Hood River – White Salmon BRIDGE REPLACEMENT PROJECT

Final Noise Technical Report

November 2020

Prepared for:

PORT OF HOOD RIVER

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LIST OF EXHIBITS

ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

BMPs	best management practices
CRITFC	Columbia River Inter-Tribal Fish Commission
dBA	A-weighted decibels
EB	eastbound
EIS	environmental impact statement
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
I-	Interstate
lbs.	pounds
L_{eq}	equivalent sound level
$L_{eq(h)}$	hourly equivalent sound level
L_{max}	maximum sound level
L_{min}	minimum sound level
MATS	Mt. Adams Transportation Service
mph	miles per hour
NAAC	noise abatement approach criteria
NAC	noise abatement criteria
NB	northbound
NEPA	National Environmental Policy Act
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
OHWM	ordinary high water mark
receiver	Modeling or measurement location that represents noise sensitive land uses; can represent multiple receptors or equivalent units
receptor	An activity or unit represented by a measured or modeled receiver, also called an equivalent unit (subset of receiver)
SB	southbound
SEL	sound exposure level
SR	State Route
the Port	Port of Hood River
the Project	Hood River-White Salmon Bridge Replacement Project
TFAS	Treaty Fishing Access Site
TNM	Traffic Noise Model
TS&L	type, size, and location
U.S.	United States
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
WAC	Washington Administrative Code
WB	westbound
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation

1. SUMMARY

The Hood River-White Salmon Bridge Replacement Project (the "Project," formerly named the SR-35 Columbia River Crossing Project) would construct a replacement bridge and then remove the existing Hood River Bridge between White Salmon, Washington, and Hood River, Oregon (Exhibit 1). The bridge is owned by the Port of Hood River (the Port), serving an average of over 4 million trips annually.

Through a review of Project elements and coordination with the Oregon Department of Transportation (ODOT), it was determined that this Project is defined as a Type I Project requiring a traffic noise study. The Type I determination is because the Project includes shifting the alignment of an existing roadway that shifts traffic closer to noise sensitive land uses.

A technical noise analysis was performed to document the existing conditions, future No Action Alternative and three build alternatives: Preliminary Preferred Alternative EC-2, Alternative EC-1, and Alternative EC-3. The traffic noise analysis complies with guidelines established by the Federal Highway Administration (FHWA) and ODOT.

Exhibit 2 shows the alignment of the existing bridge, which represents the No Action Alternative, and the three build alternatives. The No Action Alternative and all three build alternatives would have different locations for the northern terminus and the connection to SR 14 in White Salmon, Washington, but generally have the same southern terminus location in Hood River, Oregon, just north of the Interstate 84 (I-84)/United States Highway 30 (US 30) interchange (Exit 64).

The study area contains a variety of existing land uses consisting primarily of commercial and recreational uses. The south shore of the Columbia River, or City of Hood River side, has a higher concentration of development within the immediate vicinity of the bridge than the north shore, or City of White Salmon side. The White Salmon Treaty Fishing Access Site (TFAS) is located immediately west of the existing bridge at its northern end.

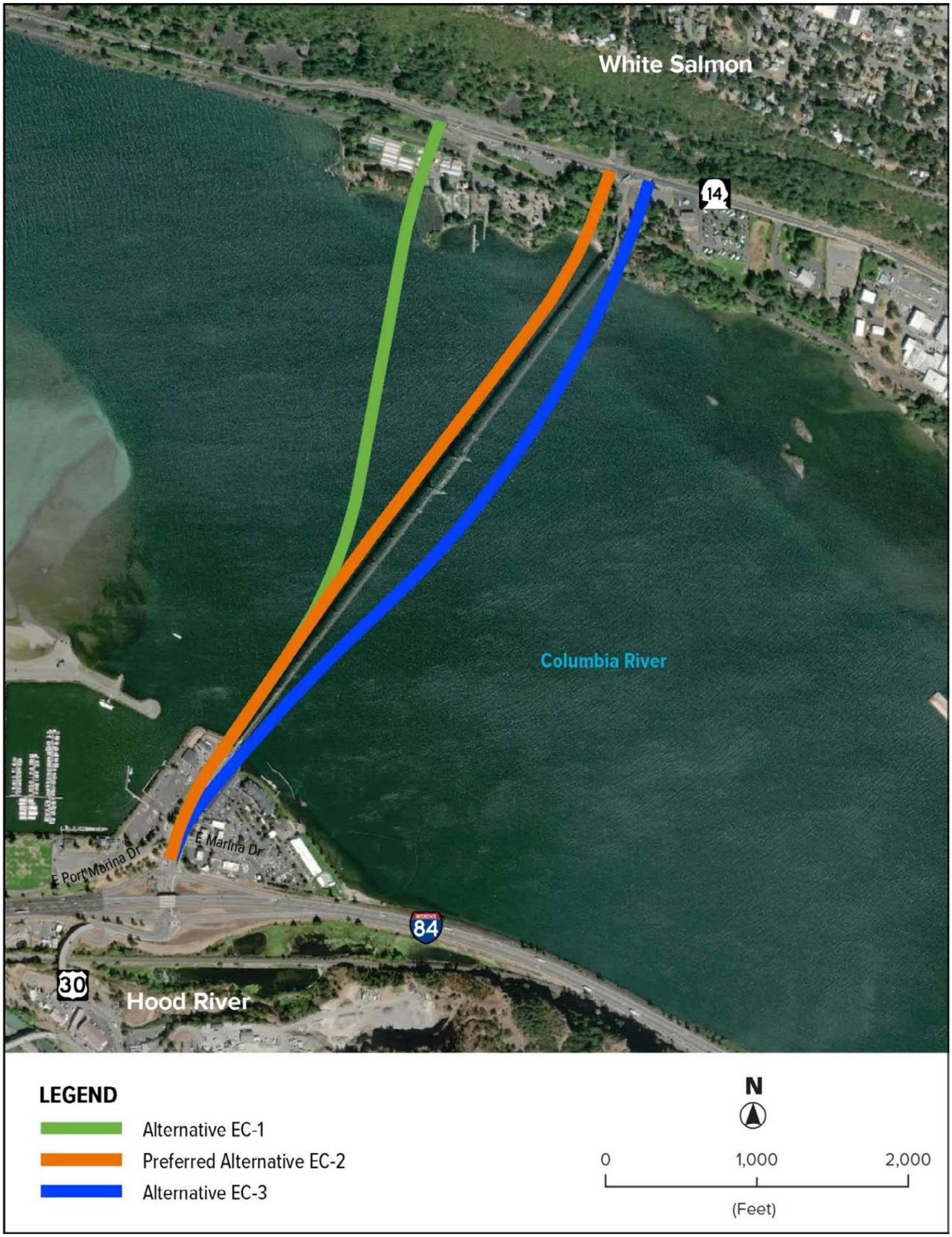
Existing noise levels reach the ODOT Noise Approach Abatement Criteria (NAAC) at one modeled site in the noise study area, Hood River WaterPlay, that includes an outdoor pool near I-84. Noise levels for the future no build alternative and all future build alternatives are predicted to reach the ODOT NAAC at the same outdoor recreation site that reaches the ODOT NAAC in the future no build condition. No sites are predicted to experience a substantial increase of 10 A-weighted decibels (dBA) or more in future noise levels with the Project.

Modeled sites representing the White Salmon TFAS are predicted to experience 2 dBA to 3 dBA increases in noise levels totaling 54 dbA to 55 dBA under Alternative EC-2. The predicted increase in noise levels at the TFAS would be noticeably lower than ODOT NAAC levels and barely perceptible to most listeners including the commercial, subsistence, or ceremonial fishers and residents and campers at the site.

Noise abatement was considered at the one location predicted to experience future build noise levels above the ODOT NAAC. One noise barrier was evaluated to reduce traffic noise levels at the one impact location. The evaluated noise barrier met ODOT feasibility criteria but was unable to meet ODOT Criteria for Reasonableness. Chapter 7 of this report provides details of abatement considerations. No noise abatement is recommended for this Project.

Exhibit 1. Project Area

Exhibit 2. Location of Preferred Alternative EC-2, Alternative EC-1, and Alternative EC-3



During Project construction, areas adjacent to the Project would be exposed to construction noise in addition to the traffic-related noise. Impacts during construction are of short duration and standard specifications for noise control will minimize or eliminate impacts during construction.

A copy of this report will be made available to the local planning departments by ODOT. This report will serve to inform the local officials of the impacts of the roadway and roadway-construction-related noise in the area studied. The information contained within this report can assist the County in its planning process.

Based on the traffic noise modeling (TNM) and results of this report, and future traffic volumes and speeds included in this report, areas within 25 feet of the nearest travel lane on Hood River Bridge may experience noise levels up to the ODOT NAAC of 65 dBA or Washington State Department of Transportation (WSDOT) noise abatement criteria (NAC) of 66 dBA for residential land use and other outdoor land uses, such as playfields and parks. Commercial and related business uses located within 10 feet of the nearest travel lane on Hood River Bridge may experience outdoor noise levels up to the ODOT NAAC of 70 dBA or WSDOT NAC of 71 dBA for hotels, offices, and similar uses such as restaurants and bars. Residential land uses and other outdoor land uses located within 60 feet of SR 14 may experience noise levels up to the WSDOT NAC of 66 dBA. Commercial and related businesses located within 25 feet of SR 14 may experience noise levels up to the WSDOT NAC of 71 dBA. Similarly, in Oregon, residential land uses and outdoor land uses located within 275 feet of I-84 may experience noise levels up to the ODOT NAAC of 65 dBA within commercial or related businesses located within 160 feet of I-84 may experience noise levels up to the ODOT NAAC of 70 dBA.

2. INTRODUCTION

The purpose of this Project is to improve multi-modal transportation of people and goods across the Columbia River between the communities of White Salmon and Bingen, Washington and Hood River, Oregon. The Project is intended to: a) improve traffic operations for current and future cross-river traffic and at connections to I-84 and SR 14; b) provide a cross-river connection for bicyclists and pedestrians; c) improve vehicle and freight travel safety by reducing real and perceived hazards; d) maintain and improve a transportation linkage between the White Salmon, Bingen, and Hood River communities, businesses, and services; e) fulfill the legislative directives tied to the Project funding; f) improve river navigation for vessels passing under the bridge; and g) improve the river crossing’s seismic resiliency.

The overall need for the Project is to rectify current and future transportation inadequacies and deficiencies associated with the existing bridge. Specifically, these needs are to:

- Present Capacity: substandard width and operational issues are causing traffic congestion on the bridge and at both approaches
- Future Transportation Demand: the existing bridge is not designed to meet future travel demand for vehicles
- Bicycle and Pedestrian Facilities: lack of bicycle and pedestrian facilities limits multi-modal mobility
- Safety: narrow lanes and lack of shoulder create real and perceived safety hazards

- Social Demands/Economic Development: the existing bridge restricts the current and projected flow of goods, labor and consumers across the river
- Legislation: comply with federal funding obligation Transportation Equity Act for the 21st Century (TEA-21), the Washington State Legislature designation of the SR-35 corridor, and Oregon HB 2017
- River Navigation: the substandard horizontal clearance creates difficulties for safe vessel navigation
- Seismic Deficiencies: the existing bridge does not meet current seismic standards and is vulnerable to a seismic event

The Project began in 1999 with a feasibility study that ultimately resulted in the publication of the State Route (SR) 35 Columbia River Crossing Draft Environmental Impact Statement (EIS) in 2003, which identified the “EC-2 West Alignment” as the preliminary preferred alternative. In 2011, the Type, Size, and Location (TS&L) Study recommended a fixed-span concrete segmental box girder bridge as the recommended bridge type. In 2017, the Project was relaunched to complete the National Environmental Policy Act (NEPA) process. This report provides an update to the 2003 Noise Technical Report describing the existing conditions and anticipated construction, direct, and indirect impacts on noise. Measures to avoid, minimize, and/or mitigate these impacts are also identified in this report.

3. PROJECT ALTERNATIVES

Four alternatives are being evaluated to address the Project’s purpose and need:

- No Action Alternative
- Preferred Alternative EC-2
- Alternative EC-1
- Alternative EC-3

Exhibit 3 shows the alignment of the existing bridge, which represents the No Action Alternative, and the three build alternatives. The build alternatives connect to SR 14 in White Salmon, Washington, and Button Bridge Road in Hood River, Oregon, just north of the Interstate 84 (I-84)/United States Highway 30 (US 30) interchange (Exit 64).

Each alternative is summarized in Exhibit 4 and described in more detail in the following sections. Exhibit 5 illustrates the navigational clearance for the existing bridge and the replacement bridge (same for each build alternative).

Exhibit 3. Location of the Preferred Alternative EC-2, Alternative EC-1, and Alternative EC-3

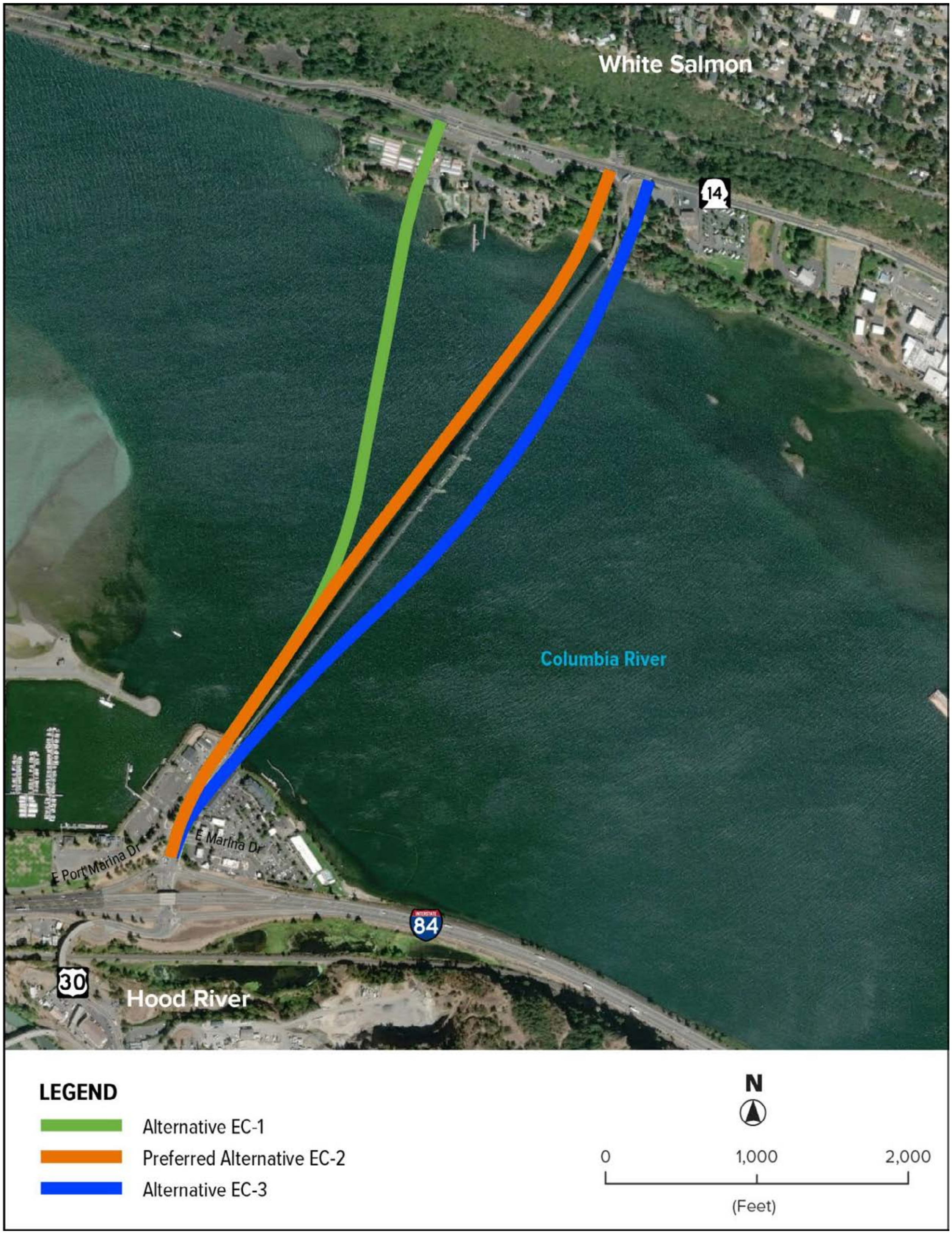
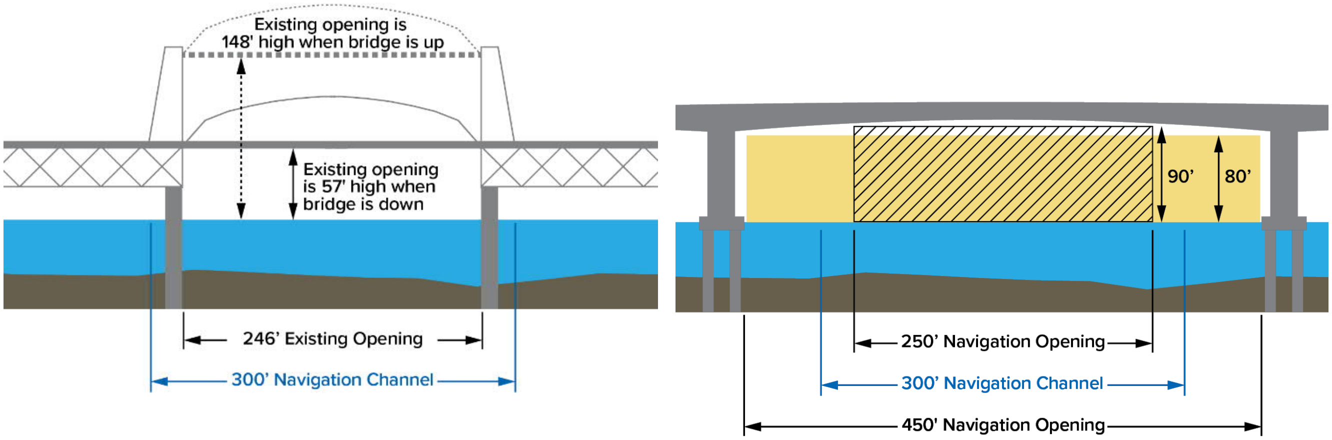


Exhibit 4. Summary Comparison of Key Elements of Alternatives

	No Action Alternative	Preferred Alternative EC-2	Alternative EC-1	Alternative EC-3
Bridge alignment	No change	Slightly west of existing	WA: West of existing OR: Slightly west of existing	Slightly east of existing
Bridge structure				
Bridge type	Steel deck truss bridge with vertical lift span	Segmental concrete box girder bridge (fixed span)		
Total number of piers (in water / on land)	28 (20 / 8)	13 (12 / 1)	13 (11 / 2)	13 (12 / 1)
Structure length	4,418 feet	4,412 feet	4,375 feet	4,553 feet
Travel lanes	9-foot 4.75-inch lanes	12-foot lanes		
Roadway shoulders	No shoulders	8-foot shoulders		
Vehicle height limit	14 feet-7 inches	None		
Shared Use Path	None	12-foot wide, only on west side with overlooks		
Bridge deck	Steel-grated	Concrete		
Vehicle Gross Weight Limit	80,000 pounds (lbs.); no trip permit allowance for overweight vehicles	> 80,000 lbs., with approved trip permit		
Design speed	Unknown	50 miles per hour (mph)		
Posted speed	25 mph	35 mph		
Toll collection	Toll booth on Oregon side	Electronic tolling/No toll booth		
Stormwater treatment	None	Detention and water quality treatment		
Navigation clearance	246 feet horizontal by 57 feet vertical when bridge is down and up to 148 feet vertical when lifted	450 feet horizontal x 80 feet vertical (maximum horizontal opening) 250 feet horizontal x 90 feet vertical (centered within maximum vertical opening)		
SR 14/Hood River Bridge intersection	Signalized intersection	Roundabout slightly west of existing intersection; SR 14 raised approximately 2 feet above existing road level	Roundabout with connection to N. Dock Grade Road west of existing intersection; SR 14 raised approximately 17 feet above existing road level	Roundabout slightly east of existing intersection; SR 14 remains at existing road level
Button Bridge Road/E. Marina Way intersection	Signalized intersection	Signalized intersection		
Anticipated construction duration	None	6 years (3 years to construct the replacement bridge and 3 years to remove the existing bridge)		

Exhibit 5. Navigation Clearance of Existing Bridge and Proposed Replacement Bridge



Existing Bridge

Proposed Replacement Bridge

3.1. No Action Alternative

The No Action Alternative would retain the existing bridge in its existing condition and configuration. Routine operations would continue, and maintenance would be implemented to continue operations. Under the No Action Alternative, elements of the existing bridge include:

- Alignment: The bridge would continue to span the Columbia River between its northern terminus at the SR 14/Hood River Bridge intersection in White Salmon, Washington, and its southern terminus at the Button Bridge Road/E. Marina Way intersection in Hood River, Oregon, as shown in the aerial photograph in Exhibit 3.
- Type: The bridge would continue to be a 4,418-foot steel deck truss bridge with a vertical lift span. The bridge would continue to have 20 piers in the Columbia River.
- Ownership: The bridge will continue to be owned and operated by the Port.
- Vehicle lanes: The bridge will continue to have one narrow (9 feet, 4.75 inches) travel lane in each direction and no shoulders.
- Bicycle and pedestrian facilities: The bridge would continue to have no pedestrian or bicycle facilities, and signage would continue to prohibit pedestrians and bicycles on the bridge.
- Speed: The posted speed limit on the bridge would continue to be 25 mph.
- Vehicle restrictions: Vehicles would continue to be weight-restricted to 80,000 lbs.; vehicles with approved trip permits would still not be allowed to use the bridge. Wide loads would continue to be prohibited without special arrangements, and large vehicles would be encouraged to turn their mirrors in. The height limit for vehicles would continue to be 14 feet, 7 inches where the lift span occurs.
- Tolling: The bridge would continue to be tolled for all vehicles with a toll booth on the south end of the bridge and electronic tolls collected through the Port's Breezeby system. Plans to shift to all ETC are being considered, but there is no certainty they will be implemented.

- Navigational clearance: The horizontal clearance for marine vessels would continue to be 246 feet, narrower than the navigation channel width of 300 feet, as shown Exhibit 5. The vertical clearance would continue to be 57 feet when the lift span is down and 148 feet when it is raised; vessels would continue to be required to request bridge lifts in advance. The lift span section would continue to use gate and signals to stop traffic for bridge lifts.
- Seismic resilience: The bridge would continue to be seismically vulnerable and would not be cost effective to be seismically retrofitted.
- Stormwater: No stormwater detention or water quality treatment would be provided for the bridge. Stormwater on the bridge would continue to drain directly into the Columbia River through the steel-grated deck.
- Roadway connections: The bridge would continue to connect to SR 14 on the Washington side at the existing signalized SR 14/Hood River Bridge intersection. On the Oregon side, the southern end of the bridge would continue to transition to Button Bridge Road, connecting to the local road network at the existing signalized Button Bridge Road/E. Marina Way intersection north of I-84. The bridge would continue to cross over the BNSF Railway tracks on the Washington side and over the Waterfront Trail along the Oregon shoreline.
- Bicycle and pedestrian connections: The bridge would continue not to provide bicycle or pedestrian connections across the Columbia River. Bicyclists and pedestrians wanting to cross the river would continue to need to use an alternate means of transportation, such as the Mt. Adams Transportation Service (MATS) White Salmon/Bingen to Hood River bus (buses provide bicycle racks), or a private vehicle.

The Supplemental Draft EIS considers two scenarios for the No Action Alternative:

- End of bridge lifespan: assumes that the existing Hood River Bridge would remain in operation through 2045[1] and would be closed sometime after 2045 when maintenance costs would become unaffordable. At such a time, the bridge would be closed to vehicles and cross-river travel would have to use a detour route approximately 21 miles east on SR 14 or 23 miles east on I-84 to cross the Columbia River using The Dalles Bridge (US 197). Alternatively, vehicles could travel 25 miles west on SR 14 or 21 miles west on I-84 to cross the Columbia River via the Bridge of the Gods. When the bridge would be closed, the lift span would be kept in a raised position to support large vessel passage that previously required a bridge lift or the existing bridge would be removed.
- Catastrophic event: addresses the possibility that an extreme event that damages or otherwise renders the bridge inoperable would occur prior to 2045. Such events could include an earthquake, landslide, vessel strike, or other unbearable loads that the bridge structure cannot support.

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[1] The year 2045 is the design horizon for the Project. The design horizon is the year for which the Project was designed to meet anticipated needs.

3.2. Preferred Alternative EC-2

Alternative EC-2 would construct a replacement bridge west of the existing bridge. The existing bridge would be removed following construction of the replacement bridge. Under Alternative EC-2, elements of the replacement bridge would include:

- Alignment: The main span of the bridge would be approximately 200 feet west of the existing lift span. The bridge terminus in White Salmon, Washington, would be located approximately 123 feet west of the existing SR 14/Hood River Bridge intersection, while the southern terminus would be in roughly the same location at the Button Bridge Road/E. Marina Way intersection in Hood River, Oregon, as shown in Exhibit 6 and Exhibit 7.
- Type: The bridge would be a 4,412-foot fixed-span segmental concrete box girder bridge with a concrete deck and no lift span. The bridge would have 12 piers in the Columbia River and one land-based pier on the Washington side of the river.
- Ownership: While the Port may own and operate the replacement bridge, other options for the ownership and operation of the replacement bridge that may be considered include other governmental entities, a new bi-state bridge authority, and a public-private partnership, depending on the funding sources used to construct the replacement bridge.
- Vehicle lanes: The bridge would include one 12-foot travel lane in each direction, an 8-foot shoulder on each side, as shown in Exhibit 8.
- Bicycle and pedestrian facilities: The bridge would include a 12-foot wide shared use path separated from traffic with a barrier on the west side, as shown in Exhibit 8. In the middle of the bridge the shared use path would widen an additional 10 feet in two locations to provide two 40-foot long overlooks over the Columbia River and west into the CRGNSA with benches; the overlook locations are shown in Exhibit 6 and Exhibit 7. The cross-section of the overlooks is shown in Exhibit 8.
- Speed: The design speed for the bridge would be 50 mph with a posted speed limit of 35 mph.
- Vehicle restrictions: Vehicles would no longer be limited by height, width, or weight. Vehicles exceeding 80,000 lbs. that have approved trip permits could use the bridge.
- Tolling: Tolls for vehicles would be collected electronically so there would be no toll booth on either side of the bridge. No tolls would be collected from non-motorized users (e.g., pedestrians, bicyclists) who travel on the shared use path.
- Navigational clearance: Vertical clearance for marine vessels would be a minimum of 80 feet. The horizontal bridge opening for the navigation channel would be 450 feet, greater than the existing 300-foot wide federally recognized navigation channel, as shown in Exhibit 5. Centered within this 450-foot opening, there would be a 250-foot wide opening with a vertical clearance of 90 feet. Similar to the existing bridge, the replacement bridge would cross the navigation channel at roughly a perpendicular angle as shown in Exhibit 6 and Exhibit 7.
- Seismic resilience: The bridge would be designed to be seismically sound under a 1,000-year event and operational under a Cascadia Subduction Zone earthquake.

- Stormwater: Stormwater from the entire Project area (bridge and improved roadways) would be collected and piped to detention and treatment facilities on both sides of the bridge as shown in Exhibit 7. On the Washington side, separate stormwater facilities would be used for the roadways and the bridge.
- Roadway connections: The bridge would connect to SR 14 on the Washington side at a new two-lane roundabout slightly west of the existing SR 14/Hood River Bridge intersection, as shown in Exhibit 7. On the Oregon side, the southern end of the bridge would transition to Button Bridge Road, connecting to the local road network at the existing signalized Button Bridge Road/E. Marina Way intersection north of I-84. The private driveway on Button Bridge Road north of E. Marina Way may be closed under this alternative. Like the existing bridge, the replacement bridge would cross over the BNSF Railway tracks on the Washington side and over the Waterfront Trail along the Oregon shoreline.
- Bicycle and pedestrian connections: The new shared use path would connect to existing sidewalks along the south side of SR 14 in Washington and to roadway shoulders (for bicyclists) on both sides of SR 14 at the new roundabout with marked crosswalks, as shown in Exhibit 7. On the Oregon side, the shared use path would connect to existing sidewalks, bicycle lanes, and local roadways at the signalized Button Bridge Road/E. Marina Way intersection.
- Cost: Total Project construction cost is estimated to be $300 million in 2019 dollars.

Exhibit 6. Preferred Alternative EC-2 Alignment

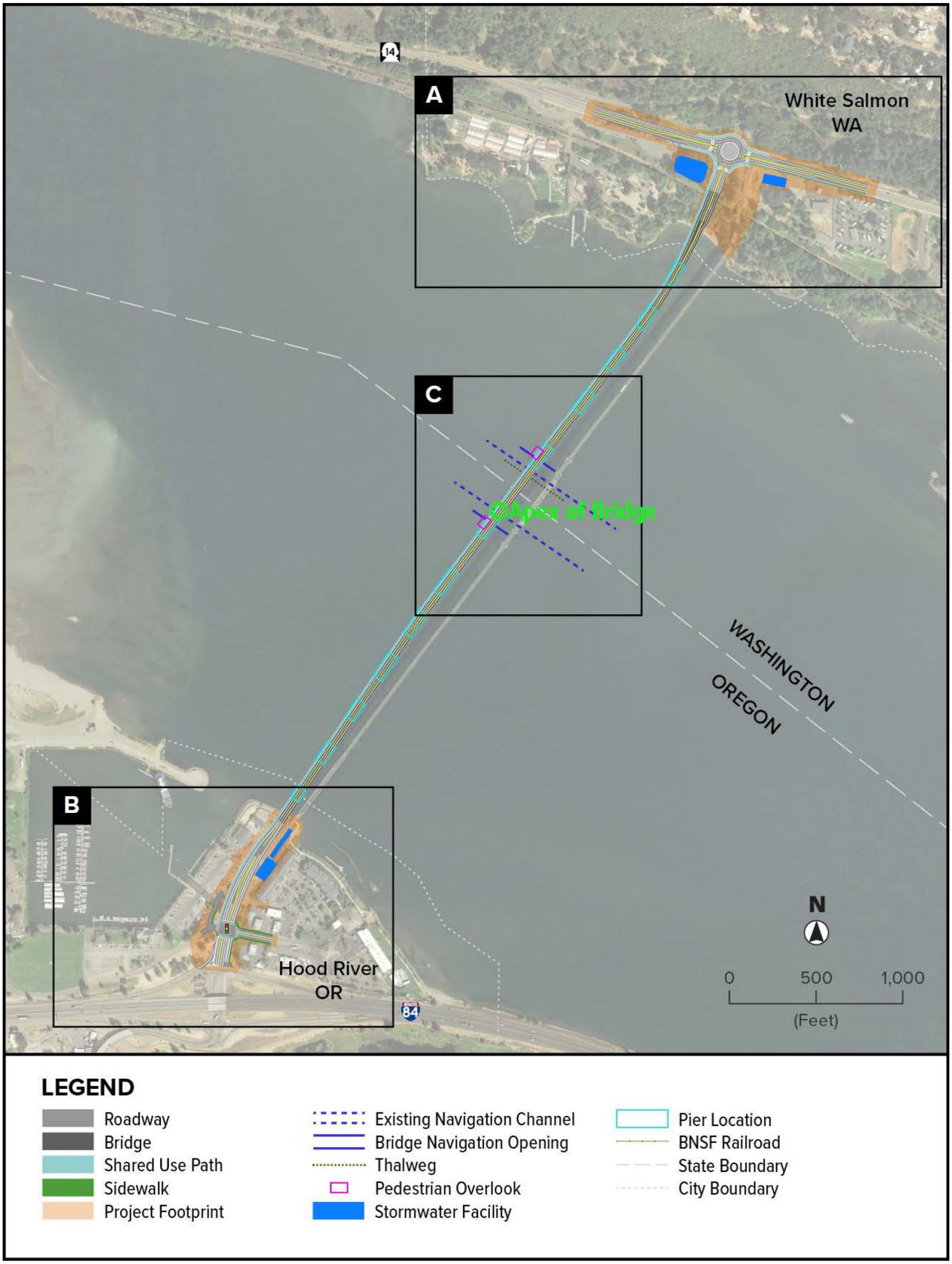
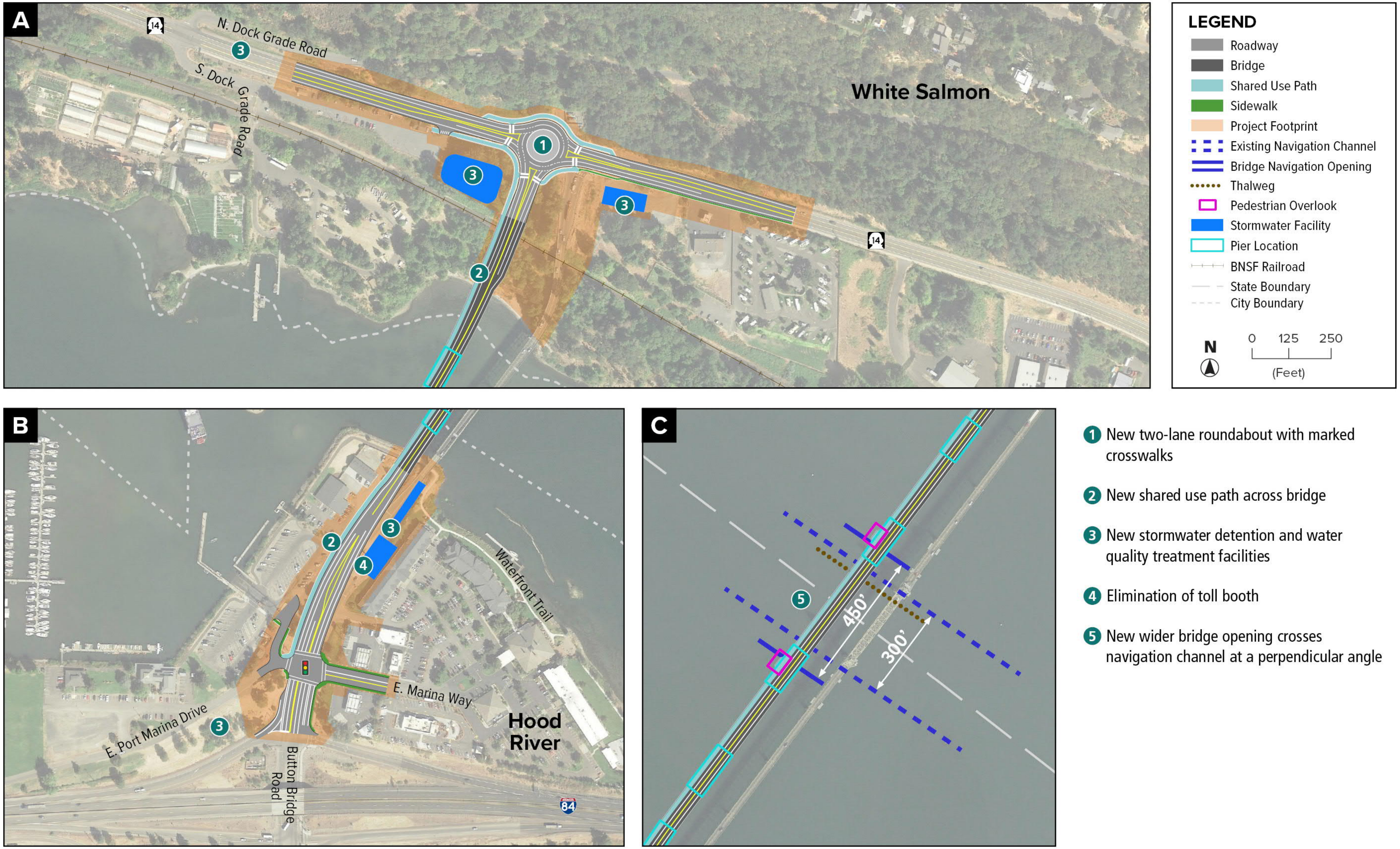


Exhibit 7. Preferred Alternative EC-2 Enlargements



① New two-lane roundabout with marked crosswalks

② New shared use path across bridge

③ New stormwater detention and water quality treatment facilities

④ Elimination of toll booth

⑤ New wider bridge opening crosses navigation channel at a perpendicular angle

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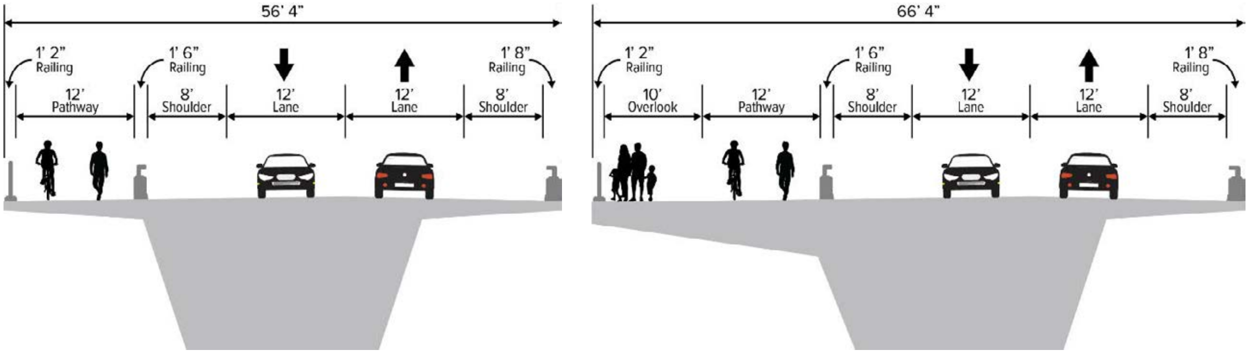
Exhibit 8. Replacement Bridge Typical Cross-Section



Typical **With Pedestrian Overlook**

3.3. Alternative EC-1

Alternative EC-1 would construct a replacement bridge west of the existing bridge. Like Alternative EC-2, the existing bridge would be removed following construction of the replacement bridge. Exhibit 9 shows alignment of Alternative EC-1 and Exhibit 10 provides enlargements of the improvements that would be constructed under Alternative EC-1.

Like Preferred Alternative EC-2, the total Project construction cost for Alternative EC-3 is estimated to be $300 million in 2019 dollars. Under Alternative EC-3, elements of the replacement bridge would be the same as the elements described for Alternative EC-2 except:

- Alignment: The main span of the bridge would be approximately 700 feet west of the existing lift span. The bridge terminus in White Salmon, Washington, would be located approximately 2,309 feet west of the existing SR 14/Hood River Bridge intersection, while the southern terminus would be in roughly the same location as the existing terminus at the Button Bridge Road/E. Marina Way intersection in Hood River, Oregon.
- Type: The bridge would be a 4,553-foot fixed-span segmental concrete box girder bridge with a concrete deck and no lift span. Like Preferred Alternative EC-2, the bridge would have 12 piers in the Columbia River and one land-based pier on the Washington shore.
- Navigational clearance: The navigational opening would be the same as Alternative EC-2, but the bridge would cross the navigation channel at a more skewed angle than under Alternative EC-2.
- Roadway connections: Connections to roadways would generally be the same as Alternative EC-2, but the bridge would connect to SR 14 on the Washington side at a new two-lane roundabout at the SR 14/Hood River Bridge/N. Dock Grade Road intersection west of the existing bridge. Access to S. Dock Grade Road would be provided via the driveway east of the Mt. Adams Chamber of Commerce and Heritage Plaza Park and Ride.
- Bicycle and pedestrian connections: Connections to bicycle and pedestrian facilities would generally be the same as Alternative EC-2, but the roundabout intersection with SR 14 on the Washington side would be located further west at N. Dock Grade Road.

Exhibit 9. Alternative EC-1 Alignment

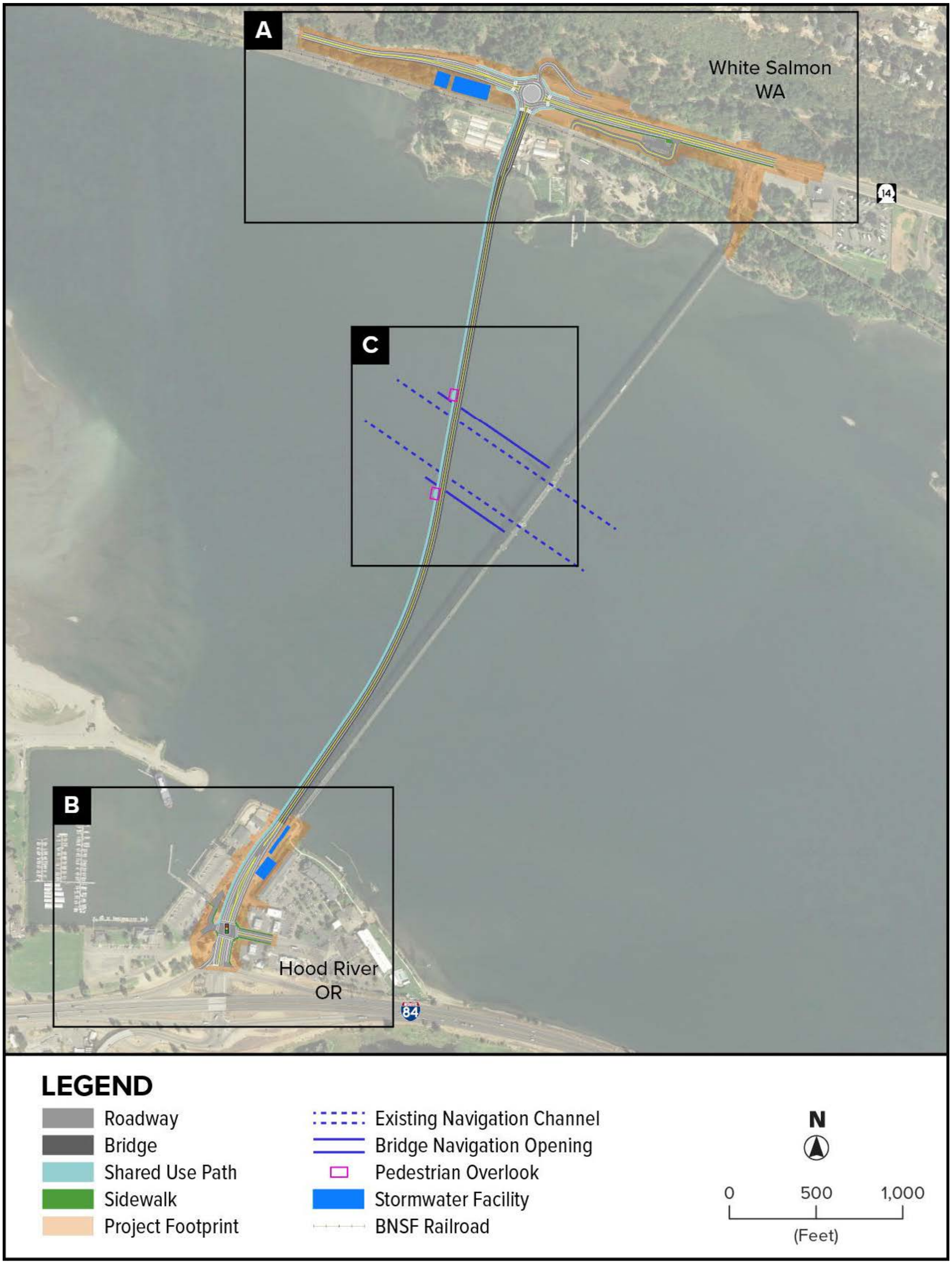
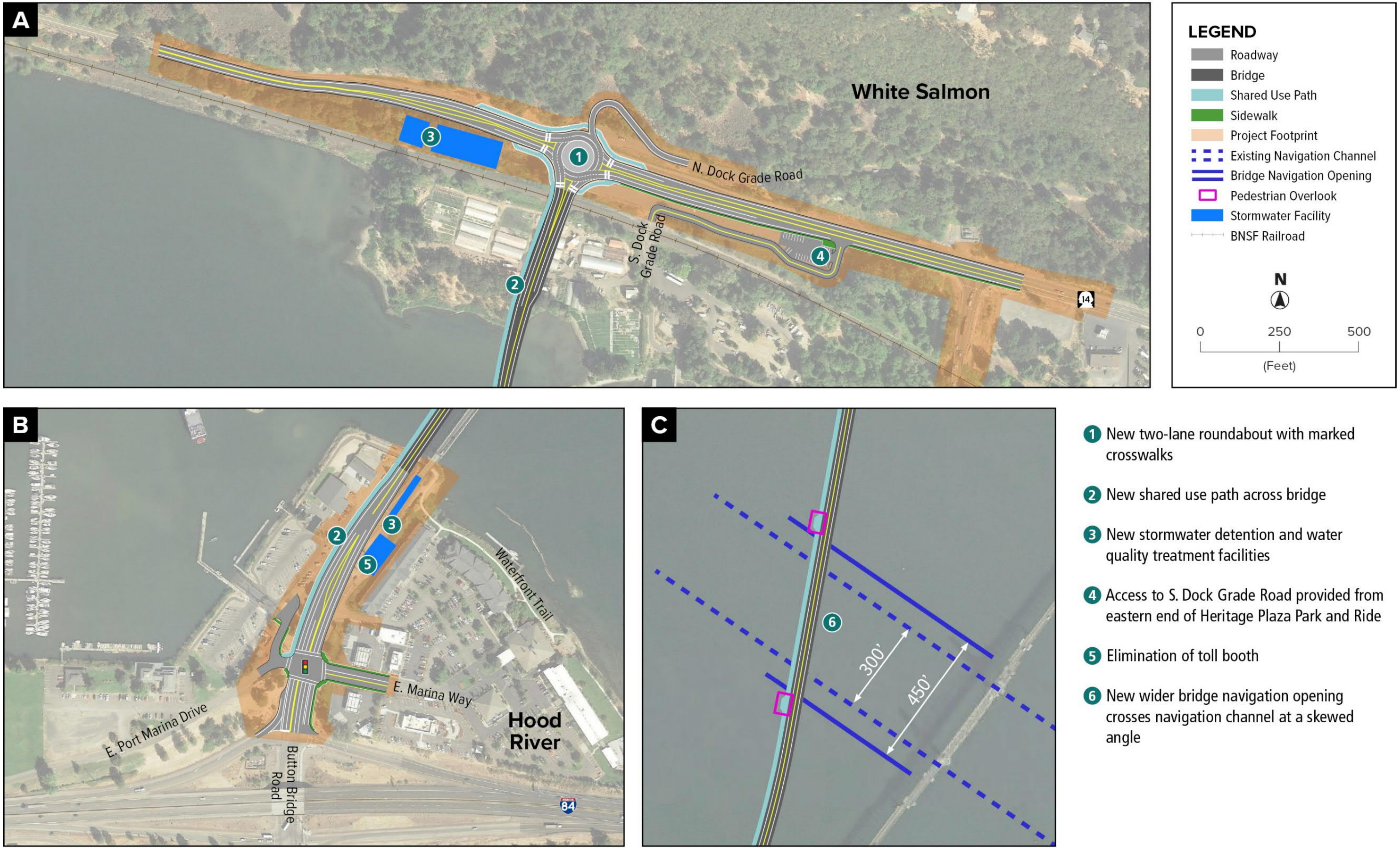


Exhibit 10. Alternative EC-1 Enlargements



① New two-lane roundabout with marked crosswalks

② New shared use path across bridge

③ New stormwater detention and water quality treatment facilities

④ Access to S. Dock Grade Road provided from eastern end of Heritage Plaza Park and Ride

⑤ Elimination of toll booth

⑥ New wider bridge navigation opening crosses navigation channel at a skewed angle

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3.4. Alternative EC-3

Alternative EC-3 would construct a replacement bridge east of the existing bridge. Like Alternative EC-2, the existing bridge would be removed following construction of the replacement bridge. Exhibit 11 shows alignment of Alternative EC-3 and Exhibit 12 provides enlargements of the improvements that would be constructed under Alternative EC-3.

Like Preferred Alternative EC-2, the total Project construction cost for Alternative EC-3 is estimated to be $300 million in 2019 dollars. Under Alternative EC-3, elements of the replacement bridge would be the same as the elements described for Alternative EC-2 except:

- Alignment: The main span of the bridge would be approximately 400 feet east of the existing lift span. The bridge terminus in White Salmon, Washington, would be located approximately 140 feet east of the existing SR 14/Hood River Bridge intersection, while the southern terminus would be roughly the same as the existing terminus at the Button Bridge Road/E. Marina Way intersection in Hood River, Oregon.
- Type: The bridge would be a 4,553-foot fixed-span segmental concrete box girder bridge with a concrete deck and no lift span. Like Alternative EC-2, the bridge would have 12 piers in the Columbia River and one land-based pier on the Washington side of the river.
- Roadway connections: Connections to roadways would generally be the same as Alternative EC-2, but the bridge would connect to SR 14 on the Washington side at a new two-lane roundabout slightly east of the existing SR 14/Hood River Bridge intersection. On the Oregon side, improvements extend slightly further south to the Button Bridge Road/I-84 on and off ramps. The private driveway on Button Bridge Road north of E. Marina Way would be closed under this alternative.
- Bicycle and pedestrian connections: Connections to bicycle and pedestrian facilities would generally be the same as Alternative EC-2, but the roundabout intersection with SR 14 on the Washington side would be located approximately 264 feet further east than under Alternative EC-2.

Exhibit 11. Alternative EC-3 Alignment

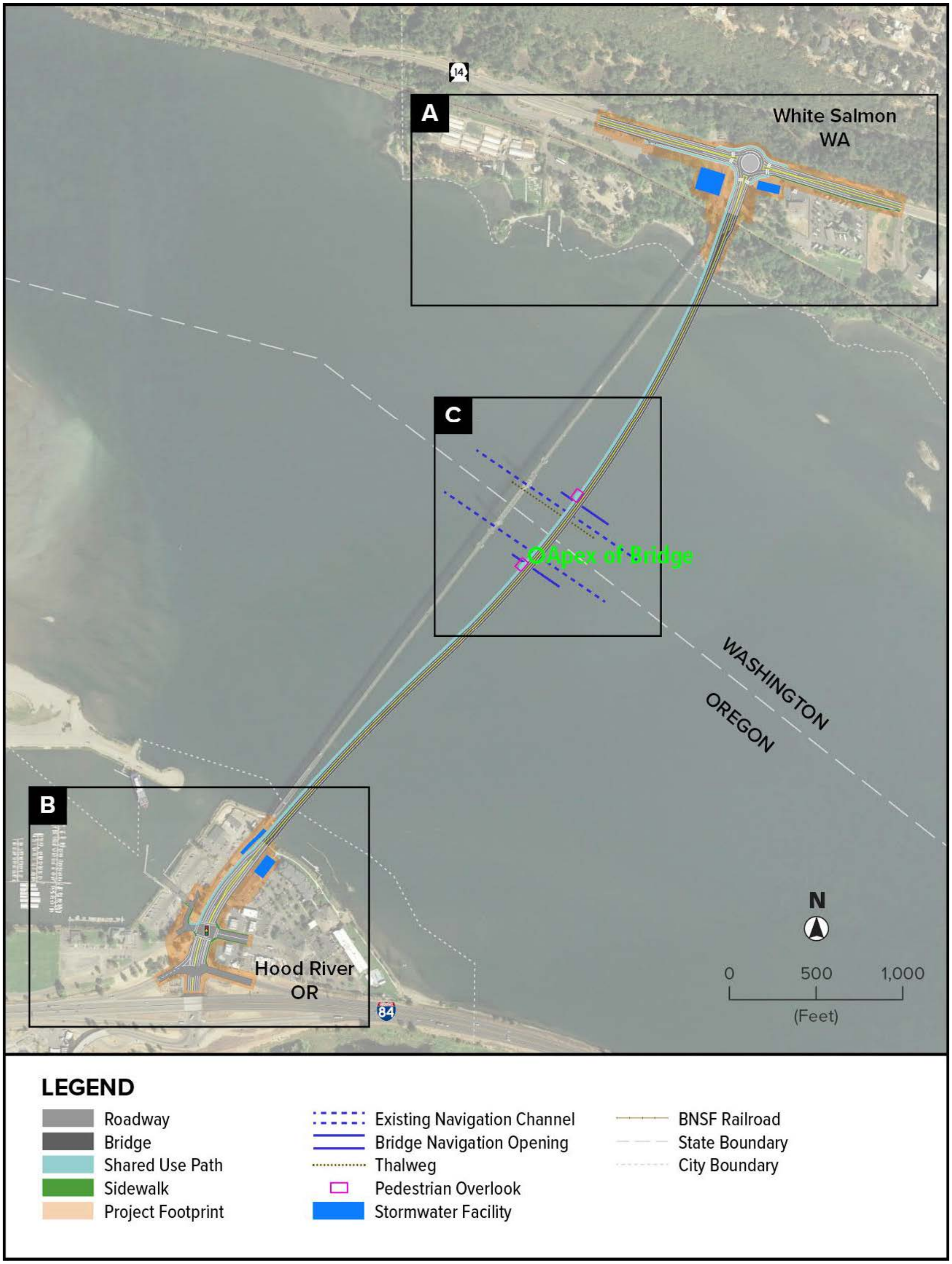
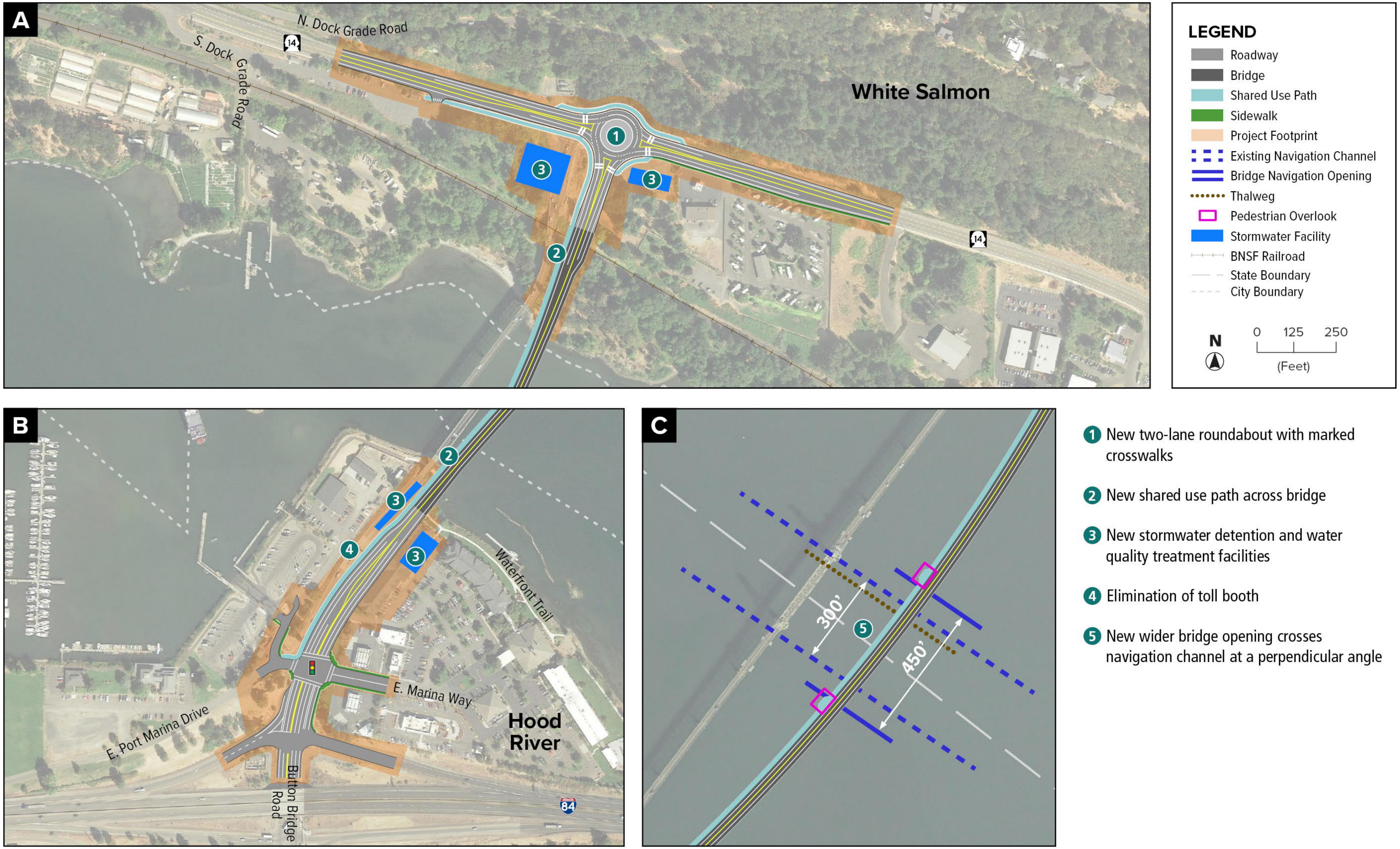


Exhibit 12. Alternative EC-3 Enlargements



1. New two-lane roundabout with marked crosswalks
2. New shared use path across bridge
3. New stormwater detention and water quality treatment facilities
4. Elimination of toll booth
5. New wider bridge opening crosses navigation channel at a perpendicular angle

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3.5. Construction of the Build Alternatives

Construction of the build alternatives would be similar in duration and approach.

- Timeline and sequencing: The NEPA process is anticipated to be complete in 2021; subsequent phases of the Project would be dependent on funding availability. Construction would take approximately 6 years and would require work during approximately six in-water work windows (IWWWs). Approximately three IWWWs would be necessary to construct the replacement bridge, and approximately three additional IWWWs would be necessary to complete the removal of the existing bridge.
- In-water work window: Certain construction and removal activities conducted below the OHWM of the Columbia River would be restricted to an IWWW established for the Project. The IWWW would be established in permits for the Project through inter-agency coordination including Washington Department of Fish and Wildlife (WDFW), Oregon Department of Fish and Wildlife (ODFW), NOAA Fisheries, and USFWS. Preliminary discussions with these agencies indicate that the authorized IWWW would likely be October 1-March 15 of each year. In-water work activities that would be restricted to this IWWW would include vibratory and impact pile installation, installation of drilled shaft casings, installation of cofferdams, and unconfined wiresaw removal of the existing pier foundations. Vibratory pile removal would not be restricted to the IWWW.
- Mobilization and site preparation: The contractor would likely mobilize equipment to the construction site via barges and trucks. Erosion control measures (e.g., silt fences, etc.) and debris containment devices (i.e., floating debris booms) would be installed and clearing and grubbing limits would be established prior to vegetation removal. Barges would require anchoring, tethering, and spudding.
- Construction staging: At least two staging areas would be necessary for staging and storage of materials and equipment; the location of these areas would be determined later in the design process, including obtaining all relevant environmental permits and land use approvals. It is estimated that a minimum of 2 acres would be necessary for staging and storage of materials and equipment. Materials arriving by barge may be offloaded to upland staging areas or may be temporarily stored on barges. All staging areas and equipment fueling areas would be located above the OHWM and outside of environmentally sensitive areas. Staging and temporary access areas will occur in upland locations, on areas that are either already disturbed or that will be restored post-Project.
- Temporary work structures: The Project would likely require the installation of several temporary in-water structures during construction and removal of the existing bridge. These structures would include temporary work bridges, cofferdams, drilled shaft casings, and temporary piles. These temporary features would be designed by the contractor after a contract is awarded, but prior to construction.

  Three temporary work bridges would likely be installed to support construction activities. One temporary work bridge would be installed at each end of the replacement bridge alignment. A third temporary work bridge would be constructed on the Washington side of the river to support the removal of the existing bridge. These temporary structures would likely be supported by 24-inch steel pipe piles.

Additional temporary piles would be necessary throughout construction and removal of the existing bridge for a variety of purposes, including supporting falsework and formwork, pile templates, reaction piles, and for barge mooring. These temporary piles would also likely be 24-inch steel pipe piles.

Barges would be used as platforms to conduct work activities and to haul materials and equipment to and from the work site. Three barges would typically be needed at each pier during drilled shaft construction, and at least one barge would remain at each pier after shaft construction to support column and superstructure construction.

Temporary cofferdams would likely be installed to create isolated in-water work areas for certain activities. A temporary cofferdam would likely be installed to create an isolated in-water work area for construction of a spread footing foundation on the Washington shoreline. Sheet pile cofferdams may also be installed at one or more piers on the existing bridge to create an isolated work area for removal of the existing bridge foundations.

Drilled shaft shoring casings would also be installed as temporary work structures to create isolated work areas for drilled shaft construction. An outer steel casing, with a diameter approximately 12-inches larger than that of the finished drilled shaft, would be installed to act as an isolation structure. The outer cases will be 84 inches in diameter for the 72-inch shafts, and 108 inches in diameter for the 96-inch shafts.

- Work area isolation and fish salvage: To minimize impacts to fish, fish salvage measures would be employed to remove fish from temporarily isolated in-water work areas during and after the installation of drilled shaft shoring casings and cofferdams. Fish salvage would follow the best management practices (BMPs) established in the biological opinion for FHWA and ODOT's Federal Aid Highway Program programmatic consultation and would be supervised by a fish biologist. A fish biologist with the experience and competence to ensure the safe capture, handling, and release of all fish will supervise all fish capture and release. To minimize take, efforts will be made to capture ESA-listed fish known or likely to be present in an in-water isolated work area using methods that are effective, minimize fish handling, and minimize the potential for injury. Attempts to seine and/or net fish, or the use of minnow traps shall precede the use of electrofishing equipment. Isolation structures will be installed such that they will not be overtopped by high water. A reasonable effort would be made to re-locate threatened or endangered fish using methods that minimize the risk of injury.
- Bridge foundation installation: The foundations for the replacement bridge would consist of three different foundation types: 1) pile-supported foundations; 2) drilled-shaft-supported foundations; and 3) spread footings. In general, pile-supported foundations would be used at locations where the depths to bedrock are relatively deep (greater than 50 feet below ground surface) while drilled shaft-supported foundations would be more economical in locations where depths to bedrock are nearer to the surface (less than 50 feet below ground surface). Spread footings would be used where bedrock is located at or near the surface and deep foundations are not required.

  Pile-supported foundations would be supported by 48-inch diameter steel pipe piles. The typical in-water foundation would require 25 piles, where-as smaller terrestrial pile-supported foundations would require fewer piles. Piles would be installed with a vibratory hammer to the extent practicable, as a means of minimizing impacts associated with underwater noise. An impact hammer would be used to drive the piles to the final tip elevation, and/or to proof the piles to verify load-bearing capacity.

Drilled shaft-supported foundations would be supported by either 72-inch-diameter drilled shafts or 96-inch-diameter drilled shafts. The larger-diameter drilled shafts would be used on the bents that flank the navigation channel. Installation of drilled shafts would be conducted by first oscillating an outer steel casing to a specified design depth. As the casing is being advanced to the design depth, soil would be removed from inside the casing using an auger and clamshell. Excavated soils would be temporarily placed onto a barge with appropriate containment and ultimately placed at an approved upland site. Once the interior of the casing has been excavated to the design depth, an interior steel casing of the finished diameter of the shaft would be installed. This casing would be installed either with an oscillator or vibratory hammer. Once the interior casing has been installed to final depth, a steel reinforcement cage would be installed within the casing, and the shaft would be filled with concrete.

Construction of spread footing foundations below the OHWM of the river would be conducted within a temporarily dewatered work area within a cofferdam. Once the cofferdam is installed and the work area established, formwork would be installed for the spread footing, steel reinforcing would be installed within the forms, and the concrete for the footing would be poured. The cofferdam would remain in place until the concrete is fully cured to allow the concrete to cure in a dewatered environment. Once the concrete for the footing is fully cured, the formwork would be removed followed by the temporary cofferdam.

- Bridge superstructure construction: Once the foundation piles and drilled shafts are installed, a concrete pile cap would be installed atop the shafts at the waterline, and the concrete pier and superstructure would be installed atop the pile cap. Pile caps may be either precast or cast-in-place.

  The superstructure would consist of both precast and cast-in-place concrete segments. Additional finish work would also be conducted, including surfacing, paving, and installation of other finish features, such as striping and signage.

  Work on the superstructure would be conducted either from the bridge deck, from the deck of temporary work bridges, or from barges. It is anticipated that the superstructure would be constructed using a balanced cantilever method that uses paired sets of form travelers to build outwards from each pier. It is assumed that a contractor may operate up to four pairs of form travelers at a given time to expedite the construction of the superstructure.

  Many of the bridge superstructure components would be composed of precast concrete. Precast elements would likely include bridge columns, beams, girders, and deck panels. Precast bridge elements would be constructed in upland controlled environments and would be transported to the Project site by either barge or truck.

- Dismantling and removal of the existing bridge: The existing bridge would remain open until the replacement bridge is constructed and operational, at which point it would be dismantled and removed. This work would be conducted via barges and/or temporary work platforms and may require in-water isolation.

  Removal of the superstructure would most likely be conducted by barge-mounted cranes. Removal of the superstructure would likely begin with removal of the counterweights, followed by the lift towers and the individual truss sections. The lift towers and truss sections would be cut into manageable pieces and loaded onto barges or trucks by a crane. Each section would then be either transported to an upland site for further dismantling or disposed of directly at an appropriately permitted upland facility.

Removal of the existing foundations would be conducted by one of the following two methods:

  - Wiresaw removal to mudline, without a cofferdam. A diamond wire/wire saw would be used to cut the foundation into manageable pieces that would be transported to a barge and disposed of in a permitted off site upland location. The foundations would be removed to the mudline and the substrate would be naturally restored with surrounding sediments.
  - Wiresaw or conventional pier removal techniques within a cofferdam. Conventional removal techniques consist of using a hydraulic ram to break the piers into rubble, and torches or other cutting methods to cut reinforcement. Materials would then be transported to a barge and disposed of in a permitted off site upland location. The foundations would be removed to the mudline and the substrate would be naturally restored with surrounding sediments.

It is assumed that the cofferdam removal option would be used at both piers that flank the navigation channel, but may also be used in other pier locations. At the two navigation channel piers, once cofferdams are installed and fish salvage has occurred, approximately 7,800 cubic yards of existing riprap would be removed. Riprap would be removed via a barge mounted clamshell, and loaded onto barges, and disposed of at an off-site permitted upland location. Once riprap has been removed, the existing piers would either be removed using one of the methods described above.

- Post-Project site restoration: Construction of the Project would result in temporary impacts to native and non-native vegetation on both the Oregon and Washington sides of the river. Areas temporarily disturbed during construction would be restored upon completion of the Project consistent with state and local regulations.

  On the Oregon side of the river, most temporary disturbance would occur within areas that are either impervious or already developed. Temporary disturbance would occur within areas that consist of landscaping, lawns, or similar heavily managed vegetation. Post-Project site restoration in these areas would likely consist of replacement landscaping with similar ornamental species. No native plant communities would be disturbed on the Oregon side of the river.

  On the Washington side of the river, vegetation would be cleared within temporary work zones to allow construction equipment to access the site, to construct the replacement bridge abutments and stormwater treatment facilities, and to remove the existing bridge. A portion of the area to be cleared would be within a forested riparian area that is within the 200-foot shoreline jurisdiction of the Columbia River, and is regulated by the City of White Salmon under its Shoreline Master Program (City of White Salmon 2016). A large oak tree that is present east of the existing bridge would be preserved and would not be affected.

  Temporarily disturbed areas within ODOT and WSDOT rights-of-way would be replanted consistent with applicable ODOT and WSDOT requirements and design standards. Temporarily disturbed vegetation within the riparian shoreline buffer on the Washington side of the river would be conducted consistent with requirements in the City of White Salmon Critical Areas Ordinance (White Salmon Municipal Code Chapter 18.10) (and Shoreline Master Program (City of White Salmon 2016).

- Compensatory Mitigation: The Project would result in permanent impacts to wetland and aquatic habitats, and a compensatory mitigation plan would likely be required by federal, state and local regulations to offset these permanent impacts. The compensatory mitigation plan would be developed during the permitting phase of the project. The mitigation plan would identify the amount, type, and specific locations of any proposed compensatory mitigation actions, specific impact avoidance and minimization measures to be implemented, as well as the goals, objectives, and performance standards for measuring success. Full implementation of the compensatory mitigation plan would be a condition of the applicable permits of the agencies with jurisdiction (i.e., USACE Section 404 permit, the Oregon Department of Environmental Quality [DEQ] and the Washington State Department of Ecology [Ecology] Section 401 permits, the Oregon Department of State Lands [DSL] Removal-Fill permit, WDFW Hydraulic Project Approval, and City of White Salmon Shorelines and Critical Areas permits), and the mitigation would comply fully with all applicable permit terms and conditions.

The method of delivery for Project final design and construction has not been determined at this time. Traditional delivery methods, such as design-bid-build, and alternative delivery methods, such as design-build and public-private-partnerships to name a few, will continue to be considered by the Port. As part of Oregon's HB 2017, the Port was provided legal authority by the state to enter into a public-private-partnership.

4. METHODOLOGY

Noise was previously analyzed in the Project's Draft EIS and Noise Technical Report (Parsons Brinckerhoff 2003). A comparison between the Draft EIS and Supplemental Draft EIS noise analysis results is provided in Section 6.6 of this report. A description of the characteristics of noise is presented in Attachment A of this report.

4.1. Study Area

The study area contains a variety of existing land uses consisting primarily of commercial and recreational uses. The south shore, or City of Hood River side, has a higher concentration of development within the immediate vicinity of the bridge than the north shore, or City of White Salmon side. The existing land uses are shown within the 500-foot noise study area Exhibit 13.

4.1.1. Noise Monitoring

Ambient noise levels were measured for one 15-minute period at seven locations near the Project area to describe the existing noise environment, identify major noise sources in the Project area, and validate the noise prediction model (Exhibit 14). Ambient noise levels were measured at several locations near the Project area to characterize weekday environmental noise levels. Measurements were conducted on May 5 and 6, 2019, with a calibrated Larson Davis Model 820 noise meter, which complies with ANSI S1.4 Standard for a Type I accuracy instrument. Calibration forms for all instruments used for field monitoring are provided in Attachment B of this report. In some cases, measurement locations represent larger clusters of noise-sensitive receptors near the Project. Measurements were performed at outdoor use areas of private residences and land owners near the Project area when possible. Some measurements were performed at publicly accessible locations adjacent to outdoor use locations. Locations were selected to represent existing traffic noise levels near the Project area for use as model validation points. The seven measured sites represent: 1) the Waterfront Trail, 2) a 10-unit apartment complex, 3) Port Marina Park, 4) 35 RV camping spaces, 5) a park and ride lot, 6) a private outdoor recreation area at Hood River WaterPlay, and 7) a Tribal campground/treaty fishing access site.

Exhibit 13. Existing Land Use and Noise Study Area

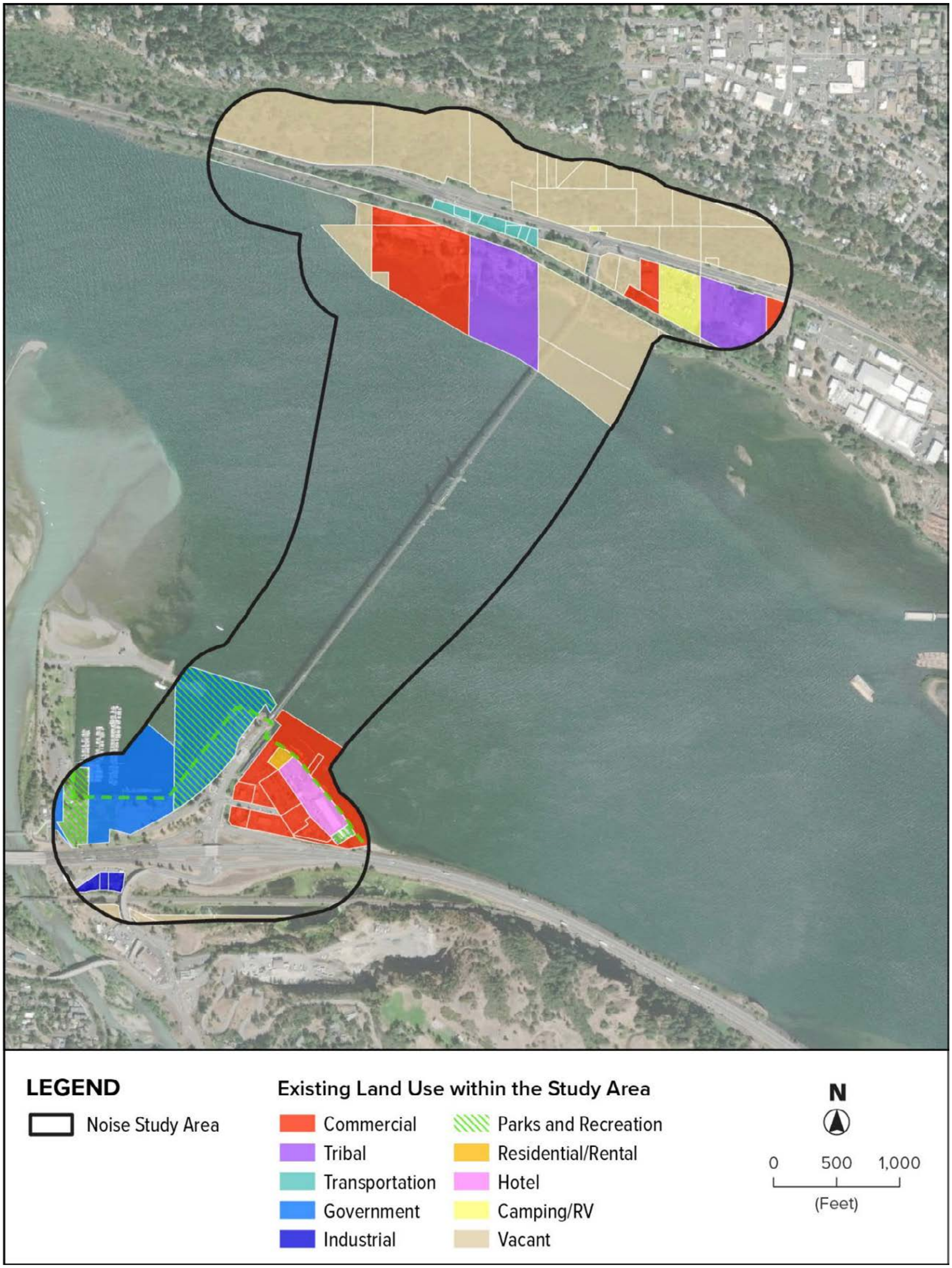
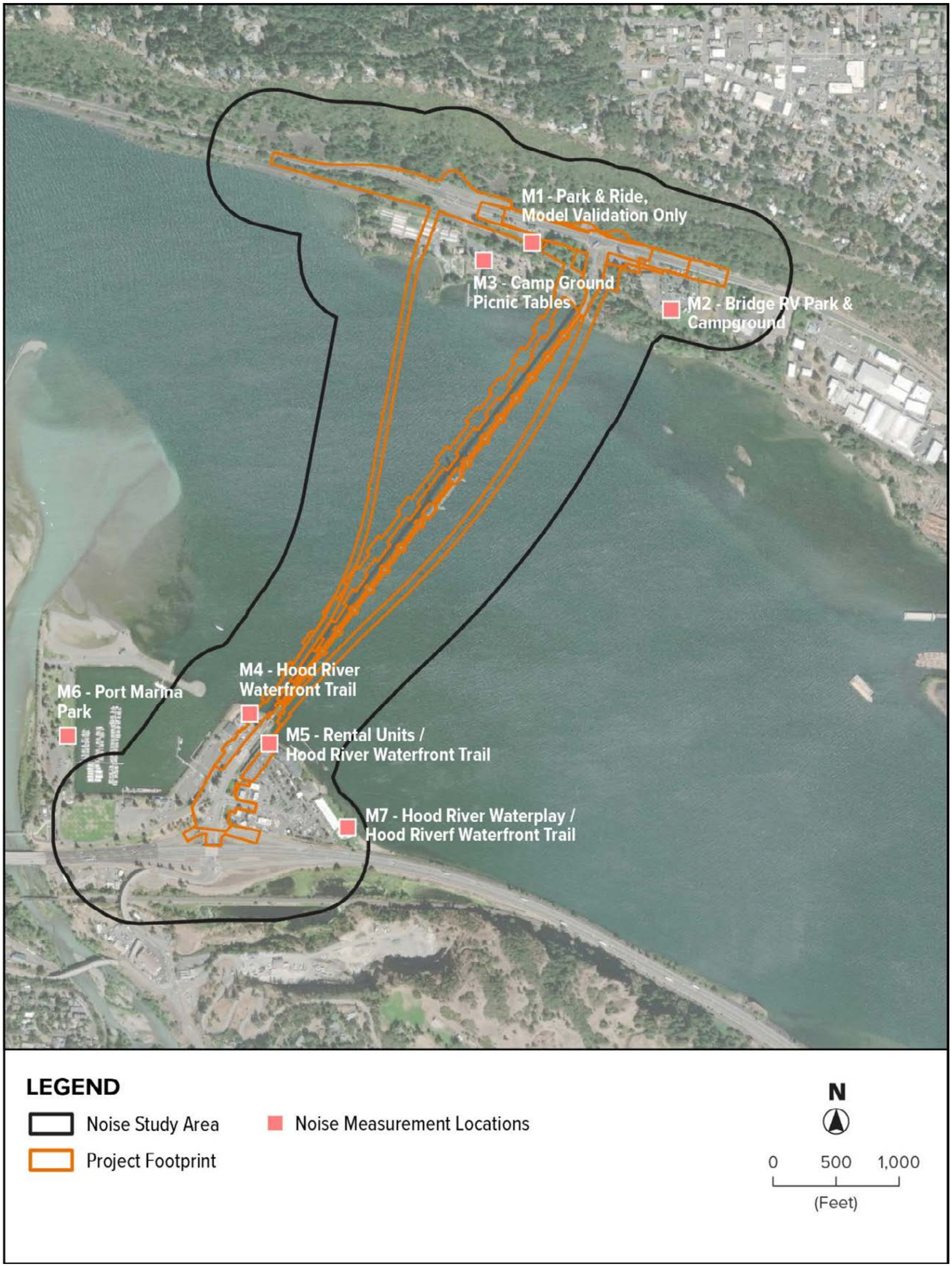


Exhibit 14. Noise Measurement Locations



4.1.2. Noise Modeling

Existing noise levels were modeled at 25 locations that are representative of properties that could potentially be affected by the Project. Along with the seven measured sites previously described, eighteen (18) additional modeled-only sites were added totaling 25 modeled receivers (representing 1 residence, 10 apartment units, 35 RV camping spaces, 1 public trail, 1 public park, 1 private outdoor recreation area, 1 hotel, and 1 tribal campground/treaty fishing access site) were also included in the TNM® model to provide predicted traffic noise levels for receivers that could be impacted by the Project. The modeling locations were chosen because they are representative of outdoor ground floor and above ground floor areas of frequent human use, such as residential front yards, outdoor patios, trails, benches or sitting areas (ODOT 2011).

Local terrain in the noise study area includes a steep slope on the Washington side north of SR 14 and is mostly flat on the Oregon side. As standard practice, base maps were imported into the TNM® package via DXF file import. In addition, ArcGIS was used to develop the TNM® model. Design drawings were used to locate and verify roadway widths and for additional base mapping. Major roadways, terrain features, and sensitive receptors were digitized into the model. The U.S. Geological Survey (USGS) 7.5-minute Digital Elevation Model was also used (USGS 2004).

TNM® Version 2.5 computer model (FHWA 2004) was used to predict hourly equivalent sound level ($L_{eq(h)}$) traffic noise levels as shown in Section 5. TNM® was used to predict noise levels at discrete points by considering interactions between different noise sources and the effects of topographical features on the propagation of noise. The model estimates the traffic noise level at a receptor location resulting from a series of straight-line roadway segments. Noise emissions from free-flowing traffic depend on the number of automobiles, medium trucks, and heavy trucks per hour; vehicular speed; and reference noise emission levels of specified vehicles. TNM® also considers effects of intervening barriers, topography, trees, and atmospheric absorption. By intent and design, noise from sources other than traffic is not included. Therefore, when non-traffic noise, such as aircraft, is considerable in an area, the TNM® results can be slightly less than the measured noise levels.

Analysis of sound levels at noise sensitive land uses were conducted following standard ODOT, WSDOT, and FHWA noise policy guidance. The proposed alignments were provided to the Project Design noise team. The noise model was developed by using the roadway centerline from the Project design file and digitized into TNM.

Construction noise was qualitatively assessed using FHWA reference levels. Suggested construction noise mitigation measures are provided for inclusion in contractor documents.

4.1.3. Modeled Traffic Data

Per ODOT policy, a comparison of the peak truck hour $L_{eq(h)}$ and peak vehicle hour $L_{eq(h)}$ is typically performed. A comparison is made because noise from truck traffic has been found to be much louder than automobile traffic, with one truck equaling approximately 47 passenger cars on average (NYC 2010). Therefore, the peak truck hour is often found to be noisier than the peak vehicular hour, although it may have lower overall traffic volumes. For this study, PM peak hour volumes were used in the existing conditions (2019), No Action Alternative (2045), and build alternative (2045) after a comparison of peak hour and peak truck hour noise levels showed that sound levels from peak hour traffic volumes were slightly higher than noise levels resulting from peak truck hour traffic volumes. Traffic data and speeds were developed by the Project team for use in this noise study. Traffic counts were also recorded during field measurements for model validation. All traffic volumes used for this noise study are documented in Attachment C.

4.2. Noise Regulations and Impact Criteria

Applicable noise regulations and guidelines provide a basis for evaluating potential noise impacts. For highway transportation projects with FHWA involvement, the Federal-Aid Highway Act of 1970 and the associated implementing regulations (23 Code of Federal Regulations 772) govern the analysis and abatement of traffic noise impacts. The regulations require that potential noise impacts in areas of frequent human use be identified during the planning and design of a highway project. The noise regulations govern noise prediction requirements, noise analyses, NAC, and requirements for informing local officials. The NAC are used to determine when a noise impact would occur. The NAC differ depending on the type of land use under analysis. For example, the NAC for residences (67 dBA) is lower than the NAC for commercial areas (72 dBA).

Predicted noise levels were compared to the FHWA NAC and if found to approach or exceed the NAC the number of affected receptors were counted for the build alternative. If impacts were predicted, then mitigation measures were evaluated using ODOT's and WSDOT's reasonableness and feasibility criteria at receptors where noise levels were modeled to approach or exceed the NAC.

4.3. Noise Regulations in Oregon

4.3.1. ODOT Noise Policy

ODOT implements FHWA noise regulations in the State of Oregon in accordance with the ODOT Noise Manual (ODOT 2011). According to this manual, a noise impact occurs when the future noise level for a build alternative results in a substantial increase in the noise level, defined as a 10 dBA or more increase over the existing noise levels, or when the future noise level for a build alternative approaches or exceeds the FHWA NAC. ODOT noise policy defines the NAAC as 2 dBA less than the FHWA NAC. This report complies with the current ODOT manual. Exhibit 15 shows the ODOT NAAC and FHWA NAC.

Exhibit 15. FHWA NAC, ODOT NAAC, and WSDOT NAC Hourly dBA

Activity Category	Activity Criteria $L_{eq(h)}$[a] FHWA NAC	ODOT NAAC	WSDOT NAC	Evaluation Location	Activity Description
A	57	55	56	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[b]	67	65	66	Exterior	Residential
C[b]	67	65	66	Exterior	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or non-profit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails and trails crossings.
D	52	50	51	Interior	Auditoriums, campgrounds, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or non-profit institutional structures, radio studios, recording studios, schools, and television studios.
E[b]	72	70	71	Exterior	Hotels, motels, offices, restaurants/bars, and other develop lands, properties, or activities not included in A through D or F.
F	—	—	—	—	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	—	—	—	—	Undeveloped lands that are not permitted.[c]

Notes:

[a] The $L_{eq(h)}$ Activity Criteria values are for impact determination only and are not design standards for noise abatement measures.

[b] ODOT NAAC

[c] Includes undeveloped lands permitted for this activity category

4.3.2. Oregon Department of Environmental Quality Noise Policy

The Oregon Department of Environmental Quality Chapter 340 Division 35 sets allowable noise levels for individual vehicles and for industrial and commercial uses. Maximum allowable noise levels for in-use vehicles in Oregon are determined by vehicle type, operating conditions, and model year (http://www.deq.state.or.us/aq/rules/div35/table2.pdf).

4.4. Noise Regulations in Washington

4.4.1. WSDOT Noise Policy

WSDOT considers a noise impact to occur if predicted $L_{eq(h)}$ noise levels approach within 1 dBA of the NAC (WSDOT 2011). The FHWA NAC specify exterior $L_{eq(h)}$ noise levels for various land activity categories as described in Exhibit 15. WSDOT also considers an increase of 10 dBA or more to be a substantial increase and a traffic noise impact.

4.4.2. Washington Administrative Code (WAC)

Along with the federal noise impact criteria, most cities in Washington, including those in the Project area, rely, at least in part, on the Washington State Noise Control Ordinance (Washington Administrative Code (WAC) 173-60). The WAC 173-60 establishes residential, commercial, and industrial noise limits, along with construction noise limits. Traffic noise from public roadways is exempt from the WAC 173-60. Project construction would need to adhere to the ordinances applicable in the individual jurisdictions, which are based on the WAC noise control ordinance. Local noise ordinances can include different provisions from the state law.

4.5. Local Noise Rules

The City of Hood River limits noise levels at or within the boundary of noise sensitive properties (City of Hood River Noise Ord. Chapter 8.09). Sounds regulated by federal law, sounds when performed under permit, sounds from construction during the hours of 7 am to 10 pm and sounds caused by regular vehicular traffic upon premises open to the public are exempt. Noise levels between the hours of 10 pm to 7 am may not exceed 50 dBA and between the hours of 7 am to 10 pm noise levels may not exceed 60 dBA. Also, noise levels that are plainly audible from a distance of 100 feet from the source are prohibited between the hours of 7 am to 10 pm. Construction, excavation, or demolition is not permitted prior to 7 am and after 7 pm unless a permit is issued by the council or it’s designee.

In Washington, construction noise is exempt from property line standards during daytime hours. During nighttime hours (10 pm and 7 am), construction noise must meet Department of Ecology property line regulations. Restricted noise levels apply to construction equipment only at rural and residential receiving properties between 10 pm and 7 am the following day for the Washington side. In the City of White Salmon, the local noise ordinance (City of White Salmon Noise Ordinance Chapter 8.05), construction noise is exempt from 7 am to 7 pm Monday through Friday. Construction noise occurring outside those exempted times must comply with the noise ordinance and would require a permit from the City.

4.6. Sources of Existing Data

The noise analysis was updated with current land uses in the noise study area, existing noise conditions, analysis methods, noise level descriptors, noise regulations and noise impact criteria, long-term Project impacts on noise levels, short-term impacts from construction activities, and abatement measures. The following coordination, data gathering, analysis, and reporting was collected in support of the traffic noise analysis.

4.7. Impact Analysis Techniques

Modeled noise levels for existing year and future year scenarios were evaluated with ODOT NAAC and WSDOT NAC to determine impact by land use category and impacts resulting from substantial increase in noise levels over existing noise levels. Potential construction impacts are qualitatively discussed. Operation and construction activities planned as part of the Project in 2003 were compared with current assumptions to determine if previous construction impacts remain valid.

4.7.1. Construction Impacts

Construction activities would have short-term noise impacts on noise sensitive land uses in the immediate vicinity of construction activities. Impacts on adjacent communities would include noise from the operation of construction equipment and noise from construction and delivery vehicles traveling to and from the construction site. The level of impact would depend on the noise characteristics of the equipment, activities involved, the construction schedule, and the distance of equipment from sensitive receptors.

A qualitative discussion of noise levels anticipated during construction was developed using construction timing and the mix of construction equipment and locations of equipment.

4.7.2. Direct Impacts

Predicted noise levels for existing and future build and no action conditions were compared with the ODOT NAAC. All impact locations were described and shown graphically.

4.7.3. Indirect Impacts

This noise analysis is based on the transportation demand forecasting model that generates projected traffic volumes and includes the impacts of unmet demand on the transportation system from future population, housing and land use changes, and growth. Therefore, the traffic analysis used to assess the direct noise impacts also takes into account indirect impacts.

4.7.4. Evaluation of Mitigation

Noise barriers were evaluated at the location of all traffic noise impacts. The evaluation of all noise barriers followed ODOT and WSDOT guidance for feasible and reasonable noise abatement measures.

4.8. Agency Coordination

Coordination occurred with local officials to obtain plans of future development in the noise study area as required by updated ODOT and WSDOT noise policies. This coordination helped determine field measurement and noise modeling locations to assess existing and future land uses. Coordination with ODOT noise staff also took place regarding noise measurement locations prior to field activities. In addition, before modelling took place, consultation was conducted with ODOT noise staff for approval regarding the specifics of assigning receivers to receptors.

Local jurisdictions were contacted as a part of the land use study for this Project. No permits or zoning changes were identified within the noise study area. No displacements are planned for the Project.

5. AFFECTED ENVIRONMENT

5.1. Land Use

The study area contains a variety of existing land uses consisting primarily of commercial and recreational uses. The north shore, or City of White Salmon side, has a lower concentration of development within the immediate vicinity of the bridge than the south shore, or City of Hood River side. Exhibit 13 shows existing land uses within the 500-foot noise study area.

Existing land uses near the north approach to the existing bridge are located on the relatively narrow strip of land between the Columbia River and SR 14. To the east of the approach is vacant land, then a Texaco service station/food mart, and the Bridge R.V. Park and Campground. To the west of the approach is vacant land, followed by a WSDOT park and ride, a Native American treaty fishing access site (White Salmon TFAS that includes a picnic area and camping and residential area), picnicking, and boat launch area, and a commercial nursery.

The following land uses are near the east side of the south approach to the existing bridge:

- Two-story office/commercial building (the Marketplace, housing over 10 different offices and 1 restaurant/pub)
- Two service stations (Chevron and Texaco)
- Two fast food establishments (Taco Time and McDonalds)
- Hotel and restaurant (Best Western Hood River Inn and Riverside Grill)
- Parking for the businesses
- One single-family residence
- Recreation opportunities (such as fishing, Waterfront Trail that passes underneath the bridge, and a boat dock)

On the west side, adjacent to the south approach is:

- Commercial/retail establishment with outdoor storage area (Bubba Louie's Sailboat)
- Marina park, vehicle and boat trailer parking lot, boat ramp and public restrooms (Mid-Columbia Marina)
- Waterfront Trail (a continuation of the trail on east side)
- Port's office

Slightly further west, across the marina there are additional recreational and office land uses, all part of the Port's property. These uses include the Oregon D.M.V., Hood River County Historical Museum, Port Marina Park, several small buildings housing windsurfing schools, windsurfing, kiteboarding and kayaking launch sites, boat docks, picnic areas, lawn areas, public restrooms, and paved parking areas.

5.2. Noise Monitoring and Model Validation

Existing noise levels were field measured at seven locations (Exhibit 14). Fifteen-minute noise measurements were taken at each location during different times of the day (Exhibit 16). The measured noise levels were used to verify the results of the traffic noise model used to predict noise levels of the proposed alternatives, existing conditions, and the No Action Alternative. Traffic noise from Hood River Bridge, SR 14 and I-84, including traffic on the existing Hood River Bridge, was the dominant noise source in the study area, with minor contributions from aircraft and trains from both Washington and Oregon shores. The existing Hood River Bridge grated deck results in more noise than would a solid deck as planned in all future build alternatives.

Exhibit 16. Noise Measurement Data and Noise Model Validation Results

Site #—Location	Date	Start Time	Measured L_{eq} (dBA)	Modeled L_{eq} (dBA)	Difference (dBA)
M1—WSDOT Park and Ride	5/7/19	11:00	61.9	61.2	-0.7
M2—Bridge RV Park and Campground	5/7/19	12:00	56.9	55.5	-1.4
M3—Tribal Treaty Fishing Access Site and Campground	5/7/19	11:30	54.4	53.1	-1.3
M4—Waterfront Trail (west)	5/6/19	14:30	60.6	58.1	-2.5
M5—Extended Stay Hotel / Waterfront Trail (east)	5/6/19	14:55	60.4	61.1	0.7
M6—Port Marina Park	5/6/19	16:45	51.1	52.6	1.5
M7—Hood River WaterPlay	5/6/19	15:20	61.0	61.2	0.2

Notes:
Leq = equivalent sound level
Short term measured noise levels were used for model validation near existing roadways.

The hum generated by vehicles crossing the grated deck of the existing Hood River Bridge is noticeable as you move closer to the bridge and more obvious within a few hundred feet of the bridge. The noise study performed in 2003 included a correction factor to validate noise measurements conducted at that time. This study did not use a correction factor as noise measurements validated within TNM®.

Noise levels at the seven measurement locations representing the Waterfront Trail, a hotel complex, Port Marina Park, RV and camping spaces, a single-family residence, a park and ride lot, one private outdoor recreation area at Hood River WaterPlay, and a Tribal campground/treaty fishing access site were modeled using the FHWA Traffic Noise Model (TNM2.5) (Exhibit 16). Traffic noise, mostly from I-84, Hood River Bridge, and SR 14, was the dominant source in the study area.

Noise levels at the seven measurement sites ranged from 51 dBA equivalent sound level (L_{eq}) to 62 dBA L_{eq}, depending on the proximity to Hood River Bridge, I-84, and SR 14 (Exhibit 16). The noise measurements were performed during satisfactory weather conditions for performing noise measurements in the daytime on May 6 and 7, 2019. The temperatures during measurement periods ranged from 69 degrees to 82 degrees Fahrenheit with mostly sunny skies, no precipitation, and low wind speeds during measurement periods. Descriptions of each measurement site follow:

- Measurement Site M1 was located at a park and ride lot located along SR 14 west of the Hood River Bridge in Washington. Site M1 was located approximately 520 feet west of vehicles traveling on SR 35 and 20 feet to 30 feet higher in elevation than SR 35. The monitored noise level at Site M1 was 62 dBA L_{eq}.
- Measurement Site M2 was located at a RV and camping park located along SR 14 east of the Hood River Bridge in Washington. Site M2 was located approximately 675 feet east of vehicles traveling on SR 35 and 20 feet to 30 feet higher in elevation than SR 35. The monitored noise level at Site M2 was 57 dBA L_{eq}.
- Measurement Site M3 was located at a Tribal campground/treaty fishing access site located along SR 14 west of the Hood River Bridge in Washington. Site M3 was located approximately 815 feet west of vehicles traveling on SR 35 and 5 feet to 10 feet lower in elevation than SR 35. The monitored noise level at Site M3 was 54 dBA L_{eq}.
- Measurement Site M4 was located along the Waterfront Trail approximately 150 feet west of Button Bridge Road in Oregon. Site M4 was located approximately 15 feet lower in elevation than Button Bridge Road in this area. The monitored noise level at Site M4 was 61 dBA L_{eq}.
- Measurement Site M5 was located along the Waterfront Trail alongside ground floor outdoor use areas at the extended stay apartment complex located at 1108 E. Marina Way, approximately 85 feet east of Button Bridge Road in Oregon. Site M5 was located approximately 10 feet lower in elevation than Button Bridge Road in this area. The monitored noise level at Site M5 was 61 dBA L_{eq}.
- Measurement Site M6 was located at picnic benches at Port Marina Park approximately 1,300 feet west of Button Bridge Road in Oregon. Site M6 was located approximately 10 feet lower in elevation than Button Bridge Road in this area. The monitored noise level at Site M6 was 51 dBA L_{eq}.
- Measurement Site M7 was located alongside the Hood River WaterPlay outdoor pool approximately 1,000 feet east of Button Bridge Road in Oregon. Site M7 was located approximately 10 feet lower in elevation than Button Bridge Road in this area. The monitored noise level at Site M7 was 61 dBA L_{eq}.

For noise model validation, measured noise levels, traffic counts, and average traffic speeds taken during the measurements were used to validate the TNM® traffic noise model. The study area and surrounding topographic features were included in the modeling. The existing conditions TNM® model was validated by ensuring that the modeled noise levels at each of the seven measured sites were within +/- 2 dBA of the measured levels per WSDOT Noise Policy and within +/- 3 dBA of measured levels per ODOT Noise Policy as shown in Exhibit 16.

Verification of the modeled and measured noise levels within 3 dBAs (2 dBAs in Washington) indicates that the model is accurately representing the noise levels in this area and within the requirements of +/- 3 dBA (2 dBAs in Washington) for model validation. Thus, the model can be relied upon to accurately predict the noise levels for existing and future peak vehicle hour traffic conditions. Attachments C and D contain the data (traffic counts, photographs, and other site information) collected during noise measurements. Attachment E contains the TNM modeling runs for model verification.

5.3. Existing Noise Conditions

Exhibit 17 shows the TNM® predicted noise results for the measured and modeled sites within the area studied for the existing noise condition (2019). The locations of all modeled sites can be seen on Exhibit 18 and Exhibit 19 with site descriptions provided in Attachment C, Table C-3. The modeled noise levels along the current roadways range from 47 dBA $L_{eq(h)}$ to 65 dBA $L_{eq(h)}$.

Predicted existing noise levels were compared with the FHWA NAC (Exhibit 17) and were found to reach the ODOT NAAC at one modeled site in the noise study area, Hood River WaterPlay, that includes an outdoor pool near I-84. Upper floor balconies at the Best Western Hotel that face the Hood River Bridge and outdoor areas at the Hood River WaterPlay recreation area experience the loudest noise levels in the area. The modeled noise levels at these receivers are primarily influenced by the proximity of the receiver to the existing roadways but are also influenced by the amount of physical shielding provided by nearby buildings and topography. Modeled sites R15 and R16 represent locations within the White Salmon TFAS; existing noise levels at both sites are predicted to be 52 dBA. Attachment E contains the TNM modeling runs for the Existing Condition.

Exhibit 17. Predicted Noise Levels for the Existing Condition

Noise Receiver Number	Number of Uses Represented by the Receiver	Land Use Criteria	Activity Category/ ODOT NAAC/ WSDOT NAC dBA $L_{eq(h)}$	Existing (2019 PM Peak) Traffic Noise Level dBA $L_{eq(h)}$	Exceeds ODOT NAAC / WSDOT NAC (Yes or No)
R1	1	Recreation	C/65	50	No
R2	1	Recreation	C/65	54	No
R3	1	Recreation	C/65	53	No
R4	1	Recreation	C/65	55	No
R5	1	Recreation	C/65	60	No
R6-1	2	Commercial	E/70	56	No
R6-2	2	Commercial	E/70	59	No
R6-Trail	2	Recreation	C/65	57	No
R7-1	2	Commercial	E/70	53	No
R7-2	2	Commercial	E/70	56	No
R7-3	2	Commercial	E/70	63	No
R8-1	4	Commercial	E/70	52	No
R8-2	4	Commercial	E/70	56	No
R8-3	4	Commercial	E/70	63	No
R9-1	3	Commercial	E/70	51	No
R9-2	3	Commercial	E/70	55	No
R9-3	3	Commercial	E/70	64	No
R10	1	Recreation	C/65	58	No
R11-1	12	Commercial	E/70	57	No
R11-2	12	Commercial	E/70	61	No
R12-1	12	Commercial	E/70	60	No
R12-2	12	Commercial	E/70	63	No
R13	1	Recreation	C/65	65	Yes
R14	1	Residential	B/66	51	No

Noise Receiver Number	Number of Uses Represented by the Receiver	Land Use Criteria	Activity Category/ ODOT NAAC/ WSDOT NAC dBA $L_{eq(h)}$	Existing (2019 PM Peak) Traffic Noise Level dBA $L_{eq(h)}$	Exceeds ODOT NAAC / WSDOT NAC (Yes or No)
R15	1	Recreation	C/66	52	No
R16	4	Recreation/ Residential	B/C/66	52	No
R17	1	Commercial	E/71	60	No
R18	1	Recreation	C/66	54	No
R19	1	Recreation	C/66	52	No
R20	2	Recreation	C/66	53	No
R21	2	Recreation	C/66	54	No
R22	2	Recreation	C/66	56	No
R23	2	Recreation	C/66	58	No
R24	1	Residential	B/66	47	No
R25	1	Residential	B/66	49	No

Notes:
See Exhibit 15 for information on the NAAC activity categories.
See Attachment C for descriptions of modeled sites.
-1 modeling site located on 1st floor
-2 modeling site located on 2nd floor
-3 modeling site located on 3rd floor

Exhibit 18. Modeled Locations and Predicted Existing Conditions – Hood River, OR (2019)

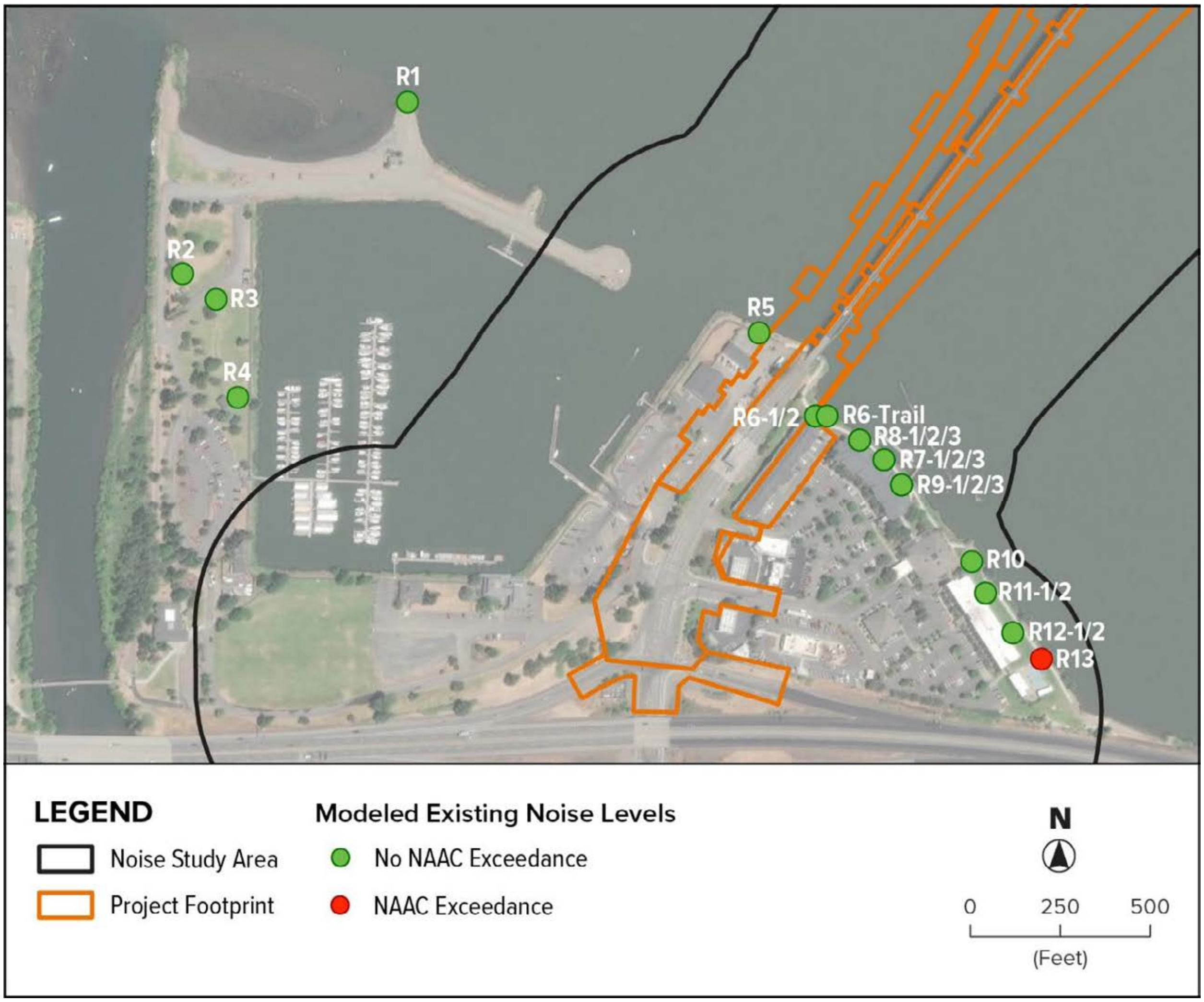
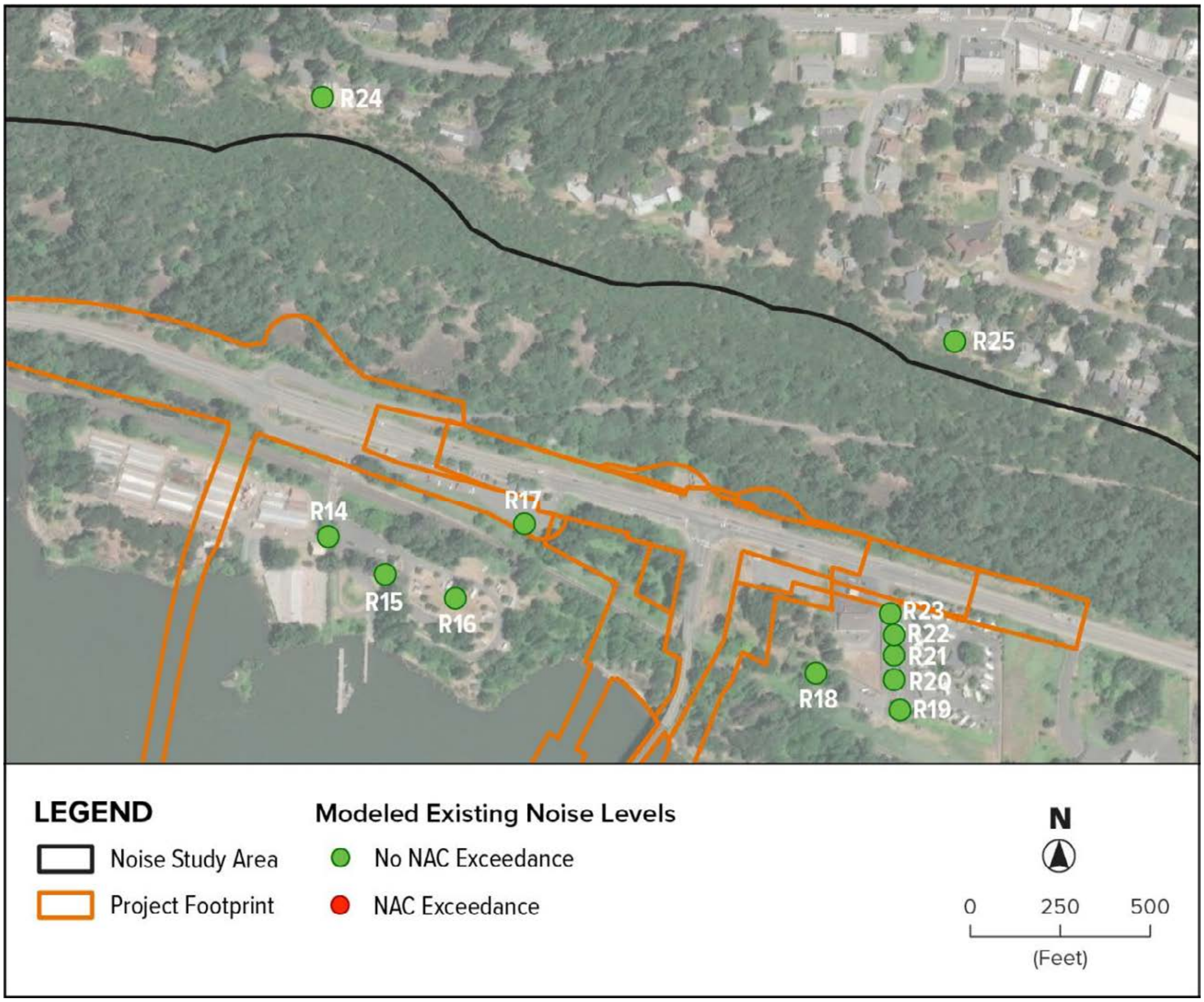


Exhibit 19. Modeled Locations and Predicted Existing Conditions – White Salmon, WA (2019)



6. ENVIRONMENTAL CONSEQUENCES

6.1. No Action Alternative

6.1.1. Direct Impacts

The proposed Hood River Bridge would not be constructed under this alternative. Future modeled worst-hour traffic noise levels under the No Action Alternative range from 49 dBA to 65 dBA with increases in noise levels by 0 dBA to 3 dBA at all noise receptors in the study area (Exhibit 20). The increase in modeled noise levels at these sites are a result of increased traffic in the future. Actual maximum noise level increases may be less than the predicted increase as congestion increases in the peak hour and slows traffic. Should this occur in the Hood River Bridge corridor, peak noise levels would be similar to existing peak hour noise levels; however, they would occur for a longer period each day. A 1 dBA to 3 dBA increase is not perceptible to most individuals. Noise levels would exceed the ODOT NAAC at one (R13) out of 25 modeled sites representing the outdoor pool at Hood River WaterPlay under the No Action Alternative as well as each of the build alternatives. The predicted increase in the noise level at this site was due to the proximity to I-84 and the associated predicted traffic numbers for the year 2045. The noise level is not appreciably affected by traffic on the Hood River Bridge.

Modeled sites R15 and R16, representing a picnic area and short- and long-term camping and residential areas located within the White Salmon TFAS are predicted to experience a 2 dBA increase in noise levels totaling 54 dBA under the No Action Alternative.

Following closure of the existing bridge in 2045 when the bridge reaches its operational lifespan, traffic noise on the bridge would cease.

If a catastrophic event occurs such as an earthquake, landslide, or barge or vessel strike, the bridge could be damaged or collapse into the river. At the time of the catastrophe, noise levels may temporarily increase associated with bridge components being damaged and debris falling into the river. Specific noise could include decking or bridge girders rupturing and concrete piers cracking and splashing in to the river below. Following the catastrophe, the bridge could be closed to traffic, ending usual noise from automobiles crossing the bridge including tires on the steel grating, engines, and brakes. The bridge closure would divert cross-river traffic 21 miles east to the Dalles Bridge or 25 miles west to the Bridge of the Gods, increasing traffic noise marginally at these locations.

6.1.2. Indirect Impacts

The noise analysis for this Project is based on the transportation demand forecasting model and includes the impacts of capacity constraints on the transportation system. By including the vehicles that are not moving efficiently through the transportation system, the indirect impacts of increased transportation capacity are included in the analysis. The results of the noise analysis already reflect the potential delayed and distant impacts of the Project. Indirect impacts for the No Action Alternative would be similar to the indirect impacts of the build alternatives, as described in Sections 6.2, 6.3, and 6.4. Data presented in Exhibit 20 reflect modeled noise levels for the No Action Alternative through 2045.

Exhibit 20. Predicted Existing and Future Traffic Noise Levels

Noise Receiver Number	Activity Category/ ODOT NAAC/ WSDOT NAC dBA $L_{eq(h)}$	Existing (2019) Traffic Noise Level dBA $L_{eq(h)}$	No Action Alternative (2045) Traffic Noise Level dBA $L_{eq(h)}$	No Action Alternative (2045) Increase over Existing Traffic Noise Level dBA $L_{eq(h)}$	Preferred Alternative Build EC-2 (2045) Traffic Noise Level dBA $L_{eq(h)}$	Preferred Alternative Build EC-2 (2045) Increase over Existing Traffic Noise Level dBA $L_{eq(h)}$	Alternative EC-1 (2045) Traffic Noise Level dBA $L_{eq(h)}$	Alternative EC-1 (2045) Increase over Existing Traffic Noise Level dBA $L_{eq(h)}$	Alternative EC-3 (2045) Traffic Noise Level dBA $L_{eq(h)}$	Alternative EC-3 (2045) Increase over Existing Traffic Noise Level dBA $L_{eq(h)}$
R1	C/65	50	51	1	50	0	50	0	50	0
R2	C/65	54	54	0	54	0	54	0	54	0
R3	C/65	53	53	0	53	0	53	0	53	0
R4	C/65	55	56	1	55	0	56	1	56	1
R5	C/65	60	61	1	63	3	63	3	58	-2
R6-1	E/70	56	57	1	55	-1	57	1	58	2
R6-2	E/70	59	60	1	58	-1	59	0	62	3
R6-Trail	C/65	57	58	1	56	-1	57	0	58	1
R7-1	E/70	53	54	1	53	0	53	0	55	2
R7-2	E/70	56	56	0	55	-1	56	0	57	1
R7-3	E/70	63	63	0	63	0	63	0	64	1
R8-1	E/70	52	53	1	52	0	52	0	53	1
R8-2	E/70	56	56	0	56	0	56	0	57	1
R8-3	E/70	63	64	1	63	0	63	0	64	1
R9-1	E/70	51	52	1	52	1	52	1	53	2
R9-2	E/70	55	56	1	56	1	56	1	56	1
R9-3	E/70	64	64	0	64	0	64	0	64	0
R10	C/65	58	59	1	58	0	58	0	59	1
R11-1	E/70	57	57	0	57	0	57	0	57	0
R11-2	E/70	61	61	0	61	0	61	0	62	1
R12-1	E/70	60	60	0	60	0	60	0	60	0
R12-2	E/70	63	64	1	64	1	64	1	64	1

Noise Receiver Number	Activity Category/ ODOT NAAC/ WSDOT NAC dBA $L_{eq(h)}$	Existing (2019) Traffic Noise Level dBA $L_{eq(h)}$	No Action Alternative (2045) Traffic Noise Level dBA $L_{eq(h)}$	No Action Alternative (2045) Increase over Existing Traffic Noise Level dBA $L_{eq(h)}$	Preferred Alternative Build EC-2 (2045) Traffic Noise Level dBA $L_{eq(h)}$	Preferred Alternative Build EC-2 (2045) Increase over Existing Traffic Noise Level dBA $L_{eq(h)}$	Alternative EC-1 (2045) Traffic Noise Level dBA $L_{eq(h)}$	Alternative EC-1 (2045) Increase over Existing Traffic Noise Level dBA $L_{eq(h)}$	Alternative EC-3 (2045) Traffic Noise Level dBA $L_{eq(h)}$	Alternative EC-3 (2045) Increase over Existing Traffic Noise Level dBA $L_{eq(h)}$
R13	C/65	65	65	0	65	0	65	0	65	0
R14	B/66	51	53	2	53	2	58	7	53	2
R15	C/66	52	54	2	54	2	56	4	54	2
R16	B/C/66	52	54	2	55	3	54	2	53	1
R17	E/71	60	63	3	61	1	63	3	62	2
R18	C/66	54	56	2	55	1	53	-1	57	3
R19	C/66	52	54	2	53	1	52	0	55	3
R20	C/66	53	55	2	55	2	53	0	56	3
R21	C/66	54	57	3	56	2	55	1	57	3
R22	C/66	56	58	2	58	2	57	1	58	2
R23	C/66	58	61	3	60	2	60	2	60	2
R24	B/66	47	49	2	49	2	51	4	49	2
R25	B/66	49	51	2	51	2	50	1	51	2
Exceedance of NAC/NAAC Totals		1	1		1		1		1	

Notes:
See Exhibit 15 for information on the NAAC activity categories.
Bold denotes ODOT NAAC Exceedance.
See Attachment C for descriptions of modeled sites.

6.2. Preferred Alternative EC-2

6.2.1. Construction Impacts

Construction activities would generate noise during the construction period. Construction usually would be carried out in several reasonably discrete steps, each of which has its own mix of equipment and, consequently, its own noise characteristics. Bridge construction would involve clearing, cut-and-fill activities, removing old roadways, and paving. For the Project, the greatest amount of construction noise would be associated with the pile driving, demolition, and earthwork phase of the Project near the Columbia River shoreline. Also, construction noise would be associated with the construction of the bridge approaches and traffic circle.

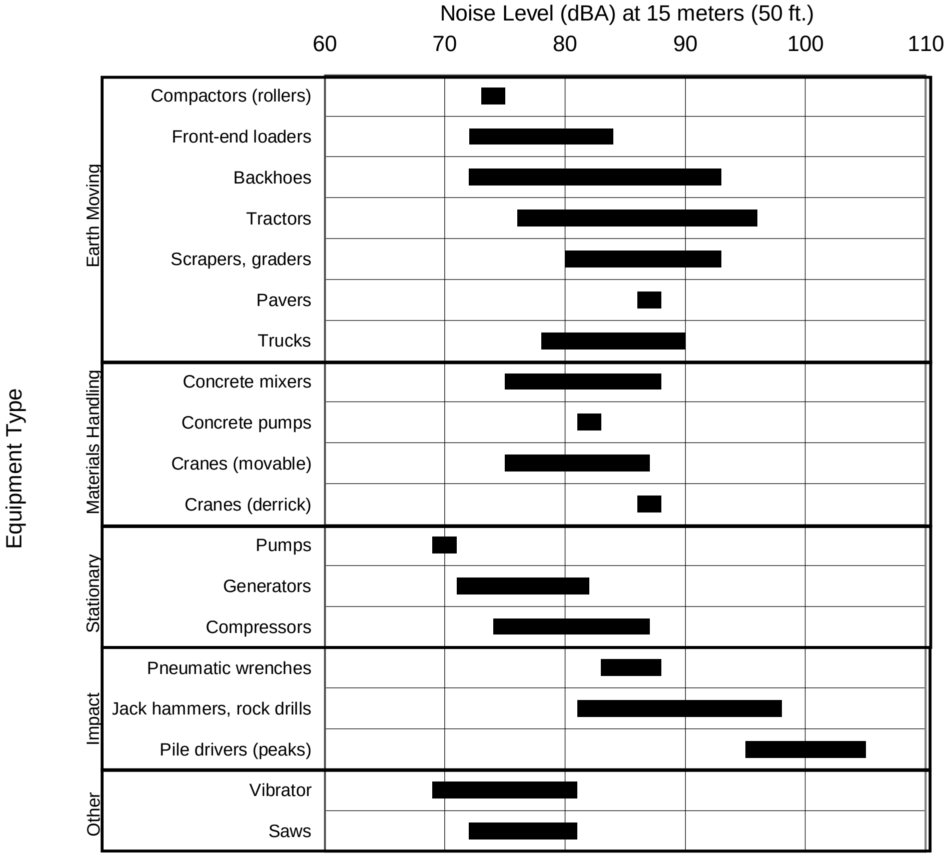
The most prevalent noise source at construction sites would be internal combustion engines. Engine-powered equipment includes earth-moving equipment, material-handling equipment, and stationary equipment. Mobile equipment operates in a cyclic fashion, while stationary equipment, such as generators and compressors, operates at sound levels fairly constant over time. Because trucks would be present during most phases and would not be confined to the Project site, noise from trucks could affect more receptors. Other noise sources would include impact equipment and tools such as pile drivers. Impact tools could be pneumatically powered, hydraulic, or electric. Construction noise would be intermittent, occurring seasonally during an approximate 2-year construction period. Construction noise levels would depend on the type, amount, and location of construction activities. The type of construction methods would establish the maximum noise levels of construction equipment used. The amount of construction activity would quantify how often construction noise would occur throughout the day. The location of construction equipment relative to adjacent properties would determine any impacts of distance in reducing construction noise levels. Maximum noise levels of construction equipment under all build alternatives would be similar to typical maximum construction equipment noise levels presented in Exhibit 21.

During the construction of Alternative EC-2, areas adjacent to the Project would be exposed to construction noise. Impacts during construction would be of short duration, and standard specifications for noise control would minimize or eliminate impacts during construction. As shown in Exhibit 21, maximum noise levels from construction equipment would range from 69 dBA to 106 dBA at 50 feet. Construction noise at locations farther away would decrease at a rate of 6 dBA per doubling of distance from the source. The number of occurrences of the maximum sound level (L_{max}) noise peaks would increase during construction, particularly during pile-driving activities. Because various pieces of equipment would be turned off, idling, or operating at less than full power at any time, and because construction machinery is typically used to complete short-term tasks at any given location, average L_{eq} noise levels during the day would be less than maximum noise levels presented in Exhibit 21.

Construction activities for Alternative EC-2 would be near noise sensitive land uses including the White Salmon TFAS that would be located approximately 500 feet west of the replacement bridge. Other noise sensitive land uses in proximity to the bridge that would experience construction noise include Bridge RV Park and Campground on the Washington side of the river and the Hood River Waterfront Trail, Hood River Waterplay, and townhouses and hotels on the Oregon side.

Construction noise is exempt from local regulations during daytime hours. Construction workers also would be subject to construction noise while working on the site. Construction noise levels could be reduced by the construction practices identified in Section 7.

Exhibit 21. Construction Noise Levels



Source: EPA, 1971 and WSDOT, 1991.

6.2.2. Direct Impacts

Future modeled worst-hour traffic noise levels for areas near Alternative EC-2 range from 49 dBA to 65 dBA (Exhibit 20). The modeled noise levels at these sites depend on the proximity of the site to the existing roadways, primarily I-84. Of the 25 total modeled sites, one outdoor pool at the Hood River WaterPlay recreation area is predicted to experience traffic noise levels above the ODOT NAC of 65 dBA with Alternative EC-2 in 2045, as shown in Exhibit 20. The one impacted site is also above impact criteria under the other build alternatives and No Action Alternative in 2045. Roadway traffic noise levels under Alternative EC-2 are not expected to change much over time despite a projected increase in future traffic volumes on the existing roadway network. Alternative EC-2 traffic noise levels in the year 2045 for all modeled sites are within 3 dBA of existing noise levels, with increases up to 3 dBA and decreases up to 1 dBA from existing noise levels as shown in Exhibit 20. Reduction in noise levels with Alternative EC-2 are primarily the result of the shift in the roadway alignment and reduced bridge noise with the replacement bridge deck. No substantial increase impacts are predicted under Alternative EC-2 2045 conditions.

Modeled sites representing the White Salmon TFAS are predicted to experience 2 dBA to 3 dBA increases in noise levels at 54 dBA to 55 dBA under Alternative EC-2. The predicted increase in noise levels at the TFAS would be noticeably lower than ODOT NAAC levels and barely perceptible to most listeners including the commercial, subsistence, or ceremonial fishers and residents and campers at the site.

6.2.3. Indirect Impacts

The noise analysis for the Project is based on the transportation demand forecasting model and includes the impacts of capacity constraints on the transportation system. By including the vehicles that are not moving efficiently through the transportation system, the indirect impacts of increased transportation capacity are included in the analysis. The results of the noise analysis already reflect the potential delayed and distant impacts of the Project. Indirect impacts for Alternative EC-2 would be similar to the indirect impacts of the No Action Alternative and other build alternatives, as described in Sections 6.1, 6.3, and 6.4. Data presented in Exhibit 20 reflect modeled noise levels for Alternative EC-2 through 2045. No indirect impacts are expected to be associated with noise for this alternative.

6.3. Alternative EC-1

6.3.1. Construction Impacts

During the construction of Alternative EC-1, areas adjacent to the Project would be exposed to construction noise in addition to traffic-related noise. Impacts during construction would be of short duration and standard specifications for noise control would minimize or eliminate impacts during construction. Alternative EC-1 is located further from larger concentrations of noise sensitive land uses than the other build alternatives, which would limit the number of sites that experience the increase in noise during construction.

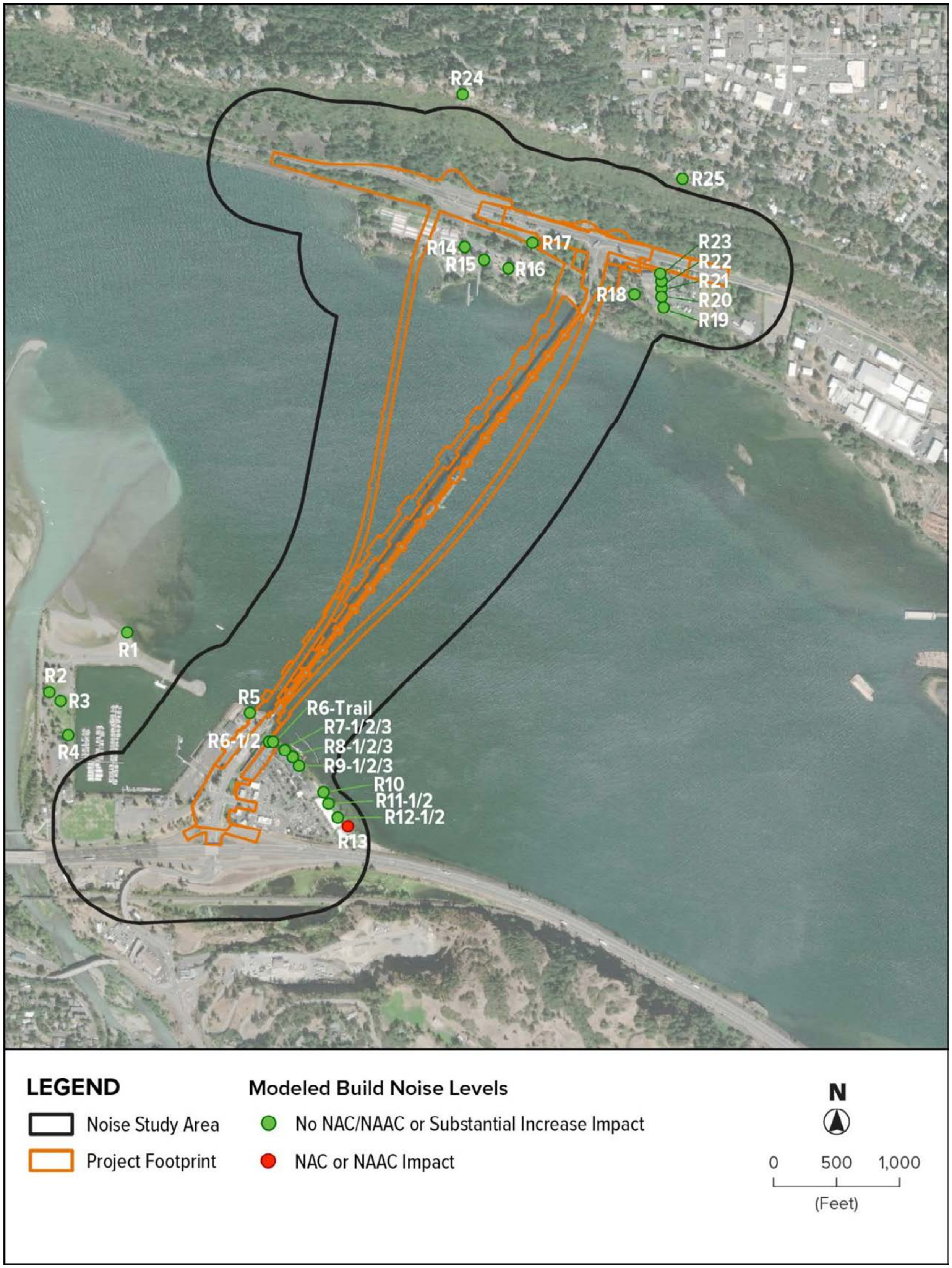
6.3.2. Direct Impacts

Future modeled worst-hour traffic noise levels for areas near Alternative EC-1 range from 50 dBA to 65 dBA (Exhibit 20). The modeled noise levels at these sites depend on the proximity of the site to the existing roadways, primarily I-84. Of the 25 total modeled sites, the outdoor pool at the Hood River WaterPlay recreation area is the only site predicted to experience traffic noise levels above the ODOT NAC of 65 dBA with Alternative EC-1 in 2045, as shown in Exhibit 20. The one impacted site is also above impact criteria under the other build alternatives and No Action Alternative in 2045. Roadway traffic noise levels under Alternative EC-1 are not expected to change much over time despite a projected increase in future traffic volumes on the existing roadway network. Alternative EC-1 traffic noise levels in the year 2045 for all modeled sites are within 7 dBA of existing noise levels, with increases up to 7 dBA and decreases up to 1 dBA from existing noise levels as shown in Exhibit 20. Reduction in noise levels with Alternative EC-1 are primarily the result of the shift of the roadway alignment and reduced bridge noise with the replacement bridge deck. Modeled sites representing the White Salmon TFAS are predicted to experience 2 dBA to 4 dBA increases in noise levels totaling 54 dBA to 56 dBA under Alternative EC-2. No substantial increase impacts are predicted under Alternative EC-1 2045 conditions.

6.3.3. Indirect Impacts

As described for Alternative EC-2, no indirect impacts are expected to be associated with noise for this alternative.

Exhibit 22. Modeled Locations and Predicted Build Impacts (2045) for Preferred Alternative EC-2, Alternative EC-1, and Alternative EC-3



6.4. Alternative EC-3

6.4.1. Construction Impacts

During the construction of Alternative EC-3, areas adjacent to the Project would be exposed to construction noise in addition to traffic-related noise. Impacts during construction would be of short duration and standard specifications for noise control would minimize or eliminate impacts during construction. Alternative EC-3 is located closer to larger concentrations of noise sensitive land uses than the other build alternatives, which would increase the number of sites that experience elevated noise levels during construction.

6.4.2. Direct Impacts

Future modeled worst-hour traffic noise levels for areas near Alternative EC-3 range from 49 dBA to 65 dBA (Exhibit 20). The modeled noise levels at these sites depend on the proximity of the site to the existing roadways, primarily I-84. Of the 25 total modeled sites, the outdoor pool at the Hood River WaterPlay recreation area is the only site predicted to experience traffic noise levels above the ODOT NAC of 65 dBA with the other build alternatives and No Action Alternative in 2045, as shown in Exhibit 20. Roadway traffic noise levels under Alternative EC-3 are not expected to change much over time despite a projected increase in future traffic volumes on the existing roadway network. Alternative EC-3 traffic noise levels in the year 2045 for all modeled sites are within 3 dBA of existing noise levels, with increases up to 3 dBA and decreases up to 2 dBA from existing noise levels as shown in Exhibit 20. Reduction is noise levels with Alternative EC-3 are primarily the result of the shift of the roadway alignment and reduced bridge noise with the replacement bridge deck. Modeled sites representing the White Salmon TFAS are predicted to experience 1 dBA to 2 dBA increases in noise levels totaling 53 dBA to 54 dBA under Alternative EC-2. No substantial increase impacts are predicted under Alternative EC-3 2045 conditions.

6.4.3. Indirect Impacts

As described for Alternative EC-2 and Alternative EC-1, no indirect impacts are expected to be associated with noise for this alternative.

6.5. Summary of Impacts by Alternative

Exhibit 23 provides a comparison of anticipated noise impacts by alternative.

Exhibit 23. Summary of Noise Impacts by Alternative

Impacts	No Action Alternative	Preferred Alternative EC-2	Alternative EC-1	Alternative EC-3
Construction Impacts	• None	• Temporary increase in noise at areas near construction		
Direct Impacts / Locations Exceeding NAAC	• One recreation area, Hood River Waterplay, approaches Noise Abatement Criteria; modeled for 65 dBA in 2045 due to I-84 traffic			
Indirect Impacts	• None			

6.6. Comparison to 2003 Noise Study Results

This study compares the current modeling to the results from the SR-35 Columbia River Crossing Project Noise Technical Report completed in May 2003. The current study attempted to locate noise modeling sites as close to those modeled in 2003; however, site mapping from the 2003 study was limited and no other electronic files were available to locate the precise modeling locations as in 2003. Future traffic volumes for the 2003 study used a design year 2025. The design year for the Project now in 2019 is for future traffic year 2045. The 2025 PM Peak Hour volumes used in the 2003 study included mostly lower overall volumes, but noticeably higher truck volumes than the 2045 PM Peak Hour volumes used for this 2019 study.

Eight sites were modeled in the 2003 study (Site 1 OR, Site 2 OR, Site 4 OR, and Site 5 OR, and Site 6 WA through Site 9 WA) that generally correlate to most of the current modeled sites provided in Exhibit 24. Existing modeled noise levels are within 6 dBA at most modeled locations presented in the 2003 noise analysis. Updated modeled levels are as much as 7 dBA to 10 dBA below 2003 levels at three of the eight modeled locations comparable between the two studies. The reason for the difference in modeled noise levels at these locations does not have an obvious explanation. The distance and modeling attributes which could change line-of-sight to noise sources between the sites modeled in 2003 and in 2019 may be the biggest contributing factor to the difference in modeling results. The current modeling results identified the same impact location as in 2003 and did not identify any new noise impacts relative to the prior modeling in this area.

Exhibit 24. Comparison of Predicted Existing and Future Traffic Noise Levels with Noise Study completed in 2003

Noise Receiver Number (2019 Study = R#, 2003 Study = #OR/WA)	Existing (2019/2003 from Previous Study) Traffic Noise Level dBA $L_{eq(h)}$	No Action Alternative (2045/2025 from Previous Study) Traffic Noise Level dBA $L_{eq(h)}$	Preferred Alternative EC-2 (2045/2025 from Previous Study) Traffic Noise Level dBA $L_{eq(h)}$	Alternative EC-1 (2045/2025 from Previous Study) Traffic Noise Level dBA $L_{eq(h)}$	Alternative EC-3 (2045/2025 from Previous Study) Traffic Noise Level dBA $L_{eq(h)}$
R1 / 1 OR	50 / 55	51 / 58	50 / 58	50 / 58	50 / 58
R3 / 2 OR	53 / 58	53 / 62	53 / 62	53 / 62	53 / 62
R6-Trail / 4 OR	57 / 63^	58 / 63^	56 / 62	57 / 62	58 / 63
R13 / 5 OR	65 / 65	65 / 69	65 / 69	65 / 69	65 / 69
R15 / 9 WA	52 / 56	54 / 58	54 / 60	56 / 58	54 / 57
R17 / 7 WA	60 / 63	62 / 65	60 / 65	63 / 65	60 / 65
R18 / 6 WA	54 / 60	55 / 60	55 / 59	53 / 59	57 / 60
R25 / 8 WA	49 / 57	50 / 60	51 / 61	50 / 60	51 / 60

Notes:
See Exhibit 15 for information on the NAAC activity categories.
Bold denotes ODOT NAAC Exceedance.
Traffic volumes and modeling locations used in the 2003 noise study were not available for further comparison with the 2019 noise study results.
^ - Denotes modeling site located within 200 feet of the existing bridge and provided additional 4 dBA correction factor to compensate for increased noise from existing bridge decking. The measurement at the R6-Trail (2019) location was verified within 3 dBA validation modeling thus the correction factor was not applied at R6-Trail.

7. AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES

7.1. Construction Impacts

The following measures, many of which are included in Section 290.32 of ODOT standard specifications, would be implemented by the bridge owner to avoid, minimize, and mitigate construction related adverse noise impacts:

- The contractor would comply with all state and local sound control and noise level rules, regulations, and ordinances that would apply to any work performed pursuant to the contract.
- All equipment would comply with pertinent equipment noise standards of the U.S. Environmental Protection Agency (EPA).
- All equipment used would have sound control devices no less effective than those provided on the original equipment. No equipment would have unmuffled exhaust.
- No construction would be performed within 1,000 feet of an occupied dwelling unit on Sundays, legal holidays, or between the hours of 10:00 pm and 6:00 am on other days without the approval of the Port construction Project Manager.
- No vibratory or impact hammers, hoe ramming, or blasting operations would be performed within 3,000 feet of any occupied dwelling unit, including camping areas at the White Salmon TFAS or Bridge RV Park on Sundays, legal holidays, and between the hours of 8:00 pm and 8:00 am Monday through Saturday without the approval of the Project Manager.
- The noise from rock crushing or screening operations within 3,000 feet of any occupied dwelling would be mitigated by strategic placement of material stockpiles between the operation and the affected dwelling or by other means approved by the Project Manager.

Should specific noise complaints occur during the construction of the Project, one or more of the following noise abatement measures would be required, as directed by the Project Manager:

- Locate stationary construction equipment as far from the nearby noise-sensitive properties as practical.
- Shut off idling equipment.
- Reschedule construction operations to avoid periods of noise annoyance identified in the complaint.
- Notify nearby residences, Columbia River Inter-Tribal Fish Commission (CRITFC), and Columbia River treaty tribes whenever extremely noisy work would be occurring.
- Install temporary or portable acoustic barriers around stationary construction noise sources.
- Consider operating electric-powered equipment using line voltage power or solar power instead of on-site generators.

7.2. Long-Term Impacts

Noise abatement is necessary only where frequent human use occurs and where a lower noise level would provide benefits (FHWA 1982).

Any specific mitigation measure recommended as part of the Project must be feasible and reasonable. For abatement to be feasible, ODOT requires that a simple majority of impacted receptors achieve at least a 5 dBA reduction in noise levels. ODOT also considers engineering factors such as barrier height, safety, topography, drainage, utilities, and access issues when determining feasibility. For abatement to be reasonable, ODOT must consider the viewpoints of the residents and property owners that benefit from the proposed abatement, the cost-effectiveness of the abatement measure, and the ODOT noise reduction design goal of the abatement measure providing at least a 7 dBA noise reduction at one benefited property.

To determine cost effectiveness for residential areas, all benefited residences must be considered in calculating a noise barrier's cost per residence. A benefited residence is any impacted or non-impacted residence that receives a noise reduction of 5 dBA or more. A reasonable cost is considered to be a maximum of $25,000 per benefited residence. This cost is based on $20 per square foot for a post and panel barrier up to 16 feet tall. For wall heights from 17 feet to 25 feet, the unit cost increases to $25 per square foot to account for additional structural considerations.

One recreation area, the pool at Hood River WaterPlay, represented by Site R13 (Exhibit 20) would be impacted by traffic noise by all 2045 build alternatives. Possible mitigation measures are discussed below. Future build alternative noise levels at the Hood River WaterPlay would be within 1 dBA of existing conditions noise levels (64 dBA $L_{eq(h)}$) and would be the same as the future No Action Alternative noise levels of 65 dBA $L_{eq(h)}$. The impacted site is located at 1108 East Marina Drive, approximately 1,000 feet east of the south approach of the Hood River Bridge. The primary noise source at this site is traffic on I-84. The impacted site is located approximately 130 feet from vehicles traveling on I-84 and would be located at or near the same distance from the same roadways with the build alternatives.

7.3. Noise Mitigation Considerations

The following noise mitigation options were considered to reduce noise levels at the one impacted site, Hood River WaterPlay:

- Traffic management: traffic control devices could be used to reduce the speed of the traffic; however, the minor benefit of 1 dBA per 5 mph reduction in speed does not outweigh the associated increase in congestion and air pollution. Other measures, such as time or use restrictions for certain vehicles, do not meet the transportation objectives of the facility.
- Alteration of horizontal and/or vertical alignments: any alteration of the build alternatives' alignment would displace residences, require additional right of way and not be cost effective/reasonable.
- Buffer zone: the acquisition of undeveloped property to act as a buffer zone is designed to avoid rather than abate traffic noise impacts and, therefore, is not feasible.
- Noise barriers include noise walls, berms, and buildings that are not sensitive to noise. A noise barrier's effectiveness is determined by its height and length and by project site topography. To be effective, the barrier must block the line-of-sight between the noise source and the receptor. It must be long enough (at least eight times as long as the distance from the home or receptor

to the barrier) to prevent sounds from passing around the ends, have no openings (i.e., driveway connections), and be dense enough so that noise would not be transmitted through it. Intervening rows of buildings that are not noise sensitive could also be used as barriers (FHWA 1973).

7.3.1. Noise Barriers

One noise barrier was evaluated along within the noise study area of the three build alternative alignments to reduce traffic noise levels at the one site exceeding ODOT NAAC. The location of the evaluated noise barrier is shown on Exhibit 25. Attachment C includes the ODOT Noise Abatement Evaluation and Recommendation Form for the noise barrier evaluated for the project.

Noise Barrier 1

Noise Barrier 1 was evaluated along the edge of pavement north of the westbound I-84 off-ramp to SR 35 to reduce traffic noise levels at one impacted site (modeled R13, Hood River WaterPlay recreation area) located north of I-84 and east of Hood River Bridge. I-84 is the primary source of noise at Hood River Waterplay. Noise Barrier 1 (Exhibit 25) was evaluated at a total length of 1,003 feet long along the eastbound I-84 off-ramp to SR 35. At 12 feet tall and 803 feet long, Noise Barrier 1 would meet ODOT feasibility criteria by providing at least a 5 dBA noise reduction at the one impacted location located behind the barrier. A 16-feet tall and 1,003-foot-long Noise Barrier 1 is needed to meet the ODOT 7 dBA noise reduction design goal. Attachment C provides the Reasonableness calculation for Noise Barrier 1 at the one impacted site, Hood River WaterPlay. ODOT Noise Manual Appendix F specifies how to consider cost effectiveness for Special Use Locations for Activity Categories C, D, and E that includes Hood River WaterPlay. As shown in Attachment C, the Reasonableness calculation totals $2,006,750 per person-hour per square foot for Noise Barrier 1, which exceeds ODOT's standard Abatement Cost Factor allowance of $518,758 per person-hour per square foot; therefore, Noise Barrier 1 does not meet ODOT reasonableness criteria and is not recommended for placement.

No measures are recommended to avoid, minimize, or mitigate the traffic noise impact at the one impacted receptor.

Exhibit 25. Location of Evaluated Noise Barrier 1

8. INFORMATION FOR LOCAL GOVERNMENT OFFICIALS

A copy of this report will be made available to local planning departments by ODOT and WSDOT. This report will serve to inform local officials of the impacts of the roadway and roadway-construction-related noise in the area studied. The information contained within this report can assist local officials in their planning process.

It is recommended that the local jurisdictions use this information as a guide when developing future land use plans, zoning, or building code requirements. The use of this information may assist local government with future development plans and, thereby, result in development that is consistent with the noise environment.

At the time of this report, undeveloped or vacant lots are located in the vicinity of both the northern and southern Project ends. Per the ODOT and WSDOT Noise Policies, if building permits have been submitted for the undeveloped properties, the proposed development needs to be included in the noise study. As of June 7, 2019, no building permits were on file with local planning departments with the intent to develop structures such as residences, commercial uses, or other NAAC/NAC B, C, D, or F at the undeveloped properties along the Project corridor.

Based on the TNM modeling and results of this report, and future traffic volumes and speeds included in this report, areas within 25 feet of the nearest travel lane on Hood River Bridge may experience noise levels up to the ODOT NAAC of 65 dBA or WSDOT NAC of 66 dBA for residential land use and other outdoor land uses, such as playfields and parks. Commercial and related business uses located within 10 feet of the nearest travel lane on Hood River Bridge may experience outdoor noise levels up to the ODOT NAAC of 70 dBA or WSDOT NAC of 71 dBA for hotels, offices, and similar uses such as restaurants and bars. Residential land uses and other outdoor land uses located within 60 feet of SR 14 may experience noise levels up to the WSDOT NAC of 66 dBA. Commercial and related businesses located within 25 feet of SR 14 may experience noise levels up to the WSDOT NAC of 71 dBA. Similarly in Oregon, residential land uses and outdoor land uses located within 275 feet of I-84 may experience noise levels up to the ODOT NAAC of 65 dBA within commercial or related businesses located within 160 feet of I-84 may experience noise levels up to the ODOT NAAC of 70 dBA. It should be noted that predicted noise levels provided at relative distances from roadways included in this section of the report are estimated based on noise modeling at discrete locations. Actual noise levels require further study to reflect the exact locations of noise sensitive uses at future developments along with any change in terrain, shielding, and noise sources.

9. PREPARERS

Individuals involved in preparing this technical report are identified in Exhibit 26.

Exhibit 26. List of Preparers

Name	Role	Education	Years of Experience
Patrick Romero, INCE, ENV SP	Noise Technical Lead	MS, Environmental Policy and Management BS, Environmental Science	20
Rebecca Frohning	Noise Technical QC Reviewer	BS, Earth and Atmospheric Science	19
Angela Findley	Project Manager; QC	MS, Forest Resources BA, Mathematics	25
Scott Polzin, PMP	Environmental Task Lead; QC	MCRP, Planning BS, Finance	24

10. REFERENCES

City of Hood River, Oregon Noise Ordinance. 2019. Chapter 8.09. http://ci.hood-river.or.us/pageview.aspx?id=18303#809. Accessed June 2019.

City of White Salmon Noise Ordinance. 2019. Chapter 8.05 Noise. https://library.municode.com/wa/white_salmon/codes/code_of_ordinances?nodeId=TIT8HESA_CH8.05NODI_8.05.030EX. Accessed June 2019.

New York City (NYC). 2010. New York City Environmental Quality Review Technical Manual, Chapter 19 Noise. Mayor's Office of Environmental Coordination. New York, New York.

Oregon State Department of Transportation (ODOT). June 2011. Oregon State Department of Transportation, Noise Manual. Salem, Oregon.

SW Washington Regional Transportation Council, WSDOT, ODOT, 2003. SR-35 Columbia River Crossing Project – Noise Technical Report. Dated May 2003.

U.S. Code of Federal Regulations. Part 772. July 2010.

U.S. Department of Transportation. Federal Highway Administration (FHWA). 1973. Fundamentals and Abatement of Highway Traffic Noise. Washington D.C.

U.S. Department of Transportation. Federal Highway Administration (FHWA). 1982. "Procedures for Abatement of Highway Traffic Noise and Construction Noise." Federal-Aid Highway Program Manual. Volume 7. Chapter 7. Section 3. Washington, D.C.

U.S. Department of Transportation. Federal Highway Administration (FHWA). 1996. Measurement of Highway-Related Noise. Washington D.C.

U.S. Department of Transportation. Federal Highway Administration (FHWA). 1998. FHWA Traffic Noise Model User's Guide. Washington D.C.

U.S. Department of Transportation. Federal Highway Administration (FHWA). 2006. FHWA Highway Construction Noise Handbook and Roadway Construction Noise Model (version 1.0). Washington D.C.

U.S. Department of Transportation. Federal Highway Administration (FHWA). 2010. Highway Traffic Noise: Analysis and Abatement. Revised December 2010.

U.S. Department of Transportation. Federal Highway Administration (FHWA). 2010. Highway Traffic Noise: Analysis and Abatement Guidance. Revised December 2010.

U.S. Department of Transportation. Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Impact Assessment. Washington D.C.

U.S. Environmental Protection Agency (EPA). 1971. Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances. Washington, D.C.

U.S. Environmental Protection Agency (EPA). 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Report Number 550/9-74-004.

United States Geological Survey (USGS). https://viewer.nationalmap.gov/basic/. Accessed June 2019.

Washington Administrative Code. 1989. Chapter 173-60. Maximum Environmental Noise Levels. Olympia, Washington.

Washington State Department of Transportation (WSDOT). 2012. Traffic Noise Policy and Procedures. Olympia, Washington.

WSP USA, Inc. 2019. Hood River-White Salmon Bridge Replacement Project, Impact Assessment Methodology Memorandum. Section 10 Noise. February 2019.

WSP USA, Inc. 2019. Hood River-White Salmon Bridge Replacement Project Land Use Report. Review of Permitted Developments in the Hood River-White Salmon Bridge Replacement Project. June 2019.

WSP USA, Inc. 2019. Hood River-White Salmon Bridge Replacement Project Design, Existing and Future Design Data for Noise Modeling. June 2019.

WSP USA, Inc. 2019. Hood River-White Salmon Bridge Replacement Project Traffic Report, Existing and Future Traffic Data for Traffic Noise Modeling. June 2019.

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Attachment A

Characteristics of Noise and Methodology

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Characteristics of Noise

Sound is created when objects vibrate, resulting in a minute variation in surrounding atmospheric pressure called sound pressure. The human response to sound depends on the magnitude of a sound as a function of its frequency and time pattern (EPA 1974). Magnitude measures the physical sound energy in the air. The range of magnitude from the faintest to the loudest sound the ear can hear is so large that sound pressure is expressed on a logarithmic scale in units called decibels (dB). Loudness, compared to physical sound measurement, refers to how people subjectively judge a sound and varies from person to person. Magnitudes of typical noise levels are presented in Table A-1.

Humans respond to a sound's frequency or pitch. The human ear is very effective at perceiving sounds with a frequency between approximately 1,000 Hz and 5,000 Hz, with the efficiency decreasing outside this range. Environmental noise is composed of many frequencies, each occurring simultaneously at its own sound pressure level. Frequency weighting, which is applied electronically by a sound level meter, combines the overall sound frequency into one sound level that simulates how an average person hears sounds. The commonly used frequency weighting for environmental noise is A-weighted decibels (dBA), which is most similar to how humans perceive sounds of low to moderate magnitude.

Because of the logarithmic decibel scale, a doubling of the number of noise sources, such as the number of cars operating on a roadway, increases noise levels by 3 dBA. A tenfold increase in the number of noise sources will add 10 dBA. As a result, a noise source emitting a noise level of 60 dBA combined with another noise source of 60 dBA yields a combined noise level of 63 dBA, not 120 dBA. The human ear can barely perceive a 3 dBA increase, while a 5 dBA or 6 dBA increase is readily noticeable and sounds as if the noise is about 1.5 times as loud. A 10 dBA increase appears to be a doubling in noise level to most listeners.

Noise levels from traffic sources depend on volume, speed, and the type of vehicle. Generally, an increase in volume, speed, or vehicle size increases traffic noise levels. Vehicular noise is a combination of noises from the engine, exhaust, and tires. Other conditions affecting traffic noise include defective mufflers, steep grades, terrain, vegetation, distance from the roadway, and shielding by barriers and buildings.

Noise levels decrease with distance from the noise source. For a line source, such as a roadway, noise levels decrease 3 dBA over hard ground (concrete, pavement) or 4.5 dBA over soft ground (grass) for every doubling of distance between the source and the receptor. For a point source, such as construction sources, noise levels will decrease between 6 dBA and 7.5 dBA for every doubling of distance from the source.

The propagation of noise can be greatly affected by terrain and the elevation of the receiver relative to the noise source (Figure A-1). Level ground is the simplest case. Noise travels in a straight line-of-sight path between the source and the receiver. The addition of a berm or other area of high terrain will reduce the noise energy arriving at the receiver. Breaking the line of sight between the receiver and the highest noise source results in a noise reduction of approximately 5 dBA.

If the noise source is depressed or the receiver is elevated, noise generally will travel directly to the receiver. In some situations, noise levels may be reduced because the terrain crests between the source and receiver, resulting in a partial noise barrier near the receiver. If the noise source is elevated or the receiver is depressed, noise is often reduced at the receiver, because the edge of the roadway can act as a partial noise barrier, blocking some sound transmission between the source and receiver.

Table A-1. Typical Noise Levels

Transportation Sources	Noise Level (dBA)	Other Sources	Description
	130		Painfully loud
Jet takeoff (200 feet)	120		
Car horn (3 feet)			Maximum vocal effort
	110		
	100	Shout (0.5 feet)	
			Very annoying
Heavy truck (50 feet)	90	Jack hammer (50 feet)	Loss of hearing with prolonged exposure
		Home shop tools (3 feet)	
Train on a structure (50 feet)	85	Backhoe (50 feet)	
City bus (50 feet)	80	Bulldozer (50 feet)	Annoying
		Vacuum cleaner (3 feet)	
Train (50 feet)	75	Blender (3 feet)	
City bus at stop (50 feet)			
Freeway traffic (50 feet)	70	Lawn mower (50 feet)	
		Large office	
Train in station (50 feet)	65	Washing machine (3 feet)	Intrusive
	60	TV (10 feet)	
Light traffic (50 feet)		Talking (10 feet)	
Light traffic (100 feet)	50		Quiet
		Refrigerator (3 feet)	
	40	Library	
	30	Soft whisper (15 feet)	Very quiet

Sources: FTA 1995; EPA 1971; EPA 1974

Noise Level Descriptors

A widely used descriptor for environmental noise is the equivalent sound level (L_{eq}). The L_{eq} can be considered a measure of the average noise energy level during a specified period of time. It is a measure of total noise, or a summation of all sound energy averaged over a time period. L_{eq} is defined as the constant level that, over a given period of time, transmits to the receiver the same amount of acoustical energy as the actual time-varying sound. For example, two sounds, one of which contains twice as much energy but lasts only half as long, have the same L_{eq} noise levels. L_{eq} measured over a 1-hour period is the hourly L_{eq} [$L_{eq(h)}$], which is used for highway noise impact and abatement analyses.

Short-term noise levels, such as those from a single truck pass-by, can be described by either the total noise energy or the highest instantaneous noise level that occurs during the event. The sound exposure level (SEL) is a measure of total sound energy from an event, and is useful in determining what the L_{eq} would be over a period in time when several noise events occur. The maximum sound level (L_{max}) is the greatest short-duration sound level that occurs during a single event. L_{max} is related to impacts on speech interference and sleep disruption. In comparison, L_{min} is the minimum sound level during a period of time.

Effects of Noise

Environmental noise at high intensities directly affects human health by causing the disease of hearing loss. Although scientific evidence currently is not conclusive, noise is suspected of causing or aggravating other diseases. Environmental noise indirectly affects human welfare by interfering with sleep, thought, and conversation. The Federal Highway Administration NAC are based on speech interference, which is a well-documented impact that is relatively reproducible in human response studies.

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Attachment B

Instrumentation Calibration Forms

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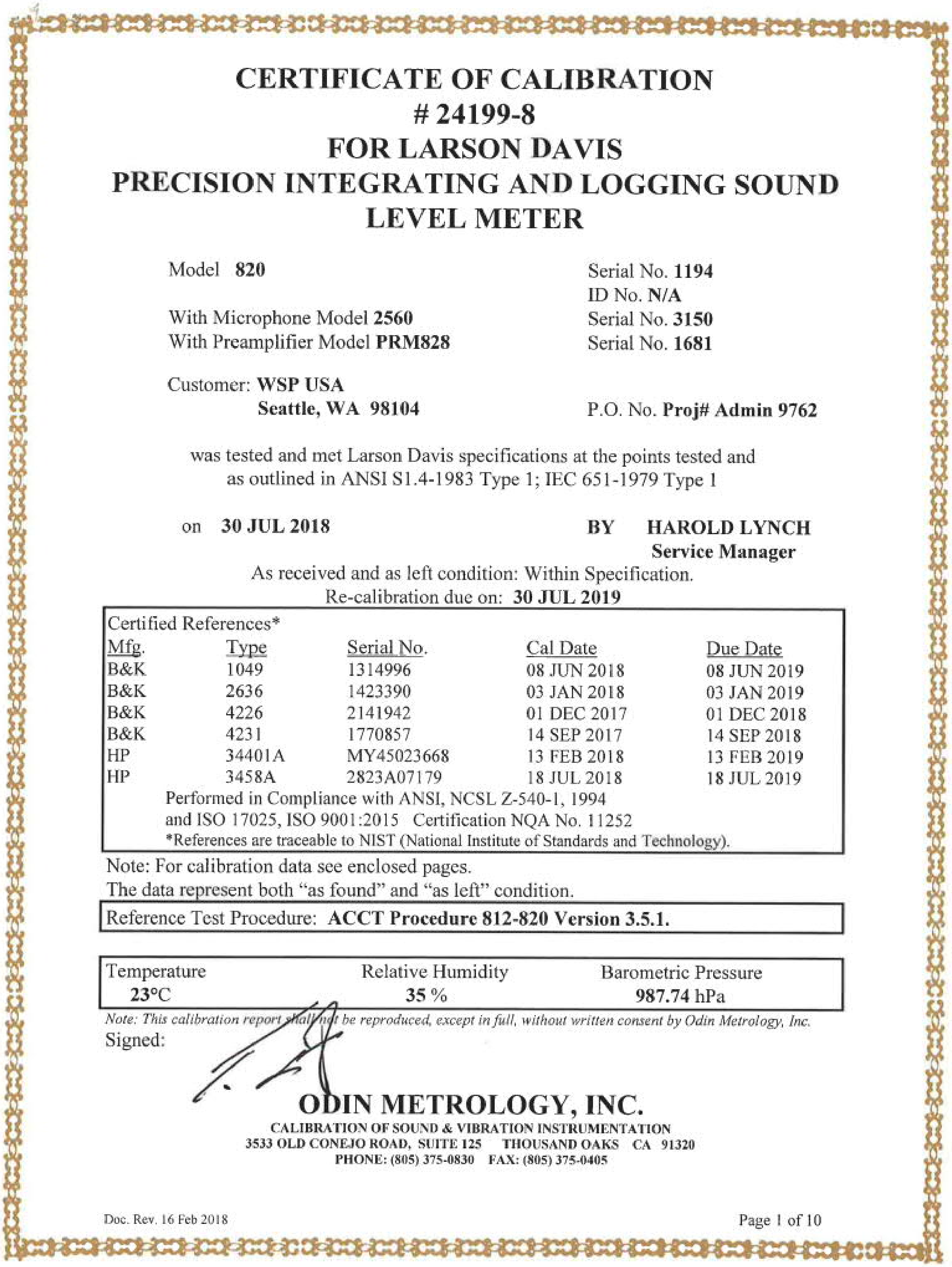

CERTIFICATE OF CALIBRATION
24199-8
FOR LARSON DAVIS
PRECISION INTEGRATING AND LOGGING SOUND LEVEL METER

Model **820**	Serial No. **1194**
	ID No. **N/A**
With Microphone Model **2560**	Serial No. **3150**
With Preamplifier Model **PRM828**	Serial No. **1681**

Customer: **WSP USA**
Seattle, WA 98104

P.O. No. **Proj# Admin 9762**

was tested and met Larson Davis specifications at the points tested and as outlined in ANSI S1.4-1983 Type 1; IEC 651-1979 Type 1

on **30 JUL 2018**

BY **HAROLD LYNCH**
Service Manager

As received and as left condition: Within Specification.
Re-calibration due on: **30 JUL 2019**

Certified References*

Mfg.	Type	Serial No.	Cal Date	Due Date
B&K	1049	1314996	08 JUN 2018	08 JUN 2019
B&K	2636	1423390	03 JAN 2018	03 JAN 2019
B&K	4226	2141942	01 DEC 2017	01 DEC 2018
B&K	4231	1770857	14 SEP 2017	14 SEP 2018
HP	34401A	MY45023668	13 FEB 2018	13 FEB 2019
HP	3458A	2823A07179	18 JUL 2018	18 JUL 2019

Performed in Compliance with ANSI, NCSL Z-540-1, 1994
and ISO 17025, ISO 9001:2015 Certification NQA No. 11252
*References are traceable to NIST (National Institute of Standards and Technology).

Note: For calibration data see enclosed pages.
The data represent both "as found" and "as left" condition.

Reference Test Procedure: **ACCT Procedure 812-820 Version 3.5.1.**

Temperature	Relative Humidity	Barometric Pressure
23°C	**35** %	**987.74** hPa

Note: This calibration report shall not be reproduced, except in full, without written consent by Odin Metrology, Inc.

Signed:

ODIN METROLOGY, INC.
CALIBRATION OF SOUND & VIBRATION INSTRUMENTATION
3533 OLD CONEJO ROAD, SUITE 125 THOUSAND OAKS CA 91320
PHONE: (805) 375-0830 FAX: (805) 375-0405

Doc. Rev. 16 Feb 2018

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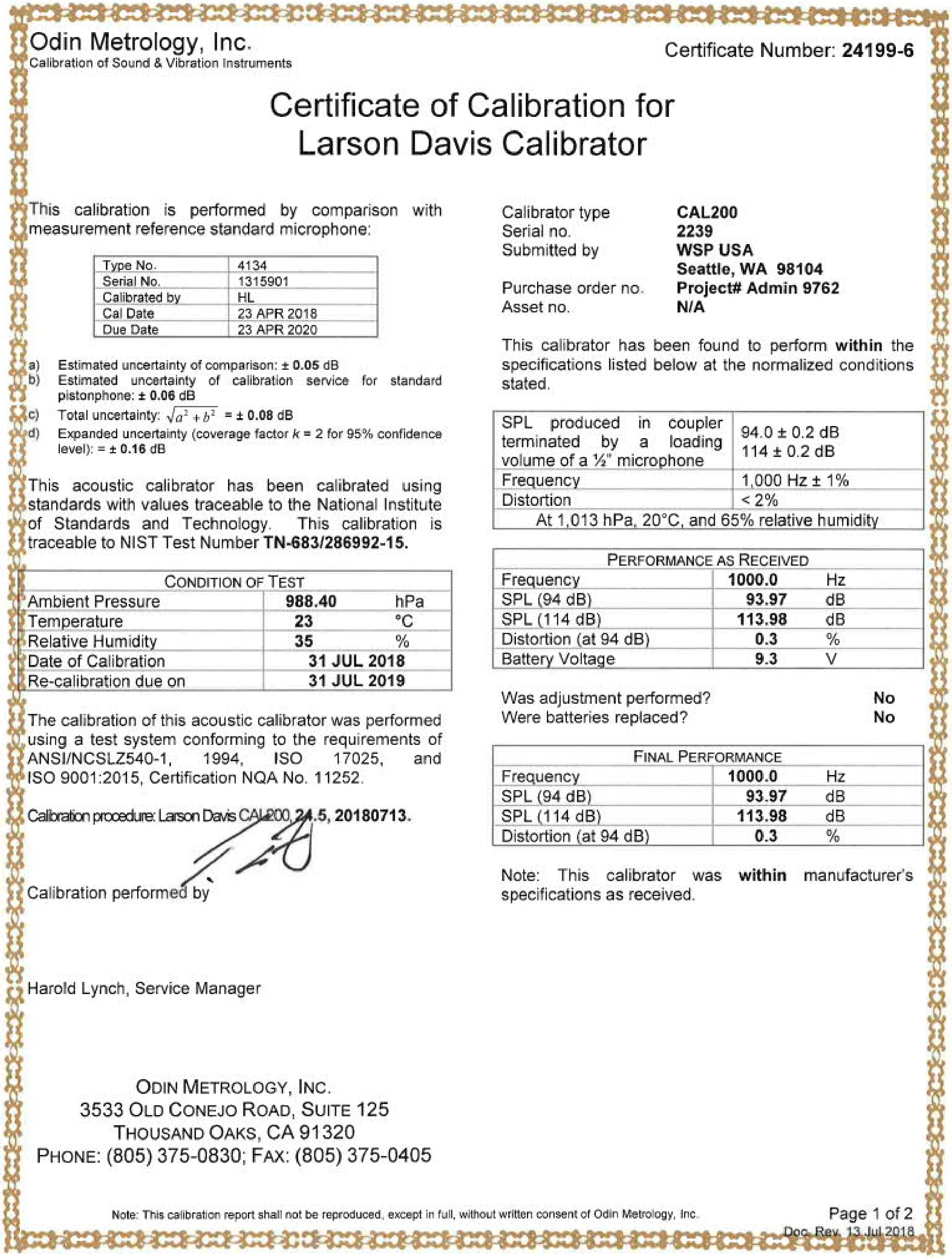

Odin Metrology, Inc.
Calibration of Sound & Vibration Instruments

Certificate Number: **24199-6**

Certificate of Calibration for Larson Davis Calibrator

This calibration is performed by comparison with measurement reference standard microphone:

Type No.	4134
Serial No.	1315901
Calibrated by	HL
Cal Date	23 APR 2018
Due Date	23 APR 2020

a) Estimated uncertainty of comparison: ± **0.05** dB
b) Estimated uncertainty of calibration service for standard pistonphone: ± **0.06** dB
c) Total uncertainty: $\sqrt{a^2+b^2}$ = ± **0.08** dB
d) Expanded uncertainty (coverage factor *k* = 2 for 95% confidence level): = ± **0.16** dB

This acoustic calibrator has been calibrated using standards with values traceable to the National Institute of Standards and Technology. This calibration is traceable to NIST Test Number **TN-683/286992-15.**

Condition of Test		
Ambient Pressure	**988.40**	hPa
Temperature	**23**	°C
Relative Humidity	**35**	%
Date of Calibration	**31 JUL 2018**	
Re-calibration due on	**31 JUL 2019**	

The calibration of this acoustic calibrator was performed using a test system conforming to the requirements of ANSI/NCSLZ540-1, 1994, ISO 17025, and ISO 9001:2015, Certification NQA No. 11252.

Calibration procedure: Larson Davis CAL200, **24.5, 20180713.**

Calibration performed by

Harold Lynch, Service Manager

Calibrator type **CAL200**
Serial no. **2239**
Submitted by **WSP USA**
Seattle, WA 98104
Purchase order no. **Project# Admin 9762**
Asset no. **N/A**

This calibrator has been found to perform **within** the specifications listed below at the normalized conditions stated.

SPL produced in coupler terminated by a loading volume of a ½" microphone	94.0 ± 0.2 dB 114 ± 0.2 dB
Frequency	1,000 Hz ± 1%
Distortion	< 2%
At 1,013 hPa, 20°C, and 65% relative humidity	

Performance as Received		
Frequency	**1000.0**	Hz
SPL (94 dB)	**93.97**	dB
SPL (114 dB)	**113.98**	dB
Distortion (at 94 dB)	**0.3**	%
Battery Voltage	**9.3**	V

Was adjustment performed? **No**
Were batteries replaced? **No**

Final Performance		
Frequency	**1000.0**	Hz
SPL (94 dB)	**93.97**	dB
SPL (114 dB)	**113.98**	dB
Distortion (at 94 dB)	**0.3**	%

Note: This calibrator was **within** manufacturer's specifications as received.

ODIN METROLOGY, INC.
3533 OLD CONEJO ROAD, SUITE 125
THOUSAND OAKS, CA 91320
PHONE: (805) 375-0830; FAX: (805) 375-0405

Note: This calibration report shall not be reproduced, except in full, without written consent of Odin Metrology, Inc.

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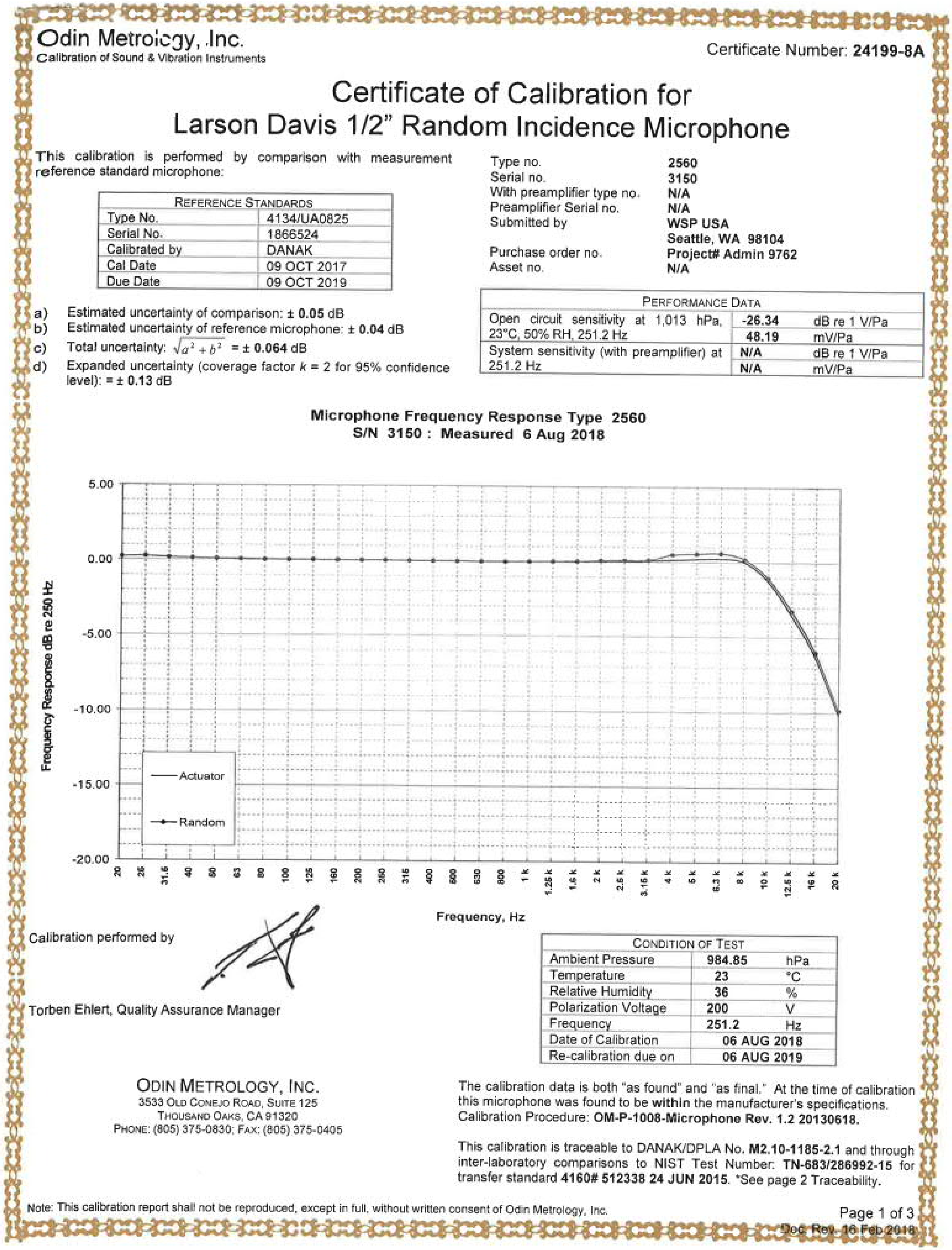

Odin Metrology, Inc.
Calibration of Sound & Vibration Instruments

Certificate Number: **24199-8A**

Certificate of Calibration for
Larson Davis 1/2" Random Incidence Microphone

This calibration is performed by comparison with measurement reference standard microphone:

REFERENCE STANDARDS	
Type No.	4134/UA0825
Serial No.	1866524
Calibrated by	DANAK
Cal Date	09 OCT 2017
Due Date	09 OCT 2019

Type no.	**2560**
Serial no.	**3150**
With preamplifier type no.	**N/A**
Preamplifier Serial no.	**N/A**
Submitted by	**WSP USA** **Seattle, WA 98104**
Purchase order no.	**Project# Admin 9762**
Asset no.	**N/A**

a) Estimated uncertainty of comparison: **± 0.05** dB
b) Estimated uncertainty of reference microphone: ± **0.04** dB
c) Total uncertainty: $\sqrt{a^2 + b^2}$ = **± 0.064** dB
d) Expanded uncertainty (coverage factor *k* = 2 for 95% confidence level): = **± 0.13** dB

PERFORMANCE DATA		
Open circuit sensitivity at 1,013 hPa, 23°C, 50% RH, 251.2 Hz	**-26.34** **48.19**	dB re 1 V/Pa mV/Pa
System sensitivity (with preamplifier) at 251.2 Hz	**N/A** **N/A**	dB re 1 V/Pa mV/Pa

Microphone Frequency Response Type 2560
S/N 3150 : Measured 6 Aug 2018

Calibration performed by

Torben Ehlert, Quality Assurance Manager

CONDITION OF TEST		
Ambient Pressure	**984.85**	hPa
Temperature	**23**	°C
Relative Humidity	**36**	%
Polarization Voltage	**200**	V
Frequency	**251.2**	Hz
Date of Calibration	**06 AUG 2018**	
Re-calibration due on	**06 AUG 2019**	

ODIN METROLOGY, INC.
3533 OLD CONEJO ROAD, SUITE 125
THOUSAND OAKS, CA 91320
PHONE: (805) 375-0830; FAX: (805) 375-0405

The calibration data is both "as found" and "as final." At the time of calibration this microphone was found to be **within** the manufacturer's specifications. Calibration Procedure: **OM-P-1008-Microphone Rev. 1.2 20130618.**

This calibration is traceable to DANAK/DPLA No. **M2.10-1185-2.1** and through inter-laboratory comparisons to NIST Test Number: **TN-683/286992-15** for transfer standard **4160# 512338 24 JUN 2015**. *See page 2 Traceability.

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Attachment C

Traffic and Noise Modeling Data

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Table C-1. 15-Minute Traffic Counts and 1-Hour Modeled Traffic Volumes at Validation Sites

Validation Site / Roadway	Traffic Speed	15-Minute Traffic Counts			1-Hour Modeled Traffic Volumes		
		Cars	Medium Trucks	Heavy Trucks	Cars	Medium Trucks	Heavy Trucks
M1 – Park & Ride							
NB Bridge	25	98	0	1	392	0	4
SB Bridge	25	95	0	0	380	0	0
WB SR 14	55	84	0	3	336	0	12
EB SR 14	55	52	0	6	208	0	24
M2 – Bridge RV Park & Camp							
NB Bridge	25	94	0	0	376	0	0
SB Bridge	25	102	0	6	408	0	24
WB SR 14	50	115	0	7	460	0	28
EB SR 14	50	81	0	9	324	0	36
M3 – Tribal Camp Ground							
NB Bridge	25	98	0	7	392	0	28
SB Bridge	25	99	0	0	396	0	0
WB SR 14	55	64	0	6	256	0	24
EB SR 14	55	52	0	0	208	0	0
M4 – Hood River W.R. Trail							
NB Bridge	25	109	0	2	436	0	8
SB Bridge	25	100	1	2	400	4	8
NB Button Bridge	25	55	0	1	218	0	4
SB Button Bridge	25	50	0	1	200	2	4
EB I-84*	60	215	4	30	860	16	120
WB I-84*	60	407	4	39	1628	16	156

Notes:
NB = northbound; SB = southbound; WB = westbound; EB = eastbound; HRB = Hood River Bridge
Roadway count shown with (*) denotes count collected during M6 measurement

Table C-1. 15-Minute Traffic Counts and 1-Hour Modeled Traffic Volumes at Validation Sites (Cont'd)

Validation Site / Roadway	Traffic Speed	15-Minute Traffic Counts			1-Hour Modeled Traffic Volumes		
		Cars	Medium Trucks	Heavy Trucks	Cars	Medium Trucks	Heavy Trucks
M5 – Rental Units / HRW Trail							
NB Bridge	25	140	0	6	560	0	24
SB Bridge	25	94	0	1	376	0	4
NB Button Bridge	25	70	0	3	280	0	12
SB Button Bridge	25	47	0	1	188	0	2
EB I-84*	60	215	4	30	860	16	120
WB I-84*	60	407	4	39	1628	16	156
M6 – Port Marina Park							
NB Bridge	25	156	0	3	624	0	12
SB Bridge	25	124	0	2	496	0	8
NB Button Bridge	25	78	0	2	312	0	6
SB Button Bridge	25	62	0	1	248	0	4
EB I-84	60	215	4	30	860	16	120
WB I-84	60	407	4	39	1628	16	156
M7 – HR WaterPlay/WR Trail							
NB Bridge	25	112	0	0	448	0	0
SB Bridge	25	120	0	7	480	0	28
NB Button Bridge	25	56	0	0	224	0	0
SB Button Bridge	25	60	0	4	240	0	14
EB I-84	60	143	3	45	572	12	180
WB I-84	60	210	3	33	840	12	132

Notes:
NB = northbound; SB = southbound; WB = westbound; EB = eastbound; HRB = Hood River Bridge
Roadway count shown with (*) denotes count collected during M6 measurement

Table C-2. Existing 2019 and Future 2045 PM Peak Modeled Traffic Volumes

Location	Modeled Speed (Posted)	2019 Existing Conditions PM Peak			2045 Traffic PM Peak		
		Cars	Medium Trucks	Heavy Trucks	Cars	Medium Trucks	Heavy Trucks
I-84 EB1	65	3072	68	274	3150	70	280
I-84 EB2	65	2404	62	270	2150	60	278
I-84 EB3	65	2664	66	272	2552	68	280
I-84 WB1	65	2400	52	156	2990	66	196
I-84 WB2	65	2190	50	154	2652	60	114
EB-I-84-Off1	45	668	6	1	1000	9	1
EB-I-84-On2	45	260	4	1	402	7	1
WB I-84 Off1	45	211	3	1	338	6	1
WB-I-84-On1	45	707	12	1	1036	17	2
Button Bridge Road NB to HRB	25	720	16	10	1078	14	10
Button Bridge Road SB from HRB	25	604	22	6	908	32	8
HRB NB Bridge (and approach & landing)	25 / 35	720	15	9	1078	26	18
HRB SB Bridge (and approach & landing)	25 / 35	604	21	5	907	31	4
SR 14 Roundabout-1	25	N/A	N/A	N/A	1098	20	7
SR 14 Roundabout-2	25	N/A	N/A	N/A	1249	23	8
SR 14 Roundabout-3	25	N/A	N/A	N/A	1928	36	12
SR 14 EB West of HRB2	40	246	14	5	382	32	6
SR 14 WB West of HRB2	40	825	15	5	1210	48	13
SR 14 EB East of HRB2	40	299	8	3	470	25	5
SR 14 WB East of HRB2	40	761	20	4	1142	60	13

Notes:

Traffic data for peak truck models are provided in Attachment E.

NB = northbound; SB = southbound; WB = westbound; EB = eastbound; HRB = Hood River Bridge

* Traffic Data used for Alternative EC-1 only

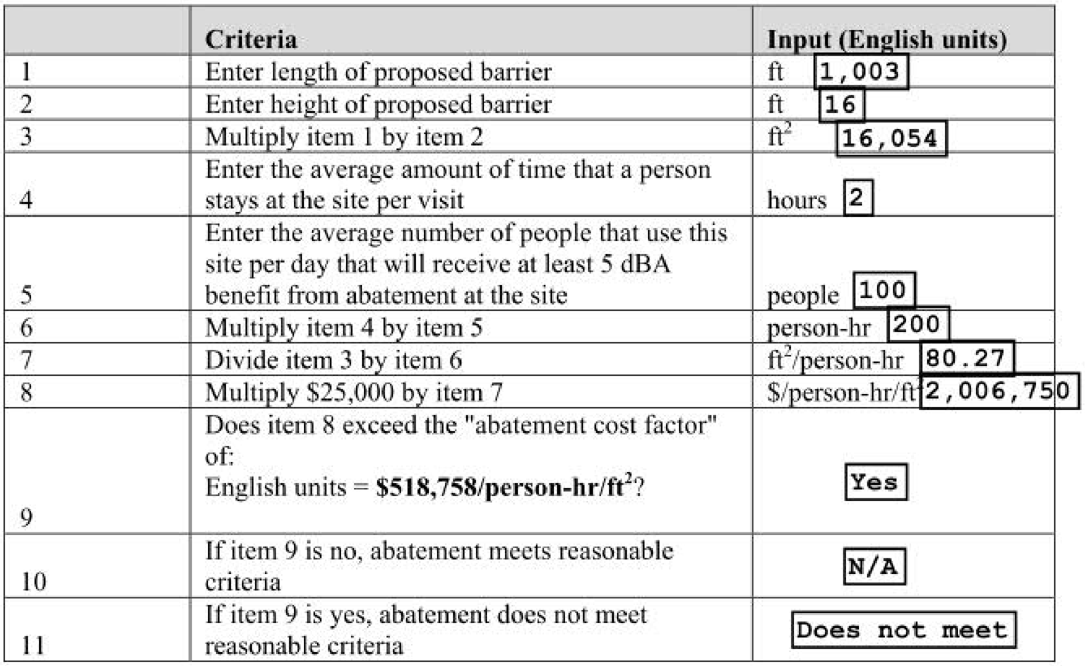
N/A – no separate traffic data modeled for roadway

Table C-3. Modeled Receptor Descriptions

Modeled Site ID	Modeled Site Description	Nearest Existing Roadway (Approximate Distance in Feet)
R1	Port Marina Benches at small water craft launch area	Hood River Bridge (1,300)
R2	Port Marina Park Rest Area	I-84 (1,250)
R3	Port Marina Park Play Area	I-84 (1,150)
R4	Port Marina Park Rest Area	I-84 (950)
R5	Hood River Waterfront Trail (west of Hood River Bridge)	Hood River Bridge (150)
R6-1	Townhouse Rentals – 1st Floor Outdoor Use	Hood River Bridge (75)
R6-2	Townhouse Rentals – 2nd Floor Balcony	Hood River Bridge (75)
R6-Trail	Hood River Waterfront Tail (east of Hood River Bridge)	Hood River Bridge (125)
R7-1	Best Western Hood River Inn – 1st Floor Outdoor Use	Hood River Bridge (250)
R7-2	Best Western Hood River Inn – 2nd Floor Balcony	Hood River Bridge (250)
R7-3	Best Western Hood River Inn – 3rd Floor Balcony	Hood River Bridge (250)
R8-1	Best Western Hood River Inn – 1st Floor Outdoor Use	Hood River Bridge (325)
R8-2	Best Western Hood River Inn – 2nd Floor Balcony	Hood River Bridge (325)
R8-3	Best Western Hood River Inn – 3rd Floor Balcony	Hood River Bridge (325)
R9-1	Best Western Hood River Inn – 1st Floor Outdoor Use	Hood River Bridge (400)
R9-2	Best Western Hood River Inn – 2nd Floor Balcony	Hood River Bridge (400)
R9-3	Best Western Hood River Inn – 3rd Floor Balcony	Hood River Bridge (400)
R10	Best Western Hood River Inn – Outdoor Use Area	I-84 (475)
R11-1	Best Western Hood River Inn – 1st Floor Outdoor Use	I-84 (350)
R11-2	Best Western Hood River Inn – 2nd Floor Balcony	I-84 (350)
R12-1	Best Western Hood River Inn – 1st Floor Outdoor Use	I-84 (250)
R12-2	Best Western Hood River Inn – 2nd Floor Balcony	I-84 (250)
R13	Hood River WaterPlay – Outdoor Pool	I-84 (175)
R14	Single-Family Residence	SR 14 (350)
R15	Tribal Camp Ground – Picnic Bench	SR 14 (375)
R16	Tribal Camp Ground – Common Outdoor Use Area	SR 14 (400)
R17	Park and Ride Stop	SR 14 (125)
R18	Bridge RV – Campground	SR 14 (325)
R19	Bridge RV – Parking Space & Rest Area	SR 14 (350)
R20	Bridge RV – Parking Space & Rest Area	SR 14 (250)
R21	Bridge RV – Parking Space & Rest Area	SR 14 (200)
R22	Bridge RV – Parking Space & Rest Area	SR 14 (150)
R23	Bridge RV – Parking Space & Rest Area	SR 14 (75)
R24	Single-Family Residence on SE Oak St - backyard	SR 14 (750)
R25	Single-Family Residence on W Jewett Blvd - backyard	SR 14 (975)

Notes:
Model Sites included in all Traffic Noise Models for Existing Conditions (2019) and Future Conditions (2045).

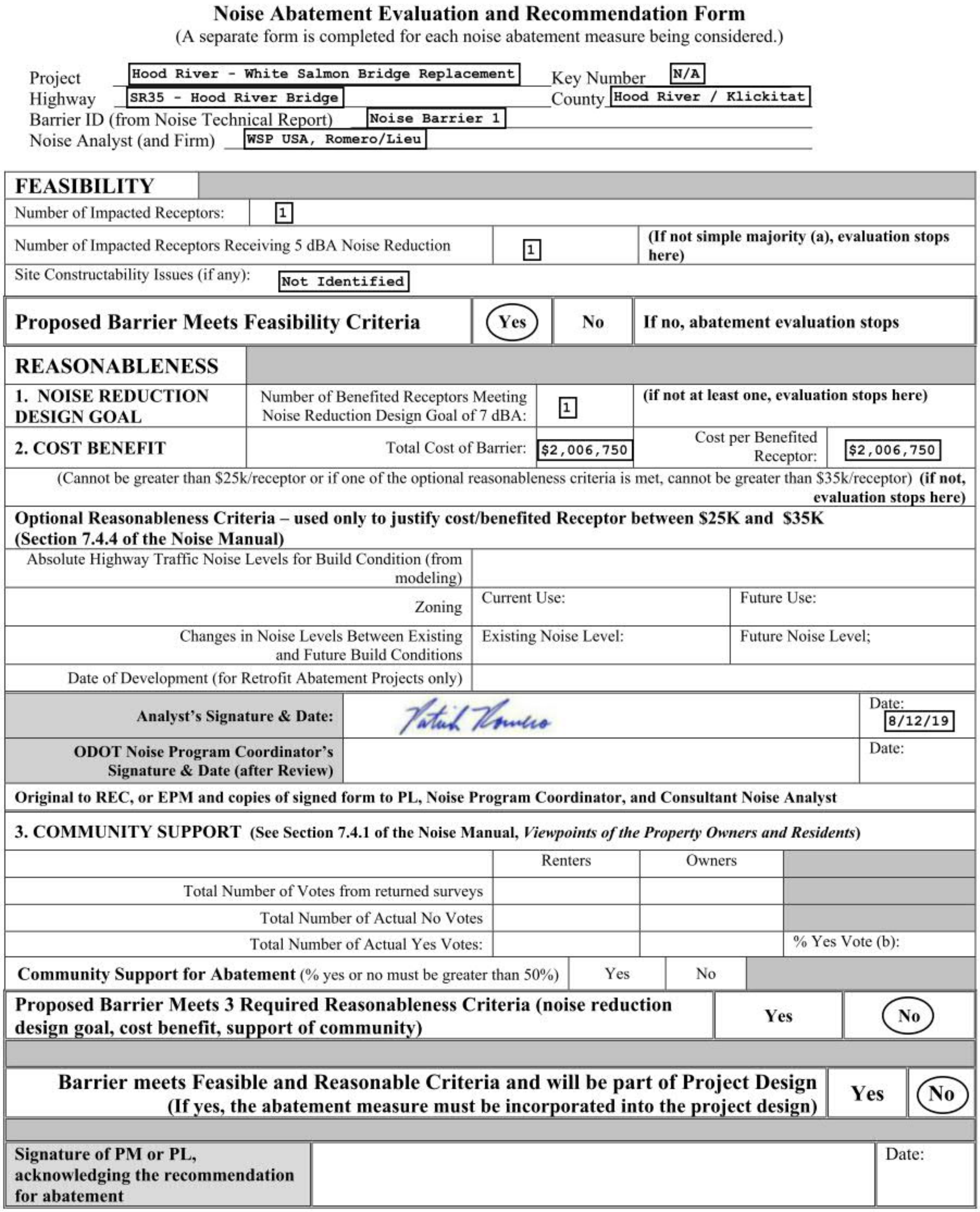
Table C-4. Reasonable Matrix: Cost of Abatement of Hood River WaterPlay



	Criteria	Input (English units)
1	Enter length of proposed barrier	ft 1,003
2	Enter height of proposed barrier	ft 16
3	Multiply item 1 by item 2	ft^2 16,054
4	Enter the average amount of time that a person stays at the site per visit	hours 2
5	Enter the average number of people that use this site per day that will receive at least 5 dBA benefit from abatement at the site	people 100
6	Multiply item 4 by item 5	person-hr 200
7	Divide item 3 by item 6	ft^2/person-hr 80.27
8	Multiply \$25,000 by item 7	\$/person-hr/ft 2,006,750
9	Does item 8 exceed the "abatement cost factor" of: English units = **\$518,758/person-hr/ft^2**?	Yes
10	If item 9 is no, abatement meets reasonable criteria	N/A
11	If item 9 is yes, abatement does not meet reasonable criteria	Does not meet

Notes:
Source File: July 2011 ODOT Noise Manual, Appendix F.
Average visitation based on peak usage during summer season and capacity of outdoor use area.

Table C-5. Reasonable Matrix: Cost of Abatement of Hood River WaterPlay



Noise Abatement Evaluation and Recommendation Form

(A separate form is completed for each noise abatement measure being considered.)

Project Hood River - White Salmon Bridge Replacement
Key Number N/A
Highway SR35 - Hood River Bridge
County Hood River / Klickitat
Barrier ID (from Noise Technical Report) Noise Barrier 1
Noise Analyst (and Firm) WSP USA, Romero/Lieu

FEASIBILITY			
Number of Impacted Receptors:	1		
Number of Impacted Receptors Receiving 5 dBA Noise Reduction	1	**(If not simple majority (a), evaluation stops here)**	
Site Constructability Issues (if any):	Not Identified		
Proposed Barrier Meets Feasibility Criteria	[✓ Yes]	No	**If no, abatement evaluation stops**

REASONABLENESS				
1. NOISE REDUCTION DESIGN GOAL	Number of Benefited Receptors Meeting Noise Reduction Design Goal of 7 dBA:	1	**(if not at least one, evaluation stops here)**	
2. COST BENEFIT	Total Cost of Barrier:	$2,006,750	Cost per Benefited Receptor:	$2,006,750

(Cannot be greater than $25k/receptor or if one of the optional reasonableness criteria is met, cannot be greater than $35k/receptor) **(if not, evaluation stops here)**

Optional Reasonableness Criteria – used only to justify cost/benefited Receptor between $25K and $35K (Section 7.4.4 of the Noise Manual)

Absolute Highway Traffic Noise Levels for Build Condition (from modeling)		
Zoning	Current Use:	Future Use:
Changes in Noise Levels Between Existing and Future Build Conditions	Existing Noise Level:	Future Noise Level;
Date of Development (for Retrofit Abatement Projects only)		
Analyst's Signature & Date:	Patrick Romero	Date: 8/12/19
ODOT Noise Program Coordinator's Signature & Date (after Review)		Date:

Original to REC, or EPM and copies of signed form to PL, Noise Program Coordinator, and Consultant Noise Analyst

3. COMMUNITY SUPPORT (See Section 7.4.1 of the Noise Manual, *Viewpoints of the Property Owners and Residents*)

	Renters	Owners	
Total Number of Votes from returned surveys			
Total Number of Actual No Votes			
Total Number of Actual Yes Votes:			% Yes Vote (b):

Community Support for Abatement (% yes or no must be greater than 50%)	Yes	No
Proposed Barrier Meets 3 Required Reasonableness Criteria (noise reduction design goal, cost benefit, support of community)	**Yes**	**[✓ No]**
Barrier meets Feasible and Reasonable Criteria and will be part of Project Design (If yes, the abatement measure must be incorporated into the project design)	**Yes**	**[✓ No]**
Signature of PM or PL, acknowledging the recommendation for abatement		Date:

Notes:
Source File: July 2011 ODOT Noise Manual, Appendix G.

Attachment D

Noise Measurement Data

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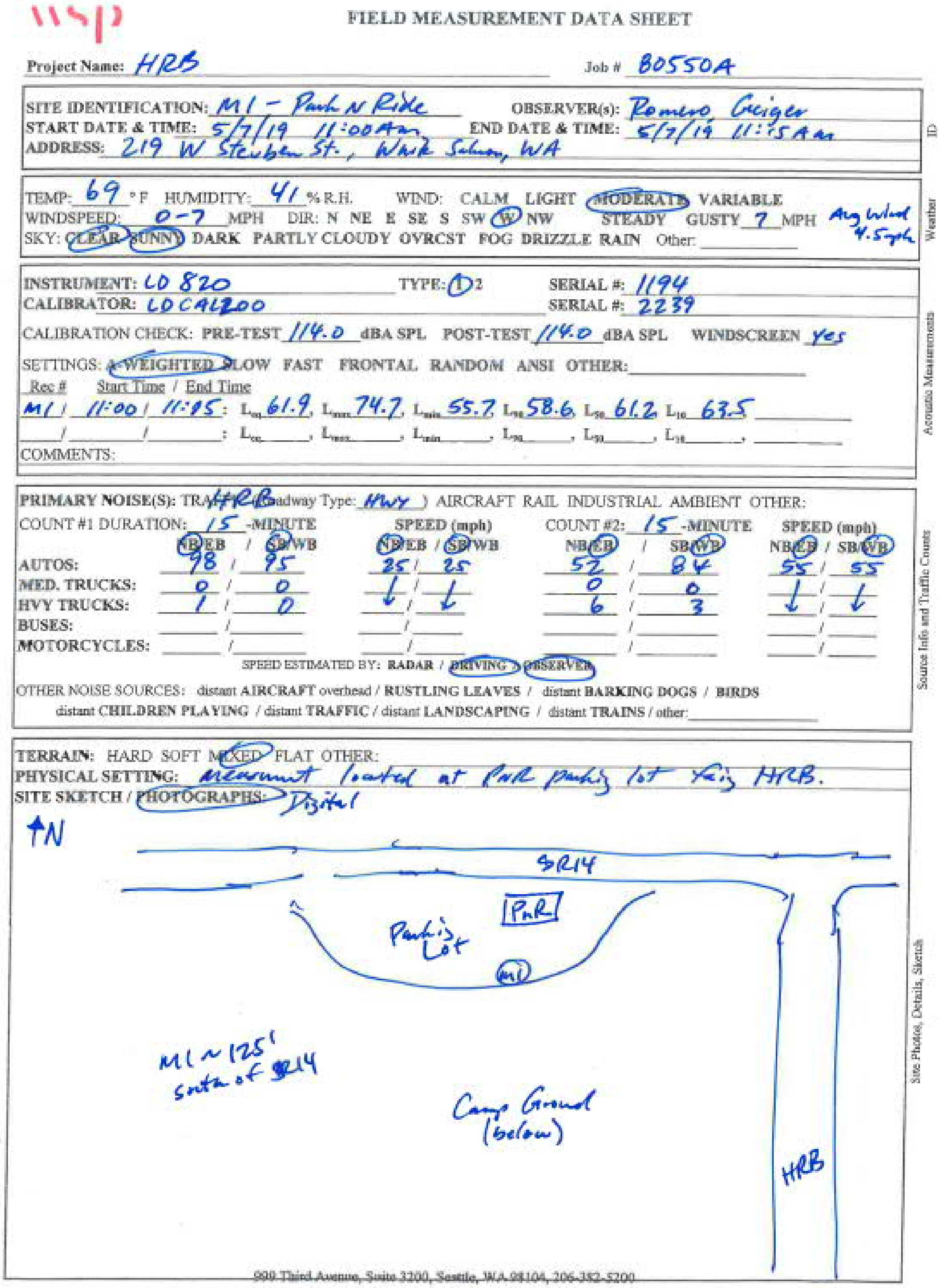
Measurement Site M1—Field Data Sheet



wsp

FIELD MEASUREMENT DATA SHEET

Project Name: HRB **Job #** 80550A

SITE IDENTIFICATION: M1 – Park N Ride **OBSERVER(s):** Romero Geiger
START DATE & TIME: 5/7/19 11:00Am **END DATE & TIME:** 5/7/19 11:15Am
ADDRESS: 219 W Steuben St., White Salmon, WA

ID

TEMP: 69 °F HUMIDITY: 41 %R.H. WIND: CALM LIGHT [✓ MODERATE] VARIABLE
WINDSPEED: 0-7 MPH DIR: N NE E SE S SW [✓ W] NW STEADY GUSTY 7 MPH Avg Wind 4.5mph
SKY: [✓ CLEAR] [✓ SUNNY] DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: ________

Weather

INSTRUMENT: LD 820 **TYPE:** [✓ 1] 2 **SERIAL #:** 1194
CALIBRATOR: LD CAL200 **SERIAL #:** 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN yes
SETTINGS: [✓ A-WEIGHTED] SLOW FAST FRONTAL RANDOM ANSI OTHER: ________
Rec # Start Time / End Time
M1 / 11:00 / 11:15: L_{eq} 61.9, L_{max} 74.7, L_{min} 55.7, L_{90} 58.6, L_{50} 61.2, L_{10} 63.5 ________
____/________/________: L_{eq}____, L_{max}____, L_{min}____, L_{90}____, L_{50}____, L_{10}____, ________
COMMENTS:

Acoustic Measurements

PRIMARY NOISE(S): TRAFFIC (Roadway Type: HWY HRB) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:

	COUNT #1 DURATION: 15 -MINUTE	SPEED (mph)	COUNT #2: 15 -MINUTE	SPEED (mph)
	[✓ NB]/EB / [✓ SB]/WB	[✓ NB]/EB / [✓ SB]/WB	NB/[✓ EB] / SB/[✓ WB]	NB/[✓ EB] / SB/[✓ WB]
AUTOS:	98 / 95	25 / 25	52 / 84	55 / 55
MED. TRUCKS:	0 / 0	↓ / ↓	0 / 0	↓ / ↓
HVY TRUCKS:	1 / 0		6 / 3	
BUSES:	/	/	/	/
MOTORCYCLES:	/	/	/	/

SPEED ESTIMATED BY: RADAR / [✓ DRIVING] / [✓ OBSERVER]

OTHER NOISE SOURCES: distant AIRCRAFT overhead / RUSTLING LEAVES / distant BARKING DOGS / BIRDS
distant CHILDREN PLAYING / distant TRAFFIC / distant LANDSCAPING / distant TRAINS / other: ________

Source Info and Traffic Counts

TERRAIN: HARD SOFT [✓ MIXED] FLAT OTHER:
PHYSICAL SETTING: Measurement located at PnR parking lot facing HRB.
SITE SKETCH / [✓ PHOTOGRAPHS]: Digital

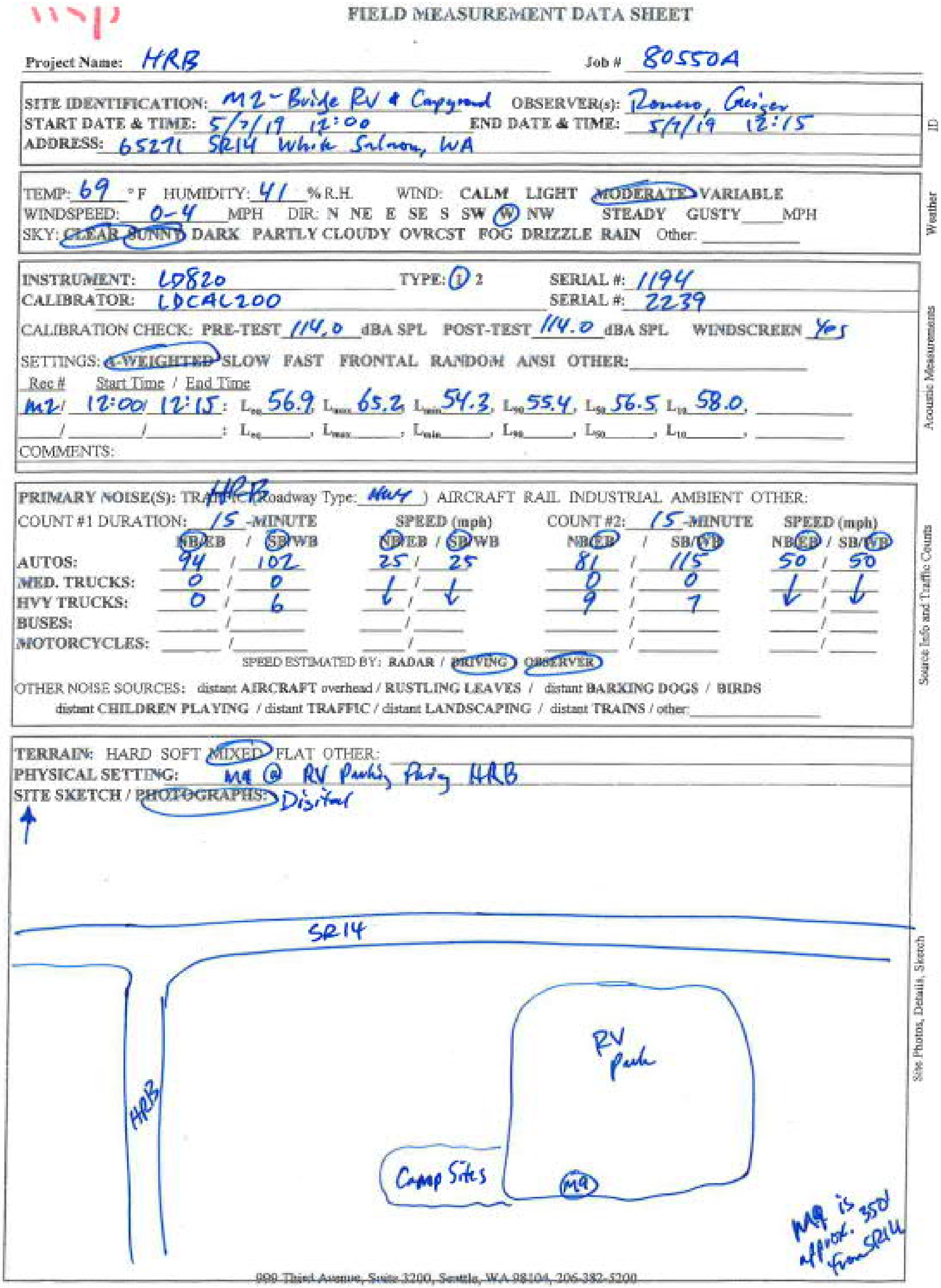
Site Photos, Details, Sketch

999 Third Avenue, Suite 3200, Seattle, WA 98104, 206-382-5200

Measurement Site M1—View of Measurement Site Looking East

Measurement Site M1—View of Measurement Site Looking South

Measurement Site M2—Field Data Sheet



FIELD MEASUREMENT DATA SHEET

Project Name: HRB
Job # 80550A

SITE IDENTIFICATION: M2 - Bridge RV & Campground
OBSERVER(s): Romero, Geiger
START DATE & TIME: 5/7/19 12:00
END DATE & TIME: 5/7/19 12:15
ADDRESS: 65271 SR14 White Salmon, WA

TEMP: 69 °F HUMIDITY: 41 % R.H. WIND: CALM LIGHT [✓ MODERATE] VARIABLE
WINDSPEED: 0-4 MPH DIR: N NE E SE S SW [✓ W] NW STEADY GUSTY ____ MPH
SKY: [✓ CLEAR] [✓ SUNNY] DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: ____

INSTRUMENT: LD820 TYPE: [✓ 1] 2 SERIAL #: 1194
CALIBRATOR: LDCAL200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: [✓ A-WEIGHTED] SLOW FAST FRONTAL RANDOM ANSI OTHER: ____

Rec # / Start Time / End Time
M2 / 12:00 / 12:15 : L_{eq} 56.9, L_{max} 65.2, L_{min} 54.3, L_{90} 55.4, L_{50} 56.5, L_{10} 58.0, ____
____ / ____ / ____ : L_{eq} ____, L_{max} ____, L_{min} ____, L_{90} ____, L_{50} ____, L_{10} ____, ____
COMMENTS:

PRIMARY NOISE(S): TRAFFIC (Roadway Type: Hwy) HRB AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:
COUNT #1 DURATION: 15 -MINUTE
COUNT #2: 15 -MINUTE

	COUNT #1 [✓ NB]/EB	[✓ SB]/WB	SPEED (mph) [✓ NB]/EB	[✓ SB]/WB	COUNT #2 NB/[✓ EB]	SB/[✓ WB]	SPEED (mph) NB/[✓ EB]	SB/[✓ WB]
AUTOS:	94	102	25	25	81	115	50	50
MED. TRUCKS:	0	0	↓	↓	0	0	↓	↓
HVY TRUCKS:	0	6	↓	↓	9	7	↓	↓
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / [✓ DRIVING] / [✓ OBSERVER]

OTHER NOISE SOURCES: distant AIRCRAFT overhead / RUSTLING LEAVES / distant BARKING DOGS / BIRDS
distant CHILDREN PLAYING / distant TRAFFIC / distant LANDSCAPING / distant TRAINS / other: ____

TERRAIN: HARD SOFT [✓ MIXED] FLAT OTHER:
PHYSICAL SETTING: M2 @ RV Parking Facing HRB
SITE SKETCH / [✓ PHOTOGRAPHS]: Digital

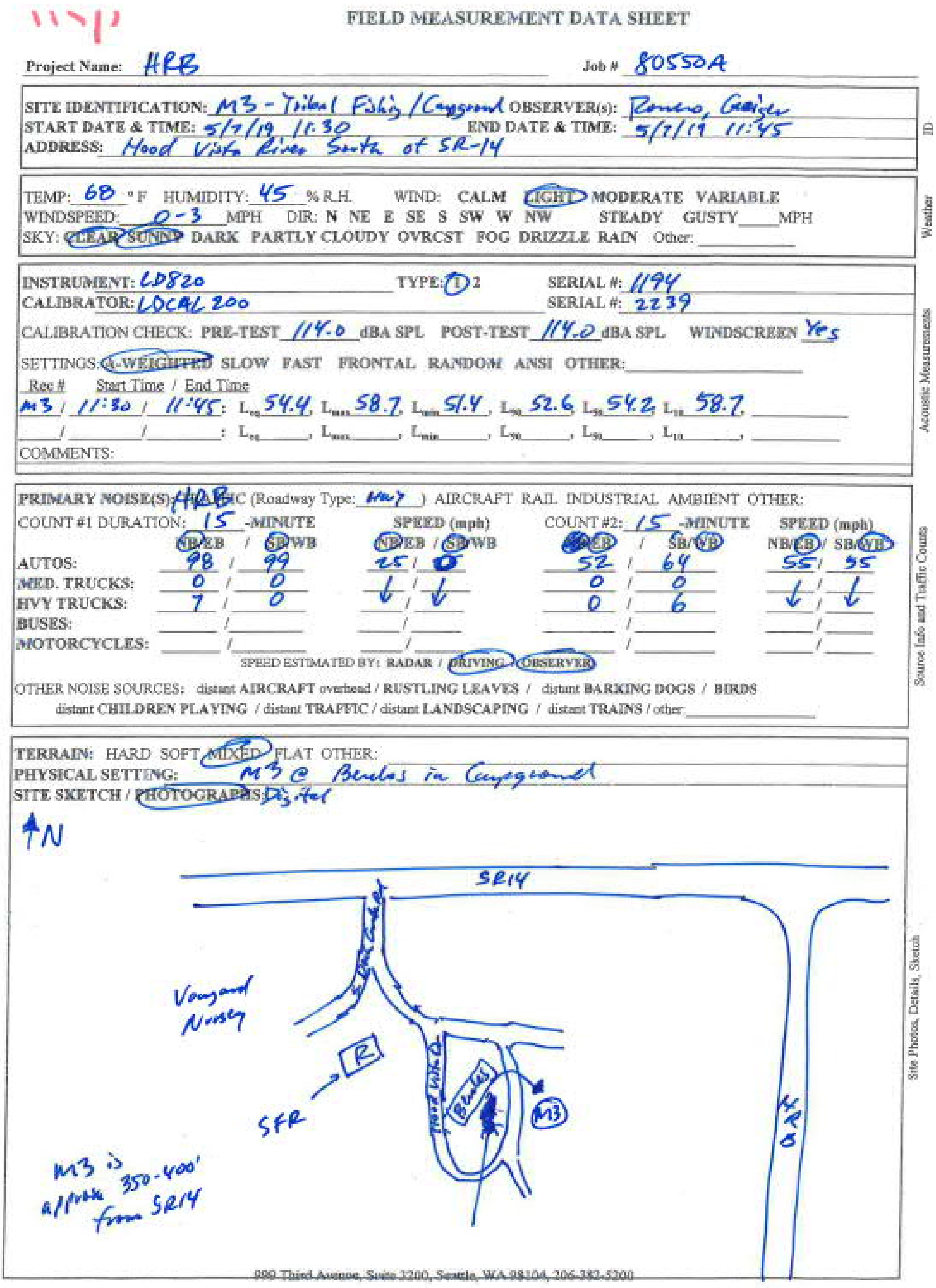
M2 is approx. 350' from SR14

999 Third Avenue, Suite 3200, Seattle, WA 98104, 206-382-5200

Measurement Site M2—View of Measurement Site Looking South

Measurement Site M2—View of Measurement Site Looking West

Measurement Site M3—Field Data Sheet



FIELD MEASUREMENT DATA SHEET

Project Name: HRB
Job # 80550A

SITE IDENTIFICATION: M3 - Tribal Fishing / Campground
OBSERVER(s): Romero, Geiger
START DATE & TIME: 5/7/19 11:30
END DATE & TIME: 5/7/19 11:45
ADDRESS: Hood Vista River South of SR-14

TEMP: 68 °F HUMIDITY: 45 % R.H. WIND: CALM [✓ LIGHT] MODERATE VARIABLE
WINDSPEED: 0-3 MPH DIR: N NE E SE S SW W NW STEADY GUSTY ____ MPH
SKY: [✓ CLEAR] [✓ SUNNY] DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: ________

INSTRUMENT: LD820 TYPE: [✓ 1] 2 SERIAL #: 1194
CALIBRATOR: LDCAL 200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: [✓ A-WEIGHTED] SLOW FAST FRONTAL RANDOM ANSI OTHER: ________

Rec # / Start Time / End Time
M3 / 11:30 / 11:45: L_{eq} 54.4, L_{max} 58.7, L_{min} 51.4, L_{90} 52.6, L_{50} 54.2, L_{10} 58.7, ________
____ / ________ / ________: L_{eq} ____, L_{max} ____, L_{min} ____, L_{90} ____, L_{50} ____, L_{10} ____, ________
COMMENTS:

PRIMARY NOISE(S): HRB TRAFFIC (Roadway Type: Hwy) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:

	COUNT #1 DURATION: 15 -MINUTE		SPEED (mph)		COUNT #2: 15 -MINUTE		SPEED (mph)	
	[✓ NB]/EB	[✓ SB]/WB	[✓ NB]/EB	[✓ SB]/WB	NB/[✓ EB]	SB/[✓ WB]	NB/[✓ EB]	SB/[✓ WB]
AUTOS:	98	99	25	0	52	64	55	55
MED. TRUCKS:	0	0	↓	↓	0	0	↓	↓
HVY TRUCKS:	7	0	↓	↓	0	6	↓	↓
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / [✓ DRIVING] / [✓ OBSERVER]

OTHER NOISE SOURCES: distant AIRCRAFT overhead / RUSTLING LEAVES / distant BARKING DOGS / BIRDS
distant CHILDREN PLAYING / distant TRAFFIC / distant LANDSCAPING / distant TRAINS / other ________

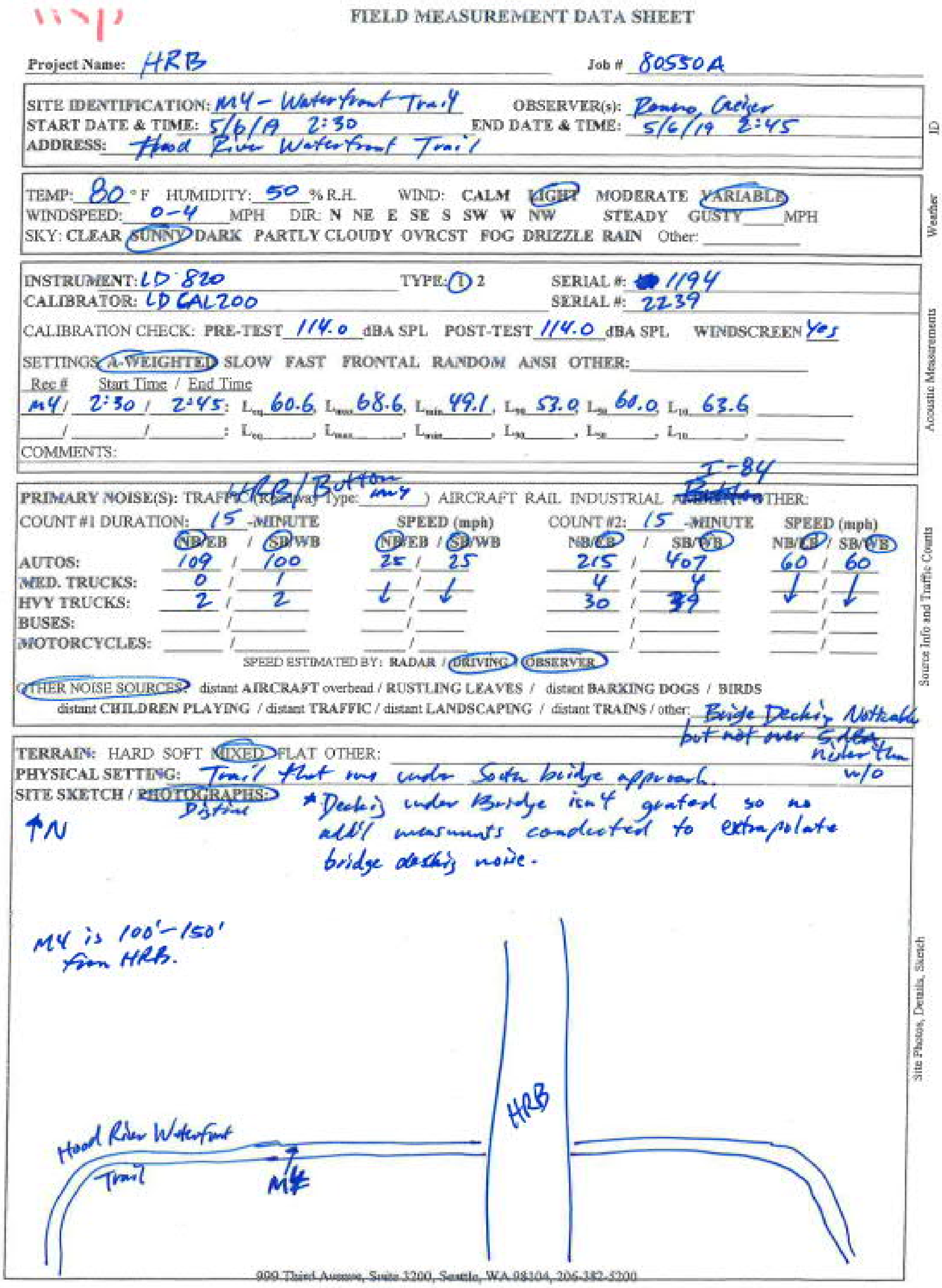
TERRAIN: HARD SOFT [✓ MIXED] FLAT OTHER:
PHYSICAL SETTING: M3 @ Benches in Campground
SITE SKETCH / [✓ PHOTOGRAPHS]: Digital

999 Third Avenue, Suite 3200, Seattle, WA 98104, 206-382-5200

Measurement Site M3—View of Measurement Site Looking South

Measurement Site M3—View from Measurement Site Looking West

Measurement Site M4—Field Data Sheet



wsp

FIELD MEASUREMENT DATA SHEET

Project Name: HRB **Job #** 80550A

SITE IDENTIFICATION: M4 – Waterfront Trail **OBSERVER(s):** Romo, Creger
START DATE & TIME: 5/6/19 2:30 **END DATE & TIME:** 5/6/19 2:45
ADDRESS: Hood River Waterfront Trail

ID

TEMP: 80 °F HUMIDITY: 50 % R.H. WIND: CALM [✓ LIGHT] MODERATE [✓ VARIABLE]
WINDSPEED: 0–4 MPH DIR: N NE E SE S SW W NW STEADY GUSTY ___ MPH
SKY: CLEAR [✓ SUNNY] DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: ___

Weather

INSTRUMENT: LD 820 TYPE: [✓ 1] 2 SERIAL #: 1194
CALIBRATOR: LD CAL200 SERIAL #: 2239
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes
SETTINGS: [✓ A-WEIGHTED] SLOW FAST FRONTAL RANDOM ANSI OTHER: ___
Rec # / Start Time / End Time
M4 / 2:30 / 2:45: L_{eq} 60.6, L_{max} 68.6, L_{min} 49.1, L_{90} 53.0, L_{50} 60.0, L_{10} 63.6
___ / ___ / ___: L_{eq} ___, L_{max} ___, L_{min} ___, L_{90} ___, L_{50} ___, L_{10} ___
COMMENTS:

Acoustic Measurements

PRIMARY NOISE(S): TRAFFIC (Roadway Type: hwy) HRB / Bottom AIRCRAFT RAIL INDUSTRIAL ~~AMBIENT~~ Bottom I-84 OTHER:
COUNT #1 DURATION: 15 -MINUTE COUNT #2: 15 -MINUTE

	COUNT #1 [✓ NB]/EB	COUNT #1 [✓ SB]/WB	SPEED (mph) [✓ NB]/EB	SPEED (mph) [✓ SB]/WB	COUNT #2 NB/[✓ EB]	COUNT #2 SB/[✓ WB]	SPEED (mph) NB/[✓ EB]	SPEED (mph) SB/[✓ WB]
AUTOS:	109	100	25	25	215	407	60	60
MED. TRUCKS:	0	1	↓	↓	4	4	↓	↓
HVY TRUCKS:	2	2			30	39		
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / [✓ DRIVING] / [✓ OBSERVER]

[✓ OTHER NOISE SOURCES]: distant AIRCRAFT overhead / RUSTLING LEAVES / distant BARKING DOGS / BIRDS
distant CHILDREN PLAYING / distant TRAFFIC / distant LANDSCAPING / distant TRAINS / other: Bridge Decking Noticeable but not over [illegible] noisier than w/o

Source Info and Traffic Counts

TERRAIN: HARD SOFT [✓ MIXED] FLAT OTHER:
PHYSICAL SETTING: Trail flat [illegible] under South bridge approach.
SITE SKETCH / [✓ PHOTOGRAPHS:] Distant

*Decking under Bridge isn't grated so no add'l measurements conducted to extrapolate bridge decking noise.

↑N

M4 is 100'–150' from HRB.

Hood River Waterfront Trail

M4

HRB

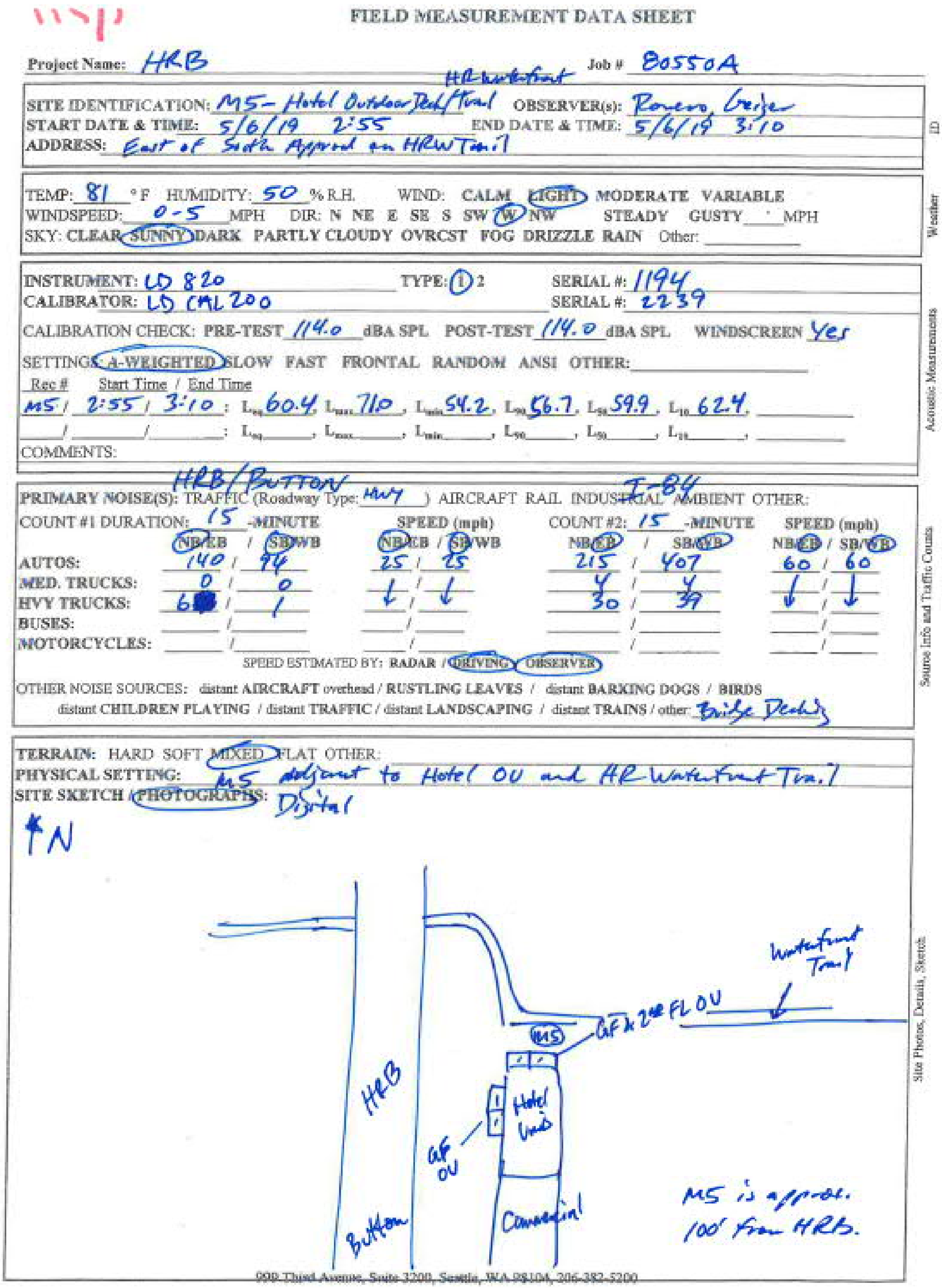
Site Photos, Details, Sketch

999 Third Avenue, Suite 3200, Seattle, WA 98104, 206-382-5200

Measurement Site M4—View of Measurement Site Looking East

Measurement Site M4—View of Measurement Site Looking North

Measurement Site M5—Field Data Sheet



wsp

FIELD MEASUREMENT DATA SHEET

Project Name: HRB **Job #** 80550A

SITE IDENTIFICATION: M5- Hotel Outdoor Deck/HR Waterfront Trail **OBSERVER(s):** Romero, Greije
START DATE & TIME: 5/6/19 2:55 **END DATE & TIME:** 5/6/19 3:10
ADDRESS: East of South Approach on HRW Trail

ID

TEMP: 81 °F HUMIDITY: 50 % R.H. WIND: CALM [✓ LIGHT] MODERATE VARIABLE
WINDSPEED: 0-5 MPH DIR: N NE E SE S SW [✓ W] NW STEADY GUSTY ' MPH
SKY: CLEAR [✓ SUNNY] DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: ______

Weather

INSTRUMENT: LD 820 **TYPE:** [✓ 1] 2 **SERIAL #:** 1194
CALIBRATOR: LD CAL 200 **SERIAL #:** 2239
CALIBRATION CHECK: **PRE-TEST** 114.0 **dBA SPL POST-TEST** 114.0 **dBA SPL WINDSCREEN** Yes
SETTINGS: [✓ A-WEIGHTED] SLOW FAST FRONTAL RANDOM ANSI OTHER: ______

Rec #	Start Time	End Time	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	
M5	2:55	3:10	60.4	710	54.2	56.7	59.9	62.4	

COMMENTS:

Acoustic Measurements

PRIMARY NOISE(S): TRAFFIC (Roadway Type: HWY HRB/BUTTON I-84) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:

COUNT #1 DURATION: 15 -MINUTE COUNT #2: 15 -MINUTE

	COUNT #1 [✓ NB]/EB	COUNT #1 [✓ SB]/WB	SPEED (mph) [✓ NB]/EB	SPEED (mph) [✓ SB]/WB	COUNT #2 NB/[✓ EB]	COUNT #2 SB/[✓ WB]	SPEED (mph) NB/[✓ EB]	SPEED (mph) SB/[✓ WB]
AUTOS:	140	94	25	25	215	407	60	60
MED. TRUCKS:	0	0	↓	↓	4	4	↓	↓
HVY TRUCKS:	6[illegible]	1	↓	↓	30	39	↓	↓
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / [✓ DRIVING] / [✓ OBSERVER]

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS** / other: Bridge Decking

Source Info and Traffic Counts

TERRAIN: HARD SOFT [✓ MIXED] FLAT OTHER:
PHYSICAL SETTING: M5 adjacent to Hotel OU and HR Waterfront Trail
SITE SKETCH / [✓ PHOTOGRAPHS]: Digital

↑N

HRB

Button

M5

GF & 2nd FL OU

Waterfront Trail

Hotel Units

GF OU

Commercial

M5 is approx. 100' from HRB.

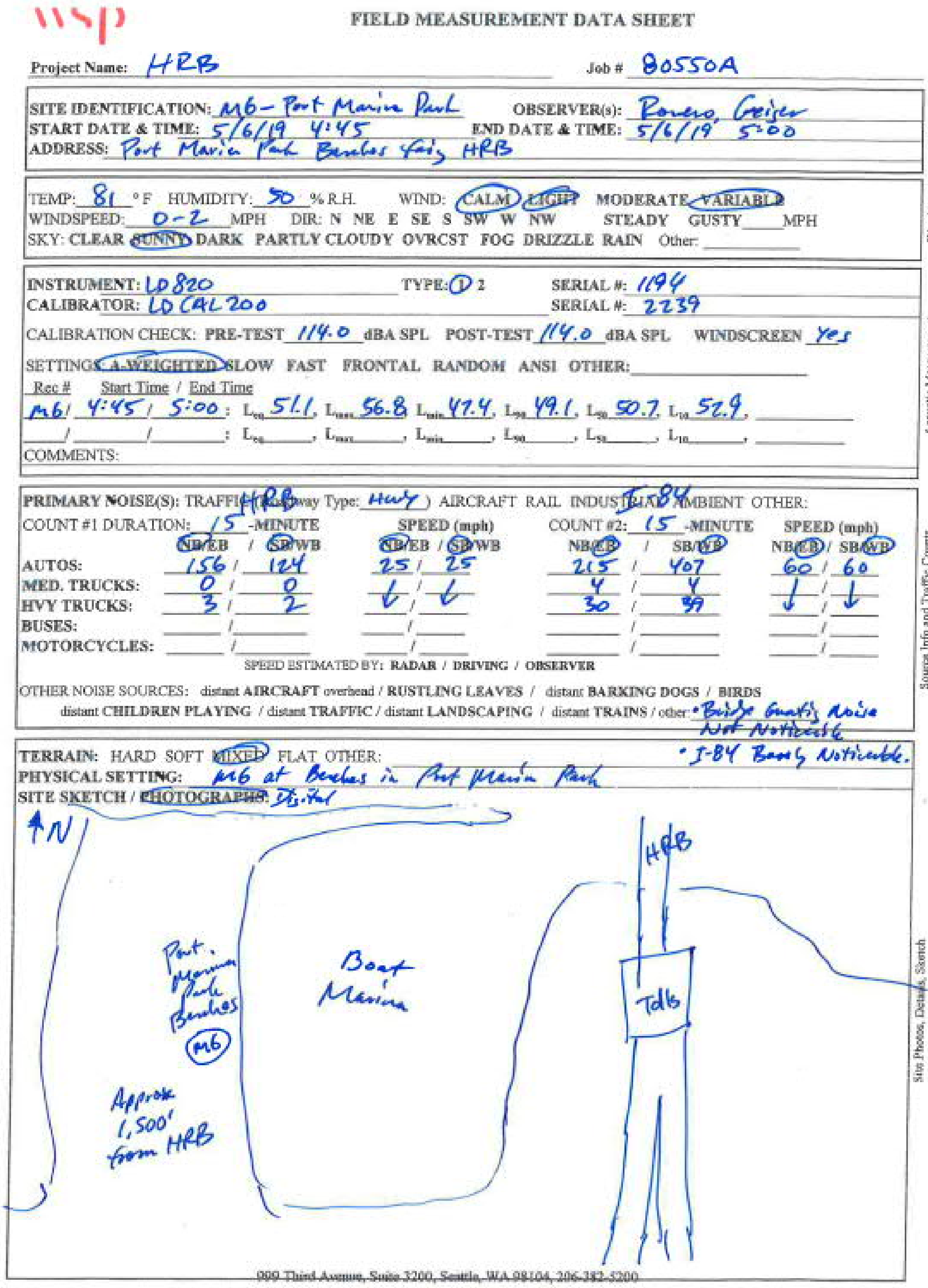
Site Photos, Details, Sketch

999 Third Avenue, Suite 3200, Seattle, WA 98104, 206-382-5200

Measurement Site M5—View from Measurement Site Looking Northwest

Measurement Site M5—View from Measurement Site Looking Southeast

Measurement Site M6—Field Data Sheet



wsp

FIELD MEASUREMENT DATA SHEET

Project Name: HRB Job # 80550A

SITE IDENTIFICATION: M6 – Port Marina Park OBSERVER(s): Romero, Geiger
START DATE & TIME: 5/6/19 4:45 END DATE & TIME: 5/6/19 5:00
ADDRESS: Port Marina Park Beaches Facing HRB

ID

TEMP: 81 °F HUMIDITY: 50 % R.H. WIND: [✓ CALM] [✓ LIGHT] MODERATE [✓ VARIABLE]
WINDSPEED: 0-2 MPH DIR: N NE E SE S SW W NW STEADY GUSTY ____ MPH
SKY: CLEAR [✓ SUNNY] DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: ____

Weather

INSTRUMENT: LD 820 TYPE: [✓ 1] 2 SERIAL #: 1194
CALIBRATOR: LD CAL 200 SERIAL #: 2239

CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST 114.0 dBA SPL WINDSCREEN Yes

SETTINGS: [✓ A-WEIGHTED] SLOW FAST FRONTAL RANDOM ANSI OTHER: ____

Rec # / Start Time / End Time
M6 / 4:45 / 5:00 : L_{eq} 51.1, L_{max} 56.8, L_{min} 47.4, L_{90} 49.1, L_{50} 50.7, L_{10} 52.9, ____
____ / ____ / ____ : L_{eq} ____, L_{max} ____, L_{min} ____, L_{90} ____, L_{50} ____, L_{10} ____, ____

COMMENTS:

Acoustic Measurements

PRIMARY NOISE(S): TRAFFIC (Roadway Type: Hwy) HRB AIRCRAFT RAIL INDUSTRIAL I-84 AMBIENT OTHER:

COUNT #1 DURATION: 15 -MINUTE SPEED (mph) COUNT #2: 15 -MINUTE SPEED (mph)

	COUNT #1 [✓ NB]/EB	[✓ SB]/WB	SPEED [✓ NB]/EB	SPEED [✓ SB]/WB	COUNT #2 NB/[✓ EB]	SB/[✓ WB]	SPEED NB/[✓ EB]	SPEED SB/[✓ WB]
AUTOS:	156	124	25	25	215	407	60	60
MED. TRUCKS:	0	0	↓	↓	4	4	↓	↓
HVY TRUCKS:	3	2			30	39		
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER

OTHER NOISE SOURCES: distant AIRCRAFT overhead / RUSTLING LEAVES / distant BARKING DOGS / BIRDS
distant CHILDREN PLAYING / distant TRAFFIC / distant LANDSCAPING / distant TRAINS / other: •Bridge Grating Noise Not Noticeable
•I-84 Barely Noticeable.

Source Info and Traffic Counts

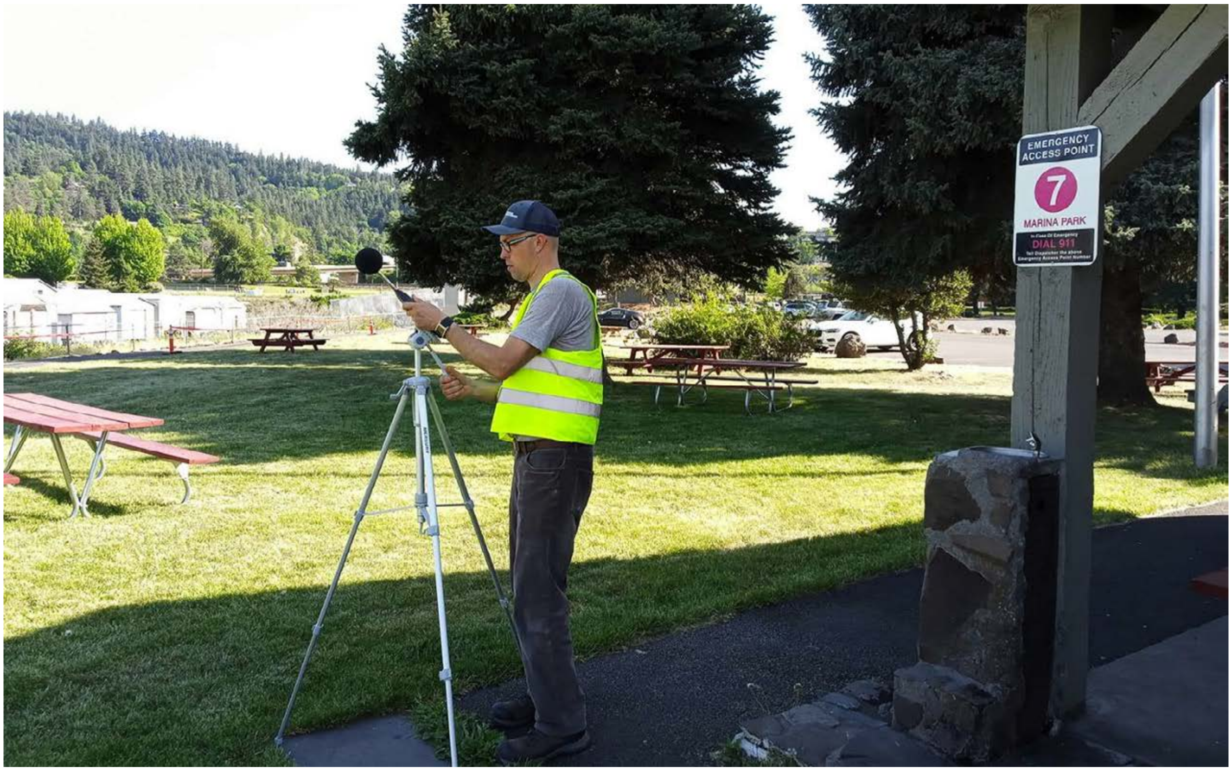
TERRAIN: HARD SOFT [✓ MIXED] FLAT OTHER:
PHYSICAL SETTING: M6 at Beaches in Port Marina Park
SITE SKETCH / [✓ PHOTOGRAPHS]: Digital

Site Photos, Details, Sketch

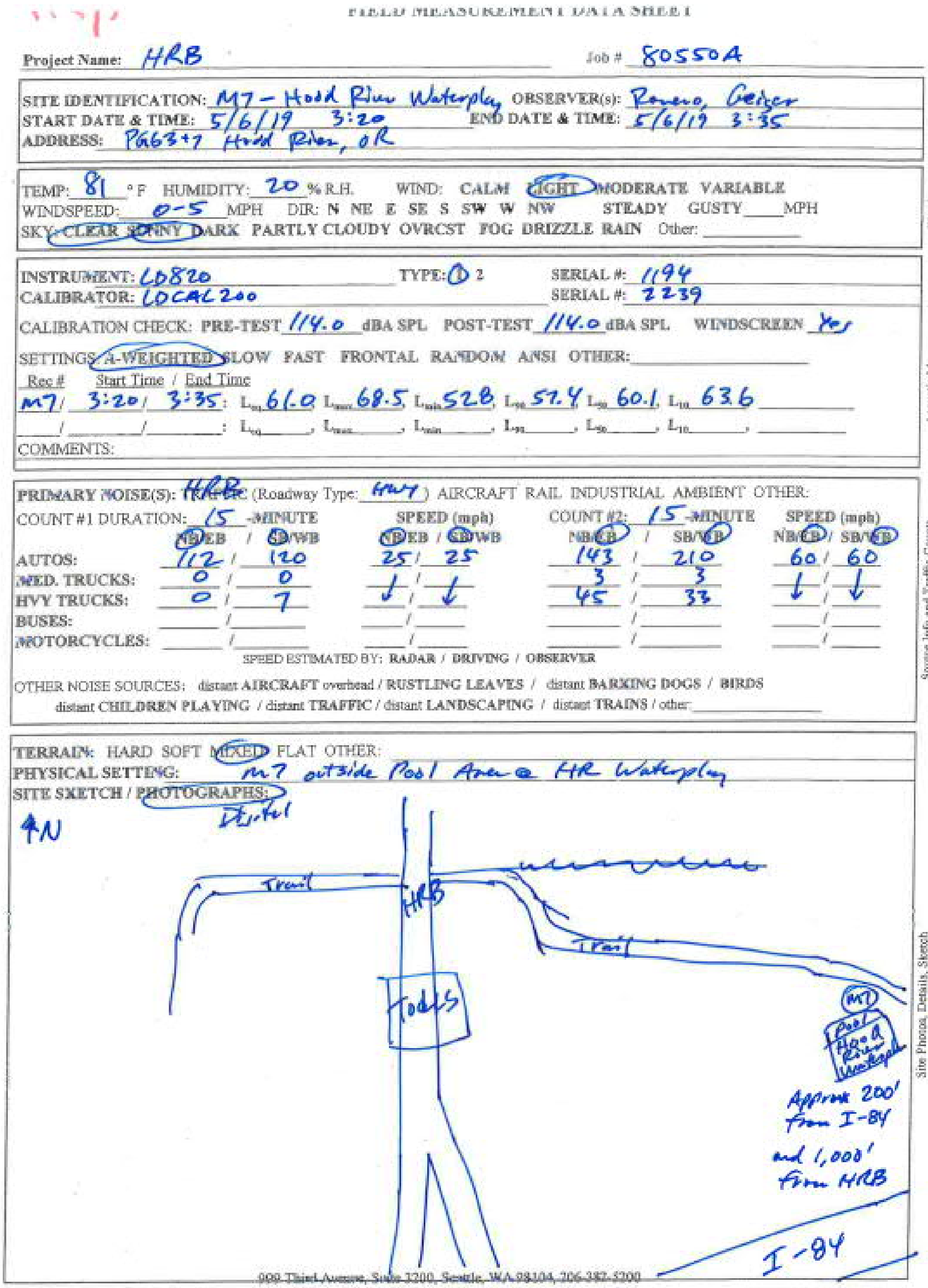
909 Third Avenue, Suite 3200, Seattle, WA 98104, 206-382-5200

Measurement Site M6—View from Measurement Site Looking East

Measurement Site M6—View of Measurement Site Looking South



Measurement Site M7—Field Data Sheet



FIELD MEASUREMENT DATA SHEET

Project Name: HRB Job # 80550A

SITE IDENTIFICATION: M7 – Hood River Waterplay **OBSERVER(s):** Romero, Geiger
START DATE & TIME: 5/6/19 3:20 **END DATE & TIME:** 5/6/19 3:35
ADDRESS: PG63+7 Hood River, OR

ID

TEMP: 81 °F HUMIDITY: 20 % R.H. WIND: CALM [✓ LIGHT] MODERATE VARIABLE
WINDSPEED: 0-5 MPH DIR: N NE E SE S SW W NW STEADY GUSTY ____ MPH
SKY: [✓ CLEAR] [✓ SUNNY] DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: ________

Weather

INSTRUMENT: LD820 **TYPE:** [✓ 1] 2 **SERIAL #:** 1194
CALIBRATOR: LDCAL200 **SERIAL #:** 2239
CALIBRATION CHECK: **PRE-TEST** 114.0 **dBA SPL** **POST-TEST** 114.0 **dBA SPL** **WINDSCREEN** Yes
SETTINGS: [✓ A-WEIGHTED] SLOW FAST FRONTAL RANDOM ANSI OTHER: ________
Rec # / Start Time / End Time
M7 / 3:20 / 3:35: L_{eq} 61.0, L_{max} 68.5, L_{min} 528, L_{90} 57.4, L_{50} 60.1, L_{10} 63.6 ________
____ / ____ / ____: L_{eq} ____, L_{max} ____, L_{min} ____, L_{90} ____, L_{50} ____, L_{10} ____, ________
COMMENTS:

Acoustic Measurements

PRIMARY NOISE(S): HRB TRAFFIC (Roadway Type: HWY) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:

	COUNT #1 DURATION: 15 -MINUTE	SPEED (mph)	COUNT #2: 15 -MINUTE	SPEED (mph)
	[✓ NB]/EB / [✓ SB]/WB	[✓ NB]/EB / [✓ SB]/WB	NB/[✓ EB] / SB/[✓ WB]	NB/[✓ EB] / SB/[✓ WB]
AUTOS:	112 / 120	25 / 25	143 / 210	60 / 60
MED. TRUCKS:	0 / 0	↓ / ↓	3 / 3	↓ / ↓
HVY TRUCKS:	0 / 7	↓ / ↓	45 / 33	↓ / ↓
BUSES:	/	/	/	/
MOTORCYCLES:	/	/	/	/

SPEED ESTIMATED BY: **RADAR / DRIVING / OBSERVER**

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS** / other: ________

Source Info and Traffic Counts

TERRAIN: HARD SOFT [✓ MIXED] FLAT OTHER:
PHYSICAL SETTING: M7 outside Pool Area @ HR Waterplay
SITE SKETCH / [✓ PHOTOGRAPHS]: Digital

↑N

Trail

HRB

Trail

Tolls

M7

Pool Hood River Waterplay

Approx 200' from I-84 and 1,000' from HRB

I-84

Site Photos, Details, Sketch

999 Third Avenue, Suite 3200, Seattle, WA 98104, 206-382-5200

Measurement Site M7—View of Measurement Site Looking Northwest

Measurement Site M7—View of Measurement Site Looking South

Attachment E

TNM2.5 Output Files

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Model Name	**Description**
MODEL VALIDATION RUNS	
Validations_Site_M1	Validation model for measurement 1
Validations_Site_M2	Validation model for measurement 2
Validations_Site_M3	Validation model for measurement 3
Validations_Site_M4	Validation model for measurement 4
Validations_Site_M5	Validation model for measurement 5
Validations_Site_M6	Validation model for measurement 6
Validations_Site_M7	Validation model for measurement 7
EXISTING CONDITIONS MODEL RUN	
Existing_PM_PeakVolume	Existing PM peak hour noise levels calculated for draft report.
Existing_AM_PeakTruck	Existing AM peak truck hour noise levels calculated for comparison with PM peak hour.
NO ACTION ALTERNATIVE MODEL RUN	
NB_PM_PeakVolume	No Action Alternative PM peak hour (2045) noise levels calculated for draft report.
NB_AM_PeakTruck	No Action Alternative AM peak truck (2045) noise levels calculated for comparison with PM peak hour.
BUILD ALTERNATIVE MODEL RUNS	
Alt-EC1_PM_PeakVolume	Build Alternative EC-1 PM peak hour (2045) noise levels calculated for the draft report and future development consideration.
Alt-EC1_AM_PeakVolume	Build Alternative EC-1 AM truck peak (2045) noise levels calculated for comparison with PM peak hour.
Alt-EC2_PM_PeakVolume	Build Alternative EC-2 PM peak hour (2045) noise levels calculated for the draft report and future development consideration.
Alt-EC2_AM_PeakVolume	Build Alternative EC-2 AM truck peak (2045) noise levels calculated for comparison with PM peak hour.
Alt-EC3_PM_PeakVolume	Build Alternative EC-3 PM peak hour (2045) noise levels calculated for the draft report and future development consideration.
Alt-EC3_AM_PeakVolume	Build Alternative EC-3 AM truck peak (2045) noise levels calculated for comparison with PM peak hour.
EC2 ALTERNATIVE MITIGATION RUN	
Alt-EC2_MIT_PM_PeakVolume	Build Alternative EC-2 PM peak hour (2045) noise levels calculated for Noise Barrier 1 Evaluation.

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