Appendix F

Technical Background Information

Appendix F.1

Additional Detail on the Two Site OMSF Option

LINK OPERATIONS AND MAINTENANCE SATELLITE FACILITY

Additional Detail on the Two Site OMSF Option

September 5, 2013

Rev 2

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Introduction

This paper evaluates in more detail the feasibility of constructing and operating two smaller Operating and Maintenance Satellite Facilities (OMSFs) to support the ST2 light rail fleet requirements. The paper is prepared in response to inquiries from partner jurisdictions requesting more information on why the Two Site OMSF Option was eliminated from further consideration during the environmental impact scoping process. The paper compares a Two Site OMSF Option to the alternatives being studied in the OMSF Draft Environmental Impact Statement (DEIS). The paper discusses Operation and Maintenance (O&M) facility functions, staffing requirements, estimated capital, operating and right-of-way (ROW) costs, and it assesses the consequences of a Two Site OMSF Option relative to future O&M facility requirements as the Link light rail system is expanded beyond ST2.

Background

Sound Transit's ST2 Plan includes light rail extensions from Seattle to Overlake in Redmond, Northgate to Lynnwood, and SeaTac to Kent/Des Moines. To implement the ST2 expansion, Sound Transit needs to increase its light rail vehicle fleet to approximately 180 vehicles by 2023. The existing light rail operations and maintenance facility (OMF) is located on a 25-acre site in the industrial area south of Downtown Seattle south of South Forest Street and west of Airport Way. It is sized and configured to serve 104 vehicles. Sound Transit must construct additional operations and maintenance facility capacity to support ST2's light rail vehicle storage and maintenance needs.

Sound Transit is evaluating alternatives to meet the needs of the expanded fleet of light rail vehicles required to serve the ST2 system. During the environmental scoping period for the OMSF, the idea of constructing two or more smaller O&M facilities in addition to the existing OMF was suggested as an alternative to constructing a single OMSF. An initial review of this concept revealed that it resulted in higher construction costs, duplicated functions and did not meet the project purpose to minimize system operating costs. More recently, interest in the Two Site OMSF Option has been raised by our partner jurisdictions, and they requested additional information. This paper provides a more detailed analysis of a Two Site OMSF Option.

Project Purpose

The project's purpose is to enable Sound Transit to meet the maintenance and storage needs of the expanded fleet of light rail vehicles identified in the ST2 Plan. ST2's vehicle acquisition and delivery schedule requires additional capacity to be operational by 2020. The OMSF project will:

- Accommodate expansion of the Link system to Lynnwood Transit Center, Overlake Transit Center and Kent / Des Moines;
- Support efficient and reliable light rail service and vehicle maintenance and minimize system annual operating costs; and
- Support regional long-range plans, including the Puget Sound Regional Council's (PSRC) VISION 2040 and Transportation 2040 plans, and Sound Transit's Regional Transit Long-Range Plan.

Identification of OMSF Sites

Potential OMSF sites identified for consideration in the DEIS were based on the following physical and operational requirements:

Physical Requirements

- **Location:** site is proximate to a built or funded light rail segment
- **Size:** accommodate at least 80 vehicles and include at least 20-25 acres of usable land
- **Configuration:** generally rectangular in shape

Operational Requirements

- **Operating Cost:** located within a transit corridor that minimizes the overall system operating costs
- **Reliability:** transition of light rail vehicles between the OMSF and the revenue line should not negatively impact revenue operations or the available nightly maintenance window (1:00 am to 5:00 am)
- **Efficiency:** site characteristics and location will minimize excessive vehicle maneuvering to position the trains for morning deployment

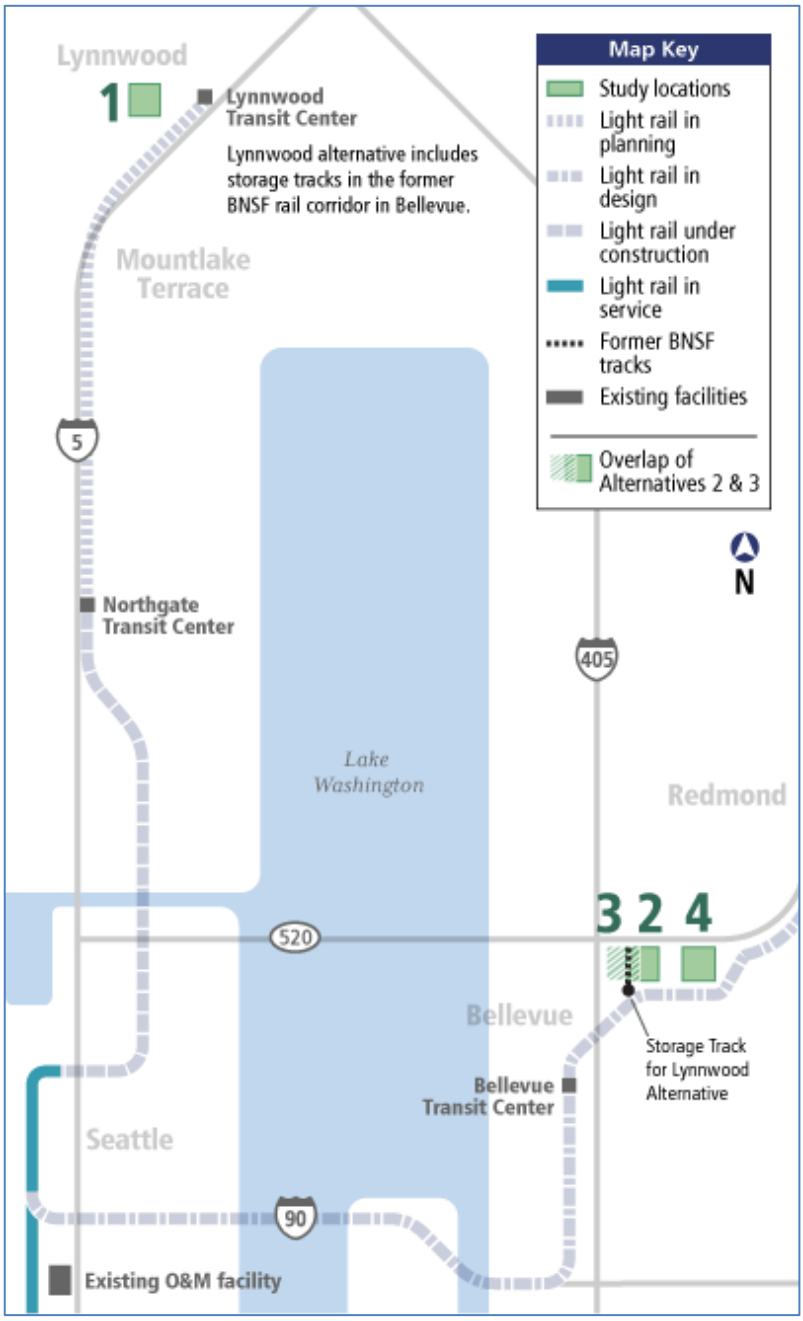
The sites that met the physical, operational and plan consistency requirements were included in environmental scoping process. At the December 20, 2012 Sound Transit Board meeting, four OMSF site alternatives were identified for study in the DEIS:

- Alternative 1: Lynnwood/BNSF Storage Tracks
  - Lynnwood C1
  - Lynnwood C2
  - Lynnwood C3
- Alternative 2: BNSF
- Alternative 3: BNSF Modified
- Alternative 4: SR520

Figure 1 shows the four OMSF site alternatives being studied in the DEIS. Alternative 1: Lynnwood/BNSF Storage Tracks site includes three different access options depending on which Lynnwood Link alignment is selected to service the Lynnwood Transit Center Station. It should be noted that Alternative 1: Lynnwood/ BNSF storage tracks; assumes 32 cars (or eight trains) will be stored on the BNSF tracks owned by ST in the Bel-Red area of Bellevue. This is required so morning service can start at the Overlake Transit Center at approximately 5:00 am.

The three Bellevue sites are also shown on Figure 1. Alternative 2: BNSF and Alternative 3: BNSF Modified is both located along the former BNSF rail corridor that is owned by Sound Transit and are in close proximity to the East Link 120th Station. Alternative 4: SR520 is located south of SR520 and north of NE 20th Ave.

Figure 1: OMSF Alternative Sites



OMSF Storage Requirements

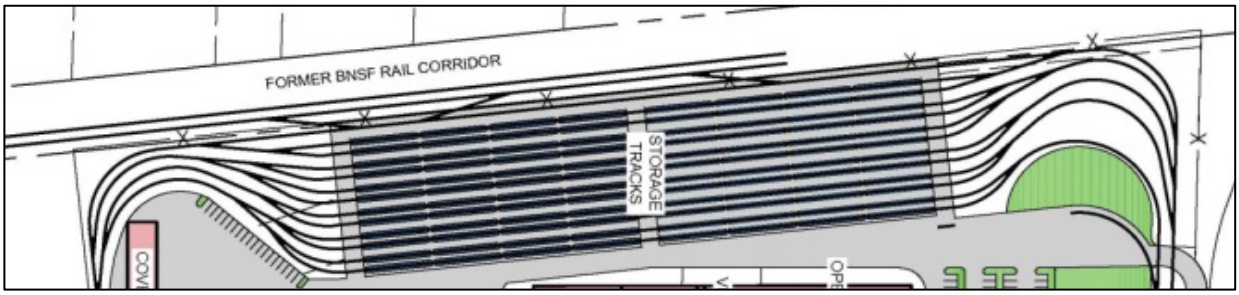
Sound Transit's current fleet is 62 light rail vehicles. The 62 vehicles are required to serve the extensions to the University of Washington and S. 200th Street planned to open in 2016. ST2 light rail expansion to Lynnwood and the eastside will require a fleet of approximately 180 light rail vehicles. The existing OMF has a storage capacity of 104 light rail vehicle (13 rows and 8 cars per row = 104). The future OMSF will need to accommodate a minimum of 76 vehicles (180 fleet – current 62 car fleet = 76 vehicles). However for planning purposes, a contingency of a 4-car train has been assumed. In addition, the Record of Decision (ROD) for East Link includes a future extension from the Overlake Transit Center to downtown Redmond. A condition of the East Link ROD is that before the line can be extended to downtown Redmond, maintenance facility capacity must be identified. It is estimated that 10 additional light rail vehicles will be required to provide service to downtown Redmond. Therefore, the need for a minimum of 90 storage spaces has been assumed for the future OMSF (76 vehicles + 4 spare spaces + 10 for Redmond = 90 storage spaces).

The dimensions and configuration of a typical light rail operations and maintenance facility is primarily driven by the space required for a runaround track. The runaround track allows vehicles to enter the site and either goes directly to the storage area or continues to the maintenance and/or wash bays for service and then return to the storage area directly without the operator changing ends of the train. The size is also driven by the size of the maintenance building and the number of storage tracks needed to accommodate the fleet. As stated previously, the existing OMF has 13 rows with eight cars per row. Assuming the OMSF will need to store and maintain 90 cars, a minimum of 11 rows of 8-cars is required. However, 11 rows of 8 cars each only allow space to store 88 cars. Adding a 12th row provides the opportunity to store up to 96 cars, and as a result,

all OMSF sites assume storage for up to 96 cars (12 rows x 8 cars = 96). Figure 2 shows the typical storage space for 96 vehicles.

The ability to store 96 cars is also important for the future fleet and associated service requirement. See section "ST2 O&M Facility Needs verses Future Requirements" further in this report for more detail on future light rail feet needs.

Figure 2: OMSF Storage Tracks to Accommodate 96-Cars



Assumption of Two Site Storage Requirements

For the purpose of this paper it has been assumed that the two smaller OMSF site would accommodate storage for 48 light rail vehicles (96 cars/2 = 48 spaces). Storage for 48 cars requires 6 rows of parking with 8 cars per row. As a proof of concept, a layout for 48 cars has been developed for both the Lynnwood site and Alternative 2: BNSF. Figure 3 shows the Lynnwood alternative with the OMSF layout for 96 cars and a 48 car 19.1 acre site.

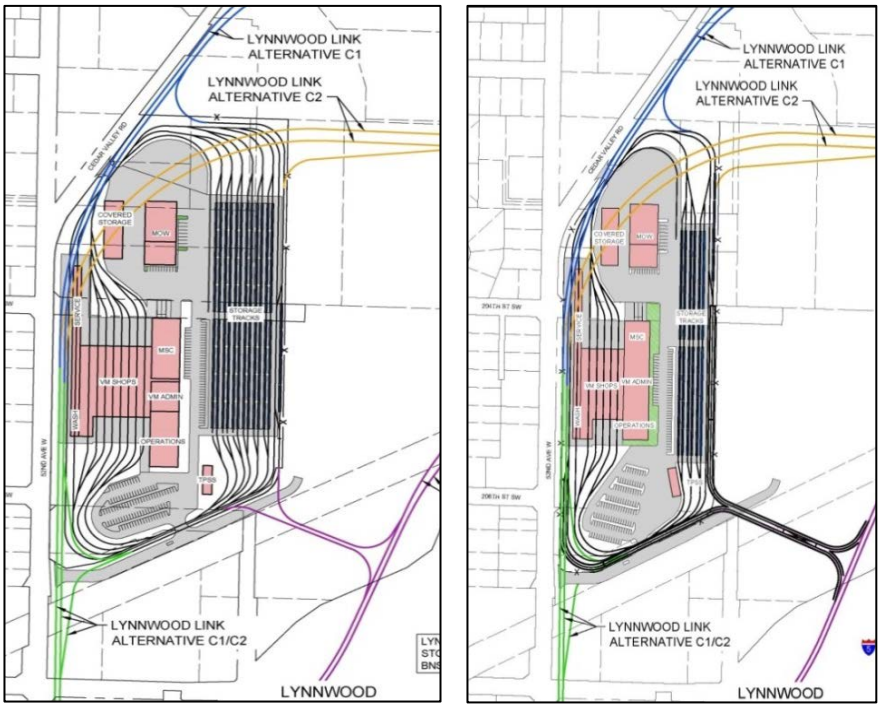
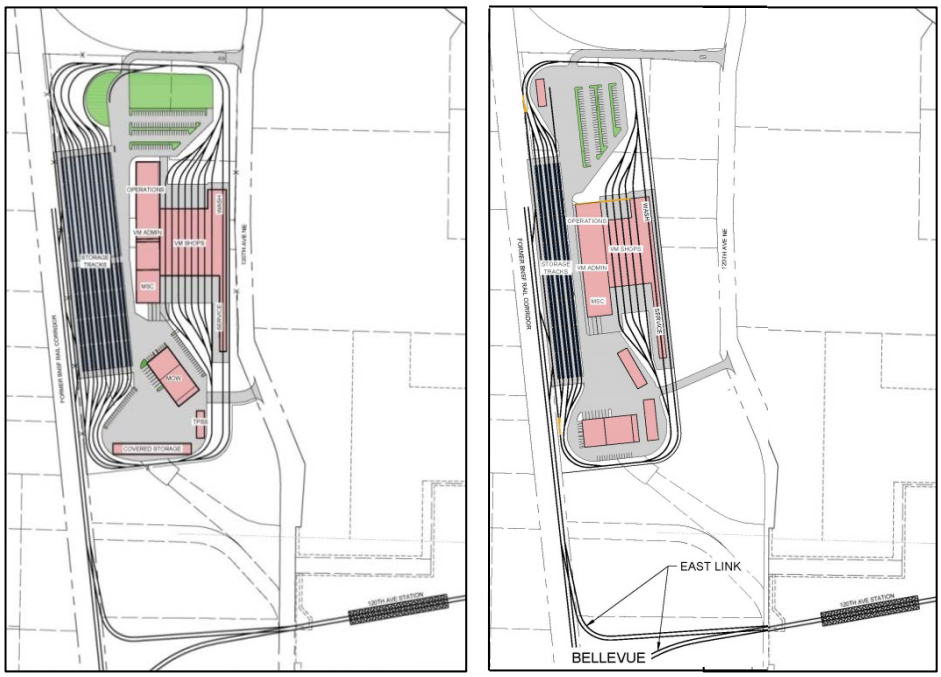


Figure 3: Lynnwood OMSF

Figure 4 shows both the 96 car and 48 car (16.6 acres) layouts for Alternative 2: BNSF in Bellevue. Both the 96-car and 48-car site concepts have similar boundaries to the north, south and west.

Figure 4: Bellevue BNSF Site



OMSF Functions

Table 1 compares site functions included in the existing Forest Street OMF, a 96-car OMSF, and the Two Site OMSF Option. The site functions are exterior, general, vehicle shop, maintenance functions, vehicle maintenance shop and the maintenance of way building (MOW).

Table 1: Site and Functions for the OMSF and Two-Site Option

Function	Forest Street OMF	96-Car OMSF	Two Site OMSF (each will include)
Exterior Areas			
Acres	24.8	22.5	16.6 and 19.1
LRV storage capacity	104	96	48
Non-Revenue Vehicle Parking	15	10	6
Employee/Visitor parking	150	110	90
Storage and laydown areas	✓	✓	✓
General			
Control Center	✓		
Training Area	✓	✓	✓
Dispatch	✓	✓	✓
Admin offices for operations & maintenance Staff	✓	✓	✓

Function	Forest Street OMF	96-Car OMSF	Two Site OMSF (each will include)
Maintenance Functions			
Loading Dock	✓	✓	✓
Battery Service Area	✓	✓	✓
Training Area	✓	✓	✓
Bulk Fluid Storage	✓	✓	✓
Compressor	✓	✓	✓
Waste/Hazardous Storage	✓	✓	✓
Emergency Generator	✓	Portable	Portable
Frame straightening capability	✓		
Paint shop	✓		
Major component replacement	✓		
Expanded parts storage	✓		
Space for vehicle overhauls	✓		
Vehicle Maintenance Shop			
Drive Thru Service Repair Bays	8	7	4 each
Car Washing	✓	✓	✓
Sanding (Sand Silo)	✓	✓	✓
Service & Inspection Bay	✓	✓	✓
In Floor Hoist	✓	✓	✓
Truck Shop	✓	✓	One base only
Overhead Cranes	✓	✓	✓
Parts Storage	✓	✓	✓
Wheel Truing	✓	✓	One base only
Maintenance of Way Building			
	✓	✓	✓
Test Area	✓	✓	✓
Welding Shop	✓	✓	✓
Equipment Storage			

The Forest Street OMF provides all the functions listed Table 1, including heavy maintenance functions such as frame straightening, a paint shop and the capability to overhaul vehicles. The Forest Street OMF includes the ability to store and maintain 104 light rail vehicles and all the functions of an OMF. In contrast the OMSF assumes maintenance and storage for up to 96 light rail vehicles on site (assumes build-out of all track storage area). It does not include the heavy maintenance functions or the capability to overhaul vehicles. The two smaller sites would have fewer service bays, only one of the sites would include wheel truing, and neither would have heavy maintenance functions.

Staffing Requirements

A complete list of staff by alternative and work assignment is shown in Table 2. The 96-car OMSF will require 231 employees. The total number of train operators does not increase with two smaller facilities; however additional operations and maintenance staff are required. Using this information the number of staff required to operate and maintain one OMSF verses two smaller facilities is summarized in Table 2. Because many of the staff functions are duplicated, two smaller sites require over 40 more staff, which increases operating costs when compared to a single OMSF.

Table 2: Summary Staff Positions by Title and Alternative

Title	Base OMSF	Two Site Option North	Two Site Option East	Two Site Option Total
ST On-Site ST Administration Staff				
Transportation Manager	1	1	Floating	1
Maintenance Manager	1	Floating	1	1
Transportation Superintendent	2	1	1	2
Maintenance Superintendent	2	1	1	2
Senior Administrative Specialist	1	1	1	2
Subtotal	**7**	**4**	**4**	**8**
KCM Rail Operation Staff				
Operations Assistant Superintendent	1	1	1	2
Administrative Specialist	1	1	1	2
Operations Base Chief	1	1	1	2
Operations Chief	2	1	1	2
Technical Trainer	1	1	1	2
Safety Officer	2	1	1	2
Dispatch	4	4	4	8
Field Supervisor	12	7	7	14
Operator	74	37	37	74
Subtotal	**98**	**54**	**54**	**108**
KCM Vehicle Maintenance Staff				
Vehicle Maintenance Assistant Superintendent	1	1	1	2
Light Rail Vehicle Engineer/QC Inspection	1	1	1	2
Administrative Specialist	1	1	1	2
Vehicle Maintenance Chief	4	2	2	4
Vehicle Maintenance Technical Trainer	1	1	1	2
Electro-Mechanic	47	24	24	48
Subtotal	**55**	**30**	**30**	**60**
KCM Vehicle Maintenance Staff				
LRV Service and Cleaning Chief	1	1	1	2
Rail Service Worker (cleaner)	25	12	12	24
Subtotal	**26**	**13**	**13**	**26**
MSC/Material Handling Staffing				
Maintenance Service Center Chief	1	1	1	2
Maintenance Service Center Worker	3	2	2	4
Subtotal	**4**	**3**	**3**	**6**
Facilities, WPS Staffing				
Facilities WPS Assistant Superintendent	1	1	1	2
Administrative Specialist	1	1	1	2
Track and ROW Chief	1	1	1	2
Track and ROW Maintainer	6	4	4	8
Grounds Specialist	2	1	1	2
Station Custodian	6	5	5	10
Laborer	1	1	1	2
Facilities Chief	1	1	1	2
Facilities Mechanic	3	3	3	6
Facilities Electrician	2	2	2	4
Facilities Custodian	3	2	2	4
Power Chief	1	1	1	2
Electrical Worker	8	4	4	8
SCAD System specialist	1	1	1	2
SCAD Technician	2	2	2	4
Signal/SCAD Chief	1	1	1	2
Subtotal	**40**	**31**	**31**	**62**
Total Employees	**230**	**135**	**135**	**270**
Net Increase in Staff by Alternative	**-**			**40**

Table 3 shows the approximate square footage required to accommodate the OMSF program and a Two Site OMSF Option. Many of the site requirements for two separate facilities are duplicative, and as a result the two smaller facilities would add an overall total of approximately 11 additional acres of space. The increased space requirements increase construction costs substantially.

Table 3: Staff and Square Footage per Site

	OMSF Program		Two Site OMSF Option					
			North		East		Total	
Area Description	Staff	Area (sq. ft.)	Staff	Area (sq. ft.)	Staff	Area (sq. ft.)	Staff	Area (sq. ft.)
Operations/Maintenance Building Area								
Sound Transit Administration	7	1,058	4	741	4	741	8	1,481
Rail Ops: Administration	8	7,247	6	6,522	6	6,522	12	13,045
Rail Ops: Dispatch & Support	90	8,556	49	4,278	49	4,278	90	8,556
VM: Administration	8	7,052	6	7,052	6	7,052	12	14,104
VM:LRV Repair Positions & Shops	47	56,070	24	39,249	24	39,249	48	78,498
VM: Shop Storage/Support	0	4,805	0	3,364	0	3,364	0	6,727
LRV Service Areas	26	18,007	13	12,605	13	12,605	26	25,210
MSC/Material Handling	4	18,311	3	18,311	3	18,311	6	36,622
Subtotal	**190**	**121,106**	**105**	**92,121**	**101**	**92,121**	**202**	**184,243**
Facilities/WPS Building Areas								
Facilities/WPS: Office	40	5,659	31	4,527	31	4,527	62	9,054
Facilities WPS: Shop & Support Areas	0	14,760	0	10,332	0	10,332	0	20,664
Subtotal	**40**	**20,419**	**31**	**14,859**	**38**	**14,859**	**62**	**29,718**
Total All Buildings	**230**	**141,525**	**132**	**106,981**	**139**	**106,981**	**271**	**213,961**
Total All Exterior Areas		**348,031**		**257,980**		**257,980**		**515,959**
Total Building and Exterior Areas		**489,556**		**364,960**		**364,960**		**729,920**
Site Circulation/Landscape/Setbacks		**489,556**		**364,960**		**364,960**		**729,920**
Total Site Requirements		**979,112**		**729,920**		**729,920**		**1,459,840**
Acres		**22.5**		**16.8**		**16.8**		**33.5**

Estimated Project Costs

The estimated project costs are reported in three categories; capital, operating and ROW. As indicated above the capital and operating costs associated with the Two Site OMSF Option are greater than building one OMSF. These cost differences will be even more pronounced in the future when additional operations and maintenance facility capacity will be needed to serve the light rail system beyond the ST2 expansion.

Estimated Capital Costs

The capital costs for a single OMSF versus two O&M facility sites are shown in Table 3. The range of capital costs vary by OMSF alternative being evaluated in the Draft EIS. The range is $200 million (Alt. 2: BNSF) to

$243 million (Alt 1: Lynnwood). The difference in the two options is between $69 million and $112 million depending upon the alternative.

Table 4: Estimated Capital Costs (millions of 2013$)

Two Site OMSF Option	OMSF*	Difference
$312	$200 to $243	$69 to $112

*Assumes range of costs associate with EIS alternatives

Operating Costs

The estimated operating costs are primarily driven by staffing requirements. As shown in Table 2, the Two Site OMSF Option requires over 40 additional employees. The need for additional staff results in an estimated annual operating cost that is $5 million greater than a single OMSF (see Table 5).

Table 5: Annual Operating Costs (millions of 2013$)

Two Site OMSF Option	OMSF	Difference
$68	$63	$5

Estimated Right-of-Way Costs

In addition to capital and operating costs, the construction of two smaller facilities would not necessarily reduce the ROW costs for each site. Figures 3 and 4 show the "proof of concept" layouts for a 48-car site compared to the 96-car sites for Lynnwood (Alt. 1) and the BNSF (Alt. 2). In the case of the BNSF site, the total number of parcels needed to build the 48-car option verses the OMSF 96-car option are roughly the same, with the exception of the parcel in the northeast corner of the site. The same is true of the Lynnwood site, where the smaller 48-car option requires the same number of parcels to be purchased. Therefore, the construction of two 48-car facilities would result in no savings in the initial ROW costs over the 96-car facility.

ST2 O&M Facility Needs versus Future Requirements

The Two Site OMSF Option must be considered in the context and needs associated with the eventual expansion of the light rail system as envisioned in the Sound Transit adopted Long-Range Plan and the PSRC's Vision *2040* and Transportation *2040* regional plans. This expansion assumes extending light rail to Everett in the north, Tacoma in the south and Downtown Redmond in the east.

Light Rail System Expansion

The needs associated with the future light rail expansion are documented in the *Task 2.3B Technical Memo; Core Light Rail System Expansion* (available on the OMSF project ST website). The memo identified the following future light rail system and its features:

- Future ridership demand will require trains to operate every three minutes in the peak periods through the 8.7 mile tunnel that extends from the International District/Chinatown Station to just south of the Northgate Station and every six minutes in the off-peak;
- Four-car trains will need to be operated in the peak periods; and
- A fleet of up to approximately 300 light rail vehicles will be required to meet the ridership demand.

To meet this future operations plan, three O&M facilities will be required. These sites include the existing Forest Street OMF heavy maintenance facility, a second O&M heavy maintenance facility plus one satellite O&M facility. The system operations and passenger demand require that one of the new O&M facilities be located along the north operating line to Everett and one along the east operating line to Downtown Redmond. Based on this requirement, no matter which corridor is selected for an OMSF to meet the ST2 fleet needs, a second Operations and Maintenance Facility will eventually be needed in the other corridor.

Impact of Selecting the Two Site OMSF Option to Serve ST2

Selecting the Two Site OMSF Option for ST2 would have implications for accommodating the fleet associated with a future light rail expansion. Four possible scenarios have been identified to serve the future light rail fleet needs. The assumptions that define the four scenarios are described below and the advantages and disadvantages of each scenario are discussed in Table 6.

Scenario A: Build one OMSF Now and One in the Future

- Continued use of the Forest Street OMF as a heavy maintenance facility
- Construct one 96-car OMSF to serve the ST2 fleet, either in the north or east
- In addition to the Forest ST OMF and ST2 OMSF, add a third ~100-car O&M facility in the future in either the north or east corridors, whichever corridor is not selected for the ST2 facility.

Scenario B: Build Two 48-Car O&M Facilities for ST2 and Expand Both in the Future

- Continued use of the Forest Street OMF as a heavy maintenance facility
- Construct a 48-car OMSF in the north corridor to serve the ST2 fleet and expand the facility to a ~100-car O&M facility in the future
- Construct a 48-car OMSF in the east corridor to serve the ST2 fleet and expand the facility to a ~100-car O&M facility in the future

Scenario C: Build Two 48-Car O&M Facilities for ST2, Demolish and Build two Full-size O&M Facilities in the Future

- Continued use of the Forest Street OMF as a heavy maintenance facility
- Construct a 48-car OMSF in both the north and east corridors to serve the ST2 fleet

- Decommission/demolish the 48-car OMSF's in the north and east corridors and construct two new ~100-car O&M facilities in each corridor

Scenario D: Build Two 48-Car O&M Facilities for ST2, Add Two 48-car O&M Facilities in the Future

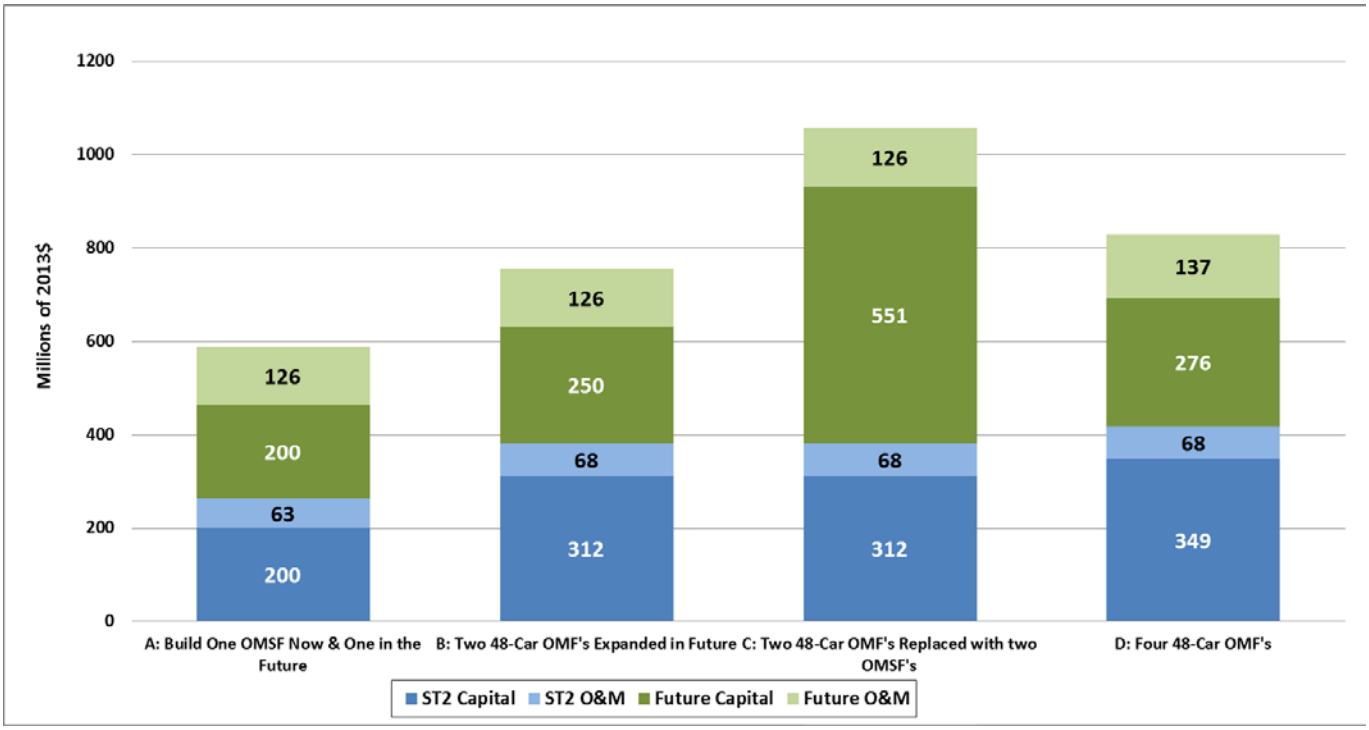
- Continued use of the Forest Street OMF as a heavy maintenance facility
- Construct a 48-car facility in both north and east now
- In the future construct additional 48-car facilities in both the north and east (one of the facilities will need to accommodate heavy maintenance functions)

Table 6: Advantages and Disadvantages of each Scenario

Scenario	Advantages	Disadvantages
A: Build One OMSF Now and one in the future	• Lowest cost scenario • Defers decision of siting the second facility (in addition to the Forest Street OMF) • Expands the potential locations for a second facility in the future	• Risk of future land availability • ROW costs could be higher in the future
B: Build Two 48-Car O&M Facilities for ST2 and Expand Both in the Future	• Potentially lower cost than scenarios C and D	• Requires the purchase of the land for the future expansion of the site now or this scenario is not feasible • Future expansion would disrupt existing service, maintenance and deployment, and may be a fatal flaw
C: Build Two 48-Car O&M Facilities for ST2, Decommission and Build two Full-size O&M Facilities in the Future	• Defers decision of siting a second facility	• Highest total cost • Risk of future land availability • Highest overall ROW cost • Requires ST to reimburse FTA for the remaining useful life of the facilities • Not consistent with ST's asset management guidelines. Would add additional equipment replacement needs over a single site
D: Build Two 48-Car O&M Facilities for ST2, Add Two 48-car O&M Facilities in the Future	• Defers decision of siting a second facility	• Risk of future land availability • Increased ROW costs • Increase operating costs • Not consistent with ST's asset management guidelines. Would add additional equipment replacement needs over a single site

Figure 5, illustrates the estimated capital (excludes right-of-way) and operating costs associated with the four scenarios in constant 2013 dollars. Scenario A is the lowest cost option and assumes a second full-size OMSF to support the future fleet expansion would be constructed in the corridor not selected to support ST2 fleet expansion. Scenario C is the highest cost, and assumes that the two 48-car O&M facilities built to service ST2 would be demolished and replaced with two full-size OMSF's, one in the north corridor and one in the East Corridor. It is likely that one of the two new OMSF's would be built north of Lynnwood on the way to Everett, and the east base built in Redmond assuming potential sites in the Bel-Red area have been developed.

Figure 5: Two Site OMSF Scenarios Estimated Capital and Operating Costs (2013 constant $)



Note: Capital Costs for 96-car facility is based on Alternative 2: BNSF

Findings

The findings of the Two Site OMSF Option are summarized below:

1. Two smaller facilities to accommodate the ST2 fleet would require more land in total than the individual site alternatives being studied in the EIS (approximately 36 acres total compared to 22 to 25 acres). This option would have associated increases in property acquisition costs.

2. Two smaller O&M facilities would require more staff than one 96-car OMSF. It is estimated that two smaller facilities would result in approximately 40 additional operations and maintenance staff to run the facilities. The result is an increase in annual operating costs of over $5 million.

3. Sound Transit is developing asset management guidelines to address the life-cycle replacement costs of its ever growing number of assets. An O&M facility consists of many elements and large numbers of specialized equipment. The construction of two smaller facilities to meet the ST2 fleet requirements would result in an additional facility to maintain and the need to replace greater number of redundant specialized equipment. Some of the asset management costs are reflected in the $5 million additional annual operating cost difference between building a single OMSF versus two smaller facilities.

4. The capital costs for a single 96-car OMSF is estimated at between $200 and $243 million. The cost of two 48-car facilities is estimated at $312.4 million, or $69 million to $112 million more than the 96-car facility.

5. Scenario A (Build One OMSF Now and One in the Future) advantages are that it has the lowest cost, defers decision of where to site the second facility and expands the potential search area for locating a second facility. The disadvantages include the risk of future land availability and potentially higher ROW costs in the future.

6. Scenario B (Build Two 48-Car O&M Facilities for ST2 and Expand Both in the Future) has the advantage of potentially lower construction costs than scenarios C and D, but is still more expensive than Scenario A. The disadvantages include the need to purchase land for the future expansion now to assure the land is available when both sites are expanded. In addition, expanding a facility that is currently in operation would likely disrupt existing maintenance functions and the deployment of trains. Ultimately, this scenario would conflict with partner agencies' desire for a smaller facility, which is the genesis of this evaluation.

7. Scenario C (Build Two 48-Car O&M Facilities for ST2, Demolish and Build two Full-size O&M Facilities) has the advantage of deferring the decision of where to locate a second facility. The disadvantages include that it has the highest total cost, there is risk of future land availability, it has the highest ROW cost, would require ST to reimburse FTA for the remaining useful life of the facilities and is not consistent with ST's asset management guidelines.

8. Scenario D (Build Two 48-Car O&M Facilities for ST2, Add Two 48-car O&M Facilities in the Future) has the advantage of deferring the decision of where to locate the two new facilities. The disadvantage includes the risk of future land availability and risk of finding two alternative sites in the future and on-going higher operating costs.

Conclusion

The analysis and findings discussed in this paper confirms the assessment made during the EIS scoping process that the Two Site OMSF Option should not be analyzed further. The Two Site OMSF Option will be discussed in Chapter 2 of the DEIS as an alternative considered but not carried forward.

Attachment 1

Two Site OMSF Option Assumptions for Comparison

The Two Site OMSF option design and cost estimates have been developed using the Alternative 2 (BNSF) as the basis of design. Site elements, buildings, and track work have been adjusted for each alternative to meet the needs of a 48 car program.

- Track Cost Ratio: This cost is based on the linear feet of track of the 48-car and 96-car options (48-cars 15,165 LF / 96-cars 26,144 LF = 0.58 linear feet of track

- The Main Building:
  - The 96-car shop has 7 shop tracks through the building. The 48-car shop has 4 shop tracks
  - Using a ratio of 4 tracks/7 tracks=0.57, then rounding to 60%. Although the total number of cars is reduced by 50% there will be some components and space that cannot be cut in half
  - Circulation within the shop areas is not reduced by 50%
  - The Service/Clean and Wash are not reduced

- MOW Building: The Maintenance-of-Way (MOW) functions are unlikely to be reduced significantly. No reduction is taken

- Auxiliary Building is similar to the MOW Building and is not reduced

- Maintenance equipment is reduced for some items to a single unit where appropriate. Miscellaneous shop equipment is reduced by the 4 tracks/7 tracks ratio.

- Site Work General:
  - Within the detail for the track work, Embedded Track is adjusted based on the 4/7 ratio, rounded to 60%
  - Traffic Signals and Crossing are not adjusted as these are at the access points to the site
  - All other track work items are adjusted by the Track Ratio of 58%

- Site Work Utilities: These are adjusted based on the Site Size ratios, however, for public utilities, an additional 5% was added for taps and miscellaneous baseline cost.
  - Water Supply was adjusted by the Site Size Ratio + 5%
  - Sanitary was adjusted by the Site Size Ratio + 5%
  - Stormwater was adjusted by the Site Size Ratio
  - Gas Supply was adjusted by the Site Size Ratio + 5%
  - Site Electrical includes the relocation and connection to existing power distribution. This work was not adjusted; the remainder of the Electrical Supply and Distribution was adjusted by the Site Size Ratio + 5%
  - Site Lighting was adjusted by the Site Size Ratio
  - Site Communication and Security was adjusted by the Site Size Ratio

- Site Work Connecting Lead Track: not adjusted

Appendix F.2

Land Acquisition Data

Appendix F.2
Land Acquisition Data

The Sound Transit Link Light Rail Operations and Maintenance Satellite Facility (OMSF) project (proposed project) would require acquiring property and presumes displacing and relocating some existing uses. This appendix presents the likely property acquisitions based on the current conceptual designs of the OMSF. This list of acquisitions could be updated as the project design is refined; therefore, it should not be interpreted as the final determination regarding property acquisition. Furthermore, the estimates described in this appendix reflect existing conditions at the time the analysis was conducted. Accordingly, the number and/or type of displacements could vary between what has been disclosed in this Draft Environmental Impact Statement (Draft EIS) and what is actually required because currently underdeveloped or vacant properties might be developed between the publication date of this Draft EIS and the time of construction.

There are two types of property acquisitions: partial and full.

- **Partial acquisitions.** Partial acquisitions acquire part of a parcel and generally do not displace the existing use. In a few instances, some of the businesses on a parcel are displaced.
- **Full acquisitions.** Full acquisitions acquire the full parcel and displace the current use. Full acquisitions include parcels that might not be fully needed for the project but are affected to the extent that existing uses are substantially impaired (e.g., loss of parking or access). This includes parcels that acquired for construction activities, although in some cases all or part of the parcels are available for other use or redevelopment after construction is complete.

Tables F.2-1 through F.2-7 in this appendix present information on the likely acquisitions by build alternative for the proposed project. Information associated with partial and full acquisitions for each build alternative was collected from aerial photos, King and Snohomish County geographic information system (GIS) data, and windshield reconnaissance site visits.

In addition to the potential property acquisitions described, the proposed project would also require subterranean easements, temporary construction easements, and the use of public right-of-way not listed here.

Table F.2-1. Potential Land Acquisition, Displacement, and Relocation of Existing Uses—Lynnwood Alternative, Design Option C1

Parcel Number	Existing Land Use
01082800010100, 01082800010200, and 01082800010300	1 – Commercial Office
1082800010400	1 - Commercial Office
1067400000100	1 - Commercial Office 1- Vacant
00608400300401 and 00608400300402	6 - Commercial Office
619500000102	1- Vacant
00619500000301 and 00619500000300	1 - Industrial
608400300303	1 - Vacant
608400300300	1 - Industrial
608400400301	1 - Vacant
608400300203	Partial - No Displacement; also affected by Lynnwood Link Extension project
619500000602	Partial - No Displacement; also affected by Lynnwood Link Extension project
Total Displacements by Land Use	9 - Commercial Office 2 - Industrial 4 - Vacant

The Lynnwood Alternative site, Design Option C1, contains industrial uses, such as Connolly Ski Manufacturing and sheet metal manufacturing. The site is also developed with a mid-rise office that is host to various State of Washington offices, such as Children's Administration, Community Service Office, Division of Development Disabilities, Home and Community Service, and Vocational Rehabilitation. The site also contains a single-story office/flex space development currently occupied by engineering and law services. Vacant parcels make up the largest component of land use at the site, which includes the planned district support center for the Edmonds School District.

Table F.2-2. Potential Land Acquisition, Displacement, and Relocation of Existing Uses—Lynnwood Alternative, Design Option C2

Parcel Number	Existing Land Use
01082800010100, 01082800010200, and 01082800010300	1 - Commercial Office
1082800010400	1 - Commercial Office
1067400000100	1 - Commercial Office 1 - Vacant
00608400300401 and 00608400300402	6 - Commercial Office
619500000102	1- Vacant
00619500000301 and 00619500000300	1 - Industrial
608400300303	1- Vacant
608400300300	1 - Industrial
608400400301	1- Vacant
608400400302	1- Vacant
619500000602	Partial - No Displacement; also affected by Lynnwood Link Extension project
Total Displacements by Land Use	9 - Commercial Office 2 - Industrial 5 - Vacant

The Lynnwood Alternative site, Design Option C2, contains the same industrial uses as Design Option C1. However, it does not include the northernmost parcel of Design Option C1, parcel number 00608400300203. Design Option C2 also incorporates an additional parcel to the east that is dominated by wetlands.

Table F.2-3. Potential Land Acquisition, Displacement, and Relocation of Existing Uses—Lynnwood Alternative, Design Option C3

Parcel Number	Existing Land Use
01082800010100, 01082800010200, and 01082800010300	1 - Commercial Office
1082800010400	1 - Commercial Office
1067400000100	1 - Commercial Office 1 - Vacant
00608400300401 and 00608400300402	6 - Commercial Office
619500000102	1 - Vacant
00619500000301 and 00619500000300	1 - Industrial
608400300303	1 - Vacant
608400300300	1 - Industrial
608400400301	1 - Vacant
619500000900	2 - Commercial Retail/Service 1- Industrial
Total Displacements by Land Use	2 - Commercial Retail/Service 9 - Commercial Office 3 - Industrial 4 - Vacant

The Lynnwood Alternative site, Design Option C3, contains the same industrial uses as Design Option C1, less parcel number 00608400300203 in the northernmost part of the site. Design Option C3 incorporates an additional parcel, used for recreational vehicle storage and towing, in the southernmost part of the site.

Table F.2-4. BNSF Storage Tracks

Parcel Number	Existing Land Use
2825059182	Vacant (owned by Sound Transit)
Total Displacements by Land Use	1 – Vacant (owned by Sound Transit)

The BNSF Storage Tracks component of the Lynnwood Alternative consists of right-of-way currently under the ownership of Sound Transit and one single vacant industrial parcel (previously occupied by the International Paper facility), also under the ownership of Sound Transit.

Table F.2-5. Potential Land Acquisition, Displacement, and Relocation of Existing Uses—BNSF Alternative

Parcel Number	Existing Land Use
282505-9156	1 - Commercial/Retail Service 2 - Industrial
282505-9218	1 - Commercial/Retail Service 1 - Commercial Office 1 - Industrial
282505-9213	3 - Commercial Office 2 - Industrial
282505-9294	1 - Industrial
282505-9298	1- Vacant (right-of-way owned by Sound Transit)
282505-9307	1 - Commercial Office
282505-9326	1 - Vacant (right-of-way owned by Sound Transit)
282505-9070	1 - Commercial Retail/Services
282505-9182	1 – Vacant (owned by Sound Transit)
Total Displacements by Land Use	3 - Commercial Retail/Service 5 - Commercial Office 6 - Industrial 3 - Vacant (owned by Sound Transit)

The BNSF Site Alternative site includes the International Paper facility, along with various commercial/light industrial uses, such as Eastside Staple and Nail, a medical supply facility, some technology based businesses, and a part of the Audi dealership.

Table F.2-6. Potential Land Acquisition, Displacement, and Relocation of Existing Uses—BNSF Modified Alternative

Parcel Number	Existing Land Use
282505-9278	1 - Commercial Retail/Service
282505-9277	1 - Commercial Retail/Service
282505-9276	8 - Commercial Office 1 - Industrial
282505-9091, 282505-9234, and 282505-9235	1 - Industrial
282505-9307	Partial - No Displacement
282505-9103 and 282505-9290	2 - Vacant
282505-9182	1 - Vacant (owned by Sound Transit)
282505-9156	1 - Commercial Retail/Service 2 - Industrial
282505-9218	1 - Commercial Retail/Service 1 - Commercial Office 1 - Industrial
282505-9213	4 - Commercial Office 1 - Industrial
282505-9294	1 - Industrial
282505-9326	1- Vacant (right-of-way owned by Sound Transit)
282505-9070	1 - Commercial Retail/Service
Total Displacements by Land Use	5 - Commercial Retail/Service 13 - Commercial Office 7 - Industrial 4 – Vacant

The BNSF Modified Alternative site includes the same parcels as the BNSF Alternative and extends across the Eastside Rail Corridor incorporating 9 additional acres of industrial/commercial uses. Three of the additional parcels are developed with the Bellevue Public Safety Training Center, a training facility equipped with drill areas for firefighter and other officers of public safety.

Table F.2-7. Potential Land Acquisition, Displacement, and Relocation of Existing Uses—SR 520 Alternative

Parcel Number	Existing Land Use
282505-9116	19 - Commercial Retail/Service 9 - Commercial Office
272505-9188	7 - Commercial Retail/Service 15 - Commercial Office
272505-9122, 272505-9259, 272505-9226, 272505-9199, and 272505-9227	13 - Commercial Retail/Service 5 - Commercial Office
272505-9187	13 - Commercial Retail/Service 8 - Commercial Office
272505-9007	5 - Commercial Retail/Service 5 - Commercial Office
272505-9191	1 - Commercial Retail/Service
272505-9330	1 - Commercial Office
272505-9061	Partial - No Displacements
272505-9328	Partial - No Displacements
272505-9148	Acquisition of this parcel included in East Link project
Total Displacements by Land Use	58 - Commercial Retail/Service 43 - Commercial Office

The SR 520 Alternative site contains a broad range of commercial uses in mostly one-level, strip-style developments. Uses include a variety of retail and restaurants with some offices.

Appendix F.3

Visual Simulations and Key Observation Point Analysis

Appendix F.3
Visual Simulations and Key Observation Point Analysis

Table F.3-1. Operational Visual Impacts—Lynnwood Alternative

Key Observation Point	Viewer Group Sensitivity	Changes in Landscape Elements	Existing Visual Quality	Degree of Change	Resulting Visual Quality
A: Residential on 52nd Avenue W	High	**Current view:** Undeveloped, partially graded, and cleared property and office space (Photograph 1). **Effect:** The Lynnwood Link Extension would begin construction during the construction of the proposed OMSF project. Its elevated guideway would run along 52nd Avenue W and dominate the view in Design Options C1 and C2 (Photographs 2 and 8). The upper portions of the OMSF and trains may be visible to viewers beneath and behind the proposed light rail line in Design Options C1 and C2. A 6-foot sight-obscuring fence would surround the site and partially obscure the view. Under Design Option C3, the guideway would not run along 52nd Avenue W, and viewers would see the tops of the OMSF, trains, and lead tracks. A 6-foot sight-obscuring fence would surround the site and partially obscure the view (Photograph 14)	Moderate	Moderate	Moderate
B: Interurban Trail	Moderate	**Current view:** Undeveloped, partially graded, and cleared property (Photograph 3). **Effect:** The proposed project would be in the background for viewers along the majority of the trail. As viewers approach the south end of the site, the proposed project would be in the foreground. The top of the OMSF, trains, and lead track may be visible to viewers. The site would be partially blocked by landforms. A 6-foot sight-obscuring fence would surround the site and partially obscure the view (Photographs 4, 10, and 16).	Moderate	Moderate to High	Moderate

Key Observation Point	Viewer Group Sensitivity	Changes in Landscape Elements	Existing Visual Quality	Degree of Change	Resulting Visual Quality
C: I-5	Low	**Current view:** From I-5 southbound, intermittent views of the site, with undeveloped, partially graded, and cleared property visible. The view is primarily blocked by landforms and existing development. The view is blocked from viewers traveling north on I-5 (Photograph 5). **Effect:** The Lynnwood Link Extension would begin construction during construction of the proposed project. For Design Options C1 and C2, the elevated guideway would leave I-5 south of the site. From north and south on I-5, views of the site and the lead track would be limited. For Design Option C3 the elevated guideway would dominate the view in the foreground. For all options, glimpses of upper portions of the building and trains may be visible (Photographs 6, 12, and 18).	Moderate	Low	Moderate
1: Industrial Facilities to the South	Low	**Current view:** Undeveloped, partially graded, and cleared property. **Effect:** The top of the facility, trains, and lead track may be visible to viewers. The lead tracks would be in the foreground. Proposed grading would lower the site below the existing grade. A 6-foot sight-obscuring fence would surround the site and partially obscure the view.	Low	Low	Low
2: Scriber Creek Park	Moderate to High	**Current view:** Office buildings through the trees (intermittent views). **Effect:** Proposed grading would raise the site above the existing grade. Views of the fence, building, and trains would be partially visible through gaps in existing vegetation in the park.	Moderate to High	Moderate	Moderate to High

Table F.3-2. Operational Visual Impacts—BNSF Storage Tracks (Lynnwood Alternative)

Key Observation Point	Viewer Group Sensitivity	Changes in Landscape Elements	Existing Visual Quality	Degree of Change	Resulting Visual Quality
A: 120th Ave NE	Low	**Current view:** Industrial facilities and warehouses (Photograph 19). **Effect:** Views of a small office with covered platforms and trains on the existing BNSF tracks. The proposed project would be set back from the road and in the background for viewers along 120th Ave NE. Initial views of the site would be blocked at the south end for viewers traveling north on 120th Ave NE. The view would be partially blocked by vegetation for the length of the site in both directions (Photograph 20). Viewers on the upper levels of the future Spring District development may have views of the site.	Low	Low	Low
B: 116th Ave NE – Buildings facing the OMSF	Moderate	**Current view:** Industrial facilities and warehouses. **Effect:** Views of a small office with covered platforms and trains on the existing BNSF tracks. The proposed project would be in the foreground for these buildings; however, the view would not be substantially different than the current view.	Moderate	Moderate	Moderate
C: NE 24th St and NE 26th Pl	Moderate	**Current view:** Overview of industrial facilities, warehouses, and SR 520. **Effect:** View of the proposed project would be blocked by buildings and landforms.	Moderate	Low	Moderate
1:Northup Way	Low	**Current view:** Industrial facilities and warehouses. **Effect:** View of the proposed project would be blocked by buildings and landforms.	Low	No change	Low
2: 116th Ave NE – Main Road	Moderate	**Current view:** Industrial facilities and warehouses. **Effect:** View of the proposed project would be blocked by buildings and landforms.	Moderate	No change	Moderate
3: NE 12th St	Moderate	**Current view:** Industrial facilities and warehouses. **Effect:** Views of a small office, with covered platforms and trains on the existing BNSF tracks. View of the proposed project would be blocked by buildings from most of NE 12th St. Viewers may have fleeting views of the proposed project as they cross the bridge over the BNSF Storage Tracks. Viewers on the upper levels of the Spring District developments may have views of the site.	Moderate	Low	Moderate

Table F.3-3. Operational Visual Impacts—BNSF Alternative and BNSF Modified Alternative

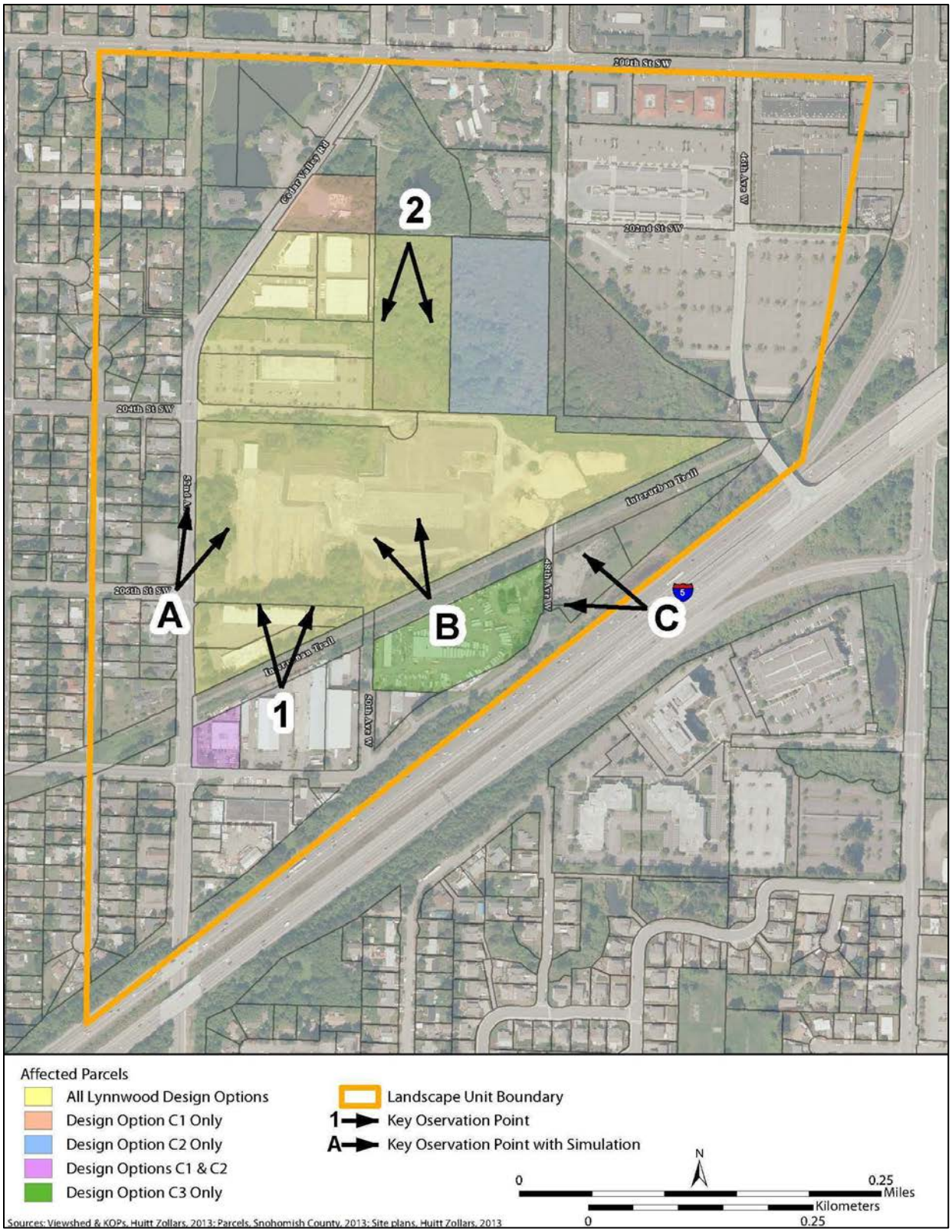
Key Observation Point	Viewer Group Sensitivity	Changes in Landscape Elements	Existing Visual Quality	Degree of Change	Resulting Visual Quality
A: 120th Ave NE	Low	**Current view:** Industrial facilities and warehouses (Photograph 21). **Effect:** Views of an industrial facility with rail storage and trains. The facility would be in the foreground for viewers along 120th Ave NE. Initial views would be blocked at the south end for viewers traveling north. The upper portion of the OMSF and trains may be visible. The BNSF Modified Alternative would be set 200 feet farther back from the road than the BNSF Alternative and would allow for future development between the proposed project and the road that may screen some or all of the facility from this location. A 6-foot sight-obscuring fence would surround the site and partially obscure the view (Photographs 22 and 28). Viewers on the upper levels of the Spring District developments may have views of the site.	Low	Low	Low
B: 116th Ave NE, Buildings facing the OMSF	Moderate	**Current view:** Industrial facilities and warehouses (Photograph 23). **Effect:** The facility would be in the foreground. The rear-facing offices are elevated above the site and would have a partially screened view of the facility under the BNSF Alternative. The proposed project would be much closer to these offices and in the foreground under the BNSF Modified Alternative. The view would not be substantially different than the current view (Photographs 24 and 30).	Moderate	Low	Moderate
C: NE 24th St and NE 26th Place	Moderate	**Current view:** Industrial facilities and warehouses (Photograph 25). **Effect:** Views of an industrial facility with rail storage and trains, but blocked from view for most of the neighborhood. The facility would be in the background as viewers travel south along NE 26th Place and approach NE 24th; it would be in the background to the left as viewers travel west along a short portion of NE 24th St, from approximately 124th Ave NE to NE 26th Pl (Photographs 26 and 32).	Moderate	Low	Moderate
1: Northup Way	Low	**Current view:** Commercial developments. **Effect:** The proposed project would be blocked from view by buildings and landforms.	Low	No change	Low

Key Observation Point	Viewer Group Sensitivity	Changes in Landscape Elements	Existing Visual Quality	Degree of Change	Resulting Visual Quality
2:116th Ave NE, Main Road	Moderate	**Current view:** Office and commercial developments. **Effect:** The proposed project would be partially blocked from view by buildings and landforms.	Low	Moderate	Low
3:NE 12th St	Moderate	**Current view:** Office and commercial developments. **Effect:** The proposed project would be blocked by buildings for most of NE 12th St. Viewers may have fleeting views of the OMSF as they cross over the BNSF Storage Tracks. Viewers on the upper levels of the Spring District developments may have views of the site.	Moderate	Low	Moderate

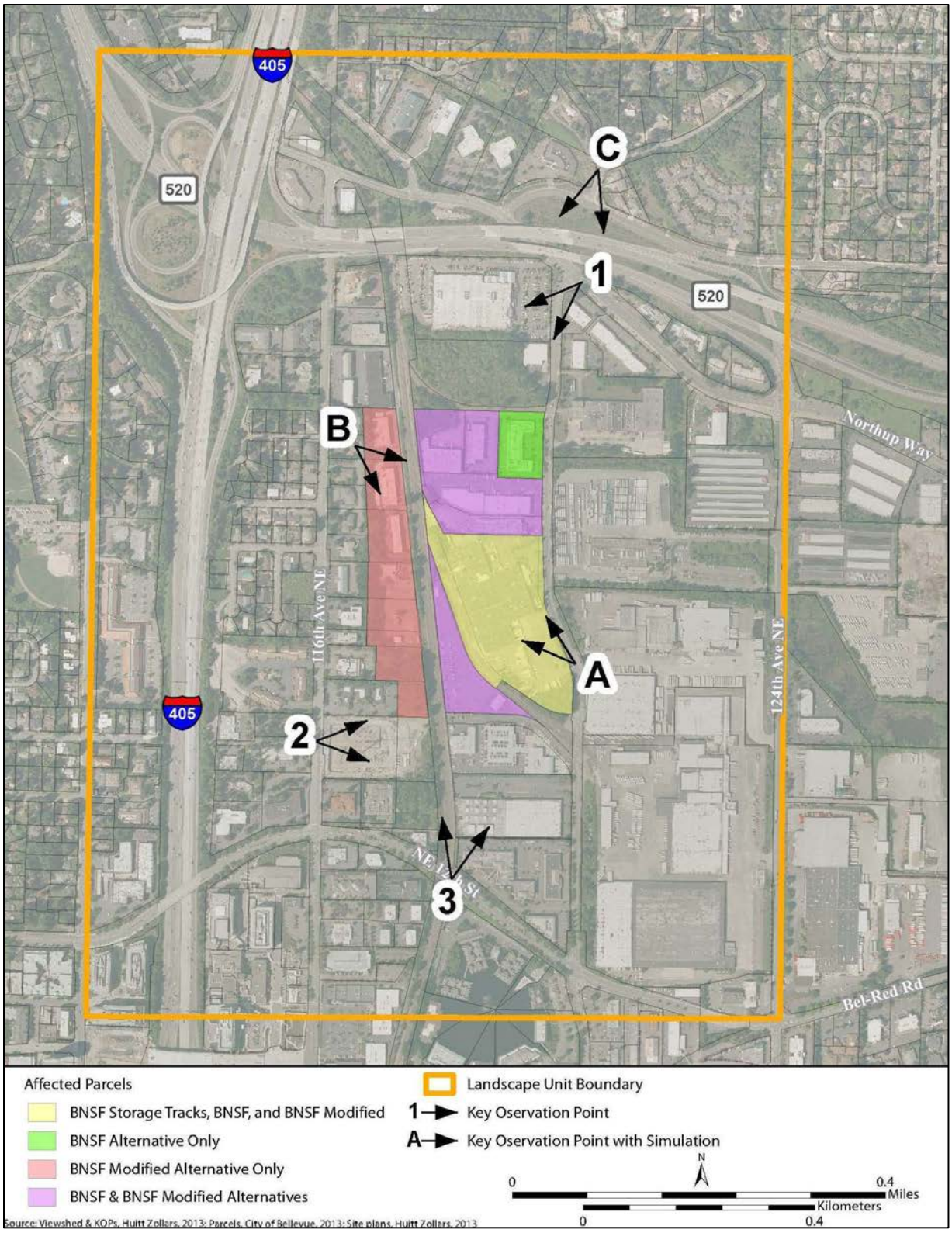
Table F.3-4. Operational Visual Impacts—SR 520 Alternative

Key Observation Point	Viewer Group Sensitivity	Changes in Landscape	Existing Visual Quality	Degree of Change	Resulting Visual Quality
A: Northup Way	Moderate	**Current view:** Commercial developments (Photograph 33). **Effect:** Views may include the upper portion of the facility and trains as viewers travel past the site. The facility would be in the foreground for viewers traveling along Northup Way (Photograph 34).	Moderate	Moderate	Moderate
B: 132nd Ave NE	Moderate	**Current view:** Commercial developments (Photograph 35). **Effect:** Views of the proposed project and trains as viewers travel toward the site. The proposed project would be in the foreground for viewers at the intersection of 132nd Ave NE and Northup Way (Photograph 36).	Moderate	Moderate	Moderate
C: NE 20th St east of the site	Low	**Current view:** Commercial developments (Photograph 37). **Effect:** Views of the proposed project and trains as viewers travel toward the site. Viewers traveling west on NE 20th St would see the site in the background from approximately west of the 148th Ave NE to 140th Ave NE (Photograph 38).	Low	Low	Low
1:Bridle Trails Neighborhood	Moderate	**Current view:** Residential developments and trees. **Effect:** The proposed project is would be blocked from view by SR 520, landforms, and vegetation.	Moderate to High	No change	Moderate to High
2: Viewpoint Park	High	**Current view:** Residential developments and trees. **Effect:** The proposed project is would be blocked from view by SR 520, landforms, and vegetation.	High	No change	High

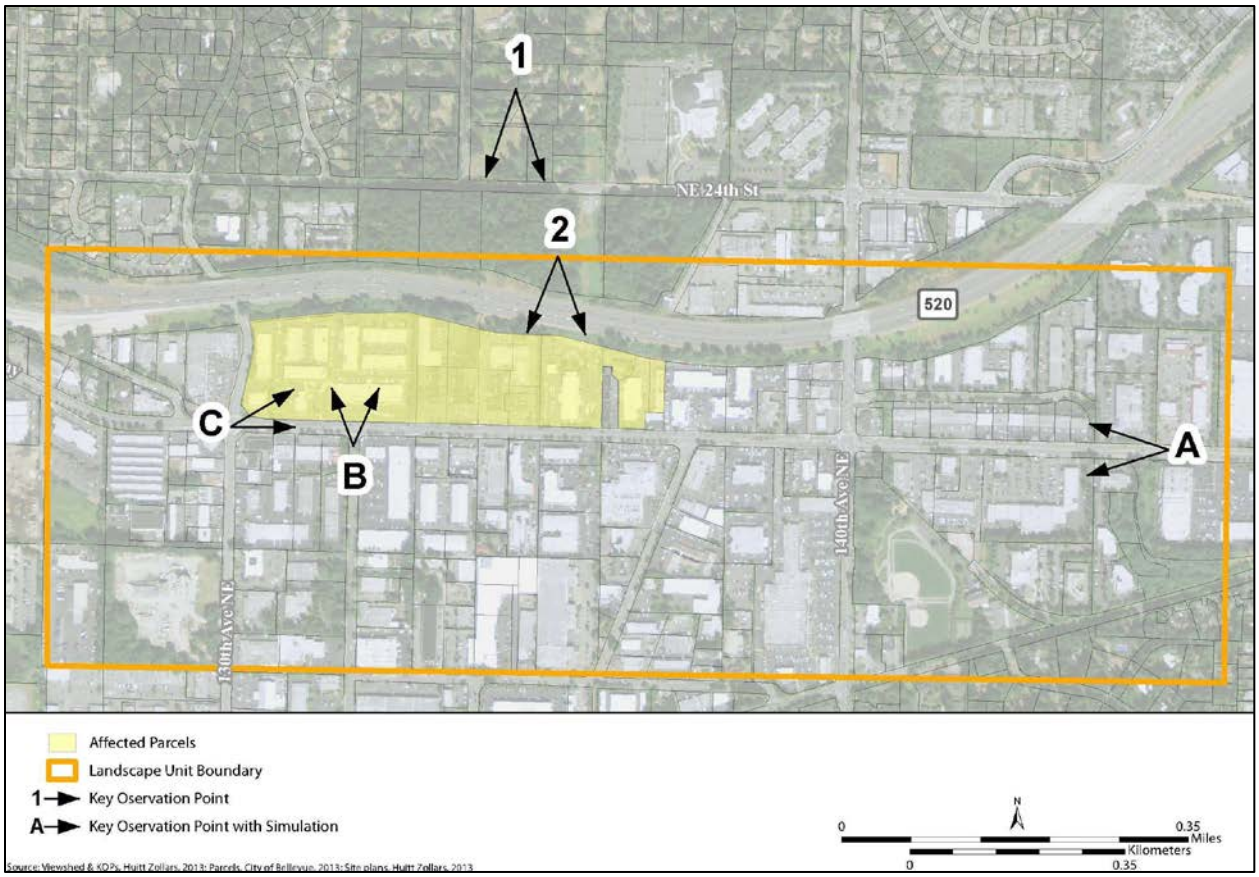
Key Map F.3-1. Lynnwood Alternative—Viewshed and KOPs



Key Map F.3-2. BNSF Alternative and BNSF Modified Alternative—Viewshed and KOPs



Key Map F.3-3. SR 520 Alternative—Viewshed and KOPs



Photograph F.3-1. Lynnwood Alternative Design Option C1—KOP A, Existing View, 52nd AVE and 206th ST SW, Looking Northeast

Photograph F.3-2. Lynnwood Alternative Design Option C1—KOP A, Proposed View, 52nd AVE and 206th ST SW, Looking Northeast

Photograph F.3-3. Lynnwood Alternative Design Option C1—KOP B, Existing View, Interurban Trail, Looking Northwest

Photograph F.3-4. Lynnwood Alternative Design Option C1—KOP B, Proposed View, Interurban Trail, Looking Northwest

Photograph F.3-5. Lynnwood Alternative Design Option C1—KOP C, Existing View, I-5, Looking Northwest

Photograph F.3-6. Lynnwood Alternative Design Option C1—KOP C, Proposed View, I-5, Looking Northwest

Photograph F.3-7. Lynnwood Alternative Design Option C2—KOP A, Existing View, 52nd AVE and 206th ST SW, Looking Northeast

Photograph F.3-8. Lynnwood Alternative Design Option C2—KOP A, Proposed View, 52nd AVE and 206th ST SW, Looking Northeast

Photograph F.3-9. Lynnwood Alternative Design Option C2—KOP B, Existing View, Interurban Trail, Looking Northwest

Photograph F.3-10. Lynnwood Alternative Design Option C2—KOP B, Proposed View, Interurban Trail, Looking Northwest

Photograph F.3-11. Lynnwood Alternative Design Option C2—KOP C, Existing View, I-5, Looking Northwest

Photograph F.3-12. Lynnwood Alternative Design Option C2—KOP C, Proposed View, I-5, Looking Northwest

Photograph F.3-13. Lynnwood Alternative Design Option C3—KOP A, Existing View, 52nd AVE and 206th ST SW, Looking Northeast

Photograph F.3-14. Lynnwood Alternative Design Option C3—KOP A, Proposed View, 52nd AVE and 206th ST SW, Looking Northeast

Photograph F.3-15. Lynnwood Alternative Design Option C3—KOP B, Existing View, Interurban Trail, Looking Northwest

Photograph F.3-16. Lynnwood Alternative Design Option C3—KOP B, Proposed View, Interurban Trail, Looking Northwest

Photograph F.3-17. Lynnwood Alternative Design Option C3—KOP C, Existing View, I-5, Looking Northwest

Photograph F.3-18. Lynnwood Alternative Design Option C3—KOP C, Proposed View, I-5, Looking Northwest

Photograph F.3-19. Lynnwood Alternative, BNSF Storage Tracks—KOP A, Existing View, 120th AVE NE, Looking Northwest (*Note: Same viewpoint location as BNSF and BNSF Modified KOP A as shown on Key Map 2*)

Photograph F.3-20. Lynnwood Alternative, BNSF Storage Tracks—KOP A, Proposed View, 120th AVE NE, Looking Northwest (*Note: Same viewpoint location as BNSF and BNSF Modified KOP A as shown on Key Map 2*)

Photograph F.3-21. BNSF Alternative—KOP A, Existing View, 120th AVE NE, Looking Northwest

Photograph F.3-22. BNSF Alternative—KOP A, Proposed View, 120th AVE NE, Looking Northwest

Photograph F.3-23. BNSF Alternative—KOP B, Existing View, Offices at 116th AVE NE, Looking Southeast

Photograph F.3-24. BNSF Alternative—KOP B, Proposed View, Offices at 116th AVE NE, Looking Southeast

Photograph F.3-25. BNSF Alternative—KOP C, Existing View, 120th AVE NE and NE 26th PL, Looking Southwest

Photograph F.3-26. BNSF Alternative—KOP C, Proposed View, 120th AVE NE and NE 26th PL, Looking Southwest

Photograph F.3-27. BNSF Modified Alternative—KOP A, Existing View, 120th AVE NE, Looking Northwest

Photograph F.3-28. BNSF Modified Alternative—KOP A, Proposed View, 120th AVE NE, Looking Northwest

Photograph F.3-29. BNSF Modified Alternative—KOP B, Existing View, Offices at 116th AVE NE, Looking Southeast

Photograph F.3-30. BNSF Modified Alternative—KOP B, Proposed View, Offices at 116th AVE NE, Looking Southeast

Photograph F.3-31. BNSF Modified Alternative—KOP C, Existing View, 120th AVE NE and 26th PL, Looking Southwest

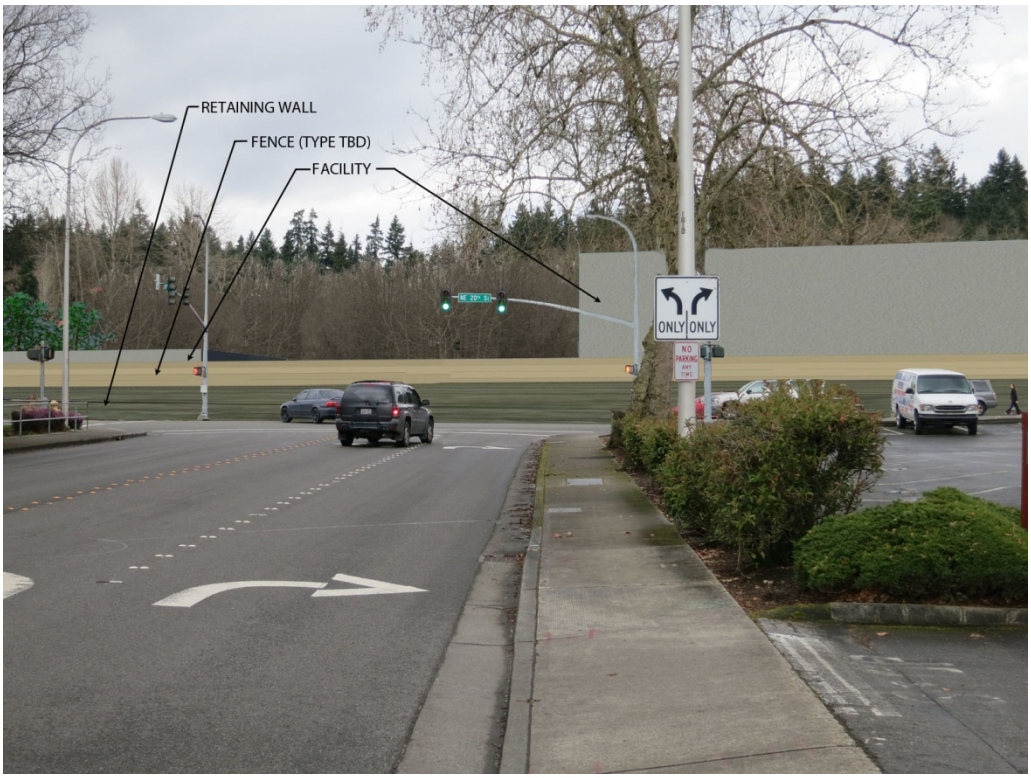
Photograph F.3-32. BNSF Modified Alternative—KOP C, Proposed View, 120th AVE NE and 26th PL, Looking Southwest

Photograph F.3-33. SR 520 Alternative—KOP A, Existing View, Northup Way near 148th AVE NE, Looking West

Photograph F.3-34. SR 520 Alternative—KOP A, Proposed View, Northup Way near 148th AVE NE, Looking West

Photograph F.3-35. SR 520 Alternative—KOP B, Existing View, 132nd AVE NE at Northup Way, Looking North

Photograph F.3-36. SR 520 Alternative—KOP B, Proposed View, 132nd AVE NE at Northup Way, Looking North



Photograph F.3-37. SR 520 Alternative—KOP C, Existing View, Northup Way at 130th AVE NE, Looking Northeast

Photograph F.3-38. SR 520 Alternative—KOP C, Proposed View, Northup Way at 130th AVE NE, Looking Northeast

Appendix F.4

Air Quality Analysis Details

Appendix F.4
Air Quality Analysis Details

Introduction

This appendix provides additional air quality and greenhouse gas (GHG) details to support the impact assessment provided in Section 3.7, Air Quality and Greenhouse Gases, of the Draft Environmental Impact Statement (Draft EIS). An expanded discussion of applicable regulatory requirements is provided, as well as information on criteria pollutants of concerns and existing pollutant concentrations in the study area. The appendix concludes with technical information on the approach and methodology used to assess construction and operational emissions associated with the proposed project.

Regulatory Agencies and Requirements

This section provides additional details on air quality and climate change regulations applicable to the proposed project.

Criteria Air Pollutants

Clean Air Act and Ambient Air Quality Standards

The Clean Air Act (CAA), promulgated in 1963 and amended several times thereafter, including the 1990 Clean Air Act amendments (CAAA), establishes the framework for modern air pollution control. The act directs the U.S. Environmental Protection Agency (EPA) to establish national ambient air quality standards (NAAQS) for the following six criteria pollutants: ozone, carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter (PM), which consists of PM 10 microns in diameter or less (PM10) and PM 2.5 microns in diameter or less (PM2.5). The NAAQS are divided into primary and secondary standards; the former are set to protect human health within an adequate margin of safety, and the latter to protect environmental values, such as plant and animal life. The Washington State Department of Ecology (Ecology) establishes state ambient air quality standards for the same six pollutants that are at least as stringent as the national standards. Table 1 summarizes the NAAQS and state air quality standards.

Transportation Conformity Requirements

The CAAA and Washington State require all transportation projects located within maintenance and nonattainment areas to follow conformity regulations specified under federal (40 Code of Federal Regulations [CFR] 51,93) and state (Washington Administrative Code [WAC]-173-420) regulations. Maintenance areas are those where monitored pollutant concentrations previously exceeded one or more NAAQS, but are no longer in violation of that standard. Nonattainment areas are those where monitored pollutant concentrations consistently violate one or more NAAQS. Attainment areas,

which include regions where pollutant concentrations meet the NAAQS, are not subject to transportation conformity.

Table F.4-1. National and Washington State Ambient Air Quality Standards

	Federal Standard		
Pollutant	**Primary**	**Secondary**	**State Standard**
Carbon monoxide			
8-hour average[a]	9 ppm	No standard	9 ppm
1-hour average[a]	35 ppm	No standard	35 ppm
Ozone			
8-hour average[b]	0.075 ppm	0.075 ppm	0.075 ppm
Total suspended particles			
Annual average	No standard	No standard	60 µg/m^3
24-hour average[c]	No standard	No standard	150 µg/m^3
Particulate matter—PM10			
24-hour average[c]	150 µg/m^3	150 µg/m^3	150 µg/m^3
Particulate matter—PM2.5			
Annual average	15 µg/m^3	15 µg/m^3	15 µg/m^3
24-hour average[d]	35 µg/m^3	35 µg/m^3	35 µg/m^3
Lead			
Quarterly average	1.5 µg/m^3	1.5 µg/m^3	1.5 µg/m^3
Sulfur dioxide			
Annual average	0.03 ppm	No standard	0.02 ppm
24-hour average[a]	0.14 ppm	No standard	0.10 ppm
3-hour average[a]	No standard	0.50 ppm	No standard
1-hour average[e]	0.075 ppm	No standard	0.40 ppm
Nitrogen dioxide			
Annual average	0.053 ppm	0.053 ppm	0.05 ppm
1-hour average[f]	0.100 ppm	No standard	No standard

Source: WAC 173-470.

Notes:

Annual standards are never to be exceeded. Short-term standards are not to be exceeded more than once per year unless noted.

[a] Not to be exceeded once per year.

[b] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008).

[c] Not to be exceeded more than once per year on average over 3 years.

[d] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3.

[e] 0.25 ppm are not to be exceeded more than two times in 7 consecutive days.

[f] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm.

ppm = parts per million; µg/m^3 = micrograms per cubic meter.

The intent of the conformity regulations is to ensure that transportation projects, plans, and programs affecting regional and local air quality conform to existing state implementation plans (SIP) and time tables for attaining and maintaining federal health-based air quality standards. Air quality–based criteria for demonstrating conformity to the SIP are developed by Washington State Department of Transportation (WSDOT).

EPA and Ecology designate regions as being attainment or nonattainment areas for regulated air pollutants based on monitoring information collected over a period of years. Attainment status indicates that air quality in an area meets the NAAQS; nonattainment status indicates that air quality in an area does not meet those standards. The proposed project area is currently designated a maintenance area for CO and an attainment area for all other criteria air pollutants (ozone, PM10, PM2.5, Pb, SO_2, and NO_2) (U.S. Environmental Protection Agency 2012a).

The proposed project is required to meet both regional and project-level conformity requirements. Regional conformity is met by demonstrating that the proposed project is included in a conforming regional transportation plan (RTP) and a regional transportation improvement program (RTIP). Project-level conformity is met through air quality dispersion modeling. The project-level analysis must demonstrate that the proposed project would not result in any of the following conditions.

1. Increase in the severity or frequency of existing violations of the CO NAAQS.
2. New violations of the CO NAAQS.
3. Delay the timely attainment of the CO NAAQS.

The permitting agency must demonstrate transportation conformity as part of the proposed project's environmental review process.

Puget Sound Clean Air Agency Regulations

All construction sites in the Puget Sound region are required to implement rigorous emissions controls to minimize fugitive dust and odors during construction, as required by Puget Sound Clean Air Agency (PSCAA) Regulation 1, Section 9.15, Fugitive Dust Control Measures. Industrial and commercial air pollutant sources are also required to register with PSCAA. Facilities with substantial emissions are required to obtain a Notice of Construction air quality permit before construction is allowed to begin. The application for this permit requires the facility to install best available control technology to reduce emissions, conduct computer modeling to demonstrate that the facility's emissions will not cause ambient concentrations to exceed the NAAQS limits, and minimize the impacts of odors and toxic air pollutants.

Greenhouse Gases

National Environmental Policy Act Guidance for Climate Change Analysis

On December 7, 2009, EPA signed the Endangerment and Cause or Contribute findings for GHGs under Section 202(a) of the CAA. Under the Endangerment Finding, EPA determines that the current and projected concentrations of the six key well-mixed GHGs (carbon dioxide [CO_2], methane [CH_4], nitrous oxide [N_2O], perfluorocarbons [PFCs], hydrofluorocarbons [HFCs], and sulfur hexafluoride [SF_6]) in the

atmosphere threaten the public health and welfare of current and future generations. Under the Cause or Contribute Finding, EPA determines that the combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution that threatens public health and welfare.

On February 19, 2010, the Council on Environmental Quality (CEQ) issued draft NEPA guidance on the consideration of the effects of climate change and GHG emissions. This guidance advises federal agencies to consider opportunities to reduce GHG emissions caused by federal actions, adapt their actions to climate change impacts throughout the NEPA process, and address these issues in their agency NEPA procedures. Where applicable, the scope of the NEPA analysis should cover the GHG emission effects of a proposed action and alternatives and the relationship of climate change effects to a proposed action or alternatives.

State of Washington Greenhouse Gas Initiatives

In response to growing worldwide concerns, Washington State Governor Christine Gregoire issued Executive Order 07-02 in February 2007. The executive order established the following GHG reduction limits.

- Reduce emissions to 1990 levels by 2020, 25% below 1990 levels by 2035, and 50% below 1990 levels by 2050.
- Increase "green economy jobs" to 25,000. The term *green economy jobs* means the design, manufacture, marketing, and installation of equipment to support sustainable development both within and beyond Washington State.
- Reduce expenditures on fuel imported into Washington State by 20% by 2020.

The above GHG reduction goals apply state-wide, but they do not specify any requirements for local government agencies to implement measures to reduce emissions within their local jurisdictions. The GHG reduction goals established by Executive Order 07-02 were codified by RCW 70.235, which identifies the goals as "limits." The new law also adds a fourth requirement to decrease the annual per capita vehicle miles traveled 18% by 2020, 30% by 2035, and 50% by 2050.

Ecology has issued guidance for the State Environmental Policy Act (SEPA) reviews related to GHG emissions, for SEPA actions for which a local government agency is the SEPA lead agency. That guidance indicates all SEPA reviews must evaluate GHG emissions. The guidance presents a range of ways that local agencies could set significance thresholds and calculate GHG emissions and potentially mitigate those emissions. However, the guidance does not stipulate what GHG significance threshold must be used, nor does it specify what level of GHG emission reductions is required under SEPA. The guidance emphasizes those decisions must be made by the SEPA lead agency on a case-by-case basis.

In 2012, the Washington State Department of Commerce released an updated Washington State Energy Strategy (Washington State Department of Commerce 2012), which includes short- and long-term policy options to meet several emissions reduction goals. The Washington State Energy Strategy outlines strategies for meeting these goals in the categories of transportation efficiency, building efficiency, distributed energy and pricing.

Puget Sound Clean Air Agency GHG Guidance

In 2004, the PSCAA published its strategy document for climate change, entitled Roadmap for Climate Protection: Reducing Greenhouse Gas Emissions in Puget Sound (Puget Sound Clean Air Agency 2004). In this strategy document, PSCAA recommended a broad range of GHG reduction measures, including regional vehicle trip reduction, building energy efficiency improvements, solid waste reduction, forestry and agriculture practice improvements, and community education. This document also encouraged local municipalities to establish their own GHG reduction measures; however, it did not propose a SEPA significance threshold for GHG emissions, nor did it require local governments to impose future mitigation measures for future development projects for which the municipality is the SEPA lead agency. Regardless, this document illustrates the importance of local government actions to reduce GHG emissions.

Existing Air Quality Conditions

This section provides additional information of key air pollutants of concern, toxic air contaminants, and ambient air quality monitoring trends in the study area for the proposed project. The study area for this analysis is the metropolitan Puget Sound region. The proposed project would be located between the cities of Lynnwood and Bellevue. Air quality conditions in the study area provide a baseline for evaluating the impacts of the proposed project.

Air Pollutants of Concern

The following discussion describes the sources and environmental effects of key criteria pollutants (CO, ozone, and PM) considered in this analysis.

CO is a product of incomplete combustion generated by mobile sources, residential wood combustion, and industrial fuel-burning sources. CO is a concern related to on-road mobile sources because it is the pollutant emitted in the greatest quantity for which short-term health standards exist. CO is a pollutant whose impact is usually localized, and CO concentrations typically diminish within a short distance of roads. The highest ambient concentrations of CO usually occur near congested roadways and intersections during wintertime periods of air stagnation.

Ozone is a highly reactive form of oxygen created by an atmospheric chemical reaction of nitrogen oxides (NO_X) and reactive organic gases (ROG), both of which are emitted directly from industrial and mobile sources. Ozone problems tend to be regional in nature because the atmospheric chemical reactions that produce ozone occur over a period of time, and because, during the delay between emission and ozone formation, ozone precursors can be transported far from their

sources. Vehicles such as automobiles and trucks are some of the sources that produce ozone precursors.

PM is generated by industrial emissions, residential wood combustion, motor vehicle tailpipes, and fugitive dust from roadways and unpaved surfaces. When first regulated, particle pollution was based on "total suspended particulate," which included all size fractions. As sampling technology has improved and the importance of particle size and chemical composition has become clearer, ambient standards have been revised to focus on the size fractions thought to be most dangerous to people. At present, there are standards for PM10 and PM2.5, because these sizes of particulate contribute the most to human health effects, regional haze, and acid deposition. The highest ambient concentrations generally occur near the emissions sources, which in the vicinity of the proposed project area would be motor vehicle tailpipes from I-5 and major roads. PM2.5 has a greater impact than PM10 at locations far from the emitting source, because it remains suspended in the atmosphere longer and travels farther.

Air Toxics and Hazardous Air Pollutants

Air toxics are pollutants that may result in an increase in mortality or serious illness, or that may pose a present or potential hazard to human health. Health effects of air toxics include cancer, birth defects, neurological damage, damage to the body's natural defense system, and diseases that lead to death. The CAA identifies 188 air toxics, also known as hazardous air pollutants (HAPs). In its latest rule on the control of HAPs from mobile sources (Federal Register [FR], volume 72, page 8430), EPA identified a group of 93 compounds emitted from mobile sources that are listed in its Integrated Risk Information System (IRIS). From this list of 93 compounds, the EPA has identified seven as priority mobile source air toxics (MSATs). The high regulation priority of these seven MSATs was based on EPA's 1999 National Air Toxics Assessment (NATA).

- Acrolein
- Benzene
- 1,3-butadiene
- Diesel particulate matter/diesel exhaust organic gases
- Formaldehyde
- Naphthalene
- Polycyclic organic matter

Air Quality Monitoring and Trends

The existing air quality conditions in the proposed project area can be characterized by monitoring data collected in the region. PSCAA monitors criteria pollutant concentrations at several sites throughout Puget Sound. Table 2 summarizes data for criteria air pollutant levels from the

Table F.4-2. Ambient Air Quality Monitoring Data at the Seattle Beacon Hill South Monitoring Station

Pollutant Standards	2010	2011	2012
Ozone			
Maximum 1-hour concentration (ppm)	0.056	0.059	0.063
Maximum 8-hour concentration (ppm)	0.044	0.046	0.049
Number of days standard exceeded[a]			
NAAQS 8-hour (>0.075 ppm)	0	0	0
Carbon monoxide (CO)			
Maximum 1-hour concentration (ppm)	1.2	1	1
Maximum 8-hour concentration (ppm)	0.8	0.9	0.7
Number of days standard exceeded[a]			
NAAQS 1-hour (≥35 ppm)	0	0	0
NAAQS 8-hour (≥9 ppm)	0	0	0

Source: U.S. Environmental Protection Agency 2012b.

[a] An exceedance is not necessarily a violation.

NAAQS = national ambient air quality standards; ppm = parts per million.

Seattle Beacon Hill South monitoring station. Air quality concentrations are expressed in terms of parts per million (ppm) or micrograms per cubic meter (µg/m3). The last 3 years (2010–2012) of data collected at the minoring station indicated that pollutant concentrations have not exceeded the NAAQS.

Air Quality Analysis Methods

This section discusses the approach and methods used to quantify construction and operational emissions associated with the proposed project.

Construction

Criteria Pollutants

Criteria pollutants associated with the construction phase of the proposed project would result from the exhaust emissions of on-road and off-road vehicles and construction equipment, as well as the particulate matter released into the local air shed from dust from earthmoving activities and diesel combustion. To be consistent with the methodology used in calculating construction-related criteria pollutants in the *East Link Project Final Environmental Impact Statement* (*East Link Project Final EIS)* (Sound Transit 2011) and due to the lack of specific construction equipment and phasing information, the *Road Construction Emissions Model Version 7.1.2,* which was developed by the Sacramento Air Quality Management District (SAQMD)(2012) was used to model construction emissions. Although the model is specifically designed for roadway construction, the model provides a description of the potential magnitude of construction emissions.

Available project data from the construction consultants included specific information about the disturbed surface area, the quantity of cut-and-fill material, and the construction duration period for each alternative. The model's defaults were used for the number and types of project construction equipment needed, the number of construction workers commuting to the job sites, and the length of their commute. The overall period from start of construction and operation of the proposed project was assumed to range between 34 and 45 months, or approximately 3 to 4 years.

Greenhouse Gas Emissions

GHGs associated with the construction phase of the proposed project use the same methods as for a prototypical Sound Transit maintenance facility analyzed in the *East Link Project Final EIS* (Sound Transit 2011). In large-scale construction projects, the major sources of GHG emissions are fossil-fueled construction equipment (mobile and stationary). The amount of GHG emissions produced by fossil-fueled construction equipment is directly proportional to the quantity of fuel used. It was conservatively assumed that all of the fossil fuel used during construction would be diesel. The CO_2e factor for diesel used in the analysis is from The Climate Registry's default emission factors (The Climate Registry 2012).

The construction fuel usage is taken from estimates for a similar maintenance facility modeled for the East Link project. These estimates consisted of fuel used in the transport of construction materials, waste, and fill material for the Sound Transit maintenance facility. The estimated material use for the maintenance yards, buildings, elevated guideways and/or lead tracks, and storage tracks as well as associated transport fuel use was originally provided by Douglas King of Sound Transit as part of the East Link analysis (Hale pers. comm.). The original calculations used for the East Link analysis were scaled by the square footage of the maintenance yards (paved areas) and buildings to reflect the different areas for each of the four build alternatives.

To simplify reporting and analysis, methods have been set forth to describe emissions of GHGs in terms of a single gas. The most commonly accepted method to compare GHG emissions is the global warming potential (GWP) methodology defined in the Intergovernmental Panel on Climate Change (IPCC) (1996 and 2001) reference documents. The IPCC defines the GWP of various GHG emissions on a normalized scale that recasts all GHG emissions in terms of CO_2 equivalent (CO_2e), which compares the gas in question to that of the same mass of CO_2 (CO_2 has a GWP of 1 by definition). GHG emissions generated by construction were translated to CO_2e using the GWPs presented in Table 3.

Operational Emissions

The two primary sources of operational emissions associated with the proposed project include energy consumption (natural gas and electricity) and vehicle trips. Because the differences in alternatives are mainly in project siting and the Forest Street OMF is used as a proxy for all alternatives[1].

[1] The operational activities for all of the build alternatives are assumed to be similar to those at the Forest Street OMF. No vehicle painting would occur at the proposed OMSF.

Table F.4-3. Lifetimes and Global Warming Potentials of CO_2, CH_4, N_2O, and SF_6

Greenhouse Gases	Global Warming Potential (100 years)	Lifetime (years)	2005 Atmospheric Abundance
CO_2 (ppm)[a]	1	50–200	379
CH_4 (ppb)	21	9–15	1,774
N_2O (ppb)	310	120	319
SF_6 (ppt)[a]	23,900	5.6	5.6

Source: Intergovernmental Panel on Climate Change 1996, 2001.
ppm = parts per million by volume; ppb = parts per billion by volume; ppt = parts per trillion by volume.

Natural gas emissions were calculated by applying natural gas combustion emission factors (pounds of pollutant per therm) for small boilers and residential space and water heaters.[2] The natural gas GHG emission factors were from the Climate Registry 2012 default emission factors (Climate Registry 2012: Tables 12.1 and 12.9). Natural gas criteria pollutant factors were from EPA's AP42, Fifth Edition, Chapter 1.4 (U.S. Environmental Protection Agency 1998).

Indirect CO_2 emissions from electricity were calculated by applying utility-specific emission factors (pounds per kilowatt-hours [kWh]) for the Snohomish County Public Utilities District (SnoPUD) and Puget Sound Energy (PSE) to the annual kWh consumed for operations at the Forest Street OMF, which is being used as a proxy for the OMSF Project (Burrell pers. comm.). It was assumed SnoPUD would provide electricity for the Lynnwood Alternative and PSE would provide electricity for the BNSF Alternative, BNSF Modified Alternative, and SR 520 Alternative. Emission factor data for CH_4 and N_2O were not available for SnoPUD or PSE. Accordingly, average GHG emission factors for EPA's eGrid Western Electric Coordinating Council (WECC) Northwest Power Pool (NWPP) subregion were used to calculate CH_4 and N_2O emissions for all alternatives (U.S. Environmental Protection Agency 2012c). Criteria pollutants from electricity were not evaluated here due to the state and federal permitting requirements that already address and mitigate emissions from electricity generators themselves.

For GHG emissions from vehicle trips, the California Emissions Estimator Model (CalEEMod Version 2011.1.1), developed by Environ International Corporation and the South Coast Air Quality Management District (SCAQMD), was used to quantify these emissions. Although the vehicle trips are located in Washington State, the Seattle metropolitan area was modeled as the similarly urban San Francisco County within CalEEMod, as data from the Puget Sound Regional Council indicates the average worker commute for the Puget Sound Region is 12.8 miles (Puget Sound Regional Council 2007), which is consistent with the default trip length assumed by CalEEMod for San Francisco, which is 12.4 miles (South Coast Air Quality Management District 2011). The number of trips was provided by Appendix E.1, *Transportation Technical Report*, of the Draft EIS, which assumed that the trip rate did not change between the BNSF Alternative, BNSF Modified Alternative, and SR 520

[2]Sources of natural gas used at the Forest Street OMF include the hot water pressure washers, hot water heater, boilers for office heat, an air handling unit, and gas overhead heaters. No quantities were provided as to the amount of natural gas used per source. It was assumed, using AP42 categories that the natural gas emission factors would reflect 50% small boilers and 50% residential heaters, based on the provided description of natural gas combustors.

Alternative. Table 4 summarizes the estimated energy and vehicle trip data for the proposed project, as well as corresponding emissions.

Table F.4-4. Annual Operational Criteria Pollutant and GHG Emissions Common to all Alternatives

			Annual Emissions (lbs/day)					
OMSF Operations	**Unit**	**Value**	**ROG**	**NO_X**	**CO**	**PM10**	**PM2.5**	**CO_2e**
Natural Gas[a]	Therms/yr	60,673 65,830	0.09	1.61	1.40	0.13	-	322
Electricity (Lynnwood Alternative)	kWh/yr	8,416,274	-	-	-	-	-	399
Electricity (BNSF Alternative BNSF Modified Alternative, and SR 520 Alternative)	kWh/yr	8,416,274	-	-	-	-	-	3,287
Vehicle Trips (Lynnwood Alternative)[b]	Trips/day	650	1.33	2.12	9.43	5.19	0.24	540
Vehicle Trips (BNSF Alternative BNSF Modified Alternative, and SR 520 Alternative)[b]	Trips/day	570	1.46	2.33	10.36	5.71	0.26	593
Total (Lynnwood Alternative)[c]			**1.42**	**3.73**	**10.83**	**5.32**	**0.24**	**1,261**
Total (BNSF Alternative BNSF Modified Alternative, and SR 520 Alternative)[c]			**1.55**	**3.94**	**11.76**	**5.84**	**0.26**	**4,202**

Sources: Sound Transit 2012; United States Environmental Protection Agency 1998; South Coast Air Quality Management District 2011.

lbs/day = pounds per day; kWh/yr = kilowatt hours per year.

[a] 65,830 assumed for Lynnwood Alternative (includes BNSF Storage Tracks) and 60,673assumed for all other build alternatives. Assumes 50% of therms are used in uncontrolled small boilers and 50% used as uncontrolled "residential heating" to be conservative. Emission factors from EPA AP42 Tables 1.4-1 and 1.4-

[b] Assume vehicle mix is equal to that of the Unrefrigerated Rail-Warehouse land use category in CalEEMod.

[c] Criteria pollutants from electricity were not evaluated due to state and federal permitting requirements that already address and mitigate emissions from power producers throughout the state. Volatile organic compound emissions from evaporative loses were not quantified due to lack of data.

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