional multimodal transportation system with peak and off-peak transit service.
- Provide the high-capacity transit (HCT) infrastructure and service to support the adopted regional and local land use, transportation, and economic development plans. Plans such as Puget Sound Regional Council’s (PSRC) VISION 2040 call for growth to be concentrated in designated urban centers connected to each other by HCT. Several individual cities have adopted land use plans to support this regional vision.
- Advance the Sound Transit Long-Range Plan’s vision, goals, and objectives for high-quality regional transit service connecting major activity centers in King, Pierce, and Snohomish counties.
- Implement a financially feasible HCT system to help preserve and promote a healthy environment.

Meeting the Purpose and Need

In all cases, the alternatives would meet the purpose and need to a lesser extent if the project did not extend all the way to Federal Way. Delaying construction of some or all of the project would delay the project’s ability to meet the purpose and need and would benefit fewer people in the near term.

All FWLE build alternatives would meet this purpose by improving transit mobility and access to regional activity centers and advancing implementation of local and regional land use and transportation

plans. The following paragraphs summarize how the FWLE would meet the six need statements presented in Chapter 1. The No Build Alternative would not meet the purpose and need for the project.

Need #1: Increasing congestion on I-5 and on the key arterials leading in and out of the study area will further degrade existing transit performance and reliability.

Passenger load, reliability, and on-time performance would all degrade under the No Build Alternative as additional congestion would further strain the existing transit system. All the FWLE alternatives would improve service frequency and provide continuous, 20-hour-a-day, two-way service between the FWLE corridor and many Puget Sound regional destinations. Reliability of bus service in 2035 is expected to degrade under the No Build Alternative. Several bus routes would exceed their seated capacity. Both bus and light rail would operate at acceptable passenger levels of service with the FWLE because some bus riders would transfer to light rail. With the No Build Alternative, key transit facilities such as the I-5 HOV lanes are expected to have speeds decrease by up to 30 percent in the peak direction of travel during the peak periods. The FWLE's exclusive right-of-way would assure a reliable transit alternative.

Need #2: North-south transit demand is expected to grow by about 80 percent by 2035 as a result of residential and employment growth in the FWLE study area. This growth will require additional and more reliable transportation options than currently exist.

The project would create an additional and more efficient form of transit for travel within the corridor and between this corridor and other regional centers. It would complement other local and regional transit services. FWLE alternatives are projected to have ridership ranging from 35,000 to 39,500 daily riders when options are considered (see Section 8.2, Comparison of Alternatives). Of these, approximately 7,500 to 9,000 are expected to be new transit riders.

Need #3: People in the corridor need reliable and efficient peak and off-peak transit service to connect with the region's growth centers.

All FWLE alternatives would provide convenient, frequent transit service with reliable access to many regional destinations. They would provide better connections for transit-dependent populations than currently available or planned under the No Build Alternative. The stations along I-5 would not provide access to the same degree as

stations along SR 99, which are more easily accessible by non-motorized users and by all-day transit routes. The build alternatives would provide more service to downtown Seattle than the No Build Alternative from both the Federal Way Transit Center and the S 272nd (Redondo Heights/Star Lake) service areas.

Service frequency in 2035 to Seattle for the No Build Alternative is expected to be at the same level or better than existing conditions. However, service from the study area to other regional destinations, such as downtown Bellevue, Overlake, and the University of Washington, would be similar to existing conditions. Direct transit service to the University of Washington would have limited frequency and would be provided only in the peak direction of travel. Service to downtown Bellevue or Overlake would still require a transfer to another bus or light rail. All of the build alternatives would improve the service frequency between the FWLE corridor and many other Puget Sound regional destinations and growth centers, including Downtown Seattle, the University of Washington, Northgate, Lynnwood, Bellevue, Overlake, and Redmond.

Need #4: The corridor has a high concentration of transit-dependent populations who need efficient and reliable regional transit connectivity.

As described under Need #1, transit reliability with the No Build Alternative is expected to degrade compared with existing conditions, and service frequency to regional destinations besides downtown Seattle would remain limited. For all build alternatives, transit-dependent populations in the FWLE corridor would have improved access to more employment opportunities and better access to services in larger regional centers such as Seattle or Bellevue, as described under Need #3.

Need #5: Regional and local plans call for HCT in the corridor consistent with PSRC's VISION 2040 and Sound Transit's Long-Range Plan.

All FWLE alternatives would help realize plans for the South Corridor in place since the 1990s. PSRC and Sound Transit plans call for high-capacity transit, and the ST2 and ST3 funding packages include funding for this project.

Need #6: Environmental and sustainability goals of the state and region include reducing vehicle miles traveled and greenhouse gas emissions.

The FWLE would lower vehicle emissions by reducing vehicle miles traveled and vehicle hours traveled each weekday by approximately 160,000 miles and 10,000 vehicle hours, respectively. Section 8.2 describes how environmental and other impacts vary among the different build alternatives.

8.2 Comparison of Alternatives

This section focuses on trade-offs among the alternatives in meeting the project's purpose and need. It describes the benefits and impacts associated with each alternative and how they relate to the others. Exhibit 8-1 summarizes three performance measures for each build alternative (cost, travel time, and projected ridership). All build alternatives would meet the purpose and need; the No Build Alternative would not.

8.2.1 No Build Alternative

Under the No Build Alternative, the FWLE would not be built and there would be no new HCT in this corridor. Traffic volumes in the transportation study area are projected to increase by 17 percent by 2035 because regional population growth will continue and travel patterns are not forecasted to change appreciably. Under the No Build Alternative, transit would continue to be focused on peak-direction trips to and from Downtown Seattle (north in the morning and south in the evening) with higher frequency during peak hours. Non-peak-hour and non-peak-direction trips would continue to have longer travel times and be less frequent, and there would be limited direct service to other regional destinations besides Downtown Seattle. However, there would be no construction impacts (such as traffic disruptions), nor permanent impacts (such as displacements, noise and vibration impacts, visual changes, and permanent impacts on ecosystems) from the project. Construction impacts in the area would still occur from the No Build projects, including the SR 509 Extension.

Performance Measures

How to Read

EIS Measure

Alternatives Comparison

Units Preferred (Red) Units SR 99 to I-5 (Light Blue)

Units SR 99 (Green) Units I-5 to SR 99 (Dark Blue)



- Preferred Alternative would have lowest cost because profile would include at-grade areas, which are less expensive.
- SR 99 Alternative would have highest project cost because entirely elevated.
- Travel time would be similar for all alternatives.
- Ridership would be similar for all alternatives.

TOD Potential within FWLE Corridor by Station

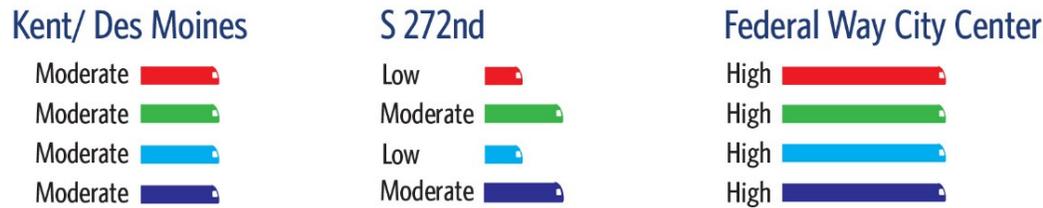
How to Read

TOD Potential Measure

Alternatives Comparison

Units Preferred Alternative (Red) Units SR 99 to I-5 (Light Blue)

Units SR 99 (Green) Units I-5 to SR 99 (Dark Blue)



- The Federal Way Transit Center stations would have the highest TOD potential.
- The Kent/Des Moines stations are all on SR 99 or 30th Avenue S and therefore would have similar moderate TOD potential.
- The S 272nd Star Lake Station for the Preferred Alternative and SR 99 to I-5 Alternative would have the lowest TOD potential.

EXHIBIT 8-1
FWLE Alternatives Performance Measures

8.2.2 Build Alternatives

Exhibit 8-1 shows that the alternatives perform similarly in terms of travel time, and ridership. Costs vary more widely, with the Preferred Alternative being the least expensive and the SR 99 Alternative being the most expensive. Based on refinements to the Preferred Kent/Des Moines Station since the Draft EIS, the TOD potential is now similar for all alternatives and does not differentiate them.

Exhibit 8-2 shows impact areas where the alternatives have notable differences. It omits resources such as air quality, energy, geology, hazardous materials, historic and archaeological resources, and parks that have only minor differences among alternatives.

Resources such as streams and wetlands that have greater differences between alternatives, but relatively minor overall impacts, are also not included in Exhibit 8-2. Direct stream impacts would only occur with the Preferred Alternative and SR 99 to I-5 Alternative.

Exhibit 8-3 shows that the options perform very similarly to the alternatives in terms of travel time and ridership. Costs vary more widely; some options have substantial cost savings, while others increase costs substantially. Exhibits 8-4 and 8-5 show where the options differ in impacts from the alternatives using the same measures as in Exhibit 8-2.

Key Impacts

How to Read

EIS Measure

Alternatives Comparison

Units █ Preferred	Units █ SR 99 to I-5
Units █ SR 99	Units █ I-5 to SR 99

<p>Residential Displacements</p> <p>196 █</p> <p>36 █</p> <p>108 █</p> <p>203 █</p>	<ul style="list-style-type: none"> • Displacements for the Preferred, SR 99 to I-5 and I-5 to SR 99 would occur mostly north of Kent-Des Moines Road and in the Kent/Des Moines Station area. • SR 99 Alternative displacements would mostly occur in the Kent/Des Moines Station area.
<p>Business Displacements</p> <p>42 █</p> <p>101 █</p> <p>46 █</p> <p>96 █</p>	<ul style="list-style-type: none"> • Preferred Alternative displacements would occur in the Kent/Des Moines Station area and the Federal Way Transit Center Station area. • SR 99 displacements would occur along the entire corridor, but would mostly be at station areas. • SR 99 to I-5 Alternative would avoid many of the business displacements associated with the SR 99 Alternative by being primarily in the I-5 right-of-way south of Kent-Des Moines Road.
<p>Residences with Reduced Visual Quality</p> <p>290 █</p> <p>260 █</p> <p>175 █</p> <p>375 █</p>	<ul style="list-style-type: none"> • I-5 to SR 99 Alternative would have most residences with reduced visual quality due to housing density along I-5 north of Kent-Des Moines Road and south of S 240th Street. • Reduced visual quality along the I-5 corridor would be primarily caused by removal of vegetation to the east. • Reduced visual quality along the SR 99 corridor would be primarily caused by the elevated guideway in the SR 99 median.
<p>Noise Impacts</p> <p>647 █</p> <p>2,266 █</p> <p>1,200 █</p> <p>1,860 █</p>	<ul style="list-style-type: none"> • Preferred Alternative would have the fewest noise impacts due to the lower density of housing along I-5 and a mixed profile that includes at-grade and trenched portions. • SR 99 Alternative would have the most noise impacts due to the greater density of housing along SR 99 and an entirely elevated guideway. • All noise impacts would be mitigated. Most would be mitigated with sound walls, although some would require residential insulation.
<p>Vibration Impacts</p> <p>193 █</p> <p>50 █</p> <p>209 █</p> <p>45 █</p>	<ul style="list-style-type: none"> • SR 99 to I-5 Alternative would have the most vibration impacts because its alignment is close to residences and includes at-grade and trenched portions. • SR 99 would have the fewest vibration impacts due the greater distance from residences and an entirely elevated guideway. • All vibration impacts would be mitigated at the source (at the rails).
<p>Upland Habitat Impacts</p> <p>35 Acres █</p> <p>3 Acres █</p> <p>22 Acres █</p> <p>4 Acres █</p>	<ul style="list-style-type: none"> • Preferred Alternative would remove the most upland habitat because it would be located primarily in the undeveloped, forested I-5 right-of-way south of S 240th Street. • SR 99 Alternative would remove the least upland habitat because it would be located primarily in the heavily developed SR 99 corridor that contains minimal vegetation.

EXHIBIT 8-2
FWLE Alternatives Key Impacts

Preferred Alternative Options Performance Measures

How to Read

EIS Measure

Option - [Orange bar with arrows] + [Red bar with arrow] * [Red bar with arrow]

Decrease Increase No Change
Units/Acres (Range)



- The Kent/Des Moines At-Grade Station Option would have the greatest cost savings.
- The Federal Way S 320th Park-and-Ride Station Option would have the greatest cost increase.
- The Kent/Des Moines Options would decrease ridership due to the closer location to I-5.
- The Federal Way I-5 Station Option would decrease ridership due to the greater distance to the Federal Way Transit Center.
- The Kent/Des Moines and Federal Way City Center station options would have lower TOD potential.

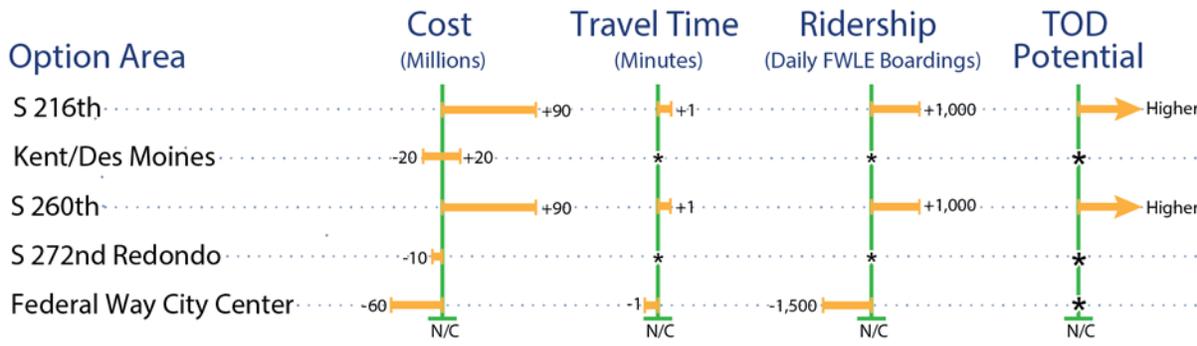
SR 99 Options Performance Measures

How to Read

EIS Measure

Option - [Orange bar with arrows] + [Green bar with arrow] * [Green bar with arrow]

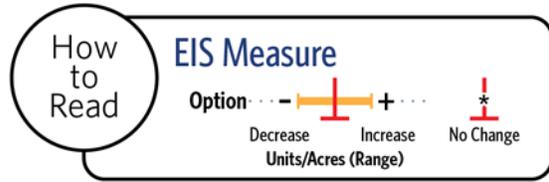
Decrease Increase No Change
Units/Acres (Range)



- Adding a station at S 216th or S 260th Street would add up to \$90M.
- Greatest cost savings would be at Federal Way SR 99 Station Option.
- In Kent/Des Moines area, the SR 99 Median Station would be the most expensive.
- There would be no change in travel time except with the Federal Way SR 99 Station Option.
- Additional stations at S 216th and S260th would each increase project boardings by 1,000.
- The Federal Way SR 99 Station Option would have lower ridership due to its distance from the transit center.
- The S 216th and S 260th station options would increase TOD potential.

EXHIBIT 8-3
Option Performance Measures

Preferred Alternative Options Impacts



Impact Category	Options and Values	Key Findings
Residential Displacements	<ul style="list-style-type: none"> Kent/Des Moines: -57 to +42 Landfill Median Alignment: +1 S 272 Star Lake: * S 317th Alignment: * Federal Way City Center: +19 	<ul style="list-style-type: none"> The Kent/Des Moines At-Grade Station Option would have the greatest reduction in residential displacements. The S 320th Park-and-Ride Station Option would have the most additional residential displacements.
Business Displacements	<ul style="list-style-type: none"> Kent/Des Moines: -16 Landfill Median Alignment: * S 272 Star Lake: * S 317th Alignment: * Federal Way City Center: -19 	<ul style="list-style-type: none"> The Kent/Des Moines I-5 East Station Option would have the greatest increase in business displacements. The S 320th Park-and-Ride Station Option would have the greatest reduction in business displacements.
Residences with Reduced Visual Quality	<ul style="list-style-type: none"> Kent/Des Moines: * Landfill Median Alignment: * S 272 Star Lake: * S 317th Alignment: * Federal Way City Center: * 	<ul style="list-style-type: none"> None of the options would change visual quality impact.
Light Rail Noise Impacts	<ul style="list-style-type: none"> Kent/Des Moines: -29 to +14 Landfill Median Alignment: +41 S 272 Star Lake: +64 S 317th Alignment: +112 Federal Way City Center: -3 to +45 	<ul style="list-style-type: none"> The S 317th Elevated Alignment Option would have the greatest increase in noise impacts. The Kent/Des Moines I-5 Station Option would have the greatest reduction in noise impacts.
Vibration Impacts	<ul style="list-style-type: none"> Kent/Des Moines: +18 Landfill Median Alignment: * S 272 Star Lake: * S 317th Alignment: * Federal Way City Center: * 	<ul style="list-style-type: none"> The Kent/Des Moines At-Grade Station Option and I-5 Station Option would increase impacts. All other options would have no changes in impacts.
Upland Habitat Impacts	<ul style="list-style-type: none"> Kent/Des Moines: +3 Landfill Median Alignment: -1 S 272 Star Lake: +1 S 317th Alignment: * Federal Way City Center: * 	<ul style="list-style-type: none"> The Landfill Median Alignment Option would have the greatest reduction in upland habitat removed. The Kent/Des Moines I-5 Station Options would have an increase in upland habitat removed.

EXHIBIT 8-4
Preferred Alternative Options Impacts

SR 99 Options Impacts

How to Read

EIS Measure

Option: - + *

Decrease Increase No Change

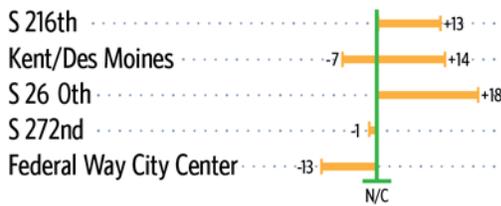
Units/Acres (Range)

Residential Displacements



- The Kent/Des Moines HC Campus Station Option from the S 216th West Station Option would have the greatest increase in residential displacements.
- The S 216th East Station Option would add residential displacements but the S 216th West Station Option would not.

Business Displacements



- The potential additional stations at S 260th Street would have the greatest increase in business displacements.
- Different businesses would be impacted by the S 272nd Redondo Trench Station Option, but the total number would not change.
- Federal Way SR 99 Station Option would have the greatest decrease in business displacements.

Residences with Reduced Visual Quality



- The S 216th West Station Option would avoid visual impacts to residence north of S 216th Street by being in a trench.
- The Kent/Des Moines HC Campus Station Option would be the only option to increase visual impacts at the Kent/Des Moines Station.
- S 272nd Redondo Trench Station Option would have the greatest increase in residences with reduced visual quality.

Light Rail Noise Impacts



- Options in trenches would have the greatest reduction in noise impacts.
- In the Kent/Des Moines Station Area, the HC Campus Station Option and SR 99 Median Station Option would increase impacts and the SR 99 East would decrease impacts.
- The Federal Way SR 99 Station Option avoids displacing a hotel, which results in more noise impacts compared to the SR 99 Alternative.

Vibration Impacts



- The S 216th West Station Option would have the greatest decrease in impacts because it would displace a hotel impacted by the SR 99 Alternative.
- The S 272nd Redondo Trench Station Option would have the greatest increase in impacts due to closer proximity to residences.

Upland Habitat Impacts



- Changes in upland habitat removed for most options would be minimal.
- The S 272nd Redondo Trench Station Option would have the greatest increase in upland habitat removed because it would be primarily undeveloped areas adjacent to SR 99.

EXHIBIT 8-5
SR 99 Options Impacts

8.2.3 FWLE Terminus Options

The FWLE includes terminus station options near the Federal Way Transit Center. These options were designed for a potential light rail extension south to Tacoma. None of the options limit future alignment decisions heading south to a specific corridor (i.e., SR 99 or I-5).

There are three potential terminus station locations associated with the Preferred Alternative. The Federal Way Transit Center Station is oriented north-south, and the alignment would need to turn west to head to SR 99 or turn east to head to I-5 in the future. The Federal Way I-5 Station Option and Federal Way S 320th Park-and-Ride Station Option would both allow for a more direct extension south in the I-5 corridor. Either of these options could also transition to the SR 99 corridor somewhere south of S 320th Street.

For the SR 99 to I-5 Alternative, the Federal Way Transit Center Station is oriented east-west and could either continue west to SR 99 or turn back towards I-5 to extend south. This alternative also has the Federal Way I-5 Station Option and Federal Way S 320th Park-and-Ride Station Option.

For the SR 99 and I-5 to SR 99 alternatives, the Federal Way Transit Center Station is also oriented east-west. This would allow for a future extension directly toward I-5, or it could transition back to the SR 99 corridor somewhere south of S 320th Street.

The Federal Way SR 99 Station Option orientation (north-south) with the SR 99 or I-5 to SR 99 alternatives would allow for a more direct extension south in the SR 99 corridor, but could also transition to the I-5 corridor along S 320th Street or somewhere farther south of S 320th Street.

8.3 Commitment of Resources

Building the FWLE would cause irreversible and irretrievable commitments of property and natural resources. Private properties with residential and commercial uses would be converted to transit use. The use of the I-5 WSDOT right-of-way for the project would limit the amount of undeveloped right-of-way that could otherwise be used for highway projects. Locating the FWLE in I-5 right-of-way could affect the costs and impacts of future WSDOT projects in the corridor.

The conversion of public or private lands would permanently alter visual quality and character along the FWLE corridor. Landscaping would screen some project elements approximately 5 to 10 years after construction, once the vegetation has matured. However, even after the landscaping has matured, some visual impacts would remain that would not be mitigated. The FWLE would affect wetlands, wildlife habitat, and aquatic habitat to varying degrees, depending on the alternative selected and built. Mitigation measures would be implemented, but some of those resources would be irretrievably altered.

Building the project would also irretrievably commit resources such as fuel and construction materials (e.g., aggregate for concrete, wood for forms and frames, and steel for rebar and rails).

8.4 Areas of Controversy and Issues to be Resolved

Areas of controversy and issues that remain to be resolved include the following:

- **Funding plan:** Current projections show that funding from ST2 tax revenue should be available to construct the FWLE from Angle Lake Station to the Kent/Des Moines Station. Funding sources for the extension to S 272nd Street and the Federal Way Transit Center have not been identified. Authorization to extend from S 272nd to Federal Way Transit Center and funds to construct from Kent/Des Moines to the Federal Way Transit Center are included in the ST3 funding package to be voted on in November 2016 (Sound Transit, 2016).
- **Location of Preferred Alternative within WSDOT right-of-way and use of WSDOT right-of-way:** While WSDOT and Sound Transit have been collaborating to develop the FWLE in a way that maintains WSDOT's flexibility to make future improvements, the project would ultimately need to secure FHWA's approval to use highway lands, considering factors such as safety, transportation and environmental performance, maintenance, and potential future improvement needs.

Sound Transit must secure from WSDOT and FHWA agreements and approvals for uses and proposed modifications such as the following:

- A preferred alternative that would use portions of the I-5 right-of-way
- Desired modifications to other parts of the freeway, such as shoulders or existing noise walls
- Construction staging and access
- Lane closures on surface streets and I-5 affecting the freeway during construction
- Modifications that could affect freeway operations or safety

Most of these approvals normally occur during final design. Sound Transit has coordinated with FHWA and WSDOT to develop conceptual engineering definitions for the alternatives and has successfully obtained similar approvals for other Sound Transit projects. As final design progresses, FHWA or WSDOT could request modifications or place other restrictions on the project. Such changes could affect the project cost, construction impacts, and work schedule. In addition, the Preferred Alternative alignment could be shifted farther east within the WSDOT right-of-way to minimize some visual, noise, vibration, and ecosystem impacts based on further coordination with FHWA and WSDOT. Such a shift may require additional guardrail or other highway design features to maintain highway safety.

- **Midway Landfill:** Sound Transit will need to continue coordination with the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology because Midway Landfill is a Superfund site. Prior to building the FWLE at the Midway Landfill, EPA will need to evaluate Sound Transit's design and construction plans to determine whether the FWLE is consistent with the remedial action that has been implemented at the Midway Landfill and what documentation is needed related to the remedy as described in the Midway Landfill Record of Decision under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (EPA, 2000).
- **Potential additional stations:** Stations at S 216th Street and S 260th Street were not included in ST2. Further evaluation of consistency with the ST2 and ST3 plans would be required before any of them could be added to the FWLE. The Preferred Alternative does not include any potential additional stations.

- **Mark Twain Elementary School:** Sound Transit has continued its coordination with Federal Way Public Schools regarding design of the Preferred Alternative and its effects on school district property. The Preferred Alternative studied in the Final EIS includes a trench profile underneath a portion of the school playfield and an elevated profile design option that would be above ground on the same portion of the playfield. When the Sound Transit Board of Directors selects the alternative to be built, the profile of the guideway in this location will be resolved. Under either scenario, Sound Transit expects ongoing coordination with the school district related to construction period effects, final design of the light rail guideway, and appropriate mitigation measures for project impacts.

Sound Transit would continue to coordinate with the appropriate federal, state, and local agencies and jurisdictions to address these issues.

9.0 Comment Summary

This chapter summarizes comments Sound Transit and the Federal Transit Administration (FTA) received during the public comment period for the FWLE Draft EIS.

9.1 Overview of the Draft EIS Comment Period

Sound Transit and the FTA released the Draft EIS for the FWLE on April 10, 2015, starting a 45-day public comment period that ended on May 26, 2015. Sound Transit held public open houses/public hearings at a community center in Federal Way (May 6, 2015) and at Highline College campus in Des Moines (May 7, 2015). Appendix B provides more information on outreach during the public comment period and Appendix I includes all comments along with responses from Sound Transit and FTA. Table 9-1 shows the number of comments received, by commenter type.

TABLE 9-1
Comment Submittals Received by Commenter Type

Commenter Type	Number
Federal Agency	4
Tribe	1
State Agency	2
Regional and Local Agency of Jurisdiction	21
Business	63
Community Organization	9
Individual	540
Total	640

9.2 Comments from Agencies and Tribes

Several federal, state, regional, and local agencies provided comments as summarized below. The Muckleshoot Indian Tribe also commented. Three agencies submitted letters stating they had no substantive comments on the Draft EIS's environmental analysis or alternatives: the U.S. Army Corps of Engineers, the U.S. Department of Interior, and the Washington State Department of Archaeology and Historic Preservation.

9.2.1 Federal Agencies and Tribes

The **Federal Highway Administration (FHWA)** expressed concern that reducing the width of clear zones along I-5, would affect highway safety, particularly in combination with the SR 509 Extension Project. It also noted construction-period traffic impacts from road closures that could affect operation or safety of I-5 ramps. FHWA asked Sound Transit to reduce vegetation removal if the Preferred Alternative is in the I-5 right-of-way, and advised FTA and Sound Transit of newly available FHWA transit noise policy guidance.

The **U.S. Environmental Protection Agency (EPA)** stated the SR 99 Alternative best avoids and minimizes environmental impacts such as residential displacements, hazardous materials, aquatic impacts, and potential environmental justice impacts, and also has the highest potential ridership and transit-oriented development (TOD) potential. EPA expressed concerns specifically about impacts on Bingaman Creek with the I-5 and SR 99 to I-5 alternatives, and requested that the Final EIS provide more information on ecosystem impacts and mitigation. It noted the importance of the remaining ecosystem resources in the urbanized project area and therefore supported stations that would minimize wetland and vegetation impacts. EPA also identified the need for additional coordination and regulatory process if the Midway Landfill were impacted, and commented on mitigation of increased greenhouse gas emissions and air quality during construction.

The **Muckleshoot Indian Tribe** requested further detail on fish passage barriers and an assessment of stream and wetland impacts by watershed basin. It also requested input on environmental review, permitting, and the development of the mitigation plan regarding wetland, stream, and vegetation impacts.

9.2.2 State Agencies

The **Washington State Department of Transportation (WSDOT)** requested coordination with Sound Transit so that the FWLE will not interfere with planned improvements in the corridor, including the SR 509 Extension Project. WSDOT encouraged non-motorized access to the stations. Other comments related to habitat and habitat connectivity, air quality, and visual impacts.

9.2.3 Regional and Local Agencies

Puget Sound Regional Council comments focused on TOD potential and the TOD study completed for the Draft EIS, noting greater TOD potential for stations along SR 99. It requested more details on TOD in the Executive Summary, discussion of areas within 1/2 mile of stations in terms of TOD planning, and door-to-door travel time rather than just light rail travel time.

King County Council member Dave Upthegrove supported the I-5 alignment from Angle Lake to Kent/Des Moines because of support from the local cities, cost, similar ridership and TOD potential to SR 99 alignments, and the avoidance of unnecessary disruption to Des Moines.

The **King County Department of Transportation** and the **King County Department of Public Health** provided joint comments encouraging Sound Transit to consider social equity, impacts on transit-dependent populations, and connections to destinations along the corridor, such as Highline College, when considering the Preferred Alternative. They acknowledged construction impacts could affect the long-term health and well-being of communities and families. These departments stated they are in favor of maximizing development potential and ridership, and that they will work to “provide good connections and find efficiency dividends between Metro services and light rail” with whatever alternative is chosen.

The **City of SeaTac** submitted technical comments requesting clarification on the process for identifying the Preferred Alternative. The comments also focused on the project purpose and need, alternatives, land use, economics, social impacts, visual impacts, water resources, electromagnetic fields, public services and safety, parks, and cumulative impacts.

The **City of Des Moines** submitted as a comment Resolution No. 1297 in support of the I-5 Alternative with a Kent/Des Moines station between the west side of 30th Avenue S and the east side of SR 99. The City requested that the station be connected to Highline College by an elevated pedestrian bridge. It also felt the Draft EIS did not fully address the feasibility and political issues of unfunded stations at S 216th and S 260th streets. It voiced concerns about the near-term construction impacts, particularly to business and City revenues, and noted that potential financial benefits are longer-term and uncertain.

The City requested additional detail on construction impacts to businesses and from detours if SR 99 is identified as the Preferred Alternative. It also requested that Sound Transit enter into a formal agreement with the cities and Highline College for joint planning, design, construction, and operations following identification of the Preferred Alternative. The City wants to ensure that:

- Disruptions to property owners, businesses, and residents are minimized.
- The highest levels of urban land use and design are achieved.
- TOD is maximized.
- Impacts on existing commercial businesses and future commercial development are minimized.
- Highline College current operations, its students, and its future development are enhanced to the extent possible.

Technical comments focused on funding, traffic, access, acquisitions, TOD, economics, neighborhood impacts, public safety, and construction impacts.

The **Mayor of Des Moines** provided additional comments in support of the I-5 Alternative and addressing the Kent/Des Moines Station location. Comments emphasized that locating the station on the east side of SR 99 could provide safe access to the Highline College campus if a pedestrian bridge is provided. The comments also discussed impacts on minority and low-income populations from lost tax revenue during construction of the SR 99 Alternative.

The **Kent Mayor** and **City Council** submitted a letter in favor of the I-5 Alternative with an elevated Kent/Des Moines station on the west side of 30th Avenue S. The letter also discussed code amendments for a pedestrian bridge over SR 99, and requirements for frontage and street improvements on SR 99 and 30th Avenue S. It noted that this alignment and station would maximize both proximity to Highline College and development potential in the Midway area. It also indicated concerns about TOD potential and the safety of non-motorized users.

The mayor and City Council suggested moving the S 272nd Star Lake Station east between I-5 and the I-5 on/off-ramps, and providing a pedestrian bridge to the parking garage. They were also concerned about traffic on S 272nd Street with both S 272nd stations, and

suggested that an I-5 alignment be as far from residents as possible to minimize noise impacts. Other comments focused on costs, traffic, access, TOD and land use, economic impacts, visual impacts, stream impacts, safety and security, and noise impacts.

The **City of Federal Way** submitted as a comment the City's Resolution 15-686 supporting the I-5 Alternative, with a station as close as possible to Highline College and a "hybrid" station in Federal Way generally located along 23rd Avenue S and straddling S 320th Street. The City is concerned with impacts on businesses, tax revenues, and developable land; noise and visual impacts; cost; transit connections; and a future extension to Tacoma via I-5. Technical comments focused on safety, parking, park impacts, and neighborhoods.

The **mayors of SeaTac, Des Moines, Kent, and Federal Way** submitted a joint letter supporting the I-5 Alternative with a Kent/Des Moines station east of SR 99 and a pedestrian/bicycle bridge from Highline College. Their goals are to work cooperatively with each other and Sound Transit to support the operations and future development of Highline College and its students; minimize disruptions to property owners, businesses, and residents; minimize adverse aesthetic, economic, and environmental impacts; maximize TOD in the Midway area; and provide safe vehicular and pedestrian access, utilities, and aesthetic improvements along the corridor and in the station areas.

The President of **Highline College** spoke at the public hearing and provided written comments on behalf of the College Board of Trustees in support of a Kent/Des Moines station on the west side of SR 99. The College believes this location offers the best safety, access, and potential ridership compared to other Kent/Des Moines stations, and that providing the best access to Highline College will help address social equity issues present in southwest King County.

The College requested a station within 1/4 mile of the campus center, and opposed any station on 30th Avenue S or along I-5. It stated the SR 99 East station location would be less safe for students, employees, and visitors. If the station is on the east side of SR 99, it requested a pedestrian bridge or a signalized pedestrian/bicycle crossing separate from other road/driveway crossings. The College did not have a preference regarding the light rail alignment from

S 200th Street to the college, but did prefer that the alignment be on SR 99 from the college south to Federal Way.

Federal Way Public Schools provided comments in support of the I-5 Alternative with a Kent/Des Moines station near Highline College and the Federal Way S 320th Station Option. The district expressed concern over construction-period and long-term development impacts at Mark Twain Elementary School, and construction-period and noise and vibration impacts at Truman High School with the I-5 and SR 99 to I-5 alternatives. It is concerned about the SR 99 Alternative's noise, vibration, and visual impacts at the new Federal Way High School.

The **Midway Sewer District** gave details on its planned improvements in the study area and relocations from the SR 509 Extension Project. It expressed concern about potential relocations that could increase operation and maintenance costs and about staff time for project review and coordination.

South King Fire & Rescue requested more study of impacts on its service delivery.

9.3 General Public Comments

Comments received from the public were categorized into three groups: businesses, community organizations, and individuals.

9.3.1 Businesses

Sixty-three comments were received from 18 businesses, primarily along the SR 99 corridor, and from the Greater Federal Way Chamber of Commerce. Some businesses submitted multiple comments or submitted multiple employees' comments. Most were concerned about displacement or construction impacts. Several expressed concern about disruption during construction along SR 99 similar to previous roadway reconstruction projects on SR 99.

Many of these commenters own property or have businesses on SR 99 and expressed support for the I-5 Alternative to avoid impacts on their business or property. Most stated that if an SR 99 Alternative was identified as the Preferred Alternative, they would want it on the opposite side of the road from their business or property to minimize noise, visual, economic, and construction effects.

The Greater Federal Way Chamber of Commerce encouraged Sound Transit to consider economic development, regional workforce

connections, the cost of strategic growth, and commuter demands when making route decisions. The Chamber did not specifically support any alternative or station location, but acknowledged there would be impacts and benefits to businesses in its area from all alternatives.

9.3.2 Community Organizations

Five community organizations submitted comments on the Draft EIS as summarized below.

The **Associated Students of Highline College** submitted as a comment a resolution supporting a Kent/Des Moines station on the west side of SR 99, or on the east side of SR 99 with a pedestrian bridge over SR 99, and requested that this station be named the Highline College Station.

The **30th District Democrats** submitted comments and a resolution in support of the SR 99 Alternative because it would be closer to more residents, have a similar travel time to the I-5 Alternative but greater ridership, and have greater TOD potential.

Transportation Choices submitted comments on behalf of itself, Washington Bikes, Puget Sound Sage, OneAmerica, Housing Development Consortium of Seattle-King County, Futurewise, Forterra, Feet First, and Cascade Bicycle Club. These organizations support the SR 99 Alternative with a Kent/Des Moines station west of SR 99 and stations at S 216th Street and S 260th Street due to the higher ridership potential, TOD potential, access, greenhouse gas emission reduction, and future development potential. In Federal Way, they support stations close to the Federal Way Transit Center or SR 99. They also requested study of an SR 99 to I-5 Alternative that has a S 216th station and a Kent/Des Moines station west of SR 99. Additional comments focused on the need for parking; pedestrian, bike, and transit access; environmental health; and social equity.

Futurewise supported the SR 99 Alternative with a Kent/Des Moines station west of SR 99 and stations at S 216th Street and S 260th Street for the same reasons as Transportation Choices.

The **Kent Bicycle Advisory Board** requested better bicycle connections to stations, and sidewalks and bicycle facilities incorporated into the project. It prefers an alignment and station near SR 99 in the Midway area.

9.3.3 Individuals

Sound Transit and FTA received 543 comment submittals from individuals, either in writing or through testimony at the public hearings. The following sections describe the most common comments. Most comments expressed support for either the SR 99 Alternative or the I-5 Alternative; few supported the SR 99 to I-5 or I-5 to SR 99 alternatives. In general, support from individuals for specific alternatives was greatest for the SR 99 Alternative, followed by the I-5 Alternative.

Some comments did not express support for a specific alternative or station, but discussed what the commenter thought should be important in determining location. These factors included property displacements, access, estimated cost, ridership, construction impacts, potential for redevelopment or TOD, and environmental impacts.

9.3.3.1 I-5 Alternative

The I-5 Alternative received less overall support from individuals than the SR 99 Alternative, with many comments expressing concern about the lack of direct service to residential and commercial areas.

Table 9-2 summarizes reasons frequently provided for supporting or opposing the I-5 Alternative.

TABLE 9-2

I-5 Alternative Comment Summary

Supporting	Opposing
<ul style="list-style-type: none"> • Mitigates recent reduced bus options on I-5 • Uses existing transportation corridor • More accessible for commuters and from areas east of I-5 • More cost-effective/lowest cost • Fewest impacts on businesses • Noise is closer to I-5 • Existing noise walls • Existing park-and-rides • Open area, straight-line route for better riding experience • Minimal impact on street traffic through residential areas 	<ul style="list-style-type: none"> • Existing express buses serve the corridor • Not as accessible for people without cars; encourages driving • Less TOD potential • Most residential displacements • Greater noise impacts • Existing express buses and Sounder train offer direct commuter service to Seattle • Not close enough to Highline College • Impacts on Bingaman Creek, wetlands, and acres of surrounding trees and vegetation • May impact Midway Landfill • Too few proposed stations • Infrastructure improvements required to move pedestrians to stations • Distraction to motorists on I-5

Comments about the I-5 station options focused on the Kent/Des Moines station area. Some comments supported the Kent/Des Moines At-Grade Station Option because it would reduce impacts on residents and businesses, while others opposed it because of the distance from SR 99 and Highline College, reduced economic benefits, and proximity to the Midway Landfill and neighborhoods. Comments on the Federal Way City Center station location were evenly divided between Federal Way Transit Center and the Federal Way S 320th Park-and-Ride locations.

9.3.3.2 SR 99 Alternative

Table 9-3 summarizes reasons frequently provided by individuals for supporting or opposing the SR 99 Alternative.

TABLE 9-3

SR 99 Alternative Comment Summary

Supporting	Opposing
<ul style="list-style-type: none"> • Better access • Higher potential for TOD, revitalization of businesses, and stimulation of economic growth • Better service to Highline College • Fewer residential displacements • Highest ridership potential • Improved walkability of surrounding areas • Parking closer to SR 99, thereby safer (less secluded) • Better connection of communities along SR 99, supporting the long-term vision for this area • Better for low-income populations in the area and Highline College students, a large number of which are low-income • Increased “competitiveness” for Federal Way with Seattle and Redmond • Reduced SR 99 vehicular traffic • Access for senior citizens and residents with disabilities 	<ul style="list-style-type: none"> • Higher estimated cost • Disruptions during construction (noise, business access) • Major portions of SR 99 closed during construction • Visual impacts (on views of Puget Sound, Mt. Rainier) • Poor accessibility from I-5 • Community division • Increased potential for pollution, crime, noise, and accidents • Replicates existing bus service • Increased traffic congestion • More business impacts (business and employee displacements) • Ecosystem impacts (Massey Creek, wetlands) • Negative effect on property values

One speaker at the May 6, 2015, public hearing presented a petition signed by 230 people (mostly residents of cities in the corridor and many Highline College employees) supporting the SR 99 Alternative with a station at S 216th Street. Reasons given in the petition for supporting this alternative include:

- It would be a catalyst for economic development.
- The purpose should be to connect communities, not just be commuter service to Seattle.

- The large investment should have the greatest long-term potential for serving and improving the communities in the corridor.
- This area of the county is disadvantaged, and the project should make an effort to improve conditions by making transit sustainable and community-accessible and encourage mixed development.
- Stations would be in visible, busy destinations and therefore safer for riders.

Many comments focused on station locations. Several people stated they wanted the Kent/Des Moines Station as close to Highline College as possible.

Very few comments mentioned the S 272nd station area. Most comments about the Federal Way City Center station area supported the light rail station closest to the existing Federal Way Transit Center.

About 30 comments expressed support for adding the S 216th Station, with the west station location preferred over the east.

About 10 comments expressed support for the S 260th station, with the east station location preferred over the west.

9.3.3.3 SR 99 to I-5 Alternative

Table 9-4 summarizes reasons frequently provided by individuals for supporting or opposing the SR 99 to I-5 Alternative. One comment supported a S 216th station (west) with this alternative.

TABLE 9-4

SR 99 to I-5 Alternative Comment Summary

Supporting	Opposing
<ul style="list-style-type: none"> • Serves a large number of low- to middle-income residents • Small number of business displacements • Full use of Star Lake Park-and-Ride 	<ul style="list-style-type: none"> • Indirect route • Underserves Highline College • Encourages driving to stations

9.3.3.4 I-5 to SR 99 Alternative

Table 9-5 summarizes reasons frequently provided by individuals for supporting or opposing the I-5 to SR 99 Alternative. Two comments supported a S 260th Street station with this alternative.

TABLE 9-5
I-5 to SR 99 Alternative Comment Summary

Supporting	Opposing
<ul style="list-style-type: none"> • Minimizes visual impacts • Provides connections to key businesses and organizations, including Fred Meyer, Woodmont Library, and Federal Way High School 	<ul style="list-style-type: none"> • High residential displacements • Includes out-of-direction travel between Angle Lake and Kent/Des Moines • More difficult access • Lower ridership • Displaces too many residents and businesses • Disruptive construction • More noise and visual impacts • No direct service to Highline College

9.3.3.5 Suggestions for Other Alternatives

One comment suggested a Federal Way High School station.

9.4 Responses to Common Comments

Appendix I includes responses to each of the comments received during the Draft EIS comment period. Many of the comments expressed similar themes, such as support for a particular alternative or concern about a specific issue. Table 9-6 provides responses to the most common comments. These responses are also referenced in Appendix I, using the common comment number found in the first column of the table.

TABLE 9-6

General Responses to Draft EIS Common Comments

Number	Common Theme	Common Response
1	<p>Alternatives along SR 99 are a better choice than alternatives along I-5 for one or more of the following reasons:</p> <ul style="list-style-type: none"> • They are closer to population centers. • They have greater potential for TOD. • They have greater economic development potential. • They displace fewer residents. 	<p>Chapter 8 of the Final EIS compares the alternatives, including trade-offs between ridership, cost, and environmental impacts. The alternatives along I-5 are farther than the SR 99 alignments from many of the denser multi-family residential developments and commercial uses along SR 99. However, Kent/Des Moines and Federal Way stations would be in the same general locations (within 1,000 feet) regardless of the alternative. These stations are also in areas that the cities have identified for the most increased density, growth, and TOD. The Kent/Des Moines Station area is where Kent and Des Moines are targeting higher-density development, while Federal Way is planning increased mixed-use development near the Federal Way Station.</p> <p>The SR 99 Alternative includes potential additional stations at S 216th and S 260th Streets. Although these additional stations would increase the overall TOD rating for SR 99 and increase pedestrian access to light rail, there is currently no funding available to develop these stations.</p> <p>At the S 272nd Redondo Station, the SR 99 and I-5 to SR 99 alternatives would have greater TOD potential and pedestrian access to potential future mixed-use development than the Preferred or I-5 to SR 99 alternatives. However, Federal Way is targeting more of its growth and development to occur in the City Center. Wetlands further constrain future development near this station.</p> <p>Sound Transit, with the various stakeholders, will examine ways to improve access and development opportunities in the S 272nd Street area. Sound Transit staff will evaluate ways to improve the potential for TOD at stations along the corridor, including at S 272nd Street. Examples could include improved east-west transit service and improvements to RapidRide service on SR 99 to facilitate connections to the light rail stations, pedestrian and bicycle access, placemaking initiatives, and development opportunities.</p> <p>Sound Transit and King County Metro prepared a Conceptual Transit Service Plan for all FWLE alternatives . It would add a new local route between Des Moines and Federal Way. For the Preferred Alternative, this route would provide access between SR 99 and the S 272nd Star Lake Station every 15 minutes during peak periods and every 30 minutes during the midday.</p> <p>The SR 99 Alternative would have the fewest residential displacements (36 compared to 196 with the Preferred Alternative), but would displace the most businesses (101 compared to 42 with the Preferred Alternative) since SR 99 is mostly surrounded by commercial property.</p>
2	<p>Alternatives along I-5 are a better choice for one or more of the following reasons:</p> <ul style="list-style-type: none"> • They would be less disruptive than alternatives along SR 99 during and after construction. • They would displace fewer businesses. • They would have less potential for 	<p>Chapter 8 of the Final EIS compares the alternatives, including trade-offs between ridership, cost, and environmental impacts. Chapter 5 of the Final EIS discusses construction impacts from the FWLE alternatives. Construction-period lane and road closures for the SR 99 Alternative and I-5 to SR 99 Alternative would likely cause more community and business disruption because of the many businesses located on SR 99. The Preferred Alternative and SR 99 to I-5 Alternative would cross over fewer roads, thereby reducing the number of lane or road closures needed. Also, because much of the Preferred Alternative alignment is located in the I-5 right-of-way, fewer businesses would be affected by the visual, noise, and access changes during construction.</p> <p>The Preferred Alternative would displace the fewest businesses and the SR 99 Alternative would displace the most businesses. However, residential displacements would be highest with the Preferred Alternative. Section 4.1 of the</p>

TABLE 9-6
General Responses to Draft EIS Common Comments

Number	Common Theme	Common Response
	visual impacts.	Final EIS describes displacements and acquisitions, and the mitigation for people and businesses affected. The alternatives along SR 99 would be mostly elevated and visible to more sensitive viewers than the I-5 alternatives, so they would have greater visual impacts. The Preferred Alternative would be visible to fewer sensitive viewers, but would change the visual environment for drivers on I-5, where approximately 40 acres of mature conifer trees would be removed for the light rail line.
3	There would be too many residential displacements with the I-5 Alternative. Many of these residents are low-income and/or minority.	The Preferred Alternative would displace the most residents, mostly concentrated north of S 240th Street and mostly on multi-family properties. Even without the FWLE, about half of these displacements would also occur with the SR 509 Extension Project based on the 2003 Final EIS for that project. Section 4.1, Acquisitions, Displacements, and Relocations, describes the relocation benefits for displaced residents (both owners and tenants); it also provides specific information about relocation of mobile homes. Displacements from all alternatives would occur in areas with concentrations of minority and low-income populations (both over 50 percent). Chapter 7, Environmental Justice, discusses how displacements would affect low-income and minority populations, and how Sound Transit would provide advisory services to help find comparable or better housing for these residents.
4	Good, safe access to Highline College is very important and the station should be as close to the college as possible. A pedestrian bridge across SR 99 would improve safety if the station is across the street.	<p>All FWLE alternatives would provide access to Highline College with the Kent/Des Moines Station. The Kent/Des Moines Station alternatives on the east side of SR 99 would provide safe access across SR 99 to Highline College via signalized intersections with crosswalks. After the Draft EIS, Sound Transit held stakeholder workshops to find ways to maximize safety for this station. The Preferred Kent/Des Moines Station would be approximately 1,500 feet from the center of the college campus, a distance comparable to Link stations at the University of Washington. While safe and convenient access to the college is an important feature of this station, more station users will transfer from buses or drive to the station to access other destinations than will use it to access the college.</p> <p>Proposed pedestrian improvements related to the station include wide sidewalks connecting the station to SR 99 and to Highline College. The intersection of S 236th Street and SR 99 would be signalized, and crosswalks would be designed to facilitate the projected pedestrian demand and to make the crossing safe and convenient for students as well as other Link rail users needing to cross here. Sound Transit is working with the stakeholders to evaluate other improvements for pedestrians, which may include enhanced pavements, curb bulb-outs, and lower speed limits. The Kent/Des Moines stakeholders agreed that a pedestrian bridge should not be pursued because:</p> <ul style="list-style-type: none"> • Travel times would be about the same for an at-grade crossing and a pedestrian bridge. • Many pedestrians would likely cross at street level instead of going up and down to access a pedestrian bridge. • Many at-grade improvements can enhance the pedestrian environment and improve safety for pedestrians crossing at S 236th Street. • The pedestrian bridge would have relatively few users compared to other such bridges near Link stations. <p>Section 3.5.6 in Chapter 3, Transportation Environment and Consequences, provides additional discussion of non-</p>

TABLE 9-6
General Responses to Draft EIS Common Comments

Number	Common Theme	Common Response
		motorized access for all stations.
5	There should be plenty of parking at the stations, or there is too much parking at the stations.	Sound Transit based the FWLE's parking supply on the forecasted parking demand and on data from comparable transit centers in the Puget Sound Region and more broadly at other rail systems in the United States. As discussed in Section 3.5.5 in Chapter 3, Sound Transit evaluated the parking needs as a whole along the corridor, and then developed station parking to meet the projected need based on factors such as surrounding land uses, proximity to the regional transportation system, local street access, congestion, and terminus station locations.
6	When designing the FWLE, consider the future expansion south to Tacoma.	All FWLE alternatives would allow for a future extension to Tacoma via I-5 or SR 99. The Preferred Federal Way Transit Center Station has been reoriented since the Draft EIS to make the future extension possible on either corridor. The tail track crossing S 320th Street would extend directly south of the station and would allow the future guideway to head either east to I-5 or west to SR 99.
7	The project creates pedestrian and vehicle safety concerns along SR 99 with light rail; it is safer to have light rail and stops along SR 99 where there are people and visibility; stops in I-5 park-and-rides may not be safe.	All stations would be designed to provide safe access for patrons and avoid conflicts with pedestrians and vehicles nearby. Section 4.14, Public Services, describes the safety features incorporated into stations and the use of Crime Prevention through Environmental Design (CPTED) principles in station design. Section 3.5.6 in Chapter 3 describes the features to enhance the safety of pedestrians at road crossings.
8	Sound Transit should use the investment to increase the quality of life in communities, especially in disadvantaged areas.	The FWLE stations would provide access for all populations in the FWLE corridor. As described in response to Common Comment 1, access for the Kent/Des Moines and Federal Way Transit Center stations would be similar for all alternatives, and Sound Transit will examine ways to improve access in the S 272nd area. Chapter 2, Alternatives Considered, describes improvements at each station that would either be incorporated into the project or can be considered for implementation by local jurisdictions. Chapter 7, Environmental Justice, describes the benefits and impacts for minority and low-income populations, along with outreach specifically targeted to these populations.
9	The Sea Mar Des Moines Clinic and Housing would be torn down with the SR 99 Alternative, which is an environmental justice issue and a waste of public funds. Choose an alternative other than SR 99.	The Sea Mar Community Health Center's Des Moines Medical and Dental Clinic would be displaced by two station options with the SR 99 Alternative: the Kent/Des Moines Highline College (HC) Campus Station Option and the S 260th West Station Option, both located west of SR 99. Without these options, the SR 99 Alternative alignment would not affect the clinic. Please see Section 4.4, Social Impacts, Community Facilities, and Neighborhoods, and Section 7.6.3 in Chapter 7, Environmental Justice, for discussions of the clinic, the population that it serves, its potential displacement, and mitigation options. None of the SR 99 alternatives would displace the Sea Mar Des Moines Housing associated with the clinic.

TABLE 9-6

General Responses to Draft EIS Common Comments

Number	Common Theme	Common Response
10	Build the FWLE project sooner.	Please see Chapter 2, Alternatives Considered, for a description of the FWLE schedule and funding. Sound Transit will accelerate the schedule as practicable. Funding is currently projected to allow construction of the FWLE to the Kent/Des Moines Station in 2023. In June 2016, the Sound Transit Board adopted the Sound Transit 3 (ST3) Plan, which calls for building the FWLE from Angle Lake to the Federal Way Transit Center with service at all three stations opening concurrently in 2024. If funding for ST3 is approved by voters in November 2016, the project schedule would be adjusted accordingly.
11	Comments limited to expressing a preference or objection to one or more alternatives, or comments or questions not related to the content of the Draft EIS.	Sound Transit and FTA reviewed all comments submitted during the comment period. The National and State Environmental Policy Acts (NEPA and SEPA) require FTA and Sound Transit to respond to substantive comments related to the content of the Draft EIS, but not to questions or comments limited to public policy decisions (e.g., general statements of support or opposition). However, before identifying the Preferred Alternative, the Sound Transit Board received a comment summary report with a copy of all comments submitted. Appendix I of the Final EIS includes copies of all the comments and responses to them.

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