5.0 Construction

5.1 Construction Approach

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

- Civil construction: This includes 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. Major construction activities are summarized in the text box at right.
- Systems installation: This includes the installation of the electrical system that would power the trains.
- Testing and startup activities: Before beginning revenue operations, Sound Transit would complete a safety certification process by testing communications, safety, and emergency systems.

The duration of construction would range from approximately 1 to 4 years in any given portion of the corridor. Activities would be most intense in the initial part of construction, with later periods involving station finishing, systems installation, and testing, as described in Section 5.1.1.

Following is a brief description of the methods for each major construction component. Several of the sections in this chapter quantitatively evaluate the range of potential impacts based on a low-cost project and a high-cost project, using the conceptual design level construction cost estimate developed for this Draft EIS. The low- and high-cost projects are as follows:

- **Low-cost project:** the I-5 Alternative with the Kent/Des Moines At-Grade Station Option and the Federal Way I-5 Station Option
- **High-cost project**: the 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

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

- Demolition (buildings, pavement)
- Clearing and vegetation removal
- Fill and excavation
- Utility extensions, relocations, or disruptions
- Drainage changes
- Construction easements and 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

Many impacts described in this chapter are discussed qualitatively because it is not known exactly how the project would be constructed and the design will likely be adjusted during preliminary and final design as additional information on site conditions is obtained. There are a number of factors that affect how a project is built, including site-specific conditions, permit requirements, and market conditions at the time of construction. Sound Transit will coordinate with each jurisdiction regarding the necessary permits required for construction, such as land use approvals, right-of-way use permits, and land disturbance permits. Specific mitigation measures for identified impacts would be determined through these permitting processes.

5.1.1 Types of Construction

5.1.1.1 Elevated Light Rail Construction

Construction of elevated guideway would involve demolition of structures, clearing, grading, relocating utilities, preparing necessary construction access, and constructing the guideway structure. A temporary construction road would typically be built for constructing an elevated guideway in undeveloped areas or where access is not available from existing roads. Constructing an elevated guideway within existing street right-of-way may require temporary closure of some traffic lanes and detours.

Construction of Elevated Guideway Showing False-Work

Elevated guideways and stations for light rail, similar to structures such as highway bridges, are generally reinforced concrete, steel, or combinations of both. Construction would begin with preparation work to build foundations that may consist of shallow spread footings, deep-driven or augured piles, or drilled shafts. Once foundations are in place, concrete columns would be constructed. The elevated superstructure could be steel, cast-in-place concrete, pre-cast concrete, or segmental concrete. If steel and/or cast-in-place concrete is used, false-work could be required to support the superstructure while the concrete is poured and while the cast concrete gains enough strength during curing to support itself, or while the steel beams are joined through welding or bolting. If the elevated guideway is close to or

Columns Under Construction for the Central Link Project in Seattle

within the roadway, the false-work would require temporary lane closures and traffic detours until a sufficient portion of the elevated structure is complete. Segmental construction is expected to be the primary method of construction for the FWLE elevated guideway and can typically be built without false-work between the columns. Some short-term, partial to full, street closures may be required to accommodate segmental construction activities. After construction, an elevated guideway can have vegetation under and around it, although there would be a tree-clear zone within 15 feet of the edge of the guideway.

False-work

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

5.1.1.2 At-Grade Light Rail Construction

Construction methods and impacts for at-grade guideways would be similar to typical road construction. Existing structures in the project footprint would be demolished and conflicting utilities would be relocated first. Shallow, near-surface excavations would be required to construct the subgrade, track, and station platform slabs for at-grade segments. In areas where access is not available from existing roads, a temporary construction road would be built. During the grading phase, the contractors would install culverts or other permanent drainage structures and below-grade light rail infrastructure.

5.1.1.3 Trench and Retained Fill Light Rail Construction

Construction of trenches and retained fill guideways would be similar to construction of at-grade guideway, but may be more intensive and of longer duration due to the need to construct retaining walls. Construction of trenches and fills may include demolition of existing structures, clearing and grading, excavation, utility relocation, construction of temporary access roads between 15 and 30 feet wide, and temporary traffic detours and lane closures. Depending on the depth of the trench and groundwater conditions, dewatering may be necessary during construction. Construction under roads would use cut-and-cover construction methods, potentially with metal plates over the trench to maintain traffic flow.

Fill material for retained fill construction would be delivered to the site by truck. Retained fill structures may require ground improvement, depending on the ability of existing soils to support the increased loads. Reconstruction of streets, sidewalks, and other existing facilities may also be necessary, depending on the final alignment and profile of the trench or retained fill.

5.1.2 Staging Areas and Construction Easements

Construction staging areas are needed before, during, and for a short time after construction work occurs. Staging areas would be used for construction, equipment storage, construction materials delivery and storage, demolition or spoils handling (in accordance with applicable regulations), contractor trailers, access roads, and construction crew parking. At-grade, elevated, trench, and retained fill sections would have construction staging areas along the alignments. Contractors would generally use the property in which the facility is being constructed and property that has been acquired for right-of-way by Sound Transit or other properties as negotiated by the contractor. Additional property may be required for activities such as contractor employee parking. Also, construction may require using one lane or all lanes (temporary closure) of a road. Potential lane and road closures for each alternative are discussed in Section 5.2.1, Transportation.

Staging Area Adjacent to the New Guideway Under Construction

Following construction, staging sites may be used for project-related purposes or might be redeveloped consistent with the current zoning. Construction easements are for temporary use of property during construction and would be required in numerous locations along the alignment. In undeveloped areas, 50- to 100-foot-wide construction areas could be necessary to maneuver equipment and materials along the corridor during construction. These would include areas acquired for project right-of-way as well as temporary construction easements. Where the project would have limited property acquisitions on either side, construction activities may require narrow temporary easements from adjacent properties. Following construction, these easements would be restored to preconstruction conditions.

Where the project would temporarily partially or fully close streets, traffic would need to be rerouted via detours so that construction could proceed in an efficient and timely manner while still maintaining access to existing businesses and residences. Traffic closures or detours would require approval by local jurisdictions and/or Washington State Department of Transportation (WSDOT).

5.1.3 Construction Plan

Construction of linear projects is typically divided into segments. The extent of these segments is generally based on the nature of the

construction activity (e.g., foundations, column placement, at-grade guideway construction, elevated guideway construction, retained-cut/fill sections, station platforms, park-and-ride facilities, etc.). To reduce the overall project construction period, the contractor may be required to use multiple work crews/work zones along the corridor at any given time.

A work-specific construction plan would be developed during final design to establish the various construction phases and construction contracts, their estimated schedules and durations, and appropriate sequencing. Where possible, construction activities would be coordinated with other capital improvement projects being carried out by or permitted by the local jurisdictions to help minimize construction impacts.

Typical construction would occur on a 5- to 6-day work-week schedule and would occur primarily between the hours of 7 a.m. and 10 p.m. In some locations (such as when street or freeway detours are involved and/or daytime construction periods need to be abbreviated to reduce impacts), additional shifts, all-week, nighttime, or 24-hour construction activities could be necessary.

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 to occur in off-peak periods or during daytime periods to avoid peak traffic periods or to minimize potential impacts from noise on sensitive receptors such as residences.

An example of construction steps and durations for each alternative is provided below. Durations provided assume ½-mile segments of guideway construction. An overview of station construction is provided after the discussion of alternatives.

5.1.3.1 SR 99 Alternative

Construction in the Median of SR 99

Where the SR 99 Alternative is located in the roadway median, primary civil construction would occur during five phases:

1) Utility relocation: Utility relocations would be required where the guideway would conflict with above-ground or below-ground utilities, including electric, sewer, water, gas, and communications. The utility relocation process is described in

Section 5.2.15. This phase would last approximately 6 months for all relocations in a ½-mile section. This phase could overlap with street reconstruction in some areas.

2) Street reconstruction: This phase would involve widening the existing SR 99 roadway on one or both sides to allow adequate space in the median for column construction. The area needed for road widening would be cleared and prepared for work crews, and the existing street infrastructure (sidewalks, curbs, gutters, and pavement) would be removed and rebuilt. Once paving is completed, all lanes would be restriped in their new configuration and the widened median area would be prepared for light rail construction. This phase would last approximately 6 months for a ½-mile distance. This work could overlap with utility relocations in some areas.

3) Foundation and column construction: This phase would involve drilling shafts for the columns, pouring the footings for the columns, and then installing the columns. For most of the guideway, this phase would last 6 to 8 months for a ½ -mile distance. Exhibit 5-1 shows a typical cross-section of column construction in the median; Exhibit 5-2 provides a plan view of typical construction in the median. Longer spans, such as over SR 99 and the proposed SR 509 extension, would take up to a year and a half.

4) Guideway placement: It is expected that the elevated guideway structure would be constructed using concrete segmental box girders, which are typically poured offsite and trucked to the project location to be placed by crane. This phase would last about 6 months for a ½ -mile distance.

5) Track and systems installation: This phase involves placement of track on the guideway and installation of electrical, communication, and signaling systems, much of which would be completed by equipment operating from the side of the guideway and/or workers on the guideway.

As shown in Exhibits 5-1 and 5-2, work in the median for Phases 2 through 4 would require closure of the adjacent northbound and southbound lanes, and the existing business access and transit (BAT) lanes would be converted to general purpose lanes.

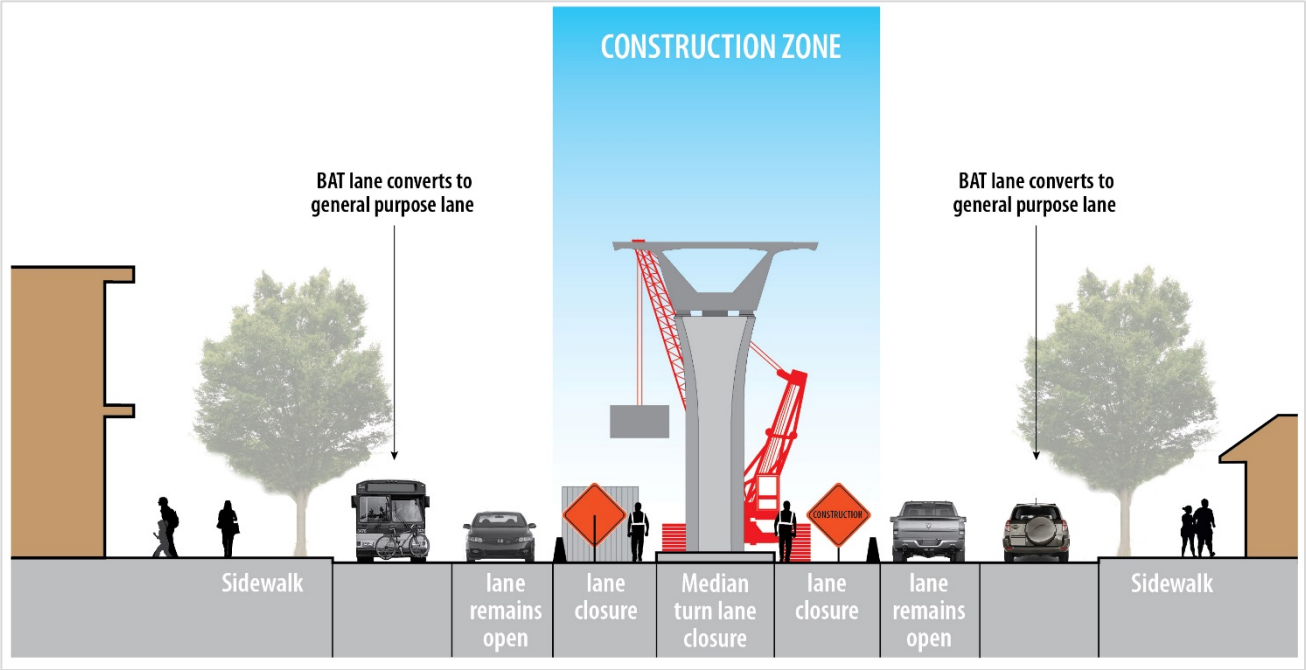

EXHIBIT 5-1
Construction of Elevated Guideway in SR 99 Median (Typical Cross-Section)

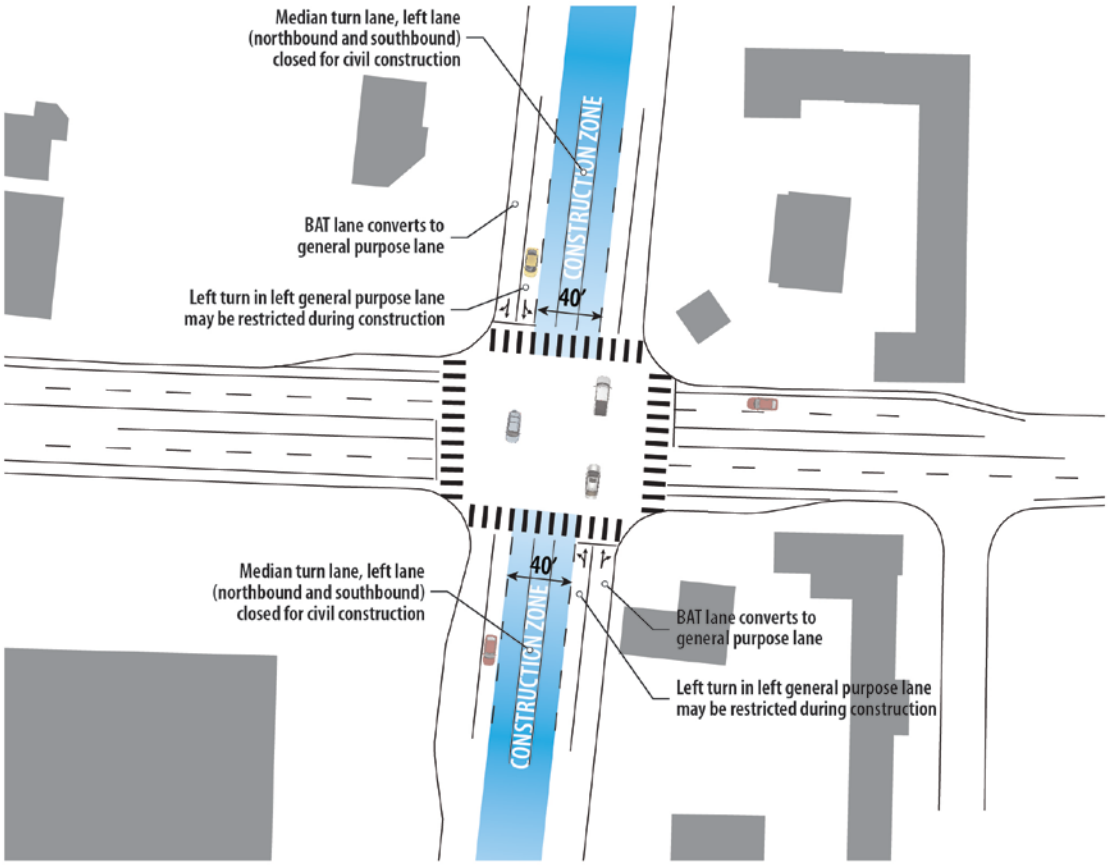

EXHIBIT 5-2
Construction of Elevated Guideway in SR 99 Median (Typical Plan View)

Construction on the Side of SR 99

For areas along SR 99 where the alignment would be located on the side of the road, either elevated or in a trench, roadway reconstruction would generally not be necessary, and utility relocations could be less. The overall construction period could therefore be shorter in locations where these phases take less time or are not necessary. Business access points would be reconstructed where necessary and alternate access may need to be provided.

Column and guideway construction for elevated profiles along the side of SR 99 would be the same as described above (Exhibit 5-3), although only the adjacent BAT lane would be closed. For trenched areas on the side of SR 99, the column and guideway construction phases would be replaced with excavation and retaining wall construction (Exhibit 5-4). Impacts to SR 99 would be similar to those described for construction of an elevated structure on the side of SR 99. Driveway access to businesses would be maintained during business hours, although periodic short-term closures might be necessary. Driveway access to residential properties would also be maintained, except for periodic short-term closures. One-half mile of trenching would take approximately 6 to 9 months to complete. Depending on the station option, there could be 0.25 to 1.5 miles of trenching.

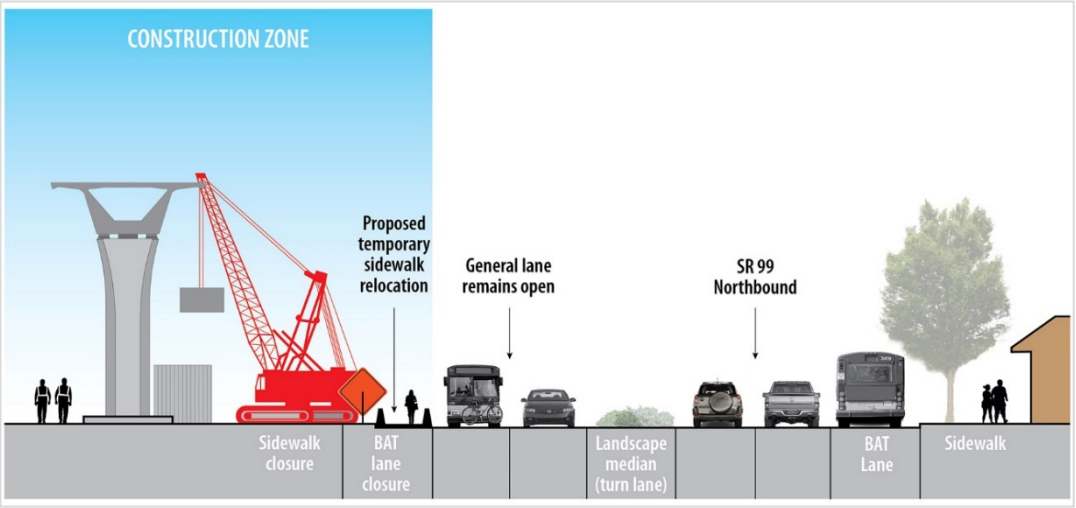

EXHIBIT 5-3
Construction of Elevated Guideway on Side of SR 99

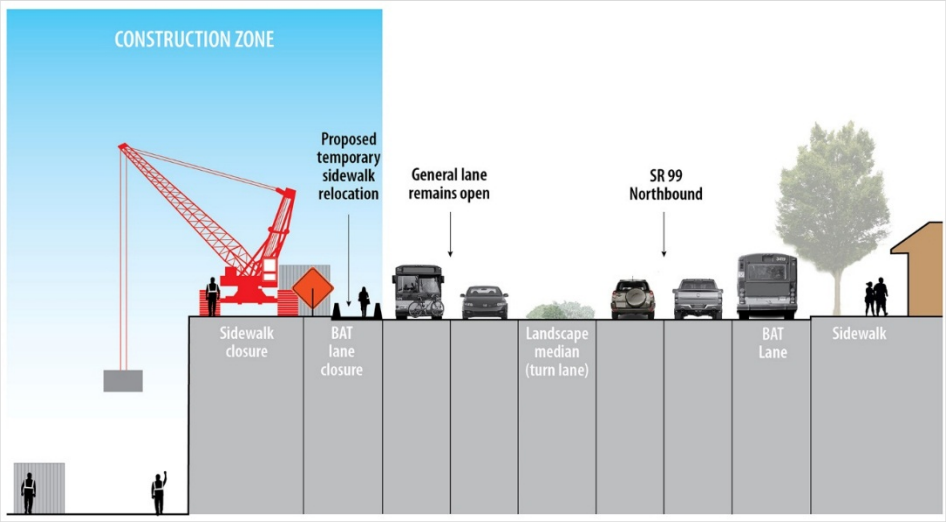

EXHIBIT 5-4
Construction of Trench Guideway on Side of SR 99

5.1.3.2 I-5 Alternative

The I-5 Alternative would be a combination of elevated, at-grade, and trench profiles located inside and outside of the WSDOT right-of-way. Where the light rail would go under existing roadways, including S 216th Street, S 272nd Street, and S 317th Street, cut-and-cover construction would be used to allow for construction of the guideway trench while maintaining some surface traffic. The roadway would then be reconstructed to restore its existing configuration; it would not be widened.

The S 320th Park-and-Ride Station Option would also require temporary demolition and reconstruction of the southbound on- and off-ramps at S 320th Street, where the alignment would go under the ramps. It is expected that sequential excavation mining could be used to cross under S 320th Street itself, avoiding this type of disturbance of the roadway.

The profile within the I-5 right-of-way would be primarily at-grade with existing topography (Exhibit 5-5), except for road crossings, and 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, and retaining walls would be constructed where necessary for retained fills. Elevated structures would be constructed in the same manner as described for SR 99 Alternative. Timeframes would be similar as described for the SR 99 Alternative.

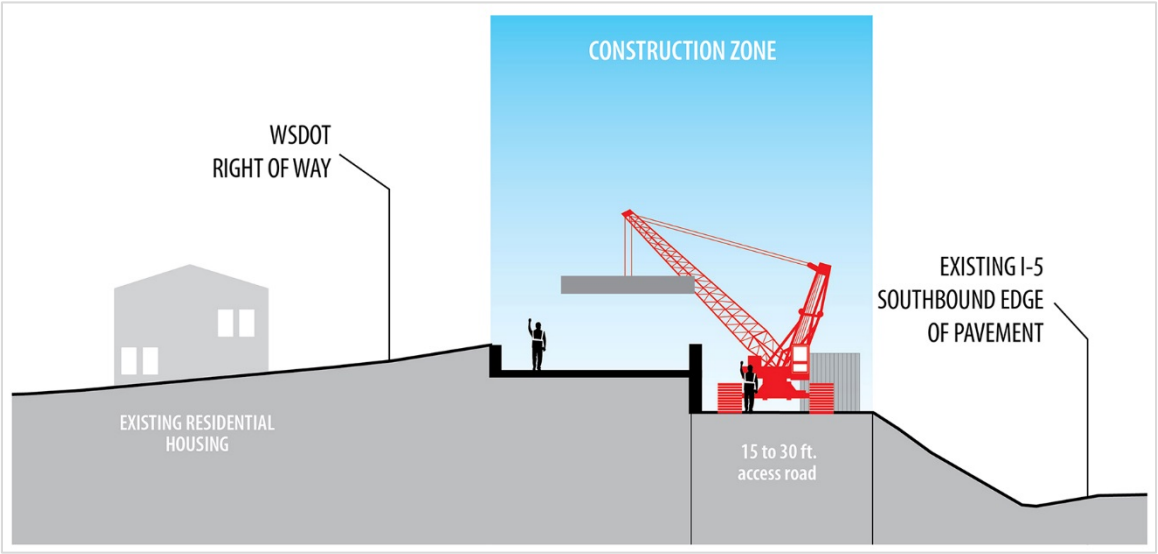

EXHIBIT 5-5
I-5 Construction (Typical Cross-Section)

For the Landfill Median Alignment Option, construction would require a series of straddle bents to cross over I-5, which includes large piers on the side and median of I-5, with beams placed across I-5 southbound travel lanes to support the guideway. If cast-in-place construction is used, it could require a shoring tower in the middle of I-5 for support of the straddle bents while they are being constructed. This would require either closing one to two lanes for up to 2 months or the I-5 mainline would be restriped around the construction area. Using pre-cast cap beams across I-5 would avoid the need for shoring towers but would require overnight closures. A 15- to 30-foot-wide construction access road would be built within the median for this option, which may require grading of the median. Different types of construction equipment would be stored in the median during different phases of construction. 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).

5.1.3.3 SR 99 to I-5 Alternative

Construction methods for the SR 99 to I-5 Alternative would be the same as the SR 99 Alternative north of Kent-Des Moines Road and the same as the I-5 Alternative south of S 240th Street. Between Kent-Des Moines Road and S 240th Street, the profile would be elevated primarily on private property or within the station footprint and would not require any roadway reconstruction. Utility relocations would also occur in this area.

5.1.3.4 I-5 to SR 99 Alternative

Construction methods for the I-5 to SR 99 Alternative would be the same as the I-5 Alternative north of Kent-Des Moines Road and the same as 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 or within the station footprint and would not require any roadway reconstruction. Utility relocations would also occur in this area.

5.1.3.5 Stations

For all alternatives, station footprints would be approximately 8 to 10 acres and would accommodate construction of the station, parking (if provided), and construction staging areas. Potential additional stations at S 216th Street and S 260th Street would have smaller footprints of approximately 4 to 6 acres because they would not have parking. Construction of the station itself would be similar to construction of 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 extent of demolition and utility relocations would be greater than for the guideway, due to the size of the sites. Once the station structure itself is complete, other components of station construction would include parking lots and/or structures, bus circulation areas, internal circulation facilities (stairways, escalators, and elevators), and other ancillary facilities, such as the TPSS, storage buildings, payment kiosks, etc. Trench stations would require greater excavation than for the guideway due to a wider footprint.

With the exception of the Kent/Des Moines SR 99 Median Station Option for the SR 99 Alternative, stations would not be located in roadways and would not require roadway reconstruction, although they may include new access roads on what is currently private property. The SR 99 Median Station Option would be constructed in multiple phases and would detour northbound traffic to 30th Avenue S to allow for construction next to the median. 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

This section discusses potential construction impacts and mitigation measures by resource type.

5.2.1 Transportation

This section provides an overview of potential construction impacts and mitigation measures for regional transportation facilities and travel, transit, arterials and local streets, parking, nonmotorized facilities, and freight mobility and access. Additional details are included in Appendix G1, Transportation Technical Report.

5.2.1.1 Regional Facilities and Travel

Construction Impacts

SR 99 and I-5 are the two key regional facilities that serve the FWLE transportation study area. Approval would be needed from WSDOT and/or local jurisdictions for traffic control plans on SR 99 and I-5 for all alternatives. Impacts specific to each alternative are described in this section.

SR 99 Alternative

Construction of the SR 99 Alternative in the median of SR 99 would require the closure of adjacent travel lanes. During construction, some traffic may divert to parallel roads, including I-5, Military Road, and 16th Avenue S. On SR 99 during peak hours, one travel lane in each direction of travel would likely be closed directly adjacent to the construction area. It is expected that this lane closure would have temporary impacts on traffic operations along SR 99. Therefore, within the construction area, the existing high-occupancy vehicle (HOV) lanes would be converted to allow access for all traffic during construction. During peak periods, many intersections along SR 99 operate at or near capacity, and therefore a reduction in capacity would increase congestion and travel time through the construction area. In general, during off-peak periods and overnight, a maximum of two lanes in each direction would be closed for construction activities because traffic volumes along SR 99 decrease substantially, especially overnight. Truck access to the work areas would be provided via arterials, local streets, SR 99, and I-5 interchanges. Up to 15 truck trips per hour are estimated from each work area. The increase in trucks could result in a small increase in delay at intersections near work areas.

When the guideway transitions to and from the median, the lanes in one direction of SR 99 could be closed or realigned when installing box girders. These short-term closures would likely occur during nights or over a weekend. Once the girders are installed, at least two lanes of traffic would be maintained in each direction during peak periods for the remaining long-term civil construction period. During construction, vertical clearance would be maintained on SR 99.

If portions of SR 99 are temporarily closed for nights and/or weekends, traffic detour routes north of Kent-Des Moines Road would likely include 24th Avenue S west of SR 99 and 30th Avenue S and possibly Military Road east of SR 99. South of Kent Des-Moines Road, 16th Avenue S could serve as a detour route west of SR 99, but there would be limited detour options east of SR 99 and would likely require use of Military Road S. During off-peak periods and weekends, traffic volumes are generally lower than during peak commute periods and detour routes would have available capacity to handle increased traffic from SR 99. These roads may also be used by some traffic that diverted from SR 99, even when there are no road closures.

At signalized intersections within active construction areas, left-turning vehicles from SR 99 would be restricted. These vehicles would be rerouted to nearby intersections where left-turns and U-turns are allowed. Midblock left turns and U-turns would also be closed within the construction area.

At the station areas, there would be no additional impacts on regional facilities with any of the station options except for the Kent/Des Moines SR 99 Median Station Option and the S 272nd Redondo Trench Station Option. The SR 99 Median Station Option would be constructed in multiple phases and would detour northbound traffic to 30th Avenue S to allow for construction next to the median. Further discussion on the SR 99 Median Station Option detour is provided in section 5.2.1.3. The S 272nd Redondo Trench Station Option would require crossing under SR 99 south of S 279th Street. In order to maintain two lanes of traffic in each direction on SR 99 during peak periods, this option would be constructed in multiple stages and would likely require the temporary narrowing of lanes and the median to shift traffic through the construction area.

I-5 Alternative

Construction for the I-5 Alternative would have minimal impacts to highway operations on the I-5 mainline or shoulders; however, the I-5 southbound ramps at Kent-Des Moines Road would require closure or temporary realignment of the ramps during the installation of the girders for the guideway bridges across Kent-Des Moines Road. These closures would occur during nights or over a weekend.

All of the construction activities would occur west of the I-5 mainline. Truck access to the construction areas would be provided west of the guideway via arterials, local streets, and I-5 interchanges. Up to 15 trucks per hour would use the I-5 mainline and ramps; however, no direct access to the construction area would be provided from the I-5 mainline. A small increase in delay could occur at ramp terminal intersections. A Maintenance of Traffic Plan that addresses all modes would be prepared during subsequent FWLE design phases for agency approval.

Construction of the I-5 Alternative guideway over SR 99 near S 208th Street would require periodic nighttime or weekend closures of SR 99 and lane reductions during other hours. The inside southbound travel lane would be closed while constructing a column in the median. The existing southbound SR 99 HOV lane in this construction area would be converted to allow access for all traffic during construction. Full night and weekend closures of all northbound lanes or southbound lanes (at different times) would be required while constructing the guideway over these lanes.

The roundabout at S 317th Street and 28th Avenue S would require reconstruction where the guideway crosses under the intersection. The temporary conversion of this intersection from a roundabout to a stop-controlled intersection during construction is not expected to result in impacts on the I-5 317th direct-access ramps or the I-5 mainline because this intersection has low traffic volumes.

There would be no additional impacts on regional facilities associated with the Kent/Des Moines At-Grade Station Option or the Federal Way I-5 Station Option. The Kent/Des Moines SR 99 East Station Option would have impacts similar to the I-5 Alternative, except that no impacts would occur at the I-5 southbound ramps at Kent-Des Moines Road. For the Federal Way S 320th Street Park-and-Ride Station Option, the I-5 southbound ramps at S 320th Street would require night and weekend closures for guideway construction and

would require a temporary reduction in the southbound off-ramp right-turn pocket length of approximately 250 feet for a substantial portion of the construction period. The off-ramp would be restored to existing conditions after construction is complete. This reduction in right-turn pocket length would not likely cause traffic to back up onto the I-5 mainline.

Landfill Median Alignment Option

Construction of the guideway within the I-5 median for the Landfill Median Alignment Option would require the closure of the inside shoulder for approximately ½ mile between S 240th Street and S 259th Place in each direction on I-5 during the construction of the guideway, which could take approximately 4 to 6 months. Closing the I-5 inside shoulder would reduce the I-5 mainline capacity through the work zone. Construction over the southbound lanes of I-5 would have impacts on I-5 traffic operations during installation of the girders for the guideway bridges. Cast-in-place construction, if used, could require a shoring tower within southbound I-5 mainline to support the straddle bents while they are being constructed. To maintain safe operations of I-5, either closing one to two lanes for up to 2 months or restriping the southbound I-5 mainline travel lanes around the construction area would be coordinated with and subject to a separate agreement with WSDOT. Even if the southbound I-5 travel lanes were able to be fully accommodated and re-striped around the construction area during this construction period, capacity on I-5 southbound would be reduced. Using precast cap beams across southbound I-5 would avoid the need for shoring towers, but would require multiple overnight and/or weekend closures. If I-5 southbound were closed, the likely detour route would use the Kent/Des Moines interchange to SR 99 and/or Military Road, with traffic re-routed back to I-5 at S 272nd Street. During off-peak periods and weekends, traffic volumes along these routes are generally lower than during peak commute periods, and detour routes would have additional capacity to accommodate some traffic from I-5. Vertical clearance during construction would be maintained on I-5. Construction vehicle access to the median construction area would be provided from northbound or southbound I-5.

SR 99 to I-5 Alternative

North of Kent-Des Moines Road, where the SR 99 to I-5 Alternative would be located on SR 99, impacts would be similar to those described 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 the same as with the I-5 Alternative, including for the Landfill Median Alignment Option. There would be no additional impacts on regional facilities between Kent-Des Moines Road and S 240th Street where the alternative transitions from SR 99 to I-5.

I-5 to SR 99 Alternative

North of Kent-Des Moines Road, where the I-5 to SR 99 Alternative would be the same as the I-5 Alternative, impacts would be the same as with the I-5 Alternative. South of S 240th Street, where the SR 99 to I-5 Alternative is located on SR 99, impacts would be similar to those described for the SR 99 Alternative. There would be no additional impacts on regional facilities between Kent-Des Moines Road and S 240th Street where the alternative transitions from SR 99 to I-5.

Potential Mitigation Measures

During FWLE construction, Sound Transit would work with WSDOT and the local agencies to develop a construction plan. This plan would coordinate construction activities, such as, incident management, construction staging, and traffic control where the light rail construction might affect either I-5 or SR 99. Sound Transit would also coordinate with WSDOT to disseminate construction closure information to the public as needed.

5.2.1.2 Transit

Construction Impacts

All alternatives would involve lane closures, bus stop relocations, partial or full temporary closures of park-and-ride facilities, and sidewalk impacts that would affect transit operations within the FWLE study area during construction. Impacts specific to each alternative are described in this section.

SR 99 Alternative

Bus operations on SR 99 would be affected in the construction areas by the decrease in road capacity and increase in delay that would result from the reduced number of lanes and use of the existing HOV lane for all vehicles. Buses along SR 99 would be less reliable, have increased travel times, and may have temporary service disruptions from increased congestion, 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. Service at the Redondo Park-and-Ride lot would be disrupted during construction of the S 272nd Redondo Station; however, bus routes serving this transit center could be relocated to the Star Lake Park-and-Ride during the S 272nd Redondo Station construction period. Bus service at the existing Federal Way Transit Center is not expected to be disrupted with the construction of the Federal Way Transit Center Station. Bus stops on SR 99 could be temporarily relocated during construction.

There would be similar transit impacts with any SR 99 Alternative station options except for the Kent/Des Moines SR 99 Median Station Option, which would require transit along northbound SR 99 to detour around the construction area, resulting in longer travel times.

I-5 Alternative

Construction activities along I-5 mainline are not expected to impact bus service. Construction of the S 272nd Star Lake Station at the Star Lake Park-and-Ride lot could result in temporary relocation of transit service, possibly to the Redondo Heights Park-and-Ride and/or the Kent-Des Moines Park-and Ride. The re-routed buses could incur additional travel time and lead to longer transit travel times for riders.

Bus service would also be impacted at the S 317th Street and 28th Avenue S intersection during construction. The guideway would be constructed under the existing roundabout at this intersection, and this intersection would be converted into a stop-controlled intersection, which could result in an increase in bus travel times.

There would be no change in transit impacts associated with any of the Kent/Des Moines station options. With the Landfill Median Alignment Option, closure of the inside shoulder of I-5 between S 240th Street and S 259th Place may result in slightly slower speeds in the HOV lane through this ½-mile segment. Night and weekend closures of I-5 for guideway girder placement across I-5 would require transit to use a detour route, resulting in longer transit travel times.

The Federal Way I-5 Station Option requires the S 317th Street and 28th Avenue S roundabout to be removed during construction. A phased long-term temporary closure of both 28th Avenue S and S 317th Street would be required, resulting in rerouting transit to either

S 312th Street or S 320th Street which would increase transit travel times. The Federal Way S 320th Street Park-and-Ride Station Option would require the temporary closure of the park-and-ride, and transit service would be rerouted to other transit centers, such as the Federal Way Transit Center. This could increase the travel time for those bus routes.

SR 99 to I-5 Alternative

North of Kent-Des Moines Road, where the SR 99 to I-5 Alternative would be located on SR 99, impacts would be similar to those described 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 the same as with the I-5 Alternative. There would be no additional transit impacts between Kent-Des Moines Road and S 240th Street.

I-5 to SR 99 Alternative

North of Kent-Des Moines Road, where the I-5 to SR 99 Alternative would be the same as the I-5 Alternative, impacts would be the same as with the I-5 Alternative. South of S 240th Street, where the SR 99 to I-5 Alternative is located on SR 99, impacts would be similar to those described for the SR 99 Alternative. There would be no additional transit impacts between Kent-Des Moines Road and S 240th Street.

Potential Mitigation Measures

Transit service modifications would be coordinated with King County Metro, Pierce Transit, and Sound Transit to minimize construction impacts and disruptions to bus facilities and service. This includes developing modified service plans to accommodate park-and-ride closures during construction of stations at those locations. During construction of alternatives within street rights-of-way, buses would either continue service on the street or would be rerouted to nearby roadways, where appropriate, to maintain transit service. Bus stops would be maintained in their existing location where possible, but in construction areas may need to be relocated. Access between the surrounding land uses and the bus stops would be maintained to the extent feasible. Other measures could include posting informative signage before construction at existing transit stops that would be affected by construction activities.

5.2.1.3 Arterial and Local Streets

Construction Impacts

With each of the FWLE alternatives, construction would require local road closures, lane closures, traffic detours, and property access

modifications and closures to maintain traffic flow. Streets that intersect the alternatives would require full and/or partial closures for short durations to construct the guideway or other associated features. If driveway closures are required, access to these properties would be maintained to the extent possible. If alternative access to a business is not available, then the specific construction activity would be reviewed to determine if it could occur during non-business hours.

Appendix G to the Transportation Technical Report (Appendix G1 to this Draft EIS) shows the potential construction staging areas and truck haul routes for each FWLE alternative and option. The peak number of truck trips is expected to occur during earthwork operations and during concrete delivery for both the guideway and station construction. For the elevated guideway construction, peak truck trips are estimated at 10 to 15 trucks per hour for the concrete delivery, or between 80 and 240 trips per day, assuming 8 to 16 hours per day of active construction. A similar level of truck activity is expected for earthwork activities, but this would be focused on trucks hauling material during excavation.

Generally, construction truck traffic would use SR 99 and, if required, local roadways to access the construction areas. There would be no direct access via the I-5 mainline except for the Landfill Median Alignment Option, although trucks may use I-5 for trips to/from other locations in the region. For these trips, access would be from existing interchange ramps. Specific local street impacts with each alternative are described in this section.

SR 99 Alternative

Construction of the guideway over roadways would occur at any of the arterial and local streets that intersect with SR 99 between S 200th Street and S 316th Street. Street crossings include 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, and S 316th Street. Depending on the type and length of guideway, these cross-street roadway and lane closures would likely occur overnight and/or over weekends and access would be maintained via detours. Detours would have impacts to traffic, bus transit, bicyclists, and pedestrians because the local roadway system, in general, provides only a limited number of detour routes along the corridor. Access modifications (such as only providing for right-in, right-out) would also occur on these roadways within the construction areas.

Construction impacts on SR 99 are previously described in Section 5.2.1.1.

Roads near the Federal Way Transit Center between S 308th Street and S 316th Street may have local street closures or access modifications that would extend for a longer duration due to the larger construction area required for this segment of the guideway.

Most station options would have similar construction impacts on local and arterial streets as already described except for the Kent/Des Moines SR 99 Median Station Option, which would require a complete reconstruction of SR 99 to widen the roadway for the median station. 30th Avenue S, which is currently a low-volume road, would be used as a detour route for northbound SR 99 traffic. Traffic would be routed from SR 99 to 30th Avenue S via S 240th Street. S 236th Lane 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, and traffic congestion would be expected. Drivers could potentially avoid this area by using other roads in the area and congestion could increase on those streets as well.

For station options that have portions of the guideway located in a trench, lane reductions would be required and temporary plates would be used to maintain traffic flow on cross streets over the trench for periods up to a year. Construction impacts for FWLE alternatives and station options with a trench would be longer in duration compared with guideway over-crossings.

For roads that have two or more lanes in each direction, at least one lane in each direction would be kept open during construction. Roads with one lane in each direction, such as S 220th Street and S 224th Street, may be closed for a portion of the civil construction period and vehicles rerouted to a nearby road. Drivers on these roads would likely have increased delays during this construction period. For the S 272nd Redondo Trench Station Option, the removal of one westbound left-turn lane at the intersection of SR 99 and S 272nd Street would likely be required during the civil construction period. The reduction in capacity associated with this closure would result in increased congestion and delays at this intersection.

Property access impacts would be similar for most station options except for the Kent/Des Moines HC from S 216th West Station Option and the S 272nd Redondo Trench Station Option. Construction of these options would require trenching adjacent to properties, and the use of temporary plates over the guideway would be required to maintain property access. Night and weekend closures may be required for placement of plates. If alternative access to a property is not available, then the specific construction activity would be reviewed to determine when it could occur. Highline College access would be provided from SR 99, either via S 240th Street or from the completion of the S 236th Lane extension.

The potential closure of the Redondo Heights Park-and-Ride during construction would change traffic circulation patterns around S 272nd Street. Vehicle trips would likely relocate to the Star Lake Park-and-Ride, and some intersections along SR 99 and S 272nd Street could have additional congestion.

I-5 Alternative

Construction of the guideway over or under local streets and arterials would be more limited with the I-5 Alternative but would still occur at S 208th Street, S 216th Street, Kent-Des Moines Road, S 259th Street, S 272nd Street, Military Road (two locations), S 288th Street, S 317th Street, and 23rd Avenue S. In general, construction activities would require weekend and nighttime road and lane closures except at S 216th Street and S 272nd Street. S 216th Street would require construction of a temporary bridge approach to maintain traffic across I-5 and may result in lane closures and detours for up to 6 months. At 272nd Street, plates would be required where the guideway crosses under the road, and one lane in each direction would be closed for up to one year. Because of the limited number of I-5 crossings, detour routes for weekend or nighttime closures would be fairly long and would likely use SR 99 or Military Road.

The roundabout at S 317th Street and 28th Avenue S would require reconstruction where the guideway crosses under the intersection. The intersection would be reconstructed in three phases and would temporarily convert the existing roundabout into a stop-controlled intersection. The temporary conversion of this intersection from a roundabout to a stop-controlled intersection would likely increase vehicle delay. Once the guideway construction is completed, the roundabout would be reconstructed in its current location.

Construction of the guideway and station near the Federal Way Transit Center would require temporary nighttime closures of 21st Avenue and 23rd Avenue during construction.

Construction access for the I-5 Alternative and station options would be provided via a temporary construction road adjacent to the guideway. Construction truck traffic would use I-5, SR 99 and local streets and arterials for haul routes. Direct access to the temporary construction road would be provided from arterials, local streets or I-5 interchange areas. No direct access would be provided from the I-5 mainline. The potential closure of the Star Lake Park-and-Ride during construction would change traffic circulation patterns around S 272nd Street. Vehicle trips would likely relocate to the Redondo Heights Park-and-Ride, and some intersections along SR 99 and S 272nd Street could have additional congestion.

There would be no changes in local street and arterial impacts for the Kent/Des Moines station options or the Landfill Median Alignment Option. For the Federal Way I-5 Station Option, the roundabout at S 317th Street and 28th Avenue S would be reconstructed in two phases. The first phase would close S 317th Street and traffic would reroute to S 312th Street or S 320th Street. The second phase would require the closure of 28th Avenue S. Each phase would last for approximately 6 to 9 months. For the Federal Way S 320th Street Park-and Ride Station Option, local arterial and street impacts would be less than the I-5 Alternative, as guideway construction would not impact 23rd Avenue S and 28th Avenue S.

SR 99 to I-5 Alternative

Impacts with the SR 99 to I-5 Alternative north of Kent-Des Moines Road would be the same as under the SR 99 Alternative. South of S 240th Street, impacts would be similar to the I-5 Alternative. 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 Lane. Traffic would likely be detoured to SR 99, with local property access maintained.

I-5 to SR 99 Alternative

Impacts with the I-5 to SR 99 Alternative north of Kent-Des Moines Road would be the same as under the I-5 Alternative. South of S 240th Street, impacts would be similar to the SR 99 Alternative. 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 Lane. Traffic would likely be detoured to SR 99, with local property access maintained.

Potential Mitigation Measures

All mitigation measures associated with constructing the FWLE would comply with local regulations governing construction traffic control and construction truck routing. Sound Transit would finalize detailed construction plans in close coordination with local jurisdictions and WSDOT during the final design and permitting phases of the project. Potential mitigation measures for traffic impacts due to light rail construction could include the following practices:

- Conform to the *Manual on Uniform Traffic Control Devices* (WSDOT, 2005) and jurisdictional agency requirements for all traffic plan maintenance.
- Clearly sign and provide reasonable detour routes when cross streets are closed for 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.
- Communicate public information through tools such as print, radio, posted signs, web sites, 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 spaces and users of this access (for example, deliveries) could be provided 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 during periods of higher traffic volumes as much as possible.
- Cover potholes and open trenches, where possible, and use protective barriers to protect drivers from open trenches.
- For the SR 99 Median Station Option, improve 30th Avenue S and S 236th Lane prior to the station construction to accommodate increased traffic from SR 99 when lanes are closed.

5.2.1.4 Safety

Construction Impacts

With each of the FWLE alternatives, traffic diversion and detours caused by light rail guideway construction would lead to additional traffic volumes on those facilities. The additional traffic volumes could lead to a potential increase in collision frequency; however, crash rates should remain similar to existing conditions. In locations where there is no physical change to the roadway, the types of crashes could also remain similar to existing conditions. Currently, the majority of crashes in the study area are property damage only.

SR 99 Alternative

As described in Sections 5.2.1.1 and 5.2.1.3, access modifications (such as right-in, right-out) and left-turn restrictions at intersections along SR 99 would occur in the construction areas. This would eliminate some vehicle conflicts at these locations. Detour routes would change the traffic circulation and could lead to driver confusion; increasing the potential for crashes. Strategic sequencing or construction phasing would minimize the potential safety impacts and be addressed in a Maintenance of Traffic Plan.

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

I-5 Alternative

The construction area for the I-5 Alternative would be located near the I-5 pavement edge in several locations. During construction, there would be temporary impacts to the clear zone along most of I-5 southbound through the study area, but in particular south of Kent-Des Moines Road. Where the light rail alignment is parallel to 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. This temporary construction barrier would be present for the duration of guideway construction, approximately 1 to 4 years. During this period, an increase of up to four crashes per construction year could be expected. The majority of these crashes would likely be property damage only based on the severity distribution of the existing crash history. Current I-5 travel lane and shoulder widths would be maintained during construction.

Converting the S 317th Street and 28th Avenue S roundabout to a temporary stop-controlled intersection would increase the potential for crashes. The roundabout has a low crash frequency (three crashes over 5 years). The Highway Safety Manual suggests that converting a roundabout to a stop-controlled intersection could increase the potential for crashes by up to 65 percent during the construction period.

Landfill Median Alignment Option

The I-5 Alternative station options would have the same safety impacts as the I-5 Alternative, except for the Landfill Median Alignment Option. Construction of the guideway with this option would require short-term, temporary narrowing of the inside shoulder to provide adequate construction space between approximately S 240th Street and S 252nd Street, over approximately 4 to 6 months. Temporary barriers during construction would be placed along the median for northbound and southbound I-5. Also, as mentioned in Section 5.2.1.1, if cast-in-place construction methods are used, a shoring tower may be needed within southbound I-5 mainline to support the straddle bents. To safely accommodate vehicles around this tower, either closing one to two lanes or re-striping southbound I-5 mainline travel lanes around the construction area would be coordinated with and agreed to by WSDOT. The addition of a fixed object in the roadway could increase the crash potential; however, this construction area would be designed to minimize any safety impacts.

Potential Mitigation Measures

Potential safety mitigation measures along local streets and arterials are previously described in Section 5.2.1.3. With FWLE alternatives

near I-5, potential mitigation measures include placing 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. Additional mitigation measures that address safety on regional facilities are described in Section 5.2.1.1.

5.2.1.5 Parking

Construction Impacts

Parking by construction workers would be provided within the construction area where possible. Construction worker parking could also occur on local streets and arterials where parking is unrestricted. Construction workers parking near designated construction staging areas could affect the nearby parking supply during heavy construction periods. Contractors are generally responsible for providing parking for construction workers where necessary. It is expected that some worker parking could be accommodated at the staging areas and along the alignment construction area.

SR 99 Alternative

During construction, loss of available parking at the Redondo Heights Park-and-Ride is expected. The existing park-and-ride facility would be partially or fully closed while the parking structure is constructed. The facility is currently underused, with less than 10 percent (approximately 60 spaces) being used. The Star Lake Park-and-Ride has enough capacity (approximately 240 spaces available) to accommodate any displaced riders with the closure of the Redondo Heights Park-and-Ride.

There is no on-street parking allowed along the length of SR 99. Available on-street parking is generally located in neighborhoods east and west of SR 99 and would not likely be affected by construction activity. There would be no additional parking impacts with any of the station options, except for the Kent/Des Moines HC Campus Station Option. During FWLE construction and operation, some Highline College student parking would be removed from a highly utilized Highline College parking lot. Permanent replacement parking for Highline College would be provided by Sound Transit prior to station construction.

I-5 Alternative

There is limited on-street parking along the length of the I-5 Alternative. The same on-street parking stalls identified in Section

3.4.5, generally located in neighborhoods west of I-5 in the Kent/Des Moines Station area, would be removed during construction.

Loss of parking spaces at the Star Lake Park-and-Ride is expected during construction. The existing park-and-ride is 60 percent used today, with over 300 of the 540 parking stalls being occupied. The park-and-ride would be partially or fully closed during the construction period while the station and parking structure are being built. If bus service was rerouted to the Redondo Heights Park-and-Ride, this location would have enough capacity (approximately 640 spaces) to accommodate the displaced riders from the Star Lake Park-and-Ride. There would be no additional parking impacts with any of the station options except the Federal Way S 320th Park-and-Ride Station Option. The existing S 320th Park-and-Ride is currently 45 percent used, with almost 400 of the 877 parking stalls typically occupied. The existing park-and-ride would be partially or fully closed during the construction period while the station and parking structure are being built. Displaced riders would need to use the Federal Way Transit Center, which is currently at capacity, or other facilities that are under capacity, such as the Star Lake Park-and-Ride.

Construction worker parking would be similar between all station options except the I-5 Landfill Median Option. No construction worker parking would be allowed in the I-5 median.

SR 99 to I-5 Alternative

Impacts north of Kent-Des Moines Road would be the same as for the SR 99 Alternative described above. South of S 240th Street, impacts would be the same as for the I-5 Alternative described above, including impacts at the Star Lake Park-and-Ride. There would be no additional impacts between Kent-Des Moines Road and S 240th Street.

I-5 to SR 99 Alternative

Parking impacts north of Kent-Des Moines Road with the I-5 to SR 99 Alternative would be the same as under the I-5 Alternative described above. South of S 240th Street, impacts would be the same as for the SR 99 Alternative described above, including impacts at the Redondo Heights Park-and-Ride. No additional impacts between Kent-Des Moines Road and S 240th Street are expected.

Potential Mitigation Measures

Depending on the alternative and station options, the existing Star Lake, Redondo Heights, or S 320th Street park-and-ride lots could be

fully closed. Measures to mitigate the loss of parking at these locations 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.

5.2.1.6 Nonmotorized Facilities

Construction Impacts

All alternatives would either close sidewalks or reduce the sidewalk width within the construction areas. Impacts specific to each alternative are described in this section.

SR 99 Alternative

There would be some impact on nonmotorized travel (pedestrians and bicyclists) with constructing the elevated guideway along SR 99. Wherever feasible, sidewalks would remain open in the construction areas. Protected sidewalks next to the construction area would be provided when detour routes are not feasible. Short sections of sidewalks may need to be closed 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. Bicycle routes and lanes adjacent to the construction areas, such as those located along S 216th Street, may be temporarily removed during construction.

Crosswalks located at signalized intersections would remain open, except when SR 99 or side streets are temporarily closed. The midblock pedestrian crossing north of Kent-Des Moines Road would be closed during the construction period in that area and would require pedestrians to detour to another crossing.

Near the Kent/Des Moines Station area, S 236th Lane would be built prior to station construction to provide an additional SR 99 pedestrian crossing that would minimize pedestrian impacts near the Highline College campus if sidewalks are temporarily closed. In addition, a protected pedestrian pathway along S 236th Lane or S 240th Street would be constructed to provide access between the Highline College

campus and SR 99. During construction of the S 272nd Redondo Station, sidewalks on the east side of SR 99 may be closed or a protected sidewalk would be provided next to the station. Sidewalks would remain open at the two signalized intersections on SR 99 adjacent to the station area, S 272nd Street and S 276th Street. During the Federal Way Transit Center Station construction, sidewalks would be maintained, except along short portions of 20th Avenue S, 21st Avenue S, and 23rd Avenue S where the sidewalks may be temporarily closed or a protected sidewalk would be provided through the construction area.

Similar impacts on nonmotorized facilities would occur for all other station options except for Kent/Des Moines station options. For the SR 99 Median Station Option, sidewalks would likely be closed on one side of SR 99 during construction. The Kent/Des Moines HC Campus Station Option and Kent/Des Moines HC from S 216th West Station Option would have impacts similar to the SR 99 Alternative, except that the midblock pedestrian crossing on SR 99 between S 226th Street and Kent-Des Moines Road would remain open. Similar to the SR 99 Alternative, a protected pathway along S 236th Lane or S 240th Street would be provided to facilitate pedestrian movement between the Highline College campus and SR 99 through the construction area. Sidewalks along SR 99 between S 226th Street and Kent-Des Moines Road would remain open with the Kent/Des Moines HC Campus Station Option. The Kent/Des Moines SR 99 East Station Option would likely not close sidewalks in the vicinity of the Highline College campus and pedestrian movement to and from the Highline College campus should not be impacted. For all the station options described above, S 236th Lane would be initially constructed to provide an additional pedestrian crossing across SR 99. With the Federal Way SR 99 Station Option, no impacts would occur on 20th Avenue S, 21st Avenue S, and 23rd Avenue S. For other options, the nonmotorized impacts would be similar to the SR 99 Alternative.

I-5 Alternative

Nonmotorized travel could be affected in the vicinity of station areas during construction as well as from construction of the elevated guideway over arterials and local streets. The limited number of I-5 crossings currently restricts the pedestrian and bicycle activity in the study area. Therefore, existing nonmotorized facilities across I-5 would be maintained to the extent feasible.

The nonmotorized impacts associated with the station or alignment options would be similar to each other, except with the Federal Way I-5 Station Option and S 320th Park-and-Ride Station Options. The Federal Way I-5 Station Option would have similar impacts as the I-5 Alternative, except no nonmotorized impacts would occur on 23rd Avenue S and portions of Gateway Center Boulevard may have sidewalk closures. The Federal Way S 320th Park-and-Ride Station Option would have similar impacts as the I-5 Alternative north of S 317th Street. With this station option, no nonmotorized impacts would occur near the existing Federal Way Transit Center.

SR 99 to I-5 Alternative

Impacts north of Kent-Des Moines Road with the SR 99 to I-5 Alternative would be the same as with the SR 99 Alternative. South of S 240th Street, impacts would be the same as with the I-5 Alternative. Between Kent-Des Moines Road and S 240th Street, no additional nonmotorized impacts are identified.

I-5 to SR 99 Alternative

Impacts north of Kent-Des Moines Road with the I-5 to SR 99 Alternative would be the same as with the I-5 Alternative described above. South of S 240th Street, impacts would be the same as with the SR 99 Alternative described above. Between Kent-Des Moines Road and S 240th Street, no additional nonmotorized impacts are identified.

Potential Mitigation Measures

Most of the nonmotorized impacts during construction would be related to the closure of sidewalks along SR 99 and other arterial and local streets. Sound Transit would minimize potential impacts on pedestrian and bicycle facilities by providing detours within construction areas, such as protected walkways, and notify the public as appropriate.

5.2.1.7 Freight Mobility and Access

Construction Impacts

For all alternatives, impacts on freight truck movements would be approximately the same as impacts to general traffic, described in Sections 5.2.1.1 and 5.2.1.3.

The SR 99 lane closures within the construction areas could temporarily affect freight mobility in a manner similar to the general traffic. When partial lane closures are necessary during construction on SR 99, the intended purpose of any provided detour routes is to

provide an alternate route for general purpose traffic. It is expected that freight would continue to travel on SR 99 or on other designated freight corridors. Temporary closures of access for businesses could also occur, affecting freight (such as deliveries). If driveway closures are required, access to these properties would be maintained to the extent possible. With driveway closures, detours for freight would be treated similar to what is described for the general traffic.

With the I-5 Alternative, some of the short-term (nights and weekends) I-5 interchange ramp closures at Kent-Des Moines Road and S 272nd Street would affect freight. In addition, freight would be affected with the S 320th Park-and-Ride Station Option as a short-term (nights and weekends) southbound on-ramp closure at the S 320th Street interchange would be required. This would require rerouting or rescheduling of freight trips during these periods. Detour routes for freight would need to be approved by affected jurisdictions.

Construction activities with the Landfill Median Alignment Option could have short-term travel impacts on freight movement because of increased congestion on I-5 or along any detour routes.

Potential Mitigation Measures

To minimize potential freight impacts, Sound Transit would coordinate with affected businesses throughout the construction period to notify them of lane and/or access closures and maintain business access as much as possible.

For any construction activities that might have possible I-5 impacts, Sound Transit would provide construction information to WSDOT for use in the state's freight notification system. Sound Transit would provide information in a format required by WSDOT.

5.2.2 Acquisitions, Displacements, and Relocations

5.2.2.1 Construction Impacts

Property impacts during construction would consist of staging area acquisition and temporary construction easements. Staging areas would be accommodated within areas permanently needed for right-of-way wherever possible, reducing the need for additional properties to be acquired. In areas where the land is more heavily developed, primarily along SR 99, additional property acquisition for staging areas may be required. The land could be used for a range of construction activities, including equipment storage, work coordination, and contractor offices. The contractor might lease or

make arrangements for additional staging areas if needed. The staging areas identified in this Draft EIS are preliminary and could be refined during final design.

Temporary construction easements would also be needed along each of the project alternatives to allow for project construction. Construction easements are temporary uses of adjacent property during construction and would be required in numerous locations along the alignment. In undeveloped land areas, easements would be necessary to maneuver equipment and materials during construction. Where the project would follow an existing transportation corridor, construction activities might require narrow temporary easements from adjacent properties. Following construction, easements would be returned to preconstruction conditions.

5.2.2.2 Potential Mitigation Measures

No temporary impacts related to property acquisition were identified; therefore, no mitigation measures are required.

5.2.3 Land Use

5.2.3.1 Construction Impacts

Impacts Common to All Alternatives

Potential construction impacts on the existing land use in the FWLE study area include temporary land use impacts resulting from construction easements and staging areas, and noise, air emissions, visual changes, and traffic congestion. Although some businesses may experience hardship during construction, these effects 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, including Transportation, Economics, Visual and Aesthetics, Air Quality, and Noise and Vibration.

Where an alignment displaces all or most buildings on a property and the occupants, the entire property would typically be purchased and could be used for staging. Some parcels would be acquired for the project but only a portion of the property would be used. Following construction, redevelopment of the remaining parcels would occur consistent with land use zoning for the parcels.

Construction would also require easements beyond the property acquisitions needed within the project limits, as discussed in Section 5.2.2. These easements might affect portions of property on residential, commercial, industrial, and public properties throughout

the study area. The easements are temporary and the affected property would be restored upon construction completion in accordance with the terms of the temporary construction easement.

Impacts by Alternative

SR 99 Alternative

For the SR 99 Alternative and its options, most staging would occur within the alignment and station footprint.

I-5 Alternative

North of S 240th Street, staging would primarily occur from property within the project footprint or on adjacent properties using temporary construction easements. Some work may occur from within the I-5 and future SR 509 right-of-way owned by WSDOT. From S 240th Street to S 317th Street, construction activities would occur primarily within the I-5 right-of-way, except for where the alignment exits the right-of-way for the S 272nd Star Lake Station. Temporary construction easements may be needed on some adjacent properties along the alignment. South of 317th Street, staging would occur within the project footprint. For the S 320th Park-and-Ride Station Option, construction impacts would extend to approximately S 324th Street but would remain in I-5 right-of-way until reaching the existing park-and-ride property.

SR 99 to I-5 Alternative

For the SR 99 to I-5 Alternative and its options, most staging would occur within the alignment and station footprint north of S 240th Street. From S 240th Street to S 317th Street, construction activities would occur primarily within the I-5 right-of-way, except for where the alignment exits the right-of-way for the S 272nd Star Lake Station. Temporary construction easements may be needed on some adjacent properties along the alignment. South of 317th Street, staging would occur within the project footprint. For the S 320th Park-and-Ride Station Option, construction impacts would extend to approximately S 324th Street but would remain in I-5 right-of-way until reaching the existing park-and-ride property.

I-5 to SR 99 Alternative

North of S 240th Street, staging would primarily occur from property within the project footprint or on adjacent properties using temporary construction easements. Some work may occur from within the I-5 right-of-way owned by WSDOT. South of S 240th Street, most staging would occur within the alignment and station footprint for this alternative and its options.

5.2.3.2 Potential Mitigation Measures

Although Sound Transit cannot minimize all disturbances to adjacent land uses during construction, impacts would not be expected to cause substantial changes in land use. Therefore, 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 such as the influx of money into the economy from construction jobs, purchasing of local goods and services for construction, and the 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

The value of construction labor and materials to make the improvements would be subject to state and local sales tax for the duration of the FWLE construction. The revenues from local sales tax on construction accrues to local jurisdictions based on the location of the construction activity. The sales tax would be levied on taxable retail sales in the project corridor at a total rate of 9.5 percent, of which the city component – SeaTac, Des Moines, Kent, or Federal Way – is approximately 0.85 percent. King County would receive 0.15 percent of all taxable activities that occur within county boundaries.

Based on the current conceptual design, construction of the FWLE is expected to cost between $856 million and $1.31 billion (in 2014 dollars), depending on which alternative and options are selected. The project is expected to take approximately 4 years to build.

In Washington state, construction costs, including labor and materials, are subject to retail sales tax (Revised Code of Washington 82.04.050 and Washington Administrative Code 458-20-170). As of July 1, 2008, tax revenues collected are based on the construction job site, not on the vendor's location. While not all construction costs would be subject to retail sales tax, a reasonable estimate, given statewide experience with construction activities, is that 90 percent of project costs would be subject to retail sales tax. Based on this assumption, approximately $193 to $295 million a year in

construction spending would generate tax revenue for the affected cities combined.

By comparison, the Washington State Department of Revenue reports that in 2013 the combined taxable retail sales of SeaTac, Des Moines, Kent and Federal Way were $4.2 billion, generating $35.8 million in tax to the cities. From the combined cities' perspective, an additional $193 to $295 million per year of taxable sales would represent roughly 4 to 7 percent of the combined cities' taxable retail sales, thereby generating approximately $1.6 to $2.5 million in additional sales tax revenue per year across all cities.

According to the multiplier tables in the Washington State Input-Output economic model, $1 million of highway construction activity is estimated to generate 12 jobs. As shown in Table 5-1, it is estimated that construction of FWLE would generate between approximately 8,900 and 13,600 direct jobs over the life of the project, based on the current cost estimate. The majority of the activity would occur within the Puget Sound Region.

TABLE 5-1
Direct Expenditures and Total Employment Stateside from FWLE Construction

Cost Estimates and Employment	Project Construction[a]
High-cost Estimate[b]	
Direct Expenditures	$1,310,000,000
Total Employment (Direct and Indirect)	13,600
Annual Employment (Direct and Indirect)	3,400
Low-cost Estimate[c]	
Direct Expenditures	$856,400,000
Total Employment (Direct and Indirect)	8,900
Annual Employment (Direct and Indirect)	2,200

[a] Does not include right-of-way or engineering 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 I-5 Alternative with the Kent/Des Moines At-Grade Station Option and the Federal Way I-5 Station Option.

A job that is created by a transportation investment should not necessarily be viewed as a *new* job to the region. If FWLE construction funds entered the regional economy through other channels (for example, through different transportation investments) or if they were spent by households or businesses, then the effects of that money being spent could be similar to the job-creating effects being

attributed to 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. Therefore, 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

Businesses within the study area near the construction of the FWLE could also be negatively affected by the construction activity. Negative impacts to businesses may include reduced sales resulting from changes in traffic, access, parking, visibility, dust, and noise, because patrons may choose to avoid construction areas or have greater difficulty accessing retail businesses near construction activity. This type of impact affects retail businesses most directly, with associated loss in sales tax revenues to local jurisdictions. The extent and duration of the interference, the location of competitors, and the type of affected business would all influence the magnitude of economic effects to local businesses resulting from construction. Impacts specific to each alternative are described in this section.

SR 99 Alternative

The SR 99 transportation corridor has many small and medium-sized businesses located adjacent to the highway. Construction along SR 99 may result in lane closures and temporary left turn restrictions. The impacts on local and business traffic would be greater along this corridor than the I-5 Alternative corridor. There would likely be periods of time when there are access and noise impacts on adjacent businesses. This would be particularly true at the large construction areas, such as station areas. There are approximately 350 businesses along the SR 99 Alternative that could be affected by construction at some point. Of these, about 300 are retail, 40 are office, and 10 are industrial. Station options for this alternative that would be on the side of SR 99 would generally have similar or fewer impacts, while the Kent/Des Moines SR 99 Median Station Option and the Federal Way SR 99 Station Option would increase these potential impacts slightly.

I-5 Alternative

Construction along I-5 would result in fewer impacts on local traffic patterns, which affect local businesses, than the SR 99 Alternative except where the alignment would be outside of the I-5 right-of-way. There are also fewer businesses along the I-5 corridor that could be affected by construction. Approximately 60 businesses, almost all of which are retail, along the I-5 Alternative could be affected by construction. The Kent/Des Moines station options would have similar impacts, but the Federal Way City Center station options would disrupt less than approximately 10 businesses each, by staying closer to I-5 and further away from the city center. As a result, economic impacts on businesses would also be less.

SR 99 to I-5 Alternative

The SR 99 to I-5 Alternative would likely have fewer impacts on local businesses along SR 99 than the SR 99 Alternative, but more overall impacts on local businesses than the I-5 Alternative. Where this alternative would be located on SR 99, construction would result in lane closures and turn restrictions, limiting access and affecting local traffic patterns, particularly in the Kent/Des Moines area. There would be approximately 120 businesses along the SR 99 to I-5 Alternative that could be affected by construction. Of these, about 100 are retail; the rest are mostly office.

I-5 to SR 99 Alternative

The I-5 to SR 99 Alternative would have fewer impacts on local businesses along SR 99 than the SR 99 Alternative, but more overall impacts on local businesses than the I-5 Alternative. Where this alternative would be located on SR 99, construction would result in lane closures and turn restrictions, limiting access and affecting local traffic patterns, particularly in the Kent/Des Moines area. There would be approximately 280 businesses along the I-5 to SR 99 Alternative that could be affected by construction. Of these, about 240 are retail; the rest are mostly office.

5.2.4.3 Potential Mitigation Measures

To minimize the negative impacts to retail businesses, Sound Transit would dedicate staff to work specifically with affected businesses and develop a construction mitigation plan to address the needs of businesses within the study area. Actions in the plan could include, but are not limited to, the following elements:

- 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 measures such as meetings and construction updates, alerts, and schedules.
- Implement promotion and marketing measures to help affected business districts maintain their customer base during construction.
- Maintain access to each business as much as possible and coordinate with businesses during times of limited access.
- Provide a community ombudsman.

Open For Business Signage

5.2.5 Social, Community, and Neighborhoods

5.2.5.1 Construction Impacts

Construction would temporarily affect neighborhood quality in nearby areas. Activities related to building the project would include the presence and movement of equipment and materials, clearing and exposure of soils, introduction of lights for nighttime work, storage of construction materials, and 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 during construction. Adjacent neighborhoods may experience increased difficulty accessing residential, commercial, and office properties because of road closures, construction equipment, and elevated guideway or trench construction activities that could affect movement. Roadway closures or lane closures could result in detours and cut-through traffic through neighborhoods and community facilities. Access to construction areas along I-5 for alternatives along I-5 and for the Kent/Des Moines HC Campus Station Option and S 272nd Redondo Trench Station Option along SR 99 may be required from neighborhood streets adjacent to these alignments. Emergency

access points that would be created along I-5 for the I-5 and SR 99 to I-5 alternatives could also be used for construction access. Where these locations occur in neighborhoods, access would be limited to light trucks and vehicles. Heavy trucks and construction equipment access to the right-of-way would be limited to arterial roadways. All access would be coordinated with WSDOT and the local jurisdiction, and all appropriate permits would be required for use of local roadways.

Construction would also require a substantial amount of earthmoving for the trench portions of the alternatives and options. The average number of truck trips per day and per hour for each alternative is discussed in Section 5.2.1. Haul trucks are expected to arrive and depart from I-5 and SR 99 to access local construction sites.

Although some residents and businesses in the immediate construction area would experience impacts and cohesion may be temporarily affected, the overall neighborhood cohesion would not be permanently affected. Sound Transit would minimize construction-related parking and travel in the adjacent residential neighborhoods.

In general, Sound Transit would maintain access to adjacent properties and prevent barriers to social interaction during construction to the extent possible. Because the FWLE primarily follows major transportation corridors, short-term effects on pedestrian and vehicular circulation are not considered a barrier to interaction because they would not prevent movement within any neighborhoods. Noise, dust, and congestion may affect the use of some community resources, and to some extent, the quality of the neighborhood's edges would be reduced for a period of time.

Although the project would not result in the loss of public recreation facilities, there would be short-term impacts on some facilities as described in Section 5.2.18, Parks and Recreational Resources. These short-term impacts would primarily be felt by those near the facilities and would not result in permanent adverse impacts on the surrounding neighborhoods.

5.2.5.2 Potential Mitigation Measures

During construction, Sound Transit would use advertisements and signage to help businesses remain accessible, and would continue to perform public outreach (i.e., public involvement meetings, website, and a toll-free telephone number) to allow residents and businesses to voice their concerns and enable Sound Transit to respond to those

concerns. Other measures that could mitigate impacts on community resources and neighborhoods during construction are described in detail in other parts of Section 5.2, including Sections 5.2.1, Transportation; 5.2.2, Acquisitions, Displacements, and Relocations; 5.2.3, Land Use; 5.3.4, Economics; 5.2.6, Visual and Aesthetics; 5.2.7, Air Quality; 5.2.8, Noise and Vibration; and 5.2.18, Parks and Recreational Resources. No additional mitigation measures related to social impacts, community, and neighborhoods would be required.

5.2.6 Visual and Aesthetics

5.2.6.1 Construction Impacts

Construction of the FWLE would result in temporary changes on the visual environment. The removal and demolition of existing buildings, paved areas, roads, landscaping, and vegetation along and near SR 99 and/or along the I-5 corridor would change the visual environment for varying periods of time during construction. Other possible construction-related impacts include staging and storing material and equipment; using equipment and resulting noise, light, and potential glare; detours; delivery of construction materials; and removal of debris. Most of these activities would not occur near sensitive viewers, but some would, and would be noticed by sensitive viewers for varying periods of time.

5.2.6.2 Potential Mitigation Measures

During construction, Sound Transit would provide visual screening for station construction in locations adjacent to residential areas if requested by local jurisdictions. Visual screening for these areas could include construction of a solid barrier to screen ground-level views into the construction area. When possible, Sound Transit would preserve existing vegetation to assist in screening views. The decision whether to revegetate disturbed areas following construction would be determined based on future use of lands outside the trackway. Nighttime construction lighting would be shielded and directed downward to avoid light spillover onto adjacent sensitive uses. Construction barriers could incorporate pedestrian-oriented murals or other displays of graphic interest. These displays could be integrated with public notifications of detours, areas to be closed, and the access routes for the public. Sound Transit would comply with the construction measures required by local jurisdictions related to controlling dust, noise, and light.

5.2.7 Air Quality

5.2.7.1 Construction Impacts

During construction, the release of particulate emissions (airborne dust) associated with site preparation, fill operations, and roadway improvements is anticipated to be the primary cause of potential short-term air quality impacts from the FWLE. A multitude of types of equipment would be required, and related impacts are described qualitatively below. Increases in air pollutant emissions from construction are considered temporary impacts.

Construction equipment is expected to produce carbon monoxide (CO), particulate matter (PM), nitrogen oxide (NOx), and volatile organic compound (VOC) emissions. Site preparation and roadway construction would involve clearing, cut-and-fill activities, grading, removing or improving existing roadways, and paving roadway surfaces.

Construction-related impacts on air quality would be greatest during the site preparation phase 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 construction-related activities would temporarily generate particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and small amounts of CO, sulfur dioxide (SO_2), 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, which would be an additional source of airborne dust after it dries. PM_{10} and $PM_{2.5}$ emissions would vary from day to day, depending on the nature and magnitude of construction activity 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 from the construction site.

In addition to PM_{10} and $PM_{2.5}$ emissions, heavy trucks and construction equipment powered by gasoline and diesel engines would generate CO, SO_2, NO_x, and VOCs in exhaust emissions. If construction traffic were to reduce the speed of hauling trucks and other vehicles in the area, CO emissions from traffic would increase slightly while those vehicles are delayed. These emissions would be

temporary and limited to the immediate area surrounding the construction site. SO_2 is generated by oxidation during combustion of organic sulfur compounds contained in diesel fuel. Some phases of construction, particularly asphalt paving, would result in short-term odors from VOC in the immediate area of paving sites. Such odors would be quickly dispersed below detectable thresholds as distance from the site 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 of the fossil fuel used during construction would be diesel. The carbon dioxide equivalent (CO_{2e}) factor for diesel used in the GHG analysis is from The Climate Registry General Reporting Protocol (The Climate Registry, 2008).

The amount of GHG emissions produced by fossil-fueled construction equipment is directly proportional to the quantity of fuel used. The estimate of construction fuel consumption for FWLE 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, associated parking lots, and a representative maintenance facility

This analysis compared the total CO_{2e} emissions for the overall low- and high-cost project scenarios. Table 5-2 shows the range of the GHG emissions for constructing the project. The highest potential GHG emissions for the FWLE would result from building the high-cost alternative, and the lowest GHG emissions would result from building the low-cost alternative. The estimated energy consumption for the low- and high-cost alternatives is approximately 3.5 trillion British thermal units (Btu) and 5.8 trillion Btu, respectively. The high-cost alternative is estimated to consume approximately 160 percent as much energy during construction as the low-cost alternative. In comparison, the construction of the low-cost alternative would be the equivalent of adding 6,721 typical passenger vehicles to the road, and

construction of the high-cost alternative would be the equivalent of adding 10,998 typical passengers to the road (U.S. Environmental Protection Agency, 2014).

TABLE 5-2
CO_2e Emissions for Construction of Full-Length Project

Alternative	Energy Consumption (MMBtu)	Tons of CO_2e
High-cost Alternative[a]	5,355,496	52,238
Low-cost Alternative[b]	3,272,166	31,923
Potential difference in CO_2e	Not Applicable	20,315

[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 I-5 Alternative with the Kent/Des Moines At-Grade Station Option and the Federal Way I-5 Station Option.
MMBtu = million British thermal units

5.2.7.2 Potential Mitigation Measures

For construction impacts, Puget Sound Clean Air Agency (PSCAA) regulates particulate emissions (in the form of fugitive dust). Any emission of fugitive dust requires the use of best practices to minimize impacts. The general policy of PSCAA is to prevent and reduce fugitive dust resulting from construction activities so as not to injure human health, plants and animals, or property, and so as not to unreasonably interfere with the enjoyment of life and property. To comply with PSCAA policy of preventing air quality degradation, the following potential mitigation measures may be used as necessary and in accordance with standard practice to control PM_{10} and $PM_{2.5}$, and emissions of CO and NO_X during construction of the project. Several of these measures would also reduce GHG emissions and mobile source air toxics.

- Spray exposed soil with a dust control agent as necessary 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 that would be carried off site by vehicles and to decrease particulate matter on area roadways where needed.
- Remove the dust and mud that are deposited on paved public roads to decrease particulate matter.

- 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 practical.
- Require appropriate emission-control devices on all construction equipment powered by gasoline or diesel fuel to reduce CO and NO_X emissions in vehicular exhaust.
- Use well-maintained heavy equipment to reduce CO and NO_X emissions, which may also reduce GHG emissions.
- Cover, install mulch, or plant vegetation as soon as practical after grading to reduce windblown particulates in the area.

The following other readily available mitigation measures could potentially be used:

- 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 of newer construction equipment and proper maintenance of this equipment. Use of low-sulfur diesel fuel controls emissions of SO_2. SO_2 and NO_X emissions are considered precursors to $PM_{2.5}$ emissions; therefore, reductions in SO_2 and NO_X would also help reduce $PM_{2.5}$ emissions. All construction activities would comply with local regulations governing air quality, including those for controlling fugitive dust during construction.

5.2.8 Noise and Vibration

Noise and vibration impacts during construction would be similar for all alternatives because construction equipment would be fairly similar for all alternatives. The degree of noise and vibration impacts depends on the proximity of sensitive receivers to the construction activity, and are not quantified in this analysis because of the variability in how the project could be constructed and what specific equipment would be used in a given location.

5.2.8.1 Noise

Construction Impacts

Noise related to construction would result from the operation of heavy equipment needed to construct the project. State and local ordinances regulate construction noise, and the contractor would be required to adhere to these regulations.

In the City of SeaTac, construction noise is prohibited between the hours of 10:00 p.m. and 7:00 a.m. on weekdays and 10:00 p.m. and 9:00 a.m. on weekends. In the cities of Des Moines and Kent, construction activities are exempt from the maximum permissible environmental noise level requirements between the hours of 7:00 a.m. and 10:00 p.m. on weekdays and 9:00 a.m. and 10:00 p.m. on weekends. In the City of Federal Way, sounds originating from construction sites and activities are similarly exempt between 7:00 a.m. and 8:00 p.m. on weekdays and 9:00 a.m. and 8:00 p.m. on weekends.

There are exemptions for short-term noise exceedance based on the minutes per hour that the noise limit is exceeded (Table 5-3). These exemptions are valid in the Cities of Des Moines, Kent, and Federal Way only. 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.

It is expected that nighttime construction work could be required or preferred to minimize lane closures and traffic disruptions, and to speed construction time. Nighttime construction in any of the jurisdictions would require a noise variance from those jurisdictions. Noise variances typically limit noise levels and construction times depending on the land use in the area and type of construction required.

This section provides a general understanding of average and worst-case noise levels from construction. Because of the varying types of construction activities, the location of noise-sensitive properties,

distances from construction sites and staging areas to noise-sensitive properties, and other construction-related variables, it is not possible to provide exact construction noise levels.

Several construction phases would be required to complete the FWLE, as described in Section 5.1. Using reference noise levels from the typical construction equipment necessary to complete the civil construction phases defined in Table 5-4, and accounting for the amount of time that the equipment is in operation, worst-case construction noise levels were projected for three scenarios. The results of these projections are provided in Table 5-4.

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.
dBA = A-weighted decibels

The table includes a listing of the typical construction equipment used for the noise projections. The actual noise levels that could be expected during construction would generally be lower. The noise levels discussed here are for periods of maximum construction activity and are considered worst-case for the major phases of construction, measured at a distance of 50 feet from the construction site.

Pile installation might be required at some locations along the corridor for construction of elevated profiles and bridges, and might also occur in trenched areas. Piles can be installed using a standard pile-driver, which produces an impact noise up to 105 dBA. The use of an augur instead of a pile-driver would greatly reduce the noise levels related to pile installation.

Potential Mitigation Measures

Noise from project construction would be required to meet the local noise control regulations. Most daytime construction activities are provided exemptions from the noise control ordinances. When required, Sound Transit or its contractor would seek the appropriate noise variance from the local jurisdiction. Sound Transit would control nighttime construction noise levels by applying noise level limits established through the variance process, and 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 mitigation 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 aboveground jack-hammering and impact pile-driving during nighttime hours.
- 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.

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

5.2.8.2 Vibration

Construction Impacts

The level of vibration produced by project construction is dependent on the equipment and methods employed. Construction vibrations, depending on the magnitude, have the potential to affect vibration-sensitive equipment, produce rumbling or groundborne noise, and, in extreme cases, to cause damage to buildings. The major sources of construction vibration would include impact pile-driving, augered pile construction, and vibratory rollers. Generally, construction vibrations are assessed at locations where prolonged annoyance or damage could be expected.

In most cases, the main concern for construction vibration is potential damage to structures. Most construction processes do not generate high enough vibration levels to approach damage criteria. The thresholds for building damage are 1 to 2 orders of magnitude higher than 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 cause building damage is impact pile driving within 25 feet of structures. There are many alternatives to impact pile driving, including sonic pile driving and augered or drilled pile construction. Specific locations of piles would not be available until final design, but would likely include the locations of elevated structures or retained cuts. As specific locations of piles are developed, more analysis would be conducted to assess specific impacts. To prevent damage, care would be taken not to pile-drive close to buildings, where possible.

Table 5-5 shows the typical distances at which groundborne vibration annoyance would occur for both single-family residences and large masonry buildings for each type of construction equipment. Impacts from pile driving would only occur at locations where piling is planned. 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.

TABLE 5-5
Typical Distances from Sources to Vibration Impact

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

For more detailed information on construction-related vibration, see Appendix G3, Noise and Vibration Technical Report.

Potential Mitigation Measures

Measures to minimize short-term annoyance from groundborne vibration and groundborne noise related to project construction include use of alternate methods that result in less vibration, such as auger cast piles or drilled shafts in place of driven piles, or use of static roller compactors rather than vibratory compactors. The hours and durations of these types of activities can also be restricted to daytime hours when vibrations and noise are less noticeable. Sound Transit would consider monitoring vibration levels for pile-driving, vibratory sheet installation, and other construction activities that have the potential to cause high levels of vibration.

5.2.9 Water Resources

5.2.9.1 Construction Impacts

The potential construction-related risks to water resources would be similar for all build alternatives because construction equipment and techniques would be similar. Construction of alternatives with more at-grade portions, such as the I-5 Alternative or station options on SR 99 with trenches, would have more disturbed ground area, with more areas that would require water pollution protective measures. The activities that could affect water resources include:

- **Earthwork, stockpiling, and material transport:** Soil exposed in sloped excavations or fills is especially susceptible to local erosion until vegetation is established. If exposed soil becomes dry, it can be eroded by wind. Loose soil can be carried by water or wind into adjacent stormwater drains and streams. Construction vehicle tires can carry soil onto roadways, where the soil could be washed into ditches or streams during storms.

- **Concrete work and paving:** The pH in surface water can be increased to levels harmful to fish and wildlife if runoff comes in contact with process water or slurry from concrete work or curing concrete.
- **Storm drainage utility work:** Changes to municipal systems can cause water quality problems or flooding during construction.
- **Over-water work:** Construction at stream crossing locations 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.

There are several project locations where a combination of steep slopes and proximity to a stream would make the stream particularly vulnerable to erosion and sedimentation during construction. These include the following:

- 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
- The portion of Bingaman Creek that parallels the I-5 Alternative for about 500 to 1,000 feet north and south of S 288th Street

In each of these instances there is potential for excessive sedimentation during construction. Sound Transit would develop and implement a Construction Stormwater Pollution Prevention Plan (SWPPP). This plan would address each of 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

A variety of best management practices (BMPs) would be employed to avoid or minimize erosion and other water quality impacts during construction. These include such measures as stabilized construction site entrances, silt fencing, and the mulching or covering of stockpiles and other disturbed sites.

To avoid potential adverse impacts on any of the affected streams, construction within stream channels or buffers would likely be limited to the dry season. 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), erosion blankets would be placed 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 within designated wellhead protection zones (see Appendix D4.8). During construction, hazardous materials, such as petroleum products, may be stored or transferred (e.g., by refueling) within a wellhead protection zone. Most of the protection measures in the City of Federal Way's Wellhead Protection Ordinance are similar to standard BMPs that would be carried out during the project, including refueling requirements (minimum distance from water bodies), prompt cleanup of spills, and onsite maintenance of cleanup equipment and materials. Other cities in the FWLE corridor do not have such code requirements. In addition, any hazardous materials storage areas must provide double containment to prevent spills of stored hazardous materials from reaching soils or waterways. These measures assure that groundwater quality would be protected within all of the wellhead protection zones during construction.

The I-5 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 these methods of constructing across the landfill and potential impacts on groundwater are discussed in Section 5.2.13, Hazardous Materials.

A number of sections of the alternatives and options would lie within excavated trenches generally ranging in depth from 20 to 40 feet. The trenches would be constructed with solid concrete sides and bottoms designed to permanently maintain the integrity of the trench.

Groundwater levels could become temporarily depressed during the trench construction, because of dewatering, but would be expected to recover close to pre-project levels following construction.

5.2.9.2 Potential Mitigation Measures

The risk of construction-related impacts on water resources would be controlled by complying with the National Pollutant Discharge Elimination System Construction Stormwater General Permit process (including development of a SWPPP and temporary erosion and sediment control plan), the Washington Department of Fish and Wildlife Hydraulic Project Approval (if required), U.S. Army Corps of Engineers Section 404 permit (if required), and applicable guidance manuals. 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. Discharge of dewatering water to a sanitary sewer may also be an option, if permission can be secured from the local sewer utility.

Through compliance with applicable construction permits and the BMPs that the permits would incorporate, none of the light rail alternatives would adversely affect water resources during construction. Permanent impacts on Bingaman Creek are discussed in Section 4.9, Ecosystems.

5.2.10 Ecosystems

Construction impacts on ecosystems would be temporary and limited to the period during and immediately following project construction. Estimated temporary construction impacts on ecosystem resources are summarized in Table 5-6.

5.2.10.1 Wetlands Impacts

A temporary loss of wetland or wetland buffer would occur within the construction footprint, which includes the long-term footprint, staging areas at stations, and expected construction easements along the guideway. These areas would be cleared of vegetation or temporarily graded, which may temporarily decrease or alter wetland area, soil, hydrology, vegetation, or type.

TABLE 5-6
Summary of Temporary Construction Impacts on Ecosystem Resources by FWLE Alternative

Alternative	Wetlands		Streams	
	Wetland Area (acres)	Wetland Buffer Area (acres)	Stream Area (acres)[a]	Stream Buffer Area (acres)[a]
SR 99 Alternative	**<0.1** <0.1-0.3)	**0.2** (0.2-0.5)	**0** (0-0.1)	**<0.1** (0.1-0.2)
I-5 Alternative	**0.5** (0.5-0.5)	**1.2** (0.9-1.2)	**0** (0-0)	**1.0** (1.0-1.0)
SR 99 to I-5 Alternative	**0.3** (0.3-0.3)	**0.9** (0.9-0.9)	**0** (0-0)	**1.0** (1.0-1.0)
I-5 to SR 99 Alternative	**<0.1** (0.1-0.3)	**0.2** (0.1-0.4)	**0** (0-0.1)	**<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).

Trench and retained fill construction would require dewatering activities, which might temporarily alter groundwater discharge to wetlands where dewatering would be required. These activities could also include stream relocations, cofferdams, stockpiles, erosion and sediment controls, or other temporary structures necessary to complete construction of the permanent facilities. Wetland and wetland buffer functions could also be affected by soil compaction, accidental spills of hazardous substances, and other human-caused disturbances, sedimentation, and introduction of invasive species. While temporary effects are not as long as permanent effects, they may result in a short-term decline in wetland functions that extends over a period of years. Impacts specific to each alternative are described below.

SR 99 Alternative

The SR 99 Alternative would result in temporary impacts on less than 0.1 acre of wetlands and 0.2 acre of wetland buffers. 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 increase this amount, but total temporary impacts would be less than 0.5 acre.

Construction of the S 272nd Redondo Trench might require direct dewatering in small portions of the McSorley Creek Wetland adjoining the east side of SR 99. However, the effect of dewatering is

anticipated to be localized and temporary because drawdown of groundwater would be temporary (less than one growing season). Groundwater levels are anticipated to recover quickly in the McSorley Creek Wetland, which is a large basin with a high groundwater table throughout the wetland.

I-5 Alternative

The I-5 Alternative would result in temporary impacts on approximately 0.3 acre of wetlands and 1.2 acres of wetland buffers. The Kent/Des Moines station options and the Landfill Median Alignment Option would reduce these impacts.

SR 99 to I-5 Alternative

The SR 99 to I-5 Alternative would result in temporary impacts on approximately 0.3 acre of wetlands and 0.9 acre of wetland buffers. The station options for this alternative would not change these impacts.

I-5 to SR 99 Alternative

The I-5 to SR 99 Alternative would result in temporary impacts on less than 0.1 acre of wetlands and 0.2 acre of wetland buffers. The S 260th potential additional station options and the S 272nd Redondo Trench Station Option would slightly increase this amount by between 0.2 and 0.4 acre.

5.2.10.2 Streams Impacts

Construction impacts on streams and their associated buffers are summarized in Table 5-6 above. Impacts were assessed within the construction footprint, the same as for wetland impacts. Stream crossings would be elevated on structures, and construction activities would be outside the stream channel itself and avoid in-water work to the extent possible. However, temporary culverts or pipe bypasses for the stream could be used in order to prevent impacts on the stream and on water quality during construction activities. Work over or in any water bodies would require a Hydraulic Project Approval from Washington Department of Fish and Wildlife, and any in-water work would be required to occur during preferred “work windows,” which are periods of the year when fish would be minimally affected. After construction is completed, these temporary culverts or bypasses would be removed and the stream would be restored to its original location and condition. Section 4.9, Ecosystems, discusses long-term impacts to Bingaman Creek.

Within the construction footprint, aquatic resources would be at risk during construction based largely on the amount of ground-disturbing activity within each basin. Removal of vegetation along the stream banks during construction would increase the erosion hazard for the stream bank and result in the temporary loss of potential large woody debris recruitment until vegetation becomes reestablished. Native vegetation would be planted and large woody debris added after construction to improve stream habitat within the affected areas. For aquatic species and habitat, earthwork and equipment associated with project construction could introduce sediment and contaminants (e.g., fuel or hydraulic fluids) to streams that could also be carried downstream of the project.

Under all alternatives, the potential for temporary adverse effects on aquatic species and habitat would be minimized by ensuring that work conditions and activities comply with applicable laws and regulations and with the required project permits, and by implementing construction BMPs designed to avoid and minimize the delivery of construction-related sediment or contaminants to streams.

Appropriate BMPs would be employed to avoid or minimize water quality impacts during construction as described in Appendix D4.8, Water Resources. Impacts specific to each alternative are described below.

SR 99 Alternative

Construction activities for the SR 99 Alternative would temporarily impact less than 0.1 acre of stream buffer and are not expected to temporarily affect streams unless the contractor chooses to use temporary culverts. The Kent/Des Moines HC Campus Station Option, the S 260th potential additional station options, and the S 272nd Redondo Trench Station Option would increase temporary impacts, but total impacts would remain under 0.5 acre. The small resident fish species that may inhabit these streams would be affected by noise and riparian clearing during construction.

I-5 Alternative

Construction activities for the I-5 Alternative would temporarily impact approximately 1.0 acre of Bingaman Creek stream buffer, resulting in impacts on the existing forested riparian corridor. As described in Sections 4.8 and 4.9, the stream channel north of S 288th Street would likely be relocated to the west to accommodate the

project, and the channel south of S 288th Street would likely need to be piped. For this reason, all impacts on the stream channel itself are documented as permanent impacts. Tree removal would reduce shading of the stream until vegetation becomes reestablished after project completion.

SR 99 to I-5 Alternative

Construction activities for the SR 99 to I-5 Alternative would temporarily impact approximately 1.0 acre of Bingaman Creek stream buffer north of S 288th Street, similar to the I-5 Alternative. The station options for this alternative would not change these impacts.

I-5 to SR 99 Alternative

Construction activities for the I-5 to SR 99 Alternative would temporarily impact less than 0.1 acre of stream buffer and are not expected to temporarily affect streams unless the contractor chooses to use temporary culverts. The S 260th potential additional station options and the S 272nd Redondo Trench Station Option would increase temporary impacts, but total impacts would remain under 0.5 acre.

5.2.10.3 Vegetation and Wildlife Impacts

Vegetation and wildlife habitat would be temporarily affected by construction activities. Impacts to vegetation are included in Table 4.9-3 in Chapter 4, Affected Environment and Environmental Consequences, because the project footprint and areas cleared for vegetation management are considered long-term impacts. This clearing area would include all areas needed for construction and therefore no additional construction impacts for vegetation were quantified.

Wildlife species near the project corridor could be affected by construction noise, vibration, dust, dirt, light, and the clearing and grubbing of the landscape along the alignment. There would be a low risk of disturbance to wildlife from contractor access to construction sites, noise, and light during construction because the affected areas currently have high noise levels and low habitat value. Clearing vegetation for project construction could potentially affect bird nesting sites and could result in the “take” of migratory bird nests and/or their eggs that are protected under the Migratory Bird Treaty Act if the clearing were conducted during the breeding and nesting season. Vegetation clearing would also increase the risk of introducing or contributing to the spread of noxious or invasive weed

species, although the risk would be low and minimized by replanting and by implementing BMPs during project construction to avoid, reduce, and control new infestations of noxious weeds.

5.2.10.4 Potential Mitigation Measures

Sound Transit would require use of appropriate BMPs and compliance with applicable federal, state, and local mitigation requirements during design, construction, and post-construction activities for the selected FWLE alternative. The potential avoidance, minimization, and compensatory mitigation measures that would be applied to avoid and minimize construction impacts on ecosystem resources are identified below.

Sound Transit would implement construction BMPs that would apply to all work in or around valued habitats and sensitive areas. Prior to construction, Sound Transit would mark work limits with perimeter fencing and signage to prevent unintended impacts on ecosystems designated for protection (for example, riparian vegetation, wetlands, woodlands, and other sensitive sites). A full list of potential BMPs that could be used to protect wetlands, streams and habitat is provided in the Ecosystems Technical Report, Appendix G2.

Sound Transit would implement a stormwater pollution prevention plan and develop a temporary erosion and sediment control plan to assure that turbidity plumes and pollutants from equipment and runoff would not enter streams and wetlands as described in Section 5.3.9, Water Resources. Seasonal work restrictions (i.e., work windows) would apply to work conducted below the ordinary high water mark of streams and during the migratory bird nesting season. If any culverts need to be installed or extended on fish-bearing or potentially fish-bearing streams, design and construction methods would comply with Washington Administrative Code 220-110-070 regarding fish passage. Any streambeds and stream banks affected by construction would be restored after in-water work.

Mitigation measures would be implemented before and during project construction to avoid or minimize effects on wetland and upland vegetation and wildlife resources. Examples of these potential strategies are minimizing vegetation clearing, restoring temporarily affected areas, and preparing and implementing a revegetation plan. To comply with Migratory Bird Treaty Act regulations, schedule restrictions will be established for clearing activities. To the extent possible, contractors will schedule clearing activities outside the bird

nesting period. In the event that this is not feasible, Sound Transit will work with qualified staff at the U.S. Department of Agriculture to conduct preconstruction surveys. Surveys will determine the presence of nesting migratory birds in the corridor. If old nests are present, they will be removed to prevent future use of those nests. If an active nest is found during construction, buffer zones may be established until the young birds fledge. If removing an active nest or other action is recommended, Sound Transit will consult with the U.S. Fish and Wildlife Service (USFWS) to perform such activities in accordance with USFWS procedures and appropriate permit conditions. Sound Transit may use contracted staff, permitted by USFWS, to perform additional compliance or management activities.

Sound Transit would also implement a weed-control plan to minimize the risk of introduction and spread of noxious and invasive species, including restoring temporarily disturbed areas immediately following construction.

5.2.11 Energy Impacts

5.2.11.1 Construction Impacts

During project construction, energy would be consumed when construction materials are produced and transported to the site. Operating and maintaining construction equipment would also consume energy. Construction-related impacts were estimated by applying a highway construction energy factor to the total construction cost of the FWLE. The California Department of Transportation (CALTRANS) derived energy consumption factors for different light rail transit facilities in *Energy and Transportation Systems*, and these factors are still widely used in the industry today (CALTRANS, 1983). For this analysis, the following energy consumption factors were used to estimate the energy consumed during project construction:

- Track work: 5,414 Btu per 2014 dollar
- Structures: 5,4141 Btu per 2014 dollar
- Electric substations: 8,322 Btu per 2014 dollar
- Signaling: 2,278 Btu per 2014 dollar
- Stations, stops, and terminals: 5,414 Btu per 2014 dollar
- Parking: 6,659 Btu per 2014 dollar

The consumption factors were reported in Btu per dollar of construction spending. Because the CALTRANS report was developed using 1973 construction dollars, the energy consumption factors were

adjusted to account for the change in construction costs. The California Construction Cost Index was used to adjust the factors to 2014 dollars. Only direct construction costs related to this project were used to calculate energy consumption; engineering and right-of-way costs were not included in the cost estimate used in the analysis.

The analysis compared the total energy consumption projections for the overall low- and high-cost project scenarios. 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)
High-cost Alternative[b]	$1,049.3	5,355,496
Low-cost Alternative[c]	$686.0	3,272,166

[a] 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 I-5 Alternative with the Kent/Des Moines At-Grade Station Option and the Federal Way I-5 Station Option.

These energy consumption estimates provide a range of potential energy consumption during construction of the build alternatives, from 3.3 trillion Btu to 5.4 trillion Btu. The high-cost alternative is estimated to consume approximately 160 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 42 MMBtu per year in 2012 (Energy Information Administration, 2013). Assuming a 4- year construction period, the average annual energy consumed by the construction of the project would provide the energy needs for approximately 19,000 to 32,000 residential homes.

Sound Transit's commitment to sustainability practices includes minimizing greenhouse gas emissions during construction, which could be achieved by conserving energy. Sound Transit would work with the contractor on measures that may include, but not be limited to, conserving fuel usage, providing or pre-demolition extraction of recyclable materials, and reducing traffic for detours.

5.2.11.2 Potential Mitigation Measures

There would be no adverse impacts to energy use; therefore, no mitigation is required.

5.2.12 Geology and Soils

5.2.12.1 Construction Impacts

Construction activities have the potential to cause a number of short-term impacts related to geology and soils. These potential impacts are related to erosion hazards, slope instability and excavations, settlements from new earth loads, construction-induced vibration, and dewatering. If not properly managed, the construction impacts could become long-term problems. These impacts are described below, along with discussions of seismic ground shaking/liquefaction due to earthquakes and the challenges of crossing the Midway Landfill.

Erosion Hazards

Construction activities for each alternative could include clearing of vegetation, excavation and grading, spoils removal and stockpiling, and fill placement, all of which could expose soil to rainfall and potential erosion. The severity of potential erosion is a function of the quantity of vegetation removed, slope inclination, soil type, volume and configuration of soils stockpiles, and rainfall intensity. The I-5 Alternative would have the greatest amount of vegetation removal and therefore greater potential for erosion.

Erosion hazards could be reduced using BMPs that include, but are not limited to, the following:

- Maintaining vegetative growth
- Providing adequate 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

Construction of the FWLE may require temporary and permanent retaining walls for grade separation, temporary and permanent cut slopes, or placement of earth embankment fills. These activities could affect the stability of slopes during construction, particularly in steep slope areas along both SR 99 and I-5, increasing the potential for instability of hillsides and other areas with sloping ground.

Slopes and retaining structures would be evaluated and designed to provide for adequate stability using several potential techniques, such as cast-in-place concrete cantilever walls, mechanically stabilized earth walls, soil-nail walls, or soldier-pile walls. Shallow or perched groundwater intersected by cut slopes or other excavations, including below-ground sections of the alignment in trenches, would require drainage to control seepage and prevent it from contributing to surface soil sloughing or slope instability.

Existing soils excavated during construction that cannot be used as structural fill would require removal from the project footprint and disposal either within the project limits as landscape fills or at permitted disposal sites. Table 5-8 summarizes the estimated earthwork quantities for excavation (cut) and fill placement activities for each alternative. These estimates include all excavation, not just unsuitable soils. These quantities are intended to provide a range of potential volumes and station or alignment options could increase or decrease the amount for a given alternative.

TABLE 5-8
Estimated Earthwork Quantities (cubic yards)

Alternative	Cut	Fill
SR 99	50,000	10,000
I-5	450,000	230,000
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

Overexcavation

Overexcavation means excavating beyond the depth needed for structural foundations in order to remove unsuitable soils.

Where the I-5 Alternative would be at-grade, some overexcavation and placement of structural fill would likely be required in locations where soft, compressible soils occur. In these locations, existing soils could result in safety concerns to the operation of the system from settlement of the track or could result in settlement of adjacent properties. The soils underlying both the I-5 and SR 99 alignments are typically able to withstand increased loads without settling or collapsing when undisturbed, so the amount of overexcavation would likely be limited.

The settlement impacts are most relevant to at-grade and trenched facilities. The need for overexcavation should be expected where the FWLE would cross areas mapped as underlain by wetlands or other soft clay and silt deposits, as well as ditches or existing stormwater facilities where soft soils have accumulated. In areas mapped as

underlain with wetland deposits, such as near the S 272nd Star Lake Station, substantial settlement could occur which could affect the safety of the rail system and adjacent land uses.

If overexcavation is not feasible because of the depth of soft soil, additional measures would be required to adequately support the FWLE for these locations. These additional measures could include use of deep foundations, preloading of the ground, ground improvement using vibro-replacement, or use of lightweight fill.

Design studies would include geotechnical explorations to define the thickness, limits, and character of wetland and other soft soil deposits underlying at-grade or trenched facilities in order to quantify the expected settlement under new earth or facility loads. Overexcavation, preloading, ground improvement, or lightweight fill are all options for accommodating at-grade and trenched facilities supported on soils that would otherwise undergo too much settlement under new earth and facility loads.

Seismic Ground Shaking/Liquefaction

An earthquake could occur during construction, resulting in slope failure, liquefaction, or ground settlement. If a large earthquake were to occur, the major risk would be damage to facilities under construction and delay to the project schedule due to repair work. The risk of seismic hazards to construction is considered low because there is a very low probability that a strong earthquake producing large levels of ground shaking would occur during construction.

Dewatering

Sound Transit does not expect to perform substantial dewatering of groundwater during construction. Various areas of the project would be constructed at-grade, elevated, or in a trench above the water table in most areas, which limits the need for dewatering. The exception would occur in wetland areas, where soft material below the water table needs to be removed to create a stable base for the track or transit facility. Deep foundations are the primary project element that would extend below the groundwater table; however, this foundation support method can be completed without the need for dewatering.

If dewatering is required, the design process would consider the potential for dewatering-induced settlement on nearby structures. Methods that could help minimize soil settlement would include using localized dewatering and groundwater injection methods, using

sheet-pile walls for horizontal groundwater containment, or underpinning nearby structures. Engineering studies to quantify the effects of dewatering would also be carried out during final design or as an early phase of construction. By implementing early dewatering tests, the risks of settlement can be minimized.

Midway Landfill

The I-5 and SR 99 to I-5 alternatives would be located to the west of I-5 and would travel along the eastern edge of the Midway Landfill. Although these alternatives could be constructed either at-grade or as an elevated structure across the landfill, settlement considerations would likely require use of deep foundations, ground improvement, or removal and replacement of landfill materials if at-grade methods are used.

If at-grade construction is chosen, the grade would be higher than I-5 and retaining walls would be needed to support cut and fill. Because of the nature of the landfill material, substantial settlement would be expected below any new fill or structures placed to support the FWLE across the landfill. This settlement could occur differentially and could change with time from location to location. The light rail structure across the landfill surface would have to be designed to accommodate differential and total settlement by using highly flexible retaining wall systems that can tolerate large ground settlement, by using ground improvement methods that reduce the potential for ground settlement, or by supporting retaining walls on deep foundations extending through the landfill to the underlying deep soils.

If an elevated crossing of the landfill is selected, the structure would need to be supported on deep foundations into suitable load-bearing soils. Both driven and bored pile foundations have been used in other landfills to provide support of structures. Design of the deep foundations would consider the chemical composition of the landfill waste to confirm that subsurface elements of the FWLE would not be damaged due to chemical action.

5.2.12.2 Potential Mitigation Measures

Additional geotechnical studies during final design will inform and refine development of construction techniques and mitigation measures to avoid potential impacts and geologic risks. Engineering design standards and BMPs would be used to avoid and minimize potential construction impacts. Based on the review of potential

impacts, the design and construction process would address seismic hazards, soft soils, settlement, steep-slope hazards, landslide hazards, erosion and sediment control, vibrations, and groundwater.

5.2.13 Hazardous Materials

5.2.13.1 Construction Impacts

Potential hazardous materials impacts during construction could result from encountering existing soil or groundwater contamination and from encountering containers holding hazardous materials. Soil or groundwater contamination could be found on or adjacent to contaminated sites and in utility corridors, which can be conduits for contamination. Containers that hold hazardous materials include aboveground storage tanks (ASTs) and underground storage tanks (USTs), which typically contain petroleum products, and pole-mounted transformers, which might contain polychlorinated biphenyl (PCB)-contaminated transformer oil. The likelihood of impacts from encountering existing contamination or hazardous materials containers depends upon the extent and characteristics of the contamination and hazardous materials along an alternative. A variety of impacts, both beneficial and adverse, would be possible, including the following:

- Construction activities, such as grading, in the vicinity of these materials could release contaminants to soil, groundwater, and surface water.
- Contaminated materials might be uncovered, allowing more direct exposure to the public.
- Contamination might spread as a result of construction.
- Dewatering for construction activities might generate large quantities of contaminated water that would need to be treated and disposed of.
- Contamination that otherwise would remain in place and potentially migrate might be discovered and addressed by the project.
- To accommodate project construction, contamination might be cleaned up earlier than otherwise would occur.
- Contamination might be prevented by removing potential existing sources, such as USTs and ASTs, before they cause releases.

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.

Demolishing, removing, and disposing of existing structures during planned construction could release hazardous materials such as asbestos or lead. Potential construction impacts could result from accidental release of hazardous substances (such as lubricants and fuels needed for heavy equipment), a hazard common to all construction projects but particularly acute for construction over water or in areas where stormwater runs off into water bodies such as Puget Sound. Spills of any size, if not contained, could harm water quality, vegetation, and wildlife in the immediate area and downstream; large spills could require emergency response.

The following subsections focus on the potential impacts on the project from high-risk sites (known contaminated sites) based on their location relative to each alternative. The actual impacts on the environment at each hazardous materials site cannot be identified and assessed without detailed evaluation of site-specific conditions, which would be performed prior to or during construction. Site assessments might be conducted in a phased approach to address cost, schedule, and technical requirements associated with the construction process.

Full or partial acquisition of the high-risk sites would increase Sound Transit's liability at these locations because of the potential need for large cleanup operations, management of contaminated media, and possibly long-term monitoring of soil and groundwater quality. The high-risk sites and their potential impacts are described by alternative below. The locations of these sites are shown on Exhibits 4.12-1 and 4.12-2, and a description of each site is provided in Section 4.12.

All alternatives and options associated with the FWLE pass through the ASARCO smelter plume contamination. The only method to determine the extent or severity of the soil contamination is sampling the footprint of the alternative. Surface soils in the construction zone are likely to be contaminated from the ASARCO smelter plant operations, and ground disturbance work may release contaminated dust particles that could affect the workers. Ecology requires cleanup of the contaminated soils related to the ASARCO plume during site development. The agency 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 be required to enter the Voluntary Cleanup Program in order to receive a No Further Action determination from Ecology (Ecology, 2012). Specific BMPs would be put in place to require contractors to prepare project-specific and site-specific excavation and soil management plans, construction stormwater pollution prevention plans, and health and safety plans, as necessary. These plans would establish the procedures for managing ASARCO plume contaminated soils in a safe manner. With these standard practices and measures in place, no adverse impacts are anticipated.

SR 99 Alternative

Eleven high-risk sites, 72 medium-risk sites, and 86 low-risk sites occur within 1/8 mile of the SR 99 Alternative. Nine of the high-risk sites have released contaminants to soil and groundwater. These sites have identified contamination that has not been remediated to below applicable cleanup levels, or are believed to have a high likelihood of unconfirmed contamination based on past activities and information obtained from Ecology. Six of these sites are located on parcels that Sound Transit might acquire all or part of for one or more options, or that may be impacted during construction of one or more options. Specific sites impacted by this alternative and its option are described in Section 4.12, Hazardous Materials.

I-5 Alternative

Two high risk site, 6 medium-risk sites, and 59 low-risk sites occur within 1/8 mile of the I-5 Alternative. Midway Landfill (Site 84) would be the only one impacted during construction of the I-5 Alternative. The I-5 Alternative would either be at-grade or elevated across the eastern edge of the landfill within WSDOT right-of-way. Crossing on an elevated structure would involve drilling shafts for the guideway columns, which would require removal of a portion of the landfill cover, drilling shafts up to 10 feet in diameter, removal of waste material, and replacement of the landfill cover around the shafts. Crossing the landfill at-grade 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 to support them in place. Both options would require regulatory approval from the U.S. Environmental Protection Agency and Ecology.

Constructing an at-grade trackway would result in temporary construction disturbance to the landfill cover, which may result in transient disturbance to landfill gas collection systems and potential transient impacts on groundwater from disturbance of waste below the cap. Constructing an elevated guideway would also require temporary construction disturbance to the landfill cover, but over a smaller area. Thus, construction impacts of an elevated guideway are expected to be less than the at-grade profile.

Deed restrictions are currently in effect for the landfill site, and inclusion of the site within the Comprehensive Environmental Response Compensation and Liability Act program could lead to extensive regulatory involvement prior to any activities that would disturb the landfill cap. These activities would involve a design for and then cutting, removing and replacing the cap in the areas where drilled shafts, waste removal, or compaction would occur. Environmental monitoring would take place to ensure worker and public health and safety while the landfill cap is open.

The Kent/Des Moines and Federal Way City Center station options would not change these potential impacts. The Landfill Median Alignment Option would avoid crossing the Midway Landfill and the associated impacts.

SR 99 to I-5 Alternative

Five high-risk sites, 38 medium-risk sites, and 48 low-risk sites occur within 1/8 mile of the SR 99 to I-5 Alternative. Two of these sites are located on parcels that Sound Transit might partially acquire and/or that may be impacted during construction. Impacts related to these sites would be same as for the SR 99 Alternative and S 216th West Station Option north of Kent-Des Moines Road and the same as the I-5 Alternative for the Midway Landfill. The Landfill Median Alignment Option would avoid crossing the Midway Landfill and the potential impacts associated with this crossing.

I-5 to SR 99 Alternative

Seven high-risk sites, 39 medium-risk sites, and 68 low-risk sites occur within 1/8 mile of the I-5 to SR 99 Alternative. Impacts south of S 246th Street would be the same as for the SR 99 Alternative, with two high-risk sites potentially impacted by the alternative or a station option. Full acquisition would increase Sound Transit's liability at these locations because of the potential for larger areas to be cleaned

up, contaminated media to be managed, and long-term soil and groundwater monitoring.

5.2.13.2 Potential Mitigation Measures

Sound Transit would adhere to applicable regulations regarding hazardous materials handling and spill response during construction of the FWLE. BMPs would include requiring contractors to prepare project-specific and site-specific hazardous material management plans; construction stormwater pollution prevention plans; health and safety plans; spill prevention, control, and countermeasure plans; contaminated media management plans; and lead and asbestos abatement programs, as necessary. These plans would establish the procedures for managing hazardous materials in accordance with state and federal regulations. With these standard practices and measures in place, no adverse impacts are anticipated.

All of the proposed methods for crossing Midway Landfill would result in the excavation and disposal of solid waste from under the landfill cap. These wastes would be managed in accordance with the applicable state and federal regulations. Standard BMPs for excavation would also be implemented. These would include contractor-required project- and site-specific health and safety plans, contaminated media management plans, and construction stormwater pollution prevention plans. With these standard practices and measures in place, no adverse impacts are anticipated.

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

No impacts related to electromagnetic fields were identified; therefore, no mitigation is required.

5.2.15 Public Services, Safety, and Security

5.2.15.1 Construction Impacts

Construction of the FWLE would result in increased congestion along adjacent roadways as a result of temporary lane and roadway closures, shifts in roadway alignments, detours necessary for construction, and construction activities associated with the project. This could temporarily affect access and response times for public service providers (i.e., fire and emergency medical, police, school

buses, and solid waste and recycling vehicles). However, as described in Section 5.2.1, Sound Transit would make provisions to maintain the required access during established periods or keep one lane of traffic open (especially on main arterials) and, whenever possible, accommodate additional access during peak travel hours. The relocation of water mains could affect access to and use of fire hydrants and would need to be coordinated with the local fire districts.

Prior to construction, Sound Transit would coordinate with public service providers on required detour routes and lane closures in order to minimize increases in travel and emergency response times and to avoid interference with the collection of solid waste and recyclables or the transportation of students. Traffic control plans would be reviewed and approved by applicable agencies before implementation. As a result of this coordination, public services would not be adversely affected during construction.

Roadway and lane closures along SR 99 during construction of alternatives along SR 99 could affect response times for emergency vehicles, particularly for public service providers that are located close to SR 99 and often need to travel along or across SR 99.

Construction impacts on public services would be less with alternatives along I-5 since many of the roadways in the study area would be avoided. FWLE alignments in the I-5 corridor would be located west of the southbound travel lanes near the edge of the right-of-way, so impacts on public services vehicles that travel along I-5 would be minimized.

The I-5 Alternative and SR 99 to I-5 Alternative would both have temporary construction impacts on the playfield at Mark Twain Elementary School, along I-5 at S 272nd Street. The alignment of these alternatives would cross under the athletic field, requiring 0.9 acre to be unavailable for school and public use during construction. The light rail would be constructed in a lidded trench at this location, and the playfield and bus loop would be closed for approximately 6 to 12 months during construction. Approximately 0.6 acre of the field could remain open during this construction period and would be available for school and public use. Buses are expected to be able to circulate elsewhere within the school parking lot.

The playground adjacent to the playfield would not be affected. After construction of the light rail guideway, the playfield and bus loop would be restored to existing conditions, thereby allowing the continued use of the field, and school bus circulation.

5.2.15.2 Potential Mitigation Measures

The Sound Transit Fire/Life Safety Committee and other safety and security specialists would continue to address public service issues throughout design and construction. Sound Transit would coordinate with public service providers before and during construction to maintain reliable emergency access and alternative plans or routes to minimize delays in response times. Sound Transit would also coordinate with solid waste and recycling companies and schools should any rerouting of collection or school bus routes need to occur. Postal collection and delivery and solid waste and recycling collection would be maintained at all addresses.

If an alternative affecting Mark Twain Elementary School were advanced, additional coordination with Federal Way Public Schools would occur to make sure school buses could operate safely during construction.

5.2.16 Utilities

5.2.16.1 Construction Impacts

Sound Transit conducted an inventory of possible effects on major utilities in the study area to identify potential conflicts and utilities that might require relocation for the project. These utilities were divided into major utilities and minor utilities, with major utilities 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

Minor utilities were not inventoried. Information obtained on the major utilities adequately depicts the degree to which alternatives could impact various utilities and could present potential construction impacts. According to this inventory, major utilities affected by all alternatives include stormwater and sanitary sewers, above ground electric lines, and underground water and natural gas mains. The inventory did not identify telephone or fiber optic duct banks.

Sound Transit identified utility conflicts for each alternative where aboveground or underground utilities would be within the project limits. The purpose of identifying these conflicts is to plan for relocating the utilities during construction to remove possible conflicts; to prevent disturbing the route during future maintenance of underground utilities; to keep the FWLE profile, whether underground, surface, or elevated, clear of the minimum required distance from all utilities; and to account for the relocation costs.

Potential impacts during construction include:

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

In some cases, aboveground utilities located on poles could be relocated to taller poles or a different type of pole. Maintenance activities and access to underground utilities such as sewer holes or vaults could be affected depending on the location of light rail facilities. In some cases, these access points might need to be relocated. Relocating water mains could also affect access to and use of fire hydrants. In some cases, establishing a parallel water main to avoid utility lines crossing under the guideway might be considered.

Underground utilities might be affected during construction, depending on their depth, material composition, the excavation limits, exact location of the proposed alignment, and other factors. However, most underground utilities crossed by the alternatives are located within approximately 6 feet of the surface and therefore are more likely to be impacted. Underground utilities would be relocated

or otherwise protected to allow for excavation and to minimize potential load impacts from the weight of the light rail vehicles.

In general, trench construction would have the greatest impacts on underground utility infrastructure, followed by at-grade construction, because these areas would relocate more underground pipes and aboveground utility poles for trackways, stations, and right-of-way curb and sidewalk acquisition. In most cases where an at-grade profile would cross an underground utility, a split casing could be installed. Underground utilities located within public road rights-of-way parallel to and near or under the light rail facilities would be moved to a different location within the right-of-way.

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.

As much as possible, piers for elevated guideways would be located to avoid conflicting with underground utilities. For overhead electric lines, conflicts could occur where elevated guideways either run directly underneath the lines or where they cross the lines. This would require raising the lines to go over the overhead catenary system at the required minimum distance of at least 35 feet from the top of rail for 115-kV lines and 37 feet for 230-kV lines.

Disruptions to utility service during utility relocations would likely be minimal because temporary connections to customers would typically be established before relocating utility conveyances. However, inadvertent damage to underground utilities could occur during construction if utility locations are uncertain or misidentified. Although such incidents do not occur frequently, the numerous relocations required during project construction under any alternative makes accidents more likely. Such accidents could temporarily affect service to customers served by the affected utility. Efforts to minimize impacts would include potholing and preconstruction surveys to identify utility locations, and communication with customers to inform them of potential service disruptions.

Sound Transit would also coordinate with utility providers to establish replacement procedures and standards of facilities as applicable. The comprehensive plan policies of SeaTac, Des Moines, and Federal Way require that existing overhead utilities (power and communications) that require relocation as part of any project be relocated underground when and where 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 impacts might be considered substantial by some utility service providers in terms of relocation costs incurred, staff time and resources, and temporary loss of access to utilities. Relocation approaches and associated costs would be evaluated by Sound Transit on a case-by-case basis. Generally, the terms of a private utility's franchise agreement would be evaluated to determine the rights of the private utility within the public right-of-way and the responsibility for relocation costs. For public utilities, Sound Transit would seek to establish formal agreements with the public utility, and the relocation costs would be allocated pursuant to local ordinances or codes. Most utilities within the I-5 right-of-way are franchise holders (the utility has an agreement with WSDOT to use the public right-of-way) who must relocate their utilities at WSDOT's request, at their own expense. Sound Transit would work with WSDOT and the affected utilities on relocation issues if an alternative using the WSDOT right-of-way is advanced, consistent with Sound Transit's relocation polices and applicable laws, including city codes and charter provisions.

Table 5-9 summarizes the major utility conflicts for each alternative. Where utilities would be directly under or above the project limits, the length of the expected relocation is provided. Where utilities would intersect with an alternative, the number of crossings is identified because the length of the potential relocation has not yet been determined. Actual relocation lengths of crossings would be determined during final design. For many underground intersecting utilities, only a split casing would need to be installed. The following text discusses differences in potential utility impacts by alternative and option.

SR 99 Alternative

As shown in Table 5-9, there would be about 3,300 feet of parallel utility conflicts and ten utility crossing conflicts with the SR 99 Alternative, with the most parallel impacts being to water line utilities. The Kent/Des Moines HC Campus Station Option would affect a stormwater surge tank that is located in the east parking lot. This tank could be relocated within the parking lot. There would be no additional utility relocations associated with the S 216th West

Station Option, the Kent/Des Moines SR 99 Median Station Option, or the Federal Way Transit Center SR 99 Station Option.

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
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	--	--	--	--
I-5 Alternative		**300 feet 3 crossings**	**700 feet 1 crossing**	**--**	**400 feet, 2 crossings**	**300 feet**
Kent/Des Moines Station Options	**Kent/Des Moines At-Grade Station**	--	--	--	--	--
	Kent/Des Moines SR 99 East Station	+2 crossings	+ 300 feet	+ 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
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 I-5 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
Federal Way City Center Station Options	**Federal Way S 320th Park-and-Ride Station**	--	--	--	--	-100 feet
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.

Of the station and alignment options along SR 99, the S 260th West Station Option and the S 272nd Redondo Trench Station Option would have the greatest additional conflicts. Crossing under S 272nd Street for the S 272nd Redondo Trench Station Option would also require maintaining the existing 10-inch gas line in S 272nd Street in place during construction.

The 115-kV overhead transmission lines located north of Dash Point Road would need to be relocated as a result of the S 272nd Redondo Trench Station Option. Based on coordination with Puget Sound Energy and the City of Federal Way, it is expected they could be relocated to the west side of SR 99 for this length, but the final location and configuration would be determined through further coordination with these entities.

I-5 Alternative

As shown in Table 5-9, there are about 2,000 feet of parallel utility conflicts and five utility crossing conflicts with the I-5 Alternative, with the most parallel impacts being to water utilities. With the exception of the Kent/Des Moines SR 99 East Station Option, there would be no additional utility relocations associated with any of the I-5 Alternative options.

The I-5 Alternative would require use of a property owned by the Highline Water District north of S 216th Street that includes four

water storage facilities, one of which would be displaced by the alignment. Sound Transit would coordinate with the water district to relocate this water tank on their property and would maintain the same capacity as is currently provided.

This alternative would also require property at a Puget Sound Energy substation at S 221st Street. The at-grade light rail trackway would not directly displace part of the substation, but the minimum distance necessary between the edge of the light rail guideway and electrical facilities is 25 feet. Sound Transit would coordinate with Puget Sound Energy regarding relocation of existing facilities at this location to allow for the necessary distance from the light rail guideway.

Crossing under S 272nd Street would require maintaining the existing 10-inch gas line in S 272nd Street in place during construction. Of the I-5 Alternative options, only the Kent/Des Moines SR 99 East Station Option would have an increase in utility impacts when compared to the I-5 Alternative, with one additional sewer line crossing conflict.

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

SR 99 to I-5 Alternative

As shown in Table 5-9, there would be no parallel utility conflicts and eight utility crossing conflicts with the SR 99 to I-5 Alternative, with the most crossing conflicts being to the sanitary sewer line utilities and the least conflicts being to water line utilities. There would be no conflicts with gas line utilities. In addition, the Kent/Des Moines 30th Avenue East Station for this alternative 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 find a new location for these offices within their service area.

I-5 to SR 99 Alternative

As shown in Table 5-9, the I-5 to SR 99 option would result in about 1,100 feet of parallel utility conflicts and only one utility crossing conflict, with the most parallel impacts being to power line utilities. There would be additional parallel utility conflicts with the potential additional station at S 260th Street and additional utility crossing conflicts with the S 260th West Station Option and the S 272nd Redondo Trench Station Option.

5.2.16.2 Potential Mitigation Measures

The project would include implementing design measures and coordinating with utility providers and the public to minimize impacts on utilities during light rail construction. These measures include potholing and conducting preconstruction surveys to identify utility locations. Sound Transit would continue to work with utility providers to minimize any potential service interruptions and perform outreach to notify the community of planned or potential service interruptions.

5.2.17 Historic and Archaeological Resources

5.2.17.1 Construction Impacts

To date, research and surveys have not identified any National Register of Historic Places (NRHP) -eligible archaeological sites within the Area of Potential Effects (APE). However, only a limited number of high-probability areas were tested. Although much of the APE has previously seen ground disturbance, fill, and development, it is possible that one or more archaeological sites may exist beneath the ground surface in areas where project excavation would take place. It is unlikely though that project alternatives would affect NRHP-eligible archaeological sites because many portions of the project are located within areas not considered sensitive for the occurrence of archaeological resources, or are located in high-sensitivity areas that have experienced previous disturbance.

In areas that are identified in the Washington State Department of Archaeology and Historic Preservation predictive archaeological model as High Probability Areas, Sound Transit is committed to either conduct archaeological surveys that may include subsurface testing before construction or to monitor ground-disturbing activities during construction. An archaeological resources monitoring and treatment plan and an inadvertent discovery plan would be prepared to provide guidance on the treatment of archaeological resources during FWLE construction. FTA and Sound Transit would consult with the SHPO, tribes, and other interested parties, as appropriate, to review these plans and to avoid adverse effects from construction of the FWLE project.

The Kent/Des Moines HC Campus Station Option to the SR 99 Alternative would be the only alignment with potential for impacts on historic resources during construction. That option would have a construction impact on nine NRHP eligible buildings along the eastern boundary of Highline College's campus (Buildings 4, 5, 6, 11, 12, 13,

14, 15, and 16). The option's station plaza would be approximately 206 feet from the nearest NRHP-eligible building at Highline College. The station would be constructed in a below-grade, open trench on the eastern edge of Highline College's east parking lot. No vibration impacts are anticipated during construction. Visual and noise impacts would be minor, and access to the historic Highline College buildings would be maintained at all times, resulting in temporary construction impacts with no adverse effects.

The only other NRHP-eligible building in the Area of Potential Effects, the Calvary Lutheran Church, would be located far enough away (approximately 400 feet) from the construction of the Federal Way I-5 Station Option for the I-5 Alternative and the SR 99 to I-5 Alternative that no construction activities are expected to impact the resource. Because of this, the Federal Way I-5 Station Option would result in no construction impacts, with no historic properties affected.

5.2.17.2 Potential Mitigation Measures

Sound Transit would conduct subsurface testing before construction and/or monitor ground-disturbing activities in archaeologically sensitive areas during construction. An archaeological resources monitoring and treatment plan or unanticipated discovery plan would be prepared to address archaeological resources should any be discovered during construction. The Federal Transit Administration and Sound Transit would consult with the State Historic Preservation Office, affected tribes, and other interested parties, as appropriate, to review the plan.

No adverse construction effects on the NRHP-eligible Highline College campus buildings or the Calvary Lutheran Church were identified; therefore, no mitigation is required.

5.2.18 Parks and Recreational Resources

5.2.18.1 Construction Impacts

Temporary impacts would occur at Federal Way Town Square Park with the Federal Way SR 99 Station Option for the SR 99 and I-5 to SR 99 alternatives. These alternatives would require construction of a transit-only roadway through the parking lot at the Federal Way Town Square Park. Noise from construction activities, dust, and visual impacts from construction equipment and fencing would be disruptive to park users. However, all construction would occur in parking and landscaping areas and would not result in the temporary closure of recreational facilities. Recreational uses would be

approximately 200 feet away. Less than 0.1 acre of the parking lot would be temporarily closed for approximately 6 to 12 months during construction, but would be returned to parking use after the roadway is completed. The project long-term footprint would displace approximately 30 of the existing 140 parking spaces for the park, and an additional 10 spaces would be affected during construction. This does not include permanent parking impacts to the park described in Section 4.17, Parks and Recreational Resources.

As described in Section 5.2.15, the I-5 and SR 99 to I-5 alternatives would require construction through the playfield at Mark Twain Elementary School and part of the field would not be available for public recreational use. No planned parks or trails in the study area are anticipated to be operational at the time of FWLE construction and therefore construction period impacts are not anticipated to occur at any planned facilities.

Potential Mitigation Measures

Sound Transit would restore disturbed parks and open space to pre-project conditions after construction in cooperation with the resource owner. This would include landscaping, paths, and any built features of the park resources. Temporary replacement parking for parking lost at the Town Square Park could be provided if necessary.

Sound Transit understands the Federal Way Public Schools district would program youth league softball and soccer practices at other district-owned facilities during construction. No other mitigation for temporary impacts at the Mark Twain Elementary playfield would be necessary.

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6.0 Cumulative Impacts

6.1 Introduction

Cumulative impact analysis evaluates a proposed project and its alternatives in a broad perspective, including how the project might interact with impacts that persist from past actions, with present-day activities, and with other planned projects. A cumulative impact assessment can reveal unintended consequences that might not be apparent when the project is evaluated in isolation.

Analysis of cumulative impacts has influenced all components of the Federal Way Link Extension (FWLE) environmental review process, including scoping, describing the affected environment, developing the alternatives, and evaluating environmental impacts.

During the FWLE scoping process and Draft Environmental Impact Statement (Draft EIS) preparation, Sound Transit gathered information from agencies and the public to identify impacts of past and present developments and reasonably foreseeable future actions that could interact with the impacts of the FWLE alternatives. Examples of these information sources include the following:

- 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

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 (CFR) 1508.7

Guidance for Cumulative Impacts Analysis

This cumulative impact assessment conforms with the National Environmental Policy Act (NEPA) (40 CFR 1500-1508), the approach recommended by the President's Council on Environmental Quality (CEQ) in *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ, 1997), and the following additional guidance documents:

- Consideration of Cumulative Impacts in EPA Review of NEPA Documents (U.S. Environmental Protection Agency [EPA], 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)

- Information provided by other organizations and the public on planned private projects, community values, and concerns

This information was used to 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.

6.2 Temporal and Geographic Boundaries of Cumulative Analysis

Consistent with regulatory guidance for a cumulative impact analysis, the development actions that were considered included those that are past, present, and reasonably foreseeable. For the purpose of this analysis, development actions were assigned to these three categories as follows:

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

Design Year 2035

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

The study area for cumulative analysis is generally a combination of the study areas defined in Chapter 3 for transportation facilities, Chapter 4 for the various environmental resources, and Chapter 5 for construction impacts. Exceptions include the following:

- Ecosystem-related resources, where broader study areas are necessary to capture how the effects from reasonably foreseeable future projects may interact to affect the function of larger ecosystem networks.
  - Wildlife corridors are considered for avian species and other migratory animals or animals with large foraging areas.
  - Fish habitats are considered 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 economics evaluation.
- Greenhouse gases are studied at the regional level, while 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 one-half to one mile of the project alternatives.

For built environment resources, such as property acquisitions, hazardous materials, geology, electromagnetic fields, utilities, historic and archaeological resources, and noise and vibration, the study area is approximately one-quarter mile or less around project alternatives. The study area for ecosystem resources, such as streams, wildlife, and wetlands, was defined based on regulatory requirements or up to 200 feet around the project alternatives, whichever was greater.

6.3 Past and Present Actions

Ongoing impacts from past actions have shaped the project vicinity since the mid-19th century, and they continue to shape how the Seattle, southwest King County, Tacoma, and northwest Pierce County areas are changing in response to activities and trends. Throughout the 20th century and continuing into the 21st, Seattle and Tacoma have become increasingly urban, with suburban population growth spreading to surrounding areas, including the cities in the FWLE study area.

Development of Washington's interstate transportation network began in 1913 with the construction of the original Highway 1, known as the Pacific Highway, which later became SR99. By October 1923, 700 miles of a two-lane highway had been completed connecting Vancouver, British Columbia, to Seattle and south to the Oregon-California border. Just after the highway was completed in 1924, plans were underway to reroute and improve the conditions of the highway. The project involved creating a new, wider, four-lane route farther west that would connect Seattle and Tacoma more directly (Kramak, 2010). In the following decades, businesses grew rapidly along the highway and a new auto-oriented roadside culture appeared, characterized by a proliferation of motels, restaurants, and

rest stops (Des Moines Historical Society, 2007). Increased automobile ownership changed people's perceptions about distance, allowing populations to live in less dense areas farther from urban centers, and increasing the number of residents in suburban towns and cities, including Des Moines, Kent, Federal Way, and SeaTac (Boyles, 2010).

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 the majority of development occurring from the 1950s to 1970s. Development that has occurred 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 as well. Past and present regional and local planning efforts have 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.

The environmental effects of past and ongoing actions are noted below in relation to the natural and built environments.

6.3.1 Natural Environment

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

Past development actions resulted in the filling and urbanization of areas that used to be wetlands. The wetlands now present in the FWLE corridor likely represent fragments of larger historical wetland systems, or they may be recently formed wetlands that have developed as a result of changes in land use and surface water drainage patterns. The McSorley Creek Wetland is the largest undisturbed wetland in the FWLE corridor and is the only wetland remaining in the study area that is larger than 5 acres.

Due to the heavily developed nature of the FWLE study area, most of the vegetation present 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 located 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 during construction of I-5 and SR 99 with engineered cuts and fills to create the existing highways.

Current federal, state, and local regulations restrict large-scale disturbances by present-day development actions affecting wetlands, plant and wildlife habitat, and other sensitive natural areas.

6.3.2 Built Environment

In the four decades since the completion of I-5 in Washington, industrial and retail development in western Washington has grown steadily along this corridor. Employment in the vicinity of the study area encompasses a variety of industries and business sectors, including transportation, education, and retail. Most of the neighborhoods in the SR 99 corridor portion of the study area were developed with single-family housing in the decades following World War II, primarily from the 1950s to 1970s. The land uses adjacent to the SR 99 corridor are primarily commercial with mixed higher density multi-family housing. In recent years, the population within the study area has become ethnically and linguistically diverse, with immigrant groups attracted to the affordable housing and entry level jobs in the area, many associated with the airport. The study area includes substantial Korean, African (Somali), and Hispanic populations. Community resources and businesses that provide services and goods to these populations have become more common.

Along SR 99, visual quality is low along much of the corridor due to the wide variety of land use types found along the corridor, the many large-scale commercial/manufacturing and storage buildings, and associated parking areas that have resulted in primarily auto-oriented development patterns. Over the past several years, improvements have been made to this roadway by each city. Landscaped medians, sidewalks, and street trees have improved the roadway's appearance. 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.

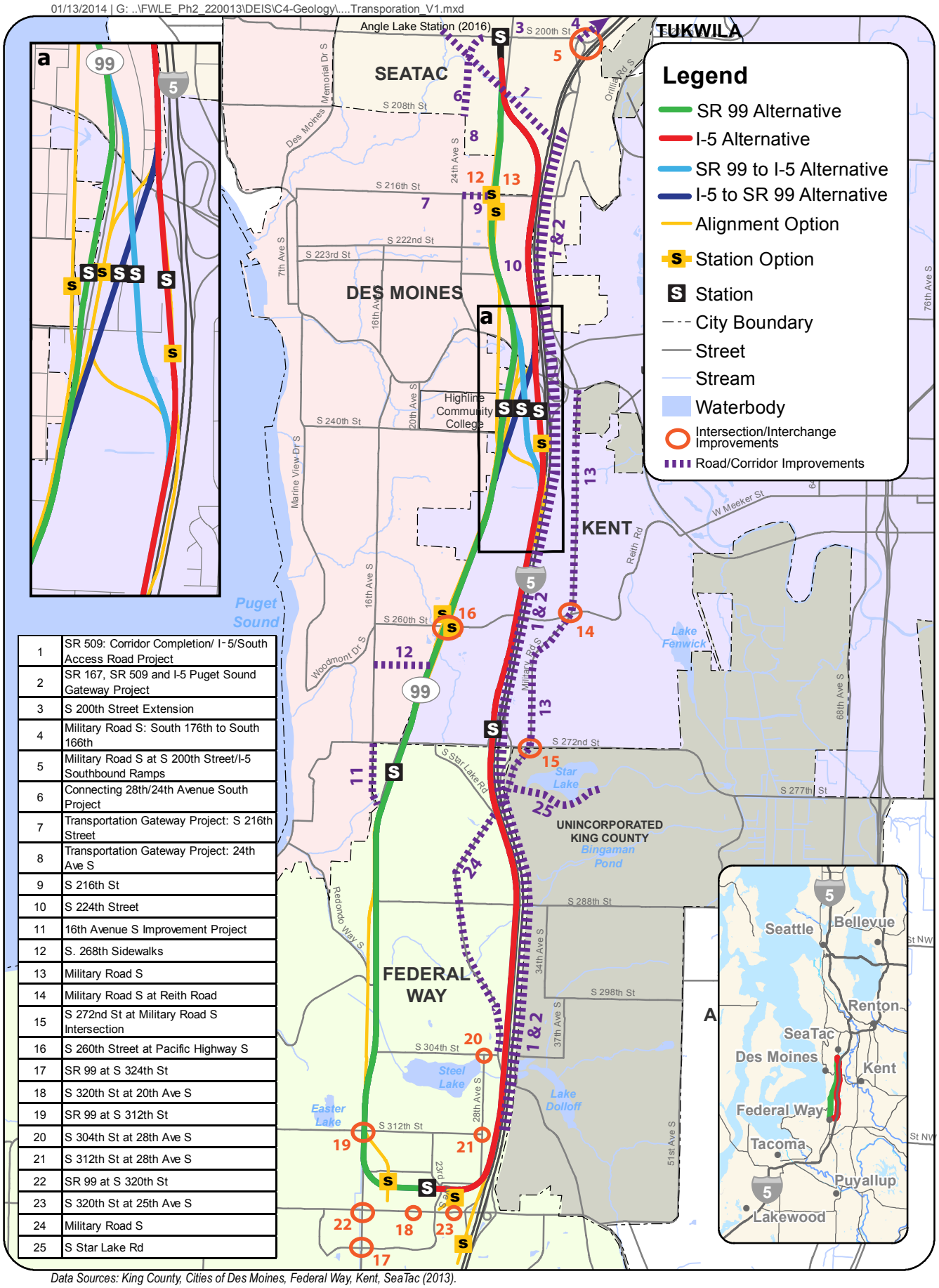
6.4 Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions are future projects that would produce environmental impacts that could add to or interact with the impacts associated with FWLE alternatives and other past and present actions. Reasonably foreseeable future actions are not speculative and are considered regardless of the agency, organization, or person serving as their proponent (CEQ, 1997). They must be likely to occur in the reasonably foreseeable future by virtue of being funded, approved, or under consideration for regulatory permitting, the subject of an environmental review process under National Environmental Policy Act (NEPA) or the State Environmental Policy Act (SEPA), or part of an officially adopted planning document or publicly available development plan.

The approximate locations of reasonably foreseeable regional transportation projects are shown on Exhibit 6-1. Specific known public and private developments that were being planned or constructed at the time of Draft EIS preparation are shown on Exhibits 6-2 and 6-3. Appendix D6 provides greater detail on the reasonably foreseeable future actions considered in this analysis, including the associated impacts identified during the environmental review processes for each project.

6.5 Cumulative Impact Assessment

Adverse and/or beneficial cumulative impacts could occur over the longer term during project operation, when impacts of the FWLE would add to or interact with long-term impacts of other past actions, present actions, and reasonably foreseeable future actions. Adverse cumulative impacts could occur over the short term during construction, when activities necessary to build the FWLE would accumulate with impacts from other projects under construction at the same time. The following sections discuss expected cumulative impacts of project construction and operations on elements of the environment.



1	SR 509: Corridor Completion/ I-5/South Access Road Project
2	SR 167, SR 509 and I-5 Puget Sound Gateway Project
3	S 200th Street Extension
4	Military Road S: South 176th to South 166th
5	Military Road S at S 200th Street/I-5 Southbound Ramps
6	Connecting 28th/24th Avenue South Project
7	Transportation Gateway Project: S 216th Street
8	Transportation Gateway Project: 24th Ave S
9	S 216th St
10	S 224th Street
11	16th Avenue S Improvement Project
12	S. 268th Sidewalks
13	Military Road S
14	Military Road S at Reith Road
15	S 272nd St at Military Road S Intersection
16	S 260th Street at Pacific Highway S
17	SR 99 at S 324th St
18	S 320th St at 20th Ave S
19	SR 99 at S 312th St
20	S 304th St at 28th Ave S
21	S 312th St at 28th Ave S
22	SR 99 at S 320th St
23	S 320th St at 25th Ave S
24	Military Road S
25	S Star Lake Rd

Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

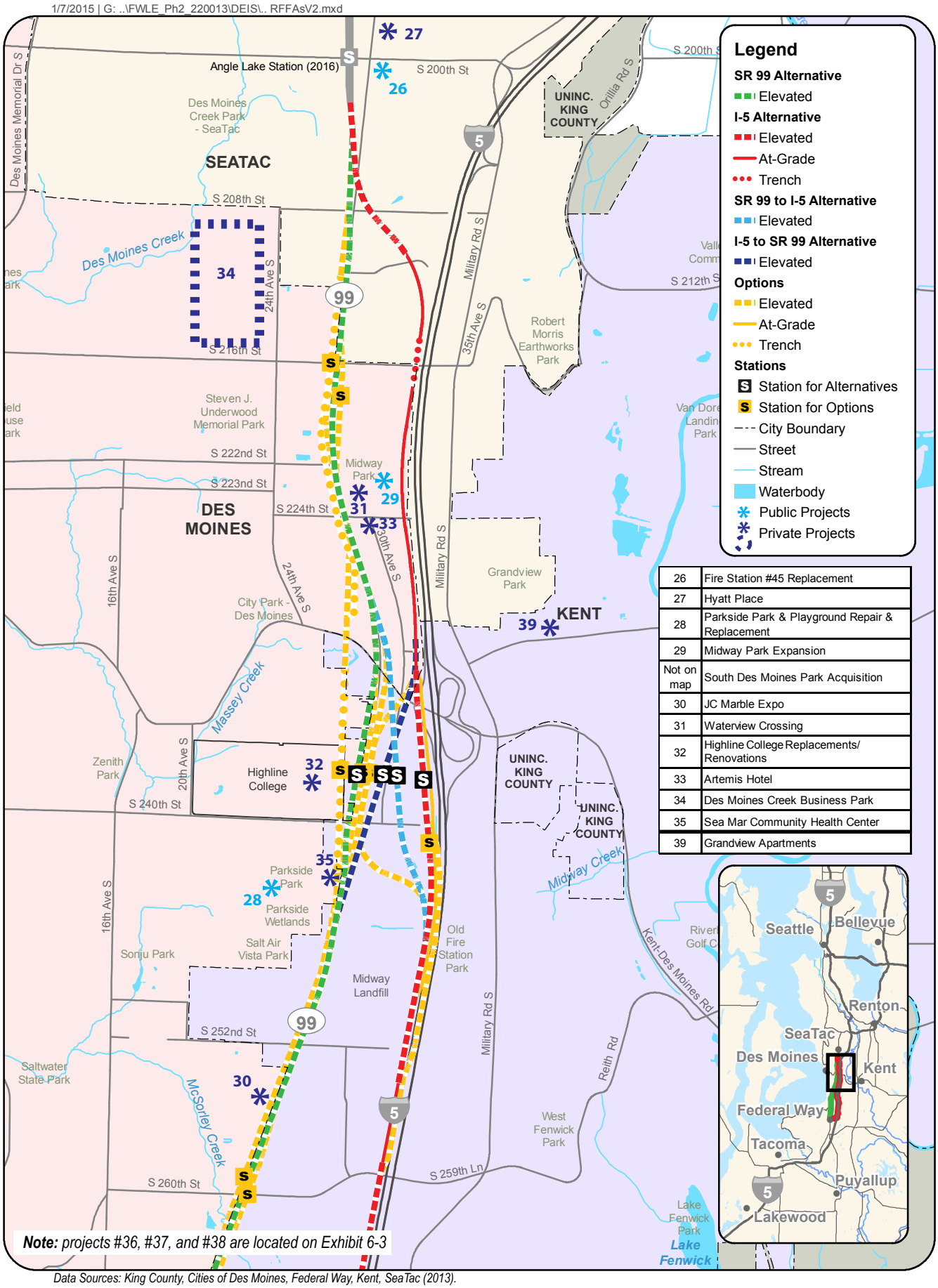
N

0 0.5 1 2 Miles

EXHIBIT 6-1

Transportation Plans & Projects

Federal Way Link Extension



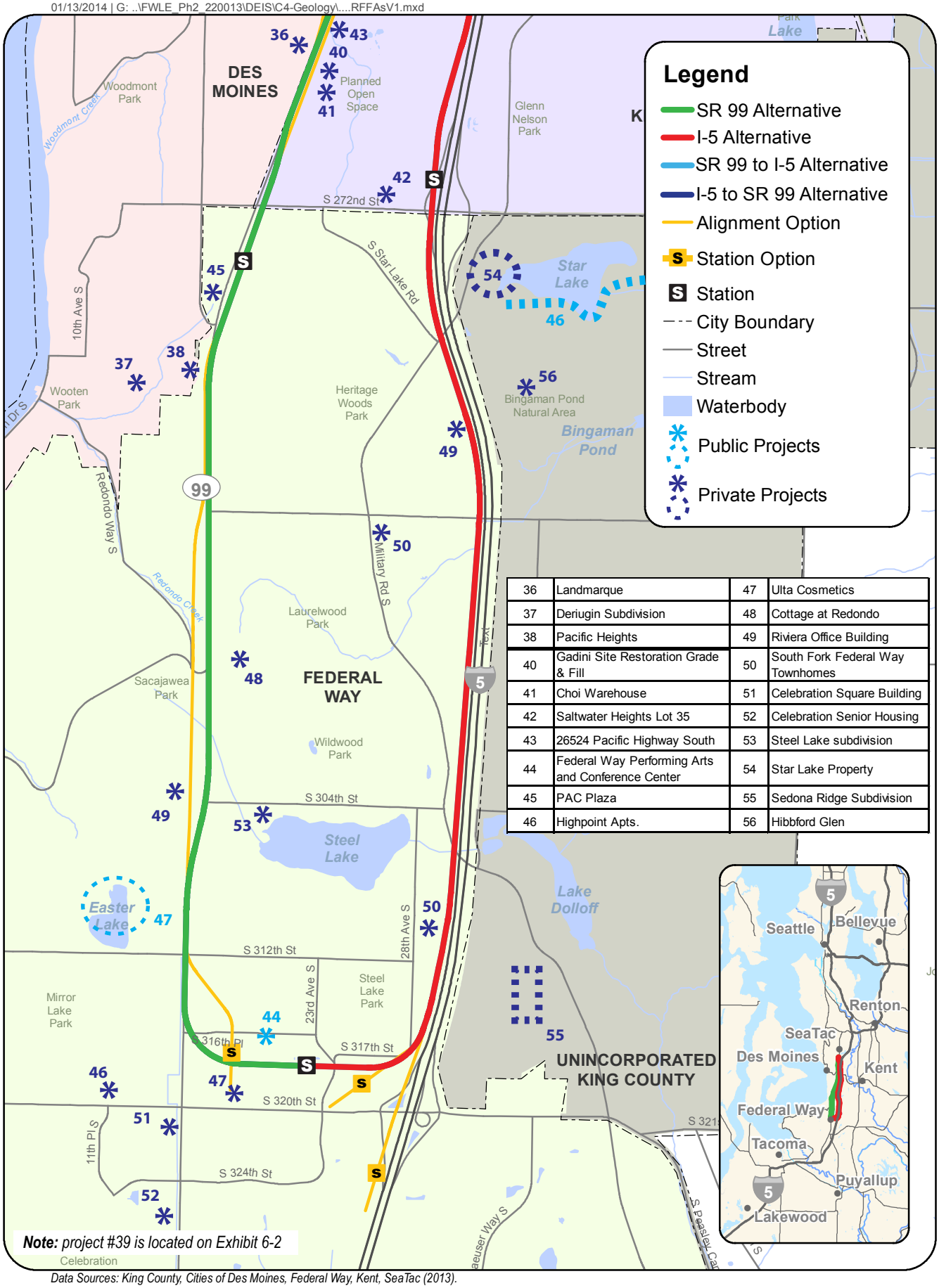
Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

EXHIBIT 6-2

Private and Public Planned Projects, Northern Extent

Federal Way Link Extension

DRAFT: For internal discussion only. Not reviewed or approved on behalf of any party.



36	Landmarque	47	Ulta Cosmetics
37	Deriugin Subdivision	48	Cottage at Redondo
38	Pacific Heights	49	Riviera Office Building
40	Gadini Site Restoration Grade & Fill	50	South Fork Federal Way Townhomes
41	Choi Warehouse	51	Celebration Square Building
42	Saltwater Heights Lot 35	52	Celebration Senior Housing
43	26524 Pacific Highway South	53	Steel Lake subdivision
44	Federal Way Performing Arts and Conference Center	54	Star Lake Property
45	PAC Plaza	55	Sedona Ridge Subdivision
46	Highpoint Apts.	56	Hibbford Glen

EXHIBIT 6-3

Private and Public Planned Projects, Southern Extent

Federal Way Link Extension

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

Operation of the FWLE would cause a shift of some vehicle trips to rail transit, thereby reducing demand on traffic and bus transit movement, air quality, noise levels, water quality, and energy consumption compared to future conditions projected under the No Build Alternative. Therefore, a key contribution of FWLE would be to reduce the adverse cumulative impacts on these resources to levels below what they would be without the project.

Because analyses of transportation, economics, air quality, and energy cannot be isolated from influences outside the FWLE, they inherently include the impacts of other projects or processes. As such, these four analyses of FWLE alternatives already have incorporated impacts from other reasonably foreseeable future actions and the analyses in Chapters 3 and 4 for these resources generally account for cumulative impacts already. Therefore, these elements of the environment are only discussed briefly below.

One project, the SR 509: Corridor Completion/I-5/South Access Road Project, or "SR 509 Extension Project," has the ability to substantially increase or decrease the impacts of some FWLE alternatives for some resource categories. As described in Chapter 2, the SR 509 Extension Project received a Record of Decision in 2003, but funding since that time has been limited to right-of-way acquisition. Because the SR 509 project is not included in any current transportation plans, this Draft EIS does not include it in the No Build Alternative or in the 2035 conditions of the build alternatives. However, to capture any potential cumulative impacts should it be built, this chapter assumes its completion. The FWLE alternatives have all been designed to accommodate the full build-out of the SR 509 project. WSDOT is currently considering phasing this project and combining it with other freight improvements in the south Puget Sound area such as the SR 167, SR 509, and I-5 Puget Sound Gateway Project. The following cumulative impact analysis considers impacts if the SR 509 Extension Project were to be built before 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 in the vicinity of 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 future transportation impacts discussed in Section 3.5 were based on the results of traffic and ridership modeling that incorporates past, present, funded, and approved future actions, as well as projected growth that would include development in the region. Other planned, but not funded, regional and local transportation projects and development projects could have some effects on transit ridership and travel patterns within the project area, including traffic operations near the proposed stations. This could include possible transit-oriented development (TOD), which could change how people access the stations with a likely increase in people walking or biking to the station as development occurs near the station.

The most substantial potential transportation improvement in the vicinity of the FWLE is the planned extension of SR 509 between its current terminus near S 188th Street and I-5, with associated improvements on I-5 south to S 320th Street in Federal Way. Cumulative effects of building and operating both projects relate to overall transportation capacity, highway operations and safety, and potential constraints around construction of these projects. The remainder of this section is focused on these effects.

Operating the FWLE and the SR 509 extension could improve overall traffic operations more than what was forecasted with the No Build or light rail alternatives alone. The cumulative effect of constructing the FWLE and the SR 509 Extension Project would likely result in less congestion on I-5 and along major north-south arterials like SR 99 in the vicinity of the study area than would occur with constructing only the FWLE.

The current design of 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. If the I-5 Alternative or I-5 to SR 99 Alternative is identified as the Preferred Alternative, roadway improvements in this area proposed as part of the SR 509 Extension Project would need to be redesigned to maintain neighborhood access and maintain a grade-separated light rail guideway in this area. Sound Transit would coordinate with WSDOT on potential alternatives to the current roadway design for S 211th Street.

Highway Design Deviations

Based on the conceptual design, design deviations could be required by WSDOT for the I-5 Alternative in two locations:

1. Where the I-5 Alternative crosses the future SR 509 extension. Future changes to the SR 509 design could 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.

The SR 509 Extension Project would require widening the I-5 mainline between S 200th Street and S 310th Street. The I-5 Alternative and the I-5 to SR 99 Alternative would have a slight impact on the I-5 southbound clear zone. There would be a short distance (approximately 800 feet) on the Kent-Des Moines Road southbound on-ramp to I-5 where a clear zone would not be provided and guardrails or barriers would be provided to protect the light rail guideway columns. No other I-5 southbound clear zones would be impacted. The barriers along the Kent-Des Moines Road southbound on-ramp could result in an increase of up to one crash a year. This on-ramp has had one crash over the past 5 years (2007-2011).

If SR 509 is constructed, the I-5 Alternative's Landfill Median Alignment Option would require the reduction of the planned inside shoulder width on I-5 from approximately 10 feet to 6 feet for approximately 1/2 mile. The light rail guideway would be located less than 30 feet from the planned edge of traveled way when the alignment is in the I-5 median. A barrier along the inside shoulder of I-5 southbound and northbound mainlines would be proposed to protect the guideway columns from vehicle collisions. Furthermore, as the guideway transitions to and from the I-5 median, a barrier would be required along the southbound I-5 outside shoulder (up to 600 feet for each section) to shield the guideway. Based on safety analysis using the *Highway Safety Manual* (HSM) (American Association of State Highway and Transportation Officials, 2014), adding a barrier, such as guardrail, through this 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.

Beyond the SR 509 Extension Project, WSDOT could implement lane management, such as express tolled lanes, as part of the I-5 Puget Sound Gateway Project. Depending on how lane management is administered, this change could improve travel conditions on I-5 for some modes.

6.5.1.2 Construction

If the SR 509 Extension Project is built prior to FWLE construction, the light rail construction area could be located adjacent to the planned I-5 pavement edge in two approximately half-mile sections—in the Midway Landfill between S 246th and S 252nd, and next to the McSorley Creek wetland in the vicinity of S 272nd Street. There would be no direct construction impact on the I-5 mainline travel lanes, but

short-term, temporary I-5 shoulder reductions would be required for these areas. These shoulder width reductions could result in slower vehicle speeds through the construction areas. For the remaining construction area along I-5, full shoulder widths would be maintained during construction. A Maintenance of Traffic plan that addresses all travel modes would be prepared during final design for agency approval.

The clear zone would be reduced along many sections of I-5 through the study area compared with the No Build Alternative if the current design of the SR 509 project were constructed. Therefore, during FWLE construction, temporary impacts to the I-5 southbound clear zone would occur. About 1,000 feet of clear zone would remain during construction. A temporary construction barrier would be placed for approximately 15,100 feet near the planned southbound I-5 edge of pavement where barriers would not already be present. Based on the safety analysis using HSM methodologies, placing a temporary barrier along southbound I-5 between S 211th Street and S 317th Street could result in an increase of up to three crashes per year during the construction period. This would be less than the condition without the SR 509 project because more permanent barriers would already be present with the SR 509 project.

Construction of the guideway with the I-5 Landfill Median Alignment Option would require the temporary closure of one southbound I-5 lane and the temporary narrowing of the inside shoulder to provide adequate space during the construction of the guideway between approximately S 240th Street and S 252nd Street. This would likely occur over a period of 4 to 6 months. During this period, the freeway capacity would be temporarily reduced in this short section from the loss of the shoulder and travel lane. The loss of capacity would result in slower vehicle speeds through this area, and drivers could detour to other roads. Construction of the girders for the guideway bridges over the southbound lanes of I-5 would have the same impacts identified for the FWLE alternatives without SR 509 in Section 5.2.1.1.

Simultaneous construction of the SR 509 Extension Project and FWLE could result in an increased number of trucks within the project corridor. Construction of the SR 509 extension would have direct impacts on the I-5 mainline and would require construction access directly from I-5, whereas the construction of the FWLE would not require direct vehicle access via I-5 and has no direct impacts on the I-

5 mainline operations except with the I-5 Landfill Median Alignment Option. Any lane closures and detour routes would be coordinated to minimize any traffic impacts related to simultaneous construction.

6.5.2 Acquisitions, Displacements, and Relocations

The SR 509 Extension Project would require several property acquisitions and residential displacements north of S 240th Street if constructed prior to the FWLE. However, land use plans for the Pacific Ridge neighborhood and Midway Subarea include redeveloping these areas to higher densities, which would provide increased housing opportunities. Additionally, high-density transit-oriented development could occur after construction of the FWLE in the vicinity of the Kent/Des Moines Station, close to where these impacts could occur. This type of development/redevelopment could provide relocation opportunities within the study area.

Sound Transit's study of currently available properties indicates that there are numerous comparable properties in the cities along the FWLE corridor where displaced residences and businesses could relocate. An adverse cumulative impact due to property 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.

Changes in transportation systems can influence changes in nearby land uses, either directly through acquisition or indirectly by providing new or improved access. Although the FWLE would not induce development beyond what is permitted under applicable local land use regulations, the project, in addition to other planned transportation and public works projects such as roadway improvements and bicycle lanes, would provide mobility options that would support local agency efforts to achieve higher land use densities, consistent with applicable regional and local plans, policies, and development ordinances. Although there are reasonably foreseeable future land developments in the study area that would increase density without light rail, light rail would support more dense urban centers (consistent with local development regulations), particularly near planned light rail stations, than would likely occur

without light rail. The FWLE could cumulatively help achieve goals that encourage high-density, mixed use, TOD in a timelier manner. Land use changes are expected to be greatest near stations due to increased transit accessibility and pedestrian activity, which are generally attractive to businesses and residents. Any changes to development regulations would be the responsibility of local governments and entirely within their control.

6.5.4 Economics

Changes to the regional transportation system can influence nearby businesses through direct acquisition and displacement as well as indirectly by providing opportunities for economic revitalization through enhanced access to businesses. The FWLE, along with other development projects in the area, is anticipated to influence long-term development and economic conditions.

As part of the larger Puget Sound Gateway Project, the extension of SR 509 would add a southern access point to Sea-Tac Airport and provide improved traffic and freight mobility through south King County. Much of the proposed SR 509 Extension Project route is within the FWLE study area and some properties that could be acquired for the FWLE could be acquired by WSDOT first for the SR 509 project. If these properties are acquired by WSDOT prior to the FWLE project, the property tax impacts associated with these properties would be reduced for the FWLE because WSDOT would convert them to a public, tax-exempt transportation use first.

Construction and the Economy

Construction activity is commonly an economic indicator, in that more construction is consistent with a stronger economy. Construction of infrastructure and development brings jobs and money to the local economy.

The SR 509 Extension Project would offer an alternate north-south travel route to I-5; combined with construction of the FWLE, this would have the cumulative effect of improving travel through the area, which could 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. Transit investment from the FWLE and other reasonably foreseeable future action projects could encourage private investment in TOD, which could result in increased property tax and sales tax revenues for local jurisdictions.

If the FWLE and other reasonably foreseeable future actions were being constructed at the same time, temporary adverse cumulative impacts on adjacent businesses could occur, including potential

increases in noise and dust, traffic congestion, visual intrusion, and increased difficulty in accessing properties. Visitors may choose to avoid areas of intense construction, resulting in a temporary adverse economic impact on local businesses, but this would not result in a long-term adverse economic cumulative impact. Additionally, the anticipated intervals of time between the noted reasonably foreseeable future action projects would lessen the potential cumulative impacts associated with multiple construction actions.

Based on the above assessment, 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

In general, neighborhoods served by light rail would benefit from increased transit access and from potential development within station areas.

To the extent that displaced residents and businesses could successfully relocate in their communities, neighborhoods (particularly those portions near stations) could experience increased vitality in terms of improved access, residential infill, growth in employment base, and greater patronage of local businesses. No other community facilities were identified that would be impacted beyond those affected by the FWLE.

The FWLE, in conjunction with other reasonably foreseeable future projects, would be consistent with applicable plans and policies related to the visual environment. The cumulative change would be a more densely developed urban environment primarily in station areas. Where land use development regulations permit, the visual change resulting from reasonably foreseeable future actions together with the FWLE stations would likely include changes in development density and more pedestrian-oriented activity than with existing or No Build conditions; increased density would also likely mean higher structures (where allowed by development regulations), which would have the effect of making the area visually more urban. The cumulative effect of denser development could also help reduce regional impacts on the visual environment associated with low-density development (e.g., loss of open space, reduction in vegetated areas, and expansion of paved areas).

The FWLE could contribute to cumulative impacts on the visual environment related to proximity impacts during construction, if any of the other reasonably foreseeable future projects are being constructed at the same time. Construction-related activities would increase the overall impacts on the surrounding visual environment.

6.5.6 Air Quality

The impact analysis for air quality in Section 4.6 is based on the Puget Sound regional traffic forecasts, which include reasonably foreseeable transportation projects. Therefore, the air pollutant and greenhouse gas emission analysis fully encompasses the cumulative effects that would occur regionally and locally, with or without the project.

The FWLE, alone and as part of the ST2, would result in reduced automobile vehicle miles traveled for the Puget Sound Region and, therefore, less petroleum consumed in the region.

The FWLE and other transportation improvement projects in the study area would cumulatively improve travel speeds for automotive travel, as compared to the No Build Alternative, for 2035. While all these projects would expend energy to build and develop, the long-term operation is an improvement over low-density, dispersed growth patterns that use more land area and require longer vehicle trips and more energy consumption. In addition, regional, state, and federal governments are adopting new regulations that will require reductions in greenhouse gas emissions. Cumulatively, these trends would have a beneficial impact on air quality.

ST2 and GHG Emissions

The FWLE is part of the ST2 Plan (Sound Transit, 2008a). This plan extends light rail north, south, and east of the Central Link Initial Segment in Seattle and makes other transit improvements throughout the central Puget Sound Region, including the FWLE. Sound Transit has conducted a cumulative analysis on how the operation of the ST2 Plan would affect greenhouse gas emissions throughout the region over the No Build Alternative.

The ST2 Plan is projected to reduce overall regional carbon dioxide equivalent (CO_2e) 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).

The cumulative greenhouse gas reductions with project operation cannot be realized without expended energy during construction. The FWLE, together with reasonably foreseeable future actions, would increase greenhouse gas emissions during construction. Temporary increases in air pollutants and greenhouse gas emissions would occur during construction of the project. However, emissions generated during construction would not exceed the National Ambient Air Quality Standards (NAAQS) and mitigation measures and best practices would be employed to minimize air quality impacts.

Although the operation of the FWLE may affect traffic patterns near proposed transit stations, the carbon monoxide hot-spot analysis determined that operation of the proposed project would not cause

any exceedances of the NAAQS. The conclusion of the air quality analysis is that the FWLE would reduce the cumulative release of car exhaust emissions to below future levels expected under the No Build Alternative, thereby providing a cumulative beneficial impact on local and regional air quality. Thus, the proposed project would not have a cumulative impact on regional and local air quality.

6.5.7 Noise and Vibration

The Federal Transit Administration (FTA) accepted methodology for noise and vibration analysis reflects both cumulative ambient noise conditions and project-specific noise and vibration impacts. FTA methods identify noise impacts and mitigation in the context of the cumulative noise exposure receivers would experience, based on existing noise levels in combination with new noise generated by the project. Therefore, the direct impacts identified for noise are cumulative in nature.

For both the SR 99 and I-5 corridors, noise from motor vehicles on these roadways as well as major arterials that cross these roadways is expected to be the dominant source of noise. Noise from aircraft approaching or departing from Sea-Tac Airport will also continue to contribute to noise levels in some parts of the project area. The future extension of SR 509 and associated improvements on I-5 may contribute to future noise and vibration in the project area.

The overall day-night average sound level (Ldn) along the FWLE corridor, when the FWLE is combined with other future projects, is not predicted to vary by more than 2 to 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, the FWLE would contribute noise and vibration impacts along with other nearby transportation and private development construction projects, and cumulative impacts could occur. Where necessary, Sound Transit would monitor noise and vibration during construction to minimize related disturbances on residential and other sensitive areas. Although Sound Transit is committed to mitigating project noise impacts, light rail would still create a new noise source and therefore would contribute to cumulative noise in the project corridor. In addition, the indirect impact of FWLE attracting more development around stations may result in more intense urban activities in some station areas, therefore adding cumulative noise to the surroundings.

Maximum vibration levels at any site are the result of heavy trucks on rough roads, light rail pass-by, where applicable, and local construction activities. Therefore, cumulative vibration levels in most areas would be the same as the existing vibration levels in most cases. Exceptions to this would include areas with extremely rough roadways with potholes and other discontinuities that result in increased vibration levels from passing trucks and other heavy vehicles, and near active construction sites, where short-term increases in vibration level would result from active construction equipment. Therefore, no cumulative vibration impacts related to the FWLE are predicted.

6.5.8 Ecosystems

Past actions and development by others have greatly changed the ecological landscape in the study area and vicinity. Presently occurring and reasonably foreseeable future actions, including other transportation and infrastructure projects, and pending or planned land use actions and developments in the project vicinity, could contribute to cumulative impacts on ecosystem resources in the study area. However, because individual project impacts are likely to be limited or minor, the potential for negative cumulative impacts on ecosystems would be low.

The FWLE, in conjunction with past urbanization, including residential development and construction of I-5, would have a potential cumulative adverse effect on Bingaman Creek. The I-5 Alternative and SR 99 to I-5 Alternative would necessitate that a currently open segment of Bingaman Creek be relocated and conveyed via culvert. Previous projects in this area have channelized this stream and degraded the habitat quality. South of S 288th Street, this section of the stream would be adversely impacted but would likely be mitigated off site. North of S 288th Street, impacts could be potentially mitigated onsite, and the new stream channel for the relocated portion would be constructed to incorporate habitat structure such as large woody debris and pools to improve fish habitat from the existing conditions, resulting in a net benefit. Additionally, culverts conveying fish-bearing or potentially fish-bearing streams would be designed to comply with federal, state, and local permit conditions, and tribal consultation.

Several proposed site development projects in the cities along the FWLE corridor could have effects on ecosystem resources in the study

area that, when combined with the effects of the FWLE, might result in cumulative effects. Proposed developments include several commercial and residential projects surrounding the McSorley Creek Wetland and McSorley Creek in the city of Kent, and a new subdivision adjoining Steel Lake at the headwaters of Redondo Creek. Although most of these projects are on previously developed or partially developed parcels, the impacts of these projects may include loss of or degradation of vegetation, wildlife habitat, streams, wetlands, and associated buffer areas. These individual impacts would be both short-term (e.g., temporary disturbance during construction) and long-term (e.g., conversion of vegetated areas to impervious surface). However, the potential for future individual projects to adversely affect aquatic species, aquatic habitat, vegetation, wildlife, or wetlands in the study area would be limited.

Any project or land use action would be subject to regulatory review and permitting under federal, state, and/or local regulations, and these review and permitting processes would trigger the implementation of measures to avoid or minimize the individual impacts on ecosystem resources. Such processes would also provide compensatory mitigation for any unavoidable impacts on streams, stream buffers, wetlands, or wetland buffers.

6.5.9 Water Resources

The FWLE is not anticipated to contribute to a cumulative adverse impact on 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. Construction of the I-5 Alternative or the SR 99 to I-5 Alternative could affect the method of stormwater treatment used for the SR 509 Extension Project. Therefore, going forward, small improvements in stormwater runoff control and water quality are expected to 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.

6.5.10 Energy Impacts

The FWLE is not anticipated to contribute to a cumulative adverse impact with respect to energy. Given the regional scale of the energy analysis and the scope of the travel demand model used for the analysis, the long-term indirect and cumulative impacts of the proposed project are accounted for in the analysis in Section 4.10.

The cumulative energy impacts of reasonably foreseeable future actions noted in this chapter would be negligible on the regional scale.

6.5.11 Geology and Soils

The FWLE is not expected to have a cumulative impact 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 associated with reasonably foreseeable future actions could increase the amount of infrastructure placed in localized geologically sensitive areas such as 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.

6.5.12 Hazardous Materials

Hazardous materials impacts are managed through cleanup and disposal. Federal and 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.

6.5.13 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. In addition, no areas were identified where EMI would combine with past, present, or future actions to result in human health effects or disturbance to sensitive equipment.

6.5.14 Public Services, Safety, and Security

Under the build 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 cumulative contribution to a potential increase in demand for public services and to safety and security would be minor and not adverse.

6.5.15 Utilities

The FWLE would not contribute to cumulative impacts related to utility demand. The availability of light rail service could encourage development of property in the vicinity of the project footprint, which in turn could increase the demand for utility services in this area. However, local governments and public utilities have already accounted for this planned growth in adopted local land use plans. The project corridor is located entirely within the city limits of the cities of SeaTac, Des Moines, Kent, and Federal Way, and any development near the project footprint would be no more intense than what is allowed in the adopted land use plans and development regulations of these local governments. Therefore, the cumulative impacts on utilities would not be greater with or without the FWLE.

6.5.16 Historic and Archaeological Resources

Within the FWLE area of potential effects for historic and archaeological resources, no archaeological resources were identified and ten historic buildings were determined eligible for the National Register of Historic Places (NRHP). None of the FWLE alternatives would result in adverse effects on a historic property. According to the *Highline Community College Master Plan* (Highline College, 2014), two NRHP-eligible buildings (Buildings 6 and 15) are scheduled for demolition and replacement between 2019 and 2021. According to the college's master plan, demolition and replacement of these buildings will be coordinated with the Department of Archaeology and Historic Preservation and other agencies for potential mitigation measures and impacts. The FWLE would not have an adverse effect on any of the NRHP-eligible buildings at Highline College, and as such would not contribute to a cumulative effect.

6.5.17 Parks and Recreational Resources

As described in Section 4.17.3, the FWLE Federal Way SR 99 Station Option would incorporate 0.7-acre of Federal Way Town Square Park's parking lot and landscaping to incorporate a new transit-only roadway. However, there would be no adverse effect on the recreational resources of the park, and the parking impact would be mitigated. No other planned projects would impact this park or any other park; therefore, there is no potential for long-term cumulative impacts.

There would be temporary construction impacts on the playfield at Mark Twain Elementary School in Federal Way. Because the playfield

would be restored to existing conditions following construction, there would be no net loss to recreational resources from the FWLE. Therefore the FWLE would not contribute to any permanent cumulative impacts on parks or recreational resources. In combination with other foreseeable projects, the FWLE could potentially cause cumulative impacts on parks if construction periods overlap. No other projects have been identified in the FWLE corridor that would also result in temporary park impacts, so the FWLE is not expected to have a temporary cumulative impact on parks and recreational resources either.

6.6 Potential Mitigation Measures for Cumulative Impacts

Operational cumulative impacts on transportation, visual, noise, and water resources could occur. Avoidance, minimization, and mitigation measures for FWLE operational impacts on these resources are discussed in Chapters 3 and 4, and except for some visual impacts, all impacts could be fully mitigated. However, most cumulative impacts would occur during construction rather than operation, so in most cases mitigation would remain the responsibility of each project proponent to meet regulatory requirements during construction for direct impacts on resources such as ecosystems, water resources, hazardous materials, and historic and archaeological resources.

The FWLE will coordinate, as necessary, with reasonably foreseeable future 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 may reduce cumulative construction impacts related to transportation, reduced access, increased dust and noise affecting businesses and residences, and visual resources.

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7.0 Environmental Justice

7.1 Summary

Based upon information presented in other sections of this Draft Environmental Impact Statement (EIS), the Federal Way Link Extension (FWLE) would not result in disproportionately high and adverse effects on minority and low-income populations and would result in a number of benefits to these populations in the FWLE corridor. These benefits include improved access to transit, improved transit reliability, improved access to employment opportunities, and improvements to air quality in the region. In addition, in the 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.

7.2 Introduction and Regulatory Framework

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) the opportunities provided to actively participate in the planning process. This analysis was prepared in compliance with Presidential Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, dated February 11, 1994, and with the 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, directs agencies to ensure limited-English-proficiency (LEP) populations have fair and equal access to services. Title VI of the Civil Rights Act of 1964 also prohibits discrimination based on race, color, and national origin.

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.

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.

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.

The DOT 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)).

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 who meets the following criteria:
   - 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)).

7.3 Methodology and Approach

The environmental justice analysis for FWLE was completed 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 Federal Transit Administration's (FTA) 2012 circular titled *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 engaging environmental justice populations in the public transportation decision-making process and 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, and 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 data (U.S. Census, 2010) and American Community Survey (ACS) data (U.S. Census, 2012). Minority populations were analyzed at the census block level, the smallest area available, using 2010 census data, and low-income populations were analyzed at the census block group level using 2007 to 2011 ACS data since data are not available at a smaller geographic scale. Demographic data from the U.S. Census and ACS were also collected for foreign-born and limited-English-proficiency populations, and transit-dependent households. These data can provide additional information on the

minority and low-income populations in the study area. Elementary school data were also used as a secondary source of information for minority and low-income populations.

The analysis also provides information on the efforts that Sound Transit has made to involve minority and low-income populations in the FWLE planning process and assesses 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 Draft EIS, including the technical appendices and reports.

7.4 Study Area Demographics

The study area for the environmental justice analysis is the area within 0.5 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 0.5-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.

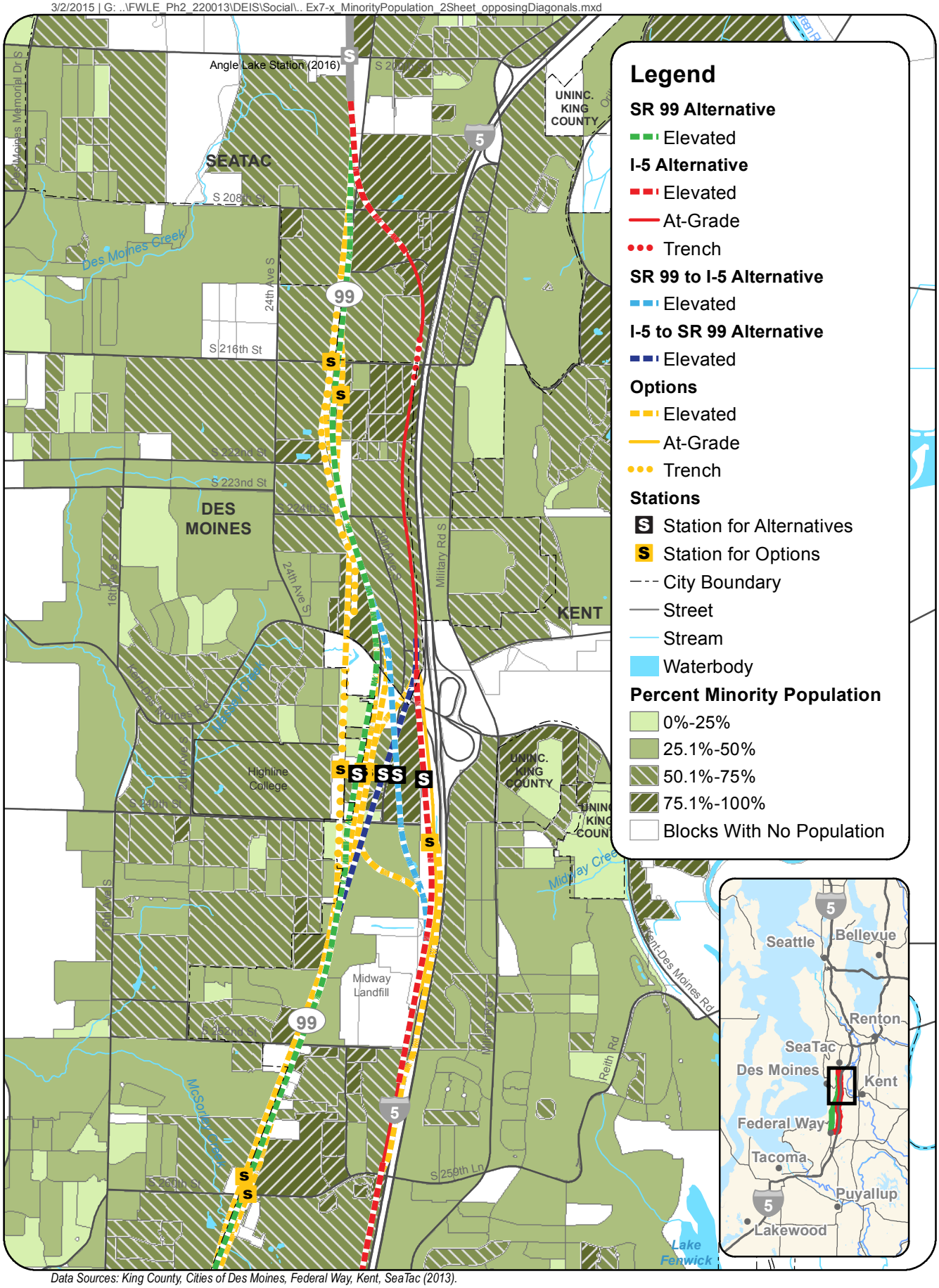
The FWLE would connect to the existing light rail system at the future southern terminus at Angle Lake Station in SeaTac. It would extend to the cities of Des Moines, Kent, and Federal Way. Areas adjacent to SR 99 are mainly commercial land uses that transition to residential land uses further away from SR 99. Areas adjacent to the I-5 corridor consist of mostly residential land uses. Transit service is provided by

King County Metro buses along SR 99 and on some local roadways. King County Metro, Sound Transit, and Pierce Transit provide bus service in the I-5 corridor, primarily with express routes to Downtown Seattle or Tacoma. 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.

Student demographic data were collected as a secondary source of data from the Washington State Report Card website for the 2011-2012 school year (Office of the Superintendent of Public Instruction, 2013) for those elementary schools whose attendance boundary crossed the study area boundary. Students within the study area attended schools in the Highline 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).

Elementary school data were used for this analysis because elementary school attendance boundaries are more representative of the study area as they encompass smaller areas than the middle school or high school attendance boundaries, which have more students living outside of the study areas. Some of the school boundaries fall outside of the study area, and therefore the demographic information also contains data on students who may live outside of the study area. Additionally, students in King County school districts can be enrolled in programs that allow parents to choose which school in the district the student attends; therefore, the school data do not provide a direct comparison with the census data, but can provide additional demographic characterization of the population of the study area.

Exhibits 7-1 through 7-4 illustrate the minority and low-income percentages in the study area. The SR 99 and I-5 corridor study areas overlap in a number of areas and have similar population concentrations in the areas east of SR 99 and west of I-5.



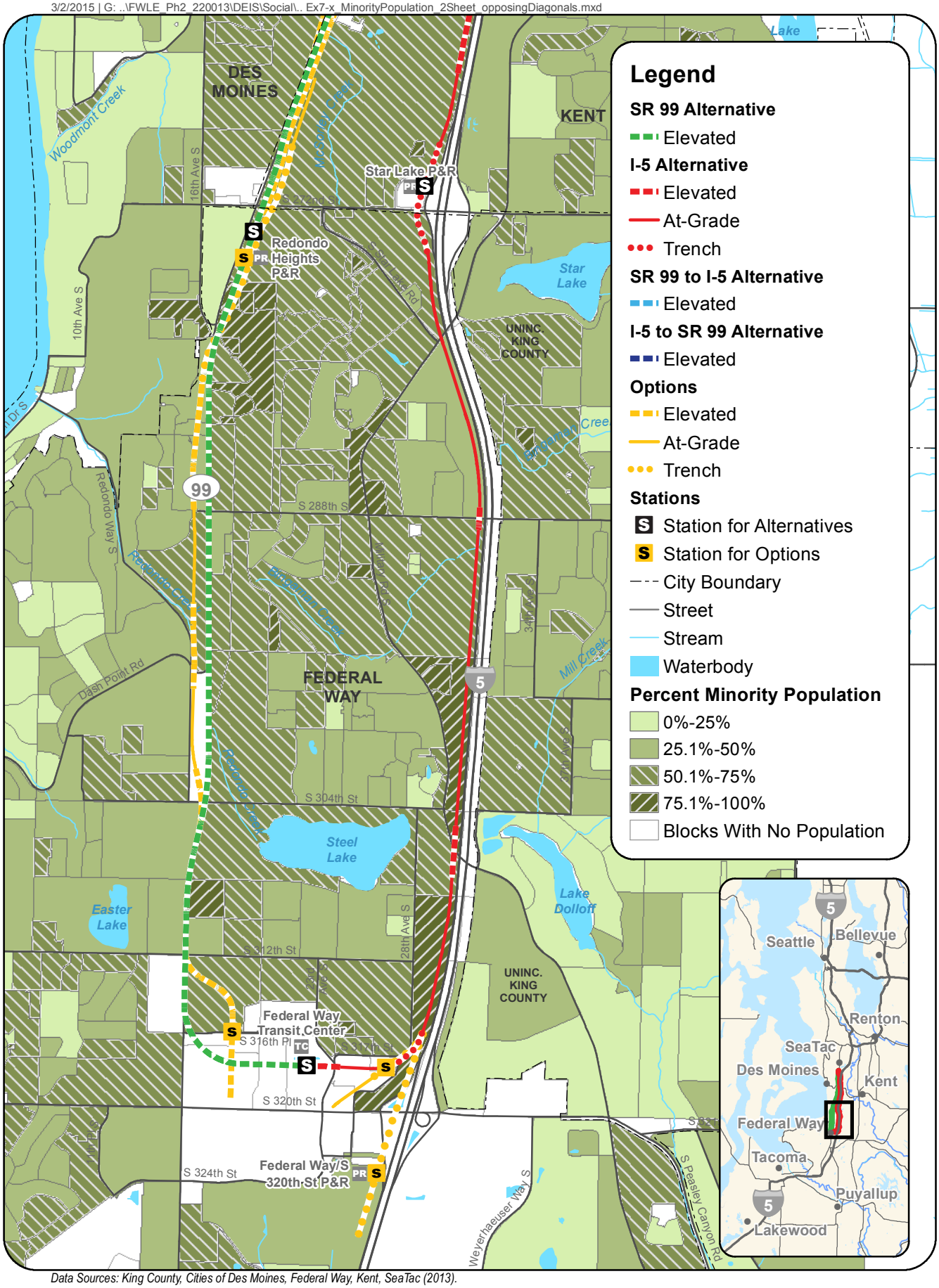
Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

N

0 0.25 0.5 1 Miles

EXHIBIT 7-1
Minority Population within Census Block (North)

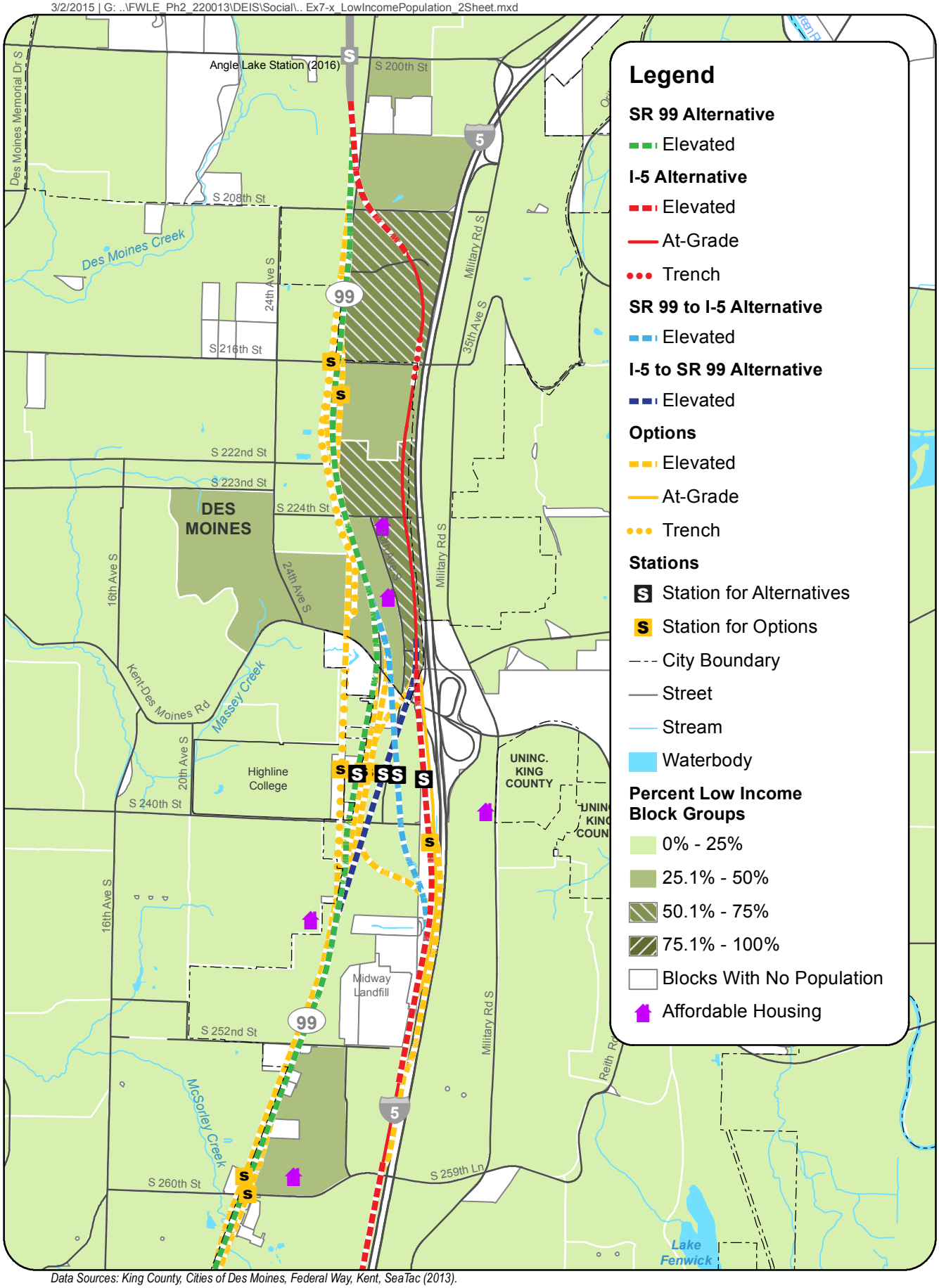
Federal Way Link Extension



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

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

Federal Way Link Extension



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

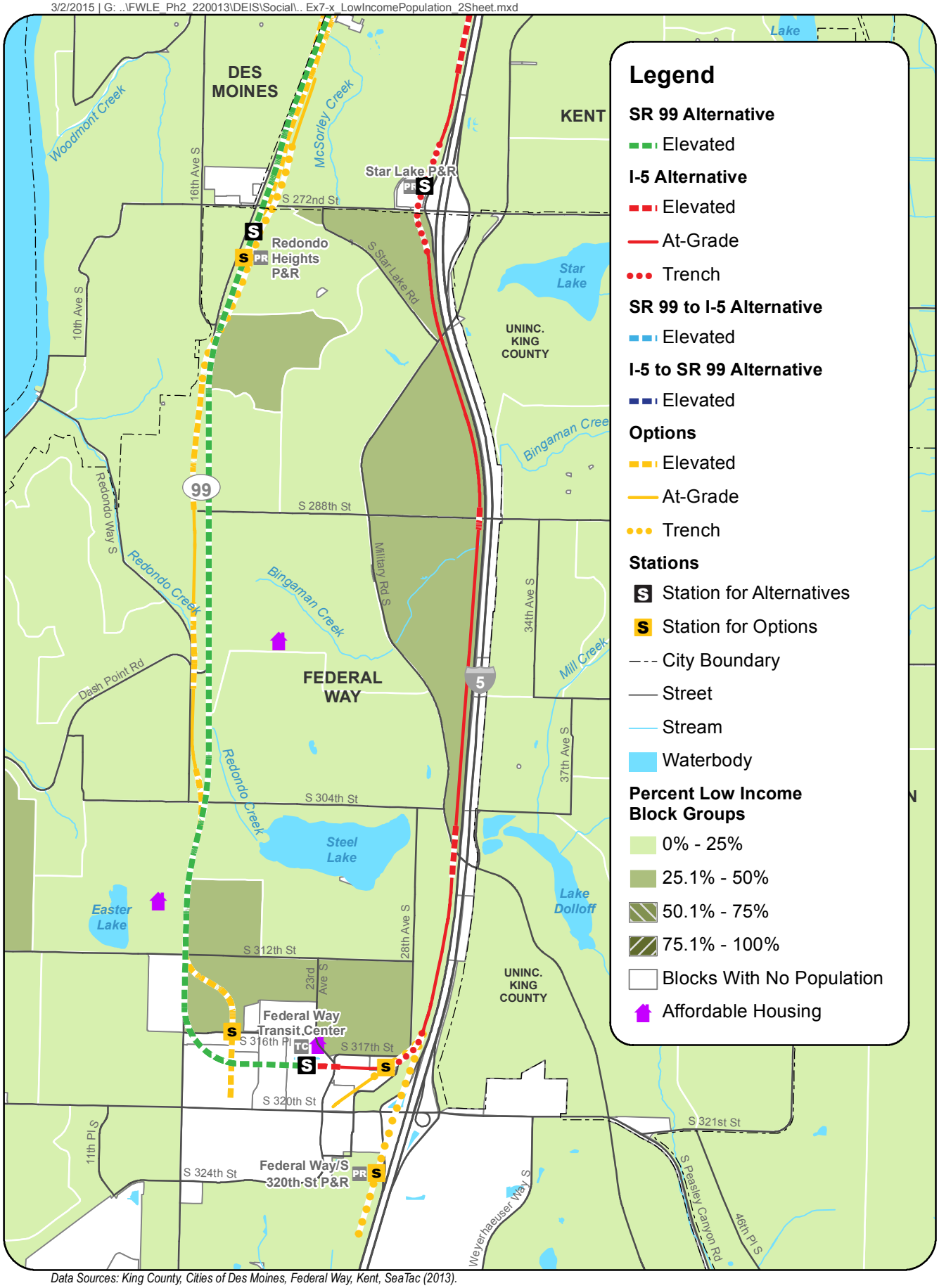
N

0 0.25 0.5 1 Miles

EXHIBIT 7-3

Low Income Population within Census Block Group (North)

Federal Way Link Extension



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

N

0 0.25 0.5 1 Miles

EXHIBIT 7-4

Low Income Population within Census Block Group (South)

Federal Way Link Extension

7.4.1 Minority Populations

As shown in Exhibits 7-1 and 7-2, the area between SR 99 and I-5 has higher minority population concentrations compared to the areas west of SR 99 and east of I-5. Minority population concentrations in this area exceed 75 percent in some census blocks. Outside of this area, most census blocks have minority population concentrations under 50 percent, although there are a few blocks with concentrations between 50 and 75 percent. The overall minority concentration in the study area is approximately 55 percent, which is higher than the cities in the study area except SeaTac and higher than the Sound Transit district-wide minority population of 31.1 percent. Based on the 2010 Census data used to map the populations within census blocks, the predominant minority concentrations are Hispanic or Latino (18.8 percent), Asian (13.6 percent), and African-American (10.6 percent).

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.

The study area also has higher concentrations of LEP households, with about 9.6 percent within 0.5 mile of SR 99 and 11 percent within 0.5 mile of I-5. The Sound Transit district LEP concentration is 4.9 percent. The concentration of LEP populations provides additional information about minorities living in the study area and was used to inform the outreach strategy targeted for EJ populations. The predominant foreign languages spoken in the study area include Spanish, Russian, Korean, Vietnamese, and Tagalog. Table 7-1 provides additional information on the population concentrations for minority populations in the study area compared to the other geographies.

TABLE 7-1
Population Characteristics

	SR 99 Corridor	I-5 Corridor	SeaTac	Des Moines	Kent	Federal Way	King County
Total Population	52,034	58,108	26,909	29,673	92,411	89,306	1,931,2446
Population under 18 (%)	25.4	25.6	23.1	22.2	26.2	25.6	21.4
Population over 65 (%)	9.7	8.8	9.7	14.8	8.8	10.3	10.9
Minority (%)	55.6	56.1	60.5	43	50.3	48.4	27.1
Low-Income (%)	19.4	17.8	14.3	13.1	16.6	13.2	6.6
Median Household Income	$52,071	$57,295	$45,970	$59,577	$54,591	$54,856	$70,567
Households with No Vehicle (%)	10.5	7.4	8.2	6.6	7.6	8.1	9.1
Households with Limited English Proficiency (%)	9.6	11.0	11.0	5.9	9.7	7.6	5.1

Source: U.S. Census Bureau, 2010 and ACS, 2012.

Much of the foreign-born population would be considered a minority population, and this population provides an additional demographic characteristic of those in the study area who may be minority. The countries of birth with the highest percentages in the study area include Mexico, the Philippines, Korea, Vietnam, India, Ethiopia, and Kenya. These countries account for approximately 60 percent of the foreign-born population, with Mexico having the highest percentage at 23.3 percent.

Elementary school data are characterized by race and/or ethnicity and may differ from census data. Based on the 2011–2012 data, minority students comprise about 88 percent of those enrolled in the study area schools. The school data may be an indication that the study area population includes higher concentrations of minorities when compared to U.S. Census data. Within these schools, students who are English language learners comprise about 29.5 percent of the student populations.

These are students that live in homes where another language is the primary language spoken, or they learned another language before English, which is another indicator of the LEP populations. However, the school data may not be a true reflection of the minority populations living within the study area because the data only represent the population with elementary school-age children that attend public schools. Therefore, as stated earlier, the school data and the census data do not allow for direct comparisons, only for potential indicators in changing demographics because the school data are more recent than the 2010 Census.

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

- Advertisements included 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 were held in transit-accessible facilities.
- Meetings were held in the evening to accommodate daytime and graveyard shift workers.
- Worked with SomTV to produce 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.

7.4.2 Low-Income Populations

Similar to the minority population, the low-income population concentration in the area between SR 99 and I-5 is higher than areas farther west or east, as shown in Exhibits 7-3 and 7-4. Much of the study area west of SR 99 and east of I-5 has low-income concentrations between 0 and 12.5 percent. Overall, low-income concentrations average 19.4 percent within 0.5 mile of SR 99 and 17.8 percent within 0.5 mile of I-5. The study area between SR 99 and I-5 north of Kent-Des Moines Road contains areas where low-income concentrations are greater than 50 percent. All other areas of the corridor are less than 50 percent low-income. These concentrations

are higher than those within the cities in the study area and higher than the 11.2 percent population in the Sound Transit district.

Exhibits 7-3 and 7-4 also provide information on the locations of affordable housing in the study area. Affordable housing was identified as residential developments with low-income 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. To be eligible for these programs in King County, a family's income must be 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 with no vehicle can be considered transit-dependent and this can be an indicator of low-income populations. The concentration of households with no vehicle for the SR 99 and I-5 corridors is 10.5 and 7.4 percent, respectively and similar to the study area cities. Section 4.4.3.1 provides information on the population concentrations of low-income, median household income, and households with no vehicle in the corridors compared to the other geographies.

The elementary school data provide an estimate of low-income population based on those students who participate in their school's free-lunch program. Eligibility for the program is based on the federal poverty guidelines issued by the Department of Health and Human Services. Of those students who attend elementary schools in the study area, about 70 percent participate in the program. Similar to the minority data, the school data do not provide a direct comparison with census data.

7.5 Outreach to Minority and Low-Income Populations

As part of public outreach for the FWLE, Sound Transit provided engagement opportunities for minority and low-income populations early and often in the planning and development process. In addition to Sound Transit outreach policy, EO 12898, DOT Order 5610.2(a), and EO 13166 require agencies to provide opportunities for minority

and low-income populations to engage in the public participation process. The following discussion provides information on the public involvement efforts to date for the FWLE. For additional information on public involvement and agency coordination, refer to Appendix B.

7.5.1 Stakeholder Outreach

At the beginning of the FWLE project development process, Sound Transit conducted stakeholder interviews with local community organizations, local jurisdictions, and social services providers that serve the minority and low-income populations in the study area. Stakeholders were interviewed to better understand the minority and low-income populations and how to reach them. Those interviewed included the following education and social services providers: Korean Women's Association, International Rescue Committee, 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, and the cities of Des Moines, SeaTac, and Federal Way.

7.5.2 Scoping Meetings

Sound Transit conducted two scoping periods for the FWLE. Early scoping was held 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 was conducted 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 in this Draft EIS. Each scoping period had 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 to this Draft EIS.

Scoping meetings provided an initial 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 0.5-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, including federally and non-federally recognized tribes, during scoping and invited them to become participating agencies. The tribes contacted included the Confederated Tribes and Bands of the Yakama Nation, Muckleshoot Indian Tribe, Puyallup Tribe of Indians, Snoqualmie Indian Tribe, Stillaguamish Tribe of Indians, Suquamish Tribe, Duwamish Tribe, and Snohomish 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.

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 including minority and low-income populations to be involved in the decision-making process. All the notices for outreach events include language blocks 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” translated into six languages (Spanish, Chinese, Vietnamese, Korean, Soli, Tagalog, and Russian). When Sound Transit staff are contacted by a member of the public who does not speak English well, they 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 has held a number of targeted outreach events to increase awareness of the project. Events have included attending 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 include:

- Open houses – Two of these were held at the Federal Way Transit Center to better reach diverse populations.
- Tabling events – Forty-nine tabling events have been 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 - Five briefings have been held in the neighborhoods adjacent to the potential station locations and project alternatives.

The events were held at various times during the day to provide area residents information on the project, answer questions, and encourage residents to sign up for the project e-mail mailing list, which provides the latest information on the project to list members. In addition to the outreach listed above, Sound Transit outreach staff regularly provides project updates to social service organizations, including King County Mobility Coalition and the South King County Human Services Council. Some information heard during these meetings helped inform the outreach process, such as:

- The City of SeaTac is a culturally diverse community with a large foreign-born population and a large Latino population. While there are not many formally organized community groups, ethnic groups are tightly knit within their own communities.
- The City of Kent has a diverse population, with many cultural and language groups and a sizable foreign-born population. The community overall is not very tightly knit and segregation between cultural and ethnic groups is common.
- The West Hill area of Kent is a tight-knit community, and predominantly Latino.
- Even though Sounder service is extremely popular, the residents of the City of Kent tend not to use transit. There is a large transit dependent population, but there is a feeling that City of Kent residents are not very aware of transit options and generally do not feel they are well served by transit.
- The area closest to the potential alignments along SR 99 and I-5 in Des Moines have relatively high levels of low-income populations and high-density housing. Closer to the water are single-family homes and primarily white retirees.
- There are large senior and Hispanic communities in the City of Des Moines.
- Businesses in the City of Des Moines tend to be smaller enterprises. It will be important but difficult to reach businesses along SR 99.

- Highline College is a major institution in the FWLE corridor. It is considered to be the most diverse educational institution in the state, with 60 to 70 percent students of color and a high number of students with low incomes. Social media, email, and the college's website are main forms of communication. Tabling events on campus would be a great way to reach students.
- There is a large ethnic presence in Federal Way that includes Islamic, Latino, and Korean people. The City of Federal Way is not a close-knit community, and ethnic groups do not appear to be as organized as those in South Seattle. They do not have spokespeople and do not attend City Council meetings.
- There are a number of lower-to-middle income residents living in multi-family housing in Federal Way.
- There are a lot of transit users in the City of Federal Way, and the Rapid Ride Line A is very popular.
- People in Federal Way get their information from the *Tacoma News Tribune* and *Seattle Times, Federal Way Mirror*, City cable access channel, Korean radio station, and local houses of worship. People in the community have responded well to MindMixer, an online public participation tool. The City of Federal Way also uses its website and social media to reach people.
- Service providers suggested several community events that are well attended and might be good opportunities for outreach.
- Southwest King County as a whole is not well organized or tightly knit.
- Information is often shared through churches and schools, and tabling at sporting events can be effective.
- With 400 members that include businesses in cities of Des Moines and SeaTac, the Southwest King County Chamber of Commerce is a good conduit for reaching many businesses. Monthly lunches are well attended and businesses committee meetings are also well attended. The Chamber offers an e-newsletter, Business Advocate, and a weekly e-mail bulletin.

Sound Transit outreach staff have also held meetings and briefings with potentially affected property owners and others upon request, to provide information and answer questions.

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

- Support for the project, including a desire to see the project completed sooner
- General questions on the project (i.e., station locations, cost to ride, and when service starts)
- Parking concerns; people want to ensure parking is included and feel that it is needed
- 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 due to 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 the potential indirect effects related to gentrification

Some of these concerns and questions may be of particular concern to lower income populations and those that rely on public transit (e.g., changes to bus service, cost to ride light rail, gentrification, etc.)

7.5.4 Targeted Outreach for Draft EIS Release

Prior to the release of the Draft EIS, Sound Transit conducted targeted outreach activities, including:

- Hosted a transportation fair at Highline College to reach students with information about FWLE
- Conducted one-on-one property owner and tenant meetings with interpretation upon request
- Distributed fliers to tenants living in apartment buildings and mobile home parks potentially affected by the project
- Translated project fact sheets into Korean, Russian, Spanish, and Vietnamese

Concurrent with the release of the Draft EIS, a public notice was published along with a request for comments and a notice of public hearing dates, times, and locations and opportunities for comment. Sound Transit also mailed a project update newsletter to approximately 25,000 households and businesses in the project corridor that included content in Korean, Russian, Spanish, and Vietnamese. Additional outreach to community groups and organizations that provide services to minority and low-income populations in the project vicinity was also conducted before the release of the Draft EIS, and additional outreach will follow.

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 Draft EIS. It summarizes direct effects from construction and operation of FWLE as well as indirect and/or cumulative effects (such as potential for redevelopment near station areas (Transit-Oriented Development)). Considering the demographics in the project area described above, impacts of the project will affect minority and low-income populations. The summary also provides information for those elements of the environment where the project impacts would accrue to a different degree for minority and low-income populations. Potential mitigation that would reduce or eliminate the impacts is also described. The No Build Alternative would not have any of the impacts described in this table.

TABLE 7-2
Summary of Potential Impacts and Mitigation

Type of Impact	Impact Summary for Build Alternatives	Mitigation Summary
Transportation	• Because the FWLE would not include any at-grade road crossings and would be outside of roadway operations, impacts to access and circulation are expected only at 3 locations near stations, and could be mitigated. • Parking would be displaced by all alternatives including private off-street parking associated with businesses. Although the project would provide parking at the Kent/Des Moines, S 272nd and Federal Way City Center stations, no parking is proposed at the potential additional stations at S 216th Street and S 260th Street. There is potential for hide-and-ride near these potential additional stations as well as at the Federal Way City	• Turn lanes would be added or extended to accommodate increased traffic and improve level of service. • Businesses that would lose parking would be provided with replacement parking or compensated for their loss of parking.

TABLE 7-2
Summary of Potential Impacts and Mitigation

Type of Impact	Impact Summary for Build Alternatives	Mitigation Summary
	Center stations. In areas where there is a potential for parking impacts, parking management programs could be introduced.	
Acquisitions, Displacements, and Relocations	• Residential displacements are highest with the I-5 Alternative (186 to 305) and would mostly occur north of S 240th Street, in the Pacific Ridge and Midway neighborhoods. Both neighborhoods have high concentrations of minority populations (over 50 percent) and Pacific Ridge has high concentrations of low-income populations (over 50 percent). Residential displacements with the SR 99 Alternative are lower (ranging from 36 to 108). These displacements would occur primarily in the Midway neighborhood, which has relatively high concentrations of minority populations (over 50 percent); low-income populations are less than 50 percent. • Business displacements are highest with the SR 99 Alternative (82 to 140) and would affect mostly retail properties in station areas. Based upon a review of the businesses that could be displaced, there are some that provide services that would be considered important to minority and/or low-income populations (e.g., an ethnic grocery store). The services provided by these businesses are also provided by other businesses in the study area that would not be displaced or relocated.	• Residents and businesses displaced by the FWLE 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, 2002 and 2011). There are opportunities for relocation of residents and businesses in the FWLE vicinity, including relocation opportunities for those residents of impacted mobile home parks. • For residential relocations, Sound Transit would work with those affected 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 the residents are transit-dependent.
Land Use	• Most land acquired for the FWLE alternatives would be converted to a transportation-related use. Some of the acquired property used for construction staging could be redeveloped consistent with existing zoning. • All of the FWLE alternatives would be generally consistent with regional and local plans and polices. • 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 transit services. Some TOD developments may include affordable housing units.	• No mitigation is required or proposed.
Economics	• Business and employee displacements are highest with the SR 99 Alternative, with business displacements ranging from 82 to 140 and employee displacements ranging from 480 to 920. Business and employee displacements would be lowest for the I-5 Alternative. 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	• Businesses displaced by the FWLE 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, 2002 and 2011).

TABLE 7-2
Summary of Potential Impacts and Mitigation

Type of Impact	Impact Summary for Build Alternatives	Mitigation Summary
	could result in additional tax revenues and business and employment growth. Benefits of increased tax revenues would improve city services including those minority and low-income populations in the study area. • New development and redevelopment in the station areas could result in increased property values, taxes and higher rents, which could have a negative impact on residents, especially those who rent.	
Social, Neighborhoods, Community	• The Kent/Des Moines HC Campus Station Option associated with the SR 99 Alternative and the S 260th West Station Option associated with the SR 99 and I-5 to SR 99 alternatives would both displace a community health clinic that serves minority and low-income populations. There would be opportunities for the clinic to be relocated in the area, but this may require building a new facility. • The Kent/Des Moines HC from S 216th W Station Option and the S 260th West Station Option would displace religious institutions. No adverse impacts on minority populations or low-income populations are anticipated with the displacement of the Citadel Church or the Open Door Baptist Church, affected by the Kent/Des Moines HC Campus Station from S 216th W Station Option, or by the displacement of 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 are known to serve predominantly minority populations. It is expected these churches could relocate within the project vicinity. • New development and redevelopment in the station areas could result in increased property values, taxes and higher rents, which could have a negative impact on 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 has adopted a Transit-Oriented Development Policy that includes goals for providing affordable housing in station areas. In addition, the Puget Sound Regional Council Growing Transit Communities program established a number of strategies related to affordable housing.	• Mitigation for displacements is described above for Acquisitions, Displacements, and Relocations.

TABLE 7-2
Summary of Potential Impacts and Mitigation

Type of Impact	Impact Summary for Build Alternatives	Mitigation Summary
Visual and Aesthetic Resources	• All of the FWLE build alternatives would lower the visual quality for some sensitive viewers in the vicinity. In general, these impacts would be the result of vegetation removal and the introduction of an elevated structure. These impacts would affect all populations similarly and are generally distributed throughout the corridor. The number of residences affected would be reduced with the implementation of landscaping and other design elements.	• Where possible, Sound Transit would preserve existing vegetation, would provide replacement landscaping, and would 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 to include visually interesting elements.
Air Quality	• No new violations of federal air quality standards would occur, and greenhouse gas emissions with the FWLE build alternatives would be less than under the No Build Alternative. This would result in beneficial effects for all populations.	• No mitigation is required.
Noise and Vibration	• The SR 99 Alternative would have the greatest number of noise impacts but the lowest number of vibration impacts. The I-5 Alternative would have the greatest number of vibration impacts but the lowest number of noise impacts. All impacts could be mitigated.	• Noise and vibration impacts would be mitigated by sound walls, special track work, or other measures. Installing residential sound insulation would also be necessary at some properties. • Most noise impacts could be mitigated with sounds 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 sounds walls. If this occurs, these mobile homes would likely be acquired as RSIP cannot be completed on mobile homes.
Water Resources	• The FWLE alternatives would increase impervious surfaces within the project footprint by between 14 percent for the SR 99 Alternative and 140 percent for the I-5 Alternative. Increases in impervious surface would be greatest with the I-5 Alternative due to large undeveloped vegetated areas of this alignment being affected.	• Stormwater would be managed according to applicable regulatory requirements.
Ecosystems	• Ecosystem impacts would be limited, and impacts on wetlands and streams with the SR 99 and I-5 to SR 99 alternatives would be minor. The I-5 and SR 99 to I-5 alternatives would have greater wetland impacts and require relocating and piping of a portion of Bingaman Creek. None of the build alternatives would result in any adverse effects on threatened or endangered species.	• Where impacts cannot be avoided, compensatory mitigation would be implemented to achieve no net loss of ecosystem function and acreage.

TABLE 7-2
Summary of Potential Impacts and Mitigation

Type of Impact	Impact Summary for Build Alternatives	Mitigation Summary
Energy	• Operation of FWLE would result in a slight reduction of passenger and transit vehicle miles traveled as people shift to the light rail system. Overall, FWLE operation is projected to result in 0.1 percent less energy use than the No Build Alternative.	• None required.
Geology and Soils	• 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.	• Risks would be avoided or minimized using engineering design standards and BMPs.
Hazardous Materials	• All build alternatives would have the potential to encounter hazardous material sites considered to be high-risk. The SR 99 Alternative would have the highest number of sites within or adjacent to the project footprint, and the I-5 Alternative would have the lowest. The likelihood of impacts from operations and maintenance activities is low given that the electric trains carry no fuel. • The I-5 Alternative would cross the Midway Landfill, a contained hazardous materials site. Based on information gathered and design analysis conducted to date, crossing the landfill is not expected to create new pathways for contaminated materials to reach groundwater aquifers because the depth of shafts to support the light rail would not be deep enough to encounter the aquifer.	• Hazardous waste would be managed and contaminated sites cleaned up or contained.
Electromagnetic Fields	• 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.	• None required.
Public Services	• All FWLE build alternatives would be grade-separated with no changes in access and would not affect travel or response times for public service vehicles. The alternatives are not expected to result in any negative impacts on overall crime rates in the surrounding neighborhoods. Crime prevention through environmental design principles would be incorporated during final design to deter criminal activity. • The Kent/Des Moines SR 99 East Station Option associated with the SR 99 and I-5 alternatives and the SR 99 to I-5 Alternative would require the relocation of a U.S. post office in the Midway area of Kent. This location has been previously identified by the U.S. post office for closure, but there are opportunities for it be relocated in the same area if desired.	• 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.
Utilities	• No long-term impacts on utility providers (electricity, natural gas, water, wastewater, telecommunications, etc.) are expected with any of the FWLE alternatives.	• None required.

TABLE 7-2
Summary of Potential Impacts and Mitigation

Type of Impact	Impact Summary for Build Alternatives	Mitigation Summary
Historic and Archaeological	• No archaeological resources were identified in the FWLE corridors. There are historic buildings determined eligible for the National Register of Historic Places (NRHP) in the FWLE study area. None of the FWLE alternatives would result in adverse effects to these buildings.	• An additional archaeological survey and/or subsurface testing before construction may be required.
Parkland and Open Space	• The Federal Way SR 99 Station Option associated with the SR 99 and I-5 to SR 99 alternatives would result in acquisition of a portion of the Federal Way Town Square Park property. The area affected includes parking stalls and landscaping. . The recreational functions of the park would not be directly affected .	• Potential mitigation measures include providing replacement lands, park enhancements, and financial compensation, where appropriate.
Construction[a]	The following summarizes construction impacts, which generally would occur under all FWLE build alternatives: • There would be temporary lane closures and traffic detours. There would be a loss of parking at the Star Lake, Redondo Heights, and S 320th Street park-and-ride lots. Increased truck traffic for all alternatives could temporarily negatively affect residents, businesses, and public service providers. • Staging areas would be required for construction and, wherever possible, would be accommodated in areas permanently needed for right-of-way. • There would be temporary impacts on nearby land uses due to construction-related activities, including 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 the greatest impacts associated with the 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. • Temporary visual quality impacts would occur due to the removal of vegetation and demolition of structures. • There might be service interruptions due to relocation of utilities during construction. • Construction of the lidded trench associated with the I-5 and SR 99 to I-5 alternatives would temporarily close all or a portion of the play fields and the existing school bus loop driveway at Mark Twain Elementary School. • Construction of the Federal Way SR 99 Station Option with the SR 99 and I-5 to SR 99 alternatives would temporarily affect the Federal Way Town Square Park.	The following summarizes the potential mitigation measures that could be implemented during construction: • 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. • Work with businesses to develop impact minimization efforts during construction. • To reduce construction air quality impacts, measures would be implemented, including limiting construction truck idling, use of wheel washes, and spraying exposed soils. • 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 minimize impacts on response and travel times within the corridor. • Disturbed parks would be restored after construction. At the Federal Way Town Square Park, temporary replacement parking could be provided.

TABLE 7-2
Summary of Potential Impacts and Mitigation

Type of Impact	Impact Summary for Build Alternatives	Mitigation Summary
	None of the recreational facilities would be affected at the 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 located adjacent to or on park property. After construction, the areas affected would be restored. • Cumulative traffic impacts due could change if the FWLE and SR 509 Extension Project were constructed at the same time. • Additional temporary barriers would be needed along I-5 with the I-5 or SR 99 to I-5 alternatives if the SR 509 Extension Project were constructed first or concurrently.	• 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 at Mark Twain Elementary. • 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 and limited in duration.

As shown in Table 7-2,many elements of the environment have no adverse impacts or minor effects. These include transportation, land use, air quality, energy, geology and soils, hazardous materials, electromagnetic fields, public services, utilities, and historic and archaeological resources. These elements of the environment are not further analyzed in the environmental justice analysis. Other elements of the environment would have impacts, but those impacts would be mitigated and would not be differentially distributed among minority or low-income populations. These include visual and aesthetic resources, noise and vibration, water resources, ecosystems, and parkland and open space. Similarly, these elements are not further analyzed in the environmental justice analysis. Property acquisitions and displacements (including residential, business, and community or social facilities) have the potential to affect minority and low-income populations differently and to also have economic and social impacts. Construction impacts also have

potential to impact minority and low-income populations, primarily economic impacts to minority-owned businesses. These elements are described further below, including additional discussion of potential mitigation measures.

7.6.1 Acquisitions and Displacements

The primary difference between the alternatives is the number of residential and business displacements: the SR 99 Alternative results in the highest number of potential business displacements and the I-5 Alternative in the highest number of potential residential displacements. Residential displacements include a mixture of single-family and multi-family (buildings ranging from 4 to over 70 units) dwellings and mobile home parks that range between 18 and 34 units. Residential displacements with the I-5 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 (ranging from 36 to 103), but also occur in areas with relatively high concentrations of minority populations (over 50 percent). While the I-5 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, although potential impacts on low-income populations would be greater with the I-5 Alternative.

For all alternatives, the majority of displaced businesses are automotive (gas stations, tire shops, auto parts), retail (coffee, nail salons, cleaners), or restaurant related, including both large chains and small, local businesses. There are some businesses that could be displaced (including ethnic grocery stores) that tend to serve mostly minority populations, but there are other businesses that provide similar services within the study area and along the SR 99 corridor. The proximity of similar businesses would reduce the impact 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. Business and residential property owners and tenants affected by property acquisitions will be treated fairly and equitably, and Sound Transit has conducted outreach to those affected as noted in Section 7.5.4.

For all acquisitions, Sound Transit would work with those affected to try to keep them in the same area in order 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 rent supplement if comparable decent, safe, and sanitary replacement housing is more than their current rental cost. In these cases, Sound Transit would pay the difference, or a portion of the difference, between the tenant's current and new rental rates for up to three and one-half years (42 months).

Mobile home residents are eligible for the same acquisition and relocation benefits that apply for other residential properties. Some residents own their mobile home, but rent or lease space in a mobile home park. In these cases, the residents would receive rental relocation assistance and their mobile home would be relocated. If the mobile home could not be relocated because of its age or condition, the owner would receive rental relocation assistance, but would also be compensated for the mobile home. The owner could then choose to use this payment for purchase of another mobile home or other real estate (for example, a down payment for a single-family home or condominium). Other mobile home residents rent both the space in a mobile home park and the mobile home unit. These residents would be eligible for rental relocation assistance, similar to someone renting an apartment or house. Still others may own land with a mobile home. They would receive payment for the land in addition to payment for the mobile home, the same as other residential land acquisition.

The No Build Alternative would not have any of the impacts described above.

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. The project would benefit residents in the study area and the project by providing

improved access to transit and employment. The redevelopment in the station areas would include new employment opportunities for those station areas where transit-oriented development has been targeted, including the Midway subarea where a subarea plan has been developed on the potential for redevelopment. New development and redevelopment in the station areas could result in increased property taxes, which could affect those property owners who are low-income or result in increases in rents, potentially requiring owners or tenants to relocate if affordable housing options are not available. As described below under social impacts, goals and strategies are in place to address the need to maintain affordable housing in the area.

Project alternatives would remove private off-street parking from businesses, including businesses that provide goods and services to minority and low-income populations. The SR 99 Alternative and I-5 to SR 99 Alternative would potentially remove the greatest number of parking spaces. The loss of parking could lead to reduced business opportunities; however, 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 not have any of the impacts described above.

7.6.3 Social Impacts, Community Facilities, Neighborhoods

As noted above in Section 7.6.2, Economics, new development and redevelopment in the station areas could result in increased property taxes and higher 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 affordable housing options, and Sound Transit has adopted a Transit-Oriented Development Policy that includes goals for providing affordable housing in station areas. Puget Sound Regional Council has also developed affordable housing strategies as part of its Growing Transit Communities program, to address the need for affordable housing as it relates to high-capacity transit such as the FWLE. The overall goals of the Growing Transit Communities program include attracting more residential and employment growth near

high-capacity transit and providing affordable housing choices to a range of incomes. The affordable housing strategy was developed with the goal of providing a range of housing options by creating tools that local governments can use to encourage housing diversity and to promote affordability near transit stations. The availability of affordable housing in the station areas minimizes impacts related to residential displacement, and as noted above under Section 7.6.2, Economics, the FWLE would improve access to transit, which may offset any potential increase in housing costs.

All Kent/Des Moines stations and station options except the Kent/Des Moines At-Grade Station Option for the I-5 Alternative would displace mobile home parks in the Midway neighborhood where minority population concentrations are over 50 percent but low-income population concentrations are under 25 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 where minority and low-income population concentrations are over 50 percent, while the Kent/Des Moines HC Campus Station Option with the SR 99 Alternative would displace part of a mobile home park where the minority population concentration is over 75 percent but the low-income population concentration is less than 50 percent.

Multi-family residences located north of Kent-Des Moines Road would be impacted by the I-5 and I-5 to SR 99 alternatives and are within areas with both minority and low-income population concentrations over 50 percent. Given the population concentrations, adverse impacts associated with these displacements would affect predominantly minority populations and low-income populations. Potential mitigation measures would reduce the impacts, as described above under Section 7.6.1. Sound Transit would work with those displaced to try to keep them in the same general area. Suitable replacement housing (homes for sale and rental properties) is available in the cities where displacements would occur. Impacts from residential displacements may be further reduced as project design continues.

The Sea Mar Health 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. This resource provides services to minority and low-income populations. It is expected it could be

relocated in the area, although the relocation might require rebuilding the facility.

Other community resources that would be displaced include the Citadel Church and the 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 are known to serve predominantly minority populations, but these churches all serve different populations, and it is expected these churches could relocate within the project vicinity. The churches which serve minority populations include the Citadel Church (African-American), Seattle Full Gospel Church (Korean), and Iglesia Cristiana Pentecostes Filidelphia (Hispanic). These churches are currently housed in office buildings. There are similar buildings with vacancies in the SR 99 corridor, as well as vacant land that could be used for construction of new church buildings for those churches that currently owning their own properties (Citadel Church and Seattle Full Gospel Church).

The No Build Alternative would not have any of the impacts described above.

7.6.4 Construction

Construction would last from 1 to 4 years in any one location, with the greatest effects anticipated to occur in the earlier stages of construction. Prior to construction, a Construction Plan would be developed to establish construction phases, estimated durations, and appropriate sequencing. Overall, given the development along the SR 99 corridor, 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 I-5 Alternative. This is because of the lane closures that would be required on SR 99 and potential temporary closures of driveways for businesses. Lane closures would also affect transit and could increase travel times or require relocation of bus stops on SR 99. Any travel-time delays could affect those who are transit-dependent, causing them to spend more time traveling to and from their destinations.

Access to individual properties during construction would be maintained to the extent possible, or alternative access would be provided. 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 has a Business Relation Program which is tailored to individual projects to help minimize impacts on businesses during construction. General goals in the Business Relation Program and potential strategies to meet the goals are described below. Specific strategies would be selected based on the types of businesses in the area and an assessment of the unique project environment.

- **Goal 1: Educate and inform businesses of construction-related impacts**. Strategies to meet this goal include providing advanced notification and tools to business owners; connecting business owners to a construction toolkit which includes partnership resources, information on what to expect, and planning guides; providing clear, timely, and accurate information during construction; and promoting awareness to parking, bike routes, and pedestrian routes.
- **Goal 2: Ease physical impacts of construction on businesses**. Strategies to meet this goal include facilitating access to parking, bike routes, and pedestrian routes; providing wayfinding; and minimizing physical impacts (noise, dust, parking, access) to extent possible.
- **Goal 3: Create awareness that businesses are open**. Strategies to meet this goal include promoting businesses that are impacted by construction through community events and encouraging existing patrons to frequent the business.
- **Goal 4: Connect businesses to partner tools and business resources**. Strategies to meet this goal include connecting businesses to existing programs, tools, and resources that may provide support during construction such as chambers, offices of economic development, and small business resources.

For alternatives that travel 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 not impact the I-5 mainline due to the width of the available right-of-way. 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 I-5 Alternative, these alternatives would have fewer business-related impacts.

Chapter 5, Construction, provides additional information on construction impacts.

The No Build Alternative would not have any of the impacts described above.

7.7 Project Benefits

Under DOT Order 5610.2(a), the benefits of a proposed transportation project should also be taken into account when determining whether disproportionately high and adverse effects on minority and low-income populations would occur. FWLE operation would provide a number of benefits to all populations within the study area, including reductions in greenhouse gases; improved access to transit; a more reliable and more efficient transportation system; improved mobility through the project vicinity; transit travel time savings; improved accessibility to employment; and extended transit service hours. These benefits would not occur with the No Build Alternative. As described in Section 7.7.1, while all populations within the FWLE service area would realize these benefits, studies have shown that they can accrue to a higher degree for minority and low-income populations.

7.7.1 Improved Access to Transit and Employment

Access to transit would improve for all populations within the service area and, in particular, for those populations residing within 0.5 mile of the stations because of the proximity to the stations. In addition, the extended transit service hours (21 hours per day) would also improve access to transit for all populations within the area due to the longer service period. The demographic makeup of potential riders was estimated using the demographics of the areas within 0.5 mile of the stations for each of the project alternatives. One-half mile was used because studies have shown residents would walk this distance to access transit (Dittmar and Ohland, 2004; Regional Plan Association, 1997).

These population estimates are based on the census blocks and census block groups that either are located within or intersect the 0.5-mile station area. Because of the larger geographic area associated with census block groups, these areas can extend beyond the 0.5-mile station area and result in a larger population compared to census blocks. As shown in Table 7-3, the minority population ranges from 47.8 to 67.4 percent and the low-income population

ranges from 14.3 to 21.4 percent within 0.5-mile of station areas. 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 be provided improved access.

TABLE 7-3
Access to Light Rail Stations for Minority and Low-Income Populations within 0.5 Mile

Project Alternative Stations	2010 Census Block Population with Access	Minority Population with Access	2007-2011 ACS Census Block Group Population with Access	2007-2011 ACS Low-Income Population with Access
SR 99 Alternative				
Kent/Des Moines SR 99 West Station[a]	7,127	4,421 (62.0%)	11,573	2,207 (19.1%)
S 272nd Redondo Station[b]	8,561	5,192 (60.6%)	11,110	2,181 (19.6%)
Federal Way Transit Center Station	3,308	1,711 (51.7%)	8,810	1,642 (18.6%)
SR 99 Alternative Station Options				
S 216th Stations	6,992	4,712 (67.4%)	10,437	2,230 (21.4%)
S 260th Stations	6,354	4,035 (63.5%)	12,738	1,823 (14.3%)
Federal Way SR 99 Station	6,360	3,466 (54.5%)	11,441	1,825 (16.0%)
I-5 Alternative				
Kent /Des Moines I-5 Station[c]	5,847	3,574 (61.1%)	10,960	1,971 (18.0%)
S 272nd Star Lake Station	5,994	3,561 (59.4%)	10,213	1,625 (15.9%)
Federal Way Transit Center Station[d]	6,360	3,466 (54.5%)	8,810	1,642 (18.6%)
I-5 Station Options				
Kent/Des Moines SR 99 East Station Option	7,127	4,421 (62.0%)	11,573	2,207 (19.1%)
Federal Way S 320th Park-and-Ride Station Option	2,937	1,405 (47.8%)	11,022	2,027 (18.4%)
SR 99 to I-5 Alternative				
Kent /Des Moines 30th Avenue East Station	5,856	3,607 (61.6%)	10,960	1,971 (18%)
S 272nd Star Lake Station	5,994	3,561 (59.4%)	10,213	1,625 (15.9%)
Federal Way Transit Center Station[d]	6,360	3,466 (54.5%)	8,810	1,642 (18.6%)
SR 99 to I-5 Alternative Station Option				
S 216th Stations	6,992	4,712 (67.4%)	10,437	2,230 (21.4%)
I-5 to SR 99 Alternative				
Kent/Des Moines 30th Avenue West Station	6,028	3,736 (62.0%)	10,960	1,971 (18%)
S 272nd Redondo Station	8,561	5,192 (60.6%)	11,110	2,181 (19.6%)
Federal Way Transit Center Station	3,308	1,711 (51.7%)	8,810	1,642 (18.6%)

TABLE 7-3
Access to Light Rail Stations for Minority and Low-Income Populations within 0.5 Mile

Project Alternative Stations	2010 Census Block Population with Access	Minority Population with Access	2007-2011 ACS Census Block Group Population with Access	2007-2011 ACS Low-Income Population with Access
I-5 to SR 99 Alternative Station Options				
S 260th Stations	6,354	4,035 (63.5%)	12,738	1,823 (14.3%)
Federal Way SR 99 Station	6,360	3,466 (54.5%)	11,441	1,825 (16.0%)

[a] Includes all Kent/Des Moines Station options for SR 99 Alternative.
[b] Includes S 272nd Redondo Trench Station Option.
[c] Includes Kent/Des Moines At-Grade Station Option.
[d] Includes Federal Way I-5 Station Option.
ACS = American Community Survey
Source: U.S. Census Bureau, 2010 and 2012.

The minority and low-income populations that would receive the transit benefits of the project are similar for all the build alternatives. However, some alternatives could include more stations than other alternatives and, therefore, a larger population would benefit from improved transit access.

With improvements in travel reliability, users of the FWLE would be able to travel longer distances with fewer transfers, which would result in travel time savings to other employment centers and could allow for new employment opportunities. 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 that cannot use the bus to access many areas in the project vicinity because of the extended travel times or bus routes that do not serve their destinations well. The FWLE would also provide more frequent service during non-peak hours to other regional centers north of SeaTac. 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, including Sound Transit's Title VI Report (Sound Transit, 2013), have shown that minority and low-income populations tend to make greater use of transit service than other groups, indicating that transit service improvements are generally more important to these populations than to other members of the population. Data from Sound Transit (2013) concluded that there are

higher concentrations of minority and low-income populations located 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. In addition, 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, including 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. As described above, the FWLE may result in increases in property taxes and rents around stations, which can negatively affect some low-income populations. The improved access to transit may allow some residents to reduce transportation costs, potentially offsetting potential increases in housing costs.

In addition to improved access to current employment, users of the FWLE would have the opportunity to look for employment in areas that were previously considered too time-consuming or difficult to reach because of improved travel times and the reliability of the FWLE compared to the No Build Alternative. The FWLE would provide more reliable and improved travel times to the large employment centers in the region including Seattle, Bellevue, Redmond, and Lynnwood, and would potentially reduce transportation costs. The project would also provide improved access for residents outside the FWLE corridor to job centers in the FWLE area, including Downtown Kent, the Kent Manufacturing/Industrial District, and the Federal Way City Center.

Increased transit access and new development could also improve overall neighborhood quality, and stations could provide improved neighborhood cohesion by providing new opportunities to interact.

7.7.2 Transit Reliability

Another benefit of the FWLE would be an increase in transit reliability. Because the FWLE would operate in an exclusive right-of-way and have no at-grade vehicle crossings, it would provide higher on-time performance for riders compared to bus service, which can be affected by increasing congestion even when using HOV lanes. 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. The improvement in transit travel times would range from 2 to 26 minutes, and 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.

As described in Section 7.7.1, 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, and other routes could be modified to provide more frequent service to better serve the study area and provide direct connections to light rail stations. In addition, King County Metro and Sound Transit have implemented a discounted fare for low-income adult riders

7.8 Conclusion

When making an Environmental Justice determination, DOT Order 5610.2 and FTA's *Environmental Justice Policy Guidance for Federal Transit Administration Recipients* direct project proponents to 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. Populations within the study area vary, but are predominantly minority overall, 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, which minimizes the impacts on all populations. Most project impacts would be limited in scope, and adverse impacts would be mitigated through the implementation of effective mitigation measures. Complete information on the project impacts and mitigation is provided in Chapters 3 through 6 of this

Draft EIS. Both negative and positive effects would occur for minority and low-income populations, but do not differ substantially between the build alternatives. Mitigation measures would be provided for impacts uniformly in all areas affected.

The FWLE would provide substantial positive effects that would benefit all populations in the study area. These benefits include improved access to transit; a more reliable and more efficient transportation system; improved mobility through the project vicinity; improved accessibility to employment; extended transit service hours; improvements in air quality; and potential benefits associated with transit-oriented development in the station areas.

Based on the conceptual design and the analysis contained in this Draft EIS, the Federal Way Link Extension is not expected to have disproportionately high and adverse effects on minority and low-income populations under Executive Order 12898 and USDOT Order 5610.2. 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 EIS; evaluation of the Preferred Alternative once it is identified; additional outreach to environmental justice populations potentially affected by the Preferred Alternative, and the analysis contained in the Final EIS for the project.

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8.0 Alternatives Evaluation

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

8.1 Meeting the Purpose and Need for FWLE

The purpose of the FWLE, as discussed in Chapter 1, 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 in order to:

- 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 (Sound Transit, 2014).
- Implement a financially feasible HCT system to help preserve and promote a healthy environment.

All FWLE build alternatives would meet this purpose because they would all provide improved transit mobility and access to regional activity centers and would advance 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, Purpose and Need for Federal Way Link Extension. The No Build Alternative would not meet the purpose and need for the project.

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 .

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.

Measures of transit service, including 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 two-way service for 21 hours a day between the FWLE and many Puget Sound regional destinations. Reliability of bus service in 2035 is expected to degrade under the No Build Alternative and several bus routes would exceed their seated capacity. Both bus and light rail would operate at acceptable passenger levels of service with the FWLE due to the transfer of some bus riders to light rail. With the No Build Alternative, key transit facilities, such as the I-5 HOV lanes, are expected to have speeds decrease up to 30 percent in the peak direction of travel during the PM peak period. 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 40 to 75 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.

For people who live and work in the corridor, 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. All FWLE alternatives are projected to have similar ridership, ranging from 25,000 to 27,500 daily riders (see Section 8.2, Comparison of Alternatives). Of these, approximately 7,500 to 8,000 are expected to be new transit riders.

Need #3: Reliable and efficient peak and off-peak transit service is needed to connect people in the FWLE corridor with the region's growth centers.

All of the FWLE alternatives would provide convenient, frequent transit service for 21 hours a day with reliable access to many regional destinations. They would provide greater transit connectivity for transit-dependent populations than is available today or is planned for under the No Build Alternative. The stations along I-5 would not provide access to the same degree as stations along SR 99 because the stations on SR 99 are more easily accessible by non-motorized users and by all-day transit routes. The build alternatives would provide greater hours of 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 compared to existing conditions. However, service to other regional destinations from the FWLE corridor, 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 due to congestion, and service frequency to regional destinations besides downtown Seattle would remain limited in frequency and hours of service. For all build alternatives, transit-dependent populations in the FWLE corridor would have improved access to more employment opportunities and better access to services that are provided 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 that have been in place since the 1990s. Providing high-capacity transit is called for in PSRC and Sound Transit plans, and the light rail extension to S 272nd Street was included in the funding package described in *Sound Transit 2: A Mass Transit Guide; The Regional Transit System Plan for Central Puget Sound* (ST2) (Sound Transit, 2008).

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

The FWLE would reduce vehicle miles traveled and vehicle hours traveled each weekday by approximately 150,000 miles and 10,000 vehicle hours, which would reduce vehicle emissions generated in the project area. Other environmental impacts vary among the different build alternatives. The next section describes the trade-offs.

8.2 Comparison of Alternatives

All FWLE Build Alternatives would meet the purpose and need as presented. This section focuses on trade-offs among the FWLE alternatives in meeting the purpose and need. It describes the benefits and impacts associated with each alternative and how they relate to the other FWLE alternatives. Exhibit 8-1 summarizes each build alternative's travel time, projected ridership, cost, and impacts.

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 not be the project's temporary disruptions to traffic, nor its permanent impacts (such as

displacements, noise and vibration impacts, visual changes, and permanent impacts on ecosystems).

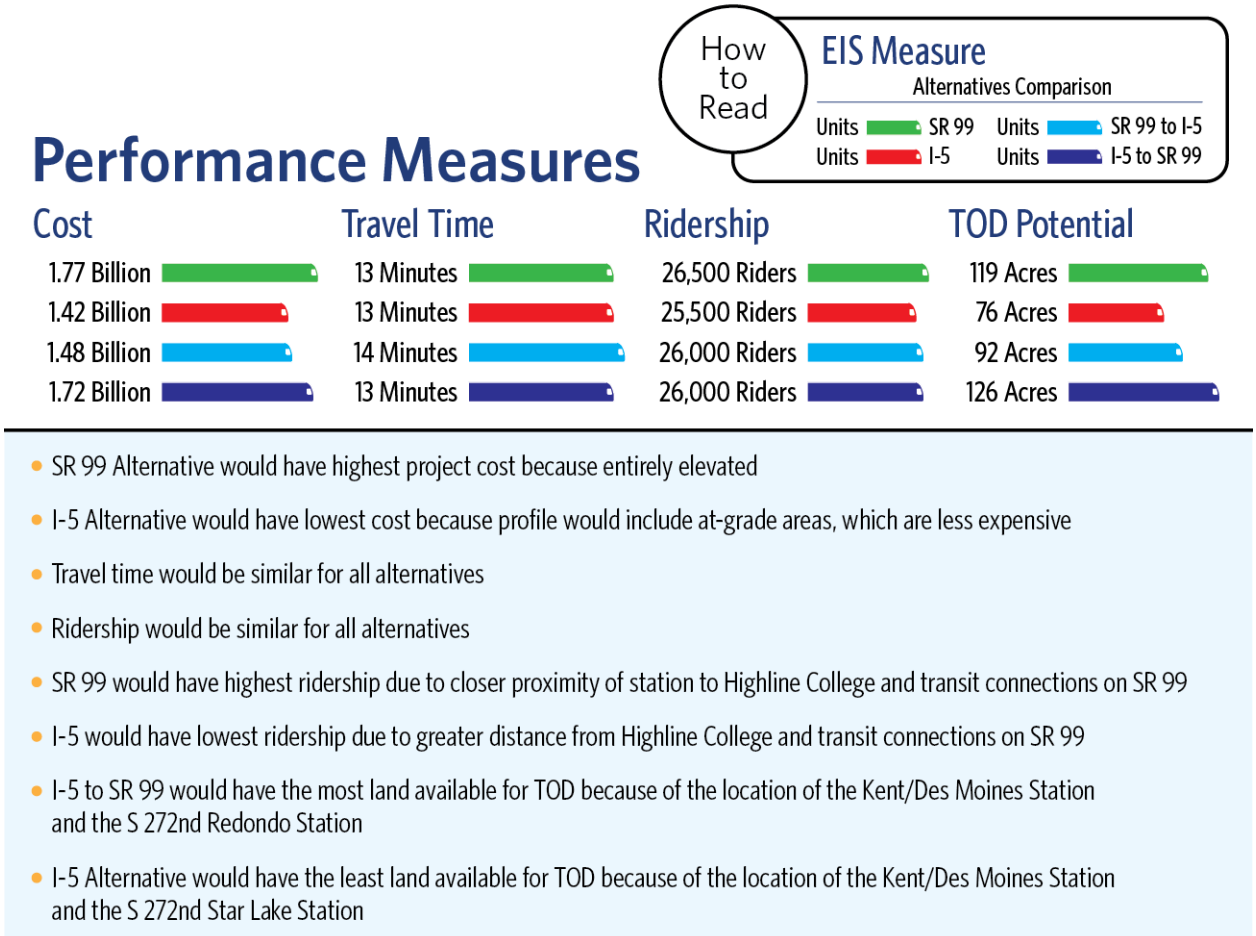


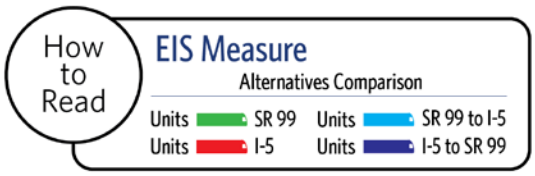
EXHIBIT 8-1
FWLE Alternatives Performance Measures

8.2.2 Build Alternatives

As shown in Exhibit 8-1, the alternatives perform very similarly in terms of travel time and ridership. Costs vary more widely, with the I-5 Alternative being the least expensive and the SR 99 Alternative being the most expensive. The amount of land available for transit-oriented development with each alternative also varies, with the I-5 to SR 99 Alternative having the most amount of land available and the I-5 Alternative having the least.

Exhibit 8-2 shows impact areas where the alternatives have notable differences. Some resources, such as air quality, energy, geology, hazardous materials, historic and archaeological resources, and parks have minor differences between alternatives and are not described in this table.

Key Impacts



Residential Displacements 36 285 106 244	• Displacements for the I-5, SR 99 to I-5 and I-5 to SR 99 would occur north of Kent-Des Moines Road and in the Kent/Des Moines Station area • SR 99 Alternative displacements would occur in the Kent/Des Moines Station area
Business Displacements 106 29 43 100	• SR 99 displacements would occur along the entire corridor, but would mostly be at station areas. • I-5 displacements would occur in the Kent/Des Moines Station area and the Federal Way Transit Center Station area • 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
Residences with Reduced Visual Quality 215 115 130 200	• SR 99 Alternative would impact the most residences because of the elevated guideway and greater housing density along SR 99 • I-5 Alternative would impact the least amount of residences due to the lower density of residence along I-5. Change in visual quality on I-5 would be primarily related to vegetation removal
Noise Impacts 3,726 1,450 2,190 2,942	• SR 99 Alternative would have the greatest number of noise impacts due to the greater density of housing along SR 99 and an entirely elevated guideway • I-5 would have the lowest number of noise impacts due to the lower density of housing along I-5 and a mixed profile that includes at-grade and trenched portions • All noise impacts would be mitigated. Most would be mitigated with sound walls, although some would require residential insulation
Vibration Impacts 50 222 209 58	• I-5 Alternative would have the greatest number of vibration impacts due to the proximity of the light rail to residences and a mixed profile that includes at-grade and trenched portions • SR 99 would have the lowest number of 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)
Vegetation Impacts 4 Acres 35 Acres 29 Acres 5 Acres	• I-5 Alternative would remove the most vegetation 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 vegetation because it would be located primarily in the heavily developed SR 99 corridor that contains minimal vegetation

EXHIBIT 8-2
FWLE Alternatives Key Impacts

Other resources, such as water resources and wetlands, have greater differences between alternatives, but the overall impacts are still relatively minor and so are not included in Exhibit 8-2 either.

Exhibit 8-3 shows how the options for both SR 99 and I-5 perform very similarly to the alternatives in terms of travel time and ridership. Costs vary more widely, with some options have substantial cost savings, while others increase costs substantially. The amount of land available for transit-oriented development also varies more widely. Exhibits 8-4 and 8-5 show impact areas where the options differ in impacts from the alternatives using the same measures as in Exhibit 8-2.

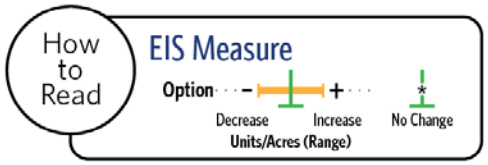
8.2.3 FWLE Terminus Options

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

There are two different station locations associated with the SR 99 Alternative. The Federal Way Transit Center Station is oriented east-west. This orientation would allow for a future extension directly toward I-5, or the extension could transition back to the SR 99 corridor somewhere south of S 320th Street. The Federal Way SR 99 Station Option orientation (north-south) 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.

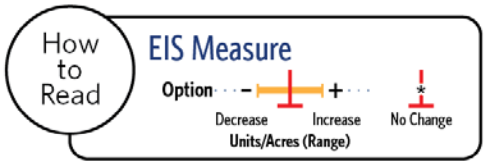
There are three different station locations associated with the I-5 Alternative. The Federal Way Transit Center Station is oriented east-west. This orientation would allow for a future extension directly toward SR-99, or the extension could transition back to the I-5 corridor somewhere south of S 320th Street. The Federal Way I-5 Station and Federal Way S 320th Park-and-Ride Station options 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.

SR 99 Options Performance Measures



- Adding a station at S 216th or S 260th Street would add up to $70M
- 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
- Kent/Des Moines HC Campus Station Option would not change cost
- 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 add 500 daily riders each
- The Federal Way SR 99 Station Option would have lower ridership due to its distance from the transit center
- The potential additional station at S 216th Street would have the greatest amount of additional land available for TOD

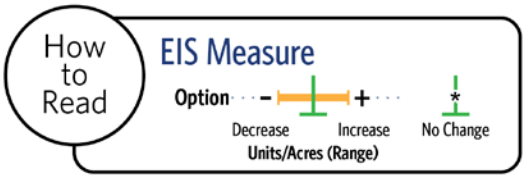
I-5 Options Performance Measures



- The I-5 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 SR 99 East Station Option would slightly increase the travel time, while the Federal Way I-5 Station Option would slightly decrease it
- The Kent/Des Moines SR 99 East Station Option would slightly increase ridership due to the closer location to SR 99 and Highline College
- The Federal Way I-5 Station Option would slightly decrease ridership due to the greater distance to the Federal Way Transit Center
- The Kent/Des Moines SR 99 East Station Option would increase land available for TOD

EXHIBIT 8-3
Option Performance Measures

SR 99 Options Impacts



Residential Displacements

- The HC Campus Station Option at Kent/Des Moines 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

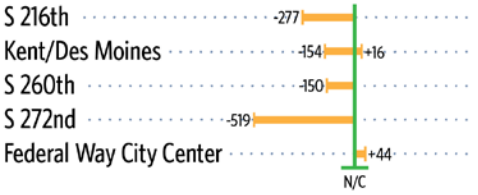
Business Displacements

- 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

Noise Impacts

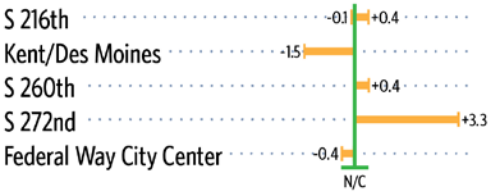


- Options in trenches would have the greatest reduction in noise impacts
- In the Kent/Des Moines Station Area, the HC Campus Station Option would decrease noise impacts, while the SR 99 Median and SR 99 East Station Options would increase impacts
- The Federal Way SR 99 Station Option avoids displacing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

Vibration Impacts

- The S 272nd Redondo Trench Station Option would have the greatest increase in impacts due to closer proximity to residences
- 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

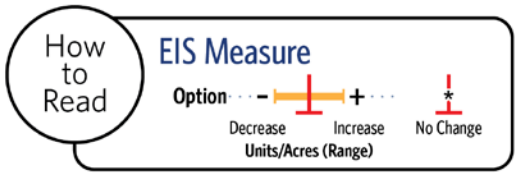
Vegetation Impacts



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

EXHIBIT 8-4
SR 99 Options Impacts

I-5 Options Impacts



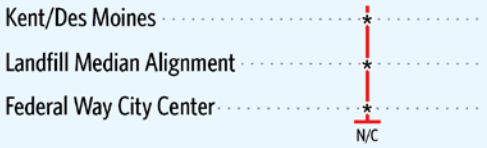
Residential Displacements

- 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

- The Kent/Des Moines SR 99 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



- None of the I-5 options would change visual quality impact

Noise Impacts

- The Kent/Des Moines SR 99 East Station Option would have the greatest increase in noise impacts
- The S 320th Park-and-Ride Station Option would have the greatest reduction in noise impacts

Vibration Impacts

- The Kent/Des Moines SR 99 East Station Option would have the greatest decrease in impacts
- All other options would have minor or no changes in impacts

Vegetation Impacts

- The Kent/Des Moines SR 99 East Station Option would have the greatest reduction in vegetated area removed
- The S 320th Park-and-Ride Station Option would have the greatest increase in vegetated area removed

EXHIBIT 8-5
I-5 Options Impacts

8.3 Commitment of Resources

If built, the FWLE would have irreversible and irretrievable commitments of property and natural resources. Private properties with residential and commercial uses would be converted to transportation use. The conversion of lands would change the character of the FWLE corridor. 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. Construction of the proposed project would also require the commitment of 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 for the project:** 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. While Sound Transit may apply for federal grants to help fund this portion of the project, funding from local tax revenue would be needed for much of this extension, and ST2 only authorized construction funding to S 272nd Street.
- **Potential additional stations:** Potential additional stations at S 216th Street and S 260th Street were not evaluated in the ST2 planning process, which analyzed ridership and cost for each station. These stations were not included in ST2, and further evaluation of consistency with the ST2 plan would be required before any of them could be added to the FWLE.
- **Location of I-5 Alternative within WSDOT right-of-way:** If the Sound Transit board identifies a preferred alternative that would use portions of the I-5 right-of-way, or wishes to modify other parts of the freeway, such as shoulders or existing noise walls, Sound Transit must secure from WSDOT and FHWA agreements and approvals for such use and for other proposed modifications

to other parts of the freeway (such as moving freeway sound walls). Sound Transit has coordinated with FHWA and WSDOT during conceptual design to identify where the alternatives evaluated in the Draft EIS could potentially use the I-5 right-of-way. If an alternative using I-5 right-of-way is identified as preferred, additional design coordination and analysis will occur during the development of the Final EIS. Ultimate approvals would not occur until final design of the FWLE. During final design, FHWA and WSDOT could require modifications or place other conditions on the project that could require environmental reviews.

Sound Transit would continue to coordinate with the appropriate federal, state, and local agencies and jurisdictions to address these issues. Additional areas of controversy and issues to be resolved will likely be identified during the Draft Environmental Impact Statement (EIS) comment period. These issues will be addressed in the Final EIS.