

MEMORANDUM

DATE: November 5, 2018
TO: Chris Ford, Metro
FROM: Heather Wills
SUBJECT: Analysis to Support LUFO Findings
PROJECT NAME: Southwest Corridor Light Rail Project

Purpose of Memorandum

This memorandum has been prepared to provide additional information and environmental analysis to support the Southwest Corridor Light Rail Project Land Use Final Order (LUFO) findings. The design for the Southwest Corridor Light Rail Project is at approximately 5%. The estimates in this memo could change based on additional analysis of impacts, geotech and further public engagement.

Determination of Draft EIS Topics Requiring Further Analysis for LUFO

Based on an independent evaluation conducted by Angelo Planning Group in September 2018, and through incorporating comments received from partner agencies, the following topics needed additional analysis to support the forthcoming LUFO findings:

- Transportation
- Economics
- Historic and Archaeological Resources
- Parks and Recreation
- Geology, Soils and Hydrogeology (Natural Hazards Mitigation)
- Ecosystem and Water Resources
- Noise and Vibration
- Stormwater Runoff (being addressed by Metro)

This memorandum provides additional analysis for each of these resource categories.

Brief Description of Design Refinements

Three design refinements are being recommended for consideration in the Preferred Alternative and were identified as part of the Initial Route Proposal in the Draft EIS.

- *Design Refinement 4: Barbur Undercrossing*

This design refinement avoids the need for a long curved aerial light rail guideway over Interstate 5 (I-5) and SW Barbur Boulevard by running along the side of SW Barbur Boulevard/Pacific Highway before turning south to connect with SW 70th Avenue. Starting from the 53rd Station, this alignment would be constructed between SW Barbur Boulevard and I-5 and then would travel west across I-5 on a new aerial guideway structure that would descend into the space between the I-5 off-ramp and southbound

SW Barbur Boulevard. The alignment would then cross under SW Barbur Boulevard to transition to the southeast side the roadway just west of SW 65th Avenue. The alignment would run along the southeast side of SW Barbur Boulevard/Pacific Highway (99W) before climbing again to cross on an aerial guideway over SW 68th Parkway and turning south. The alignment would then connect to SW 70th Avenue where it would tie in to the Segment C alignment alternatives. This design refinement could shift the Clinton Station and Park and Ride (in Segment C) north to a station at SW 68th Parkway just south of Pacific Highway.

- *Design Refinement 5: Elmhurst*

This design refinement alignment would turn west from SW 70th Avenue at SW Elmhurst Street instead of turning west farther south at SW Beveland Street to cross over Highway 217. This would shorten the curve and reduce the length of light rail guideway to be constructed. This design refinement would also substantially reduce the number of partial property acquisitions between SW 70th Avenue and Highway 217.

- *Design Refinement 6: Tigard Transit Center Station East of Hall*

This design refinement would shorten the length of the light rail alignment near downtown Tigard by not crossing SW Hall Boulevard. The exact location of the design refinement alignment in this area has not been defined but would be somewhere between SW Hall Boulevard and the Hunziker operations and maintenance (O&M) facility site (Figure E-7 illustrates the outer bounds of the potential alignment). On the westernmost side, the alignment would turn south after crossing Highway 217 to cross SW Hunziker Street at SW Knoll Drive, then run along the southeast side of SW Hall Boulevard. At the Westside Express Service (WES) Commuter Rail and freight rail tracks, the alignment would turn south to rejoin Alternative C1. The easternmost location of the alignment would cross SW Hunziker Street farther east, then run along the west edge of the Hunziker O&M facility site before turning south to rejoin Alternative C1. This would result in a different configuration and site location (farther southeast) for the O&M facility. Regardless of the exact alignment location, this design refinement would shift the light rail station and the Tigard Transit Center Park and Ride south of SW Hall Boulevard.

Analysis

1. Acquisitions, Displacements and Relocations

a) Segment C with design refinements

The Draft EIS included estimates for residential and business full and partial parcel acquisitions for Segment C without the design refinements. Estimates for acquisitions related to the LUFO Segment C that includes the design refinements were estimated to support the LUFO application. These estimates are based on a Geographic Information System analysis and could change as the design progresses during steps leading up to a Final EIS.

Based on current designs, Segment C with design refinements would result in full acquisition of approximately 30 commercial and industrial parcels and 8 single-family residences. The multi-family residences that were impacted by Segment C in the Draft EIS are no longer impacted. Currently, there are an estimated 45 partial parcel acquisitions of commercial and industrial parcels and one partial single-family residence.

2. Transportation

a) Additional analysis of traffic queueing and delay

The Draft EIS and the Transportation Impacts Results Report included queueing analysis for the Upper Boones Ferry area based on a SimTraffic analysis. The AM peak analysis focused on queueing at intersections near the I-5 interchange, and the PM peak analysis included a larger area to the west and included the Upper Boones Ferry Road/Durham Road intersection. The Draft EIS evaluated six alternatives, and those with the most potential for traffic impacts were the four alternatives that included a 600-space park and ride south of Upper Boones Ferry

Road behind Burgerville (Alternatives C1, C3, C5 and C6). The other two alternatives included a 50-space park and ride near the railroad tracks.

The Draft EIS did not analyze the potential for queues blocking the light rail crossing at Bonita Road. Potential mitigation for queuing impacts described in the Draft EIS included managing queues with traffic signal preemption and timing, or grade-separating the light rail crossing over SW Upper Boones Ferry Road.

b) Address concerns related to the light rail crossing at Hunziker and proximity to existing WES

The proposed light rail crossing on SW Hunziker Street and its proximity to the existing WES crossing at SW Hall/SW Commercial was raised as a concern. Specifically, there is concern that having two independent crossings in close proximity creates additional complications and risk; it will be necessary to ensure the roadway network and system can adequately accommodate the traffic implication of a dual demand (i.e., both trains at once) scenario.

This issue will be further analyzed in the Final EIS, but possible mitigation for this potential impact includes:

- Ensure that the gate down time on both crossings is set at minimum allowable
- Use signage to direct some traffic to alternative routes in order to reduce volumes on SW Hall Boulevard and SW Hunziker Street
- TriMet should coordinate schedules on both WES and Southwest Corridor light rail to minimize the risk of simultaneous or back-to-back gate-down events

c) Address concerns that traffic modeling appears to show less congestion than documented by field observation

The Draft EIS traffic modeling used Highway Capacity Manual (HCM), Synchro and SimTraffic tools to analyze intersection operations and queuing in the Upper Boones Ferry/Carman Drive interchange area.¹ The project team used traffic counts and field observations on several days to calibrate the models to match existing conditions. These modeling tools have some limitations and, in this instance, they seemed to understate some traffic operation impacts as expressed by concerns from project partners. The underestimation in the model can be addressed with further calibration as described below. Modifications to the design can be adjusted as the project progresses to ensure congested conditions are not exacerbated by the project.

Subsequent to publication of the Draft EIS, project partners have continued to work closely with the project design team in preparing the detailed Vissim model which is a model to assist in realistically simulating and balancing roadway capacity as well as traffic and transport demand. The project team and partners will ensure that the existing conditions shown in the Vissim model match current traffic volumes, field observations and Bluetooth data which provide the basis for model calibration. This collaborative process with the project partners and project design team will ensure that the calibration is prepared consistent with the Oregon Department of Transportation's (ODOT) Vissim Protocols and local jurisdiction expectations. Design decisions at Upper Boones Ferry/Carman Drive interchange will be made based on the updated model, and results will be presented in the Final EIS.

d) Neighborhood circulation

The Initial Route Proposal would operate light rail down the center of SW Barbur Boulevard between SW Hooker Street and in the vicinity of the Barbur Transit Center. Operating light rail in the center of SW Barbur Boulevard would include new traffic signals at nine unsignalized, local street intersections with SW Barbur Boulevard (between Hooker and the Barbur Transit Center), and other local street intersections would be limited to right-in/right-out movements (see attached figure). In some locations (SW Bancroft Street, SW 2nd Avenue, SW 13th Avenue and SW Multnomah Boulevard), these existing unsignalized local street intersections only allow right turns. A traffic signal at these locations would improve the available turning options and increase safety for

¹ HCM, Synchro and SimTraffic are widely accepted traffic modeling tools for use to support NEPA analysis and are identified as appropriate tools in ODOT's Analysis Procedures Manual, Version 2, July 2018.

vehicles turning from local streets onto SW Barbur Boulevard. At other locations, where both left and right turns are permitted from a stop-controlled local street, the new traffic signals would improve safety for vehicles turning from local streets onto SW Barbur Boulevard.

A few stop-controlled side streets would lose the ability to make a left turn onto SW Barbur Boulevard. These vehicles could choose to turn right onto SW Barbur Boulevard and make a U-turn at the next signalized intersection or change their route on local streets within the neighborhood to access SW Barbur Boulevard at a traffic signal. These movements through the neighborhood would increase traffic on local streets. A more detailed analysis of the potential increase in local street traffic will be conducted, and additional traffic mitigation will be proposed to discourage cut through traffic on local streets.

This mix of new signalized intersections and limiting some existing intersections to right-in/right-out movements would likely modify traffic patterns within neighborhoods adjacent to SW Barbur Boulevard. The magnitude of circulation changes can be addressed by conducting a circulation study at locations where these movements may increase. Potential mitigation measures to reduce increased neighborhood cut-through traffic include directional signage, speed humps, traffic diverters, road closures, traffic circles, and potentially providing a monitoring program to understand before and after volumes or parking resulting from the new light rail.

In addition to the parking impacts described in the DEIS, Design Refinement 5 could eliminate up to 10 on-street parking spaces on SW Elmhurst Street between SW 70th Avenue and SW 72nd Avenue. The current design would displace properties on the south side of the street and the replacement roadway design does not include on-street parking.

3. Economics

a) Additional analysis of Hunziker Industrial Area

The Hunziker Industrial Area in this analysis is defined as the industrial area in Tigard bordered on the north by SW Hunziker Street, on the west by SW Hall Boulevard, on the south by the WES Commuter Rail tracks and freight rail yards, and to the east by SW Wall Street. The analysis of this area does not include properties west of SW Hall Boulevard or north of SW Hunziker Street.

Freight access

Currently freight movements to the Hunziker Industrial Area are generally taken from SW Hall Boulevard and SW Hunziker Street, connecting to smaller local roads or private access roads. This access would not change with the design refinements. The alignment would run alongside SW Commercial Street for a short distance and cross SW Commercial and SW Hunziker at grade in one location on each road. These at-grade crossings would result in traffic stopping temporarily when light rail vehicles are crossing, but they are not expected to result in substantial delays and would not change freight routes or access.

b) Additional analysis of Tigard Triangle zoning

Two zoning districts exist with the Tigard Triangle: Commercial General and Triangle Mixed Use. Triangle Mixed Use is a zoning designation (and comprehensive plan designation) specific to Tigard Triangle. As part of establishing a Tigard Triangle Plan District, the Tigard City Council voted in December 2017 to rezone most of the land in the Triangle “to accelerate pedestrian-friendly, mixed-use development.”²

The Tigard Triangle Plan District outlines new circulation that includes adding streets that are missing in the grid, adding trails, and specifying the addition of bike lanes to many roads. The Plan District and the circulation map for this area note (Tigard Triangle Plan District Section 18.660.090) that transit is to be improved within the Triangle area, but they do not specify light rail or the Southwest Corridor project. However, by adding transit stops within the area, the Southwest Corridor project would be highly complementary to the pedestrian-oriented mixed-use

² See http://www.tigard-or.gov/tigard_triangle.php; Tigard Comprehensive Plan, Chapter 18.666; and http://www.tigard-or.gov/Projects/TigardTriangle/TT_LeanCode_approved.pdf

development proposed for the Tigard Triangle Plan District and would be compatible with both the Commercial General and Triangle Mixed Use zoning within the Triangle.

c) Analysis of design refinements

Business Effects

Design Refinement 4

Design Refinement 4 would displace several businesses along 99W and SW 68th Avenue including service, retail commercial and automotive businesses. It is estimated that two businesses would be displaced in Portland with approximately 46 employees, and four in Tigard with approximately 67 employees.

Design Refinement 5

Design Refinement 5 would require partial parcel acquisition of a Walmart store, though it appears that this acquisition would primarily be in an undeveloped portion of the parcel and would avoid impacts to the building and loading and parking areas. No other effects to commercial properties are anticipated under Design Refinement 5, and no displacement of businesses or employees would occur.

Design Refinement 6

Design Refinement 6 would continue access to businesses in the Hunziker Industrial Area via the major freight access route on SW Hall Boulevard. This refinement would require full and partial parcel acquisitions of industrial parcels within the Hunziker Industrial Area. It is estimated that 11 businesses (approximately 518 employees) would be displaced in the Hunziker Industrial Area.

One option for this refinement would replace a rail spur that runs parallel to and east of SW Hall Boulevard and into the Hunziker Industrial Area. This could reduce rail freight access into the area, though it is not known how much this rail spur is presently used for freight.

Tax Revenue

Tax revenue for property taxes is divided among several entities in the City of Portland and City of Tigard. These entities include school districts, fire districts, water and sewer districts and the cities where the property tax is levied. The total losses described below are the total property tax loss for the parcel, but not the revenue loss for each city. Each of the cities receives a percent of property tax for different programs and bonds.

For the likely parcel acquisitions in Portland/Multnomah County, property tax revenues are currently allocated as follows (approximately):

Portland School District	32.4 percent
City of Portland	29.6 percent
Multnomah County	21.2 percent
Urban Renewal	10.4 percent
Other districts (educational, Port of Portland, Metro, etc.)	6.4 percent

For the likely parcel acquisitions in Tigard/Washington County, property tax revenues are currently allocated as follows (approximately):

Tigard/Tualatin School District	44.1 percent
Other districts (fire/rescue, educational, Port of Portland, Metro, etc.)	25.4 percent
City of Tigard	17.1 percent
Washington County	13.3 percent

Design Refinement 4

Design Refinement 4 would result in the full acquisition of approximately 10 parcels on the west side of SW Barbur Boulevard, south of SW Dickinson Street, that are currently vacant or being used for mixed commercial uses including retail, office and service. This refinement would also result in the full acquisition of approximately 15 parcels currently used for business purposes along 99W and SW 68th Avenue, including service, retail, commercial and automotive businesses. Property tax revenues would decrease in the near term for properties within the area that would be partially or fully converted to light rail use. It is estimated that the loss of property tax for parcels in Portland would be approximately \$80,931 annually and the loss for parcels in Tigard would be \$144,586 annually. Because Portland also assesses a payroll tax, it is estimated that this refinement would result in an additional \$12,135 of annual tax losses if these businesses did not relocate within the City of Portland. Decreases in revenue could be partially offset over time through the sale of remnant parcels that could be used for new commercial and mixed-use buildings and land uses.

Design Refinement 5

Design Refinement 5 would result in full and partial acquisitions of 11 parcels containing single-family homes along SW Elmhurst Street and SW Hermoso Way, which would likely permanently reduce local property tax revenues. Property tax revenues would decrease in the near term for properties within the area that would be partially or fully converted to light rail use. Full acquisitions of parcels in Tigard would result in an estimated annual loss in property tax of \$40,177. This decrease in revenue could be partially offset over time through the sale of remnant parcels that could be used for new development.

Design Refinement 6

Design Refinement 6 would result in the partial parcel acquisition of light industrial uses and full acquisition of 11 larger industrial parcels between SW Hall Boulevard and SW Wall Street, south of SW Hunziker Street. Property tax revenues for parcels in Tigard would decrease by approximately \$180,466 annually in the near term for properties within the area that would be fully converted to light rail use. This decrease in revenue could be partially offset over time through the sale of remnant parcels that could be used for new commercial buildings and land uses.

d) Additional mitigation

Existing mitigation measures in the Draft EIS for economic impacts would apply for any impacts related to the design refinements. No additional mitigation measures are required.

4. Historic and Archaeological Resources

a) Analysis of design refinements

Design Refinements 4, 5 and 6 were evaluated for potential impacts to historic and archaeological resources and of 29 potential resources, only 2 were found to be potential historic resources:

- Oregon Education Association building (6900 Atlanta Street, Tigard) – The design refinements would result in demolition of one structure, constructed in 1968, that is potentially eligible for listing in the National Register of Historic Places (NRHP).
- Portland Community College Sylvania Campus (11900 SW 49th Avenue, Portland) – The design refinements would result in encroachment of a parking lot at the PCC Sylvania Campus. This campus was first constructed in 1968 and has not yet been determined if it is potentially an NRHP-eligible historic district. Based on a recent evaluation, it was found that while some of the 1968 buildings may be individually eligible for listing in the NRHP, the campus has limited potential to represent a significant historic district. Even were it determined to be a historic district in the future, it is unlikely that this parking lot would be considered a contributing element. Therefore, because the design refinements would not affect these structures, it is not considered likely that there would be impacts to a historic resource at the PCC Sylvania Campus.

Additionally, questions were raised regarding the Barbur Transit Center and its status on the City of Portland's Historic Resources Inventory (HRI). An important clarification is that buildings in the HRI are not automatically considered potentially eligible for listing in the National Register for Historic Places (NRHP). The HRI inventory was completed almost 35 years ago and has likely not been updated since. Evaluation of a building's historic significance needs to be updated every 5 to 10 years to bring it in line with its current context and integrity. The HRI should be seen as a guide to start a survey because it pinpoints what surveyors evaluated over 30 years ago. Checking the HRI and other previous documentation was one of the first steps for the project.

The Barbur Transit Center (circa 1976) and the Under Armor building (1977) were less than 10 years old when the HRI was conducted. It is unclear why these buildings were included because buildings must usually be 50 years in age or older to be historically significant. Consequently, these buildings were not included in the project survey because they did not meet the age threshold (constructed in or before 1970) and were not otherwise of merit. It is unlikely that either building will meet minimum qualifications to be considered eligible for listing in the NRHP.

b) Additional mitigation, if required

Existing mitigation measures in the Draft EIS for historic resources would apply to any impacts associated with the design refinements. No additional mitigation is necessary.

5. Parks and Recreation

a) Additional discussion of impacts to parks and recreation facilities and mitigation measures

As described in the Draft EIS, specific mitigation for parks and recreation impacts will be determined through coordination with park owners and will vary by property depending on the level of impacts. Impacts to parks would be mitigated through the enhancement of existing park features, such as replacement of fencing, improvement of park paths and access, and planting trees and shrubs to replace impacted vegetation.

All four Marquam Hill Connection Options would have impacts to both undeveloped park areas and active recreation facilities. Impacts to undeveloped park areas vary, depending on the connection option. During construction, Connections 1A and 1B would impact between 0.68 and 0.88 acre of Terwilliger Parkway land area and would have permanent aboveground infrastructure through the park. Replanting temporarily disturbed areas with native plants is required by the City of Portland for the removal of native forested habitat that characterizes the Terwilliger Parkway. See the Ecosystems and Water Resources section for specific tree mitigation details. In addition to reforestation of disturbed areas, additional mitigation for permanent impacts could enhance the natural setting, such as interpretive signage identifying the native flora and/or the history of Terwilliger Parkway, or through designing and planting focused areas that highlight the native forest.

During construction, Connection Options 1C and 2 would each impact a larger area totaling 1.19 acres, but they would both incorporate a tunnel through the park, so permanent aboveground features would be less visible than the aboveground infrastructure in Connection Options 1A and 1B. As noted, mitigation for removal of native forested habitat would be required by the City of Portland. Mitigation for the impacts to the parkland could be similar as that proposed for Connection Options 1A and 1B, including interpretive signage and aesthetically designed native tree and shrub plantings.

The recreation facility impacts for all four connection options would temporarily displace between 35 feet (for Option 1A) and 55 feet (for Options 1B, 1C, and 2) of the paved, approximately 6-foot-wide sidewalk used as part of the Terwilliger Parkway Trail. Mitigation for this impact could include temporary rerouting of the trail to maintain the trail connection during construction, then replacing the sidewalk with an improved facility with trail amenities such as benches or wayfinding signs.

Final mitigation commitments would be developed in coordination with the City of Portland and Oregon State Historic Preservation Office (SHPO). TriMet and Metro may coordinate with additional interested parties including Friends of Terwilliger to determine mitigation. Additionally, public participation is required to help define impacts and develop mitigation.

b) Analysis of Design Refinements

Design Refinements 4, 5, and 6 would result in no change to the impacts to parks and recreation.

c) Additional mitigation measures, if required

No additional parks and recreation mitigation measures are necessary for Design Refinements 4, 5, or 6.

6. Geology, Soils and Hydrogeology (Natural Hazards Mitigation)

a) Additional description of BMPs and engineering practices

Standard geotechnical engineering practices, which are requirements for natural hazard mitigation, and best management practices (BMPs), which are above and beyond requirements, would be used for construction of the Southwest Corridor Light Rail Project. According to Section 00721 of the TriMet General Provisions, new construction must be designed and constructed in accordance with the standards for seismic safety detailed in the U.S. Department of Transportation Seismic Safety Regulations (49 CFR Part 41). Meeting these standards ensures that engineered bridges and structures for both light rail and road facilities will withstand a major seismic event. Examples of BMPs that could be employed include:

- Avoid areas with unstable soils and/or excavate and replace remaining unstable soils with engineered fill.
- Evaluate the use of stabilizing soils or supporting structures on potentially unstable soils, such as using mat foundations or other forms of mechanical foundations.
- Use deep foundation systems (such as driven or drilled piles and large-diameter drilled shafts) for abutments and bents in areas with unstable soils.
- Use light fill structural materials (such as geofoam or low-density cellular concrete) to reduce weight loading of foundations, retaining walls, and slopes in areas with historical landslides or unstable soils and slopes.
- Where cut walls are proposed in areas with unstable soils or slopes, use a more robust wall support method such as cantilevered retaining walls or soldier pile walls with tie-backs.
- Establish erosion and slope stability controls during construction through the implementation of erosion and sediment control plans and grading permits that adhere to the ODOT Construction Project Pollution Control Manual.

b) Additional floodplain analysis in Hunziker Area*Mapped Floodplains*

Potential impacts to mapped floodplains are associated with alignments in Tigard and construction of an the Hunziker O&M facility. Development within the floodway and 100-year floodplain is regulated locally by the City of Tigard Community Development Code (CDC) and federally by Executive Order (EO) 11988. The alternatives being considered would require crossing and being adjacent to Red Rock Creek and associated floodplains. Therefore, detailed analysis to identify the boundaries of the floodway and floodplain are being conducted.

The actions are proposed in areas that are mapped locally as special flood hazard areas and sensitive lands. If the ground disturbance or land alteration occurs within a floodway or floodplain, then a Type 3 land use process would be required, which specifies consideration and approval by a hearings officer. In addition, if the proposed Hunziker O&M facility were classified as a critical facility due to its likely use of hazardous materials (Tigard CDC 18.510.040(P)), this designation would require that additional floodproofing and other design criteria be implemented to avoid hazardous materials releases during flood events. This classification requires that development occurs in accordance with Tigard CDC 18.510.070, including the maintenance of a zero-foot rise in the floodway and no rise in the water surface elevation in the floodplain. During final design, specific measures would be incorporated into the design to meet these City criteria and to avoid changing flood levels or causing hazardous material releases.

If an increase, decrease, or other change in the base flood elevation occurs through additional analysis, a Federal Emergency Management Agency (FEMA) Letter of Map Amendment will likely be required to accurately describe the floodplain in the area.

Red Rock Creek Flood and Stream Restoration Projects

The project will coordinate with the City of Tigard to design a project that supports proposed Red Rock Creek flood and stream restoration plans. Of the 18 ranked projects in the City's stormwater master plan that were identified to alleviate flooding, erosion, and sedimentation issues, 6 involved the Red Rock Creek drainage. These extend from where the stream enters the City of Tigard to its confluence with Fanno Creek. During future design phases, detailed analysis of impacts to the floodplains at these sites would include an analysis of the areas upstream and downstream. It is possible that stream and hydraulic improvement projects upstream of the Southwest Corridor sites might help alleviate downstream flooding. Therefore, a holistic approach to the system would be analyzed, including the potential for construction of a regional stormwater facility by Clean Water Services (CWS).

c) Additional mitigation measures

No additional mitigation measures are necessary.

7. Ecosystems and Water Resources**a) Applicable federal permit terms and conditions**

The Southwest Corridor Light Rail Project would require approval from several federal natural resources agencies, including the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and the U.S. Army Corps of Engineers (USACE). NMFS and USFWS conditions for the project would be confirmed during the required Endangered Species Act consultation process that would occur in 2019 and be part of the Final EIS process. Likely terms and conditions would be the same as or similar to those in recent programmatic biological opinions such as Strategic Local Operating Procedures for Endangered Species for Stormwater, Transportation, and Utilities (SLOPES V – STU) (see Attachment A) and the Federal Aid Highway Project programmatic biological opinion. Each provides detailed terms and conditions on site isolation, in-water work, stormwater management, and site restoration. Each permit or approval would contain conditions that the project would follow during construction. These conditions would be finalized during the permitting processes in 2019 or 2020.

Permitting for impacts to the wetlands and other resources would occur after the Record of Decision. USACE terms and conditions for impacts to wetland and waterways would be formalized during the permitting process. Examples of terms and conditions that may be included are listed below:

1. Minimize and avoid impacts to migratory birds by conducting surveys prior to construction activities and isolating the area or potentially moving any nests.
2. Permanent and temporary crossings of waterbodies will be culverted, bridged or designed to maintain low flows to allow movement of aquatic species.
3. Fills within floodplains shall comply with applicable FEMA-approved state or local floodplain management requirements.
4. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date.
5. Temporary fill must be removed.

b) TriMet standards and best management practices

BMPs associated with existing construction specifications and standard natural resources protection measures associated with local, state, and federal regulation approvals would be used for the project. The following TriMet standard construction specifications are likely to be incorporated into the construction contracts.

- 01-74-19 Construction Waste Management and Disposal
- 31-11-00 Clearing and Grubbing
- 31-22-16.10 Floodplain Grading
- 31-37-00 Riprap
- 32-90-00 Planting
- 35-43-00 Waterway Scour Protection

However, the TriMet specifications would likely not encompass all the necessary natural resources protections. Additional special provisions would likely come from the ODOT construction specifications. For example, compliance with ODOT standard specifications and special provisions under 01030.42 Weed Control, 01040.75 Weed Control, and 01040.79 Plant Establishment would help control further infestation and spread of the existing populations. These specifications require the contractor to prepare a weed control work plan, remove and control weeds, and replant with native species. Other specifications require contractors to prepare plans and comply with contract language to protect water quality and natural resources, and limit exposure to hazardous materials. The following specification sections would likely be incorporated into contract documents:

- 00280 Erosion and Sediment Control
- 00290 Environmental Protection
- 01010 Stormwater Control
- 01030 Seeding
- 01030.42 Weed Control
- 01040 Planting
- 01040.75 Weed Control
- 01040.79 Plant Establishment

In addition, special provisions for construction would be tailored to the project to accommodate permit and approval requirements from the City of Portland, City of Tigard, CWS, NMFS, USFWS, and the Oregon Department of Fish and Wildlife, among others.

c) **Additional analysis**

Requirements for Tree Removal and Replacement

City of Portland

Tree removal on properties not within a City of Portland environmental overlay zone (Ezone) are subject to standards in the City's Title 11 Tree Code. The Tree Code addresses tree preservation and tree density associated with development in the following sections:

- Title 11.50.040 – Tree Preservation Standards
- Title 11.50.050 – Tree Density Standards
- Table 50-3 of COP Title 11.50 defines the number of required trees for mitigation

Therefore, design plans for the project would include locations for trees and plants that would provide the required coverage and number of trees to comply with the Tree Code.

Tree removal on properties within a City of Portland Ezone is regulated under Title 33.430. This requires replacement of trees and other vegetation as follows:

- All vegetation planted in a resource area is native and listed on the Portland Plant List.
- Plants listed on the Nuisance Plants List are prohibited.
- Tree replacement to occur as shown in Table 430-3 of COP Title 33.430.

City of Tigard

City of Tigard natural resources site assessments will be required in accordance with the following development codes, primarily:

- CDC 18.510.130 – Significant Habitat Areas Map Verification Procedures
- CDC 18.510.070 – Sensitive Lands Application
- CDC 18.510.080 – Development within Locally Significant Wetlands
 - Examples of criteria that need to be met for significant wetlands include:
 - Any encroachment or change in on-site or off-site drainage that would adversely impact wetland characteristics have been mitigated by creating a new wetland or restoring or enhancing and existing wetland.
 - Where natural vegetation has been removed due to landform alteration or development, erosion control provisions of the Surface Water Management program of Washington County shall be met and areas not covered by structures or impervious surfaces will be replanted in like or similar species.

Clean Water Services

Applicable standards from CWS Design and Construction Standards (Resolution and Order 17-05) are listed below:

- Chapter 3 .03 – Vegetated Corridors
- Chapter 3.06 – General Requirements for Development Activities
- Chapter 3.08 – Replacement Mitigation Standards
- Chapter 3.14 – Assessment Methodology

Fish Habitat and Passage

Based on additional coordination with project partners, Red Rock Creek is considered fish-bearing for cutthroat trout, at least up to the culvert under Highway 217 (pers. comm., Ben White, ODOT³). Therefore, fish passage would need to be maintained below this point. Although no ESA-listed fish are recorded as being present in this stretch of the stream, it is possible that they could be present. Typical impact minimization measures such as BMPs and permit terms and conditions, as discussed above, would be implemented to protect existing fish in Red Rock Creek.

Due to the amount of urbanization in the project area, substantial channelization and piping of natural watercourses has occurred over time. Mapping of the existing streams by multiple agencies sometimes results in an inaccurate count of watercourses along the corridor. The Draft EIS identified between 24 and 26 stream crossings under the alignments. These were identified through Geographic Information System analysis and remote mapping databases. After further investigations and coordination, it was found that 9 to 10 of the crossed streams within Segment A are piped into the City of Portland's combined sewer overflow (CSO) system. Therefore, while these 9 to 10 mapped streams could provide riparian habitats uphill of SW Barbur Boulevard, they do not provide passage from downstream as they are piped to the CSO system which leads to the City's Columbia Boulevard Wastewater Treatment Plant in north Portland.

Wildlife Corridors

Wildlife corridors are protected under the existing local land use codes associated with City of Portland Ezones, CWS vegetated corridors, and City of Tigard natural resource protection zones. Any impacts to wildlife corridors would be minimized and mitigated for in accordance with City of Portland Title 33, CWS Design Standards, and City of Tigard CDC 18.510, as well as through standard BMPs and permit terms and conditions.

Much of the habitat used by wildlife is currently within Ezones and vegetated corridors that are already identified for protection and enhancement through removal of non-native vegetation and planting of native shrubs and trees. In areas not contained within these regulated areas, the local jurisdictions' tree removal, replacement, and protection codes would mandate that native trees be protected or replaced at ratios identified elsewhere in the memo. Tree and shrub removal would only take place during non-nesting seasons to minimize potential impacts to nesting birds

As discussed in Section 5.a, all four Marquam Hill Connection Options would have impacts to undeveloped park areas, including native forested areas. Replanting temporarily disturbed areas with native plants is required by the City of Portland for the removal of native forested habitat that characterizes the Terwilliger Parkway. In concert with replanting with native vegetation, removal of invasive vegetation would likely increase suitability of the habitat for native wildlife.

Riparian corridors are most likely within locally regulated resource zones such as Ezone and vegetated corridors. These regulations mandate impact avoidance or minimization measures and mitigation through removal of non-native species and planting of native shrubs and trees. Additional impact avoidance and minimization measures would likely include the identification and demarcation of no-work zones, installation of erosion and sediment control measures, and restricting potential construction footprints to the smallest extent practicable. In coordination with local agencies, planting and in-stream flow detention could be implemented to increase habitat functions within Stephens Creek and Red Rock Creek and their associated riparian areas.

Wetlands and Riparian Corridors

Similar to wildlife corridors, riparian corridors are protected under the existing land use codes associated with City of Portland Ezones and CWS vegetated corridors. Impacts to riparian corridors would be minimized and mitigated for in accordance with City of Portland Title 33, CWS Design Standards 3.02, and City of Tigard CDC 18.510.

Mitigation, where required, would likely consist of removal of non-native vegetation and planting of native shrubs and trees. It is possible that through coordination with regulatory agencies, that mitigation measures could be

³ Ben White, ODOT Region 1 Biologist, phone call to Bill Hall, Parametrix Sr. Scientist, October 9, 2018.

implemented, including wildlife fences to direct wildlife away from collision hotspots, signing for motorists to be cautious of wildlife crossing the corridor, and selected habitat enhancement projects to provide targeted species with increased habitat functions. The latter measure could include retaining snags for use by insectivorous and cavity-nesting birds, planting native fruit- and seed-bearing trees for use by birds and mammals, and placing downed logs for use by salamanders and frogs.

Impacts to wetlands are regulated by Oregon Department of State Lands and USACE. Compensatory mitigation for impacts to wetlands and jurisdictional waters would be required for the light rail project and would include on-site or off-site mitigation via creation, enhancement, or restoration of wetlands, or payment into an established mitigation bank, if available.

d) Additional analysis of water quality effects

Stormwater associated with the project includes runoff from the project footprint itself, as well as runoff that enters the project site. The project team is working closely with the City of Portland, CWS, the City of Tigard, and NMFS to identify the appropriate stormwater management techniques to meet each jurisdiction's requirements to provide benefit for water quality and aquatic life. Each treatment technique would be tailored to its unique location. Such techniques could include filtration strips, vegetated ponds, detention ponds, bio-infiltration swales, and mechanical treatment. Stormwater management would address specific pollutants of concern, including dissolved metals and temperature. Habitat restoration requirements would focus on restoration of riparian corridors with trees and other vegetation designed to cool urban streams.

e) Analysis of design refinements

Design Refinement 4

Impacts associated with Design Refinement 4 include those within City of Portland Ezones and mapped vegetation. Impacts to the Ezone from the construction footprint encompass approximately 0.03 acre of conservation zone, while the potential impacts from a 50-foot construction buffer encompass approximately 0.59 acre of conservation zone and 0.09 acre of protection zone.

Potential impacts to mapped vegetation in Portland from Design Refinement 4 are shown in Table A below. In addition, Design Refinement 4 extends into Washington County. Potential impacts to mapped vegetation are shown in Table B. Design Refinement 4 does not appear to impact any mapped wetlands or floodplains.

Table A. Potential Impacts (acres) to Mapped Vegetation in the City of Portland from Design Refinement 4

Type	Forest Natural/ Semi-natural	Herbaceous Cultivated	Herbaceous Natural/ Semi-natural	Shrubland Cultivated	Woodland Cultivated	Total
Design Refinement 4 Buffer	2.95	0.21	1.10	0.00	1.36	5.62
Design Refinement 4 Footprint	0.68	0.06	0.52	0.00	0.55	1.80
Total Acres	3.63	0.27	1.61	0.00	1.91	7.42

**Table B. Potential Impacts (acres) to Mapped Vegetation in
Washington County from Design Refinement 4**

Type	CWS Vegetated Corridors
Design Refinement 4 Footprint	0.12
Design Refinement 4 Buffer	0.33

Total Acres	0.45
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Design Refinement 5

Impacts associated with the Design Refinement 5 footprint and construction buffer include those to vegetated corridors as shown in Table C. Design Refinement 5 does not appear to impact any mapped wetlands or floodplains.

Table C. Potential Impacts (acres) to Mapped Vegetation from Design Refinement 5

Type	CWS Vegetated Corridors
Design Refinement 5 Footprint	0.30
Design Refinement 5 Buffer	0.40
Total Acres	0.70

Design Refinement 6

Potential impacts associated with the Design Refinement 6 footprint and construction buffers include those to vegetated corridors, mapped wetlands, and mapped floodplains, as shown in Table D.

Table D. Potential Impacts (acres) to Mapped Vegetation, Wetlands and Floodplains from Design Refinement 6

Type	CWS Vegetated Corridors	Mapped Wetlands	Mapped Floodplains
Design Refinement 6 Footprint	1.49	1.50	0.66
Design Refinement 6 Buffer	4.25	0.31	2.36
Total Acres	5.74	1.81	3.02

f) Additional mitigation measures, if required

No additional mitigation measures are required. Mitigation measures from the Draft EIS related to impacts to wetlands, floodplains and vegetation removal would apply to the design refinements.

8. Noise and Vibration

a) Additional analysis based on comments

Additional analysis of the project was conducted to identify potential noise and vibration impacts related to the operation of park and ride facilities, and to provide more information related to several areas where new or revised noise mitigation may be required to solve potential traffic noise impacts related to the removal of shielding or revisions to roadways.

Transit Centers and Park and Ride

Future project noise levels were calculated for the Barbur and Tigard Transit Centers, along with park and rides at SW 53rd Avenue, SW 68th Parkway, SW Hall Boulevard, and Upper Boones Ferry Road/SW Carmen Drive. Park and rides at SW Bonita Road and Bridgeport Village do not have any noise-sensitive properties within 500 feet; therefore, no operational impacts are predicted at these facilities.

Barbur Transit Center

The Barbur Transit Center is located south and across SW Barbur Boulevard from the nearest sensitive properties. Given the distance between the receivers and the transit center and the existing noise levels in this area, impacts related to the planned improvements were not anticipated. To verify this assumption, the closest residences to the park and ride were evaluated for total transit noise impacts, which include noise from light rail operations, bus activity and station parking. Two multi-family structures just north of the existing transit center were evaluated, and it was found that the total noise at the nearest sensitive receivers was predicted to increase by 1 to 3 dBA⁴ over the existing levels. An increase of 1 to 3 dBA is typically not perceptible or barely perceptible to the majority of people. In addition, the total noise levels at these seven modeling sites, representing multiple apartments at different distances from the transit center range from 53 to 57 dBA Ldn, and all receivers are at least 7 dB below the Federal Transit Administration's (FTA) moderate impact criteria.

53rd Park and Ride

Like the Barbur Transit Center, all noise-sensitive receivers are located across SW Barbur Boulevard. The analysis for the two nearest receivers, located just south and east of the station, show that while there are increases of 2 to 3 dB in the total Ldn, which is barely perceptible, the total combined noise levels of 55 to 58 dBA Ldn are still well below the FTA impact criteria of 63 dBA Ldn for this area. Further analysis is needed once more design information is made available on facility layout, and could result in slight changes in the number and location of impacts; however, any impacts in this area could be mitigated using the same mitigation methods as described in the Draft EIS.

68th Avenue Park and Ride

There is currently only one noise and vibration sensitive property near the 68th Avenue Park and Ride, the Quality Inn Motel. As part of the project this hotel would be removed to accommodate the park and ride lot and facility. Therefore there are no noise or vibration sensitive properties near the station, and no impacts are predicted for the 68th Avenue Park and Ride.

SW Hall Boulevard Park and Ride

Compared to the Draft EIS, the SW Hall Boulevard Park and Ride to the south of Hall Boulevard is expected to reduce the overall number of noise and vibration impacts in the downtown Tigard area. There is a slight potential for noise impacts at some multi-family units located near the station, just north of SW Hall Boulevard and east of SW Commercial Street; however, the initial analysis did not identify any new noise or vibration impacts. The reduced noise impacts are due, in part, to the high existing noise levels from traffic along Hall Boulevard. In addition, the relocation of the bus layover to the new site south of Hall Boulevard, in a commercial area, removed a notable noise source from the single and multi-family residences located along SW Ash Avenue, further reducing the potential for noise impacts in this area.

Evaluation of Wheel Squeal Impacts

Wheel squeal is caused by the oscillation of the wheel-rail interface on curved sections of rail. Typical maximum noise levels associated with wheel squeal can range from 75 dBA to 90 dBA at 50 feet. The actual noise level depends on many factors, including the radius and condition of the tracks. During periods of continuous rain, the level of squeal can be dramatically reduced as water can act as a lubricant, allowing the wheels to slip, reducing or eliminating the squeal. For this review, all curves with a radius of 400 feet or less located in noise-sensitive areas were identified. Table E provides a summary of tight-radius curves with the potential for wheel squeal impacts and assumes the proposed Design Refinements 4, 5 and 6.

⁴ Decibal (dB) is a scale of sound level pressure. Measured noise for humans is dBA (decibals A-weighted) which better mimics the way the human ear hears sound. dB is used when discussing noise reduction or increases.

Table E. Tight-Radius Curves with the Potential for Wheel Squeal

Light Rail Segment	Location	Curve Radius (approximate in feet)
Segment A	SW Lincoln St. at SW 4th Ave.	110
Segment B	Center of Barbur Boulevard to Barbur Transit Center	400
	Entering Barbur Transit Center	236
Segment C	Corner from SW 70th Ave. to SW Elmhurst St.	86
	Corner from SW Hall Blvd. to SW Commercial St.	93
	Curve at transition from rail corridor to I-5 corridor	180

Mitigation for squeal includes non-oil-based lubricants and friction modifiers. The lubricants can be applied by personnel working trackside or by an automated applicator along the tracks or on the trains. For example, these lubricants could be used in any locations with curves of less than a 300-foot radius near residential areas, and sites with curve radii of 400 to 600 feet should be prepared to accept a lubrication system should squeal occur during pre-revenue testing.

Traffic Noise and Removal of Shielding

Traffic noise impacts are also possible in some sections of the project corridor. More detailed noise modeling will be performed for the Preferred Alternative and will be included in the Final EIS. This detailed modeling will use the Federal Highway Administration (FHWA) Traffic Noise Model (TNM), and will consider those areas that meet the FHWA definition for areas requiring a traffic noise study. The following discussion presents a generalized evaluation of potential impacts and mitigation measures.

Potential Traffic Noise Impacts and Mitigation Measures

Increased traffic noise exposure could result from the development of new or modified roadways or from the removal of buildings, walls or berms that currently provide shielding from existing traffic noise. The potential for increased exposure to traffic noise was reviewed for noise-sensitive land uses along the Preferred Alternative. A summary of the potential impacts by project segment is provided in the sections below. Locations with potential increased traffic noise exposure were identified based on actual noise measurements taken along the corridors during the Draft EIS study.

Noise mitigation was considered for areas where traffic noise impacts are expected. Most of the receiver sites found to have potential traffic noise impacts also have noise impacts related to light rail operations. Therefore, in many cases, a noise wall proposed for light rail could also provide mitigation for traffic noise. In this case, the design of the light rail walls would be modified to also accommodate traffic noise mitigation. A list of potential traffic noise impacts and sound walls that could provide mitigation is provided in Attachment B.

Segment A Traffic Noise and Mitigation

In Segment A there are several areas where roadways are being realigned to accommodate the project. The first realignment in Segment A is the off-ramp from Interstate 405 (I-405) to SW 4th Avenue. The sight realignment of the ramps does not meet FHWA requirements for a substantial realignment⁵ and no modeling is required. Other

⁵ Under FTA and FHWA policy, traffic noise is only considered in some circumstances, such as for evaluating the effects of a new roadway, substantial horizontal or vertical realignment of an existing roadway, adding capacity (new through lanes) to an existing roadway, or when physical shielding is being removed (e.g. structures or topography) that allows for an increase in traffic noise levels above the noise criteria. Therefore, turn lanes, safety improvements, pedestrian and bicycle

roadway realignments in Segment A include SW Naito Parkway, SW Barbur Boulevard near SW Bancroft Street, SW Hamilton Street, SW Capitol Highway and at the connection to Segment B near SW Florida Street. The realignments of SW Barbur Boulevard at SW Bancroft Street and SW Hamilton Street also include the removal of several structures, thereby requiring a traffic noise study. The other realignments described do not meet FHWA requirements for a traffic noise study. Based on this analysis, there are four sites on SW Barbur Boulevard near SW Bancroft Street and SW Hamilton Street where removal of existing structures could expose second-line receivers to increased traffic noise.

Noise walls for mitigation of light rail impacts are already required in many of these areas. There are an estimated eight noise walls in Segment A, ranging from 130 to 600 feet in length for an estimated total of 2,485 feet. Noise wall heights proposed in this area are typically 6 to 8 feet high, with some potentially as high as 10 to 12 feet. The FHWA TNM will be used during preparation of the Final EIS to determine if walls proposed for the Preferred Alternative could be modified by increasing wall heights and length to also provide mitigation of traffic noise impacts.

Segment B Traffic Noise and Mitigation

Most traffic noise-related issues in Segment B are due to the removal of shielding and roadway realignment. North of Terwilliger Boulevard, there are several displaced structures in areas where light rail noise impacts would also occur. Virtually all impacts in this area would be mitigated with noise walls that would provide mitigation for traffic noise as well as the light rail noise. South of Terwilliger Boulevard, traffic noise impacts are also possible at several multi-family units and some single-family residences due to the removal of shielding and roadway realignment to accommodate stations and turn lanes. Noise wall heights considered for most impacts would not exceed 6 to 10 feet, with some 12-foot walls possible.

At the 53rd Park and Ride, any noise increase related to the removal of shielding is expected to be offset by construction of the parking garage and general station structures.

Although the planned improvements to SW 53rd Avenue for shuttle service to and from PCC would not meet the requirements for an FHWA traffic noise study, the new bus route will be analyzed in the Final EIS using the FTA methods to ensure compliance. It is possible that noise impacts related to bus operation may occur if there are notable nighttime operations (between 10:00 PM to 7:00 AM). Noise impacts are much less likely if the bus schedule consists primarily of daytime operations. If noise impacts are identified in relation to this new route, mitigation may be difficult as noise walls are not feasible in this location.

Mitigation for light rail noise impacts in Segment B includes 11 individual walls with heights of 6 to 12 feet; the combined length is 3,175 feet. As with Segment A, many of these are in areas with light rail impacts and light rail noise walls that could be extended or made taller to mitigate traffic impacts.

Segment C Traffic Noise and Mitigation

The potential for traffic noise impacts in Segment C with the Design refinements 5 and 6 would be reduced substantially when compared to the DIES alternatives. Although there are multiple structures being displaced, the majority of these structures are not providing acoustical shielding from other major roadways, and therefore would not be expected to result in any new traffic related noise impacts. The one notable exception is the realignment of SW 70th Avenue, where the realigned road, removal of structures, and station related traffic could result in potential noise impacts between SW Baylor and SW Dartmouth Streets.

The FHWA Traffic Noise Model will be used during preparation of the Final EIS, where required, to determine if any project related traffic noise impacts occur, and to model any potential noise walls for those impacts.

improvements generally are not evaluated. Additionally, the FHWA defines a “substantial realignment” as one that halves the distance between the receiver and the realigned roadway. Therefore, a travel lane currently located 50 feet from a residence would have to be relocated to 25 feet or less from the same residence before a traffic noise study would be required at that residence.

b) Analysis of Design Refinements

Design Refinement 4

The relocation of the light rail alignment from Barbur Boulevard to I-5 could reduce noise levels related to light rail operations. However, the relocation of the parking areas closer to the noise sensitive properties south of Barbur Boulevard could negate any benefit of the light rail relocation. Additional information on the layout of the park and ride would be required to fully assess potential noise impacts, but the initial review did not identify any new noise impact near the station with the proposed design refinement.

New noise impacts, and impacts of increased severity, could occur under Design Refinement 4 at the residences located along SW Palatine Street, adjacent to the off ramp from I-5. Vibration impacts may also occur at residences located along SW Palatine Street. Displacement of the Quality Inn Hotel would prevent any noise or vibration impacts near the 68th Avenue Park and Ride, as the hotel is the only noise and vibration sensitive property in this area. All other land use along Design Refinement 4 are commercial or undeveloped and would not be considered noise sensitive under FTA criteria.

Design Refinement 5

Although current design drawings show that most of the single-family residences along SW Elmhurst Street would be displaced, one remaining single-family residence along SW 72nd Avenue and the multi-family complex south of the station could have noise and vibration impacts. The new proposed curve at SW Elmhurst Street, which would have a radius of approximately 100 feet, could result in wheel squeal impacts at the nearby multi-family residences. From SW 72nd Avenue to the Highway 217 crossing, noise impacts would be expected at the remaining single-family residences along SW Hermoso Way. Vibration impacts would also be predicted at many of these same residences.

Design Refinement 6

There are 3 to 4 single-family residences along SW Knoll Drive, north of SW Hunziker Street that would be expected to have noise and vibration impacts under Design Refinement 6, with some due in part to the added noise from at-grade crossing safety systems (bells). The multi-family units north of Hall Boulevard between SW Hunziker road and SW Commercial Street are located far enough from the station that noise impacts would only be expected at the closest units to the trackway.

c) Additional mitigation

Noise and vibration mitigation measures proposed in the Draft EIS would also apply to any affected properties for the Design Refinements. The FHWA Traffic Noise Model will be used during preparation of the Final EIS to determine feasible mitigation measures. Initial results suggest that potential mitigation measures associated with Design Refinements may include:

- Design Refinement 4 – Mitigation for most noise impacts could consist of a noise wall along the side of the elevated LRT structure and along the ramp from I-5 near SW Palatine Street if necessary. Resilient fasteners or ballast mats could be used to reduce vibration levels at homes along SW Palatine Street.
- Design Refinement 5 – Mitigation could consist of noise walls where feasible. However, driveways, street openings and pedestrian access in this area may make the use of noise walls difficult. Sound insulation could be considered for some residences under this refinement given the low existing noise levels at some residence structures in this area. Additional analysis of to include the locations of track crossover locations will be required to determine appropriate mitigation for vibration impacts, however, ballast mats and resilient fasteners along with noise and vibration reducing frogs could be used to reduce both noise and vibration levels.
- Design Refinement 6 – Mitigation for noise impacts would include noise walls along SW Knoll Drive, and for sites where noise walls are not feasible, interior noise levels and sound insulation would be considered on a site by site basis. Mitigation for vibration impacts would likely consist of the use of resilient fasteners or ballast mats.

Summary of Additional Mitigation Measures for Incorporation into the Final EIS

Although there is a potential for some new noise and vibration impacts when compared to the Draft EIS, mitigation measures could be employed that are expected to eliminate these new impacts. Additional detail has been provided regarding some impacts that were identified in the Draft EIS. While the location of impacts under the design refinements differs in places from the locations in the Draft EIS, these are not considered to be new impacts. Therefore, existing mitigation measures developed for the Draft EIS will be adequate to avoid, minimize or mitigate impacts related to the design refinements.

Compliance with Other Federal Requirements

1. Section 4(f) USDOT

The U.S. Department of Transportation Act of 1966, Section 4(f) (49 United States Code [USC] 303) requires that FTA analyze the potential for transit projects to impact a significant publicly owned park (i.e., Terwilliger Parkway), recreation area or wildlife and waterfowl refuge or any significant historic site (i.e., Southwest Portland Historic District). The preliminary Section 4(f) evaluation in the Draft EIS was based on several alternatives. The Section 4(f) analysis in the Final EIS will evaluate impacts to Section 4(f) resources for the Preferred Alternative and have a final determination from FTA that includes commitments to mitigate unavoidable impacts.

The Section 4(f) analysis includes evaluating the following:

1. Feasible and prudent avoidance alternatives that avoid impacts to all Section 4(f) resources
2. Least overall harm alternatives and measures that minimize the overall impacts to Section 4(f) resources

TriMet and Metro will coordinate with the “official with jurisdiction,” the managing entity or owner, to evaluate impacts and determine mitigation for impacts to Section 4(f) resources, including SHPO for significant historic sites and the City of Portland for significant parks and recreation resources. An impact that is minor in nature, referred to as a *de minimis* impact determination, requires formal agreement from the official with jurisdiction.

Public outreach and education is a critical component of understanding the Section 4(f) resource significance, level of impacts and determining mitigation for impacts. TriMet and Metro will develop a public engagement program that provides information about the process and resources, and will specifically encourage input on any *de minimis* determinations. Additionally, TriMet and Metro will develop a separate, focused public process for selecting the Marquam Hill Connection option that will be analyzed in the Final EIS.

2. Section 106 National Historic Preservation Act

Independent of the LUFO, the project will need to comply with Section 106 of the National Historic Preservation Act. Compliance with Section 106 is a requirement for federal agencies and is generally conducted in parallel with preparation of the EIS and informs the local political process for selecting a Preferred Alternative.

Section 106 consultation was initiated by FTA in spring 2017. Interested parties and Native American tribal groups were invited to participate in the environmental review and Section 106 processes, and to review and comment on the area of potential effects (APE) for the project. The Section 106 process, including signing of a Memorandum of Agreement (MOA) for resolution of any adverse effects, will conclude prior to publication of the Final EIS and Record of Decision (ROD).

a) Area of Potential Effects

The Draft EIS includes an APE in Section 3.6 that encompasses an area defined as 50 feet in each direction from the edge of the construction within each segment, as well as the area needed to construct station access improvements such as bike lanes, new sidewalks and pedestrian bridges.

The APE will be revised following the adoption of the Preferred Alternative and prior to publication of the Final EIS/ROD. This updated APE will include area needed to accommodate the selected design refinements, station access improvements, known locations of proposed mitigation (e.g., stormwater, wetlands), and locations where impacts adversely affect the context or setting of historic resources (such as visual quality or noise and

vibration). The updated APE will include a tighter archaeological boundary where design has advanced and there is now a better understanding of the limits of direct construction activities. This updated APE will also be sent to SHPO for concurrence and to tribes and consulting parties for comment prior to publication of the Final EIS/ROD.

b) Identification and Evaluation of Historic Resources

Historic buildings, sites, structures and objects that were built in 1970 or before were reviewed and documented. The use of 1970 is based on an expected 2020 start for property acquisitions. All of these resources were reviewed for potential eligibility to be listed on the NRHP and documented in a Cultural Resources Survey Report. Additional properties from between 1970 and 1975 will be evaluated for the Preferred Alternative to capture any properties that will become potentially eligible for listing on the NRHP before the end of major project construction.

For archaeological resources, field studies were conducted within the APE to identify potential archaeological resources not previously included in local inventories, and to review locations and conditions of resources listed on inventories or eligible for, or in, the NRHP. Archaeologists also reviewed a variety of sources to predict the probability of encountering undiscovered archaeological resources.

c) Preferred Alternative Adoption and Final EIS

Once a Preferred Alternative has been identified, historic archaeological and built environment resources that would be impacted by the Preferred Alternative will be formally documented using Determination of Eligibility (DOE) forms. FTA will formally submit DOEs combined with a revised APE, and a proposed Finding of Effect (FOE) to SHPO for concurrence with a 30-day review period during Final EIS development. SHPO also recommended a programmatic agreement and detailed inadvertent discovery plan for artifacts uncovered during construction. Focused shovel tests may be undertaken in areas where there is a high probability for discovering artifacts through ground-disturbing construction activities.

The Final EIS/ROD will include resources that would be impacted by the Preferred Alternative, consistent with SHPO concurrence. The Final EIS/ROD will include FOEs on resources that are listed or eligible for listing on the NRHP, consistent with SHPO concurrence.

d) Memorandum of Agreement

A signed MOA with the inadvertent discovery plan will also be included in the Final EIS/ROD. All historic properties that would be impacted by the project will be included in the MOA, which will be signed by FTA, TriMet and the SHPO. All consulting parties, such as the tribes, City of Portland, Restore Oregon and Multnomah County, will have an opportunity to provide input on the MOA. The MOA will include the detailed inadvertent discovery plan for archeological resources. It will also include all mitigation measures that are agreed to between the parties and will be completed prior to the Final EIS publication.