WSDOT

U. S. Department of Transportation
Federal Highway Administration

April 2018

I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project (MP 0.0 to 11.9) and Downtown Bellevue Vicinity Express Toll Lanes Project (MP 11.9 to 14.6)

Attachment B: Air Quality Discipline Report

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SUMMARY

The Washington State Department of Transportation (WSDOT) is proposing two projects—the *I-405, Tukwila to I-90 Express Toll Lanes Project (MP 0.0 to 11.9)* (referred to as the I-405, Tukwila to I-90 Project) and the *Downtown Bellevue Vicinity Express Toll Lanes Project (MP 11.9 to 14.6)* (referred to as the I-405, Downtown Bellevue Project)—along Interstate 405 (I-405) to improve safety and reduce congestion. Both projects (hereafter referred to collectively as the Projects) include the addition of express toll lanes (ETLs) that would create a continuous ETL system from State Route 167 (SR 167) in Renton to Interstate 5 (I-5) in Lynnwood.

The Projects are required to undergo environmental review. As part of the environmental review, an air quality discipline report is required to evaluate the Projects' effects on air quality in the study area.

What is our study approach?

The I-405, Tukwila to I-90 and Downtown Bellevue Projects are essential components in completing the express tolling system from SR 167 in Renton to I-5 in Lynnwood. The traffic network for these Projects are interconnected and influence existing traffic patterns, travel speeds, and levels of congestion as one connected roadway network to improve safety and reduce congestion. It is likely that the Projects would be constructed together; therefore, for the purposes of this air quality analysis, the Projects were evaluated together as one connected roadway network, like the traffic analysis. The air quality discipline team defined the study area by identifying all local arterial roadway networks in addition to I-405 that would be affected.

What is CO hot-spot modeling analysis?

Transportation projects that are in non-attainment, (i.e. air quality in an area that does not meet ambient air quality standards set by the EPA) are required to perform air quality modeling to determine if CO concentrations at intersections would exceed the NAAQS for transportation conformity requirements. Areas in 'maintenance' status meet air quality standards. However, because they were previously nonattainment areas, they continue to have additional requirements to meet, like transportation conformity.

This air quality analysis focuses on the evaluation of study area pollutants, such as tailpipe emissions for criteria pollutants, mobile source air toxics (MSAT), and greenhouse gases (GHGs), and a disclosure of the Projects' emissions levels and their effects on emissions trends in the study area. We evaluated the effects of the Projects by performing modeling of emissions from motor vehicles on the affected network using the latest U.S. Environmental Protection Agency (EPA) Motor Vehicle Emission Simulator (MOVES 2014a) model for the years 2016, 2025, and 2045, to develop emissions estimates. The emissions burden analysis compared operational effects from the proposed Projects for 2025 and 2045 future Build conditions with 2016 existing and 2025 and 2045 No Build conditions to demonstrate how air quality would be affected by the proposed Projects' improvements.

What are the existing conditions?

The I-405 corridor is in attainment for all National Ambient Air Quality Standards (NAAQS). Recent air quality monitoring data demonstrate that air quality is continuing to improve in the study area regarding carbon monoxide (CO) and particulate matter (PM), but measured ozone concentrations, in contrast, have remained static. Although ozone standards have become more stringent since 2008, ozone levels have continued to remain below the NAAQS. The maintenance requirements for CO in the Puget Sound region expired on October 11, 2016, and the area is no longer required to conduct conformity demonstrations for ozone. Therefore, a CO hot-spot modeling and regional conformity analysis are no longer required.

What would be the Projects' effects?

There would be few effects on air quality from the Projects. The Projects' criteria and MSAT emissions under the 2025 and 2045 No Build are expected to decrease over existing conditions due to newer and cleaner automobiles in the future No Build and Build (with the Projects) conditions. With the exception of CO in 2025, emissions would be lower under Build conditions than under the No Build conditions. CO emissions in 2025 would be only marginally higher under Build conditions (about 1 percent).

GHG emissions would be lower with the Projects in both 2025 and 2045. In 2025, emissions both with and without the Projects would be lower than existing conditions. In 2045, GHG emissions under both Build and No Build conditions would be slightly above existing conditions.

Construction effects would be temporary and best management practices (BMPs) would be implemented. These effects would include fugitive dust from excavation and earth-moving and emissions from diesel-fueled construction equipment.

After completion of the Projects, many of the effects would be positive, such as improved roadway capacity, which would lead to lower vehicle emissions by reducing traffic congestion.

What measures would WSDOT use to avoid or minimize effects?

For temporary effects during construction, state law requires construction site owners and/or operators to take reasonable precautions to prevent fugitive dust from becoming airborne. Fugitive dust may become airborne during demolition, material transport, grading, driving vehicles and machinery on and off the site, and windy conditions.

WSDOT would comply with the procedures outlined in the Memorandum of Agreement between WSDOT and the Puget Sound Clean Air Agency for controlling fugitive dust emissions, which may include the following actions:

- Spray exposed soil with water or other dust suppressant to reduce emissions of PM_{10} by increasing deposition of PM.
- Use phased development to keep disturbed areas to a minimum.
- Use wind fencing to reduce wind disturbance of soils.
- Minimize dust emissions while transporting excavated or fill materials by wetting down loads or ensuring adequate freeboard (space from the top of the material to the top of the truck bed) on trucks.
- Promptly clean up spills of transported material on public roads.
- Schedule work tasks to minimize disruption of the existing vehicle traffic on streets.
- Restrict traffic on site to reduce soil upheaval and tracking material onto roadways.
- Provide wheel washers to decrease deposition of PM on area roadways by removing PM that would otherwise be carried off site by vehicles.
- Locate construction equipment and truck-staging areas away from sensitive receptors as practical and in consideration of potential effects on other resources.

- Cover dirt, gravel, and debris piles as needed to reduce dust and wind-blown debris.

WSDOT would minimize emissions of PM of 10 microns or less in diameter (PM_{10}), PM of 2.5 microns or less in diameter ($PM_{2.5}$), volatile organic compounds (VOCs), nitrogen oxides (NOx), and CO whenever reasonable and possible. Machinery engines would be kept in good mechanical condition to minimize exhaust emissions from construction equipment.

WSDOT encourages its contractors to reduce idling time of equipment and vehicles and to use newer construction equipment or equipment with add-on emissions controls.

Collectively, these measures to avoid or minimize potential effects on the environment are known as *avoidance measures*. If the Projects have additional effects not addressed by the avoidance measures, WSDOT would address them through appropriate mitigation.

What would happen if the Projects are not built?

If the Projects are not built, no substantial effects on air quality would occur in the region and the NAAQS would not be exceeded.

SECTION 1 INTRODUCTION

What are the primary features of the Projects?

This discipline report was prepared in support of the *I-405, Tukwila to I-90 Express Toll Lanes Project (MP 0.0 to 11.9)* (referred to as the I-405, Tukwila to I-90 Project) and the *Downtown Bellevue Vicinity Express Toll Lanes Project (MP 11.9 to 14.6)* (referred to as the I-405, Downtown Bellevue Project) *Environmental Assessments* (EAs).

Both of these projects (hereafter referred to as the Projects) propose to make several roadway, structural, drainage, and transit and high-occupancy vehicle (HOV) improvements to the Interstate 405 (I-405) corridor. Because the Projects would be built at the same time and are located next to each other, the Washington State Department of Transportation (WSDOT) has decided to evaluate possible effects on air quality in a single technical analysis since effects would be similar and occur in a contiguous area.

The I-405, Tukwila to I-90 and Downtown Bellevue Projects are part of a comprehensive strategy identified in the 2002 *I-405 Corridor Program Final Environmental Impact Statement (EIS)* and subsequent Federal Highway Administration (FHWA) *Record of Decision* to reduce traffic congestion and improve mobility along the state's second-busiest highway. The Projects are needed because travelers on I-405 face one of the most congested routes in the state, particularly during peak travel times.

What is the purpose of this report?

The purpose of the Air Quality Discipline Report is to identify potential air quality effects associated with the Projects.

Traffic in the study area would be affected by changes in the number of vehicles, travel speed, and the levels of congestion experienced on local roadways. Air quality, which is a general term used to describe pollutant levels in the atmosphere, can be affected by these changes.

Air quality is typically evaluated, either qualitatively or quantitatively, as part of the National Environmental Policy Act (NEPA) review process for large projects that receive federal funding or approvals. The level and type of such analysis is selected proportional with the potential for adverse air quality effects due to construction or operation of a project.

Why is air quality an important element to consider?

Clean air is vital to human health and is a resource protected by various federal, state, and local regulations. Pollutants in the air can not only affect humans, but can negatively affect flora, fauna, and physical structures. The NEPA and Washington State Environment Policy Act (SEPA) regulations require that environmental reviews include an evaluation of the effects of a proposed project on air quality.

Ambient air quality is a function of many factors, including climate, topography, meteorological conditions, and the production of airborne pollutants by natural or artificial sources. Both the federal Clean Air Act (CAA) and its amendments, and the Washington State Clean Air Act currently regulate air quality. The U.S. Environmental Protection Agency (EPA), Washington State Department of Ecology (Ecology), and Puget Sound Clean Air Agency (PSCAA) enforce regulations developed to protect air quality.

EPA delegates authority to manage air quality issues to the states. In Washington, EPA and Ecology further delegate authority to local air quality agencies. PSCAA has been delegated authority to regulate air quality in four counties, including King County where the Projects are located.

The study area evaluated for air quality effects includes areas likely to be affected by changes in pollutant levels because of project-related changes in traffic conditions.

The air quality analyses for the Projects followed current guidelines developed by the EPA, FHWA, WSDOT, Ecology, and the Puget Sound Regional Council (PSRC).

SECTION 2 PROJECT DESCRIPTION

Section 2 provides a description of both projects evaluated in this report: the *I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project* (Tukwila to I-90 Project) and the I-405, *Downtown Bellevue Vicinity Express Toll Lanes Project* (Downtown Bellevue Project). The Tukwila to I-90 Project is described first and the Downtown Bellevue Project follows.

What improvements are proposed with the I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project?

Exhibit 2-1 describes in detail the improvements proposed with the Tukwila to I-90 Project, and Exhibit 2-2, sheets 1 through 8, show the proposed improvements on a series of maps. In general, the Tukwila to I-90 Project proposes to add one lane to I-405 in each direction for about 8 miles beginning on I-405 near SR 167 and continuing approximately 1 mile north of I-90. The Tukwila to I-90 Project would also add a general purpose (GP) lane to southbound I-405 between milepost (MP) 6.7 (north of 30th Street) and 7.1 (south of NE 44th Street) and MP 9.4 (north of 112th Street) to 10.5 (north of Coal Creek Parkway). The existing high-occupancy vehicle (HOV) lane on I-405 and the additional lane would be operated as a two-lane express toll lane (ETL) system. Additional details describing the ETLs are provided in the next section, *How would the express toll lanes work*?

Exhibit 2-1. Improvements Proposed with the I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project

Project Element	I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project
I-405/I-5 Interchange Exhibit 2-2, Sheet 1	– Extend the southbound left lane at the I-5 interchange west for approximately 500 feet to provide additional merge distance.
I-405 Lanes and Shoulders from SR 167 to north of I-90 Exhibit 2-2, Sheets 2 through 8	– Add one lane on I-405 in each direction from MP 2.9 (northeast of the I-405/SR 167 interchange) to 11.9 (north of the I-405/I-90 interchange) and an additional GP (auxiliary) lane on southbound I-405 between MP 6.7 (north of 30th Street) and 7.1 (south of NE 44th Street) and MP 9.4 (north of 112th Street) to 10.5 (north of Coal Creek Parkway). – Bring I-405 up to current freeway standards where feasible.
I-405 Tolling from SR 167 to north of I-90 Exhibit 2-2, Sheets 2 through 8	– Construct tolling gantries. Convert the existing HOV lane on I-405 to create an express toll system from MP 2.4 (at the I-405/SR 167 interchange) to 11.9 (north of the I-405/I-90 interchange) in the northbound direction and MP 1.6 (in Renton over Springbrook Creek) to 11.9 in the southbound direction. The system would have: o Two ETLs from MP 2.9 to 11.9 by converting an additional lane on I-405 to an ETL. o One ETL from MP 2.4 to 2.9 on northbound I-405 and from MP 1.6 to 2.9 on southbound I-405.
Cedar Avenue Exhibit 2-2, Sheet 4	– Reconstruct the bridge over I-405.
Renton Avenue Exhibit 2-2, Sheet 4	– Reconstruct the bridge over I-405.
Cedar River Bridge Exhibit 2-2, Sheet 4	– Widen the southbound I-405 bridge over the Cedar River.
Sunset Boulevard N Interchange Area Exhibit 2-2, Sheet 4	– Widen the I-405 northbound and southbound bridges over Sunset Boulevard N.
NE Park Drive (SR 900) Interchange Area Exhibit 2-2, Sheet 5	– Widen the I-405 southbound bridge over NE Park Drive.
N 30th Street Interchange Area Exhibit 2-2, Sheet 5	– Replace the local road overpass abutment slopes with retaining walls on both sides of I-405 and lower the southbound I-405 roadway by approximately one foot.

Exhibit 2-1. Improvements Proposed with the I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project

Project Element	I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project
NE 44th Street Interchange Area Exhibit 2-2, Sheet 6	– Replace the northbound and southbound I-405 bridges over May Creek with two new bridges with single span and provide habitat improvements. – Replace the NE 44th Street bridge over I-405 and reconstruct the interchange. – Construct new direct-access ramps in the I-405 median. – Realign and reconstruct the northbound access to I-405 from a loop ramp to a new on-ramp from realigned Lake Washington Boulevard NE. – Build four roundabouts along local arterials. – Construct an at-grade park-and-ride lot at Lake Washington Boulevard N and N 43rd Street with a minimum of 200 parking stalls and a roundabout (improvements would be built, but may be built by Sound Transit or others).
112th Avenue SE Interchange Area Exhibit 2-2, Sheet 7	– Replace the 112th Avenue SE bridge over I-405. – Construct new direct access ramps in the I-405 median and reconfigure the interchange. – Construct a roundabout on 112th Avenue SE. – Reconfigure the Newport Hills Park-and-Ride.
Coal Creek Parkway Interchange Area Exhibit 2-2, Sheet 7	– Construct a new southbound I-405 bridge on a new alignment. Convert the existing southbound I-405 bridge to northbound ETL. – Convert the four local road intersections on Coal Creek Parkway SE to roundabouts.
I-405/I-90 Interchange Area Exhibit 2-2, Sheet 8	– Reconfigure the I-405 southbound to I-90 eastbound ramp from one to two lanes. – Realign the I-405 northbound to I-90 eastbound ramp. As part of this work, construct two new bridges over the eastbound I-90 ramp to Factoria Boulevard and over Factoria Boulevard.
Fish Passage Exhibit 2-2, Sheet 6	– Construct three fish passage crossings under NE 44th Street and the I-405 mainline at an unnamed tributary (UNT) 08.LW.0283 (formerly Gypsy Creek). – Construct a fish passage crossing under I-405 mainline for UNT 08.LW.7.7A.[a] – Construct a fish passage crossing under I-405 mainline for UNT 08.LW.7.8.[a]
Lake Washington Trail Exhibit 2-2, Sheets 6 and 7	– Realign and reconstruct the existing trail west of its current location to reside in the King County Eastside Rail Corridor Regional Trail property between Ripley Lane in Renton (MP 7.7) and Coal Creek Parkway in Bellevue (MP 10.2). As part of this work, widen a portion of the King County's Eastside Rail Corridor Regional Trail.
Stormwater Management Exhibit 2-2, Sheets 1 through 8	– Add 46.92 acres of new PGIS and 5.7 acres of non-PGIS. – Provide enhanced treatment for 100 percent of new impervious surfaces. – Retrofit 51 percent (111.5 acres) of existing untreated PGIS. – Treat a total of 179.69 acres of PGIS.
Construction Duration Exhibit 2-2, Sheet 7	– 5 years of construction is expected from 2019 through 2024.

Exhibit 2-1. Improvements Proposed with the I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project

Project Element	I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project
	– The direct-access ramps at 112th Avenue SE, reconfiguring the Newport Hills Park-and-Ride lot, and building four roundabouts on Coal Creek Parkway SE may be constructed after 2024, depending on when allocated funds for these elements become available.

[a] For these culverts, a restrictor plate would be put in place to prevent flooding until a downstream barrier is removed, at which time the restrictor plate would be removed.

I-405 = Interstate 405; I-5 = Interstate 5; SR 167 = State Route 167; I-90 = Interstate 90; SR 900 = State Route 900; MP = milepost; GP = general purpose; ETL = express toll lane; HOV = high-occupancy vehicle; PGIS = pollutant generating impervious surfaces

Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 1 of 8

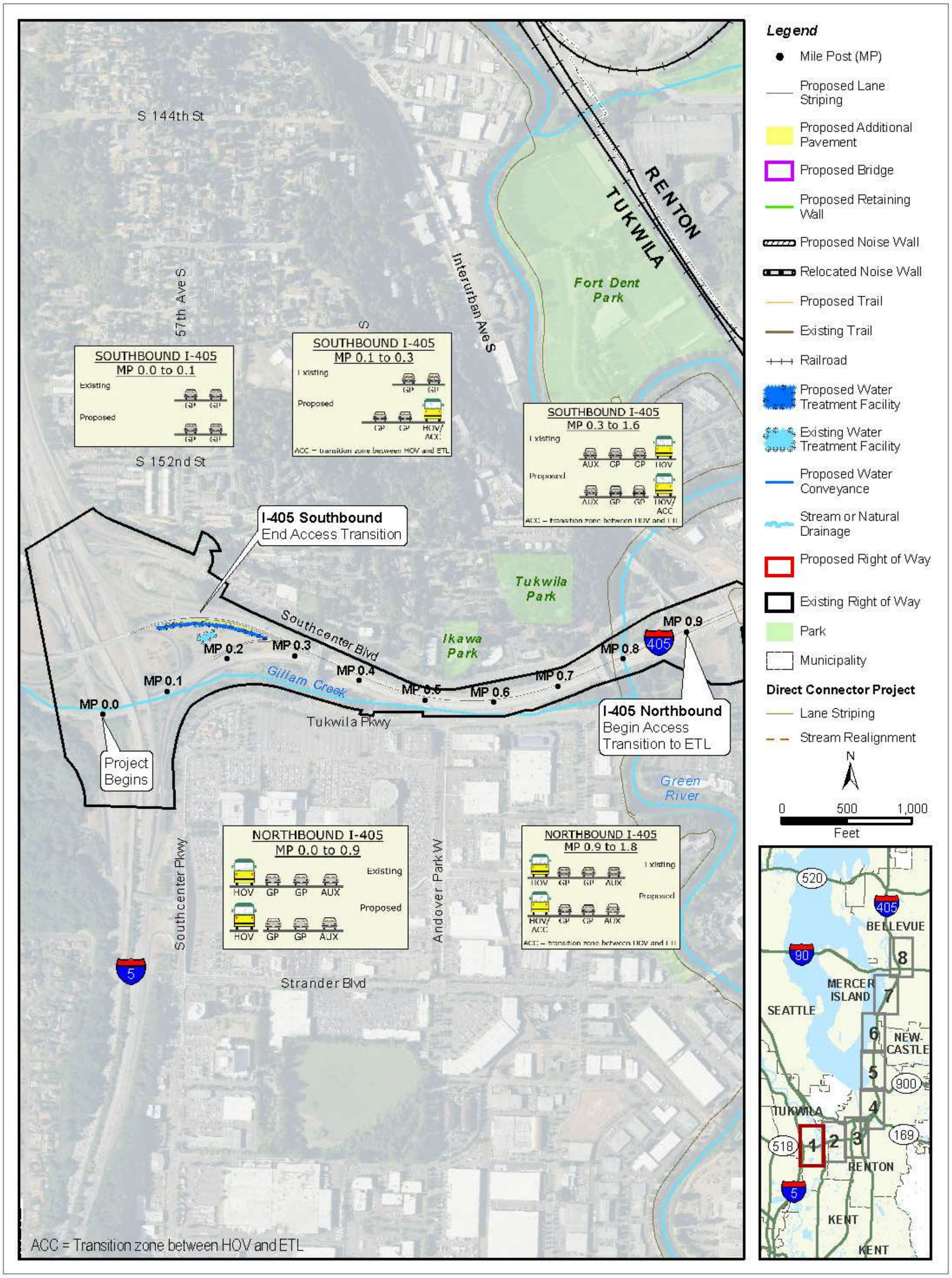


Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 2 of 8

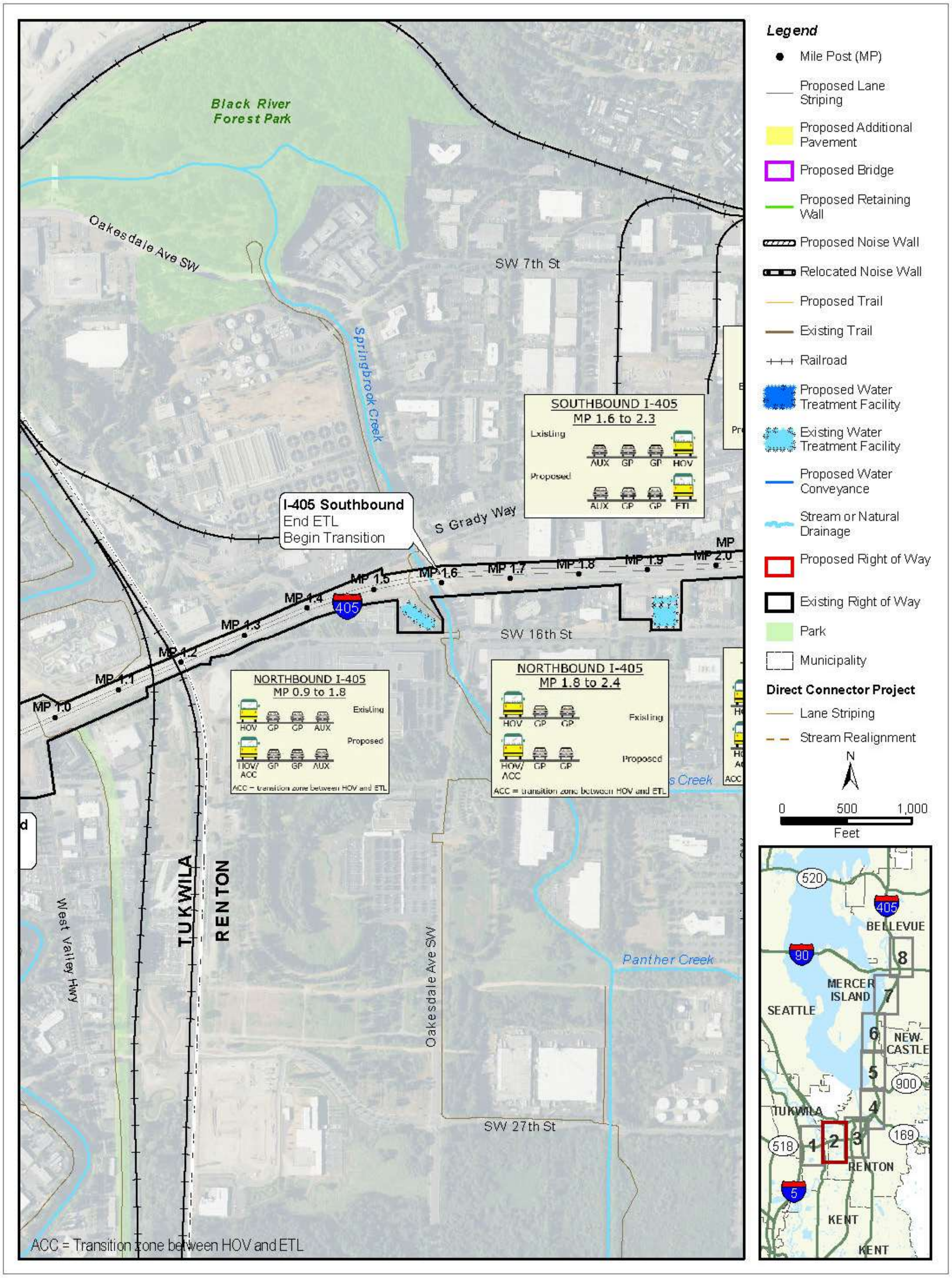


Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 3 of 8

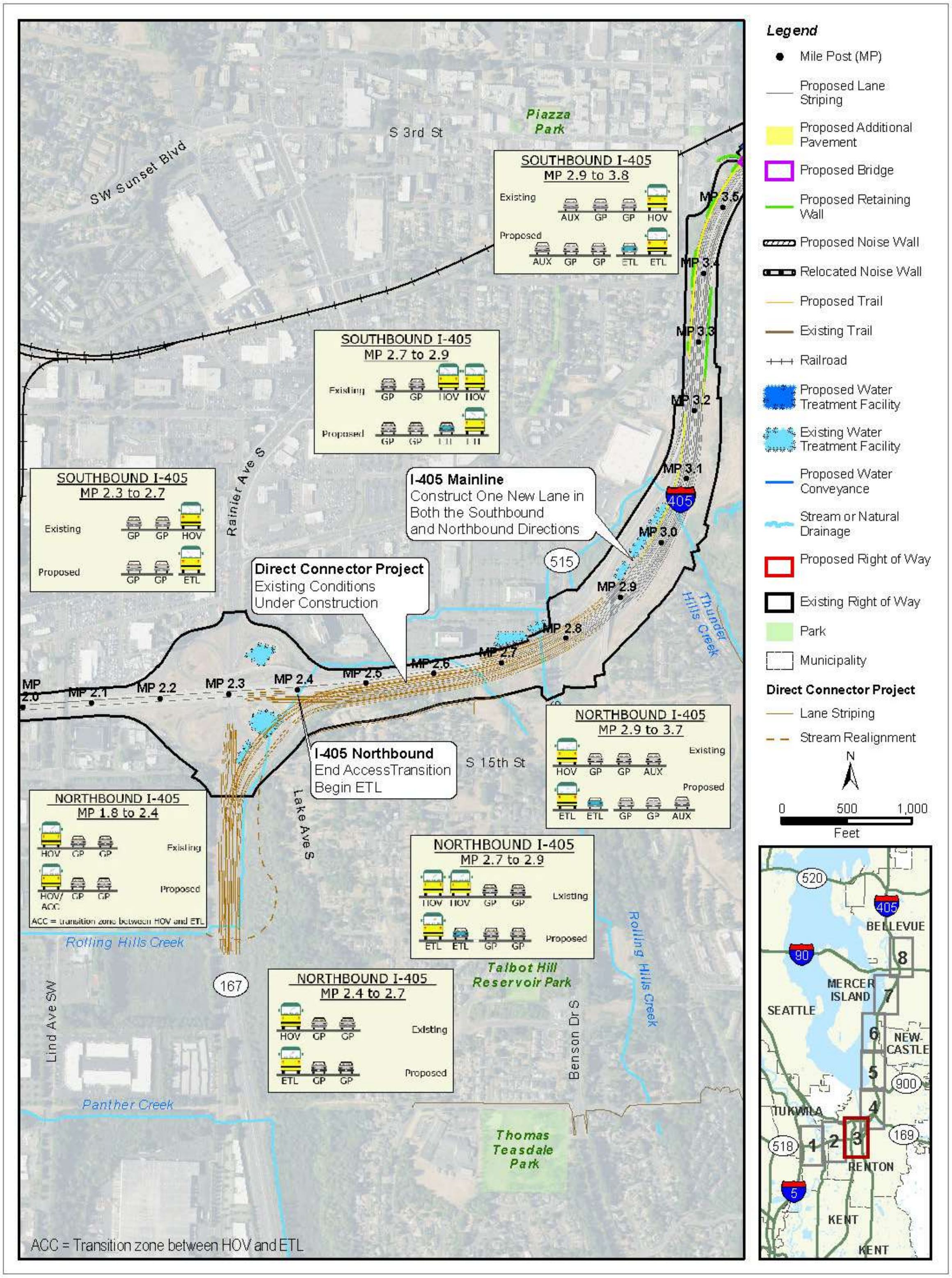


Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 4 of 8

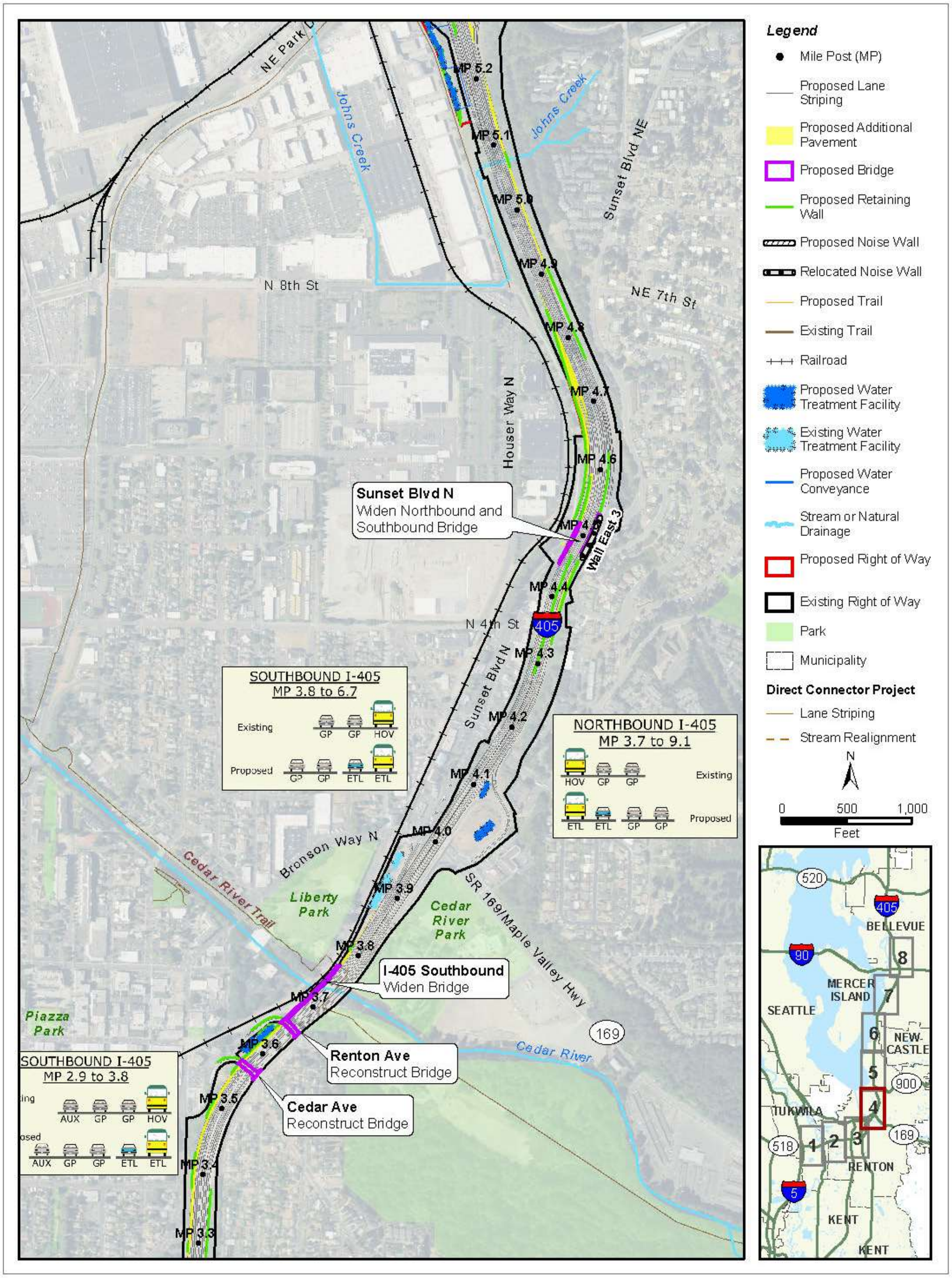


Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 5 of 8

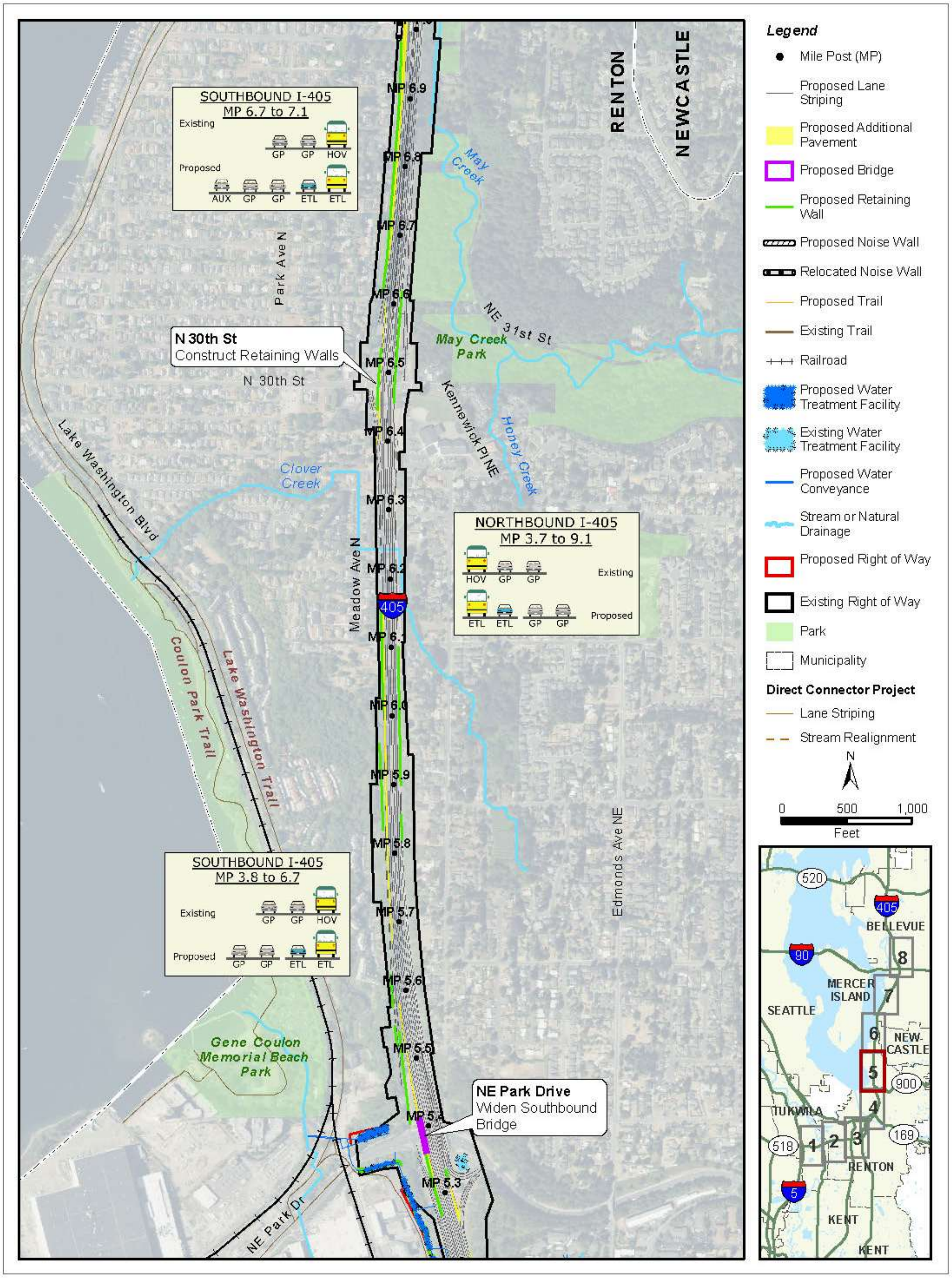


Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 6 of 8

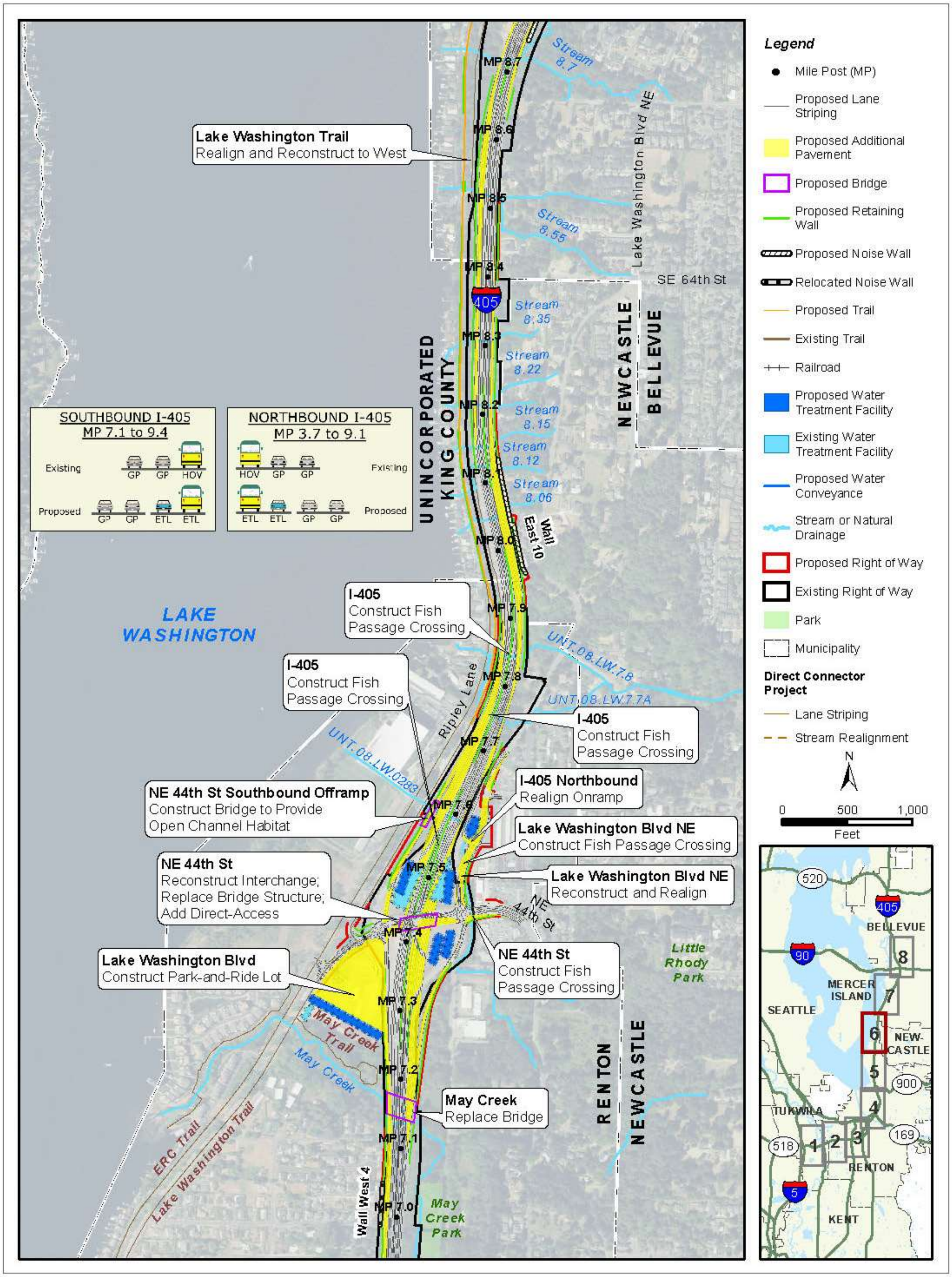


Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 7 of 8

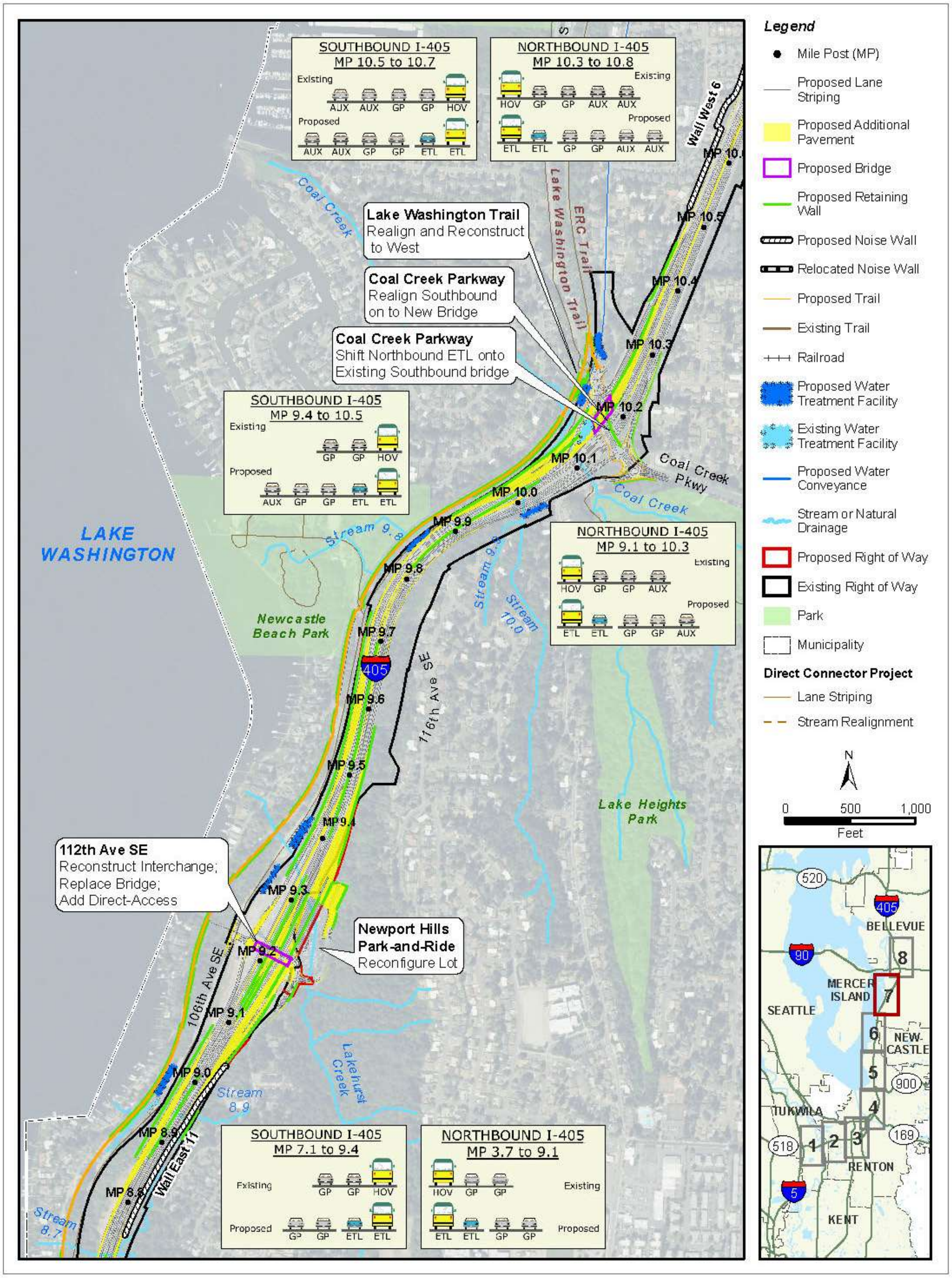
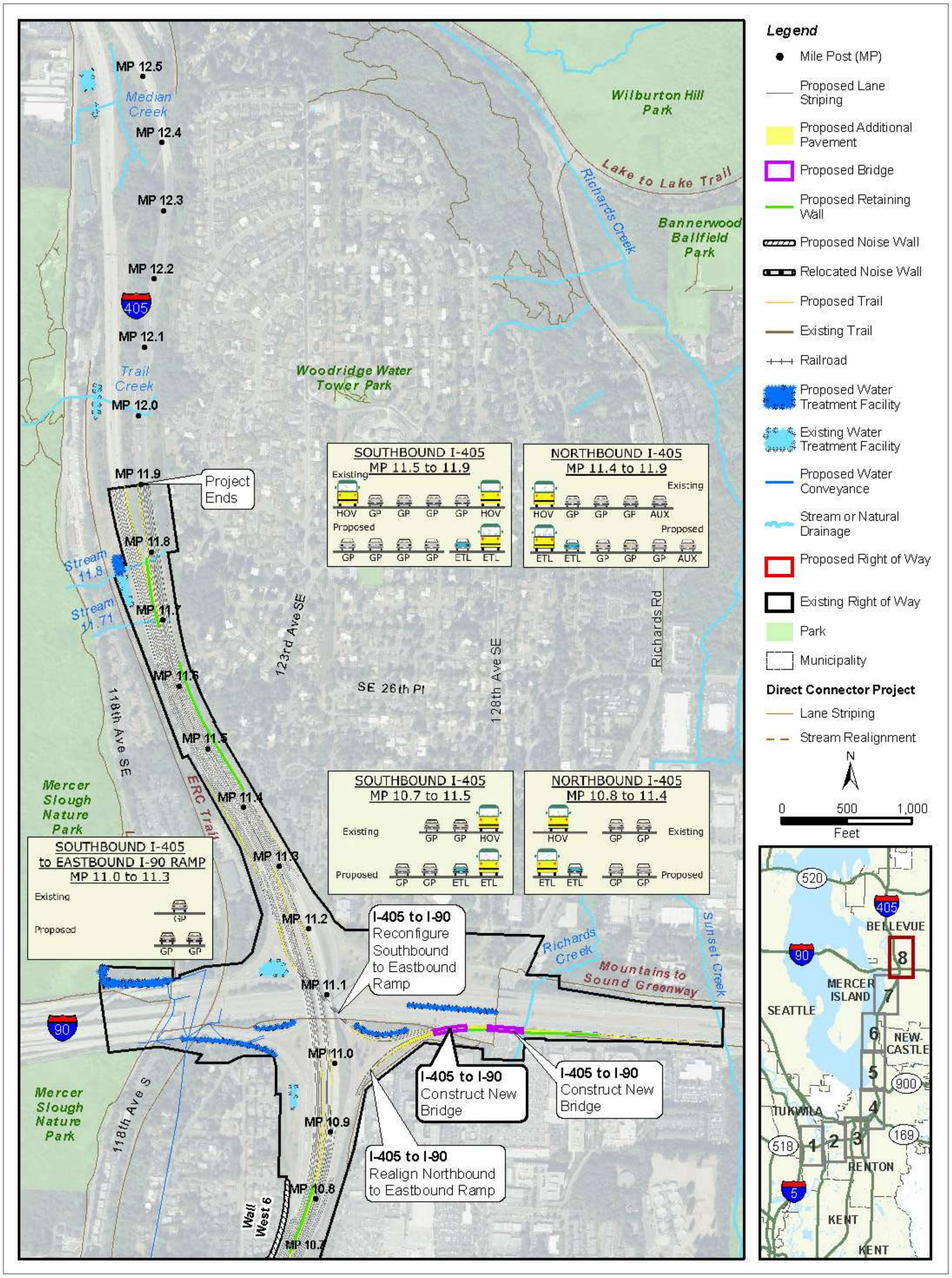


Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 8 of 8



What improvements are proposed with the I-405, Downtown Bellevue Vicinity Express Toll Lanes Project?

The Downtown Bellevue Project would extend along I-405 approximately 2.7 miles from just north of the I-90 interchange (milepost [MP] 11.9) to north of the NE 6th Street interchange (MP 14.6). The Project proposes the following improvements by mile posts, as shown in Exhibit 2-3, sheets 1 and 2:

- **Northbound I-405, I-90 to NE 6th Street (MP 11.9 to 13.7) –** Develop approximately 1.6 miles of new lane in the northbound direction by widening or restriping I-405 from MP 11.9 to 13.5. In this same section of I-405, convert the existing HOV lane to an ETL. The new lane coupled with the existing HOV lane would create a dual ETL. Between MP 13.5 and 13.7, convert the existing HOV lane to an ETL. The ETL would connect to the existing ETLs from downtown Bellevue to Lynnwood. Westward expansion of I-405 is proposed south of SE 8th Street, and eastward expansion is proposed north of SE 8th Street.
- **Southbound I-405, I-90 to NE 6th Street (MP 11.9 to 13.7) –** From MP 11.9 to 12.5, reconfigure the existing outside HOV lane to the inner roadway and convert both of the existing HOV lanes to ETLs. From MP 12.5 to 13.5, develop a new lane by widening or restriping. This new lane coupled with the existing HOV lane would result in a dual ETL south of NE 4th Street. Between MP 13.5 and 13.7, convert the existing HOV lane to an ETL. The ETL would connect to the existing ETLs from downtown Bellevue to Lynnwood. Where new pavement is needed, eastward expansion is proposed.
- **I-405 Eastside Rail Corridor Overpass (MP 12.4) –** Build a new northbound I-405 bridge structure adjacent to the existing I-405 structure over the Eastside Rail Corridor Regional Trail. The new structure would carry the two ETLs and the general purpose (GP) lanes would remain on the existing structure.
- **Eastside Rail Corridor Regional Trail (MP 12.09 to 12.49) –** Construct a new bridge for nonmotorized

travel over southbound I-405 near MP 12.15. Build a section of nonmotorized trail to connect with the Eastside Rail Corridor Regional Trail.

- **SE 8th Street Interchange (MP 12.78) –** Widen the northbound I-405 overpass over SE 8th Street.
- **Main Street Overpass (MP 13.31) –** Reconstruct the Main Street bridge (photo on right) over I-405.
- **Northbound I-405 to SR 520 Ramp (MP 14.6) –** Widen the existing northbound off-ramp to SR 520 from two lanes to three lanes for approximately 600 feet beginning where the NE 10th Street on-ramp merges onto the I-405 ramp.
- **Stormwater –** Build new flow control and runoff treatment facilities.
- **Other Improvements –** Provide pavement markings, drainage improvements, permanent signing, illumination, intelligent transportation systems, barriers, and tolling gantries.
- **Context Sensitive Solutions –** Incorporate Context Sensitive Solutions (CSS) to enhance mobility, safety, the natural and built environment, and aesthetics throughout the project corridor.
- **Property Acquisitions –** Acquire portions of five commercial and public properties to accommodate the Project.
- **Minimization Measures –** Implement avoidance and minimization measures or compensate for unavoidable effects on the environment, as described in Chapter 6, Measures to Avoid or Minimize Effects.

Existing Main Street Overpass

What are Context Sensitive Solutions?

The *Context Sensitive Solutions (CSS)* process is a model for transportation project development that has received much discussion and broad acceptance. Its essence is that a proposed transportation project must be planned not only for its physical aspects and road serving specific transportation objectives, but also for its effects on the aesthetic, social, economic, and natural environment, as well as the needs, constraints, and opportunities in a larger community setting.

Exhibit 2-3. I-405, Downtown Bellevue Vicinity Express Toll Lanes Project Improvements | Sheet 1 of 2

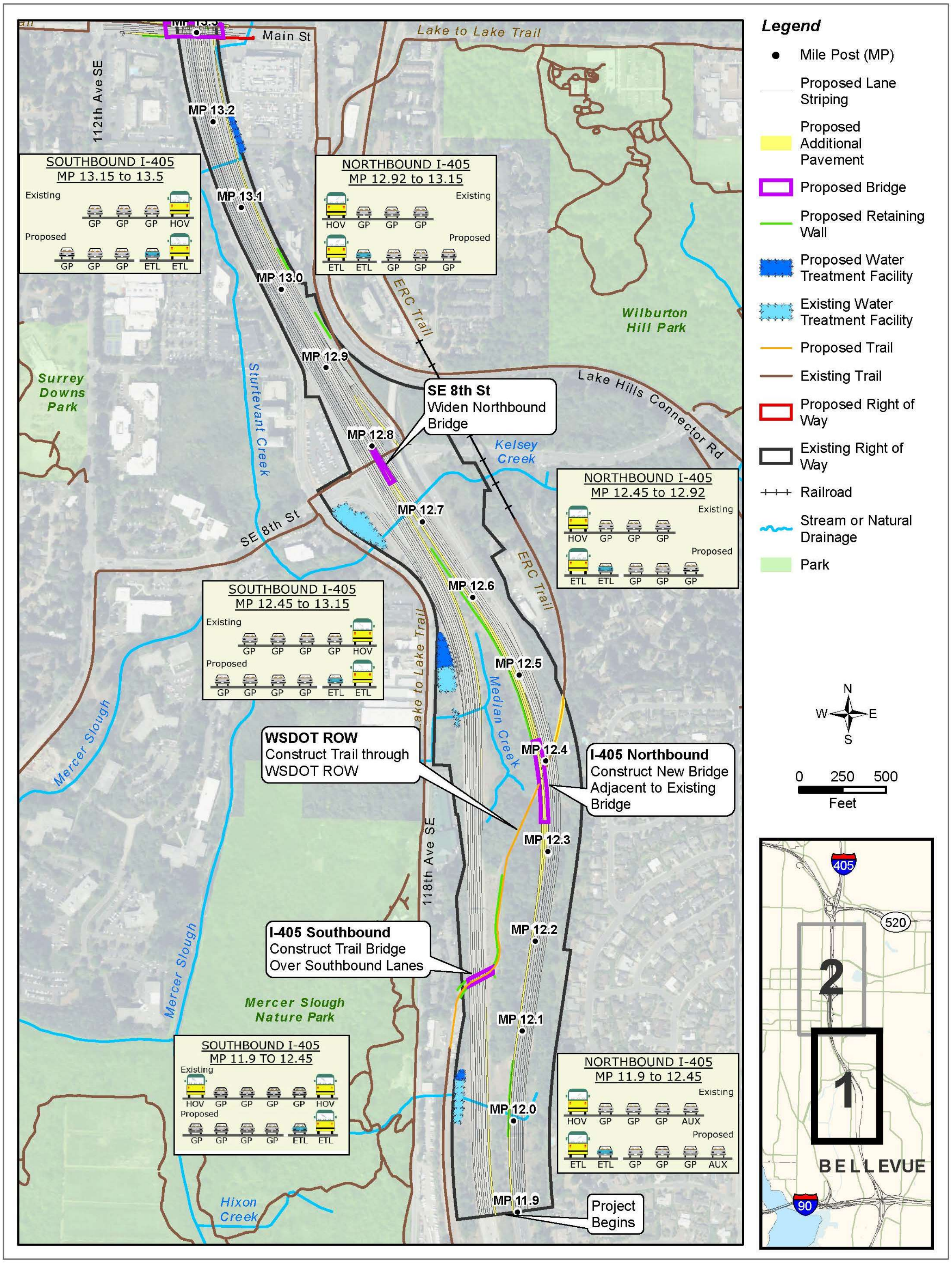
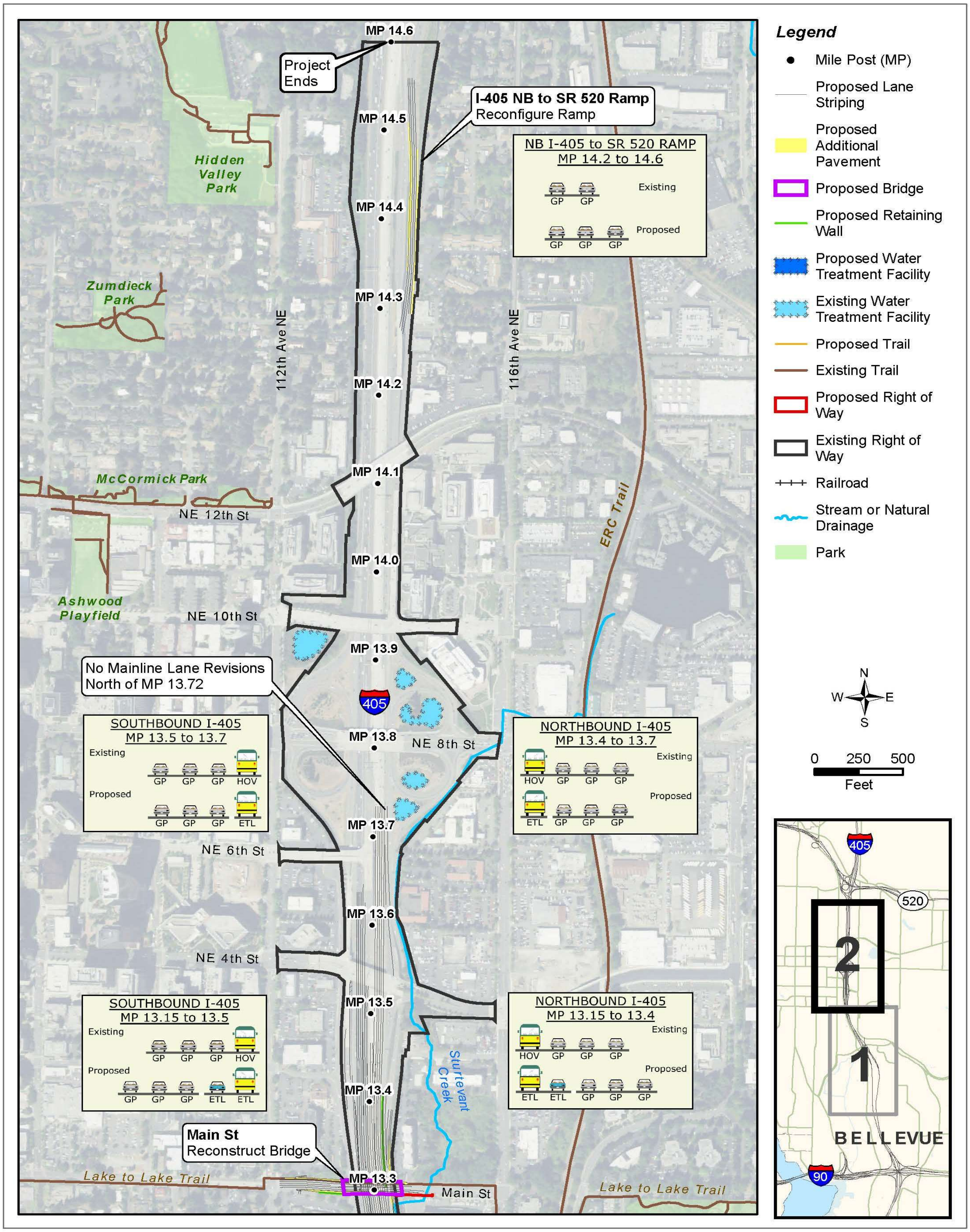


Exhibit 2-3. I-405, Downtown Bellevue Vicinity Express Toll Lanes Project Improvements | Sheet 2 of 2



How would the express toll lanes work?

At this time, the Washington State Transportation Commission (WSTC) has not established operational hours, user exemptions, occupancy requirements, and operating parameters for the ETLs proposed with both projects The WSTC will set operational requirements for the ETLs prior to opening day. For this analysis, we assumed the requirements for the current I-405, Bellevue to Lynnwood ETL system would be used for both projects. These assumptions, listed below, represent the most recent operating guidance from the WSTC for ETLs:

- **Limited Access** – The system will have designated entry and exit points, with a buffer between the ETLs and the GP lanes. These access points will vary in length, depending on the location.
- **Dynamic and Destination Pricing** – The I-405 ETL system would use both dynamic and destination pricing to determine a driver's toll at the time they enter the ETL. With *dynamic pricing*, toll rates vary based on congestion within the corridor to maintain performance. Electronic signs would be used to communicate the current toll rate for drivers. Toll rates are updated every few minutes, but the driver's price is set when they enter the system. With *destination pricing*, the toll is based on the driver's destination. Toll signs will show up to three toll rates for different toll zones, or destinations. Drivers will pay the rate they see upon entering the ETLs to reach their destination, even if they see a different toll rate for their destination further down the road. When both of these pricing approaches are used together, it means that the toll that drivers pay is based both on the congestion in the corridor and the distance they are traveling.

How does dynamic pricing work?

Electronic monitors along the roadway measure real-time information on the speed, congestion, and number of vehicles in the ETLs. This information is used to determine whether tolls go up or down to optimize lane use.

As the ETLs become congested, toll rates increase, and as congestion decreases, toll rates decrease. The use of dynamic pricing allows the lanes to operate with high volumes but avoid becoming congested.

When would tolls be charged to use the ETLs?

It is assumed the ETLs would operate from 5 a.m. to 7 p.m. on weekdays. At all other times and major holidays, the lanes would be free and open to all without a *Good To Go!* pass.

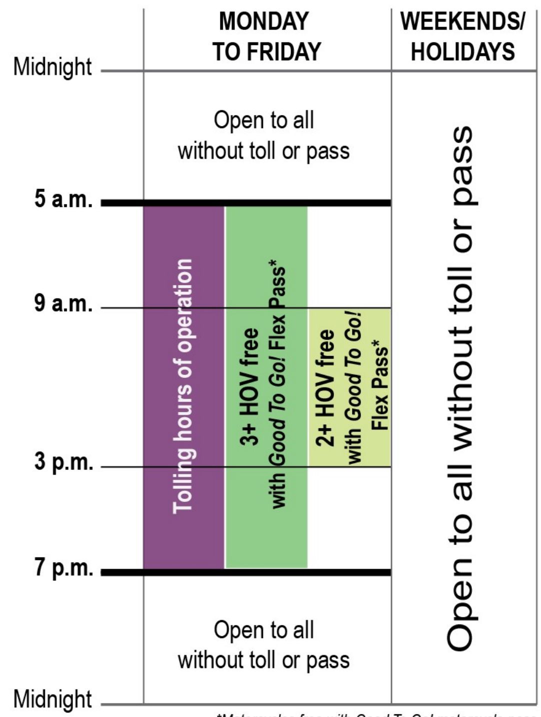
During operating hours:

- **Single Occupancy Vehicle (SOVs)** would pay a toll to use the lanes.
- **Transit, High Occupancy Vehicle (HOV) 3+, and Motorcycles** would travel for free with a *Good To Go!* pass.
- **HOV 2+** would travel for free from 9 a.m. to 3 p.m. with a *Good To Go!* pass. From 5 a.m. to 9 a.m. and 3 p.m. to 7 p.m. HOV2+ would pay a toll to use the ETLs with or without a *Good To Go!* pass.
- **Large vehicles** over 10,000 pounds gross vehicle weight would not be able to use the ETLs at any time.

- **Operating Hours and *Good To Go!* Passes** – The ETL system is expected to operate from 5 a.m. to 7 p.m. on weekdays, with the system toll-free and open to all at other hours and on major holidays. Transit, HOVs, and motorcycles would need to have a *Good To Go!* pass to use the ETLs for free during operating hours. Eligible HOV users will be required to set the *Good To Go!* pass to the HOV mode to avoid charges. SOVs could choose to pay a toll to use the ETLs during operating hours with or without a *Good To Go!* pass.
- **Occupancy Requirement**s – During the peak periods (weekdays from 5 a.m. to 9 a.m. and 3 p.m. to 7 p.m.), transit vehicles and carpools with three or more persons (HOV 3+) would be able to use the lanes for free with a *Good To Go!* pass. From 9 a.m. to 3 p.m., the system would be open toll-free to those with two or more passengers (HOV 2+) with a *Good To Go!* pass. Motorcycles ride toll-free in the ETLs with a *Good To Go!* pass. During non-operating hours, SOVs will not be permitted to enter the ETLs from ramps where access is provided directly from local streets. SOV access would only be permitted from freeway GP entry and exit points.
- **Vehicle Weight** – Vehicles over 10,000 pounds gross vehicle weight will be prohibited, which is consistent with HOV lane restrictions throughout Washington.
- **Electronic Tolling** – Payments will be made via electronic tolling with a *Good To Go!* pass. For drivers who choose not to use a *Good To Go!* Pass, WSDOT offers optional photo billing (pay by mail) for an extra fee.

What is a *Good to Go!* Account?

A Good To Go! account is the cheapest and easiest way to pay tolls in Washington. With an account, your tolls will be paid automatically without having to stop at a toll booth or worry about bills in the mail. For more information please go to: http://www.wsdot.wa.gov/GoodToGo/default.htm



*Motorcycles free with Good To Go! motorcycle pass

What is the construction schedule?

Both projects will be built at the same time. Construction is expected to last up to 5 years beginning in 2019 and ending in 2024.

SECTION 3 REGULATORY REQUIREMENTS

What affects air quality?

Air quality is affected by pollutants that are generated by both natural and human-made sources. In general, the largest human-made contributors to air emissions are transportation vehicles and power-generating equipment, both of which typically burn fossil fuels. The criteria pollutants of interest for transportation projects are carbon monoxide (CO), particulate matter (PM), ozone and the ozone precursors, volatile organic compounds (VOCs), and nitrogen oxides (NO_x). Both federal and state standards regulate these pollutants, along with two other criteria pollutants, sulfur dioxide (SO_2) and lead. Changes to CO, PM, and the ozone precursors resulting from the Projects are considered in this air quality analysis. However, lead and SO_2 were not evaluated since they are not pollutants of concern for transportation projects.

The largest contributors of pollution related to transportation projects are motor vehicles. The main pollutants emitted from motor vehicles are CO, particulates, greenhouse gases (GHGs), and mobile source air toxics (MSATs). Motor vehicles also emit pollutants that contribute to the formation of ground-level ozone. This section discusses the main pollutants of concern and their effect on public health and the environment.

Carbon Monoxide

CO is a colorless, odorless, and tasteless gas that results from the incomplete combustion of fuel. CO is taken into the body by breathing. In low concentrations, CO can cause fatigue in healthy people and chest pain in people with heart conditions. At higher concentrations, CO can cause dizziness, impaired vision and coordination, confusion, headaches, and nausea. In exceptionally high concentrations, CO can be fatal.

The major source of CO is vehicular traffic, along with industry, wood stoves, and slash burns. For urban areas, motor vehicle internal combustion engines are the principal sources of CO. The CO concentration increases from vehicle cold-starts in the winter, when meteorological conditions favor the build-up of directly emitted contaminants. Usually high CO concentrations are localized and occur near congested roadways and intersections.

Particulate Matter

PM consists of small particles of dirt, soot, metals, and organic matter. PM of 10 microns or less in diameter (PM_{10}) and PM of 2.5 or less microns in diameter ($PM_{2.5}$) pose the greatest health problems because they can bypass the natural filtration systems of the nose and throat and enter deep into the lungs, heart, and even the bloodstream, which can cause difficulty with breathing, aggravation of asthma, irregular heartbeat, nonfatal heart attacks, and death in people with heart or lung problems. Due to the size of PM_{10} and $PM_{2.5}$, the wind easily picks up the particles and transports them over long distances to settle on either the ground or water. PM that lands on the ground has the potential to deplete nutrients in the soil, damage sensitive crops, and change the structure of the ecosystem. PM that lands on water can change the acidity in lakes and streams, as well as the nutrient balance in coastal waters and large river basins. Major sources of PM are construction activity, smokestacks, fires, power plants, and automobiles.

The U.S. Environmental Protection Agency (EPA) has set standards for two different size categories of PM. The first standard set is for PM_{10}–smaller than 10 microns in size. These particles are considered “inhalable course particles” and can be found near roadways and dusty industries. The second set of standards is for $PM_{2.5}$–particles that measure 2.5 microns in size and smaller. These particles are called “fine particles” and can usually be found in smoke and haze. These particles are directly emitted from combustion, such as diesel trucks or forest fires, or can be formed from gases emitted from power plants and automobiles.

Ozone

Normally, ozone is not emitted directly into the air; however, at ground level, NO_x and VOCs react under the presence of sunlight and heat to form ozone. Emissions from industrial and electric facilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are major sources of NO_x and VOCs.

Ground-level and stratosphere-level ozone share the same chemical structure; however, their effects differ greatly due to their positions in the atmosphere. Ground-level ozone has adverse effects due to its potential effects on human health, while stratospheric ozone has a protective effect by shielding the earth’s surface from harmful radiation. When ozone is inhaled, it can cause a variety of health problems, such as chest pain, coughing, throat irritation, and congestion. The effects can potentially worsen to bronchitis, emphysema, and asthma, thus, reducing lung function and inflaming the linings of the lungs. Repeated exposure can eventually lead to permanent scarring of the lung tissue. Not only does ozone cause negative human health effects, but it also damages the environment. It can also cause sensitive plants to be more susceptible to certain diseases, insects, and other pollutants, which can lead to reduced crop yields and forest growth and, potentially, to effects on species diversity in ecosystems.

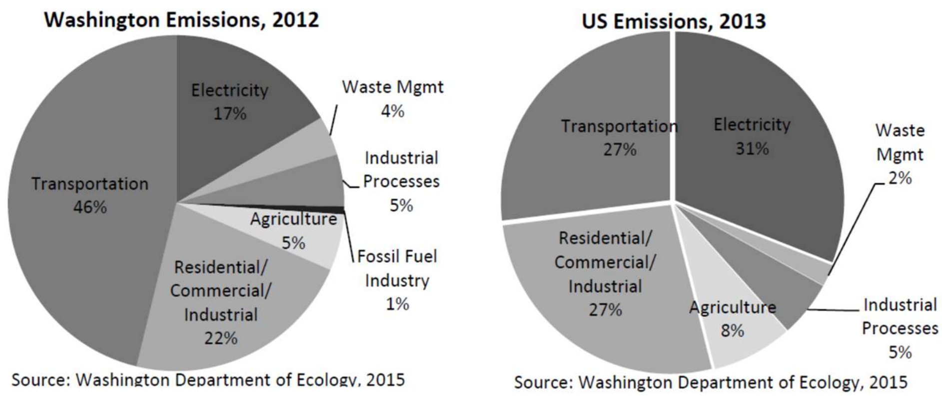
Ozone is also the primary element of smog. Sunlight and hot weather are required for ground-level ozone formation. Thus, ozone is referred to as a summertime air pollutant. Although many urban areas tend to have high levels of ozone, even rural areas are subject to increased ozone levels because NO_X and VOCs react as they are transported downwind and become ozone miles away from their original sources.

Climate Change and Greenhouse Gases

Vehicles emit a variety of gases during their operation; some of these are GHGs. The GHGs associated with transportation are carbon dioxide (CO_2), methane, and nitrous oxide. Any process that burns fossil fuel releases CO_2 into the air; CO_2 makes up the bulk of the emissions from transportation. Vehicles are a significant source of GHG emissions and contribute to global warming primarily through the burning of gasoline and diesel fuels. National estimates show that the transportation sector (including on-road vehicles, construction activities, airplanes, and boats) accounts for about 27 percent of total domestic CO_2 emissions. However, in Washington State, transportation accounts for nearly half of GHG emissions because the state relies heavily on hydropower for electricity generation, unlike other states that rely on fossil fuels such as coal, petroleum, and natural gas. The next-largest contributors to total GHG emissions in Washington State are fossil fuel combustion in the residential, commercial, and industrial sectors at 22 percent and electricity consumption at 17 percent.

Exhibit 3-1 shows the gross GHG emissions by sector, for Washington State and nationally.

Exhibit 3-1. GHG Emissions by Sector, Washington (2012) and National (2013)



Mobile Source Air Toxics

In addition to regulating the criteria pollutants, the federal Clean Air Act (CAA) identifies 188 air toxics, also known as hazardous air pollutants. EPA assessed this expansive toxic list and identified a group of 21 air toxics as MSATs, which are set forth in an EPA final rule, *Control of Emissions of Hazardous Air Pollutants from Mobile Sources (66 Federal Register [FR] 17235)*. EPA then extracted a subset of this list of 21, which it labels the nine priority MSATs: acetaldehyde, acrolein, ethylbenzene, benzene, formaldehyde, diesel PM, naphthalene, polycyclic organic matter, and 1,3-butadiene. Exposure to these pollutants for long durations and sufficient concentrations increases the chances of cancer or other serious health effects, including damage to the immune system; neurological problems; and reproductive, developmental, respiratory, and other serious health problems.

The 2004 PSCAA inventory shows that on-road vehicles continue to be the greatest contributors to both criteria pollutant and air toxics emissions in the Puget Sound airshed. Transportation projects with high potential for MSAT effects are required to perform project-level MSAT analysis.

What is an airshed?

An airshed is a part of the geography that shares a common flow of air and thus is exposed to the same things.

What federal policies or regulations are related to effects on air quality?

In the project airshed, multiple federal, state, and local level agencies have authority under the federal CAA, its amendments, and the Washington State Clean Air Act to manage and regulate air quality resources. Following the requirements of the CAA, EPA sets the criteria for National Ambient Air Quality Standards (NAAQS) and conformity requirements and has oversight authority over both PSCAA and Ecology. EPA delegated authority to Ecology and the PSCAA. Ecology strives to improve air quality throughout the state by overseeing the development and conformity of the State Implementation Plan, which is the state's plan for meeting and maintaining NAAQS. PSCAA has local authority for setting regulations and permitting of stationary air pollutant sources and construction emissions. Governing air quality plans, policies, and regulations are listed below.

National Ambient Air Quality Standards

EPA identified several air pollutants as being of concern nationwide. These pollutants are known as *criteria pollutants*. The sources of these pollutants, their effects on human health and the nation's welfare, and their concentration in the atmosphere vary considerably. Under the CAA, EPA has established NAAQS, which specify maximum allowable concentrations for six criteria pollutants: CO, lead, NO_2, PM_{10}, $PM_{2.5}$, ozone, and SO_2 (EPA 2015a and 2015b). The NAAQS for these criteria pollutants are separated into two standard categories: Primary and Secondary standards (40 Code of Federal Regulations [CFR] 50). The Primary standards were created to protect public health; the Secondary pollutant standards were established to protect public welfare and the environment.

Exhibit 3-2 displays the Primary and Secondary NAAQS for these six criteria pollutants. Ecology and PSCAA have authority to adopt more stringent standards, although many of the state and local standards are equivalent to the federal mandate.

Areas not in compliance with the NAAQS are deemed nonattainment areas. An area remains a nonattainment area for that pollutant until concentrations are in compliance with the NAAQS. When the NAAQS are attained, an area is redesignated as in attainment but must adhere to a maintenance plan for 20 years, which can require continued transportation conformity determinations.

Exhibit 3-2. Ambient Air Quality Standards by Government Jurisdiction

Pollutant	National[a]		State of Washington[b]	Puget Sound Region[b]
	Primary	Secondary		
Nitrogen Dioxide (NO_2)				
1-Hour (ppm)	0.10	NS	NS	0.10
Annual Average (ppm)	0.053	0.053	0.05	0.053
Carbon Monoxide (CO)				
1-Hour Average (ppm)	35.0	NS	35.0	35.0
8-Hour Average (ppm)	9.0	NS	9.0	9.0
Ozone (O_3)				
8-Hour Average (ppm)	0.075	0.075	NS	0.075
1-Hour Average (ppm)	Revoked	Revoked	0.12	NS
Lead				
Calendar Quarter (µg/m^3)	1.5	1.5	NS	NS
Rolling 3-Month Average (µg/m^3)	0.15	0.15	NS	0.15
Sulfur Dioxide (SO_2)				
1-Hour Average (ppm)	0.075[c]	NS	0.40[d] 0.25[e]	0.075
3-Hour Average (ppm)	NS	0.5	NS	0.5
24-Hour Average (ppm)	0.14 (certain areas)	NS	0.10	NS
Annual Arithmetic Average (ppm)	0.03 (certain areas)	NS	0.02	NS
Particulate Matter (PM_{10})				
24-Hour Average (µg/m^3)	150	150	150	150.0
Annual Arithmetic Average (µg/m^3)	Revoked	Revoked	50	NS
Particulate Matter ($PM_{2.5}$)				
24-Hour Average (µg/m^3)	35	35	NS	35
Annual Arithmetic Average (µg/m^3)	12	15	NS	15

Exhibit 3-2. Ambient Air Quality Standards by Government Jurisdiction

Pollutant	National[a]		State of Washington[b]	Puget Sound Region[b]
	Primary	Secondary		
Particulate Matter (TSP)				
24-Hour Average (µg/m^3)	NS	NS	150	NS
Annual Geometric Average (µg/m^3)	NS	NS	60	NS

Sources:
NAAQS: EPA 2015a, 2015b
WAAQS: Washington Administrative Code (WAC) 173-470, 474, and 475.
Puget Sound Region: Puget Sound Clean Air Agency Regulation 1, (2012).

[a] National standards other than O_3, PM, and those based on annual averages or annual arithmetic means are not to be exceeded more than once a year. The O_3 standard is attained when the fourth highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m^3 is equal to or less than 1. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, is equal to or less than the standard.
[b] State and Puget Sound regional standards criteria for violation are the same as the national standards unless otherwise noted.
[c] Final rule signed June 2, 2010. To attain 1-hour SO_2 standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 parts per billion.
[d] Not to be exceeded more than once a year.
[e] Not to be exceeded more than twice in a consecutive 7-day period.
µg/m3 = micrograms per cubic meter; ppm = parts per million (by volume); NS = no standard established; TSP = total suspended particulates

Transportation Conformity Requirements

The federal CAA amendments of 1990 and Washington State regulations require all transportation projects located in air quality maintenance and nonattainment areas in Washington to follow conformity requirements promulgated in their respective regulations (40 CFR 93 and Washington Administrative Code [WAC] 173-420) and to conform to the State Implementation Plan.

Air quality in the Puget Sound area, including the study area, has improved over the last several decades due to more stringent fuel standards and control technology used on vehicles to reduce emissions. The study area is in attainment for all criteria pollutants. Transportation conformity is no longer required for CO because maintenance requirements for the area expired October 11, 2016 (EPA 2004). Likewise, transportation conformity is no longer required in the Puget Sound area for the revoked 1-hour ozone standard.

National Environmental Policy Act

Under Section 309 of the CAA, EPA is required to review and publicly comment on the environmental impacts of major federal actions, including actions that are the subject of draft and final EISs, proposed environmental regulations, and other proposed major actions. On February 8, 2011, EPA issued guidance to its Section 309 reviewers making a number of recommendations regarding the use of their Motor Vehicle Emission Simulator (MOVES) model in analyses conducted only for NEPA purposes (e.g., in an attainment area or for pollutants not addressed by the CAA transportation conformity requirements).

Although transportation conformity is not required for the Projects, EPA recommends using the same emissions model (MOVES2014a, the latest version of MOVES) for NEPA purposes to predict pollutant emissions for criteria, MSATs, and GHG pollutants.

SECTION 4 STUDY APPROACH

What is the study area and how was it determined?

The air quality study area for the I-405, Tukwila to I-90 and Downtown Bellevue Projects encompasses the construction limits of the Projects and includes the I-405 freeway and arterials that would be affected by the Projects within the west-central Puget Sound region. The map in Appendix C, Project Study Area, illustrates the outer limits of the affected transportation roadway network in the study area.

Although air quality is not defined by physical boundaries, local and regional limits must be defined to analyze air quality effects. Using the PSRC regional transportation demand model, we identified these limits by considering how the Projects would affect congested roadways, traffic volume increases, and traffic circulation patterns on major arterials and higher classification roadways. This effort provided a distinct roadway network that encompasses the limits of construction for the Projects, as well as a broader roadway network that defines the airshed for this analysis.

What methodology did we use for the air quality analysis?

For the analysis of both operational and construction effects, the air quality team followed the WSDOT *Environmental Manual* (WSDOT 2017) for air quality for projects undergoing NEPA review. The study area is in attainment for all criteria pollutants, and regional and project level conformity demonstrations are not required. The air quality analysis included emissions burden modeling of criteria pollutants, MSATs, and GHG emissions under existing, Build conditions with the Projects, and No Build conditions. A quantitative analysis of construction GHG emissions was also completed.

Operational Criteria, MSAT, and GHG Emissions

As recommended by WSDOT's guidance for projects being evaluated under NEPA, we used the EPA MOVES2014a model, and the corresponding default MOVES database and relevant local inputs for this analysis to calculate daily emissions rates. The MOVES2014a model generated project specific daily emissions rates for the analysis year(s)

2016 (existing) and 2025 and 2045 (future Build and No Build) for criteria, MSATs, and GHG pollutants in the study area based on user-provided input files and run specifications. The process for developing the input files and setting up the MOVES2014a model for the run specification is discussed and fully documented in Appendix D, Motor Vehicles Emission Simulator (MOVES) Version 2014A. We used an emissions burden analysis to demonstrate the changes in tailpipe emissions for the criteria, MSAT, and GHG pollutants between 2016 existing conditions and with and without the Projects for the analysis years 2025 and 2045.

Criteria Construction Emissions

A qualitative discussion is presented in Section 6, Project Effects, for temporary emissions from construction and associated best management practices (BMPs) to reduce emissions.

GHG Construction Emissions

Following the *WSDOT Guidance for Project-Level Greenhouse Gas Evaluations (*WSDOT 2016b) under NEPA and SEPA, we quantified construction GHG emissions to assess the Projects' effects on the climate.

This guidance recommends the use of FHWA's Infrastructure Carbon Estimator (ICE) spreadsheet tool to calculate GHG emissions from fuel usage, traffic delays, and maintenance emissions resulting from construction of the Projects (FHWA 2016b). FHWA's new ICE tool incorporates project features and construction-related traffic delays to calculate emissions from construction equipment, materials, and routine maintenance. Traffic delays caused by construction are another source of emissions. Maintenance emissions come from similar sources, but occur over a project's lifespan. A discussion of the inputs used in the ICE model is provided in Appendix F, Infrastructure Carbon Estimator Spreadsheet Tool.

How did we collect information for this report?

The air quality discipline team identified current air quality standards and regulations of EPA, Ecology, and PSCAA that apply to the study area. The air quality team identified the required analyses to be performed for the Projects and gathered pertinent information on local air quality monitoring data, regulatory models and approaches, regional air quality modeling input files from PSRC, and project-specific traffic information for the study area. We evaluated the status of air quality in the study area by comparing recent air quality monitoring data available from EPA, Ecology, and PSCAA to applicable air quality standards.

We developed project-specific traffic input files for the MOVES model by using traffic data supplied by the Projects' traffic engineer. After review of the Projects' traffic data, we identified the following parameters for study area traffic: road types affected, vehicle classifications (the type of vehicle traveled on the roadway), the speeds for each vehicle classification based on the time of day, and the daily vehicle miles traveled (VMT).

We further defined the parameters for the MOVES traffic input files. The road types affected were classified as freeway (urban restricted) and affected arterial local roadways (urban unrestricted). Three vehicle classifications were identified for each roadway type: SOV, HOV, and trucks. Daily weekday VMT and vehicle hours traveled (VHT) were provided for each vehicle classification by road type for existing conditions (2016) and future (2025) and (2045) Build and No Build conditions. We then used this information to develop speeds for each condition by vehicle classification and road type.

Three MOVES input files are related to project-specific traffic data: roadway type, average speed distribution, and VMT by vehicle type. These input files influence the effects of the Projects' traffic on air quality. For the roadway type input file, the percentage of each vehicle classification's VMT was distributed on each roadway type—urban restricted (freeway) or urban unrestricted (arterials). For the average speed distribution input file, information is required on the time of day a particular vehicle classification is traveling at a particular speed on a certain roadway type. This information was calculated for each vehicle classification by time of day and speed and distributed by roadway type. Lastly, the average daily VMT was distributed by vehicle type for each month. We assumed that the daily VMT provided by the Project traffic engineer was representative of an average weekday for each month of a given analysis year.

We obtained additional input files from PSRC specific to King County to account for fuel supply, meteorological data, Inspection & Maintenance data, and the ages of vehicles registered in King County. These input files were obtained from the most recent regional modeling for King County to develop the Regional Transportation Plan.

For the construction analysis, we obtained information from the design engineers on project construction features (as shown in Appendix F, Infrastructure Carbon Estimator Spreadsheet Tool) for the ICE spreadsheet tool.

SECTION 5 EXISTING CONDITIONS

What is the local air quality like in the study area?

Air Quality Monitoring

Air quality is monitored and areas are designated according to whether or not a pollutant meets the NAAQS. PSCAA and Ecology monitor criteria air pollutant concentrations in King County. One monitoring station located near Beacon Hill and near the project vicinity (Kent station) measures concentrations of all four pollutants: CO, PM_{10}, $PM_{2.5}$, and ozone. Exhibit 5-1 displays the last 3 years of monitoring data to show that the air pollutant concentration trends for these pollutants remain below the NAAQS.

Ongoing monitoring throughout the central Puget Sound region indicates that the ambient air pollution concentrations for CO, PM_{10}, and $PM_{2.5}$ have been decreasing over the past decade. Measured ozone concentrations, in contrast, have remained static. The decline of CO is due primarily to improvements made to emissions controls on motor vehicles and the retirement of older, higher-polluting vehicles.

Exhibit 5-1. Ambient Air Quality Monitoring Data at Kent and Beacon Hill Stations

Pollutant	NAAQS	2014 Maximum Concentration	2015 Maximum Concentration	2016 Maximum Concentration
Carbon Monoxide (CO)[a]				
1-hour average (ppm)	35	1.0	1.1	1.1
8-hour average (ppm)	9	1.0	0.9	0.9
Ozone (O_3)[a]				
1-hour average (ppm)	0.070	0.048	0.062	0.060
8-hour average (ppm)	0.070	0.058	0.050	0.050
Particulate Matter (PM_{10})[a]				
24-hour average (µg/m^3)	150	25.0	37.0	PM_{10} is no longer being monitored.
Particulate Matter ($PM_{2.5}$)[b]				

Exhibit 5-1. Ambient Air Quality Monitoring Data at Kent and Beacon Hill Stations

Pollutant	NAAQS	2014 Maximum Concentration	2015 Maximum Concentration	2016 Maximum Concentration
24-hour average (98th Percentile) (µg/m^3)	35	22	26	18
Annual arithmetic average (µg/m^3)	12	6.2	6.7	5.5

Source: EPA 2016a, Note: Beacon Hill Station is located at 4103 S Beacon Hill in Seattle, Washington. Kent Station is located at 614 N Railroad Avenue in Kent, Washington.
[a] Concentrations of CO, O_3, and PM_{10} are from the Beacon Hill station.
[b] Concentrations of $PM_{2.5}$ are from the Kent station.

ppm = parts per million; PM_{10} = PM of 10 microns or less in diameter; $PM_{2.5}$ = PM of 2.5 microns or less in diameter; µg/m^3 = micrograms per cubic meter

How do baseline conditions help us understand project effects?

The existing conditions represent the current (2016) baseline conditions in the study area. By including information about existing conditions, readers can compare current conditions to future conditions and better understand what air quality would be like at the starting point of these Projects.

What are the emissions trends for air quality?

While the average weekday VMT in the central Puget Sound region has increased, pollutants associated with transportation sources have decreased over time due to more stringent federal emissions standards for new vehicles and the gradual replacement of older, more polluting vehicles. More than 90 percent of the CO emissions in Puget Sound urban areas come from transportation sources (EPA 1992).

SECTION 6 PROJECT EFFECTS

How would the Projects affect regional air quality?

Criteria Pollutants

Exhibit 6-1 summarizes tailpipe emissions for criteria pollutants for the existing and future forecast years. Compared to existing conditions, the air quality team expects that 2025 and 2045 Build and No Build conditions would have lower emissions because of improved vehicle technology. With the exception of CO in 2025, Build emissions are expected to be lower than No Build emissions in both 2025 and 2045. CO emissions in the 2025 Build conditions would be only slightly higher (about 1 percent) than No Build conditions and substantially lower than existing conditions.

Exhibit 6-1. Criteria Pollutants Daily Regional Emissions Burden Assessment for Forecast Years 2025 and 2045

Criteria Pollutant (lb/day)	Existing 2016	2025 No Build	2025 Projects	2045 No Build	2045 Projects	% Change from 2016 to 2025 No Build	% Change from No Build to 2025 Project	% Change from 2016 to 2045 No Build	% Change from 2045 No Build to 2045 Project
Daily VMT	4,129,899	4,336,881	4,428,518	5,027,883	4,858,118	5.%	2%	21%	-3%
CO	38,039	20,260	20,485	9,499	9,105	-47%	1%	-75%	-4%
$PM_{2.5}$	639	171	169	93	92	-73%	-1%	-85%	-1%
PM_{10}	699	187	185	102	101	-73%	-1%	-85%	-1%
VOCs	1,898	599	598	376	357	-68%	0%	-80%	-5%
NO_x	16,974	4,828	4,813	3,173	3,174	-72%	0%	-81%	0%

CO = carbon monoxide; lb/day = pounds per day; NOx = oxides of nitrogen; PM_{10} = PM of 10 microns or less in diameter; $PM_{2.5}$ = PM of 2.5 microns or less in diameter; VMT = vehicle miles traveled; VOCs = volatile organic compounds

Mobile Source Air Toxics

Exhibit 6-2 summarizes the tailpipe emissions for MSATs in the study area. Although the VMT estimated under the Projects for both 2025 and 2045 would increase over existing conditions, MSATs are estimated to be lower than existing conditions as a result of improved vehicle technology (Exhibit 6-2). In addition, because the estimated VMT with the Projects in each forecast year would vary by less than 2 percent compared to No Build, we expect that there would be no appreciable difference in overall MSAT emissions.

See Appendix D, Motor Vehicles Emission Simulator (MOVES) Version 2014a, for additional details regarding the limitations of incomplete or unavailable information for the MSAT analysis.

Exhibit 6-2. Toxic Air Pollutants Daily Regional Emissions Burden Assessment for Forecast Years 2025 and 2045

MSAT (lb/day)	Existing 2016	2025 No Build	2025 Projects	2045 No Build	2045 Projects	% Change from 2016 to 2025 No Build	% Change from 2025 No Build to 2025 Project	% Change from 2016 to 2045 No Build	% Change from 2045 No Build to 2045 Project
Daily VMT	4,129,899	4,336,881	4,428,518	5,027,883	4,858,118	5%	2%	21%	-3%
1-3-Butadiene	6	1	1	0	0	-85%	0%	-98%	-1%
Acrolein	6	2	2	1	1	-70%	-1%	-78%	-1%
Acetaldehyde	39	12	12	9	9	-69%	-1%	-77%	-1%
Benzene	46	13	13	7	7	-71%	1%	-85%	-4%
Ethyl Benzene	24	8	8	5	5	-67%	0%	-79%	-6%
Formaldehyde	80	30	30	28	27	-62%	-1%	-65%	-1%
Diesel PM	604	138	136	71	71	-77%	-2%	-88%	0%
PAH	9	3	3	2	2	-69%	-1%	-77%	-1%

lb/day = pounds per day; VMT = vehicle miles traveled; PM = particulate matter; PAH = polycyclic aromatic hydrocarbons.

Greenhouse Gas

The estimated carbon dioxide equivalent (CO_2e) emissions with the Projects as compared to existing conditions and future No Build conditions are shown in Exhibit 6-3. Based on modeling results, we estimate that CO_2e emissions for 2025 under both No Build and Build conditions would be lower than existing conditions. Further, in 2025, modeling does not show any meaningful difference of GHG emissions between No Build and Build conditions. In 2045, compared to existing conditions, GHG emissions would be slightly greater under both Build and No Build. Also in 2045, emissions from the Build conditions would be slightly lower than the No Build conditions.

The Projects' widening, lane additions, and intersection improvements would minimize stop-and-go conditions, thereby conserving fuel. The Projects would also promote more efficient energy use by moderating speeds. The Projects would enable better movement of vehicles in 2025 and 2045 for study area intersections and on the I-405 mainline, thereby reducing traffic congestion and collisions. Decreased vehicle delay at off- and on-ramps would further reduce collisions and promote more efficient driving.

Exhibit 6-3. Greenhouse Gas Emissions in Terms of CO_{2e} for Forecast Years 2025 and 2045

	Existing 2016	2025 No Build	2025 Projects	2045 No Build	2045 Projects	% Change from 2016 to 2025 No Build	% Change from No Build to 2025 Project	% Change from 2016 to 2045 No Build	% Change from 2045 No Build to 2045 Project
Daily VMT	4,129,899	4,336,881	4,428,518	5,027,883	4,858,118	5%	2%	21%	-3%
Annual CO_2e (MT)	2,803	2,571	2,568	2,872	2,817	-8%	-0%	2%	-2%

CO_{2e}/year = carbon dioxide equivalent per year; MT = metric tons

How would air quality be affected during construction?

Construction activities generate fugitive dust and exhaust from construction equipment engines. The regulated pollutants of concern for fugitive dust are $PM_{2.5}$ and PM_{10}. Engine and motor vehicle exhaust would result in emissions of CO, VOCs, NO_X, PM_{10}, $PM_{2.5}$, MSATs, and GHGs.

The construction of both Projects would occur over a period of 5 years. PM_{10} and $PM_{2.5}$ emissions would vary from day to day, depending on level of activity, specific operations, and weather conditions. Particulate emissions would depend on soil moisture, silt content of soil, wind speed, and the amount and type of equipment in operation. Larger dust particles would settle near their source, while fine particles would disperse over greater distances from the construction site.

The quantity of fugitive dust or particulate emissions would be related to the area of the construction operations and the level of activity. Uncontrolled fugitive dust from construction activities could be noticeable near construction sites. PSCAA regulations require mitigation measures to control dust during construction and avoid depositing mud on paved streets (PSCAA Regulation 1, Article 9). The construction section of Chapter 3.1, Air Quality, in the 2002 EIS identifies appropriate mitigation and control measures. We summarize these measures in Section 7, Measures to Avoid or Minimize Effects, of this discipline report.

In addition to particulate emissions, heavy trucks and construction equipment powered by gasoline and diesel engines would emit CO, NO_X, and MSAT. If construction traffic reduces the speed of other vehicles in the area, emissions from traffic would increase slightly while those vehicles are delayed. These emissions would be temporary and limited to the immediate area around the construction site. Their contribution to total emissions in the study area would be small compared with automobile traffic because construction traffic would be a very small fraction of the total traffic in the area.

Some phases of construction would result in short-term odors, particularly when asphalt is used for paving operations. People near the construction site might notice such odors, but the atmosphere would dilute their effect as distance from the site increases.

GHGs from construction would come from the fuel used on site to power construction equipment, as well as the emissions released in the production of materials. Traffic delays resulting from construction activities would be another source of construction emissions. Maintenance emissions would come from similar sources but would occur over the Projects' lifespans. The WSDOT *Environmental Manual* (WSDOT 2017) requires the use of FHWA's ICE spreadsheet tool to calculate GHG emissions from fuel usage, traffic delays, and maintenance emissions resulting from project construction. The FHWA ICE spreadsheet tool incorporates project features and construction traffic delays to calculate emissions from construction equipment, materials, and routine maintenance. Appendix F, Infrastructure Carbon Estimator Spreadsheet Tool, provides a discussion of the inputs used in the ICE model.

We predict that construction of the Projects would emit a total of 6,343 metric tons (MT) of CO_{2e} per year over a 5-year construction period.

Would the Projects have other effects that may be delayed or distant from the Projects?

Indirect effects have not been identified for the Projects.

SECTION 7 MEASURES TO AVOID OR MINIMIZE EFFECTS

What measures will WSDOT take to mitigate air quality effects during construction?

The construction contractor will be contractually obligated to control fugitive dust in accordance with the *Memorandum of Agreement between WSDOT and Puget Sound Clean Air Agency Regarding Control of Fugitive Dust from Construction Projects.*

The following measures will be used to control dispersion of dust (PM_{10} and $PM_{2.5}$), transmission of PM, and emissions of CO, NO_x and VOCs during construction:

- WSDOT will encourage contractors to use newer construction equipment and maintain all equipment in good mechanical condition to minimize exhaust emissions.
- WSDOT will assess the viability of carpooling, commute trip reduction, and other transportation demand management programs for construction workers.
- WSDOT will stage construction between other I-405 transportation projects to minimize congestion that contributes to regional emissions of pollutants during construction.
- WSDOT will encourage contractors to reduce construction truck idling.
- Where possible, WSDOT will locate construction equipment and staging areas away from sensitive receptors such as fresh-air intakes to buildings, air conditioners, and sensitive populations, such as the elderly and the young.
- WSDOT will spray exposed soil with water or other suppressant as needed to minimize emissions of PM_{10} and reduce deposition of PM.
- WSDOT will cover all loads in trucks transporting materials and wet materials in trucks, or will provide adequate freeboard (space from the top of the material to the top of the truck bed) to minimize PM_{10} and deposition of particulates during transportation.

- WSDOT will provide wheel washers to remove PM that would otherwise be carried off site by vehicles to decrease deposition of PM on area roadways.
- WSDOT will remove PM deposited on paved roads, public roads, sidewalks, and bicycle and pedestrian paths to reduce mud and dust.
- WSDOT will cover and stabilize project-site dirt, gravel, and debris piles, as needed, to minimize dust and wind-blown debris. This may include using wind fencing to reduce soil disturbance.
- WSDOT will restrict the speed of construction vehicles when operating in areas of exposed earth.
- WSDOT will route and schedule construction trucks to reduce delays to traffic during peak travel times to minimize air quality impacts caused by a reduction in traffic speeds.

What measures will WSDOT take to mitigate air quality effects of operation?

No negative effects that would require mitigation are expected from operation of either of the two projects.

SECTION 8 REFERENCES

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APPENDIX A ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
ADA	Americans with Disabilities Act
CAA	Clean Air Act
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CSS	Context Sensitive Solutions
EA	Environmental Assessment
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
EPA	U.S Environmental Protection Agency
ETL	express toll lane
FHWA	Federal Highway Administration
FR	Federal Register
GP	general purpose
HOT	high-occupancy toll
HOV	high-occupancy vehicle
I-405	Interstate 405
I-90	Interstate 90
ICE	Infrastructure Carbon Estimator
$\mu g/m^3$	micrograms per cubic meter
MP	milepost
MSAT	mobile source air toxics
MT	metric tons
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_x	nitrogen oxides

Acronym	Meaning
O_3	ozone
PM	particulate matter
$PM_{2.5}$	particulate matter 2.5 microns or less in diameter
PM_{10}	particulate matter 10 microns or less in diameter
PSCAA	Puget Sound Clean Air Agency
PSRC	Puget Sound Regional Council
SEPA	State Environmental Policy Act
SIP	State Implementation Plan
SO_2	sulfur dioxide
SOV	single-occupant vehicle
SR	State Route
VHT	vehicle hours traveled
VMT	vehicle miles traveled
VOC	volatile organic compound
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation
WSTC	Washington State Transportation Commission

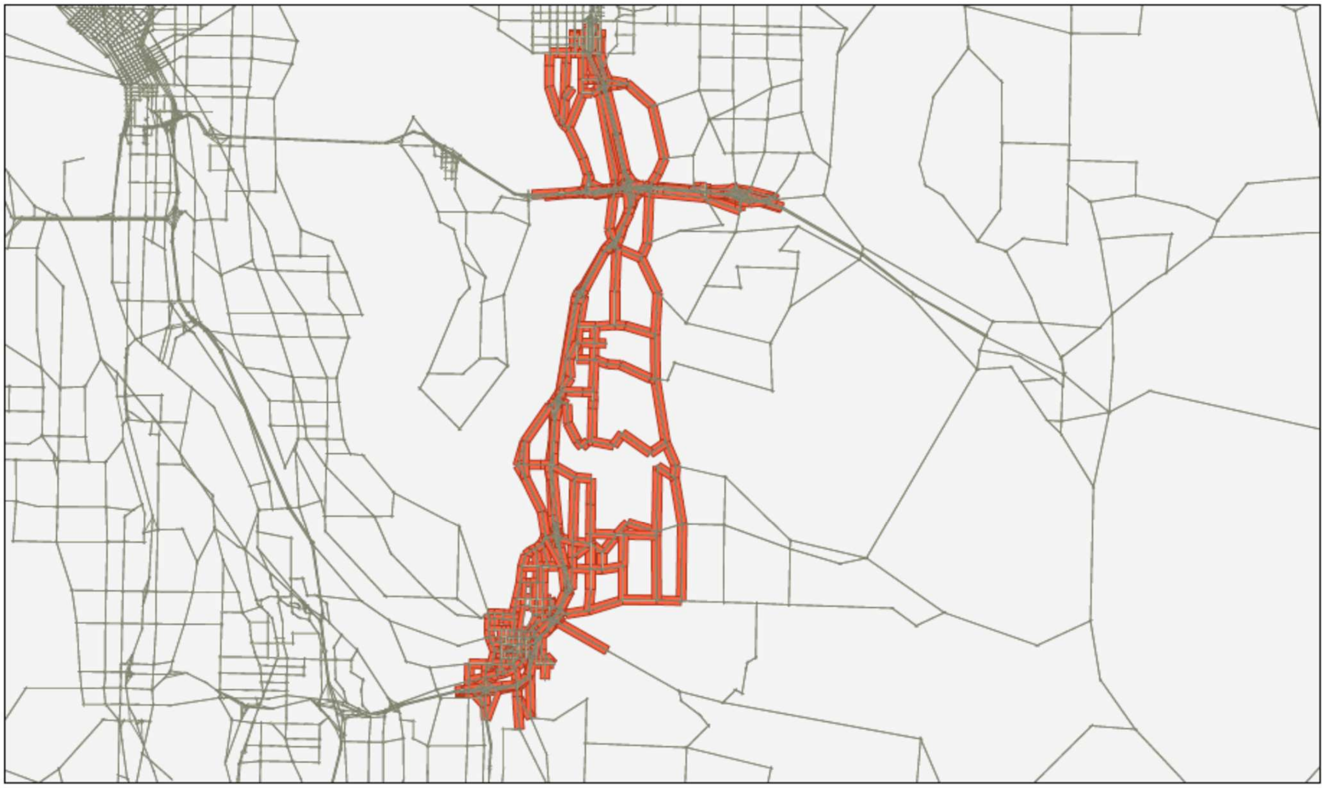
APPENDIX B GLOSSARY

Term	Meaning
Air emissions	Pollutants emitted into the air, such as ozone, carbon monoxide, nitrogen oxide, nitrogen dioxide, sulfur dioxiden and others.
Air pollutant	Any substance in air that could, in high enough concentration, harm people, animals, vegetation, or material. Pollutants include any natural or artificial matter capable of being airborne. They may be in the form of solid particles, liquid droplets, gases, or a combination thereof. Generally, they fall into two main groups: (1) those emitted directly from identifiable sources and (2) those produced in the air by interaction between two or more primary pollutants, or by reaction with normal atmospheric constituents.
Air quality standards	The level of pollutants prescribed by regulations that may not be exceeded during a given time in a defined area.
Airshed	Airshed is a part of the geography that shares a common flow of air and is exposed to the same things.
Attainment area	An area considered to have air quality as good as or better than the national ambient air quality standards as defined in the federal Clean Air Act. An area may be an attainment area for one pollutant and a non-attainment area for others
Background level	In air pollution control, the concentration of air pollutants in a defined area during a fixed period of time prior to starting or stopping a source of a regulated emission. In toxic substances monitoring, the average presence in the environment, originally referred to as a naturally occurring phenomena.
Best management practice (BMP)	BMPs are generally accepted techniques that, when used alone or in combination, prevent or reduce adverse effects of a project. Examples include erosion control measures and construction management to minimize traffic disruption. Please see Section 7 for a complete list of BMPs.
Criteria pollutants	The 1970 amendments to the Clean Air Act required the EPA to set National Ambient Air Quality Standards for certain pollutants known to be hazardous to human health. EPA has identified and set standards to protect human health and welfare for six pollutants: ozone, carbon monoxide,

Term	Meaning
	particulate matter, sulfur dioxide, lead, and nitrogen oxide. The term, "criteria pollutants" derives from the requirement that EPA must describe the characteristics and potential health and welfare effects of these pollutants. Standards are set or revised on the basis of these criteria.
Emissions factor	The relationship between the amount of pollution produced and an amount activity.
Emissions standard	The maximum amount of air-polluting discharge legally allowed from a single source, mobile or stationary.
Express toll lane	A limited-access freeway lane that is actively managed through a variable toll system to regulate its use and thereby maintain express travel speeds and reliability. Toll prices rise as the lane approaches capacity. This ensures that traffic in the express toll lane remains flowing at express travel speeds of 45 to 60 miles per hour.
Fugitive emissions	Dust released to the air.
Hazardous air pollutants	Air pollutants that are not covered by ambient air quality standards but which, as defined in the Clean Air Act, may reasonably be expected to cause or contribute to irreversible illness or death. Such pollutants include asbestos, beryllium, mercury, benzene, coke oven emissions, radionuclides, and vinyl chloride.
Maintenance area	Area that has recently met the National Ambient Air Quality Standards for the criteria pollutants designated in the Clean Air Act and for which air quality is being managed to continue to meet the standards.
Mobile source	Any non-stationary source of air pollution such as cars, trucks, motorcycles, buses, airplanes, and locomotives.
Non-attainment area	Area that does not meet one or more of the National Ambient Air Quality Standards for the criteria pollutants designated in the Clean Air Act.

APPENDIX C PROJECT STUDY AREA

Exhibit C-1. I-405 Project Study Area of Affected Roadway Network



APPENDIX D MOTOR VEHICLES EMISSION SIMULATOR (MOVES) VERSION 2014A

The Motor Vehicle Emissions Simulator (MOVES2014a) is the latest EPA tool for estimating emissions of VOCs, nitrogen oxide, CO, PM10, PM2.5, ozone, mobile source air toxic pollutants, and greenhouse gas emissions from motor vehicles. The MOVES model was used to calculate daily emissions for the existing conditions, 2015, and No Build and Build (with the Projects) for the 2025 and 2045 analysis years.

During the modeling process, the MOVES model has a series of input screens that provide an opportunity to customize modeling parameters or select default values to have an influence on emission rates. For the I-405, Tukwila to I-90 and Downtown Bellevue Projects, the following modeling input parameters were used to reflect the affected network modeling inputs from the PSRC. Specific input files were provided by PSRC to reflect current modeling inputs from the Puget Sound regional modeling for King County. The PSRC input files reflect I&M information, fuel supply data, and age distribution of vehicles within the study area.

Project-specific traffic input files were derived for the MOVES model by utilizing traffic data supplied by the traffic engineer for the Projects. For the study area, two roadway types were classified for the I-405 freeway and the associated affected local roadways as urban restricted (freeway) and urban unrestricted (arterials). Three vehicle classifications were provided for each roadway type, SOV, HOV, and trucks. In addition, daily weekday VMT and VHT were provided for each vehicle classification by road type for existing conditions (2016) and future (2025 and 2045) Build and No Build conditions. This information was used to develop speeds for each alternative by vehicle classification by road type.

There are three MOVES input files that are related to project-specific traffic data: roadway type, average speed distribution, and VMT by vehicle type. These input files influence the effects of project-related traffic on air quality. For the Roadway Type input file, the percentage of each vehicle classification's VMT was distributed on each roadway type, urban restricted (freeway) or urban unrestricted (arterials). For the Average Speed Distribution input file, information is required on the time of day a particular vehicle classification is traveling at a particular speed on a certain roadway type. This information was calculated for each vehicle classification by time of day and speed and distributed by roadway type. Lastly, the average daily VMT was distributed by vehicle type for each month. It was assumed that the daily VMT provided was representative of an average weekday for each month of the year.

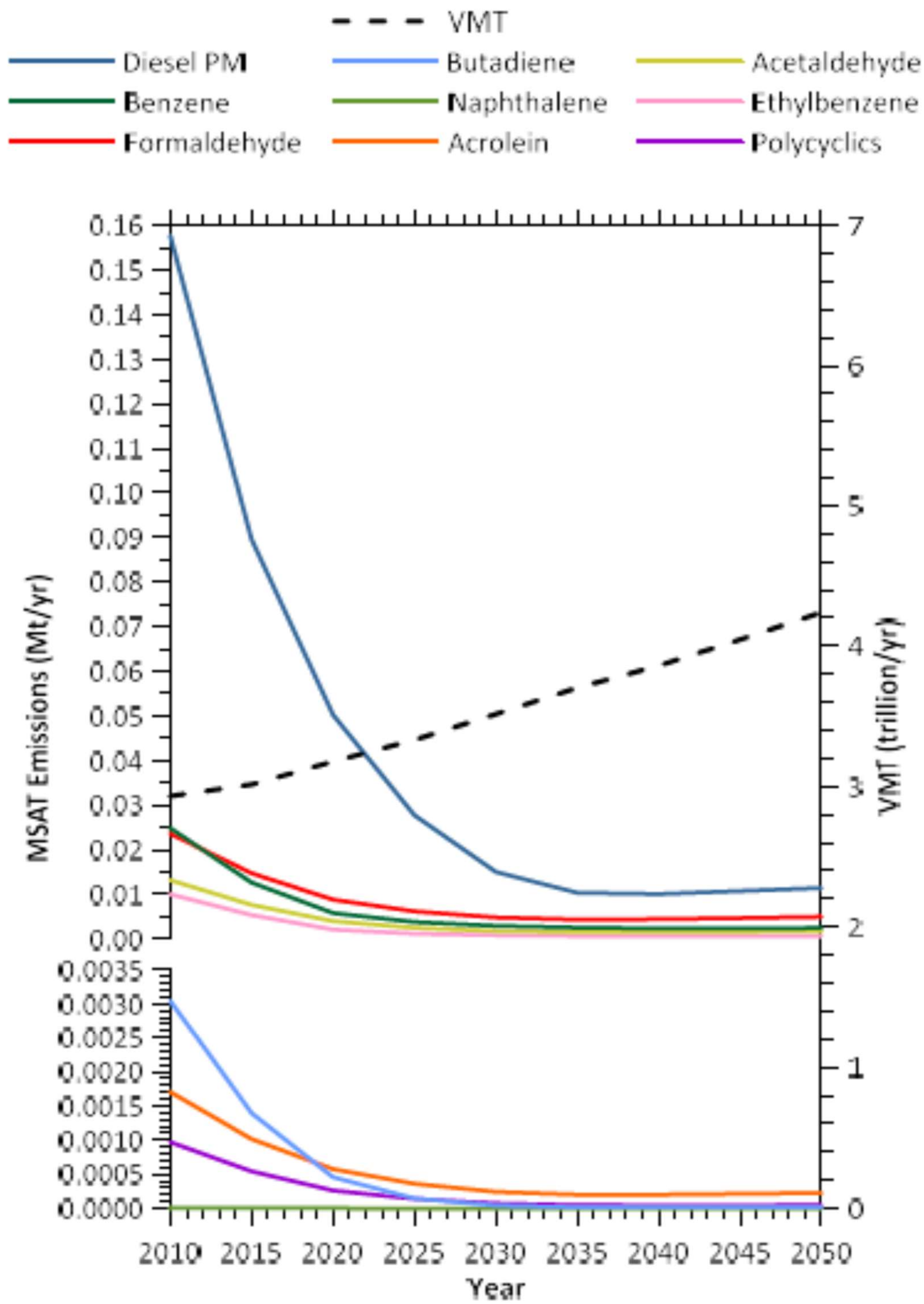
The modeling was performed on the affected network for the study area. The emissions were estimated using MOVES temperature default values. Utilizing the input files discussed above run specifications were developed to obtain PM10, PM2.5, NOX, VOC, CO, and nine MSAT emissions in grams per day and converted to pounds per day for each analysis year. In addition, operational GHG emissions were also provided in pounds per day and converted to an annual value in metric tons of CO2e/yr. Specific details of the Run Specs that were developed are provided electronically.

APPENDIX E EFFECTS ON MSAT RESULTS USING MOVES VERSION 2014A

According to EPA, MOVES2014 is a major revision to MOVES2010 and improves upon it in many respects. MOVES2014 includes new data, new emissions standards, and new functional improvements and features. It incorporates substantial new data for emissions, fleet, and activity developed since the release of MOVES2010. These new emissions data are for light- and heavy-duty vehicles, exhaust and evaporative emissions, and fuel effects. MOVES2014 also adds updated vehicle sales, population, age distribution, and VMT data. MOVES2014 incorporates the effects of three new federal emissions standard rules not included in MOVES2010. These new standards are all expected to affect MSAT emissions and include Tier 3 emissions and fuel standards starting in 2017 (79 FR 60344), heavy-duty greenhouse gas regulations that phase in during model years 2014– 2018 (79 FR 60344), and the second phase of light-duty greenhouse gas regulations that phase in during model years 2017–2025 (79 FR 60344). Since the release of MOVES2014, EPA has released MOVES2014a. In the November 2015 MOVES2014a Questions and Answers Guide, EPA states that for on-road emissions, MOVES2014a adds new options requested by users for the input of local VMT, includes minor updates to the default fuel tables, and corrects an error in MOVES2014 brake wear emissions. The change in brake wear emissions results in small decreases in PM emissions, while emissions for other criteria pollutants remain essentially the same as MOVES2014.

Using EPA’s MOVES2014a model, as shown in Exhibit E-1, FHWA estimates that even if VMT increases by 45 percent from 2010 to 2050 as forecasted, a combined reduction of 91 percent in the total annual emissions for the priority MSAT is projected for the same time-period (2016a).

Exhibit E-1. MSAT Emissions Trends for Increasing VMT 2010 to 2050



Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (EPA https://www.epa.gov/iris). Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures, with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). A number of HEI studies are summarized in Appendix D of FHWA's Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI Special Report 16, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects) or in the future as vehicle emissions substantially decrease.

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts – each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways, to determine the portion of time that people are actually exposed at a specific location, and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (Special Report 16, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA states that with respect to diesel engine exhaust, "[t]he absence of adequate data to develop a sufficiently confident dose-response relationship from the epidemiologic studies has prevented the estimation of inhalation carcinogenic risk (EPA IRIS database, Diesel Engine Exhaust, Section II.C. https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0642.htm#quainhal)."

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine an "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two-step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable (https://www.cadc.uscourts.gov/internet/opinions.nsf/284E23FFE079CD59852578000050C9DA/$file/07-1053-1120274.pdf).

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision-makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

APPENDIX F INFRASTRUCTURE CARBON ESTIMATOR SPREADSHEET TOOL

The Washington State *Environmental Manual* requires the use of FHWA's Infrastructure Carbon Estimator (ICE) spreadsheet tool to calculate GHG emissions from fuel usage, traffic delays, and maintenance emissions resulting from the construction of the Projects. FHWA's new ICE spreadsheet tool incorporates project features and construction traffic delays to calculate emissions from construction equipment, materials, and routine maintenance. The following project-specific inputs were obtained as inputs for the ICE model.

Project Features

- The Projects would be constructed within a 5-year period
- The average daily traffic per lane mile is assumed 26,000
- Total existing lane miles is 100 miles
- Total existing center line miles is 14 miles
- The newly constructed lane miles that would occur on I-405 is 20 miles
- No realignment lane miles, 0 miles (no major realignment)
- Lane-widening lane miles, is 0 miles. Lane widening is being done with existing pavement and striping
- Shoulder improvement (centerline miles) is 10 miles (length of project)
- Reconstruction pavement (lane miles) is 10 miles (area near NE 44th)
- Resurfacing pavement (lane miles) is 85 miles
- Rail bus, bicycle and pedestrian facilities: construction of 2 new BRT stations at 112th and NE 44th
- Bike and pedestrian facilities
  - New off-street bike/ped path – 0.5 miles
  - New on-street bike lanes – 0.5 miles
  - New sidewalk – 0.5 miles
  - Resurfacing off-street bike/ped path – 2.5 miles
  - Resurfacing on-street bike lanes – 0.5 miles
- Construct approximately 200 spaces at a new park-and-ride lot near NE 44th Street
- Construction 6 new bridges and reconstruct 6 bridges

Exhibit F-1. Annual GHG Emissions per year

	Annual GHG emissions (MT CO2e), per year over 5 years											
	Unmitigated						Mitigated					
	Roadway - new construction	Roadway-rehabilitation	Roadway - total	Bridges	Rail, bus, bicycle, ped.	Total	Roadway - new construction	Roadway-rehabilitation	Roadway - total	Bridges	Rail, bus, bicycle, ped.	Total
Upstream Emissions												
Materials	1,202	2,264	3,466	477	1,034	**4,977**	1,202	2,264	3,466	477	1,034	**4,977**
Direct Emissions												
Construction Equipment	569	426	995	173	9	**1,177**	569	426	995	173	9	**1,177**
Routine Maintenance						**189**						**189**
Total	**1,771**	**2,690**	**4,461**	**650**	**1,043**	**6,343**	**1,771**	**2,690**	**4,461**	**650**	**1,043**	**6,343**

Construction Delays

There are 785 project-days of lane closures expected during construction at this time. Less than half the number of lanes would be closed during construction.

Mitigation Inputs

Currently no mitigation inputs have been provided. As the Projects near construction, the contractor may incorporate recycled asphalt material to reduce GHG emissions. The inputs provided above were used to generate annualized energy consumption in million British thermal units per year (MMBTU/yr) and GHG emissions in MT of CO_2e per year. Two main construction activities would be occurring for the Projects: new construction of roadway and roadway rehabilitation. For each of the two construction activities, GHG emissions were calculated for upstream and direct emissions. Upstream GHG emissions are associated with the lifecycle emissions embodied in the materials used in construction, including raw materials, extraction ram materials transportation, materials production (such as crushing of aggregate and asphalt batch plants), and chemical reactions in materials (calcination of limestone). Direct GHG construction emissions are related to fuel usage in construction equipment and routine maintenance. Exhibit F-1 presents the total annual GHG emissions in MT CO_2e per year over 5 years for new construction and roadway rehabilitation for the I-405, Tukwila to I-90 and Downtown Bellevue Projects.