



United States
Department of
Agriculture

Forest
Service

Okanogan-Wenatchee
National Forest

215 Melody Lane
Wenatchee, WA 98801
TTY (509) 664-9201
Voice (509) 664-9200

File Code: 2730-2

Date: August 18, 2009

Daniel M. Mathis
Division Administrator
Federal Highway Administration
Suite 501 Evergreen Plaza
711 South Capital Way
Olympia, WA 98501-1284

RE: Letter of Consent: I-90 Hyak to Keechelus Dam, Mile Post 55.27 –60.96

Dear Mr. Mathis:

By letter dated April 8, 2009, the Federal Highway Administration requested the appropriation and transfer of National Forest System lands within the Wenatchee National Forest, administered by the Mt. Baker-Snoqualmie National Forest, North Bend Ranger District and the Okanogan - Wenatchee National Forest, Cle Elum Ranger District, for right-of-way for the construction/reconstruction, operation and maintenance of a segment of Interstate 90, and appurtenant highway facilities between Hyak to Keechelus Dam, in the county of Kittitas, State of Washington, shown on the attached Right of Way map entitled Exhibit "A", dated August 14, 2009

Highway right-of-way is variable in width.

The total USFS/USBR Right-of-way area is 5.69 miles long, variable in width and extents from Mile Post 55.27 to Mile Post 60.96 and comprises 63.33 acres of additional acres, more or less, as shown on attached Exhibit A.

The Forest Service consents to the appropriation and transfer of these lands under the provision of sections 107(d) and 317 of the Act of August 27, 1958, (72 Stat. 916; 23 U.S.C. 317), subject to the following Stipulations, contained herein as Exhibit 1.

You may authorize immediate entry under the above terms which includes final review and approval of the 100% Construction Plans and 100% PSE plans for "I90 Snoqualmie Pass East, Phase 1".

Sincerely,

REBECCA LOCKETT HEATH
Forest Supervisor
Okanogan – Wenatchee National Forest

Y. ROBERT IWAMOTO
Forest Supervisor
Mt. Baker-Snoqualmie National Forest



Attachments

CC: Washington State Department of Transportation, Regional Office Lands Department, Cle Elum Ranger District, Mt. Baker-Snoqualmie Lands Department, North Bend Ranger District, Katie Eirich (WSDOT), Elizabeth Healy (FHWA), USBOR

EXHIBIT 1
STIPULATIONS

This Stipulation, made this ___ day of _____, 2009, by and between the Washington State Department of Transportation, hereinafter referred to as the State, and the Forest Service, United States Department of Agriculture, acting herein by and through the Regional Forester, hereinafter referred to as the Regional Forester.

WHEREAS, the State is engaged in the laying out, construction, operation, and maintenance of a public highway designated as I90, Snoqualmie Pass, East Phase 1 which traverses lands of the United States in the State of Washington, County of Kittitas, administered by the Forest Service, and

WHEREAS, the State and the Regional Forester desire to cooperate in the development and construction of a highway that will protect adequately and afford adequate utilization of the lands of the United States traversed by the highway for the purposes for which the lands are being administered.

NOW, THEREFORE, supplementary to the terms and conditions of the highway easement deed between the United States, acting through the Department of Transportation, Federal Highway Administration, and the State, the parties hereto agree to carry out the following provisions during the construction stage: Construction stage is to begin when construction activities commence on lands administered by the Forest Service and end when the Regional Forester and the State mutually agree that any work done thereafter will be considered as maintenance, EXCEPT, that the Regional Forester reserves the right to reinstate the provisions of this stipulation if the State subsequently submits plans for reconstruction or alteration of the highway.

The Highway Easement Deed shall have the following terms and conditions:

1. Outstanding valid claims, if any, existing on the date of this grant, and the State shall obtain such permission as may be necessary on account of any such claims.
2. The State and the Forest Service shall make determination as to the necessity for archeological and paleontological reconnaissance and salvage within the right-of-way, and such reconnaissance and salvage to the extent determined necessary because of construction of the highway facility, is to be undertaken by the State in compliance with the acts entitled An Act for the Preservation of American Antiquities, approved June 8, 1906 (34 Stat. 225, 16 U.S.C. 432-433), the Archaeological Resources Protection Act of 1979 (93 Stat. 721, 16 U.S.C. 470aa-470ll), and State laws where applicable.

3. The easement herein granted is limited to use of the described right-of-way and the space above and below the established grade line of the highway pavement for the purpose of construction, operation and maintenance of a highway in accordance with the approved plans described in the following condition Number (4.) and does not include the grant of any rights for nonhighway purposes or facilities: Provided, That the right of the Forest Service to use or authorize the use of any portion of the right-of-way for nonhighway purposes shall not be exercised when such use would be inconsistent with the provisions of Title 23 of the United States Code and of the Federal Highway Administration regulations issued pursuant thereto or would interfere with the free flow of traffic or impair the full use and safety of the highway, and, in any case, the State and the Federal Highway Administration shall be consulted prior to the exercise of such rights; and Provided further, That nothing herein shall preclude the Forest Service from locating National Forest and other Department of Agriculture information signs on the portions of the right-of-way outside of construction clearing limits.
4. The design and construction of highway projects situated on this right-of-way will be in accordance with the provisions of Title 23, United States Code--Highways, and amendments; the Regulations for the Administration of Federal Aid for Highways, effective May 11, 1960; and amendments and established procedures for Federal-aid projects, including the requirements of Title 23, Code of Federal Regulations, part 771, and the construction specifications of the State highway department as approved by the Federal Highway Administration for use on Federal-aid projects.

The Forest Service will be provided an opportunity to review plans relative to effects, if any, that the project works as planned will have upon adequate protection and utilization of the land traversed by the right-of-way and adjoining land under the administration of the Forest Service for the purposes for which such land is being administered. Those features of design, construction, and maintenance of the highway facility and of use of the right-of-way that would have effect on the protection and utilization of the land under the administration of the Forest Service are to be mutually agreed upon by the Forest Service and the State by conference or other communication during the preparation of the plans and specifications for each construction project, and the plans shall be revised, modified, or supplemented to meet the approval of the Forest Service, or when deemed appropriate, supplemented by written stipulation between the Forest Service and the State, prior to the start of construction.

The final design and the construction specifications for any highway construction project on the right-of-way will be presented to the Forest Service for approval; construction shall not begin until such approval is given: Provided, That if it is subsequently deemed necessary that the approved plans, specifications, or stipulation be amended or supplemented, any amendment or

supplement which affects alignment, subgrade, etc. shall be approved by the Forest Service and the State before being placed in effect.

5. Consistent with highway safety standards, the State shall:
 - a. Protect and preserve soil and vegetative cover and scenic and aesthetic values on the right-of-way outside of construction limits.
 - b. Provide for the prevention and control of soil erosion within the right-of-way and adjacent lands that might be affected by the construction, operation, or maintenance of the highway, and shall vegetate and keep vegetated with suitable species all earth cut or fill slopes feasible for revegetation or other areas on which ground cover is destroyed where it is deemed necessary during a joint review between the Forest Service and the State prior to completion of the highway and the State shall maintain all terracing, water bars, leadoff ditches, or other preventive works that may be required to accomplish this objective. This provision shall also apply to slopes that are reshaped following slides which occur during or after construction.
6. The State shall establish no borrow, sand, or gravel pits; stone quarries, permanent storage areas; sites for highway operation and maintenance facilities, camps, supply depots, or disposal areas within the right-of-way; unless shown on approved construction plans, without first obtaining approval of the Forest Service.
7. State shall maintain the right-of-way free of noxious weeds that have been identified in Federal, State, county, or local laws, regulations or orders. The State shall maintain the right-of-way clearing by means of chemicals only after consultation with the Forest Service. Consultation must address the time, method, chemicals, and the exact portion of the right-of-way to be chemically treated.
8. When need for the easement herein granted no longer exists, the State shall give notice of that fact to the Secretary of Transportation and the rights herein granted shall terminate and the land shall revert immediately to the full control of the Department of Agriculture.
9. The State shall be responsible for the removal and cleanup of hazardous spills originating on the highway right-of-way, including those that extend beyond the boundaries of the appropriated right-of-way to adjacent National Forest System lands and resources.
10. Before any clearing, or as otherwise agreed to by the Regional Forester, of the right-of-way or construction of the highway commences, the State will:

- a) Prepare, in cooperation with the Regional Forester, a fire protection plan that sets forth in detail the fire prevention, presuppression, and suppression measures that will be taken by the State, its employees, contractors, and subcontractors, and their employees in all operations during the construction stage. The fire plan shall be made available to all bidders prior to letting contract and the State shall cause its contractors to comply with all provisions of the fire plan and of all burning permits issued for disposal of flammable materials.
- b) Prepare, in cooperation with the Regional Forester, a clearing plan that sets forth in detail the procedures and standards that will apply to (1) all clearing and disposal of merchantable timber and young growth in the right-of-way and (2) debris disposals, including debris removal from all streams. Such plan shall include provision for payment by the State or its contractors for the merchantable timber on lands of the United States to be cut, used, or destroyed in the construction of the highway or in clearing of said right-of-way. Payment for merchantable timber shall be at appraised value as determined by the Regional Forester: Provided, That the Regional Forester may dispose of the merchantable timber to other than the State or its contractors at no stumpage cost to the State or its contractors.
- c) Prepare, in cooperation with the Regional Forester, a landscape and erosion control plan with the objective of protecting, restoring, or enhancing the roadside landscape, protecting soil, and protecting or reestablishing vegetative cover. Such plan shall, when appropriate, provide for vegetating cuts, fills, and other areas damaged as a result of highway construction; maintenance or operation; and for terraces, drainage, waste disposal areas, soil replacement, and other related requirements necessary to achieve the objective.
- d) Prepare, in cooperation with the Regional Forester, a plan for the restoration of aquatic, wetland and terrestrial habitats as described in the *Final Wetlands and Aquatic Resources Mitigation Plan* (February 2009 or as officially amended) as shown in Exhibit C, to mitigate for highway construction impacts.
- e) The State shall prepare a fencing and wildlife exclusion plan. Plan shall be submitted to the Forest Service for review, and if possible shall be revised, modified or supplemented to meet the approval of the Forest Service. The State shall be responsible for the construction, monitoring, and maintenance of wildlife fencing to help prevent animals from entering the roadway, as shown on the approved plans.
- f) The State, in cooperation with the Regional Forester shall prepare a process to fulfill State's responsibility for monitoring, and maintenance of

lands within the right-of-way adjacent to Gold Creek CEA, Rocky Run CEA, Resort Creek CEA, and Townsend Creek CEA to meet hydrologic and ecological connectivity objectives as described in Appendix W, Attachment B, of the FEIS (2008).

- g) The State in cooperation with the Forest Service, shall develop a site-specific management plan for connectivity emphasis areas (CEAs) and Hydrologic Connectivity Zones (HCZs) within those CEA's, as identified below, to meet Forest Plan consistency requirements and Mitigation Development Team (MDT) Performance Standards as described in Appendix W, attachment B, C, and D of the FEIS (2008). The State will be responsible for the longterm site management and maintenance of the roadside and mitigation commitments within the right-of-way.

The management plans will address the restoration of these areas, including the landscaping and revegetation plans, riparian and aquatic habitat elements (i.e., wood, substrate, pools, canopy cover), soil treatments, invasive plant treatments, stormwater treatment areas, highway operation and maintenance and monitoring, to be implemented following construction. Management plans will be developed for the following locations:

- a. Gold Creek CEA
 - b. Rocky Run CEA
 - c. Wolfe Creek CEA
 - d. Resort Creek CEA
 - e. Townsend Creek CEA
 - f. Wildlife overpass within the Price/Noble CEA
 - g. Roadside Areas
- 11. The State will dispose of waste material resulting from slides during and after construction and surplus material at locations approved by the Forest Supervisor. A plan showing the proposed method of disposal shall be submitted by the State at the time approval is requested.
 - 12. The State will treat sections of existing road, to be abandoned as a result of the proposed new construction, as designated by the Forest Supervisor, to restore them to their natural state. The necessary treatment shall be determined during a joint review between the Forest Service and the State and may include ripping of roadbed, removal of drainage structure, and opening drainage channels. Plans and specifications as mutually deemed appropriate to accomplish the objective shall become a part of this stipulation.
 - 13. The State will permanently monument the right-of-way in accordance with State requirements for such right-of-way before completing construction, but in any event, the minimum requirements shall be to place permanent

monuments at the intersection of the right-of-way with all property lines and section lines.

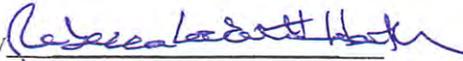
14. The State will reestablish or restore public land monuments disturbed or destroyed by construction, reconstruction, or maintenance according to instructions of the Bureau of Land Management, Department of the Interior. Other land monuments and property corners or witness markers shall not be damaged, destroyed, or obliterated without the prior permission of the Regional Forester and shall be relocated or reestablished in accordance with standards satisfactory to the Regional Forester.
15. The State shall donate the following lands to fulfill Forest Plan Consistency, National Forest Management Act, National Environmental Policy Act and Clean Water Act (CWA) to compensate for the loss of habitat including, wetlands, riparian habitat and mature forest:
 - a. Section 11, T. 22 N., R 11 E., W.M.
 - b. E1/2 NW1/4SE1/4 of Section 15, T. 22 N., R. 11 E., W.M.

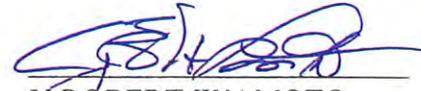
An agreement between the Forest Service and the State will be developed that details the transfer and management responsibilities associated with these mitigation lands.

The Forest Service is in the process of determining if the proposed land donation is acceptable for addition to the National Forest System. The acceptance of the donation assumes the title shall be satisfactory to the United States Attorney General or the Office of the General Counsel and the Secretary of Agriculture. If encumbrances to title are not acceptable or if hazardous substances, pollutants, contaminants or petroleum are discovered before transfer of title, the Secretary of Agriculture may reject the offered parcel and refuse to complete the proposed donation. In the event, for whatever unforeseen reason, the Forest Service can not accept this donation, the lands will be transferred to the Bureau of Reclamation. If for some reason, the Bureau of Reclamation cannot accept the donated lands, the Washington State Department of Transportation and the Forest Service will work together to identify replacement lands that meet Forest Plan Consistency and wetland mitigation requirements.

16. The State and Regional Forester shall conduct bi-annual meetings to review construction, maintenance, and monitoring activities. If the construction, operation or maintenance practices, are not meeting requirements found in the easement conditions; WSDOT, FHWA, and Forest Service will work cooperatively to find a resolution.

IN WITNESS WHEREOF, the parties hereto have caused this Stipulation to be executed on the day and year first above written.

By 
REBECCA LOCKETT HEATH
Forest Supervisor
Okanogan and Wenatchee
National Forests


Y. ROBERT IWAMOTO
Forest Supervisor
Mt. Baker-Snoqualmie National Forest

Appendix B – Letters to File

- **Air Quality**
- **Cultural Resources**
- **Energy Resources**
- **Environmental Justice**
- **Hazardous Material Sites**
- **Noise**
- **Recreational Resources**
- **Utility Services**



Letter to File Air Quality

Date: May 17, 2012

To: Jason Smith 
Environmental Manager, WSDOT SCR

From: Ron Bockelman, Karen Comings
David Evans and Associates, Inc.

Through: Phil Larson
Atkinson Construction

Subject: Letter to File for Air Quality supporting the Interstate 90 Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement

This Letter to File supports the Interstate 90 (I-90) Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement (EIS). It documents that David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, reviewed the analysis of air quality presented in the Final EIS (WSDOT 2008) and supporting documentation including the Air Quality Discipline Report (WSDOT 2003). This review led to the recommendation by DEA and subsequent conclusion by the Washington State Department of Transportation (WSDOT) and the Federal Highway Administration (FHWA) that the analysis remains valid and does not require supplementation or amendment for the Supplemental EIS.

Why is a Supplemental EIS necessary?

In fall 2011, the contractor constructing the portion of the I-90 project from milepost (MP) 57.3 to MP 60.2, Guy F. Atkinson (Atkinson Construction), proposed a design modification to construct eastbound and westbound bridges at MP 58.1 (Keechelus Lake Avalanche Bridges) instead of the expanded Snowshed that was included in the Selected Alternative, described in the Record of Decision (FHWA 2008). This would alter plans and specifications within the project area from MP 57.9 to MP 58.4 (design modification area), which may have the potential for significant impacts that were not analyzed in the Final EIS.

How were potential impacts to air quality analyzed?

Carbon monoxide (CO) in vehicle exhaust was identified as the primary pollutant of concern and was the focus of the analysis. Concentrations of CO were modeled for potential receptors based

on traffic volumes and travel speeds under existing and future (2030) conditions for the I-90 project. Other potential air pollutants were analyzed qualitatively in the discipline report.

What were the relevant impacts evaluated in the Final EIS?

The Final EIS concludes that the I-90 project would not result in ambient CO concentrations exceeding the allowable National Ambient Air Quality Standards (NAAQS) at any receiver near the highway. Other potential air pollutants from construction and operation would not produce substantial localized or regional air quality impacts.

What has changed since the Record of Decision was issued?

Since the publication of the Final EIS and the Record of Decision for the I-90 project, the NAAQS have been updated and also now include standards for PM_{2.5} (Ecology 2012). The study area is still in attainment for all criteria pollutants, and CO concentrations modeled for the I-90 project continue to be less than the current NAAQS.

Would the design modification change the impacts presented in the Final EIS?

The design modification would not result in any new receptors or change the projected traffic volumes or travel speeds. Therefore, no changes to CO concentrations modeled for the I-90 project are anticipated. Other impacts to air quality from construction and operation would also be unchanged from those evaluated in the Final EIS.

Recommendation

DEA determined that the air quality analysis presented in the Final EIS remains valid and should not require supplementation or amendment for the Keechelus Lake Avalanche Bridges Supplemental EIS.

Conclusion

WSDOT and FHWA have reviewed this Letter to File and concur with the findings and recommendation.

References

Washington State Department of Ecology (Ecology). 2012. National Ambient Air Quality Standards Website. <http://www.ecy.wa.gov/programs/air/sips/pollutants/naaqs.htm>. Reviewed 2012.



Letter to File Air Quality

Washington State Department of Transportation (WSDOT). 2003. Air Quality Discipline Report. Draft EIS Appendix F.

———. 2005. *I-90 Snoqualmie Pass East, Draft Environmental Impact Statement and Section 4(f) Evaluation*. June.

———. 2008. *I-90 Snoqualmie Pass East, Final Environmental Impact Statement and Section 4(f) Evaluation*. August.

cc: file



Letter to File Historic, Cultural, and Archaeological Resources

Date: May 17, 2012 

To: Jason Smith
Environmental Manager, WSDOT SCR

From: Ron Bockelman, Karen Comings
David Evans and Associates, Inc.

Through: Phil Larson
Atkinson Construction

Subject: Letter to File for Historic, Cultural, and Archaeological Resources supporting the Interstate 90 Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

This Letter to File supports the Interstate 90 (I-90) Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement (EIS). It documents that David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, reviewed the cultural resources analysis presented in the Final EIS (WSDOT 2008a) and supporting documentation including the Archaeological, Cultural, and Historic Resources report (WSDOT 2008b). This review led to the recommendation by DEA and subsequent conclusion by the Washington State Department of Transportation (WSDOT) and the Federal Highway Administration (FHWA) that the analysis remains valid and does not require supplementation or amendment in the Supplemental EIS.

Why is a Supplemental EIS necessary?

In fall 2011, the contractor constructing the portion of the I-90 project from milepost (MP) 57.3 to MP 60.2, Guy F. Atkinson (Atkinson Construction), proposed a design modification to construct eastbound and westbound bridges at MP 58.1 (Keechelus Lake Avalanche Bridges) instead of the expanded Snowshed that was included in the Selected Alternative, described in the Record of Decision (FHWA 2008). This would alter plans and specifications within the project area from MP 57.9 to MP 58.4 (design modification area), which may have the potential for significant impacts that were not analyzed in the Final EIS.

How were potential impacts to cultural resources analyzed?

Historic, cultural, and archeological resources were identified within the project's area of potential effect (APE) through consultation with affected tribes and the Department of Archaeology and Historic Preservation (DAHP) and during cultural resource surveys.



Letter to File Historic, Cultural, and Archaeological Resources

What were the relevant impacts evaluated in the Final EIS?

The design modification area is located within the original APE and contains only one cultural resource, the Lake Keechelus Snowshed Bridge (the existing snowshed), which is listed on the National Register of Historic Places (reference number 95000627). This historic structure will be removed as part of the Selected Alternative. A Memorandum of Agreement (MOA) is in place between FHWA, WSDOT, and the DAHP, committing FHWA and WSDOT to mitigation measures for removal of the snowshed.

What has changed since the Record of Decision was issued?

No new information pertinent to historic, archeological, or cultural resources has been identified and no substantive changes to the regulatory setting have occurred since the Record of Decision was issued.

Would the design modification change the impacts presented in the Final EIS?

The existing snowshed would be removed as part of the design modification, just as it would be under the Selected Alternative. Therefore, no alteration of the existing plan for snowshed removal or commitment to mitigation is necessary. No additional resources would be affected.

Recommendation

DEA has determined that the cultural resources analysis presented in the Final EIS (WSDOT 2008a) and the supporting Archaeological, Cultural, and Historic Resources report (WSDOT 2008b) remains valid and should not require supplementation or amendment for the Keechelus Lake Avalanche Bridges Supplemental EIS.

Conclusion

WSDOT and FHWA have reviewed this Letter to File and concur with the findings and recommendation.

References

- Washington State Department of Transportation (WSDOT). 2008a. *I-90 Snoqualmie Pass East Final Environmental Impact Statement and Section 4(f) Evaluation*. August.
- . 2008b. Archaeological, Cultural and Historic Resources. Final EIS Appendix Z.

cc: file



Letter to File Energy Resources

Date: May 17, 2012

To: Jason Smith 
Environmental Manager, WSDOT SCR

From: Ron Bockelman, Karen Comings
David Evans and Associates, Inc.

Through: Phil Larson
Atkinson Construction

Subject: Letter to File for Energy Resources supporting the Interstate 90 Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

This Letter to File supports the Interstate 90 (I-90) Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement (EIS). It documents that David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, reviewed the energy analysis presented in the Final EIS (WSDOT 2008) and supporting documentation including the Energy Discipline Report (WSDOT 2002). This review led to the recommendation by DEA and subsequent conclusion by the Washington State Department of Transportation (WSDOT) and the Federal Highway Administration (FHWA) that the analysis remains valid and does not require supplementation or amendment for the Supplemental EIS.

Why is a Supplemental EIS necessary?

In fall 2011, the contractor constructing the portion of the I-90 project from milepost (MP) 57.3 to MP 60.2, Guy F. Atkinson (Atkinson Construction), proposed a design modification to construct eastbound and westbound bridges at MP 58.1 (Keechelus Lake Avalanche Bridges [Bridges]) instead of the expanded Snowshed that was included in the Selected Alternative, described in the Record of Decision (FHWA 2008). This would alter plans and specifications within the project area from MP 57.9 to MP 58.4 (design modification area), which may have the potential for significant impacts that were not analyzed in the Final EIS.

How were potential impacts to energy resources analyzed?

The energy resources analysis presented in the Energy Discipline Report is based on anticipated energy requirements for construction of the I-90 project and vehicle operation within the project area. An accepted conversion factor was used to estimate construction energy consumption based on construction costs. Vehicle speeds and miles traveled were used to estimate the amount of energy required for vehicle operation within the project area.

What were the relevant impacts evaluated in the Final EIS?

As the least expensive Keechelus Lake alignment alternative, the Selected Alternative is also the least energy-demanding alternative in terms of construction energy requirements. Long-term, the I-90 project would reduce congestion and improve traffic flow, which would increase vehicle efficiency. Net energy consumption during operation of the highway is expected to increase. However, this increase is driven by regional and statewide population trends and is not a direct result of the project itself.

What has changed since the Record of Decision was issued?

No new information pertinent to energy resources has been identified and no substantive changes to the regulatory setting have occurred since the Record of Decision was issued.

Would the design modification change the impacts presented in the Final EIS?

The design modification would not change the overall cost of construction. Consequently, anticipated construction energy requirements would not exceed those of the Selected Alternative. The Bridges would not change projected vehicle speeds or increase vehicle miles traveled for this section of I-90 and, therefore, would not alter this portion of the energy analysis either. Additionally, the Bridges would not require ongoing operation of ventilation and fire suppression systems that are necessary for the Snowshed. This is assumed to be an energy reduction compared to the Snowshed.

Recommendation

DEA has determined that the energy analysis presented in the Final EIS remains valid and should not require supplementation or amendment for the Keechelus Lake Avalanche Bridges Supplemental EIS.

Conclusion

WSDOT and FHWA have reviewed this Letter to File and concur with the findings and recommendation.

References

- Federal Highway Administration (FHWA). 2008. I-90 Snoqualmie Pass East FHWA-WA-EIS-05-01-F Record of Decision.
- Washington State Department of Transportation (WSDOT). 2002. Energy Discipline Report. Draft EIS Appendix I.



Letter to File Energy Resources

- . 2005. *I-90 Snoqualmie Pass East, Draft Environmental Impact Statement and Section 4(f) Evaluation*. June.
- . 2008. *I-90 Snoqualmie Pass East Final Environmental Impact Statement and Section 4(f) Evaluation*. August.

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Letter to File Environmental Justice

Date: May 17, 2012

To: Jason Smith 
Environmental Manager, WSDOT SCR

From: Ron Bockelman, Karen Comings
David Evans and Associates, Inc.

Through: Phil Larson
Atkinson Construction

Subject: Letter to File for Environmental Justice supporting the Interstate 90 Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement

This Letter to File supports the Interstate 90 (I-90) Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement (EIS). It documents that David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, reviewed the impact analysis for environmental justice presented in the Final EIS (WSDOT 2008) and supporting documentation including the Environmental Justice Discipline Report (WSDOT 2003). This review led to the recommendation by DEA and subsequent conclusion by the Washington State Department of Transportation (WSDOT) and the Federal Highway Administration (FHWA) that the analysis remains valid and does not require supplementation or amendment in the Supplemental EIS.

Why is a Supplemental EIS necessary?

In fall 2011, the contractor constructing the portion of the I-90 project from milepost (MP) 57.3 to MP 60.2, Guy F. Atkinson (Atkinson Construction), proposed a design modification to construct eastbound and westbound bridges at MP 58.1 (Keechelus Lake Avalanche Bridges) instead of the expanded Snowshed that was included in the Selected Alternative, described in the Record of Decision (FHWA 2008). This would alter plans and specifications within the project area from MP 57.9 to MP 58.4 (design modification area), which may have the potential for significant impacts that were not analyzed in the Final EIS.

How were potential impacts to environmental justice analyzed?

Alternatives were evaluated for compliance with Executive Order (EO) 12898 and FHWA Order 6640.23, which establish that it is Federal policy to avoid, to the extent practicable, disproportionately "high and adverse" human health or environmental impacts on minority or low-

income populations. In accordance with WSDOT guidance, three evaluation measures were made to analyze environmental justice impacts:

- Determine whether a minority or low-income population exists in the project area.
- Determine which impacts of the alternatives are high and adverse.
- Determine whether high and adverse impacts fall disproportionately on minority or low-income population(s).

What were the relevant impacts evaluated in the Final EIS?

The discipline report and Final EIS conclude that there is no minority or low-income population in the project area and the project would have little to no impact on private property owners.

What has changed since the Record of Decision was issued?

Since the publication of the Final EIS and Record of Decision, WSDOT has changed its guidance for conducting environmental justice analyses (WSDOT 2012). However, these changes are procedural and do not require revision to the analysis in the Final EIS.

Would the design modification change the impacts presented in the Final EIS?

The design modification will not alter the I-90 project area or impact any minority or low-income populations. Therefore, the analysis of environmental justice would not change and the project would continue to be consistent with the policy established in EO 12898 and FHWA Order 6640.23.

Recommendation

DEA has determined that the environmental justice analysis presented in the Final EIS remains valid and should not require supplementation or amendment for the Keechelus Lake Avalanche Bridges Supplemental EIS.

Conclusion

WSDOT and FHWA have reviewed this Letter to File and concur with the findings and recommendation.

References

Washington State Department of Transportation (WSDOT). 2003. Environmental Justice Discipline Report. Draft EIS Appendix J.



Letter to File Environmental Justice

- . 2005. *I-90 Snoqualmie Pass East, Draft Environmental Impact Statement and Section 4(f) Evaluation*. June.
- . 2008. *I-90 Snoqualmie Pass East, Final Environmental Impact Statement and Section 4(f) Evaluation*. August.
- . 2012. Environmental Justice Website.
<http://www.wsdot.wa.gov/Environment/EJ/EnviroJustice.htm>. Reviewed 2012.

cc: file



Letter to File Hazardous Material Sites

Date: May 17, 2012

To: Jason Smith 
Environmental Manager, WSDOT SCR

From: Ron Bockelman, Karen Comings
David Evans and Associates, Inc.

Through: Phil Larson
Atkinson Construction

Subject: Letter to File for Hazardous Material Sites supporting the Interstate 90 Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

This Letter to File supports the Interstate 90 (I-90) Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement (EIS). It documents that David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, reviewed the hazardous materials analysis presented in the Final EIS (WSDOT 2008) and supporting documentation including the Discipline Report for Hazardous, Toxic, or Radiological Waste (WSDOT 2002). This review led to the recommendation by DEA and subsequent conclusion by the Washington State Department of Transportation (WSDOT) and the Federal Highway Administration (FHWA) that the analysis remains valid and does not require supplementation or amendment for the Supplemental EIS.

Why is a Supplemental EIS necessary?

In fall 2011, the contractor constructing the portion of the I-90 project from milepost (MP) 57.3 to MP 60.2, Guy F. Atkinson (Atkinson Construction), proposed a design modification to construct eastbound and westbound bridges at MP 58.1 (Keechelus Lake Avalanche Bridges) instead of the expanded Snowshed that was included in the Selected Alternative, described in the Record of Decision (FHWA 2008). This would alter plans and specifications within the project area from MP 57.9 to MP 58.4 (design modification area), which may have the potential for significant impacts that were not analyzed in the Final EIS.

How were potential impacts to hazardous material sites analyzed?

The analysis presented in the Discipline Report for Hazardous, Toxic, or Radiological Waste focused on identifying contaminated sites within one mile on either side of the existing I-90 alignment. It was conducted under the general framework of a Phase I Site Characterization

and included a review of State and Federal databases and other historical records and in-field reconnaissance of the corridor.

What were the relevant impacts evaluated in the Final EIS?

There are five properties containing known or suspected hazardous materials in the general vicinity of the I-90 project corridor. However, none of these properties are located in the design modification area.

What has changed since the Record of Decision was issued?

Databases containing lists of contaminated sites are updated on a regular basis. The Federal and State databases listed below were reviewed for new listings in April, 2012.

- Environmental Protection Agency Comprehensive Environmental Response, Compensation, and Liability Information System
- Environmental Protection Agency National Priority List
- Washington State Department of Ecology's list of underground storage tanks, leaking underground storage tanks, and facility/site database.

No new contaminated sites were identified in the Bridges design modification area.

Would the design modification change the impacts presented in the Final EIS?

The conclusions of the original analysis are unaffected because there are no known or suspected sites containing hazardous materials located in the design modification area.

Recommendation

DEA has determined that the hazardous materials analysis presented in the Final EIS remains valid and should not require supplementation or amendment for the Bridges Supplemental EIS.

Conclusion

WSDOT and FHWA have reviewed this Letter to File and concur with the findings and recommendation.

References

Washington State Department of Transportation (WSDOT). 2002. Discipline Report for Hazardous, Toxic, or Radiological Waste. Draft EIS Appendix M.



Letter to File Hazardous Material Sites

- . 2005. *I-90 Snoqualmie Pass East, Draft Environmental Impact Statement and Section 4(f) Evaluation*. June.
- . 2008. *I-90 Snoqualmie Pass East Final Environmental Impact Statement and Section 4(f) Evaluation*. August.

cc: file



Letter to File Noise

Date: May 17, 2012

To: Jason Smith 
Environmental Manager, WSDOT SCR

From: Ron Bockelman, Karen Comings
David Evans and Associates, Inc.

Through: Phil Larson
Atkinson Construction

Subject: Letter to File for the Noise Analysis supporting the Interstate 90 Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

This Letter to File supports the Interstate 90 (I-90) Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement (EIS). It documents that David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, reviewed the noise analysis presented in the Final EIS (WSDOT 2008a) and supporting documentation including the Noise Discipline Report Supplement (WSDOT 2008b). This review led to the recommendation by DEA and subsequent conclusion by the Washington State Department of Transportation (WSDOT) and the Federal Highway Administration (FHWA) that the analysis remains valid and does not require supplementation or amendment for the Supplemental EIS.

Why is a Supplemental EIS necessary?

In fall 2011, the contractor constructing the portion of the I-90 project from milepost (MP) 57.3 to MP 60.2, Guy F. Atkinson (Atkinson Construction), proposed a design modification to construct eastbound and westbound bridges at MP 58.1 (Keechelus Lake Avalanche Bridges [Bridges]) instead of the expanded Snowshed that was included in the Selected Alternative, described in the Record of Decision (FHWA 2008). This would alter plans and specifications within the project area from MP 57.9 to MP 58.4 (design modification area), which may have the potential for significant impacts that were not analyzed in the Final EIS.

How were potential impacts to noise analyzed?

The noise analysis presented in the Noise Discipline Report Supplement was conducted according to WSDOT guidance (WSDOT 2006) and FHWA policy (FHWA 1995). Noise impacts were considered for both highway operation (traffic noise) and construction activities.

Highway operation noise levels were modeled using peak-hour traffic volumes and posted speed limits for the existing year (2007) and the projected design year (2030). The analysis focused on noise-sensitive receivers at five general locations within the project area. These receivers were identified from aerial photos and site visits. No receivers were identified in the vicinity of the design modification area.

County and State regulations exempt daytime construction activities. Limits on nighttime construction apply between 10:00pm and 7:00am.

What were the relevant impacts evaluated in the Final EIS?

Construction equipment such as trucks, pavers, backhoes, pneumatic tools, and blasting equipment are known sources of temporary noise impacts. Blasting is the most extreme source of construction noise that could produce noise levels as high as 130 decibels (dB). Because daytime construction activities are exempt from Kittitas County and Washington State noise regulations, the project is not subject to any regulatory requirements for daytime construction. WSDOT considers these noise levels to be unavoidable temporary impacts typical of major construction projects.

Noise impacts from traffic are expected to approach or exceed Federal criteria of 67 dB at the five locations with noise-sensitive receivers in the project area. However, there were no noise-sensitive receivers identified near the proposed Bridges.

What has changed since the Record of Decision was issued?

WSDOT guidance on assessing noise-related impacts was updated in 2011 (WSDOT 2011) according to the new 2010 federal rule on traffic noise (23 CFR 772).

Would the design modification change the impacts presented in the Final EIS?

Construction equipment and methods that generate noise, such as blasting, will be similar for both designs. Temporary noise generated from construction of the Bridges will also be an unavoidable impact typical of major construction, which does not alter the evaluation from the Final EIS.

The design modification would not change projected traffic volumes and no new noise-sensitive receivers were identified within or near the design modification area. Although WSDOT noise policy has been revised since the Record of Decision was issued in 2008, the criteria applicable to the Bridges have not changed. Therefore, noise impacts would be consistent with those described in the Final EIS.

Recommendation

DEA has determined that the noise analysis presented in the Final EIS remains valid and should not require supplementation or amendment for the Keechelus Lake Avalanche Bridges Supplemental EIS.

Conclusion

WSDOT and FHWA have reviewed this Letter to File and concur with the findings and recommendation.

References

Federal Highway Administration. 1995. Highway Traffic Noise Analysis and Abatement Policy and Guidance. Noise and Air Quality Branch, Washington, DC. June.

Washington State Department of Transportation (WSDOT). 2006. Traffic Noise Analysis and Abatement Policy and Procedures.
www.wsdot.wa.gov/regions/Northwest/SpecialSvc/environmental/aae/policies.htm (Note: this website is no longer available).

———. 2008a. *I-90 Snoqualmie Pass East Final Environmental Impact Statement and Section 4(f) Evaluation*. August.

———. 2008b. Noise Discipline Report Supplement. Final EIS Appendix R.

———. 2011. 2011 Traffic Noise Policy and Procedures. August.

cc: file



Letter to File Recreational Resources

Date: May 17, 2012

To: Jason Smith 
Environmental Manager, WSDOT SCR

From: Ron Bockelman, Karen Comings
David Evans and Associates, Inc.

Through: Phil Larson
Atkinson Construction

Subject: Letter to File for Recreation Resources supporting the Interstate 90 Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement

This Letter to File supports the Interstate 90 (I-90) Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement (EIS). It documents that David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, reviewed the recreation analysis presented in the Final EIS (WSDOT 2008) and supporting documentation including the Recreation and Section 4(f) Discipline Report (WSDOT 2002). This review led to the recommendation by DEA and subsequent conclusion by the Washington State Department of Transportation (WSDOT) and the Federal Highway Administration (FHWA) that the analysis remains valid and does not require supplementation or amendment for the Supplemental EIS.

Why is a Supplemental EIS necessary?

In fall 2011, the contractor constructing the portion of the I-90 project from milepost (MP) 57.3 to MP 60.2, Guy F. Atkinson (Atkinson Construction), proposed a design modification to construct eastbound and westbound bridges at MP 58.1 (Keechelus Lake Avalanche Bridges) instead of the expanded Snowshed that was included in the Selected Alternative, described in the Record of Decision (FHWA 2008). This would alter plans and specifications within the project area from MP 57.9 to MP 58.4 (design modification area), which may have the potential for significant impacts that were not analyzed in the Final EIS.

How were potential impacts to recreational resources analyzed?

Recreational resources in the I-90 project area were identified through literature reviews, site visits, and coordination with agencies and jurisdictions. Once identified, these resources were evaluated relative to the I-90 project to determine impacts and benefits from the project.

What were the relevant impacts evaluated in the Final EIS?

Construction of the I-90 project will cause temporary impacts to recreational areas by changing access, implementing detours, or producing noise. However, it will provide benefits to local recreation by reducing highway congestion and closures, which improves access to recreational areas.

What has changed since the Record of Decision was issued?

No new information pertinent to recreational resources has been identified and no substantive changes to the regulatory setting have occurred since the Record of Decision was issued.

Would the design modification change the impacts presented in the Final EIS?

The design modification would not change the project impacts or benefits described in the Final EIS.

Recommendation

DEA has determined that the recreation analysis presented in the Final EIS remains valid and should not require supplementation or amendment for the Keechelus Lake Avalanche Bridges Supplemental EIS.

Conclusion

WSDOT and FHWA have reviewed this Letter to File and concur with the findings and recommendation.

References

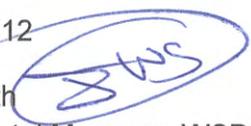
- Washington State Department of Transportation (WSDOT). 2002. Recreation and Section 4(f) Discipline Report. Draft EIS Appendix R.
- . 2005. *I-90 Snoqualmie Pass East, Draft Environmental Impact Statement and Section 4(f) Evaluation*. June.
- . 2008. *I-90 Snoqualmie Pass East Final Environmental Impact Statement and Section 4(f) Evaluation*. August.

cc: file



Letter to File Utility Services

Date: May 17, 2012

To: Jason Smith 
Environmental Manager, WSDOT SCR

From: Ron Bockelman, Karen Comings
David Evans and Associates, Inc.

Through: Phil Larson
Atkinson Construction

Subject: Letter to File for Utility Services supporting the Interstate 90 Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement

This Letter to File supports the Interstate 90 (I-90) Snoqualmie Pass East Project, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement (EIS). It documents that David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, reviewed the utilities analysis presented in the Final EIS (WSDOT 2008) and supporting documentation including the Utilities Discipline Report (WSDOT 2003). This review led to the recommendation by DEA and subsequent conclusion by the Washington State Department of Transportation (WSDOT) and the Federal Highway Administration (FHWA) that the analysis remains valid and does not require supplementation or amendment for the Supplemental EIS.

Why is a Supplemental EIS necessary?

In fall 2011, the contractor constructing the portion of the I-90 project from milepost (MP) 57.3 to MP 60.2, Guy F. Atkinson (Atkinson Construction), proposed a design modification to construct eastbound and westbound bridges at MP 58.1 (Keechelus Lake Avalanche Bridges) instead of the expanded Snowshed that was included in the Selected Alternative, described in the Record of Decision (FHWA 2008). This would alter plans and specifications within the project area from MP 57.9 to MP 58.4 (design modification area), which may have the potential for significant impacts that were not analyzed in the Final EIS.

How were potential impacts to utility services analyzed?

Existing utilities including water and sewer, electric power, and telecommunications cables were identified using permits and franchise agreements within the project boundaries. Each permit/franchise agreement was analyzed to determine location, description, and ownership of the utility. This information was compared to maps of improvements proposed under the Selected Alternative and areas of potential conflict were identified.

What were the relevant impacts evaluated in the Final EIS?

There are no significant utility services identified within the area of the Snowshed and, therefore, no conflicts with utility services in the design modification area.

What has changed since the Record of Decision was issued?

No new information pertinent to utility services has been identified and no substantive changes to the regulatory setting have occurred since the Record of Decision was issued.

Would the design modification change the impacts presented in the Final EIS?

The design modification would not change the analysis of impacts to utility services.

Recommendation

DEA has determined that the utility services analysis presented in the Final EIS remains valid and should not require supplementation or amendment for the Keechelus Lake Avalanche Bridges Supplemental EIS.

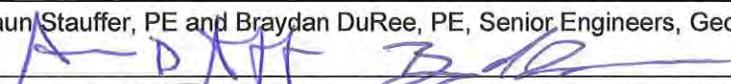
Conclusion

WSDOT and FHWA have reviewed this Letter to File and concur with the findings and recommendation.

References

- Washington State Department of Transportation (WSDOT). 2003. *Utilities Discipline Report*. Draft EIS Appendix V.
- . 2005. *I-90 Snoqualmie Pass East, Draft Environmental Impact Statement and Section 4(f) Evaluation*. June.
- . 2008. *I-90 Snoqualmie Pass East Final Environmental Impact Statement and Section 4(f) Evaluation*. August.

cc: File

<p>Subject: Geology and Soils Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.</p>
<p>Issued/Revised: June 6, 2012</p>
<p>Author: Shaun Stauffer, PE and Braydan DuRee, PE, Senior Engineers, GeoEngineers Signature: </p>
<p>Approving Manager: Jason Smith, Project Environmental Manager, WSDOT Signature: </p>

Introduction

This technical update supports the Limited Scope Supplemental Environmental Impact Statement (EIS) for the Interstate 90 (I-90) Snoqualmie Pass East, Keechelus Lake Avalanche Bridges. GeoEngineers, Inc., acting on behalf of Jacobs Engineering and Atkinson Construction, prepared this update to supplement the impact analysis for geology and soils presented in the Final EIS (WSDOT 2008a) and supporting documentation, including the *Interstate 90 – Snoqualmie Pass East Final Geology and Soils Discipline Report* (Hart Crowser 2002).

The I-90 Snoqualmie Pass East project (I-90 project) includes improvements to the existing highway from Hyak at milepost (MP) 55.1 to Easton at MP 70.3. Planned improvements would reduce road closures due to avalanches, address unstable slopes, replace deteriorating concrete pavement, add capacity, and improve ecological connectivity. The Washington State Department of Transportation (WSDOT) completed the Final EIS for the I-90 project in 2008 and the Federal Highway Administration (FHWA) issued its Record of Decision (ROD) later that same year (FHWA 2008). Construction started in 2009 and has continued in 2010 and 2011.

In fall 2011, the contractor constructing the portion of the I-90 project from MP 57.3 to MP 60.2, Guy F. Atkinson Construction, proposed a design modification to construct eastbound and westbound Bridges at MP 58.1, the Keechelus Lake Avalanche Bridges (Bridges), instead of the expanded Snowshed that was included in the Selected Alternative, described in the ROD (FHWA 2008). WSDOT has granted concept approval for this design modification as a Cost-Reduction Incentive Proposal, intended to promote innovative ideas and result in cost savings to the state.

The 1,200-foot-long Bridges would reduce risks associated with avalanches, rock fall, and landslides through removal and stabilization of loose materials upslope of the highway, and physical separation of the highway from the hillside. A combination of elevating the road surface above the existing grade and excavating up to approximately 50 feet of material below the existing grade would provide a total clearance beneath the Bridges ranging between approximately 40 and 70 feet. This space would accommodate accumulations of snow from snowfall, plowing, and avalanches with adequate freeboard (remaining distance between the

top of the accumulated snow and the Bridges) to protect motorists from additional avalanches, as they occur. The storage area beneath the Bridges has been engineered to act as a series of chutes that would direct sliding snow, rock, and debris away from the bridge piers.

To analyze the impacts of the proposed Bridges, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Bridges compared to the Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were potential geology and soils impacts analyzed in the Final EIS?

The Final EIS identified geology and soils impacts associated with earthwork (excavation and fill placement; aggregate resourcing; staging, stockpiling, and processing; transporting materials; and disposal of materials), erosion hazards, unstable slope hazards, and avalanche hazards.

Impacts were evaluated by completing several geologic and geotechnical investigations and evaluations in the I-90 project area to assess the subsurface soil and rock conditions and to evaluate geologic hazards, project design criteria, and rock slope stability. Reports reviewed included the *Interstate 90 – Snoqualmie Pass East Final Geology and Soils Discipline Report* (Hart Crowser 2002); various geotechnical and geologic investigation reports (Golder and Wyllie & Norrish 2005, Wyllie & Norrish 2006, WSDOT 2007); the *Value Engineering Study Report WSDOT I-90 Snoqualmie Summit East Hyak to Keechelus Dam* (WSDOT 2006); and the *Materials and Staging Report* (WSDOT 2008b).

What has changed since the Record of Decision was issued?

WSDOT conducted additional geologic and geotechnical investigations after the Final EIS was published. The investigations are summarized in the *Phase 1C Roadway Geotechnical Engineering Report* (URS 2011) and the *Phase 1C Rock Slope Engineering Report* (Wyllie & Norrish 2009).

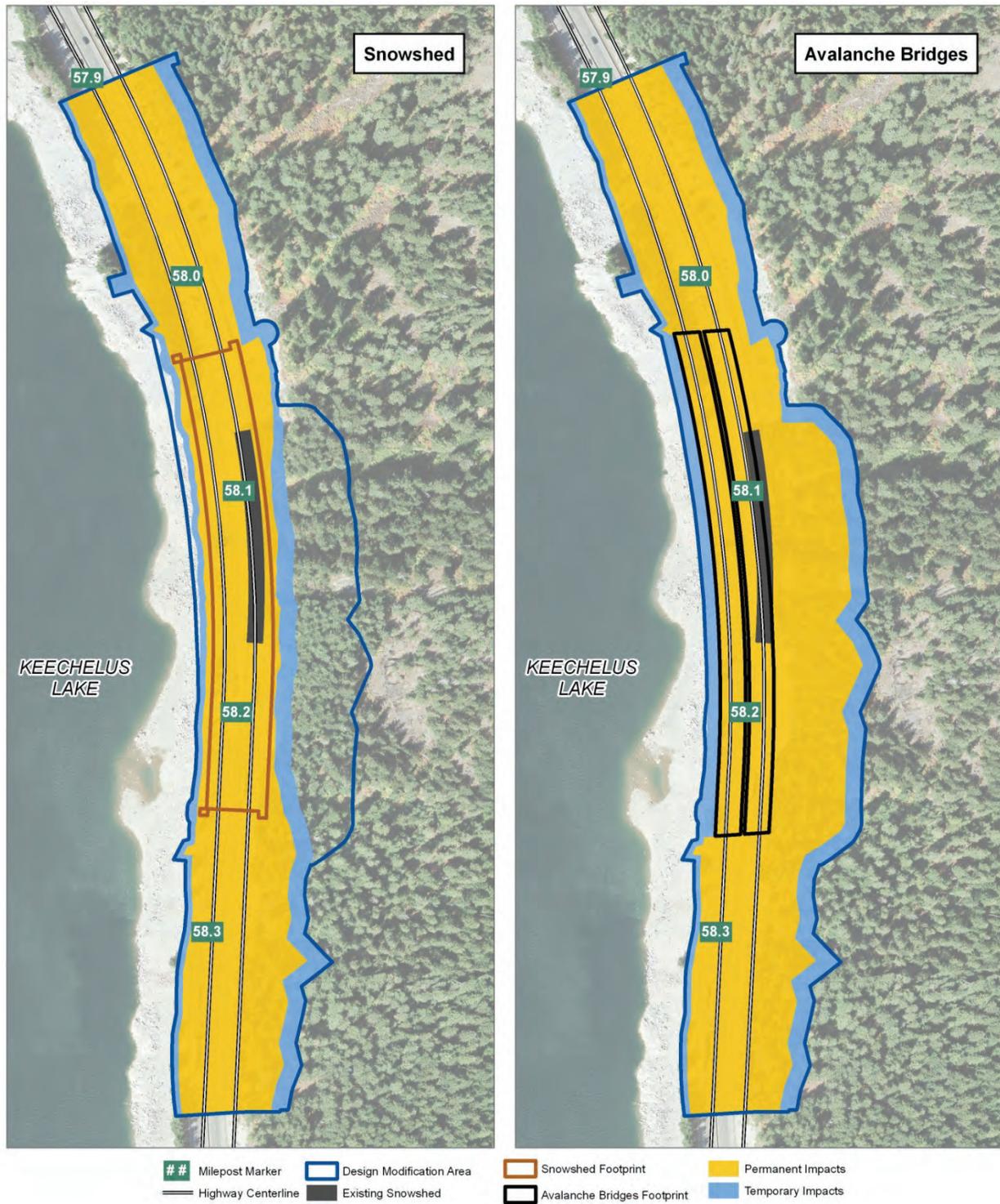
How were potential geology and soils impacts analyzed for this technical update?

Potential geology and soils impacts from the Bridges were assessed within the design modification area, which extends from approximately MP 57.9 to MP 58.4. It includes the area in which potential temporary and permanent geology and soils impacts would occur (**Exhibit 1**). Potential impacts were based on design information provided to GeoEngineers by Jacobs Engineering for the Bridges, in addition to the base design for the Snowshed provided to GeoEngineers by WSDOT. No additional geotechnical testing has been completed, although more testing is scheduled to support final design efforts.

The scope of this technical update is limited to activities directly attributable to construction and operation of the Bridges and the corresponding disturbance footprints (temporary and permanent). This technical update mirrors the topics analyzed in the Final EIS for geology and soils, which include earthwork and erosion hazards. Separate technical updates have been prepared for unstable slope and avalanche hazards.

Exhibit 1

Temporary and permanent impact areas for the Snowshed and Avalanche Bridges



Impacts

What were the relevant impacts evaluated in the Final EIS?

The Snowshed design was completed to effectively reduce road closures due to avalanches, address unstable slopes, and minimize earthwork and erosion hazards in the I-90 project area. It was determined that the Preferred Alternative (which includes the Snowshed) would not result in substantial direct or indirect permanent adverse impacts to geology and soils.

Temporary impacts associated with construction of the Snowshed include:

- **Earthwork.** Earthwork consists of excavation and fill placement; aggregate resourcing; staging, stockpiling, and processing; transporting materials; and disposal of materials. In the Final EIS, WSDOT estimated a total of 451,000 cubic yards of excavation for the Preferred Alternative of the I-90 project. The estimate did not include a breakdown of individual project elements so it is unknown how much of the total was attributable to just the Snowshed. WSDOT also estimated a total fill volume of 720,000 cubic yards, resulting in an estimated 269,000 cubic yards of net fill. Transporting, staging, stockpiling, and processing of these material would result in temporary impacts. The Materials and Staging Report for the EIS evaluated the area upslope from I-90 starting at MP 57.1 through Slide Curve to MP 59.3 for its suitability as fill material. Preliminary geotechnical investigation analysis indicated a majority of the rock in these areas is of poor quality, not suitable for mineral aggregate use in hot mix asphalt (HMA), Portland Cement Concrete Pavement (PCCP) or Crushed Surfacing Base Course (CSBC) (WSDOT 2008b). The report indicates that a very large amount of material would be removed in this area and finding places to waste materials may be difficult (WSDOT 2008b). Small quantities of rock suitable as backfill were identified within these sites.
- **Erosion Hazards.** Constructing the I-90 project creates a potential to increase erosion where grades direct surface water to areas of soft or loose soil conditions, where fill embankments are constructed near soft or loose soil, or where construction occurs in Keechelus Lake.

Would the design modification change the impacts presented in the Final EIS?

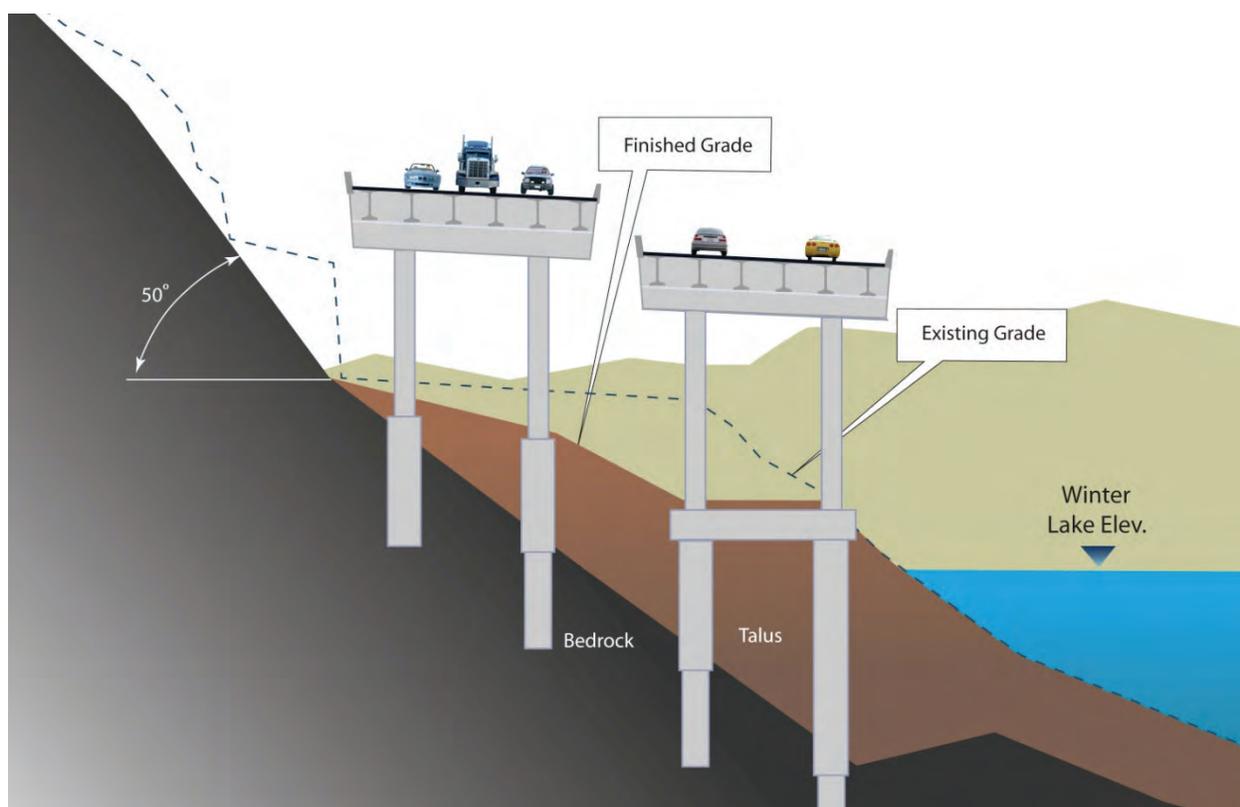
The Bridges would have geology and soils impacts similar to the Snowshed, although the quantity of excavation required would increase. The differences would include the following.

- **Earthwork.** For the Bridges more material would be removed from a larger area resulting in geology and soils impacts that are similar to those reported in the EIS for the Snowshed, but of slightly larger scale. The additional rock excavation upslope of the Bridges and excavation of soil and rock beneath the Bridges would need to be transported, stockpiled, and processed similar to the Snowshed. Based on input from the design team, an estimated total of 60,000 cubic yards of rock material would be excavated upslope of the Bridges and 100,000 to 120,000 cubic yards of soil and rock would be excavated under and around the Bridges. This material is in addition to what was reported in the Final EIS (Atkinson, personal communication, 2012). Based on these numbers, excavation quantities will be on the order of 40 percent greater than the Preferred Alternative (which includes the Snowshed); however, approximately 120,000 cubic yards of material is planned to be directly hauled from the excavation site and placed as common borrow fill for the approach

fills for the Bridges. As discussed in the Materials and Staging Report, there are some limitations on suitability of this material for some construction uses without significant processing. However, the material is suitable for common borrow, which is used regularly in embankment fill for bridge approaches. The remainder of the additional excavated material (40,000 to 60,000 cubic yards) is planned to be processed at sites identified in the *Materials and Staging Report* (WSDOT 2008b) or placed as common borrow in the balance site between about MP 59.2 to MP 59.4. These sites have adequate capacity to accommodate this increased fill. The additional excavated material will also help balance cut and fill quantities, reducing the amount of imported fill needed for the entire project.

- **Erosion Hazards.** Impacts associated with erosion hazards would remain unchanged. Excavation would only occur when the water level in Keechelus Lake was low enough to gain access to the site; therefore, it would not result in an impact to water quality. Construction and final grades would be designed to direct surface water to appropriate facilities for treatment and conveyance. The bridge approach fills would be constructed with foundations supported on bedrock and would incorporate adequate drainage measures to collect water for appropriate conveyance. The rock slopes and cuts upslope and below the Bridges would allow the hillside to return to historic flow patterns by allowing water to flow unimpeded to Keechelus Lake. Infiltration of water through the permeable soils and installation of rock surfacing Best Management Practices (BMPs) beneath the Bridges would trap sediment, reducing erosion hazards and water quality impacts. And finally, the Bridges would be designed to be supported on deep foundations installed within competent bedrock, similar to the deep foundations designed for the Snowshed (**Exhibit 2**). The deep foundations consist of drilled shafts installed with land-based equipment. The drilled shafts would be installed using the same techniques as planned for the drilled shaft deep foundations for the Snowshed. Erosion hazards will not impact foundation stability because the deep foundations planned to support the Bridges are well below the surficial soils susceptible to erosion.

Exhibit 2
Excavation and Bridge Foundation



Mitigation

What commitments were made in the Final EIS?

WSDOT worked to avoid and minimize impacts to geology and soils by conducting extensive geotechnical and geologic investigations and by designing the project based on the findings of those investigations. WSDOT committed to implement BMPs to meet applicable performance standards that included National Pollutant Discharge Elimination System (NPDES) permits, erosion and sediment control requirements, United States Forest Service (USFS) conditions and objectives, agreements with Washington State Department of Ecology (Ecology), and construction and highway safety requirements per the Occupational Safety and Health Administration (OSHA). A comprehensive list of commitments and example BMPs are provided in the Final EIS (WSDOT 2008a). A brief summary of temporary mitigation is provided below.

- **Earthwork.** WSDOT indicates that impacts associated with earthwork during construction can be minimized through avoiding areas (disturbing only those areas necessary), timing (sequencing the work as well as limiting work during wet weather), applying construction BMPs, and adhering to permit conditions to be developed in conjunction with appropriate regulatory agencies.
- **Erosion Hazards.** WSDOT minimized these soil conditions by designing appropriate shallow and deep foundations for the Snowshed structure and by implementing BMPs to minimize erosion.

No permanent adverse impacts to geology and soils were identified; therefore, no compensatory mitigation was identified in the Final EIS.

Would the design modification require additional commitments?

The geology and soils minimization and mitigation commitments identified in the Final EIS would be applicable to the more intense excavation required for the Bridges. Supplemental geologic and geotechnical explorations are planned to evaluate subsurface conditions specific to the Bridges, and data will support final design efforts including the need for processing of the excavated material for placement as common borrow. Additional commitments for geology and soils beyond the Final EIS are not anticipated.

Conclusion

Earthwork quantities for the Bridges will be larger than those planned for the Snowshed. Even though the quantities are larger, the types of impacts and mitigation commitments associated with these activities are consistent with the conclusions of the Final EIS and Record of Decision. FHWA and WSDOT have reviewed this technical update and concur with the findings.

References

- Atkinson. 2012. Personal communication with P. Larson, May 15, 2012.
- Federal Highway Administration (FHWA). 2008. *I-90 Snoqualmie Pass East FHWA-WA-EIS-05-01-F Record of Decision*. October.
- Golder Associates, Inc. and Wyllie & Norrish Rock Engineers, Inc. (Golder and Wyllie & Norrish). 2005. *Summary Geotechnical Report on I-90 Keechelus Lake Alignment (MP 57.5 to MP 59.4)*. Submitted to WSDOT. October 31.
- Hart Crowser, Inc. (Hart Crowser). 2002. *Interstate 90 – Snoqualmie Pass East Final Geology and Soils Discipline Report*. June.
- URS Corporation. 2011. *I-90 Snoqualmie Pass East Project, Phase 1C Roadway Geotechnical Engineering Report, 2010 Geotechnical Analysis and Reporting*. March.
- Washington State Department of Transportation (WSDOT). 2006. Value Engineering Study Report WSDOT I-90 Snoqualmie Summit East Hyak to Keechelus Dam. December.
- . 2007. *2006 Conceptual Geotechnical Report, I-90 Snoqualmie Pass East, Hyak to Keechelus Dam, Washington*. Volumes 1 through 5. February.
- . 2008a. *I-90 Snoqualmie Pass East Final Environmental Impact Statement and Section 4(f) Evaluation*. August.
- . 2008b. *Materials and Staging Report*. Appendix E of the Final EIS.
- Wyllie & Norrish Rock Engineers, Inc. (Wyllie & Norrish). 2006. *Draft Rock Cut Feasibility Investigation – Slide Curve I-90 MP 59*. December 11.
- . 2009. *I-90 Snoqualmie Pass East Project, Phase 1C Rock Slope Engineering Report*. April.

The Geology and Soils Technical Update supporting the Interstate 90 (I-90) Snoqualmie Pass East Avalanche Structures Supplemental Environmental Impact Statement (EIS) was finalized in June 2012. Since then, additional design data became available and additional analysis was conducted for the Draft Supplemental EIS. This addendum describes the additional information that supplements the findings presented in the technical update.

Why are these changes necessary?

The design process for the Proposed Bridges is ongoing. As the design advances, estimates of cut and fill quantities change. Since the completion of the Geology and Soils Technical Update, the cut and fill quantities for the project were revised.

What is the new information for Geology and Soils?

The updated cut and fill volumes for both structures are shown in the table below.

Estimated Cut and Fill Volumes (cubic yards)

Material Type	Selected Snowshed	Proposed Bridges	Difference
Total Cut	122,100	218,000	95,900
Total Fill	35,850	165,900	130,050
Net Cut/Fill	86,250 (net cut)	52,100 (net cut)	-34,150



Technical Update Unstable Slope Hazard Areas

Subject: Unstable Slope Hazard Areas Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

Issued/Revised: August 2, 2012

Author: David P. Findley, LG, LEG, Associate and Senior Consultant, Golder Associates Inc.

Signature: 

Approving Manager: Jason Smith, Project Environmental Manager, WSDOT

Signature: 

Introduction

This technical update supports the Limited Scope Supplemental Environmental Impact Statement (EIS) for the Interstate 90 (I-90) Snoqualmie Pass East, Keechelus Lake Avalanche Bridges. David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Guy F. Atkinson Construction, prepared this update to supplement the impact analysis for unstable slope hazard areas presented in the 2008 Final EIS (WSDOT 2008a) and supporting documentation, including the Unstable Slopes on I-90 Snoqualmie Pass (WSDOT 2006) Report.

The I-90 Snoqualmie Pass East project (I-90 project) includes improvements to the existing highway from Hyak at milepost (MP) 55.1 to Easton at MP 70.3. Planned improvements would reduce road closures due to avalanches, address unstable slopes, replace deteriorating concrete pavement, add capacity, and improve ecological connectivity. The Washington State Department of Transportation (WSDOT) completed the Final EIS for the I-90 project in 2008 and the Federal Highway Administration (FHWA) issued its Record of Decision (ROD) later that same year (FHWA 2008). Construction started in 2009 and has continued in 2010 and 2011.

In fall 2011, the contractor constructing the portion of the I-90 project from MP 57.3 to MP 60.2, Guy F. Atkinson Construction, proposed a design modification to construct eastbound and westbound Bridges at MP 58.1, the Keechelus Lake Avalanche Bridges (Proposed Bridges), instead of the snowshed that was included in the Selected Alternative (Selected Snowshed), described in the ROD (FHWA 2008). WSDOT has granted concept approval for this design modification as a Cost Reduction Incentive Proposal, intended to promote innovative ideas and result in cost savings to the state.

The 1,200-foot-long Proposed Bridges would reduce risks associated with avalanches and falling rock and debris through removal and stabilization of loose materials upslope of the highway, and physical separation of the highway from the hillside. A combination of elevating the road surface above the existing grade and excavating up to approximately 50 feet of material below the existing grade would provide a total clearance beneath the Proposed Bridges ranging between approximately 40 and 70 feet. This space would accommodate accumulations

of snow from snowfall, plowing, and avalanches with adequate freeboard (remaining distance between the top of the accumulated snow and the Proposed Bridges) to protect motorists from additional avalanches, as they occur. The storage area beneath the Proposed Bridges has been engineered to act as a series of chutes that would direct sliding snow, rock, and debris away from the bridge piers.

To analyze the impacts of the Proposed Bridges, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Proposed Bridges compared to the Selected Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were potential unstable slope hazards analyzed in the Final EIS?

Unstable slope hazard areas along the I-90 project corridor were identified using WSDOT's Unstable Slope Management System (USMS) along with construction, maintenance and rock fall incident records. The USMS is a state-wide system that has been in place since 1995 to proactively mitigate known unstable slopes within the WSDOT system.

Unstable slope hazards associated with the Selected Snowshed were evaluated as part of the Preferred Alternative in the 2008 Final EIS (WSDOT 2008). Prior to the 2008 Final EIS issues associated with unstable slopes were discussed in a variety of reports, which included:

- *Unstable Slopes on I-90 Snoqualmie Pass* (WSDOT 2006),
- *2006 Conceptual Geotechnical Report, I-90 Snoqualmie Pass East, Hyak to Keechelus Dam, Washington* (WSDOT 2007),
- *Memorandum on I-90 Keechelus Lake Slide Curve Rock Slope Stability Evaluation and Design Parameters for Conceptual Alternative 4 Rock Cuts* (Golder and Wyllie & Norrish 2005a),
- *Summary Geotechnical Report on I-90 Keechelus Lake Alignment (MP 57.5 to MP 59.4)* (Golder and Wyllie & Norrish 2005b), and
- *Draft Rock Cut Feasibility Investigation – Slide Curve I-90 MP 59* (Wyllie & Norrish 2006).

What has changed since the Record of Decision was issued?

Several reports were produced after the ROD that are relevant to the Proposed Bridges. These include:

- *I-90 Snoqualmie Pass East Project, Phase 1C Rock Slope Engineering Report* (Wyllie & Norrish 2009),
- *Phase 1C Rock Slopes I-90 Snoqualmie Pass East Snowshed Memorandum* (Wyllie & Norrish 2010),
- *Technical Memorandum – Slope Stabilization Review-Design Sectors IX and X Stn 1363+50 to 1375+50 LW* (Wyllie & Norrish 2012), and

- *I-90 Snoqualmie Pass East Project, Phase 1C Roadway Geotechnical Engineering Report* (URS 2011).

The *I-90 Snoqualmie Pass East Project, Phase 1C Rock Slope Engineering Report* includes extensive structural geologic mapping and data collection, additional subsurface drilling, downhole optical and acoustic televiewer surveys, piezometer installations, a geotechnical laboratory test program, rock mass and structural geologic characterization, rock slope stability analyses, discussion of design sector specific rock slope design issues, rock fall considerations, and general design recommendations (Wyllie & Norrish 2009). Reports completed in 2010 and 2012 by Wyllie & Norrish Rock Engineers, Inc. (Wyllie & Norrish) present recommendations and revise stabilization methods for the Selected Snowshed (Wyllie & Norrish 2010; 2012). The revised stabilization memorandum was the result of prior construction experience along design segments in Phase 1B (Wyllie & Norrish 2012). These resulted in a reevaluation and enhanced rock slope reinforcement design for the Selected Snowshed.

The additional data collection and reporting did not identify any new unstable slope hazards in the design modification area, and no new regulations or guidance has been adopted since the ROD was issued.

How were potential unstable slope hazards analyzed for this technical update?

Potential unstable slopes hazards resulting from the Proposed Bridges were analyzed within the design modification area. The design modification area includes the area where earthwork for the bridges would occur that could affect unstable slopes previously identified in the 2008 Final EIS. Potential impacts were based on design information provided to Golder Associates by Jacobs Engineering for the Proposed Bridges, in addition to the base design for the Selected Snowshed provided to Golder Associates by WSDOT.

Extensive geotechnical exploration and evaluation of rock cuts in previous phases of the I-90 project document the nature and characteristics of the bedrock formations located along the corridor (Wyllie & Norrish 2009; URS 2011). Using the existing data, a preliminary kinematic stability analysis was completed. The data included analysis of one borehole (RKS-08-07) drilled in 2007, which is located upslope of the east end of the proposed cut slope, and structural geologic field mapping data (Wyllie & Norrish 2009). This analysis established a baseline for future stability evaluation, while also validating previous analysis for the Selected Snowshed (Wyllie & Norrish 2009).

In addition, a preliminary rock fall analysis was completed to analyze potential rock fall trajectories onto the roadway from rocks or debris originating higher up on the slope. The initial analysis evaluated two potential rock fall source areas, one near the top of the proposed cuts and a second located further upslope near the crest of the existing slope.

Impacts

What were the relevant impacts evaluated in the Final EIS?

Improving public safety by reducing hazards associated with unstable slopes is an essential element in the I-90 project's purpose and need. In the 2008 Final EIS, WSDOT identified and rated 22 unstable slopes with potential for rock fall along the length of the I-90 project corridor. Three of the unstable slopes are located within the design modification area, and one of these is

rated as a “high hazard-high risk” slope (WSDOT 2008b). The analysis described both temporary and permanent impacts related to unstable slopes. Temporary impacts included the potential for increased rock fall hazards and landslides from construction activities, such as blasting, grading, or temporary drainage. Long-term, the I-90 project would reduce risk from rock fall, resulting in permanent beneficial effects.

- To reduce risk from rock fall in the I-90 project corridor, WSDOT identified a number of different design approaches, BMPs, and construction methods to minimize the potential for rock fall incidents in the I-90 project corridor. First, the I-90 project has been designed to avoid areas of unstable soil and rock to the greatest extent possible, stabilizing areas of concern only where necessary. Second, the 2008 Final EIS identifies Best Management Practices (BMPs) to address slope stability during construction. These BMPs include: Loose rocks would be removed in a controlled fashion;
- Rock faces will be bolted or doweled in place;
- Selected application of fiber-reinforced shotcrete in soft and friable zones would be applied;
- Horizontal drains would be implemented;
- Wire or cable mesh would be installed over the rock face;
- Slopes would be laid back to reduce the steepness; and
- Catchment areas for fallen rock would be improved.

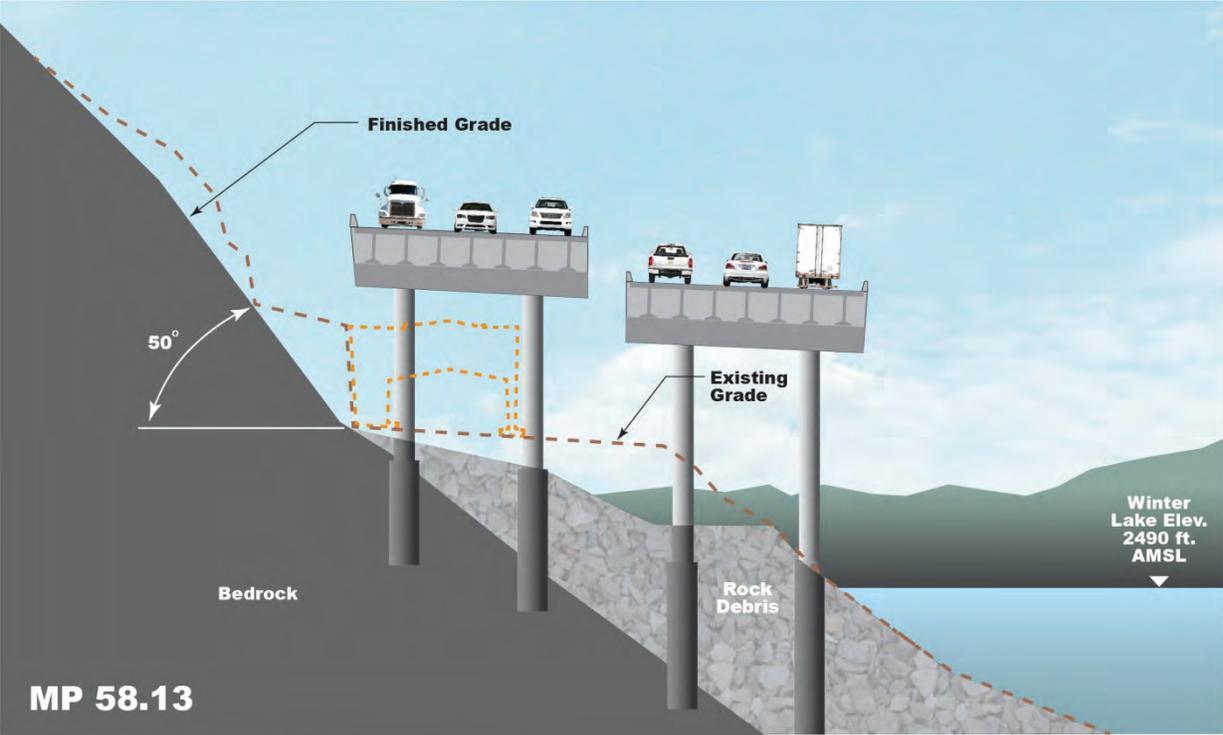
The hillside near the east portal of the Selected Snowshed was identified as an area vulnerable to slope instability and rock fall from adjacent slopes (Wyllie & Norrish 2009). The potential instability in this area is the result of the potential for planar failure along discontinuity planes that dip unfavorably out of the slope. Wedge potential was also identified where different dipping discontinuities intersect along a line that also dips unfavorably out of the slope. Construction of the Selected Snowshed would contribute to stabilizing this slope because the structure itself would provide support against the rock face and protect traffic lanes from falling rocks.

Would the design modification change the impacts presented in the Final EIS?

The Proposed Bridges would be constructed in an area where there are known rock fall and slope stability issues. The Proposed Bridges would reduce potential unstable slope and rock fall hazards by excavating unstable materials, by physically separating the highway from the hillside, and by applying BMPs and construction methods similar to those identified for the Selected Snowshed.

Overall, the Proposed Bridges would result in more extensive permanent cuts along the base of slope than the Selected Snowshed. These cuts would be a combined total of approximately 1,000 feet long and extend upslope to a maximum elevation of approximately 2,730 feet above mean sea level (amsl), with most cuts extending to elevations between 2,710 and 2,635 feet amsl. As currently planned, these cuts would largely be slender wedge shaped cuts inclined at approximately 50 degrees. The higher cuts increase the potential for rock fall, however, BMPs identified in the following mitigation section would minimize this risk. Exhibit 1 provides a representative example of proposed excavation, cuts, and slopes in relationship to the Proposed Bridges.

Exhibit 1
Excavation and Slopes for Proposed Bridges



The proposed cuts are required to create enough space for avalanches to pass beneath the bridge structures and would serve as snow storage areas (for more information on how the design addresses avalanche hazards see the *Avalanche Technical Update* [DEA 2012]). These cuts would provide horizontal and vertical separation distance between the bridge structures and the slope, which would minimize the potential for rocks or other debris to fall near passing vehicles. The current design of the Proposed Bridges would shift most of the highway away from the rock slope by 60 to 70 feet, and preliminary rock fall analysis indicates rock fall hazards are generally minimal along a majority of this Proposed Bridge alignment. However, the analysis identified a 200-foot segment of the westbound bridge located within 20 to 30 horizontal feet of the cut slope, where modeled rock fall trajectories could impact the bridge deck. Additional studies to further define the risk are underway and, if necessary, revisions to the rock cut plans would be developed to address this risk. WSDOT will conduct additional analyses and document the results in subsequent technical memorandums presented in the Final Supplemental EIS.

The rock cuts would be configured to conform to the existing avalanche paths to channel avalanches or rock falls between the bridge piers.¹ Sculpting of the bedrock surface along the face of the cut and beneath the bridge structures to enhance avalanche passage will also direct smaller scale rock fall away from the piers and footings. The potential for larger scale rock slides

¹ The slope of the avalanche chutes has been designed to facilitate the passage of avalanche and rock debris under the Proposed Bridges. The snow storage area beneath the Proposed Bridges is accessible for maintenance equipment, if occasional work is needed to clear the avalanche chutes. WSDOT maintenance staff have reviewed and provided input on the design.

would be minimized through the implementation of the BMPs described in the following mitigation section that have successfully been used by WSDOT as part of the Unstable Slopes Preservation Sub-program (P-3) and elsewhere along the I-90 corridor.

While construction activities for the Proposed Bridges may temporarily increase rock fall hazards where new cut slopes intersect with either weak rock or loose/marginally stable slopes, an overall reduction of rock fall hazards in this area would be achieved through removal and stabilization of rock along the new cuts and the implementation of BMPs, described in the following mitigation section, in areas where slope degradation is anticipated to occur.

In summary, the Proposed Bridges would reduce the risk to the highway user because, in most cases, the bridge decks would be elevated well above any possible rock fall trajectory. In addition to applying all appropriate BMPs, WSDOT is committed to performing more detailed investigations and analysis of the rock slopes within the design modification area, and will use this information to modify the final design.

Mitigation

What commitments were made in the Final EIS?

As noted, WSDOT worked to avoid and minimize impacts to geology and soils by conducting extensive geotechnical and geologic investigations and by designing the project based on the findings of those investigations. The Selected Snowshed was designed to avoid areas of unstable soil and rock to the greatest extent possible and to stabilize potentially unstable areas. Minimization of the impacts is presented through the implementation of BMPs. BMPs related to slope stability include:

- Blasting and muck removal in lifts rather than large blasts
- Rock fall fencing and netting at high-risk locations;
- Rock ballast for buttressing in landslide areas;
- Temporary containment fences for rock fall during construction;
- Replacing soft or unsuitable foundation materials;
- Rock bolting, doweling, netting, horizontal drains, shotcrete, terracing, rock fall ditches, and other methods to minimize rock fall hazard and unstable slopes;
- Slope monitoring as needed to monitor and track expected slope movement or settlement;
- Design modifications to reduce steepness, and
- Additional core sampling to understand underlying material and geology.

BMPs related to the use of explosives during construction intended to decrease impacts to fish and wildlife include:

- Rock-scaling equipment such as booms and impact hammers to remove rock where possible rather than blasting,
- Blasting charges will be limited to the minimum size necessary to fracture the rock, and
- Heavy blast mats will be used where possible to minimize noise and contain any fly-rock.

In the Final EIS, WSDOT committed to minimizing impacts by using these BMPs in order to adhere to the standards for construction and operation of transportation facilities. The effectiveness of construction BMPs will be monitored as part of WSDOT's construction compliance program. This allows WSDOT to adjust or replace BMPs in order to assure compliance with performance standards and meet I-90 project commitments.

Would the design modification require additional commitments?

The BMPs related to unstable slopes contained in the 2008 Final EIS and summarized above are applicable to the Proposed Bridges. No compensatory mitigation is required.

Preliminary rock fall modeling indicates that modifications to the proposed cut slope geometry may be required in selected areas to reduce the potential for fall rock to impact the bridge deck. A series of cross sections of the proposed cut slopes will be analyzed along with the available structural geologic information to evaluate, rock fall potential, the stability of the slope and proposed rock cut geometry for final design. From this, the appropriate grading modifications and BMPs can be identified to reduce potential rock fall impacts and improve long-term slope stability. WSDOT will conduct this additional analysis and document the results in subsequent technical memorandums presented in the Final Supplemental EIS.

Conclusion

Rock cuts required for both the Selected Snowshed and Proposed Bridges would result in temporary increased risk from falling rock and debris during construction. More extensive rock cuts would be needed for the Proposed Bridges and; therefore, the resulting risk from falling rock and debris is somewhat greater compared to the Selected Snowshed. Geologic and geotechnical investigations were used to evaluate the feasibility of planned rock cuts, and provided a preliminary assessment of slope stabilization measures necessary to obtain an acceptable factor of safety. Highway design features and BMPs would minimize hazards from falling rock and debris.

The Selected Snowshed was designed to support the rock slope and protect traffic lanes from falling rocks. Due to the uncovered design of the Proposed Bridges, the risk from rock fall is higher than under the Selected Snowshed design. Preliminary rock fall analysis identified a 200-foot segment of the westbound bridge where modeled rock fall trajectories could impact the bridge deck. This limited area will be addressed in future designs (cut geometry) and implementation of BMPs listed in the mitigation section above.

Overall, the Bridges would reduce the existing unstable slope hazards, which is consistent with the findings for the I-90 project presented in the 2008 Final EIS and ROD. FHWA and WSDOT have reviewed this technical update and concur with the findings.

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- . 2010. *Phase 1C Rock Slopes I-90 Snoqualmie Pass East Snowshed Memorandum*. August 16.
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The Unstable Slope Hazard Area Technical Update supporting the Interstate 90 (I-90) Snoqualmie Pass East Avalanche Structures Supplemental Environmental Impact Statement (EIS) was finalized in August 2012. Since then, additional data became available and additional analysis was conducted for the Draft Supplemental EIS. This addendum describes the additional information that supplements the findings presented in the technical update.

Why are these changes necessary?

At the time the Technical Update was finalized, preliminary rock fall analysis was completed to analyze potential rock fall trajectories onto the roadway from rocks and debris originating higher up slope. This analysis identified a 200-foot segment of the westbound bridge where modeled rock fall trajectories could impact the bridge deck. Once site conditions allowed for a site investigation, the topography contours that were used for the preliminary rock fall analysis were verified in the field. This work revealed that there was an anomaly in the topographic mapping and the mapped topographic feature that was initially identified as a point that could launch rocks toward the bridge deck does not actually exist on the ground. Additional rock fall analysis was completed using the revised topographic information and the results are summarized in the impacts section below.

Additional description of the factor of safety used for the design of the bridges is also included in this addendum.

What is the new information for Unstable Slope Hazard Areas?

Impacts

Rock Fall

Rock fall analysis completed using field-verified topography, showed that the potential for modeled rock fall trajectories to impact the bridge deck was negligible. This analysis supports the conclusions that rock fall hazards are minimal along the Proposed Bridge alignment and that the Proposed Bridges would reduce the risk to the highway user because the bridge decks would be elevated above rock fall trajectories.

As discussed in the previous technical update, the potential for larger scale rock slides impacting the bridge piers would be minimized through the implementation of the best management practices described in the Technical Update. There is a potential for small scale rock fall beneath the bridge. Sculpting of the bedrock surface along the face of the cut and beneath the bridge structures would typically direct smaller scale rock fall away from the piers and footings. However, if larger rocks do hit the piers, they may cause some damage to the concrete. This type of damage would not affect the structural stability of the bridge and would be patched during WSDOT's bi-annual bridge maintenance.

Factor of Safety

The Factor of Safety (FOS) in slope stability evaluations refers to the ratio between forces that resist slope movement and forces that promote slope movement. The FOS used for the design of the Proposed Bridges is 1.5. A FOS of 1 indicates the forces are in equilibrium, a FOS of less than 1 indicates driving forces are greater than resisting forces and the slope may move. A FOS greater than 1 indicates the resisting forces are greater than the driving forces and the slope is likely stable. Design standards typically dictate a FOS greater than 1.0; and 1.25 to 1.5 are common depending upon the specifics of the project. These higher FOS values provide an additional level of conservatism to cover the variability of natural materials (soil and rock) and provide an extra safety margin.

The FOS may be increased by either increasing the resisting forces or decreasing the driving forces. Examples of common methods used to increase the resisting forces in rock slopes include the installation of untensioned steel dowels or tensioned rock bolts to secure the rock face, and buttresses placed near the toe of the slope to resist driving forces. Common methods used to decrease driving forces include grading or blasting to remove rock, thus reducing the driving force or horizontal drains to reduce hydrostatic forces.

What measures are proposed to minimize and mitigate Unstable Slope impacts?

No additional measures beyond those disclosed in the Technical Update are required.



Technical Update Avalanche Risk and Mitigation

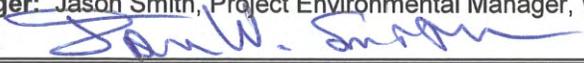
Subject: Avalanche Risk and Mitigation Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

Issued/Revised: August 28, 2012

Author: Karen Comings, P.E., Senior Engineer, David Evans and Associates, Inc.

Signature: 

Approving Manager: Jason Smith, Project Environmental Manager, WSDOT

Signature: 

Introduction

This technical update supports the Limited Scope Supplemental Environmental Impact Statement (EIS) for the Interstate 90 (I-90) Snoqualmie Pass East, Keechelus Lake Avalanche Bridges. David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Guy F. Atkinson Construction, prepared this update to supplement the avalanche risk and mitigation analyses presented in the 2008 Final EIS (WSDOT 2008) and supporting documentation, including the Avalanche Mitigation Report (Mears 2007).

The I-90 Snoqualmie Pass East project (I-90 project) includes improvements to the existing highway from Hyak at milepost (MP) 55.1 to Easton at MP 70.3. Planned improvements would reduce road closures due to avalanches, address unstable slopes, replace deteriorating concrete pavement, add capacity, and improve ecological connectivity. The Washington State Department of Transportation (WSDOT) completed the Final EIS for the I-90 project in 2008 and the Federal Highway Administration (FHWA) issued its Record of Decision (ROD) later that same year (FHWA 2008). Construction started in 2009, continuing through 2012.

In fall 2011, the contractor constructing the portion of the I-90 project from MP 57.3 to MP 60.2, Guy F. Atkinson Construction, proposed a design modification to construct eastbound and westbound bridges at MP 58.1, the Keechelus Lake Avalanche Bridges (Proposed Bridges), instead of the snowshed that was included in the Selected Alternative (Selected Snowshed).

The 1,200-foot-long Proposed Bridges would reduce risks associated with avalanches and falling rock and debris through removal and stabilization of loose materials upslope of the highway, and physical separation of the highway from the hillside. A combination of elevating the road surface above the existing grade and excavating up to approximately 50 feet of material below the existing grade would provide a total clearance beneath the Proposed Bridges ranging between approximately 40 and 70 feet. This space would accommodate accumulations of snow from snowfall, plowing, and avalanches with adequate freeboard (remaining distance between the top of the accumulated snow and the Proposed Bridges) to protect motorists from additional avalanches, as they occur. The storage area beneath the Proposed Bridges has been

engineered to act as a series of chutes that would direct sliding snow, rock, and debris away from the bridge piers.

WSDOT granted concept approval for this design modification as a Cost-Reduction Incentive Proposal, intended to promote innovative ideas and result in cost savings to the state. The concept approval allows the design and environmental impact analysis for the Proposed Bridges to proceed. To analyze the impacts of the Proposed Bridges, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Proposed Bridges compared to the Selected Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were potential avalanche risks analyzed in the Final EIS?

For the 2008 Final EIS, WSDOT's avalanche consultant reviewed historic avalanche data for the East Shed along with highway closure records to characterize risks posed by each of the five avalanche paths and determine the baseline condition for the Existing Snowshed (Mears 2007). This information was used to estimate the size and characteristics of an avalanche with a 100-year return period. Static loads from snowfall, accumulated avalanche debris, shear loads from moving avalanches, and impact loads from deflected avalanches were then calculated and incorporated into the preliminary design for the Selected Snowshed.

What has changed since the Record of Decision was issued?

The most significant change relative to avalanche risk is the design modification itself. The concept of building the Proposed Bridges instead of the Selected Snowshed changes the avalanche analysis and criteria required for the design.

Dynamic Avalanche Consulting (DAC) conducted additional analysis for avalanches at the East Shed. This additional analysis is documented in the *I-90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges; Snow Avalanche Risk and Mitigation Report for Bridge Structures* (DAC 2012) and includes updates to snowfall and avalanche dynamics for the East Shed as well as revisions to the mapped avalanche paths (**Exhibit 1**). Other objectives related to design of the Proposed Bridges included determining avalanche heights for dense flow and powder avalanches, snow depths from falling snow and plowed snow, and potential impact loads against the piers and superstructure.

Formal design criteria for the Selected Snowshed had not been established at the time the 2008 Final EIS was published. After the design modification was proposed, WSDOT formalized design criteria for the Proposed Bridges in consultation with the project contractor, Guy F. Atkinson, and avalanche expert, Arthur I. Mears, P.E., Inc. These design criteria incorporate guidelines from Canada and Switzerland that provide acceptable protection for vehicles traveling on the Proposed Bridges and ensure structural integrity of the piers and superstructure. The design criteria for the Proposed Bridges are as follows:

1. 100-year dense flowing avalanches must pass underneath the Proposed Bridges without impacting the superstructure.

2. The Proposed Bridges must provide sufficient clearance to accommodate the cumulative heights of the 100-year snowfall accumulation, plowed snow from the bridge deck, and prior avalanche deposits; plus a 100-year dense flow avalanche; plus a 30-year powder avalanche (see **Exhibit 2** for an illustration of the cumulative snow deposits under the Proposed Bridges).
3. The Proposed Bridges must be high enough so that vehicles are not impacted by powder avalanches more frequently than once in 30 years.
4. The bridge piers must be designed to withstand 100-year dense flowing avalanche forces.

These design criteria were developed specifically for the Proposed Bridges. The Selected Snowshed is designed to meet equivalent criteria for 100-year snowfall accumulation and 100-year avalanches. As an enclosed structure, powder avalanches are inconsequential to the Selected Snowshed.

How were potential avalanche risks analyzed for this technical update?

This technical update summarizes analyses from avalanche experts specific to the Selected Snowshed and Proposed Bridges. The primary source of this information is the Snow Avalanche Risk and Mitigation Report for Bridge Structures (DAC 2012). Additional information was also collected during consultation with avalanche experts (A. Jones, pers. comm., May 22, 2012; A. Mears and C. Wilbur, pers. comm., June 29, 2012).

Impacts

What were the avalanche risks and mitigation evaluated in the Final EIS?

One of the I-90 project needs identified in the 2008 ROD is to reduce closures of the highway due to avalanches and associated control work. The 2008 Final EIS states that planned improvements, including the Selected Snowshed, would prevent all avalanches that have a 30-year return period or less from reaching the highway. This would substantially reduce the need for avalanche control work and associated closures.

Would the design modification change the avalanche risks, or effectiveness of mitigation presented in the Final EIS?

Risks during construction

Construction activities on the I-90 project normally occur between April 15 and October 15 because of winter weather conditions. Between construction seasons, traffic is routed through the project area in a predetermined, winter configuration. The sequence of construction for both designs includes one winter without structural avalanche protection following removal of the Existing Snowshed. The alignment of the winter configuration for the Proposed Bridges would be twenty feet closer to the hillside than for the Selected Snowshed, but the risk from avalanches would be essentially the same for either design (P. Larson, pers. comm., July 25, 2012). Without structural avalanche protection there will be an increased risk from avalanches and WSDOT will increase avalanche control activities accordingly. As a result, closures and delays are expected to be more frequent for both designs during this one winter (J. Stimberis, pers. comm., August 9, 2012).

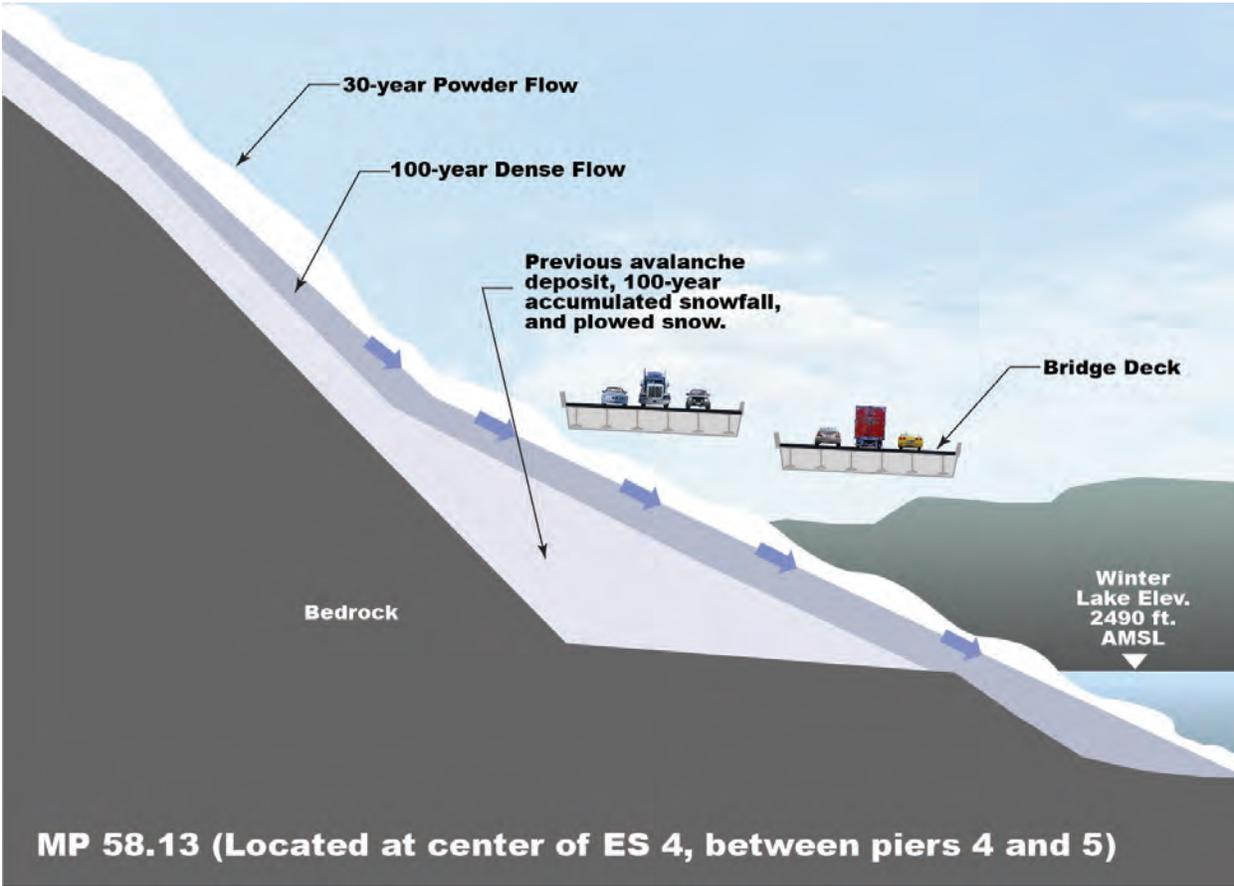
This temporary, construction-related impact was not specified in the 2008 Final EIS. Construction staging was preliminary at that time and this risk had not been identified.

Exhibit 1

Avalanche paths within the design modification area



Exhibit 2
Maximum snow accumulation underneath the Proposed Bridges



Risks during highway operation

Under typical winter conditions, both the Selected Snowshed and Proposed Bridges would prevent traffic from being impacted by avalanches. WSDOT avalanche forecasters will continue to monitor winter conditions in the Snoqualmie Pass area. However, both options would greatly reduce the need for active avalanche control¹, which currently requires an average of 30 hours of annual highway closures (WSDOT 2008).

Risk to the structures or to drivers increases during years of exceptionally high snowfall and severe storms that produce avalanches exceeding the design criteria. Avalanches of this magnitude are extremely rare. At most, a powder avalanche exceeding the design criteria has a three percent chance of occurring in any particular year, and a dense flow avalanche has a one percent chance. In such an event, WSDOT would closely monitor the situation and take appropriate action to protect public safety including initiating active avalanche control and closing the highway, if necessary. Both the Selected Snowshed and Proposed Bridges are designed with safety margins that further reduce the risk to traffic even during an avalanche exceeding the design criteria. Both structures are also designed to allow for systematic removal

¹ Active avalanche control is a process of intentionally triggering early avalanches, usually with explosives, before snow build-up becomes very deep. This minimizes the risk of large, spontaneous avalanches.

of accumulated snow, if needed. By actively removing accumulated snow from on top of the Selected Snowshed, the structure can be protected from damage from extreme snow accumulation or avalanches. Similarly, by removing snow from below the Proposed Bridges, the structure's ability to pass avalanches is renewed and structural risk to the bridge deck or risk to drivers from powder flow avalanches is reduced. If left uncontrolled, a powder flow avalanche that exceeds the design criteria could obscure driver visibility for a brief period of time (on the order of 5 to 15 seconds) for either structure. On the Proposed Bridges, drivers may also experience buffeting from crosswinds, which would mostly affect high profile vehicles. However, it is anticipated that heavy snow would be falling and visibility would already be reduced by falling and blowing snow. Drivers would be traveling at reduced speeds under these conditions, and powder flow through traffic would cause drivers to reduce speeds further until visibility returns.

Risk analysis for avalanches that exceed the design criteria is ongoing. Potential risks to the Selected Snowshed that are being analyzed are:

1. Structural damage from too much snow on the roof of the Selected Snowshed;
2. Effects to traffic from snow overtopping the portal walls;
3. Effects to traffic from powder avalanche stagnation pressure (crosswinds);
4. Visibility loss inside the Selected Snowshed from powder avalanches; and
5. Effects to traffic from avalanches in path ES-1 reaching the travel lanes.

Potential risks to the Proposed Bridges that are being analyzed are:

1. Structural damage from dense flow avalanches impacting bridge piers;
2. Structural damage from dense flow avalanches impacting the bridge deck(s);
3. Effects to traffic from powder avalanche stagnation pressure (crosswinds);
4. Visibility loss from powder avalanches;
5. Effects to traffic from dense flow avalanches overtopping the bridge deck(s); and
6. Effects to traffic from avalanches in path ES-1 reaching the travel lanes.

All of these scenarios have an extremely low risk of ever occurring. The risk analysis is being conducted so that WSDOT can make an informed decision about which structure would best serve the needs of the traveling public. Results from the analysis will be incorporated in the Final Supplemental EIS.

Risks related to each avalanche path

Each of the avalanche paths has different characteristics and avalanche potential. Designing the Selected Snowshed or Proposed Bridges to the avalanche design criteria (DAC 2012) would adequately mitigate avalanche risk to the highway. A brief summary of past and expected future conditions for each path is presented below. For more detailed information, please refer to the Snow Avalanche Risk and Mitigation Report for Bridge Structures (DAC 2012).

ES-1 is the westernmost avalanche path, which produces relatively small and infrequent avalanches that currently reach the highway about once in 10 years. Powder avalanches do not impact the highway here.

This path would not go under the Proposed Bridges or over the Selected Snowshed. Both options would intercept avalanches from ES-1 using a wall and catchment system with enough clearance and sufficient storage to prevent snow and avalanche deposits from reaching the highway. Periodic snow removal may be required from the catchment during major winters. This maintenance would be needed for both the Proposed Bridges and Selected Snowshed.

ES-2 is the avalanche path south of ES-1. Avalanches from this path fall immediately north of the Existing Snowshed, impacting the existing highway about once every 2 to 3 years. There is no historical record of powder avalanches reaching the highway from this path.

Avalanche risk from this path would be mitigated by either the Proposed Bridges or the Selected Snowshed.

ES-3 is the avalanche path south of ES-2. Avalanches from this path impact the Existing Snowshed and the adjacent eastbound traffic lanes about once every 2 years. This path has the second highest avalanche risk after ES-4. ES-3 produces both dense flowing and powder avalanches, with powder flow reaching approximately 16 to 25 feet above the ground when impacting the highway.

Avalanche risk in Path ES-3 would be mitigated by either the Proposed Bridges or Selected Snowshed.

ES-4 is the avalanche path south of ES-3. Avalanches from this path impact the Existing Snowshed and the adjacent eastbound lanes about 6 to 7 times each winter. This is the highest risk avalanche path in the East Shed area. ES-4 produces both dense flowing and powder flowing avalanches, with powder flow reaching approximately 16 to 25 feet above ground level.

Avalanche risk in ES-4 would be mitigated by either the Proposed Bridges or the Selected Snowshed.

ES-5W1 and ES-5W2 are the small avalanche paths that flow through a dense forest immediately south and east of the Existing Snowshed. Dense flowing avalanches impact the highway about once every 2 to 3 years. There is no historical record of powder avalanches impacting the highway from these paths.

Avalanche risk in ES-5W1 and ES-5W2 would be mitigated by either the Proposed Bridges or the Selected Snowshed.

ES-5E is the southernmost avalanche path in the East Shed area. Avalanches reach the highway in a distinct gully about once every 2 to 3 years. There is no historical record of powder avalanches impacting the highway at this location.

Avalanche risk in ES-5E would be mitigated by either the Proposed Bridges or the Selected Snowshed.

Mitigation

What commitments were made in the Final EIS?

Although not specified in the 2008 Final EIS, WSDOT would continue to monitor winter conditions at the East Shed area if the Selected Snowshed is constructed. The Selected Snowshed would require occasional removal of accumulated snow, rock, and debris from the snowshed roof and adjacent catchment.

Would the design modification require additional commitments?

WSDOT would continue to monitor winter conditions at the East Shed area for the Proposed Bridges. In the rare event that conditions approach or exceed the design criteria, WSDOT would take appropriate action to protect the traveling public. These actions could include any or all of the following:

1. Temporary highway closures.
2. Active avalanche control.
3. Removal of snow, rock, debris from under the Proposed Bridges and adjacent catchment to regain storage capacity.

Conclusion

The Proposed Bridges and Selected Snowshed address avalanche-related project needs documented in the 2008 ROD. Consistent with the analysis presented in the 2008 Final EIS, either option would minimize the potential for all avalanches that have a 30-year return period or less from reaching the highway. **Exhibit 3** compares the Selected Snowshed and Proposed Bridges.

Exhibit 3

Comparison of the Selected Snowshed and Proposed Bridges

	Selected Snowshed	Proposed Bridges
Proposed Bridges Design Criteria		
Passing 100-year dense flow avalanches	Exceeds	Exceeds
Structural integrity during 100-year avalanches	Exceeds	Exceeds
Passing 30-year powder flow avalanches	Exceeds	Meets
Bridge height for 100-year accumulations	N/A	Exceeds
Avalanche Control		
Removal of snow, rock, and debris	Occasional	Occasional
Active avalanche control/highway closures ¹	None anticipated	None anticipated

¹ – For avalanches that exceed the design criteria, it is anticipated that avalanche control and closures would be more frequent for the Proposed Bridges than for the Selected Snowshed.

FHWA and WSDOT have reviewed this technical update and concur with the findings.

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Appendix F

Summary of Performance Standards Governing Construction BMPs and Compensatory Mitigation Approaches from the 2008 Final EIS (Technical Update Disciplines Only)

Element of the Environment	Governing Construction BMPs	Compensatory Mitigation Approaches
<p>Geology and Soils</p>	<p>NPDES General Permit for Construction Activities NPDES General Permit for Sand and Gravel Operations Temporary Erosion and Sediment Control Plans Erosion and sediment control requirements of the WSDOT <i>Design Manual and Standard Specifications for Road, Bridge, and Municipal Construction</i> Spill Prevention, Control and Countermeasure Plans Applicable permit requirements Conditions imposed by the USFS related to use of federal land for additional easement Applicable conservation measures included in the NOAA Fisheries' ESA Consultation Concurrence Letter Applicable parts of the <i>Implementing Agreement between the Washington State Department of Ecology and the Washington State Department of Transportation</i> Objectives of the USFS Aquatic Conservation Strategy Construction safety requirements and maintaining operation of the highway during construction, including Occupational Safety and Health Administration requirements and highway safety standards</p>	<p>Since there will be no permanent adverse impacts to geology and soils, no compensatory mitigation will be required.</p>
<p>Water Resources</p>	<p>Clean Water Act Section 404 Permit(s) Clean Water Act Section 401 Water Quality Certification NPDES General Permit for Construction Activities NPDES General Permit for Sand and Gravel Operations Temporary Erosion and Sediment Control Plans Spill Prevention, Control and Countermeasures Plans Erosion and sediment control requirements of the WSDOT <i>Design Manual and Standard Specifications for Road, Bridge, and Municipal Construction</i> WSDOT <i>Highway Runoff Manual</i> Applicable measures specified in the USFWS Biological Opinion Applicable conservation measures included in the NOAA Fisheries' ESA Consultation Concurrence Letter Applicable parts of the <i>Implementing Agreement between the Washington State Department of Ecology and the Washington State Department of Transportation</i> Objectives of the USFS Aquatic Conservation Strategy</p>	<p>WSDOT will provide stormwater treatment for the equivalent of all impervious surfaces. To compensate for areas where the terrain makes treatment impracticable, WSDOT will provide additional treatment in other off-site locations in or near the project corridor. WSDOT will use the <i>Highway Runoff Manual</i> Appendix 2A procedure or the "equivalent area" approach to mitigate for constrained areas in which stormwater treatment is physically impossible. This approach allows WSDOT to retrofit stormwater treatment onto existing off-site impervious surface with pollution loading characteristics similar to the constrained areas.</p>

Element of the Environment	Governing Construction BMPs	Compensatory Mitigation Approaches
	MDT design objectives and performance standards Applicable permit conditions Applicable conditions and stipulations related to the transfer of federal land for highway easement	
Wetlands and Other Jurisdictional Waters	Standards listed under Water Resources The Final Wetland & Aquatic Resources Mitigation Plan The project-specific roadside master plan	<p>Restoration</p> <p>WSDOT will restore wetland areas, stream channels, and riparian areas at each CEA where new bridges and culverts are installed. Wetlands and riparian areas probably existed prior to the original highway construction at these locations, and the project has been designed to reestablish connections between wetlands and other high quality habitats, as well as restore channel migration and floodplain functions.</p> <p>Mitigation measures proposed at locations within and adjacent to CEAs include:</p> <ul style="list-style-type: none"> • Restoring and creating wetland, stream, and riparian zone area and function • Restoring connections between wetlands and other important wildlife habitats • Restoring channel migration and surface and subsurface flow paths • Restoring connections between streams, floodplains, and riparian zones • Restoring passage for fish and aquatic organisms at stream crossings <p>Impacts from these restoration activities would be limited to soil disturbance during construction. Mitigation sites temporarily affected by construction will be restored once construction is complete. Restoration activities may include:</p> <ul style="list-style-type: none"> • Restoring pre-construction contours • Replacing or amending surface soils • Planting or seeding with native herbaceous and/or woody vegetation <p>WSDOT will maintain and monitor all planted areas, based on the commitments made in the final <i>Wetlands & Aquatic Resources Mitigation Plan</i>, which will be completed by WSDOT as part of project permitting.</p> <p>Habitat Preservation</p> <p>WSDOT is acquiring a 265-acre property for habitat preservation in the Gold Creek Valley. This property contains wetlands, riparian areas, and mature forest, including potential habitat for northern spotted owls, marbled murrelets, and bull trout. This property has potential for high-density development, which would be avoided through this</p>

Element of the Environment	Governing Construction BMPs	Compensatory Mitigation Approaches
		<p>acquisition. WSDOT has committed to preserve this property in perpetuity.</p> <p>Proposed Wetland Mitigation Ratio</p> <p>WSDOT will compensate for unavoidable impacts to wetland area and function at a minimum 1:1 mitigation ratio, in accordance with Federal Executive Order 11990, Governor's Executive Order 89-10 (Protection of Wetlands: "No Net Loss") and WSDOT Directive 31-12 (Protection of Wetlands Action Plan). A Clean Water Act Section 404 permit will be obtained.</p> <p>Highway Reclamation</p> <p>As phases of the project are completed, WSDOT will perform extensive restoration activities that include areas of additional forested habitat, highway reclamation, buffer improvements, and highway slope vegetation with native species.</p>
<p>Fish, Aquatic Species, and Habitats</p>	<p>Standards listed under Water Resources</p> <p>The WDFW <i>Design of Road Culverts for Fish Passage</i> manual</p> <p>WSDOT's <i>Fish Exclusion Protocols and Standards</i></p> <p>The Washington State Hydraulic Code (WAC 220-110)</p> <p>Applicable measures specified in the USFWS Biological Opinion</p> <p>WDFW guidelines for stream crossing structures</p>	<p>FHWA and WSDOT believe that by combining avoidance, mitigation, and BMPs, the impacts of the project to fish and other aquatic species and their habitats will be minimized. Potential impacts to Columbia River bull trout will be mitigated through compliance with the applicable measures specified in the USFWS Biological Opinion. The project also will implement the conservation measures in the <i>Biological Assessment</i> and the <i>Biological Evaluation</i>. The remaining impacts will be mitigated through beneficial effects including fish passage restoration, increase in overall habitat, improved in-stream physical processes, and improved water quality. Consequently, no additional compensatory mitigation will be required.</p>
<p>Terrestrial Species</p>	<p>NPDES General Permit for Construction Activities</p> <p>NPDES General Permit for Sand and Gravel Operations</p> <p>Temporary Erosion and Sediment Control Plans</p> <p>Spill Prevention, Control and Countermeasure Plans</p> <p>Erosion and sediment control requirements of the WSDOT <i>Design Manual</i> and <i>Standard Specifications for Road, Bridge, and Municipal Construction</i></p> <p>Applicable measures specified in the USFWS Biological Opinion</p> <p>Applicable parts of the <i>Implementing Agreement between the Washington State Department of Ecology and the Washington State Department of Transportation</i></p> <p>Applicable permit conditions</p> <p>Applicable conditions related to the transfer of federal land for highway easement</p>	<p>FHWA and WSDOT believe that by combining avoidance, mitigation, and BMPs, the impacts of the project to terrestrial species will be minimized. Potential impacts to the marbled murrelet and northern spotted owl will be mitigated through compliance with the applicable measures specified in the USFWS Biological Opinion. The project also will implement the conservation measures in the <i>Biological Assessment</i> and the <i>Biological Evaluation</i>. The project will mitigate for remaining impacts through the beneficial effects of the build alternatives, which includes improved ecological connectivity, an increase in riparian habitat, and a decrease in wildlife mortality. Consequently, no additional compensatory mitigation will be required. However, WSDOT has acquired areas of mature forest now in private ownership as part of the preservation component for wetlands.</p>

Element of the Environment	Governing Construction BMPs	Compensatory Mitigation Approaches
Transportation	<p><i>Standard Specifications for Road, Bridge, and Municipal Construction</i></p> <p>All other applicable WSDOT design manuals and standards</p>	Since there will be no permanent adverse impacts to transportation, no compensatory mitigation will be required.
Land Use	No BMP-related commitments have been made. Construction BMPs will avoid and minimize impacts to adjacent private property	In the event that residents or businesses are relocated, WSDOT will comply with the terms of the federal Uniform Relocation Act of 1970, as amended.
Visual Quality	<p>WSDOT's Integrated Vegetation Management Program</p> <p>WSDOT's <i>Roadside Classification Plan</i>, which specifies the restoration of native forest communities using small plant material, as well as soil restoration, hydroseeding, fertilizing, and mulching</p>	WSDOT will meet the terms of the Project <i>Architectural Design Guidelines</i> and project roadside master plan.
Socioeconomics	No BMP-related commitments have been made	Since there will be no permanent adverse impacts to social and economic resources, no compensatory mitigation will be required.

BMP – best management practice
CEA – connectivity emphasis area
ESA – Endangered Species Act
FHWA – Federal Highway Administration
NPDES – National Pollutant Discharge Elimination System
USFS – US Forest Service
USFWS – US Fish and Wildlife Service
WSDOT – Washington State Department of Transportation

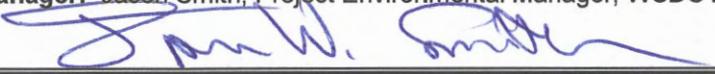
Subject: Water Resources Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

Issued/Revised: June 4, 2012

Author: Karen Comings, P.E., Senior Engineer, David Evans and Associates

Signature: 

Approving Manager: Jason Smith, Project Environmental Manager, WSDOT

Signature: 

Introduction

This technical update supports the Limited Scope Supplemental Environmental Impact Statement (EIS) for the Interstate 90 (I-90) Snoqualmie Pass East, Keechelus Lake Avalanche Bridges. David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Guy F. Atkinson Construction, prepared this update to supplement the impact analysis for water resources presented in the Final EIS (WSDOT 2008a) and supporting documentation.

The I-90 Snoqualmie Pass East project (I-90 project) includes improvements to the existing highway from Hyak at milepost (MP) 55.1 to Easton at MP 70.3. Planned improvements would reduce road closures due to avalanches, address unstable slopes, replace deteriorating concrete pavement, add capacity, and improve ecological connectivity. The Washington State Department of Transportation (WSDOT) completed the Final EIS for the I-90 project in 2008 and the Federal Highway Administration (FHWA) issued its Record of Decision (ROD) later that same year (FHWA 2008). Construction started in 2009 and has continued in 2010 and 2011.

In fall 2011, the contractor constructing the portion of the I-90 project from MP 57.3 to MP 60.2, Guy F. Atkinson Construction, proposed a design modification to construct eastbound and westbound Bridges at MP 58.1, the Keechelus Lake Avalanche Bridges (Bridges), instead of the expanded Snowshed that was included in the Selected Alternative, described in the ROD (FHWA 2008). WSDOT has granted concept approval for this design modification as a Cost-Reduction Incentive Proposal, intended to promote innovative ideas and result in cost savings to the state.

The 1,200-foot-long Bridges would reduce risks associated with avalanches, rock fall, and landslides through removal and stabilization of loose materials upslope of the highway, and physical separation of the highway from the hillside. A combination of elevating the road surface above the existing grade and excavating up to approximately 50 feet of material below the existing grade would provide a total clearance beneath the Bridges ranging between approximately 40 and 70 feet. This space would accommodate accumulations of snow from snowfall, plowing, and avalanches with adequate freeboard (remaining distance between the top of the accumulated snow and the Bridges) to protect motorists from additional avalanches,

as they occur. The storage area beneath the Bridges has been engineered to act as a series of chutes that would direct sliding snow, rock, and debris away from the bridge piers.

To analyze the impacts of the proposed Bridges, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Bridges compared to the Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were potential water resources impacts analyzed in the Final EIS?

In the years preceding the publication of the Final EIS (WSDOT 2008a), issues associated with water resources were evaluated in a variety of reports.

In 2005, WSDOT published a Draft EIS for the I-90 project (WSDOT 2005a). The Draft EIS was supported by a *Hydrologic Systems, Water Quality, and Floodplains Discipline Report* produced in 2002 (WSDOT 2002). This document determined and refined basin characteristics such as basin boundaries, fish bearing stream locations, runoff rates, water quality, and floodplains. It was also the first to establish that, while the I-90 project as a whole would improve water quality, stormwater treatment would be limited by physical constraints adjacent to Keechelus Lake, and some amount of roadway pavement would, by necessity, remain untreated. However, these untreated areas would be compensated for by additional treatment in other areas of the I-90 project.

Prior to the release of the Draft EIS, a supplement to the water resources discipline report was produced to provide updated detail about the project alternatives and their impacts (WSDOT 2005b). The update also introduced WSDOT's *Statewide Snow and Ice Plan* that has since been implemented and resulted in the reduction of traction sand used in the I-90 Snoqualmie Pass corridor compared to historic levels (WSDOT 2007a). It is expected that the program will continue to reduce the amount of chemical de-icer and anti-icers used.

In 2007, WSDOT released a Stormwater Treatment and BMP Report (WSDOT 2007b) for Signatory Agency Committee concurrence. This report discussed WSDOT's process for selecting stormwater best management practices (BMPs) for the I-90 project. The selection of stormwater BMPs has been, and continues to be, adaptive over the life of the I-90 project as designs are refined and project constraints are better understood. In general, the I-90 project design team follows the guidelines laid out in WSDOT's *Highway Runoff Manual* (HRM) (WSDOT 2011a).

In 2008, WSDOT published a brief memo discussing details of the Keechelus Lake Reservoir storage and how it will be impacted and mitigated for by the I-90 project (WSDOT 2008b). WSDOT has committed to a policy of no net loss to Keechelus Lake's storage capacity as a result of the I-90 project, which will place fill in the lake as a result of highway widening and retaining walls. To mitigate for the decrease in storage capacity, WSDOT committed to compensatory removal of material from Keechelus Lake above dead pool (elevation 2,425 feet) and below full pool (elevation 2,517 feet). This excavation was completed during the early phases of construction.

How were potential water resources impacts analyzed for this technical update?

Analyses of water resource related topics were limited to only the specific topics that could be impacted by the Bridges. Water resources topics that are not included in this report because they would not be impacted by the Bridges are impacts to streams and aquifers. The topics discussed in this discipline update are stormwater, water quality in Keechelus Lake, shallow groundwater, impacts to Keechelus Lake's storage capacity, and water use during construction.

Waterbodies discussed in the Final EIS were reviewed, and only those waterbodies that could be impacted by the Bridges were further evaluated in this update. In this case, Keechelus Lake is the only waterbody that could be impacted. Since the lake as a whole is considered the impacted area, the water resources discipline study area has been defined as the limits of the lakeshore and the upland area encompassing the design modification area. Impacts to the lake that were evaluated are:

- Water quality from stormwater discharge, evaluated as annual loading;
- Water quality as it relates to the Washington State 303(d) List (Ecology 2012);
- Impacts to storage capacity of Keechelus Lake;
- Temporary water quality management during construction as required by the National Pollution Discharge Elimination System (NPDES) permit;
- Water requirement for construction use.

Construction and operational impacts of the Bridges are compared to the Snowshed, and both are put in context of the I-90 project as a whole.

Impacts

What were the relevant impacts evaluated in the Final EIS?

For operation of I-90, WSDOT has committed to treating stormwater runoff for the equivalent of all new and existing impervious surfaces in the I-90 project area (WSDOT 2008a). WSDOT committed to providing on-site treatment systems and off-site mitigation when on-site treatment is not possible because of physical constraints. This commitment meets the requirements of the HRM (WSDOT 2011a). In 2008, WSDOT conducted additional feasibility and design work for stormwater mitigation sites, and determined that in some areas, stormwater treatment would be physically impracticable because the highway is located between steep rock banks and Keechelus Lake, with limited space for stormwater treatment (WSDOT 2008a).

The Final EIS reports that by avoiding, minimizing, and mitigating there will be no adverse effects to water resources from the Preferred Alternative. Stormwater BMPs will meet permit requirements by following criteria in the HRM. Even with some untreated pavement along Keechelus Lake, effluent loading reported in the Final EIS shows that the I-90 project will reduce levels of roadway pollution entering local waterbodies.

Storage capacity in Keechelus Lake will have no net loss because excavation from the lake, completed during early construction, compensates for all fill that will be placed in the lake by the I-90 project. In fact, the I-90 project offers an opportunity to restore some of the natural hydrology and hydraulics of the I-90 project area, which were altered as a result of the original

highway construction and other land use changes. The I-90 project will achieve these beneficial effects by replacing existing bridges, culverts, and highway fill with longer bridges and wider, bottomless culverts, along with providing additional culverts for wildlife passage at connectivity zones. These new facilities would improve hydrologic connectivity, sediment transport, channel migration, floodplain function, and groundwater movement. Water quality would be improved through lowered stream temperature and reduced sediment loading. However, these effects from the I-90 project do not apply within the design modification area because this area does not contain streams or wildlife migration zones where these effects would be localized. Shallow groundwater that supports habitat and vegetation is not abundant within the design modification area and was not discussed in the Final EIS.

Water from Keechelus Lake is planned to be used for construction needs. The amount of water used for construction is estimated in the Final EIS to be 152 million gallons. The contract between WSDOT and the contractor lists that estimate at 108 million gallons, which is further restricted by monthly withdrawal limits (WSDOT 2011b).

Impacts from the I-90 project are discussed in greater detail in the Final EIS. Impacts discussed in this discipline update focus on the differences between the impacts of the Snowshed disclosed in the EIS and the potential impacts of the Bridges.

Would the design modification change impacts to local waterbodies?

None of the fifteen creeks in the I-90 project area would be impacted by either the Snowshed or the Bridges. The only waterbody that would be directly impacted by either option is Keechelus Lake. Impacts to the lake would potentially be from stormwater runoff from the highway itself and physical changes to the lake's shoreline. The amount of water withdrawn from Keechelus Lake for use during construction is fixed within the contract and would not change because of the design modification.

The surface water that flows down the rock face adjacent to the highway would also be impacted by either the Snowshed or the Bridges. Construction and operation of the Snowshed would require collection of this water and conveyance across I-90 through a series of cross culverts, which is how water is conveyed across the highway under existing conditions. Shallow groundwater is not expected to cross the highway underneath the Snowshed because of the presence of bedrock and the collection and piping of the surface water. Construction of the Bridges would remove the highway fill from the area under the Bridges, expose the bedrock, and allow water to pass as surface flow under the structure. During construction of the Bridges, water from the hillslope would be collected and routed across the construction site, keeping it separate from water generated within the active construction area.

Would the design modification change impacts to water quality in the study area?

Stormwater

During construction, WSDOT will use BMPs established as industry standards to control stormwater runoff from active construction areas. WSDOT continues its commitment established in the Final EIS to monitor the effectiveness of these BMPs as part of the construction compliance program, and will adjust or replace BMPs if necessary to assure

compliance with performance standards. A list of guidance documents that will be followed by the I-90 project is included in the Mitigation Summary in this update.

The Bridges would be built within a confined area where stormwater treatment options are limited. Some treatment is possible using linear, roadside BMPs such as media filter drains and biofiltration ponds, but not all road surfaces are treatable in this area. Portions of the highway in the design modification area that are untreatable due to site constraints would be compensated for by treating equivalently-sized areas at other sites within the overall I-90 project limits. This approach to stormwater treatment has not changed and is consistent with the analysis and mitigation in the Final EIS.

To compare treatment areas between the Snowshed and Bridges, a 10.85-acre sub-portion of the I-90 project area that encompasses the Bridges site was defined, as shown in **Exhibit 2**. Within this area, the portion of highway that would be covered by the proposed Snowshed structure was designated in the Final EIS as a non-pollution-generating surface because precipitation would not come in direct contact with the roadway surface and “wash off” roadway pollutants. The Snowshed would cover 2.94 acres of roadway. The treated area of roadway would be 5.11 acres with 2.69 acres untreated due to site constraints (see **Exhibits 1 and 2**). To maintain the same acreage of treated roadway, the design modification would require treatment of 2.94 acres of highway that would no longer be covered by the Snowshed or that was previously found impracticable to treat. The design modification would increase the acreage of treated roadway to 8.10 acres and maintain a similar amount of roadway with untreated stormwater—2.75 acres.

The Bridges would shift the highway away from the existing rock slope by at least 30 feet along the Bridge approaches. This shift, along with some additional excavation, would allow for placement of biofiltration ponds between the highway and the steep rock slope so that increased on-site treatment would be possible with the Bridges. Runoff from an additional 2.95 acres of roadway not previously feasible to treat is now included in the treated area. **Exhibits 1 and 2** show a comparison of treated areas in the vicinity of the Snowshed and Bridges.

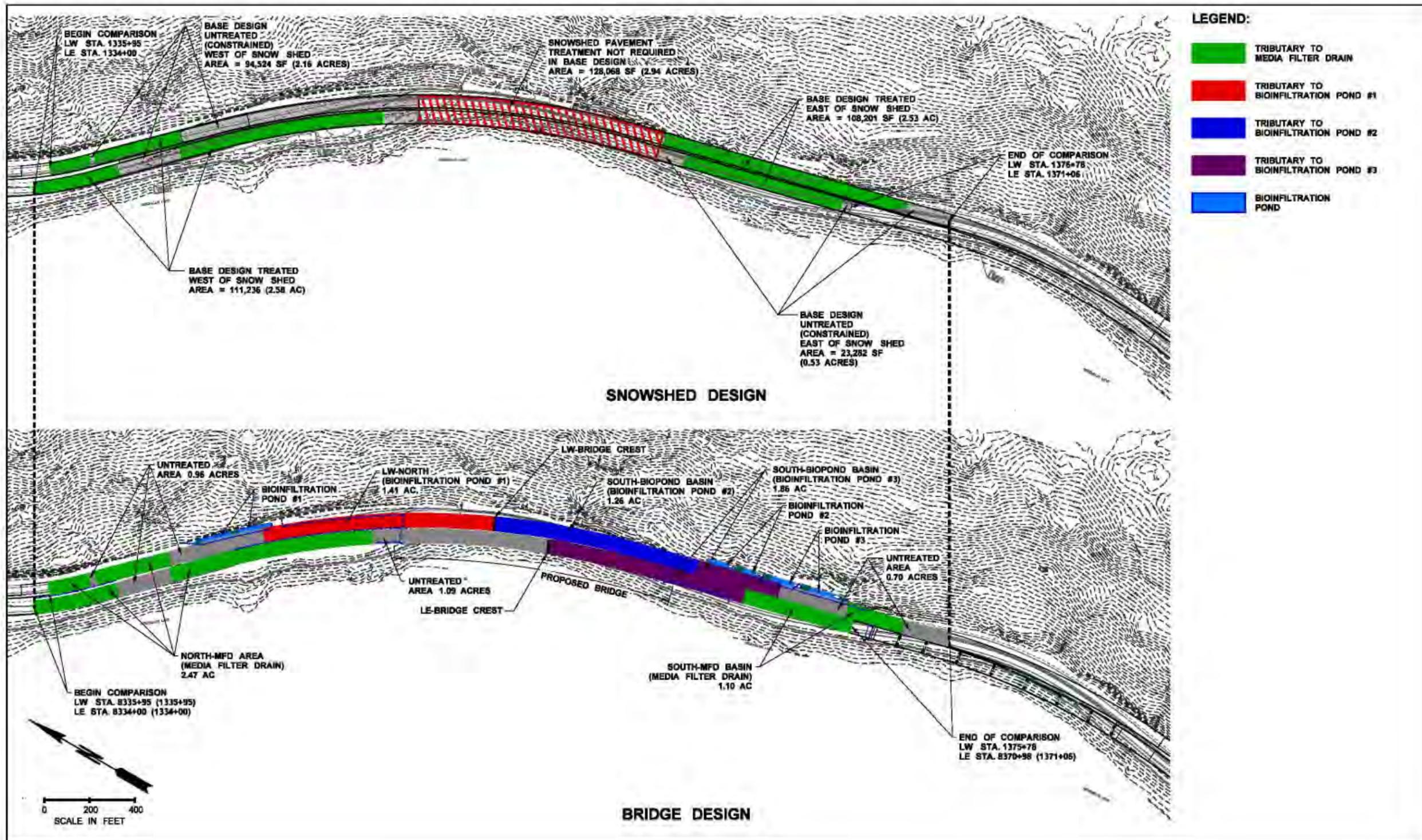
Exhibit 1**Area of highway stormwater treatment for the proposed scenarios**

	Snowshed (acres)	Bridges (acres)
Treatment Areas by Type		
<i>Media Filter Drain</i>	5.11	3.57
<i>Bioinfiltration Pond 1</i>	0	1.41
<i>Bioinfiltration Pond 2</i>	0	1.26
<i>Bioinfiltration Pond 3</i>	0	1.86
Untreated Area	2.69	2.75
Snowshed Area ¹	2.94	n/a
Pavement Area Difference ²	0.11	
Total Area	10.85	10.85

¹ This area does not require treatment for the Snowshed option. n/a=not applicable.

² This difference in area between the two designs is due to differences in shoulder widths and alignment geometry.

Exhibit 2
 Location and comparison area of highway stormwater treatment for the proposed scenarios



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Because the treated and untreated impervious areas of the I-90 project would be different with the Bridges, the pollutant loading for the I-90 project changes with the design modification. However, both designs would provide effective treatment. **Exhibits 3 and 4** show that the reduction to pollutant-loading for the I-90 project is similar for the two scenarios.

Exhibit 3

Pre- and post-project pollutant loading in pounds for the I-90 project with the Snowshed

Annual Effluent Load	Total Suspended Solids	Total Zinc	Dissolved Zinc	Total Copper	Dissolved Copper
Load from existing impervious surface, pre-project	82,603	160.82	58.48	29.24	7.75
Load from new and existing impervious surface, post-project with Snowshed	24,112	59.93	28.42	11.85	4.34
Net Change	-58,491	-100.89	-30.06	-17.39	-3.41

Post-project pollutant loadings do not include the beneficial impacts of off-site compensatory treatment.

Exhibit 4

Pre- and post-project pollutant loading in pounds for the I-90 project with the Bridges

Annual Effluent Load	Total Suspended Solids	Total Zinc	Dissolved Zinc	Total Copper	Dissolved Copper
Load from existing impervious surface, pre-project	82,603	160.82	58.48	29.24	7.75
Load from new and existing impervious surface, post-project with Bridges	24,280	60.83	29.04	12.06	4.45
Net Change	-58,323	-99.99	-29.44	-17.18	-3.30

Post-project pollutant loadings do not include the beneficial impacts of off-site compensatory treatment.

The Final EIS concludes that the I-90 project will improve water quality because of improved treatment of roadway runoff. The analysis above shows that the design modification would not alter this conclusion.

Winter Maintenance

Construction activity for the I-90 project will be shut down between October 15 and April 15 each year because the harsh winter conditions at Snoqualmie Pass make construction activities impractical during this time. At least two traffic lanes in each direction will remain open to maintain highway operation for the traveling public. These lanes will be maintained by WSDOT personnel following the *Statewide Snow and Ice Plan* for winter conditions (WSDOT 2007a). This maintenance activity will be the same under either the Snowshed or Bridges scenarios.

During regular highway operation of I-90 when it is freezing or snowing, traction sand and pavement de-icers are used on I-90 through Snoqualmie Pass to maintain highway safety. Overall, traction sand use has decreased substantially in recent years because of changes in WSDOT policy as described in the *Statewide Snow and Ice Plan* (WSDOT 2007a). WSDOT now only applies sand under certain winter road conditions, primarily to provide traction at

curves and grades where chemical treatment may not be effective. WSDOT has also partially replaced sand use with chemical de-icers (magnesium chloride and calcium chloride) (WSDOT 2008a).

Both the Snowshed and Bridges would increase the area where traction sand and de-icers would be used because both scenarios include one additional lane in each direction in the I-90 project area, and all lanes of the highway would be treated for snow and ice. Of the two scenarios, the Snowshed is expected to use less traction sand and de-icer than the Bridges because the Snowshed would protect 1,100-feet (0.2 mile) of highway from direct snowfall and compacting snow. However, this potential difference for the 0.2 mile of roadway would be minor compared to the 15 miles of I-90 project area to which snow safety measures are applied. WSDOT's approach to using de-icer mainly involves source control by following application guidelines in the *Statewide Snow and Ice Plan* (WSDOT 2007a).

WSDOT cannot eliminate the use of either traction sand or chemical de-icers entirely because they are essential to winter highway safety. In an effort to reduce the amount of traction sand entering water bodies, the highway design will include grit chambers, which are modified catch basins with enlarged sumps (J. Turcott, pers. comm., May 14, 2012).

Washington State 303(d) Listing

Keechelus Lake is on Washington State's 303(d) list for excess quantities of dioxin and polychlorinated biphenyls found in fish tissue. Neither of these compounds comes from highway runoff. Therefore, the analysts concluded in the Final EIS that construction and operation of the I-90 project will have no impact on the 303(d) listing. The proposed design modification for the Bridges does not alter this conclusion.

Would the design modification change impacts to the Keechelus Lake Reservoir?

For the I-90 project, WSDOT has committed to a policy of no net loss to Keechelus Lake's storage capacity. For the I-90 project as a whole, WSDOT replaced the capacity lost through fill by removing material from Pit Site PS-S-255. Pit Site PS-S-255 is an excavation pit near MP 56.6 that is below the ordinary high water mark of the lake. Additional storage capacity will also be added by removing existing highway fill at the new Gold Creek bridges. The Final EIS reports that 15 percent over-excavation from Pit Site PS-S-255 in the lake was planned as part of the I-90 project so that project changes subsequent to the ROD would not result in a need for additional excavation.

Exhibit 5 shows fill quantities within the lake's storage capacity that were reported in the Final EIS for the I-90 project elements that will impact the lake.

Exhibit 5

I-90 project fill quantities expected within Keechelus Lake's storage capacity

Sites	Design Fill	
	(Cubic Yards)	(Acre-Feet) ¹
Gold Creek Wall	16,000	9.9
Upper Keechelus Lake Site	29,000	18.0
2:1 Fill – Gold Creek to Rocky Run Creek	109,200	67.7
2:1 Fill – Rocky Run Creek to Snowshed	19,000	11.8
<i>Snowshed</i>	<i>4,400</i>	<i>2.7</i>
2:1 Fill – Snowshed to Keechelus Dam	119,300	74.0
Totals	296,900	184.1
Totals with 15% contingency²	341,400³	211.7

¹ 1 acre-foot = 1,613 cubic yards

² 15 percent contingency covers modifications prior to final design

³ This amount of compensatory excavation will be removed from the lake

Exhibit 5 shows that approximately 4,400 cubic yards of fill is anticipated from construction of the Snowshed. In contrast, the Bridges would not add fill, but rather increase lake storage because of the excavation needed for the avalanche chutes under the Bridges. It is anticipated that as much as 40,775 cubic yards of material would be excavated within the lake's storage capacity (below elevation 2517) for the Bridges. This excavation provides a benefit to lake storage while maintaining WSDOT's commitment to no net decrease in storage.

Mitigation

Commitments related to best management practices

In the Final EIS, WSDOT committed to minimizing impacts by using BMPs that adhere to the standards for construction and operation of transportation facilities. This commitment is not altered by the proposed design modification. The effectiveness of construction BMPs will be monitored as part of WSDOT's construction compliance program. This allows WSDOT to adjust or replace BMPs in order to assure compliance with performance standards and meet project commitments. BMPs for water resources will be designated to meet applicable commitments and performance standards, including:

- Clean Water Act Section 404 Permit(s);
- Clean Water Act Section 401 Water Quality Certification;
- National Pollutant Discharge Elimination System General Permit for Construction Activities;
- National Pollutant Discharge Elimination System General Permit for Sand and Gravel Operations;
- Temporary Erosion and Sediment Control Plans;

- Spill Prevention, Control and Countermeasures Plans;
- Erosion and sediment control requirements of the WSDOT *Design Manual* (WSDOT 2011c) and *Standard Specifications for Road, Bridge, and Municipal Construction* (WSDOT 2012);
- WSDOT *Highway Runoff Manual* (WSDOT 2011a);
- Applicable measures specified in the US Fish and Wildlife Service (USFWS) Biological Opinion;
- Applicable conservation measures included in the NOAA Fisheries' Endangered Species Act Consultation Concurrence Letter;
- Applicable parts of the Implementing Agreement between the Washington State Department of Ecology and WSDOT (Ecology and WSDOT 1998), or as revised;
- Objectives of the United States Forest Service Aquatic Conservation Strategy;
- MDT design objectives and performance standards;
- Applicable permit conditions;
- Applicable conditions and stipulations related to the transfer of federal land for highway easement.

Commitments related to compensatory mitigation

The design modification for the Bridges would not alter the compensatory mitigation commitments made in the Final EIS and ROD. In those documents, WSDOT has committed to providing stormwater treatment for the equivalent area of all new and existing impervious surfaces. To compensate for areas where the terrain makes treatment of stormwater impracticable, WSDOT will provide additional treatment in other off-site locations in or near the I-90 project corridor. WSDOT will use the HRM Appendix 2A procedure, or the "equivalent area" approach, to mitigate for constrained areas in which stormwater treatment is impracticable (WSDOT 2011a). This approach allows WSDOT to retrofit existing highway impervious surface with stormwater treatment outside of the I-90 project area to compensate for not providing treatment in constrained areas.

WSDOT has also committed to no net loss of storage capacity in the Keechelus Lake reservoir. WSDOT has excavated up to 341,000 cubic yards of material from the lake to mitigate for fill added within the lake's storage area by the I-90 project.

Conclusion

The impacts from the design modification are consistent and comparable with those documented in the Final EIS and the subsequent ROD. The following information supports this determination:

- Water quality treatment proposed for the design modification would be consistent with the Final EIS and would meet WSDOT HRM (WSDOT 2011a) standards.
- The use of de-icers and traction sand on the Bridges would be consistent with winter maintenance practices throughout the I-90 project as discussed in the Final EIS.

- The design modification would not affect 303(d) listings for receiving waterbodies.
- Storage capacity of the Keechelus Lake Reservoir would not be reduced by the design modification.
- No additional water will be required from Keechelus Lake for construction.
- FHWA and WSDOT have reviewed this technical update and concur with the findings.

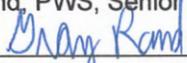
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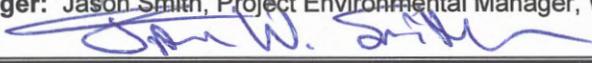
Subject: Wetland Resources Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement

Issued/Revised: May 31, 2012

Author: Gray Rand, PWS, Senior Scientist, David Evans and Associates, Inc.

Signature: 

Approving Manager: Jason Smith, Project Environmental Manager, WSDOT

Signature: 

Introduction

This technical update supports the Limited Scope Supplemental Environmental Impact Statement (EIS) for the Interstate 90 (I-90) Snoqualmie Pass East, Keechelus Lake Avalanche Bridges. David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, prepared this update to supplement the impact analysis for wetland resources presented in the Final EIS (WSDOT 2008a) and supporting documentation, including the Wetland/Biology Discipline Report (WSDOT 2008b) and the Conceptual Wetland and Aquatic Resources Mitigation Plan (WSDOT 2007).

The I-90 Snoqualmie Pass East project (I-90 project) includes improvements to the existing highway from Hyak at milepost (MP) 55.1 to Easton at MP 70.3. Planned improvements would reduce road closures due to avalanches, address unstable slopes, replace deteriorating concrete pavement, add capacity, and improve ecological connectivity. The Washington State Department of Transportation (WSDOT) completed the Final EIS for the I-90 project in 2008 and the Federal Highway Administration (FHWA) issued its Record of Decision (ROD) later that same year (FHWA 2008). Construction started in 2009 and has continued in 2010 and 2011.

In fall 2011, the contractor constructing the portion of the I-90 project from MP 57.3 to MP 60.2, Guy F. Atkinson Construction, proposed a design modification to construct eastbound and westbound Bridges at MP 58.1, the Keechelus Lake Avalanche Bridges (Bridges), instead of the expanded Snowshed that was included in the Selected Alternative, described in the ROD (FHWA 2008). WSDOT has granted concept approval for this design modification as a Cost-Reduction Incentive Proposal, intended to promote innovative ideas and result in cost savings to the state.

The 1,200-foot-long Bridges would reduce risks associated with avalanches, rock fall, and landslides through removal and stabilization of loose materials upslope of the highway, and physical separation of the highway from the hillside. A combination of elevating the road surface above the existing grade and excavating up to approximately 50 feet of material below the existing grade would provide a total clearance beneath the Bridges ranging between approximately 40 and 70 feet. This space would accommodate accumulations of snow from snowfall, plowing, and avalanches with adequate freeboard (remaining distance between the top of the accumulated snow and the Bridges) to protect motorists from additional avalanches,

as they occur. The storage area beneath the Bridges has been engineered to act as a series of chutes that would direct sliding snow, rock, and debris away from the bridge piers.

To analyze the impacts of the proposed Bridges, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Bridges compared to the Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were potential impacts to wetland resources analyzed in the Final EIS?

Impacts to existing wetland resources from the I-90 project, including the Snowshed, were summarized in the following documents:

- The Wetland/Biology Discipline Report (WSDOT 2008b)
- The Conceptual Wetland and Aquatic Resources Mitigation Plan (WSDOT 2007)
- Section 3.4 of the Final EIS (WSDOT 2008a)

Methods used for data collection and analysis of wetlands in the Final EIS are described in the Wetland/Biology Discipline Report, and included review of background information and aerial photography, multiple rounds of wetland and stream boundary field delineations, jurisdictional determinations, and extensive consultation with the US Army Corps of Engineers and Washington State Department of Ecology.

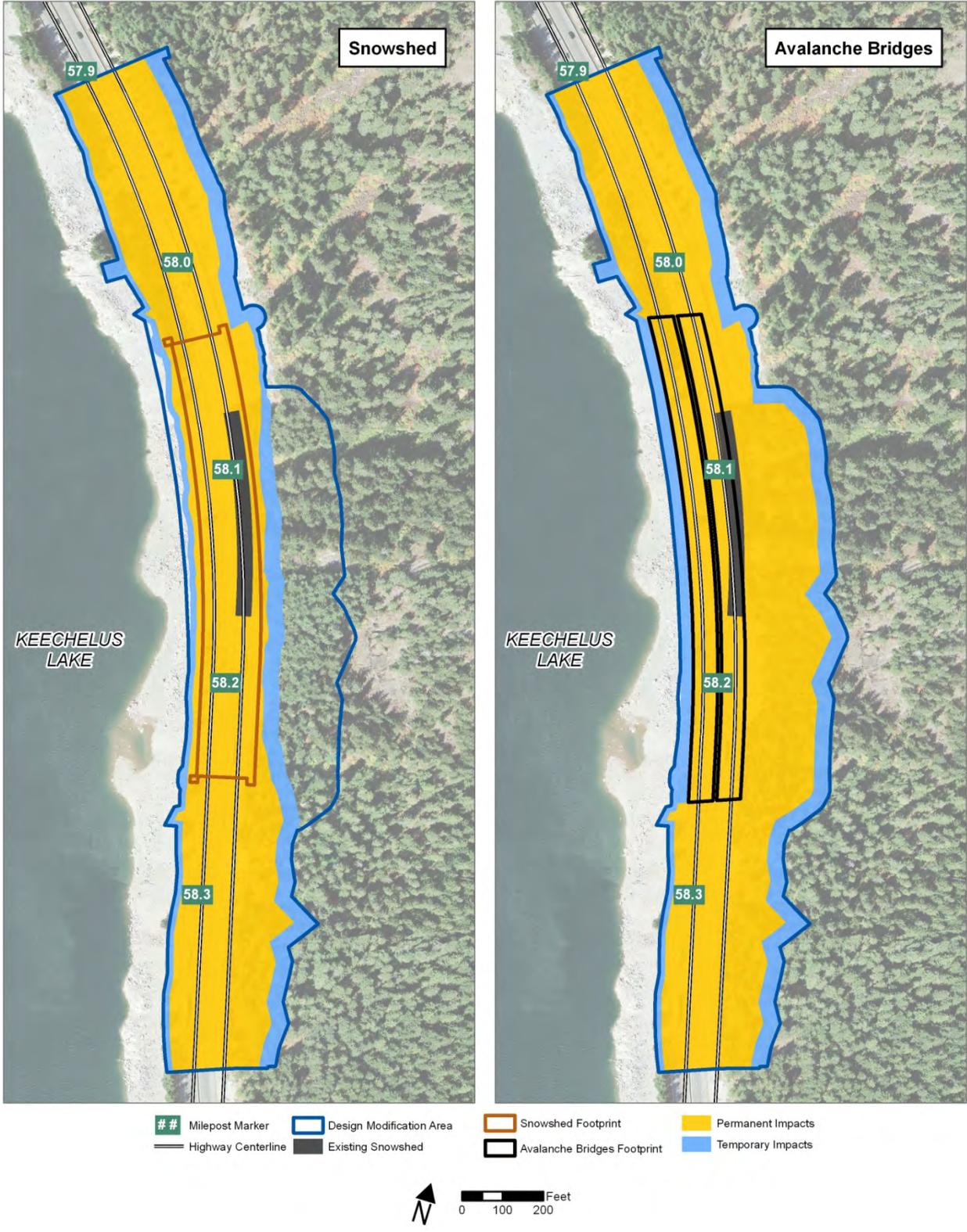
What has changed since the Record of Decision was issued?

No significant changes to existing wetland resources in the design modification area have occurred since publication of the Final EIS. The method used to identify potentially jurisdictional ditches is described in the Wetland/Biology Discipline Report (WSDOT 2008b). These methods meet the current WSDOT guidance on requirements of recent Supreme Court decisions such as *Rapanos v. United States* and *Carabell v. United States* (WSDOT 2011b).

How were potential wetland resource impacts analyzed for this technical update?

Potential impacts to existing wetland resources from the Bridges were assessed within the design modification area, which extends from approximately MP 57.9 to MP 58.4. It includes the area in which all potential temporary and permanent impacts to wetlands would occur (**Exhibit 1**). Potential impacts were based on design information provided by Jacobs Engineering for the Bridges, in addition to the base design for the Snowshed provided by WSDOT. No additional field delineations were conducted within the study area.

Exhibit 1
 Temporary and permanent impact areas for the Snowshed and Avalanche Bridges



Permanent impacts are defined as areas below the ordinary high water mark (OHWM) of waterbodies or within the delineated boundaries of jurisdictional waters, including the jurisdictional waters' buffer areas where new fill or excavation would occur. Temporary impacts are defined as those areas below the OHWM of waterbodies or within the delineated boundaries of jurisdictional waters, including the jurisdictional waters' buffer areas, outside the permanent impact zone, but within the design modification area.

Impacts

What were the relevant impacts evaluated in the Final EIS?

The Final EIS documented a total of 12.10 acres of permanent wetland and 11.68 acres of temporary wetland impacts within Phase 1 (MP 55.1 to MP 60.2) of the I-90 project, the area in which the most accurate design information was available in the Final EIS (WSDOT 2008a). In addition, 10.57 acres of permanent and 6.06 acres of temporary impacts to wetland buffer were identified within Phase 1.

Two wetlands (RRW and QQW), totaling 0.06 acre in size, were identified in the design modification area. In addition, several potentially jurisdictional ditches (D-15 and D-16) are located in the design modification area, which were artificially created to provide roadside drainage. A total of 3,644 linear feet of potentially jurisdictional ditches would be permanently affected in Phase 1, with a volume totaling approximately 188 cubic feet (WSDOT 2008b). These ditches would be replaced with ditches along the new alignment so there would be no lost drainage capacity or reduction in water treatment.

The I-90 project as a whole will permanently impact approximately 6.13 acres and temporarily impact approximately 4.62 acres of Keechelus Lake open water area.

How do the impacts associated with the Bridges compare to those of the Snowshed?

Wetland and Wetland Buffer Impacts

Exhibit 2 lists the wetlands within the design modification area that would potentially be impacted by the Bridges. All impacts are permanent. No temporary wetland impacts would occur within the design modification area.

Exhibit 2

Wetlands within the design modification area

Wetland	Lane	Category	HGM Class	Permanent Impacts with Snowshed	Permanent Impacts with Bridges
QQW	Westbound	IV	Depressional	0.01 acre	0.01 acre
RRW	Westbound	IV	Depressional	0.05 acre	0.05 acre

Notes: HGM = Hydrogeomorphic

Wetlands QQW and RRW are located between existing I-90 and a steep slope. The hydrology for each wetland is provided by highway runoff and seeps located directly upslope of the highway. Both wetlands provide low to moderate water quality function, low hydrology function, and low to moderate habitat function (WSDOT 2008b).

There would be no difference in impacts to wetlands or potentially jurisdictional ditches between the Snowshed and Bridges (**Exhibits 3 and 4**). Wetlands QQW and RRW would be permanently filled by either option.

There would be no change to anticipated impacts to wetland resources at material and staging areas, which are located outside the design modification area.

*Exhibit 3
Snowshed wetland buffer impacts*

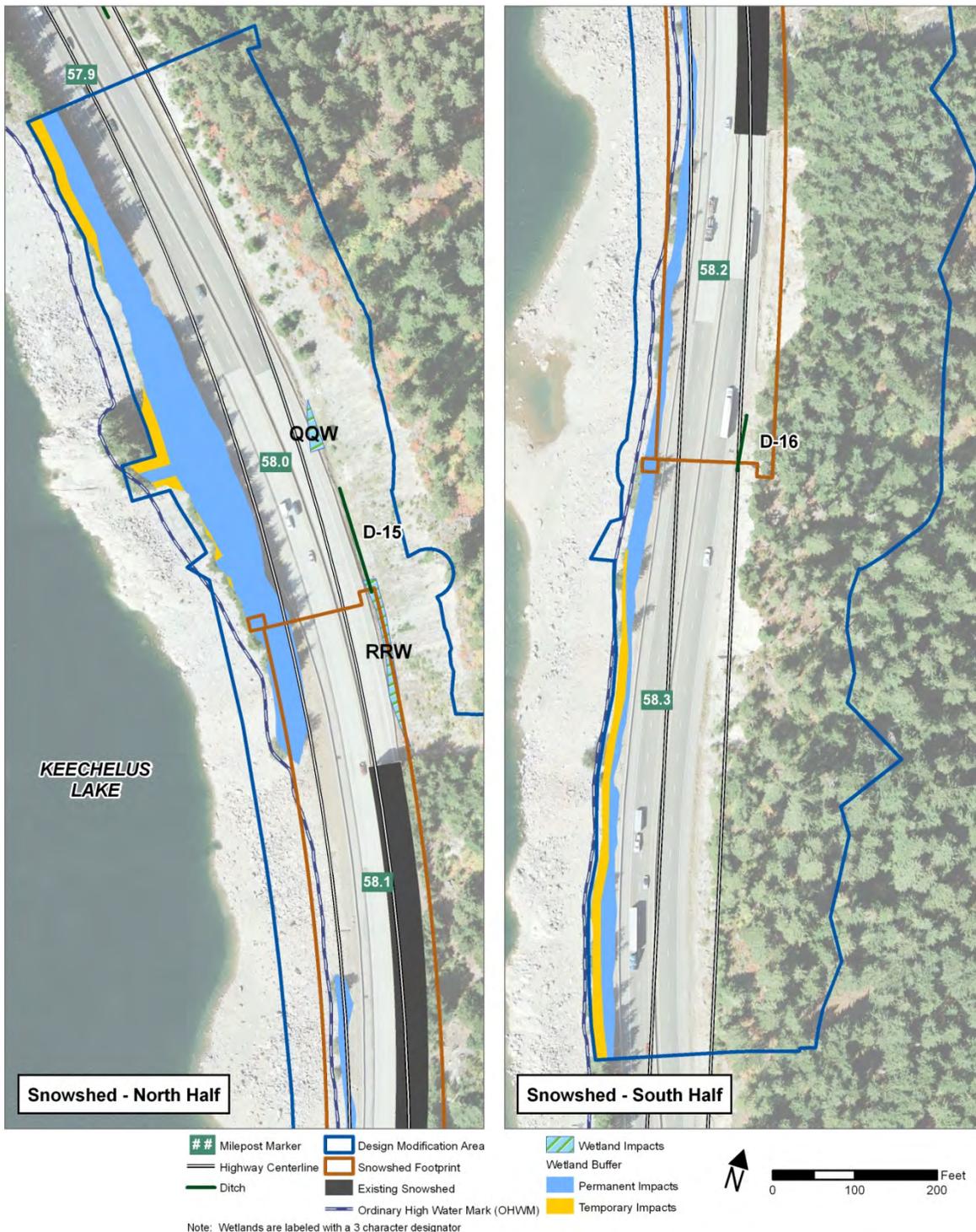
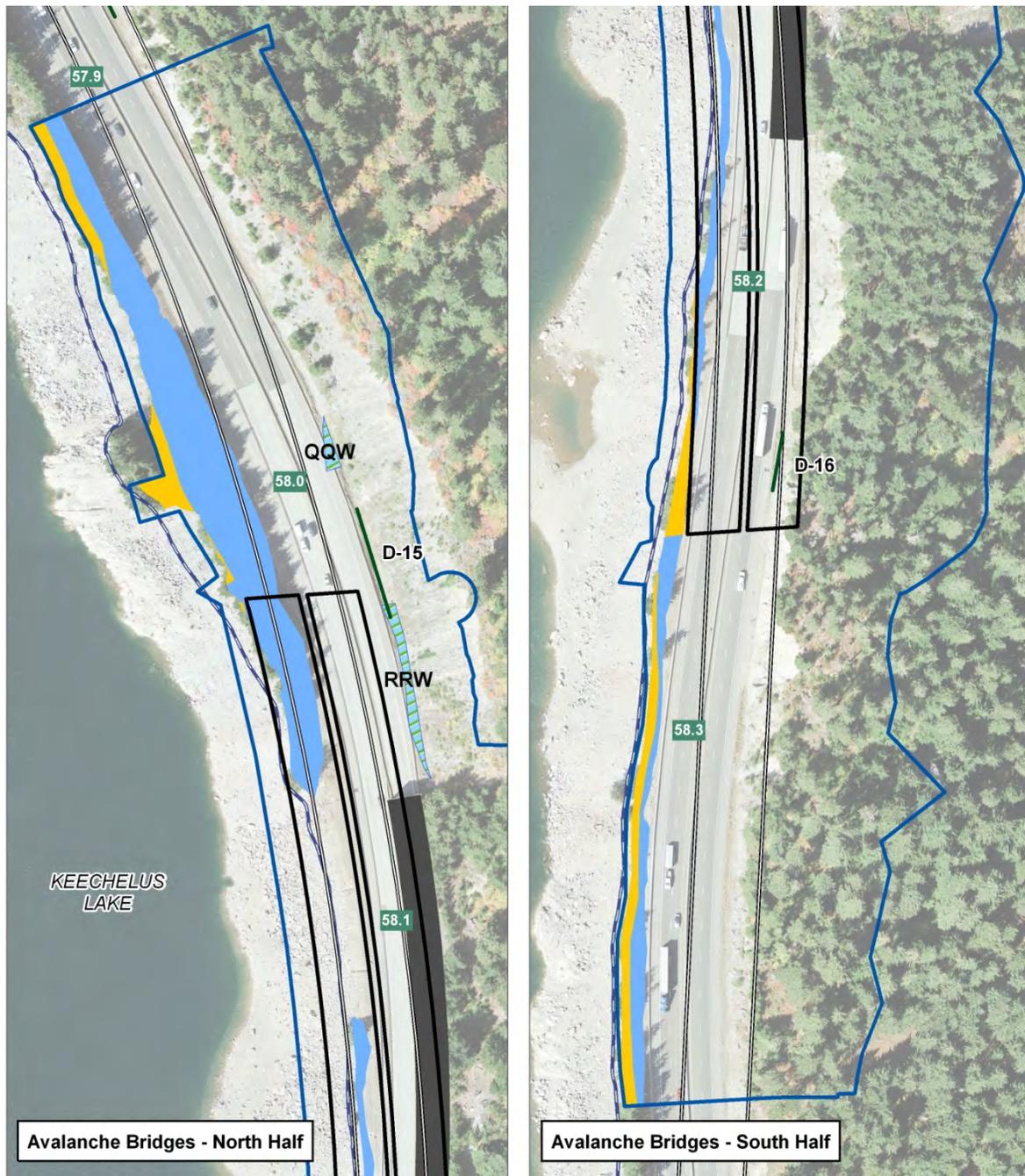


Exhibit 4
 Avalanche Bridges wetland buffer impacts



Avalanche Bridges - North Half

Avalanche Bridges - South Half



Exhibit 5 compares wetland buffer impacts for both design options. There would be no change in the overall acreage of vegetated buffer impacted; however, the Bridges would slightly alter the proportion of temporary versus permanent impacts. This disturbed buffer is a remnant fringe of vegetation between the high-pool elevation of Keechelus Lake (2,517 AMSL) and I-90. This analysis assumes that any buffer located within the footprint of the proposed Bridges would be permanently removed.

*Exhibit 5
Wetland buffer impact comparison*

Impact	Snowshed	Bridges
Temporary Impact	0.25 acre	0.31 acre
Permanent Impact	1.25 acres	1.19 acres
Total	1.5 acres	1.5 acres

Impacts to other jurisdictional waters

Other jurisdictional waters located in the design modification area include Keechelus Lake and potentially jurisdictional ditches. Impact differences between the Snowshed and Bridges are described in **Exhibits 6 and 7**.

*Exhibit 6
Impacts to Other Jurisdictional Waters below the OHWM of Keechelus Lake*

Impact	Snowshed	Bridges
Temporary Impact	0.45 acre	1.02 acres
Permanent Impact	1.5 acres	0.05 acre
Total	1.95 acres	1.07 acres

Note: OHWM = ordinary high water mark

*Exhibit 7
Impacts to potentially jurisdictional ditches (linear feet/cubic feet)*

Impact	Snowshed	Bridges
Temporary Impact	0/0	0/0
Permanent Impact	200/23	200/23
Total	200/23	200/23

Potentially jurisdictional ditches D-15 and D-16 would be completely filled during construction, but would be replaced following construction. This is true for either design.

The OHWM of Keechelus Lake is currently defined at 2,510 feet AMSL. Permanent impacts below the existing OHWM would be reduced with the design modification due to the use of piers for the Bridges instead of a fill wall along the shoreline for the Snowshed. While excavation of the engineered chutes beneath the Bridges would result in a larger temporary impact area below the OHWM, it would ultimately result in a 1.28-acre increase in the area of the reservoir below the OHWM (**Exhibit 8**). Permanent impacts below the existing OHWM would be limited to

fill associated with the central four piers in the outside row under the eastbound bridge in the amount of 0.05 acre (**Exhibit 8**).

*Exhibit 8
Avalanche Bridges impacts below OHWM*



Mitigation

What commitments were made in the Final EIS?

WSDOT is proposing a range of mitigation measures to compensate for permanent impacts to wetland resources. These measures are described in detail in the Final Wetland and Aquatic Resources Mitigation Plan (WSDOT 2011a).

Would the design modification require additional commitments?

No additional measures to mitigate for the impacts to wetland resources are proposed. Because permanent impacts would be reduced with the design modification, the current level of proposed mitigation would be sufficient.

Conclusion

The design modification would not increase permanent impacts to wetland buffers or other jurisdictional waters impacts, but it would increase the amount of aquatic area below the OHWM of Keechelus Lake over the long term. The design modification would require modification and re-issuance of aquatic resource permits (e.g., Section 401 and 404 of the Clean Water Act and Hydraulic Project Approval).

FHWA and WSDOT have reviewed this technical update and concur with the findings.

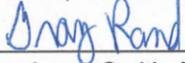
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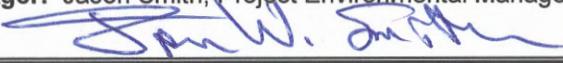
Subject: Aquatic Species Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement

Issued/Revised: May 30, 2012

Author: Gray Rand, PWS, Senior Scientist, David Evans and Associates, Inc.

Signature: 

Approving Manager: Jason Smith, Project Environmental Manager, WSDOT

Signature: 

Project Description

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To analyze the impacts of the proposed Bridges, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Bridges compared to the Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were aquatic species impacts analyzed in the Final EIS?

In the years preceding the publication of the Final EIS, issues associated with aquatic species were evaluated in several reports, which are described in this section.

In 2005, WSDOT published a Draft EIS for the I-90 project (WSDOT 2005a). This Draft EIS was supported by an Aquatic Species Discipline Report produced in 2002 (WSDOT 2002a). This discipline report compared three “Build” alternatives and one “No-Build” alternative. The Build alternatives differed in their alignment, but all three would have widened the highway from four lanes to six. This study used a wide variety of methods to assess potential impacts to fish habitat, fish species distribution, amphibian habitat, and aquatic macroinvertebrate community conditions, including review of background literature, coordination with state and federal agencies, wetland and stream delineations, snorkel and SCUBA surveys for fish, instream habitat surveys using US Forest Service and Washington State Department of Fish and Wildlife guidelines, and benthic macroinvertebrate sampling using standard Washington State Department of Ecology methods.

In 2005, prior to the release of the Draft EIS, a supplement to the Aquatic Species Discipline Report was produced to provide updated detail about the project alternatives and their impacts (WSDOT 2005b). This supplement concluded that the long-term impacts of all the Build alternatives would be primarily beneficial, mostly due to the significant improvements made to ecological and hydrological connectivity for aquatic resources on both sides of the highway.

In 2007, WSDOT released a Stormwater Treatment and BMP Report for Signatory Agency Committee (SAC) Concurrence (WSDOT 2007). This report discussed WSDOT’s process for selecting stormwater best management practices (BMPs) for the I-90 project. The selection of stormwater BMPs has been, and continues to be, adaptive over the life of the project as designs are refined and project constraints are understood. In general, the project design team follows the guidelines laid out in WSDOT’s *Highway Runoff Manual* (HRM) (WSDOT 2011).

In 2008, WSDOT published a brief memo discussing details of the Keechelus Lake Reservoir storage and how it will be impacted and mitigated for by the I-90 project (WSDOT 2008b). WSDOT has committed to a policy of no net loss to Keechelus Lake’s storage capacity as a result of the I-90 project. This project will place fill below the lake’s full pool elevation (2,517) and reduces storage volume as a result of highway widening and retaining walls. In order to mitigate for the decrease in Keechelus Lake’s storage capacity, WSDOT agreed to remove material from within Keechelus Lake above dead pool (elevation 2,425 feet) and below full pool. This was accomplished in 2009.

The Final EIS was published in August of 2008. The Preferred Alternative identified in the Final EIS was to widen the existing highway to six lanes. Adjacent to Keechelus Lake, the “Shoreline Alignment” was selected, which follows the existing highway alignment. The Preferred

Alternative included further modifications based on new technical information. Among other changes, the Final EIS Preferred Alternative included replacement of the existing snowshed with a new, larger Snowshed, covering all six lanes. This was instead of constructing viaducts lakeward of the existing snowshed as proposed in the Draft EIS.

The Final EIS reports that by avoiding, minimizing, and mitigating, there will be no adverse impacts to aquatic species from the Preferred Alternative. Stormwater BMPs will meet permit requirements by following criteria in the HRM, and the I-90 project will have a beneficial effect on water quality by providing stormwater treatment where none currently exists. Storage capacity in Keechelus Lake will not be reduced because excavation from the lake will compensate for all fill placed in the lake. In fact, the I-90 project offers an opportunity to restore some of the natural hydrology and hydraulics of the project area, which were altered as a result of the original highway construction and other land use changes. The project will achieve these beneficial effects by replacing existing bridges, culverts, and highway fill with longer bridges and wider, bottomless culverts, along with additional smaller culverts at hydraulic connectivity zones. These replacements would improve hydrologic connectivity, sediment transport, channel migration, floodplain function, and groundwater movement. Water quality would be improved through lowered stream temperature and sediment loading. All of these improvements will benefit aquatic habitats and species.

Potential impacts to Columbia River bull trout (*Salvelinus confluentus*) will be mitigated through compliance with the applicable measures identified in the US Fish and Wildlife Service (USFWS) Biological Opinion (USFWS 2008). The project will also implement conservation measures described in the Biological Assessment (WSDOT 2008c) and the Biological Evaluation (WSDOT 2008d) pertinent to aquatic habitat.

What has changed since the Record of Decision was issued?

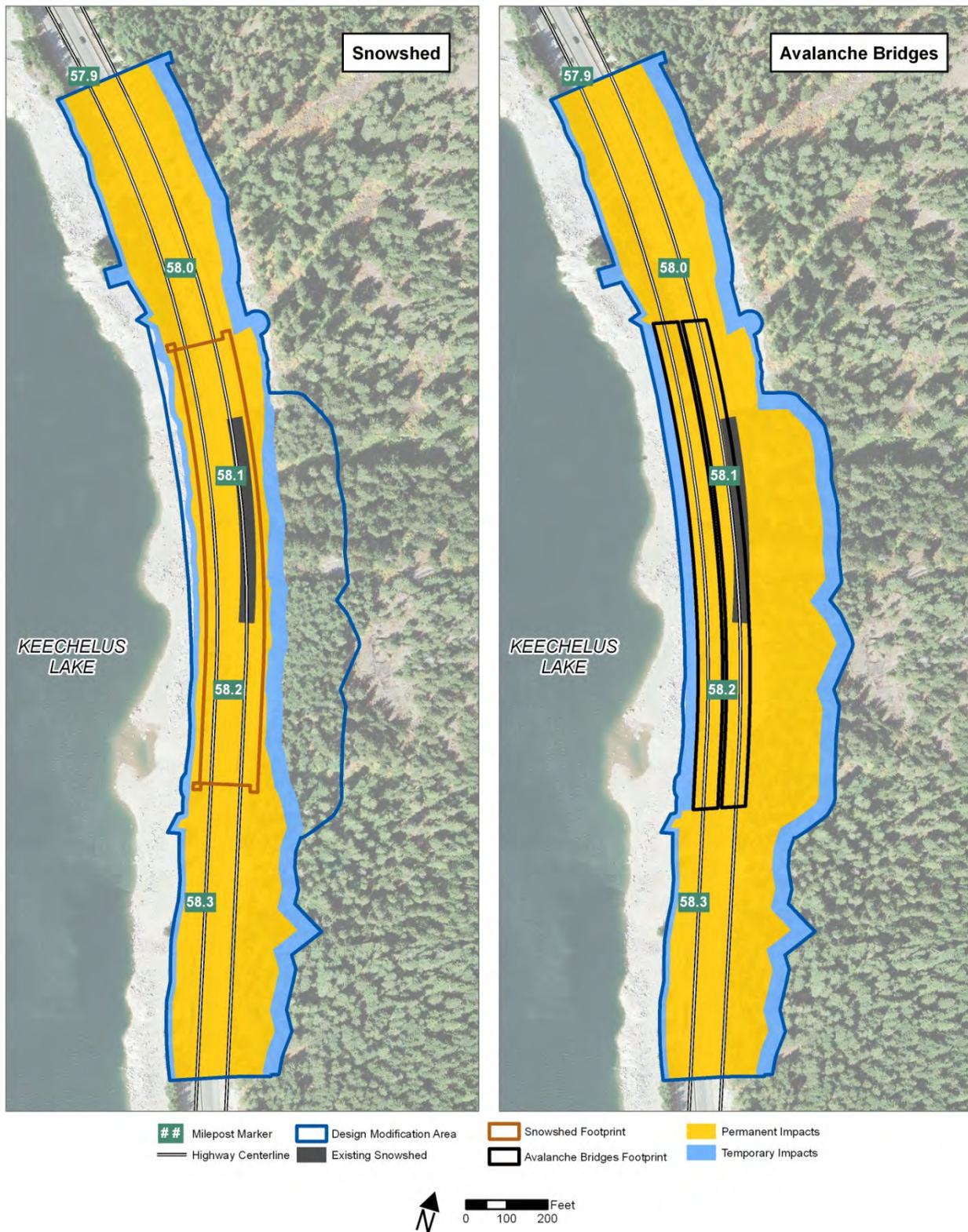
On November 17, 2010, the USFWS officially designated and modified bull trout critical habitat throughout the range of the species. This designation included Keechelus Lake. FHWA and WSDOT are currently in consultation with USFWS regarding this designation.

How were potential aquatic species impacts analyzed for this technical update?

Potential impacts to aquatic species from the Bridges were assessed within the design modification area for the Supplemental EIS, which extends from approximately MP 57.9 to MP 58.4, and includes the area in which potential temporary and permanent impacts to aquatic species from the Bridges would occur. These impact areas are shown in **(Exhibit 1)**. Potential impacts were based on design information provided to DEA by Jacobs Engineering for the Bridges, in addition to the base design for the Snowshed provided to DEA by WSDOT.

Analyses of aquatic species related topics were limited to only the specific issues that could be affected by the Bridges and that were not already addressed elsewhere. For example, impacts to wetlands are not discussed in this report because they are addressed in the Wetlands Technical Update (DEA 2012a). This discipline update only evaluates impacts to aquatic habitats and species within Keechelus Lake.

Exhibit 1
 Temporary and permanent impact areas for the Snowshed and Avalanche Bridges



Keechelus Lake is an artificial reservoir constructed at the location of a former natural lake on the Yakima River. Managed by the Bureau of Reclamation, Keechelus Lake has a high pool elevation of 2,517 feet above mean sea level (AMSL) and an ordinary high water mark (OHWM) of 2,510 feet AMSL. Potential aquatic habitat is assumed to extend up to high pool.

Impacts

What were the relevant impacts evaluated in the Final EIS?

The Final EIS concluded that while all of the build alternatives would have some impacts on aquatic habitat and species, the overall effects of any of the build alternatives would be highly positive (WSDOT 2008a). This conclusion was based, in part, on improving fish passage, improving hydrologic connectivity, providing stormwater treatment in areas where there is currently no treatment, and restoring aquatic habitat (including wetlands and floodplains). The Final EIS identified a number of potential mechanisms for temporary and permanent adverse impacts to aquatic species, including excavation and grading, removing riparian vegetation, removing and replacing culverts and bridges, in-water work, concrete curing, blasting and pile driving, equipment maintenance and fueling, and construction timing and duration.

Would the design modification change the results presented in the Final EIS?

The proposed design modification would have the same potential mechanisms of impact to aquatic species as the Snowshed. The primary mechanisms are described in more detail below.

Blasting

Blasting can be harmful to fish life when it occurs close to fish-bearing waters. The extent of blasting upslope of I-90 would be similar under both designs, but blasting under the proposed Bridges has the potential to occur closer to Keechelus Lake and below elevation 2,517 feet AMSL. All blasting would occur on dry land while the lake is drawn down to lower levels. An acoustic shock of 100 kilopascals (equivalent to approximately 194 decibels as measured in air) can cause injury to fish or fish eggs through creation of post-detonation compressive shock waves that cause a rapid high peak pressure followed by a rapid decay to below ambient hydrostatic pressure (Wright and Hopky 1998). The rapid decompression is the primary cause of damage to fish through rupture and hemorrhage of vital organs. Sub lethal disturbance effects are also possible. No current published guidelines for use of explosives near fish habitat are available in Washington State. However, guidelines have been published by the Canadian Department of Fisheries and Oceans for protection of spawning fish from explosives. These guidelines include equations for calculating appropriate setback distances to avoid exceeding the 100 kilopascals limit. These equations take into consideration a number of variables, including the density of water, density of various substrates, acoustic impedance of the substrate, and compressional wave velocity. Assuming standard values for a rock substrate, the following equation describes the relationship between peak particle velocity and charge weight and distance:

$$R = W^{.5}(K)$$

where:

R = distance to the detonation point in meters

W = charge weight per delay in kilograms

K = factor that represents peak particle velocity in rock (5.03)

Based on the preliminary design of the proposed Bridges, blasting to remove bedrock would be (at its closest point) approximately 100 feet from the wetted edge of Keechelus Lake (i.e., where the actual water level in the reservoir is at any given time), in the vicinity of the inside (south) edge of the westbound bridge. Excavation for the proposed avalanche chutes would be at its deepest point at this location, near the center of chute 4 (ES 4 on **Exhibit 2**). Based on this estimated distance, and using the equation above, an explosive charge of approximately 36.7 kg (81 pounds) per delay (i.e., successively detonated charge) could be used before harm would come to fish in the nearshore areas of Keechelus Lake. If blasting occurs closer to the lake, risk of harm to fish in the nearshore area would increase. Blasting could also generate disturbance to aquatic life in Keechelus Lake without causing actual physical injury, but given the lack of information about fish use of the nearshore areas, this impact cannot be quantified.

Blasting would not be used to install the bridge piers. Piers would be constructed using drilled shafts, which are not expected to have any impacts to fish life.

Work Below the OHWM

As described in the Wetland Resources Technical Update (DEA 2012a), construction of the Bridges would require more extensive temporary impacts below the OHWM of Keechelus Lake compared to the Snowshed (1.02 acre compared to 0.45 acre), primarily due to the excavation of the avalanche chutes. However, the Bridges would require substantially less permanent impact below the OHWM (0.05 acre compared to 1.5 acre) due to the installation of piers to support the Bridges instead of a continuous wall to support the outer edge of the Snowshed. Since excavation of the engineered avalanche chutes would occur when the lake is drawn down and the work area is dry, temporary impacts to aquatic life would be limited to minor, temporary turbidity produced following the first contact of the excavation area by water (e.g., precipitation or wave action) following construction. Since most of the substrate in this location is rock, these temporary turbidity impacts should be negligible. Excavation of the engineered avalanche chutes would also create a 1.28-acre increase in the area of the reservoir below OHWM (**Exhibit 2**). This additional area below the OHWM would likely provide additional foraging and daily movement opportunities for any fish that may use the nearshore areas of the reservoir during high pool in the spring and early summer when the lake is not frozen. These species could include bull trout, cutthroat trout (*Oncorhynchus clarkii*), rainbow trout (*Oncorhynchus mykiss*), mountain whitefish (*Prosopium williamsoni*), burbot (*Lota lota*), and northern pikeminnow (*Ptychocheilus oregonensis*) (WSDOT 2002a).

Removal of Riparian Vegetation

The Bridges would remove the same amount of riparian vegetation as the Snowshed (DEA 2012a). No difference in impacts to aquatic species as a result of riparian vegetation removal is anticipated.

Exhibit 2
 Avalanche Bridges impacts below OHWM



Stormwater Runoff

The Water Resources Technical Update (DEA 2012b) compares stormwater quality treatment between the Snowshed and the Bridges. That report explains how the Bridges would treat stormwater from a greater amount of roadway within the design modification area in order to limit the amount of untreated roadway to about the same total area as the Snowshed. This increase is necessary because the Snowshed was considered a non-pollution-generating surface while the decks of the Bridges would be pollution-generating. There may be minor behavioral impacts to fish in close proximity to outfalls in the design modification area that could detect small increases in pollutant loading from those pipes due to increased pollution-generating surfaces that feed into individual pipes. However, these impacts would be negligible. The conclusion of this analysis is that, while the Bridges would slightly increase the amount of pollutant loading compared to the Snowshed, this design would still result in overall improvements to water quality (DEA 2012b).

Adverse water quality impacts from operations would increase slightly as a result of the Bridges instead of the Snowshed, due to the larger amount of traction sand and de-icer that will presumably be required due to the ice and snow management on the bridge structures instead of a covered structure (Snowshed). The additional sand and de-icer compounds may mix with the snow that gets cleared from the Bridges, which is a small portion of the overall load of snow management products used in the project area that can potentially enter the lake. The bridge decks that would be constructed make up less than 4 percent of the total impervious surface in the I-90 project that drains to Keechelus Lake. Some research exists to indicate that an increase in de-icer components in receiving waters would not be detectable (WSDOT 2002b). Furthermore, a study commissioned during the Final EIS concluded that chloride and magnesium concentrations likely to be released into aquatic environments as a result of the use of de-icer compounds in the I-90 project area would be well below levels harmful to aquatic organisms (OTAK 2007).

Mitigation

What commitments were made in the Final EIS?

WSDOT committed to minimize impacts to aquatic species by using a wide range of BMPs that are described in various sections of the Final EIS including Water Resources (Section 3.3); Wetlands (3.7); and Fish, Aquatic Species, and Habitat (Section 3.5).

Would the design modification require additional commitments?

The Bridges would not require alteration to the compensatory mitigation commitments made in the Final EIS and Record of Decision.

Construction of the Bridges would adhere to previous commitments to avoid impacts from blasting and in-water work, which include, but are not limited to, the following:

- Limit the size of blast charges or avoid blasting altogether such that acoustic shock in Keechelus Lake fish habitat will be less than the threshold recommended in the literature (100 kPa).

- No work, including work bench excavation, drilling for pier shafts, or rock excavation will be conducted in the water, but will occur when the lake level is drawn down to an elevation below that of the work area.

Additional commitments that affect aquatic habitats and species could result from ongoing consultation with USFWS regarding bull trout in Keechelus Lake.

Conclusion

The impacts from the design modification are consistent and comparable with those documented in the Final EIS and the subsequent ROD. The design modification would not increase permanent adverse impacts to aquatic species or habitats.

FHWA and WSDOT have reviewed this technical update and concur with the findings.

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The Aquatic Species Technical Update supporting the Interstate 90 (I-90) Snoqualmie Pass East Avalanche Structures Supplemental Environmental Impact Statement (EIS) was finalized in May 2012. Since then, additional design data became available and additional analysis was conducted for the Draft Supplemental EIS. This addendum describes the additional information that supplements the findings presented in the technical update.

Why are these changes necessary?

The technical update used the existing ordinary high water mark (OHWM) elevations of Keechelus Lake to determine potential impacts to aquatic habitat. During review of the Draft Supplemental EIS, it was determined that impacts below the existing full pool needed to be provided for both the Selected Snowshed and Proposed Bridges. The revised and updated impact numbers at both lake elevations are provided below.

What is the new information for Aquatic Species?

Temporary and Permanent Impacts Below Elevation 2,510 (OHWM) and Elevation 2,517 (Full Pool) of Keechelus Lake (acres)

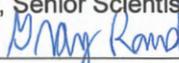
Impact	Impact Below OHWM		Impact Below Full Pool	
	Selected Snowshed	Proposed Bridges	Selected Snowshed	Proposed Bridges
Temporary Impact	0.43	1.02	0.57	1.43
Permanent Impact	0.40	0.05	0.67	0.08

When comparing impacts below existing OHWM or full pool, the Proposed Bridges would increase temporary impacts due to larger amounts of excavation below the proposed bridges than the Selected Snowshed. However, permanent impacts would be reduced due to the replacement of the outer wall of the Selected Snowshed with independent piers. In addition to the reduction in permanent impacts, the Proposed Bridges would create additional area below both the new OHWM (1.28 acres) and the new full pool (2.22 acres).

Subject: Terrestrial Resources Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement

Issued/Revised: May 30, 2012

Author: Gray Rand, Senior Scientist, PWS, David Evans and Associates, Inc.

Signature: 

Approving Manager: Jason Smith, Project Environmental Manager, WSDOT

Signature: 

Introduction

This technical update supports the Limited Scope Supplemental Environmental Impact Statement (EIS) for the Interstate 90 (I-90) Snoqualmie Pass East, Keechelus Lake Avalanche Bridges. David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, prepared this update to supplement the impact analysis for terrestrial resources presented in the Final EIS (WSDOT 2008a) and supporting documentation, including the *I-90 Snoqualmie Pass East Terrestrial Species Analysis Supplemental Report* (WSDOT 2004).

The I-90 Snoqualmie Pass East project (I-90 project) includes improvements to the existing highway from Hyak at milepost (MP) 55.1 to Easton at MP 70.3. Planned improvements would reduce road closures due to avalanches, address unstable slopes, replace deteriorating concrete pavement, add capacity, and improve ecological connectivity. The Washington State Department of Transportation (WSDOT) completed the Final EIS for the I-90 project in 2008 and the Federal Highway Administration (FHWA) issued its Record of Decision (ROD) later that same year (FHWA 2008). Construction started in 2009 and has continued in 2010 and 2011.

In fall 2011, the contractor constructing the portion of the I-90 project from MP 57.3 to MP 60.2, Guy F. Atkinson Construction, proposed a design modification to construct eastbound and westbound Bridges at MP 58.1, the Keechelus Lake Avalanche Bridges (Bridges), instead of the expanded Snowshed that was included in the Selected Alternative, described in the ROD (FHWA 2008). WSDOT has granted concept approval for this design modification as a Cost-Reduction Incentive Proposal, intended to promote innovative ideas and result in cost savings to the state.

The 1,200-foot-long Bridges would reduce risks associated with avalanches, rock fall, and landslides through removal and stabilization of loose materials upslope of the highway, and physical separation of the highway from the hillside. A combination of elevating the road surface above the existing grade and excavating up to approximately 50 feet of material below the existing grade would provide a total clearance beneath the Bridges ranging between approximately 40 and 70 feet. This space would accommodate accumulations of snow from snowfall, plowing, and avalanches with adequate freeboard (remaining distance between the top of the accumulated snow and the Bridges) to protect motorists from additional avalanches,

as they occur. The storage area beneath the Bridges has been engineered to act as a series of chutes that would direct sliding snow, rock, and debris away from the bridge piers.

To analyze the impacts of the proposed Bridges, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Bridges compared to the Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were potential impacts to terrestrial resources analyzed in the Final EIS?

Impacts to existing terrestrial resources from the Snowshed were summarized in the following documents:

- *I-90 Snoqualmie Pass East Terrestrial Species Analysis Supplemental Report* (WSDOT 2004)
- Biological Assessment (WSDOT 2008b)
- Biological Evaluation (Appendix M to the Biological Assessment) (WSDOT 2008c)
- US Forest Service Consistency Determination Support Information (WSDOT 2008d)
- Phase 1C Endangered Species Act (ESA) Consultation Reinitiation (WSDOT 2010)

Methods used for data collection and analysis of terrestrial resources in the Final EIS are described in the Supplemental Report, but generally included the following: extensive coordination with agencies, jurisdictions, and stakeholders; establishment of a Mitigation Development Team to determine a comprehensive strategy of ecological connectivity for the I-90 project; background literature review; communication with local biologists and experts; and extensive field surveys conducted by WSDOT and US Forest Service (USFS) staff (WSDOT 2004).

What has changed since the Record of Decision was issued?

Some notable information regarding the affected environment for terrestrial resources has changed since the publication of the Final EIS, particularly with regard to federally listed species.

The Final EIS and Biological Assessment (WSDOT 2008b) analyzed potential impacts to seven listed species: northern spotted owl (*Strix occidentalis caurina*), marbled murrelet (*Brachyramphus marmoratus*), gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos horribilis*), Canada lynx (*Lynx canadensis*), bald eagle¹ (*Haliaeetus leucocephalus*), and Ute's ladies'-tresses (*Spiranthes diluvialis*).

Since publication of the Draft EIS, gray wolves have extended their range in Washington; and wolves in the eastern one-third of the state are no longer listed under the Endangered Species Act, but are still listed in the vicinity of the I-90 project. Five breeding wolf packs are currently reported by the Washington Department of Fish and Wildlife (WDFW) in Washington (WDFW

¹ The bald eagle was removed from the federal Endangered Species List on June 28, 2007.

2012). This includes one wolf pack in the Teanaway area of Kittitas County, approximately 15 miles east of the I-90 project, which increases the likelihood that wolves could be encountered in the design modification area during construction.

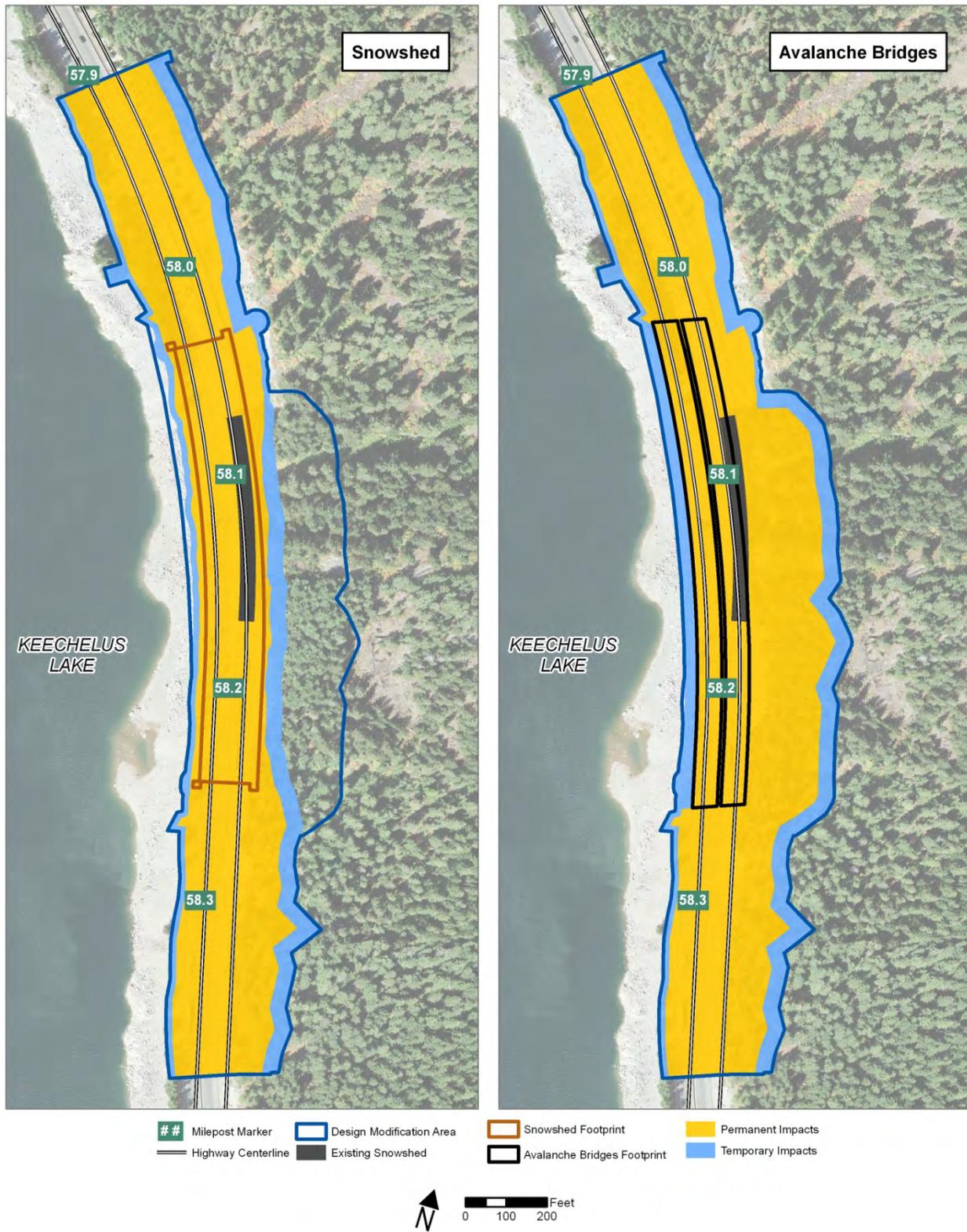
On March 8, 2012, the US Fish and Wildlife Service (USFWS) proposed revised critical habitat for the northern spotted owl. This proposal could designate critical habitat for the owl within the I-90 project area. A decision is anticipated in November of 2012. This proposal will be evaluated in greater detail in the ESA consultation reinitiation for the Bridges design modification (WSDOT 2010).

Finally, the Okanogan-Wenatchee National Forest is currently in the process of revising its Land and Resource Management Plan. A Draft EIS on the proposed plan revision is forthcoming later in 2012. A final decision and implementation is planned for late 2013. Management of the Snoqualmie Pass Adaptive Management Area, which contains the I-90 project, would remain unchanged under the new plan (USFS 2011).

How were potential terrestrial resource impacts analyzed for this technical update?

Potential impacts to existing terrestrial resources from the Bridges were assessed within the design modification area for the Supplemental EIS, which extends from approximately MP 57.9 to MP 58.4, and includes the area in which all potential temporary and permanent impacts to terrestrial resources from the Bridges could occur. These impact areas are shown in **Exhibit 1**. Potential impacts were based on design information provided to DEA by Jacobs Engineering for the Bridges, in addition to the base design for the Snowshed provided to DEA by WSDOT.

Exhibit 1
 Temporary and permanent impact areas for the Snowshed and Avalanche Bridges



Impacts

What were the relevant impacts evaluated in the Final EIS?

Including ecological connectivity as an element of the project’s purpose and need led WSDOT to design the I-90 project from the beginning with the aim of making major improvements to wildlife habitat and connectivity. Consequently, the overall effect of the I-90 project on terrestrial species will be strongly beneficial despite some localized adverse impacts resulting from habitat removal and construction impacts. The overall I-90 project improvements to wildlife habitat include restoration of riparian habitat at existing stream crossings like Gold Creek and installation of wildlife crossing structures at numerous locations to reduce wildlife mortality and population isolation across the highway.

The Snowshed would result in temporary and permanent impacts to wildlife. Temporary impacts would generally be the result of noise and other disturbance during construction, including noise from blasting and operating machinery. Proposed activities such as blasting were evaluated in the Biological Assessment (WSDOT 2008b) as well as the Final EIS (WSDOT 2008a). An additional potential temporary impact would be vegetation clearing for staging and stockpiling areas. Permanent impact to terrestrial species would primarily result from the permanent fill to create the new highway lanes. Realigning and widening the highway would result in permanent loss of some habitat, including mature forest. This may include areas important to wildlife for breeding, shelter, or foraging; and may cause some direct mortality to birds, small mammals, invertebrates, plants, or other terrestrial organisms. **Exhibit 2** displays the permanent impacts to mature forest.

*Exhibit 2
Mature forest permanent impacts*

Project	Area (acres)
I-90 Project Area	124.58
Phase 1 (MP 55.1 to MP 60.2)	18.34

Source: Phase 1C ESA Consultation Reinitiation (WSDOT 2010)

Would the design modification change the results presented in the Final EIS?

Habitat Impacts

Within the design modification area, native terrestrial wildlife habitat is dominated by mature forest (**Exhibit 3**). An isolated fringe of riparian habitat is located between I-90 and the Keechelus Lake shoreline, and isolated rock outcrops are located on the hillside above I-90. The design modification area also includes disturbed habitats such as rock cuts, pavement, the existing snowshed, and gravel road shoulders that provide little or no ecological value to terrestrial species. Impacts to the riparian habitat are discussed in the Wetland Resources Technical Update (DEA 2012) as they are part of the lacustrine wetland buffer. The rock outcrops would not be permanently impacted by either the Snowshed or the Bridges.

Exhibit 3
 Snowshed and Avalanche Bridges terrestrial habitat impacts

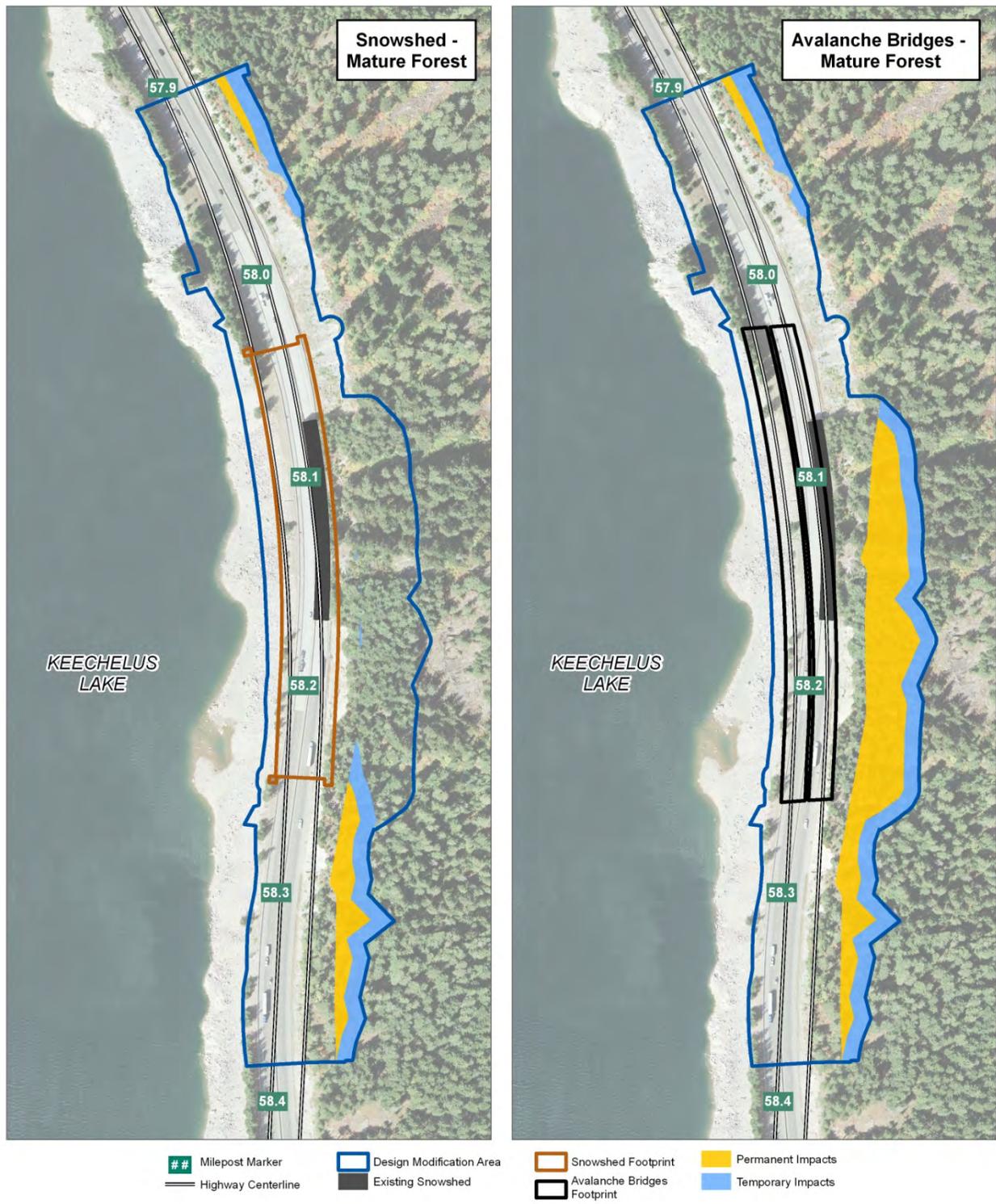


Exhibit 4 displays the mature forest habitat within the design modification area potentially affected by the Snowshed and Bridges, respectively. **Exhibit 4** compares the temporary and permanent impacts of the Snowshed and Bridges within the design modification area.

Exhibit 4

Mature forest impacts within the design modification area for the Snowshed and Avalanche Bridges (acres)

Impact	Snowshed	Bridges
Temporary	1.8	2.0
Permanent	0.7	2.9

The design modification would impact similar habitat types as the Snowshed. However, the Bridges would have the potential to permanently impact an additional 2.2 acres of mature forest, and temporarily impact an additional 0.2 acre of mature forest located upslope of the permanent impact line.

Listed Species

The design modification area is not a critical movement corridor for most terrestrial wildlife due to its location between Keechelus Lake and the steep slopes north of the highway. Wolves, grizzly bear, and Canada lynx may occur in the project vicinity on a transient basis, but no active reproducing populations are known to occur near I-90 (WSDOT 2004). These large carnivores would be much more likely to use areas such as Gold Creek and Price/Noble Creek near the north and south ends of Keechelus Lake as movement corridors.

No suitable habitat for Ute's ladies'-tresses exists in the design modification area. The USFS will conduct a survey of rare plants (as well as surveys for amphibians and fungi) in this area during the spring of 2012.

As described in the Supplemental Report (WSDOT 2004), up to 18 forest stands with suitable characteristics to provide marbled murrelet nesting habitat were identified in the I-90 project area (Hamer 2001). However, the Draft EIS concluded that all but two stands near the project's western terminus were unlikely to support marbled murrelets due to being near the range limit of murrelets where nesting has seldom been documented. The fragmented nature of suitable habitat in this area, combined with the ongoing disturbance near the highway from the high traffic levels, further reduce the likelihood of murrelet presence (WSDOT 2008b).

The mature forest habitat within the design modification area provides potential dispersal habitat for northern spotted owl (WSDOT 2004). However, the potential for spotted owl use of this habitat is unlikely due to ongoing disturbance from both active highway construction and highway traffic. No spotted owl nesting is documented in the project vicinity.

Other Species

Since habitat potentially impacted by the design modification is limited primarily to mature upland forest, terrestrial species closely associated with this habitat are the most likely to be affected. Species with a close association with mature forest that were analyzed in the EIS and supporting documentation include the following:

- Pine marten (*Martes martes*)
- Fisher (*Martes pennanti*)
- Pileated woodpecker (*Dryocopus pileatus*)
- Vaux's swift (*Chaetura vauxi*)
- Northern goshawk (*Accipiter gentilis*)

Pine martens have been documented in the Gold Creek vicinity (WSDOT 2004), but not in the design modification area. Fisher is no longer considered to have extant breeding populations in the state of Washington, except for a reintroduced population on the Olympia Peninsula.

Pileated woodpeckers are likely to occur throughout the project area, typically nesting in mature forest areas with large amounts of snags. Vaux's swift may nest in mature forests in the project vicinity during the summer. Northern goshawks use mature forests for nesting habitat, and are known to occur in the I-90 project vicinity.

Most of these species would not be expected to occur in close proximity to I-90 due to the high level of habitat fragmentation and human disturbance. Construction of the Bridges would reduce the amount of available potential habitat for these species in the short-term. Rock work associated with the Bridges would occur in the active avalanche paths, further decreasing this area's potential as habitat for these species. In the long-term, ongoing land management activities such as those promulgated in the Snoqualmie Pass Adaptive Management Area Plan (USFS 1997) and the Northwest Forest Plan (USDA 1994) would be expected to increase the extent of late-successional forest available to these species.

Other species with more generalist habitat requirements, such as mule deer (*Odocoileus hemionus*), black bear (*Ursus americanus*), cougar (*Puma concolor*), elk (*Cervus canadensis*), olive-sided flycatcher (*Contopus cooperi*), merlin (*Falco columbarius*), neotropical migratory birds, and many bat species may occur within the design modification area, but habitat for these species is not limited in the project vicinity. The USFS will conduct surveys of fungi, amphibians, and vascular plants in the spring and fall of 2012 in the design modification area.

Other types of impacts to terrestrial species, including construction noise and air quality, would be temporary and similar to the impacts of the Snowshed in both duration and type of equipment. Construction methods, including rock excavation and blasting, would also be similar and produce similar amounts of noise and temporary increases in fugitive dust.

Wildlife Movement

The design modification would have no impact on any designated Connectivity Emphasis Areas or Hydrologic Connectivity Areas (WSDOT 2008a). All of the existing crossing areas important to wildlife are located either east or west of the design modification area, at existing creek corridors (WSDOT 2008a). The location of the Bridges between the steep slopes to the north and Keechelus Lake to the south would minimize the use of this area for movement by wildlife.

Mitigation

What commitments were made in the Final EIS?

WSDOT and FHWA committed to a wide range of minimization and mitigation measures for terrestrial resources. These measures include adjusting designs to avoid mature forest, riparian areas, and wetlands; acquisition of offsite properties for habitat preservation; implementation of

best management practices and permit conditions; construction of wildlife crossing structures; and implementation of a robust wildlife monitoring plan. These measures are detailed in the Final EIS (WSDOT 2008a), the Biological Assessment (WSDOT 2008b), the Final Wetlands and Aquatic Resources Mitigation Plan (WSDOT 2011), and the Wildlife Monitoring Plan (WSDOT 2008e).

Would the design modification require additional commitments?

No additional measures are proposed to minimize and mitigate impacts from the Bridges than those committed to for the I-90 project with the Snowshed.

Conclusion

The design modification would increase temporary and permanent impacts to mature forest habitat. Wildlife species most closely associated with mature forests are unlikely to use this habitat because it is in close proximity to I-90. No other potentially significant impacts to terrestrial resources are anticipated.

FHWA and WSDOT have reviewed this technical update and concur with the findings.

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The Terrestrial Resources Technical Update supporting the Interstate 90 (I-90) Snoqualmie Pass East Avalanche Structures Supplemental Environmental Impact Statement (EIS) was finalized in May 2012. Since then, additional design data became available and additional analysis was conducted for the Draft Supplemental EIS. This addendum describes the additional information that supplements the findings presented in the technical update.

Why are these changes necessary?

The Geographic Information System (GIS) data that identifies the extent of mature forest used in the May 2012 technical update was mapped at a relatively coarse, regional scale (US Forest Service [USFS] 2002). Additional aerial photo interpretation of the area upslope of I-90, combined with ground truthing tree diameters, provided a more accurate map of mature forest and terrestrial habitat within the design modification area.

The USFS also indicated that all construction impacts that involve clearing of mature forest should be identified as long term because, unlike other habitat types, they would require at least 80 years to recover.

What is the new information for Terrestrial Species?

David Evans and Associates, Inc. mapped terrestrial habitat upslope of I-90 using all available aerial imagery, including 2007 project imagery and 2011 NAIP imagery. WSDOT staff subsequently conducted a site visit to field verify the aerial mapping. The results are shown in **Exhibit 1** below. Temporary and permanent impacts from the Proposed Bridges on terrestrial habitat were recalculated using the revised habitat map and the results are shown in **Exhibits 2 through 4** below.

Impacts

The Selected Snowshed would temporarily impact 2.32 acres of terrestrial habitat, while the Proposed Bridges would impact 0.22 acre more habitat for a total of 2.54 acres. The Selected Snowshed would permanently impact 4.45 acres of terrestrial habitat. The Proposed Bridges would impact an additional 3.26 acres of total terrestrial habitat, for a total of 7.71 acres.

Exhibit 1. Revised Map of Terrestrial Habitat Upslope of I-90

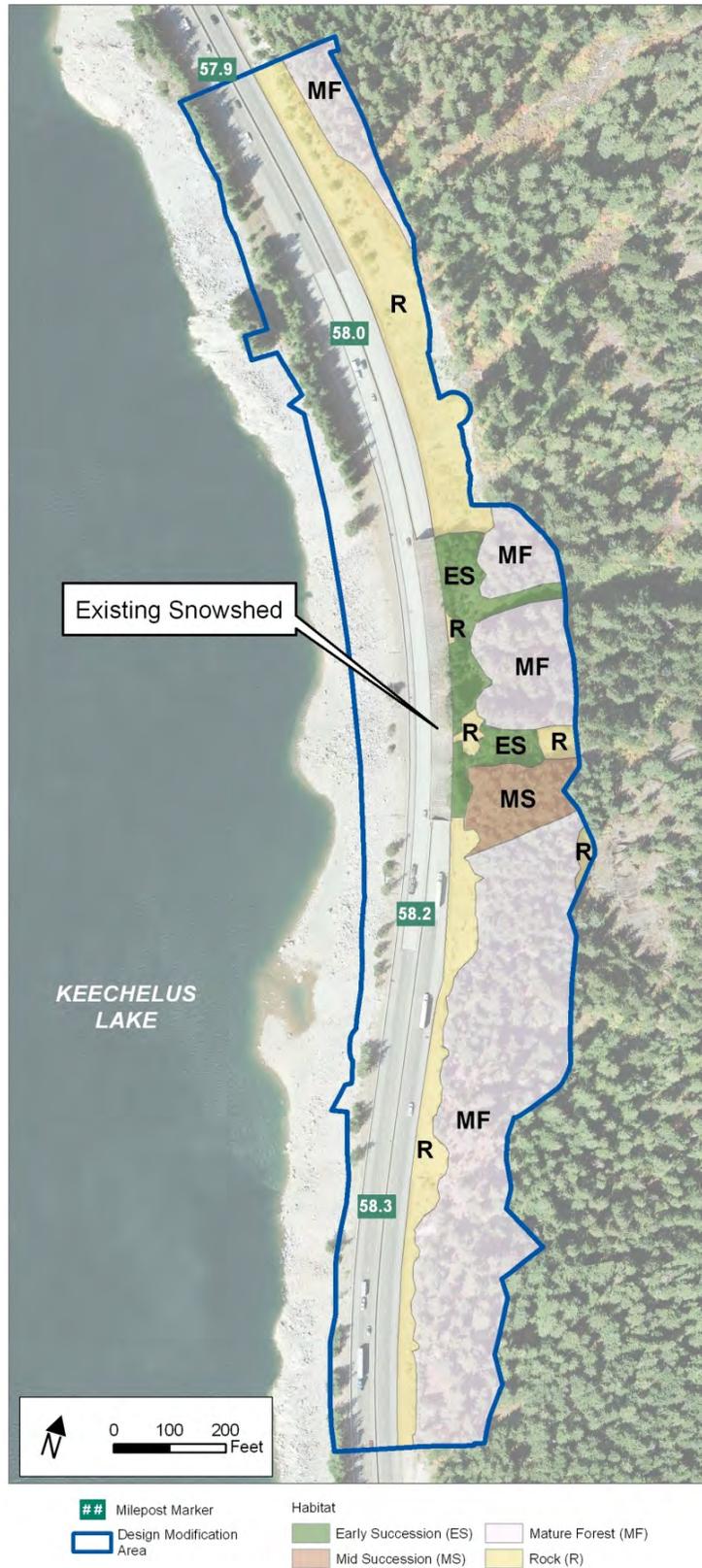
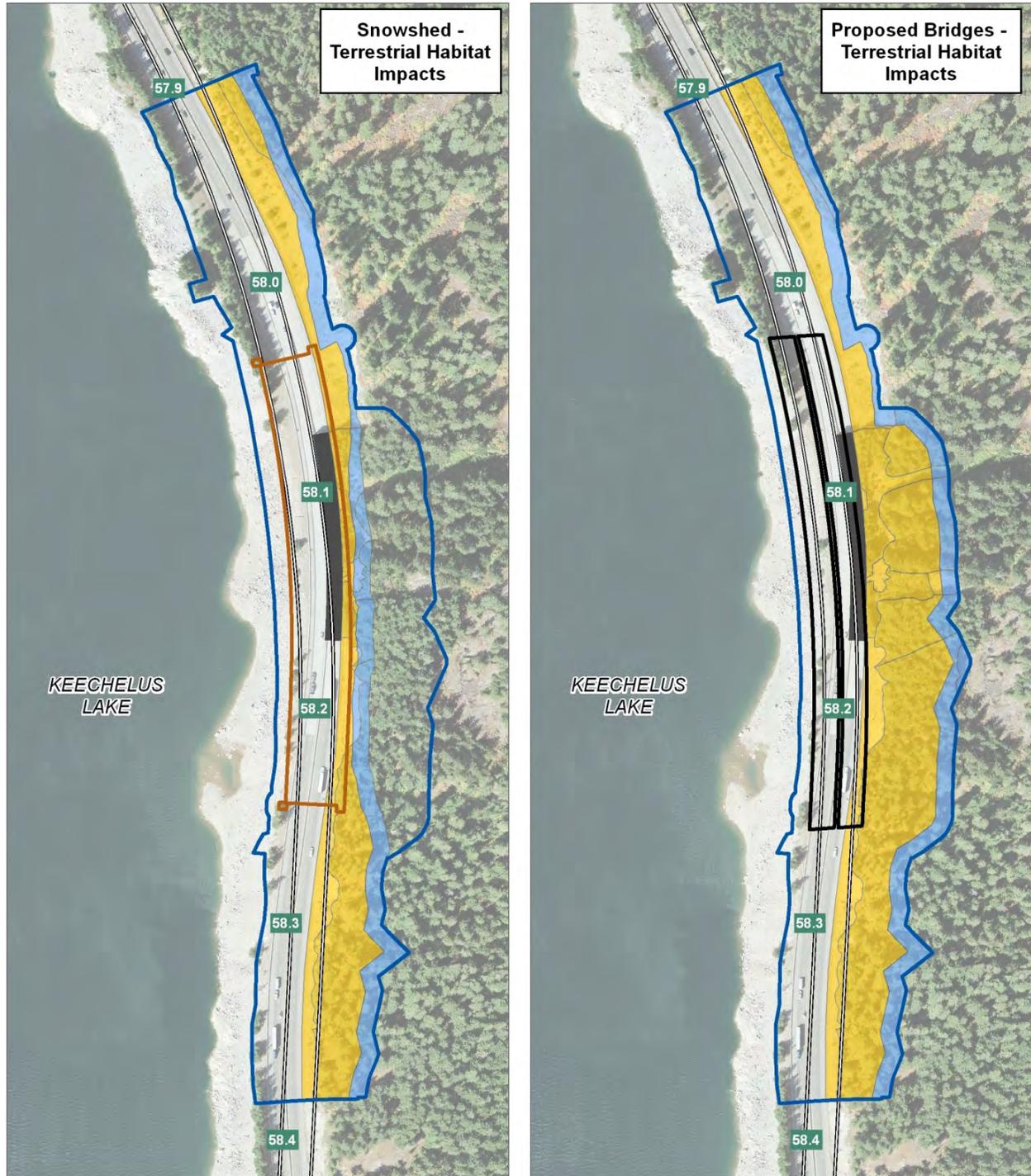


Exhibit 2. Terrestrial Habitat Impacts for Selected Snowshed and Proposed Bridges



- | | | | |
|--------------------|--------------------------|----------------------------|-------------------|
| Milepost Marker | Design Modification Area | Snowshed Footprint | Permanent Impacts |
| Highway Centerline | Existing Snowshed | Proposed Bridges Footprint | Temporary Impacts |



Exhibit 3

Selected Snowshed and Proposed Bridges Temporary Terrestrial Habitat Impacts (acres)

Habitat Type	Selected Snowshed	Proposed Bridges ¹	Difference
Early Successional Forest	0.22	0.03	-0.19
Mid Successional Forest	0.13	0.11	-0.02
Mature Forest	1.38	1.78	0.40
Rock	0.59	0.62	0.03
Total	2.32	2.54	0.22

¹ Includes impacts associated with the Selected Snowshed which may have already occurred due to ongoing Phase 1C construction activities.

Exhibit 4

Selected Snowshed and Proposed Bridges Permanent Terrestrial Habitat Impacts (acres)

Habitat Type	Selected Snowshed	Proposed Bridges ¹	Difference
Early Successional Forest	0.35	0.78	0.43
Mid Successional Forest	0.02	0.43	0.41
Mature Forest	1.97	4.25	2.28
Rock	2.11	2.25	0.14
Total	4.45	7.71	3.26

¹ Includes impacts associated with the Selected Alternative which may have already occurred due to ongoing Phase 1C construction activities.

Mature Forest

The temporary and permanent terrestrial habitat impact areas summarized in **Exhibits 3 and 4** include areas of mature forest that would be cleared during construction. Additional attention is paid to mature forest habitat because these areas are specially managed by USFS under the guidelines of the Snoqualmie Pass Adaptive Management Area. These areas require an extended amount of time - on the order of 80 years - for regrowth and reestablishment of mature forest characteristics (such as multiple canopy layers and high vegetative structure). Therefore, temporary impacts that result in clearing of vegetation within mature forest are considered long term for the purposes of coordinating with the USFS.

Construction of the Selected Snowshed would result in 1.97 acres of permanent impact to mature forest. The Proposed Bridges would result in an additional 2.28 acres, for a total of 4.25 acres.

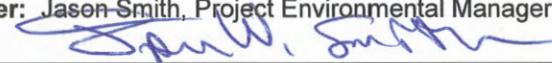
Subject: Transportation Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

Issued/Revised: June 8, 2012

Author: Karen Comings, P.E., Senior Engineer, David Evans and Associates

Signature: 

Approving Manager: Jason Smith, Project Environmental Manager, WSDOT

Signature: 

Introduction

This technical update supports the Limited Scope Supplemental Environmental Impact Statement (EIS) for the Interstate 90 (I-90) Snoqualmie Pass East, Keechelus Lake Avalanche Bridges. David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, prepared this update to supplement the impact analysis for transportation presented in the Final EIS (WSDOT 2008a) and supporting documentation, including the Transportation Discipline Report (WSDOT 2008b).

The I-90 Snoqualmie Pass East project (I-90 project) includes improvements to the existing highway from Hyak at milepost (MP) 55.1 to Easton at MP 70.3. Planned improvements would reduce road closures due to avalanches, address unstable slopes, replace deteriorating concrete pavement, add capacity, and improve ecological connectivity. The Washington State Department of Transportation (WSDOT) completed the Final EIS for the I-90 project in 2008 and the Federal Highway Administration (FHWA) issued its Record of Decision (ROD) later that same year (FHWA 2008). Construction started in 2009 and has continued in 2010 and 2011.

In fall 2011, the contractor constructing the portion of the I-90 project from MP 57.3 to MP 60.2, Guy F. Atkinson Construction, proposed a design modification to construct eastbound and westbound Bridges at MP 58.1, the Keechelus Lake Avalanche Bridges (Bridges), instead of the expanded Snowshed that was included in the Selected Alternative, described in the ROD (FHWA 2008). WSDOT has granted concept approval for this design modification as a Cost-Reduction Incentive Proposal, intended to promote innovative ideas and result in cost savings to the state.

The 1,200-foot-long Bridges would reduce risks associated with avalanches, rock fall, and landslides through removal and stabilization of loose materials upslope of the highway, and physical separation of the highway from the hillside. A combination of elevating the road surface above the existing grade and excavating up to approximately 50 feet of material below the existing grade would provide a total clearance beneath the Bridges ranging between approximately 40 and 70 feet. This space would accommodate accumulations of snow from snowfall, plowing, and avalanches with adequate freeboard (remaining distance between the

top of the accumulated snow and the Bridges) to protect motorists from additional avalanches, as they occur. The storage area beneath the Bridges has been engineered to act as a series of chutes that would direct sliding snow, rock, and debris away from the bridge piers.

To analyze the impacts of the proposed Bridges, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Bridges compared to the Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were potential effects on transportation analyzed in the Final EIS?

The Final EIS assessed a number of transportation-related issues including traffic volumes and expected growth, highway closures due to avalanches and rock slides, deteriorating pavement, highway capacity, maintenance, safety, design of sharp curves, and replacement of low-clearance bridges. This technical update focuses only on those transportation elements that would be impacted by the design modification, which are highway closures and maintenance issues. Analyses of these issues were performed in the following ways in the Final EIS.

Records of highway closures due to avalanches, weather conditions, and crew activities are kept by the WSDOT Avalanche Control Team (WSDOT 2004). These records were used by the I-90 project team to develop statistics on annual closure frequencies and durations due to avalanches. Similar records for closures due to rock fall are kept by the WSDOT Geotechnical Services Division (WSDOT 2004), which were used to develop the same statistics for closures due to rock fall. WSDOT reviewed maintenance records and summarized the maintenance activities and numbers of personnel needed to keep I-90 operating over Snoqualmie Pass.

What has changed since the Record of Decision was issued?

No substantive changes have occurred to the I-90 project's transportation goals and requirements since the ROD was issued.

In 2012, the analysis of avalanche risks was updated with refined design details (DAC 2012). The new analysis, though more detailed, did not significantly change the statistical accounts of avalanche frequency and magnitude reported in the Final EIS.

How were potential effects on transportation analyzed for this technical update?

The team compared how each structure (Snowshed and Bridges) is anticipated to perform after construction in three areas: road closures (due to snow avalanche or rock fall); maintenance requirements; and temporary transportation impacts during construction. Road closures were analyzed by estimating if the projected hours of road closure would be expected to increase with the Bridges. Maintenance requirements were analyzed by comparing maintenance requirements between the Snowshed and Bridges. Temporary construction impacts were analyzed by comparing construction tasks and staging between the Snowshed and Bridges. The intended functions of the Snowshed and the Bridges were discussed with the I-90 project design team and WSDOT personnel to compare estimates for future road closures and maintenance needs.

Impacts

What were the relevant impacts evaluated in the Final EIS?

Road Closures

The existing snowshed is located below two of five¹ mapped avalanche paths (**Exhibit 1**) and protects only the westbound lanes from avalanches. I-90 is closed at Snoqualmie Pass an average of about 42 hours each year because of avalanches (WSDOT 2008a). The Preferred Alternative from the Final EIS proposes a new, larger Snowshed in place of the existing one that would protect both eastbound and westbound lanes from four of the five avalanche paths. Avalanches would flow over the top of the Snowshed and greatly reduce the need for highway closures. The highway is protected from the fifth path by a wall with space behind the wall for snow accumulation.

WSDOT identified and rated 22 unstable slopes with potential for rock fall along the length of the I-90 project corridor. Between 1992 and 2008, there was an average of 12 hours of highway closures each year due to rock fall onto the highway. Three of the unstable slopes are located within the design modification area, with one of these rated as a “high hazard-high risk” slope (WSDOT 2008b). The Selected Alternative for the entire I-90 project corridor will reduce rock fall by one or more of the following methods: loose rocks will be removed in a controlled fashion; rock faces will be bolted and stabilized with shotcrete grout; wire mesh will be installed over the rock face; slopes will be laid back to reduce the steepness; and catchment areas for fallen rock will be improved. Construction of the Snowshed would contribute to stabilizing the adjoining slope because the structure itself would provide support against the rock face and protect traffic lanes from falling rocks.

Maintenance

The proposed Snowshed would require maintenance of the structure, lighting, ventilation, and fire suppression system. In order to maintain these systems, periodic lane closures would be required within the Snowshed (T. Kukes, pers. comm., April 16, 2012). WSDOT has estimated that these tasks would require additional full-time maintenance personnel, who would have to be trained in tunnel firefighting techniques (WSDOT 2011). The use of snow chains would also create additional wear on the pavement inside the Snowshed, where the highway would be protected from the accumulation of snow and ice, adding additional maintenance activities and costs.

Temporary Impacts

The primary temporary transportation impacts would take place during construction. These impacts would include detours, construction work zones, and reduced speed limits. WSDOT is committed to maintaining two open lanes for traffic in both directions throughout construction. However, construction would sometimes require WSDOT to reduce traffic to a single lane. WSDOT would keep lane closures as short as possible and would typically limit them to Monday through Thursday during low traffic periods. During blasting operations, traffic traveling both directions would be required to stop as a safety measure. Construction would stop for the winter

¹ Note: Exhibit 1 appears to show seven avalanche paths, but three of these paths are initiated in the same area and are, therefore, considered one path.

months, and traffic would be separated from construction zones using a four-lane configuration similar to existing conditions where possible (WSDOT 2008a).

Exhibit 1
Avalanche paths in relation to the Snowshed and Avalanche Bridges.



Would the design modification change the impacts presented in the Final EIS?

Road Closures

The design modification proposes to reduce road closures due to avalanches by constructing two Bridges, eastbound and westbound. These structures would allow four of the five avalanche paths to flow underneath the highway (**Exhibit 1**). The highway would be protected from the fifth path with a wall and space behind it for snow accumulation. It is anticipated that this design would reduce highway closures from avalanches to the same degree as the Snowshed. Both designs would reduce the frequency and duration of road closures due to avalanches and would prevent avalanches with less than a 100-year return period from reaching the highway (DAC 2012). While the need for avalanche control would be greatly reduced, both designs would also allow controlled avalanche maintenance to be conducted, if necessary, without closing the highway. For more detail on the avalanche analysis, see the Avalanche Risk Technical Update (DEA 2012).

The Bridges design modification would, in general, address unstable slopes using the similar rock stabilizing methods described in the Final EIS for the Snowshed. The main difference between the two designs is at the slope directly adjacent to the structure. In order to create clearance for avalanches, the design modification would cut the rock face back away from the highway and remove protruding areas. As part of this work, the rock face would be excavated with consideration for stabilizing the slope and reducing the risk of rock fall. Even though the designs differ in their approach to slope stabilization directly adjacent to the structure, it is anticipated that both the Snowshed and Bridges designs would reduce rock fall with a similar level of effectiveness. For more detail on the rock fall analysis, see the Unstable Slope Hazard Areas Technical Update (Golder 2012).

Maintenance

Although there would be some increased maintenance for plowing additional lanes and maintaining stormwater treatment systems, both designs would, in total, reduce existing maintenance requirements because of new pavement, reduced avalanche closures, and reduced rock fall. However, maintenance requirements for the Bridges would be even less than for the Snowshed. The Snowshed's primary maintenance needs are for the lighting, ventilation, and fire suppression systems associated with the structure. Maintaining these systems would require additional, specially trained personnel (WSDOT 2011) and periodic lane closures that could delay traffic (T. Kukes, pers. comm., April 16, 2012). The Bridges would not have these requirements and, therefore, would have lower operating costs and fewer periods of restricted traffic. Maintenance of the Bridges would primarily be plowing and de-icing of the bridge deck consistent with other structures in the I-90 corridor, and structural inspections every two years (J. Henderson, pers. comm., April 3, 2012).

Temporary Impacts

Requirements for maintaining traffic during construction would not change for the design modification; two lanes open in both directions at all times with the exception of necessary and temporary closures and lane restrictions. Construction of the Bridges would reduce the need for closures and lane restrictions compared to the Snowshed construction by moving active traffic away from the construction area, which would improve safety to both contractors and drivers.

Once the eastbound Bridge is completed, eastbound and westbound traffic would be temporarily accommodated on the structure, while the westbound structure is built. This configuration would help WSDOT meet its commitment of keeping two lanes open to traffic in both directions throughout construction. Complete highway closures required for construction would be reduced by about half for the Bridges because no construction would be required above traffic lanes (K. Dusenberry, pers. comm., May 3, 2012).

Mitigation

What commitments were made in the Final EIS?

Best management practices for transportation will be designed to meet commitments and performance standards that apply to temporary traffic control during construction, as well as the *Standard Specifications for Road, Bridge, and Municipal Construction* (WSDOT 2008c) and all other applicable WSDOT design manuals and standards.

Since there will be no permanent adverse impacts to transportation, no compensatory mitigation will be required.

Would the design modification require additional commitments?

The standards and commitments agreed upon in the Final EIS (WSDOT 2008a) remain unchanged. No additional mitigation is required or proposed.

Conclusion

The impacts from the design modification are consistent and comparable with those documented in the Final EIS and the subsequent ROD. The following information supports this determination:

- The design modification would address avalanche and rock fall risks and delays to a similar extent as the Snowshed.
- Maintenance for the Bridges would be less than the Snowshed because the Bridges would not require ventilation and fire suppression systems.
- There would be fewer closures and lane reductions during construction of the Bridges than for the Snowshed primarily because construction would not need to be done above traffic lanes.

FHWA and WSDOT have reviewed this technical update and concur with the findings.

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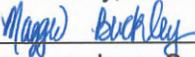
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- . 2011. Snowshed to Keechelus Dam Phase 1C – Replace Snowshed and Add Lanes: Contract Provisions for Construction of I-90 MP 57.34 to MP 60.23. Volume 2 of 5, p.7.

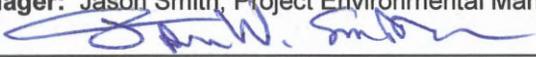
Subject: Land Use Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

Issued/Revised: June 6, 2012

Author: Maggie Buckley, Environmental Planner, David Evans and Associates, Inc.

Signature: 

Approving Manager: Jason Smith, Project Environmental Manager, WSDOT

Signature: 

Introduction

This technical update supports the Limited Scope Supplemental Environmental Impact Statement (EIS) for the Interstate 90 (I-90) Snoqualmie Pass East, Keechelus Lake Avalanche Bridges. David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, prepared this update to supplement the impact analysis for land use presented in the Final EIS (WSDOT 2008a) and supporting documentation, including the Land Use Discipline Report (WSDOT 2003) and the Land Use Technical Memorandum (WSDOT 2008b).

The I-90 Snoqualmie Pass East project (I-90 project) includes improvements to the existing highway from Hyak at milepost (MP) 55.1 to Easton at MP 70.3. Planned improvements would reduce road closures due to avalanches, address unstable slopes, replace deteriorating concrete pavement, add capacity, and improve ecological connectivity. The Washington State Department of Transportation (WSDOT) completed the Final EIS for the I-90 project in 2008 and the Federal Highway Administration (FHWA) issued its Record of Decision (ROD) later that same year (FHWA 2008). Construction started in 2009 and has continued in 2010 and 2011.

In fall 2011, the contractor constructing the portion of the I-90 project from MP 57.3 to MP 60.2, Guy F. Atkinson Construction, proposed a design modification to construct eastbound and westbound Bridges at MP 58.1, the Keechelus Lake Avalanche Bridges (Bridges), instead of the expanded Snowshed that was included in the Selected Alternative, described in the ROD (FHWA 2008). WSDOT has granted concept approval for this design modification as a Cost-Reduction Incentive Proposal, intended to promote innovative ideas and result in cost savings to the state.

The 1,200-foot-long Bridges would reduce risks associated with avalanches, rock fall, and landslides through removal and stabilization of loose materials upslope of the highway, and physical separation of the highway from the hillside. A combination of elevating the road surface above the existing grade and excavating up to approximately 50 feet of material below the existing grade would provide a total clearance beneath the Bridges ranging between approximately 40 and 70 feet. This space would accommodate accumulations of snow from snowfall, plowing, and avalanches with adequate freeboard (remaining distance between the

top of the accumulated snow and the Bridges) to protect motorists from additional avalanches, as they occur. The storage area beneath the Bridges has been engineered to act as a series of chutes that would direct sliding snow, rock, and debris away from the bridge piers.

To analyze the impacts of the proposed Bridges, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Bridges compared to the Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were potential land use impacts analyzed in the Final EIS?

In support of the original EIS, the Land Use Discipline Report (WSDOT 2003) and Land Use Technical Memorandum (WSDOT 2008b) identified existing land uses and ownership patterns within the I-90 project area. Both documents discussed the degree to which the I-90 project with the Snowshed would impact existing land uses and ownership patterns. They also contained an evaluation of the I-90 project's consistency with applicable local, state, and federal land use plans and regulations in place at the time. The land use analysis of the Land Use Technical Memorandum was based on the 2008 Kittitas County Comprehensive Plan (Kittitas County 2008) and the United States (US) Department of Agriculture – US Forest Service (USFS) management plans, including the Wenatchee Forest Plan, as amended (USFS 1990); the Northwest Forest Plan (USFS and BLM 1994); and the Snoqualmie Pass Adaptive Management Area (SPAMA) Plan Final Environmental Impact Statement (USFS and USFWS 1997). The Technical Memorandum also identified potential acquisition and relinquishment areas based upon the preliminary I-90 project design.

What has changed since the Record of Decision was issued?

The Kittitas County Comprehensive Plan is updated on a regular basis by the County. The most recent version of the comprehensive plan (Kittitas County 2011) was reviewed for this analysis.

The County issued all permits for the I-90 project as requested by WSDOT. The USFS issued a consistency determination for the I-90 project via a Letter of Consent dated August 18, 2009.

The WSDOT Environmental Procedures Manual (EPM) is also updated on a regular basis by WSDOT. The June 2011 update to the EPM (WSDOT 2011) merged six former EPM chapters into one (Chapter 450, Land Use). Each former chapter is listed below, followed by a statement of how the content of each chapter is being addressed in this update.

- Chapter 450, Land Use: Addressed in this technical update.
- Chapter 451, Land Use, Land Use Plans and Growth Management: Addressed in this technical update.
- Chapter 452, Coastal Areas and Shoreline: Addressed in this technical update, the Aquatic Species Technical Update (DEA 2012a), and the Wetland Resources Technical Update (DEA 2012b).

- Chapter 453, Wild and Scenic Rivers: There are no designated wild and scenic rivers within the I-90 project area. Therefore, this topic is not addressed in this technical update.
- Chapter 454, Farmland and Agriculture: The Land Use Discipline Report (WSDOT 2003) identified several conditions in the human environment, including farmland, which would not be affected by the I-90 project. This topic is not addressed in this technical update.
- Chapter 455, Public Lands, Section 4(f), 6(f), and Forests: Section 4(f) resources would not be impacted by the design modification. Demolition of the existing snowshed is addressed in the original EIS and ROD.

How were potential land use impacts analyzed for this technical update?

DEA used a Geographic Information System (GIS) to compare the differences in footprints and potential land use impacts for the Snowshed and Bridges. The areas of land needed for permanent highway right-of-way and for temporary use during construction of the Bridges were compared to those of the Snowshed within the design modification area shown in **Exhibit 1**. DEA then considered whether the design modification would impact land uses and ownership patterns, as well as whether any impacts would differ from what would occur with the Snowshed. The analysis also considered whether the Bridges are consistent with the Kittitas County Comprehensive Plan (Kittitas County 2011) and USFS management plans.

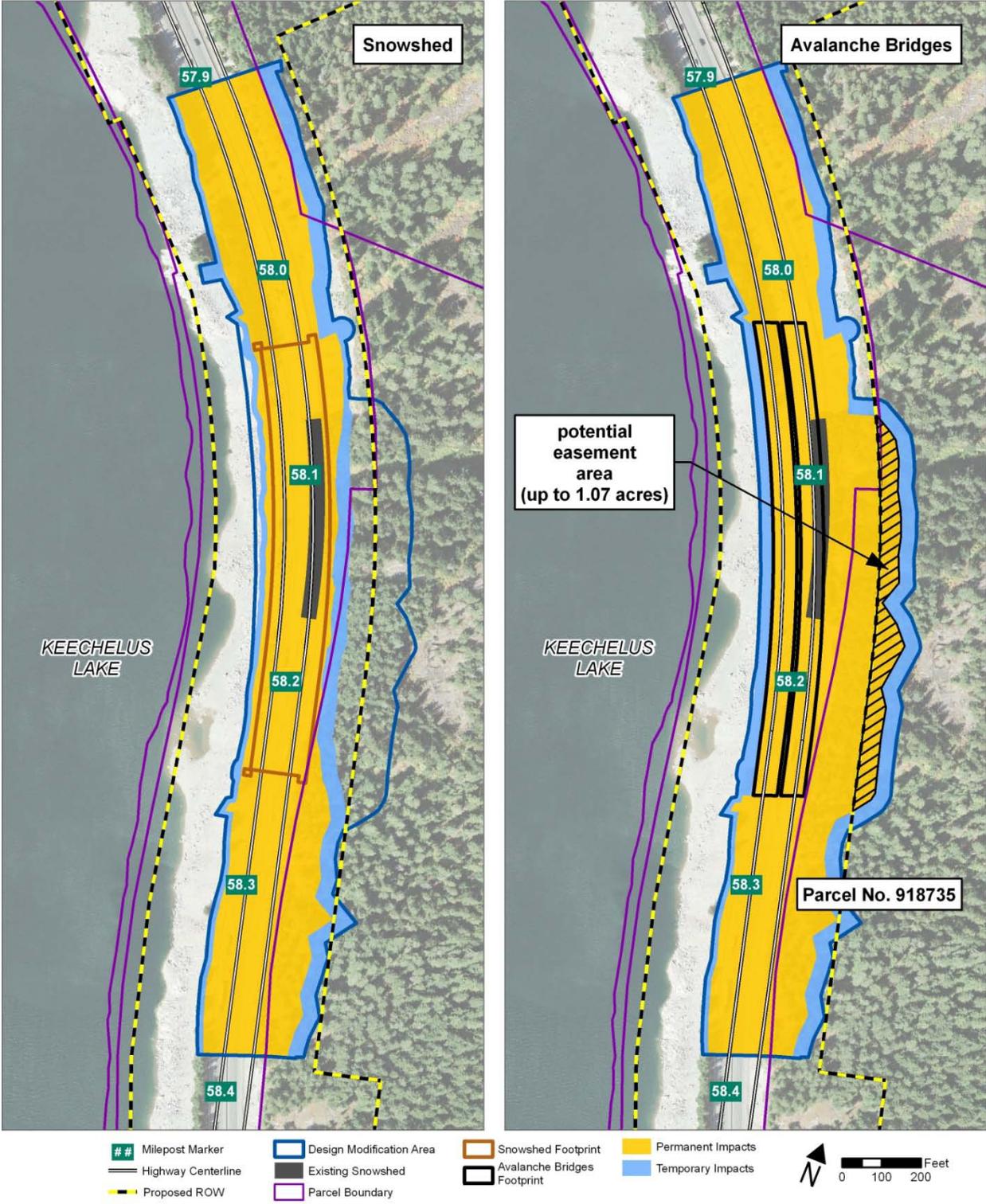
Impacts

What were the relevant impacts evaluated in the Final EIS?

As discussed in the Final EIS, the I-90 project would need to acquire or secure authorization to use both public and private land for new highway right-of-way. Land would be acquired in long, narrow strips adjacent to the existing highway. The I-90 project with the Snowshed would require the permanent acquisition of 7.3 acres of private land and 127.2 acres of public land, including a 36.52-acre right-of-way easement from the USFS. The Final EIS determined that the land acquisitions and easements needed for new highway right-of-way would not change the existing land use patterns or ownership outside of the right-of-way, nor would they be incompatible with adjacent land uses.

Construction of the I-90 project with the Snowshed would occur within the Keechelus Lake shoreline and associated critical areas. In the Final EIS, FHWA and WSDOT indicated that Kittitas County would make a formal determination about whether the I-90 project was consistent with County land use regulations, including shorelines and critical areas, as part of project permitting. The Final EIS also indicated that the USFS would make a formal determination as to whether the I-90 project was consistent with USFS land management plans after FHWA and WSDOT published the ROD. This determination of consistency is part of a USFS and FHWA Memorandum of Understanding (MOU).

Exhibit 1
 Comparison of right-of-way acquisition areas for the Snowshed and Avalanche Bridges



Would the design modification change the permanent impacts presented in the Final EIS?

The 36.52-acre right-of-way easement from the USFS for the I-90 project included a 0.42-acre easement on Kittitas County Tax Parcel No. 918735. As shown in **Exhibits 1 and 2**, the Bridges would require an additional right-of-way easement of up to 1.07 acres on that same parcel. The easement includes all areas with slope cuts and all potential maintained facilities associated with the Bridges, such as rock fall netting, avalanche fences, etc. (K. Jones, pers. comm., April 12, 2012). The Bridges would increase the amount of land needed from the USFS for the I-90 project by up to 3 percent, for a total of 37.59 acres. No additional private property would be acquired and no businesses or residences would be displaced.

Exhibit 2

Potential easement acquisition areas within the design modification area

Kittitas County Tax Parcel #	Ownership	Zoning	Comprehensive Plan Land Use Designation	Previously Secured Snowshed Right-of-Way	Additional Avalanche Bridges Right-of-Way
918735	Public	Commercial Forest	Commercial Forest	0.42 ac	1.07 ac

How would anticipated permanent impacts affect previous decisions and current land management?

As noted, the Bridges would require additional right-of-way from public land managed by the USFS. WSDOT would not obtain ownership of this federal land. Rather, the federal agencies with jurisdiction would transfer a right-of-way easement to the US Secretary of Transportation. This easement, in turn, is used by FHWA and WSDOT for the construction and operation of the I-90 infrastructure¹.

Acquisition of easements on USFS land is governed by two MOUs between the USFS, WSDOT, and FHWA (USFS and WSDOT 2002, USFS and FHWA 1998). These memoranda stipulate that the standard US Department of Transportation Easement Deed will be used on all Forest Highway and Federal-Aid System rights-of-way within National Forest boundaries and that easement grants by the USFS are subject to specified conditions in order to assure that the project is consistent with USFS requirements. The USFS procedure for processing land transfers is detailed in the MOUs and summarized in Chapter 1.13 of the Final EIS. The procedure for granting an easement modification will be the same for the Supplemental EIS as it was for the original EIS.

The Kittitas County Comprehensive Plan land use and zoning designation of the parcel that would require a right-of-way easement is Commercial Forest (**Exhibit 2**). The purpose of this designation is to provide for areas of the County wherein natural resource management is the highest priority and where the subdivision and development of lands for uses and activities

¹ 23 USC§ 317, The Act of August 27th, 1958, states: "Appropriation for highway purposes of lands or interests in lands owned by the United States": Chapter 107(d) Whenever rights-of-way, including control of access, on the Interstate System are required over lands or interests in lands owned by the United States, the Secretary may make such arrangements with the agency having jurisdiction over such lands as may be necessary to give the State or other person constructing the projects on such lands adequate rights-of-way and control of access thereto from adjoining lands, and any such agency is directed to cooperate with the Secretary in this connection.

incompatible with resource management are discouraged. This land use designation did not change in the 2011 update to the Kittitas County Comprehensive Plan (Kittitas County 2011).

The minor amount of additional right-of-way easement needed to accommodate the Bridges would not change the existing land use patterns or ownership in the design modification area, nor would the Bridges be incompatible with adjacent land uses. There are no revised or new policies contained in the 2011 update to the Kittitas County Comprehensive Plan with which the Bridges would be inconsistent. Given the minor change in impacted acreage with the design modification, and the location of this acreage, it is anticipated that Kittitas County would determine that the Bridges are consistent with their land use regulations.

Similar to the Snowshed, construction of the Bridges would occur within the Keechelus Lake shoreline and associated critical areas. The shoreline designation of the design modification area is Conservancy Environment (Kittitas County 1975). The Conservancy Environment is characterized by land uses which are primarily related to natural resource use. According to the definition of critical areas in the Kittitas County Critical Areas Ordinance, the design modification area may be located within wetland, fish and wildlife conservation, and geologically hazardous critical areas (Kittitas County 1994). Kittitas County would conduct a shoreline and critical areas review as part of project permitting prior to construction of the Bridges.

Would the design modification change the temporary impacts presented in the Final EIS?

The Bridges would require temporary use of USFS land for construction-related activities. Outside of the additional easement area, approximately 1.1 acres on Tax Parcel No. 918735 could be temporarily occupied during construction, as opposed to 1.5 acres with the Snowshed (**Exhibit 1**). Section 7 of the MOU between WSDOT and USFS indicates that use or occupancy of National Forest System lands for other highway-related uses outside easement areas will require a USFS-issued Special Use Permit (USFS and WSDOT 2002). WSDOT would obtain a Special Use Permit or an amendment of an existing permit prior to construction.

Mitigation

What commitments were made in the Final EIS?

Avoidance and minimization measures for land use presented in the Final EIS included modifying design to avoid private property wherever possible, designing connectivity improvements to be consistent with USFS land management plans, and using eminent domain and condemnation procedures only as a last resort. Compensatory mitigation presented in the Final EIS included compliance with the federal Uniform Relocation Act of 1970, as amended. None of these commitments are specifically attributed to the Snowshed or the design modification area.

Would the design modification require additional commitments?

The design modification avoids and minimizes impacts to the greatest extent practicable. Additional avoidance, minimization, or compensatory mitigation measures are not required.

Conclusion

The design modification would alter the current land use from commercial forestry to roadway on an additional 1.07 acres of public land compared to the Snowshed. This is a minor impact that would not affect adjacent land uses or ownership patterns. Similar to the Snowshed, construction of the Bridges would occur within the Keechelus Lake shoreline and associated critical areas. Therefore, the Bridges would not result in any new potentially significant land use impacts, and would be consistent with the previous findings presented within the Final EIS and the subsequent ROD.

The Final EIS indicated that Kittitas County would make a formal determination about whether the I-90 project with the Snowshed was consistent with its land use regulations as part of project permitting. All requested project permits, including a Shoreline Substantial Development Permit Exemption, were subsequently issued to WSDOT. Therefore, the I-90 project was determined consistent with the Kittitas County Comprehensive Plan and Kittitas County Code, including shorelines and critical areas. Considering the minor change in impacted acreage with the proposed design modification, it is anticipated that Kittitas County would conclude that the Bridges are consistent with the Kittitas County Comprehensive Plan and Kittitas County Code.

The Final EIS indicated that the USFS would make a formal determination as to whether the I-90 project was consistent with USFS land management plans after FHWA and WSDOT published the ROD. The USFS issued a consistency determination via a Letter of Consent dated August 18, 2009. The letter consented to the appropriation and transfer of lands requested by WSDOT for construction, operation, and maintenance of the Selected Alternative. The use of an additional 1.07 acres of USFS land for the design modification is minimal when compared to the 36.52 acres already acquired for the project. Based on discussions with USFS to date, it is anticipated that the USFS would also determine the design modification is consistent with USFS management plans.

FHWA and WSDOT have reviewed this technical update and concur with the findings. Kittitas County and the USFS will make separate determinations regarding the proposed design modification, which are presumed to be similar to the determinations which were made on the original EIS and subsequent permits.

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Technical Memorandum Visual Quality

Subject: Visual Quality Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

Issued/Revised: June 8, 2012

Author: Jon Gage, Landscape Architect, David Evans and Associates, Inc.

Signature: 

Approving Manager: Jason Smith, Project Environmental Manager, WSDOT

Signature: 

Introduction

This technical update supports the Limited Scope Supplemental Environmental Impact Statement (EIS) for the Interstate 90 (I-90) Snoqualmie Pass East, Keechelus Lake Avalanche Bridges. David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, prepared this update to supplement the impact analysis for visual quality presented in the Final EIS (WSDOT 2008a) and supporting documentation, including the *Visual Discipline Report Supplement* (WSDOT 2007).

The I-90 Snoqualmie Pass East project (I-90 project) includes improvements to the existing highway from Hyak at milepost (MP) 55.1 to Easton at MP 70.3. Planned improvements would reduce road closures due to avalanches, address unstable slopes, replace deteriorating concrete pavement, add capacity, and improve ecological connectivity. The Washington State Department of Transportation (WSDOT) completed the Final EIS for the I-90 project in 2008 and the Federal Highway Administration (FHWA) issued its Record of Decision (ROD) later that same year (FHWA 2008). Construction started in 2009 and has continued in 2010 and 2011.

In fall 2011, the contractor constructing the portion of the I-90 project from MP 57.3 to MP 60.2, Guy F. Atkinson Construction, proposed a design modification to construct eastbound and westbound Bridges at MP 58.1, the Keechelus Lake Avalanche Bridges (Bridges), instead of the expanded Snowshed that was included in the Selected Alternative, described in the ROD (FHWA 2008). WSDOT has granted concept approval for this design modification as a Cost-Reduction Incentive Proposal, intended to promote innovative ideas and result in cost savings to the state.

The 1,200-foot-long Bridges would reduce risks associated with avalanches, rock fall, and landslides through removal and stabilization of loose materials upslope of the highway, and physical separation of the highway from the hillside. A combination of elevating the road surface above the existing grade and excavating up to approximately 50 feet of material below the existing grade would provide a total clearance beneath the Bridges ranging between approximately 40 and 70 feet. This space would accommodate accumulations of snow from snowfall, plowing, and avalanches with adequate freeboard (remaining distance between the top of the accumulated snow and the Bridges) to protect motorists from additional avalanches,

as they occur. The storage area beneath the Bridges has been engineered to act as a series of chutes that would direct sliding snow, rock, and debris away from the bridge piers.

To analyze the impacts of the proposed Bridges, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Bridges compared to the Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were potential visual impacts analyzed in the Final EIS?

Visual analysis was performed following the guidelines of the US Department of Transportation FHWA publication Visual Assessment for Highway Projects (FHWA 1981). For this method, a specialist rates the three factors considered in determining visual quality as follows:

- Vividness is rated on a scale of 1 to 7, with 7 indicating a high (desirable) degree of vividness.
- Intactness is rated on a scale of 1 to 7, with 7 indicating a highly intact (desirable) landscape that contains no encroaching elements.
- Unity is rated on a scale of 1 to 7, with 7 representing a landscape with a coherent, harmonious visual pattern (desirable).

What do the Total Visual Quality Rating numbers mean?

7 - Dramatic, Pristine Natural Environment with water, mountains, and mature vegetation, or Superb example of built environment in dramatic physical setting.
6 – Very High
5 – High
4 – Moderately High
3 – Average
2 – Moderately low
1 - Low

To determine a total visual quality rating, the analyst takes a numerical average of the three ratings for vividness, intactness, and unity. A full description of the methodology can be found on pages 34 and 35 of the Visual Impact Assessment Discipline Report (WSDOT 2004).

What has changed since the Record of Decision was issued?

No significant changes to existing conditions for visual quality in the design modification area or visual regulations and guidance have occurred since publication of the Final EIS.

How were potential visual resource impacts analyzed for this technical update?

A comparison of the temporary and permanent impact areas that would affect visual resources for the Snowshed and Avalanche Bridges is shown in **Exhibit 1**. The visual analysis study area extends beyond the design modification area to include views both *from* and *toward* the design modification area (**Exhibit 2**). Visual analyses of key views determined in the Final EIS that will be impacted by the design modification were reanalyzed. Potential impacts were based on design information provided to DEA by Jacobs Engineering for the Bridges, in addition to the base design for the Snowshed provided by WSDOT.

Exhibit 1

Temporary and permanent impact areas for the Snowshed and Avalanche Bridges

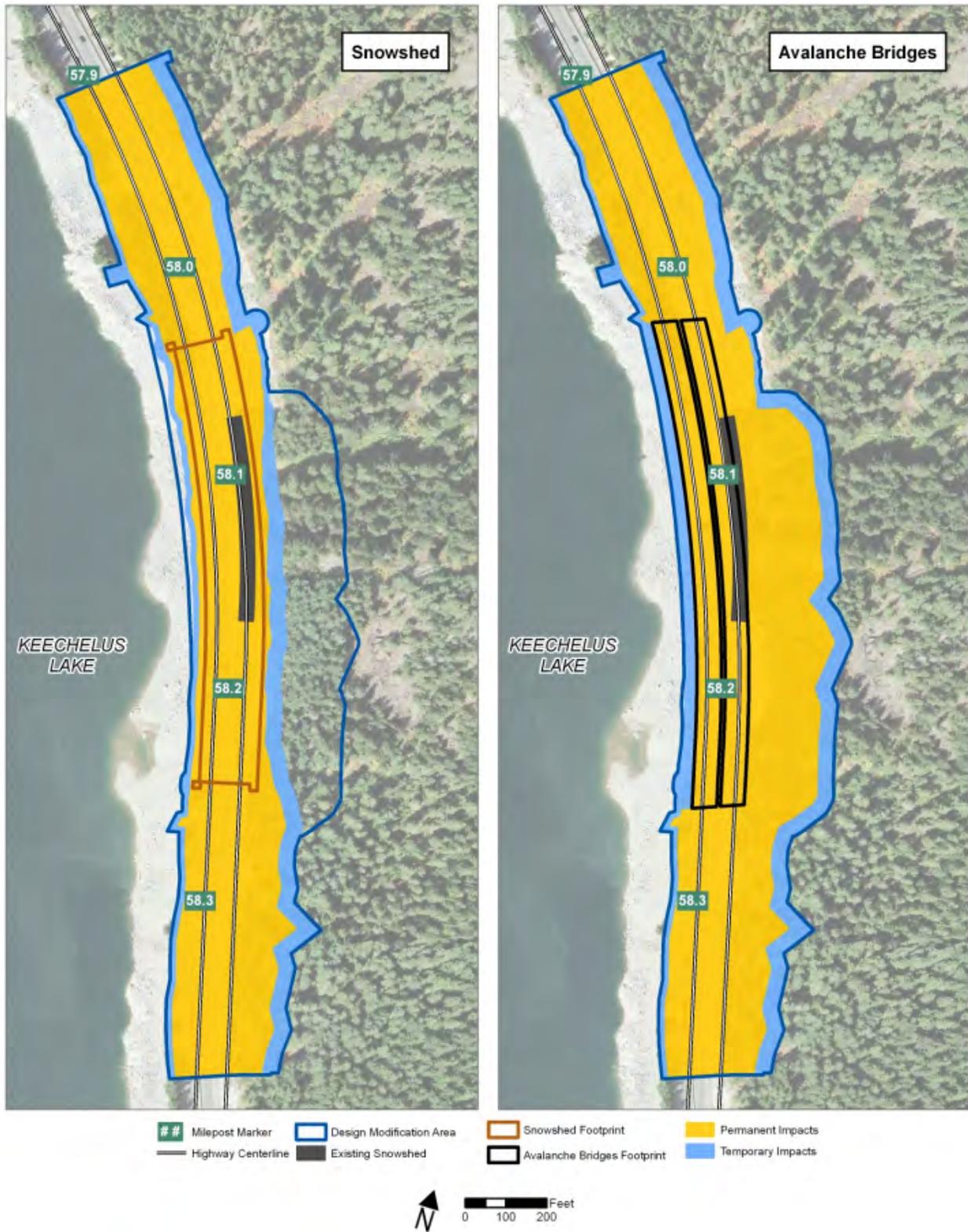


Exhibit 2
Vicinity map with key views



Impacts

What were the relevant impacts evaluated in the Final EIS?

A total of three key views identified in the 2007 *Visual Discipline Report Supplement* would be impacted by the Bridges. As shown in **Exhibit 2**, these key views are 2007-3 (from the John Wayne Pioneer Trail), 2007-4 (view eastbound from MP 58.0), and 2007-5 (view westbound from MP 58.3). Complete descriptions of the visual analysis of existing conditions and the Snowshed at these key views can be found in the “Affected Environment” and “Potential Effect” sections of the 2007 *Visual Discipline Report Supplement*. As summarized in **Exhibit 3**, the Snowshed would increase visual ratings at two key views on I-90 and decrease visual ratings at the key view from John Wayne Trail (WSDOT 2007). These views were not visually simulated in the 2007 *Visual Discipline Report Supplement*. DEA prepared a visual simulation of the Snowshed for key view 2007-3 (**Exhibit 4**) for comparison as part of this technical update.

Exhibit 3

Total visual quality ratings from Final EIS

Key View	Location	Existing Visual Quality Rating	Snowshed Visual Quality Rating
2007-3	From the John Wayne Pioneer Trail	5.5	5.3
2007-4	View Eastbound from MP 58.0	5.1	5.7
2007-5	View Westbound from MP 58.3	4.7	5.3

Source: Appendix V of the Final EIS

Exhibit 4

Comparison of existing snowshed vs. proposed Snowshed from Key View 2007-3



Existing snowshed, as seen from the John Wayne Pioneer Trail.



Snowshed, as seen from the John Wayne Pioneer Trail.

Would the design modification change the impacts presented in the Final EIS?

The following section compares the visual impacts of the Bridges and Snowshed.

Key View 2007-3: The Bridges from the John Wayne Pioneer Trail

From this distance, the Bridges would appear as a larger structure than the existing snowshed as shown in the visual simulation (**Exhibit 5**). The Bridges would span approximately 1,200 feet at an approximate elevation of 2,580 feet above mean sea level (AMSL) at their highest point. From John Wayne Trail, bridge piers would be visible, as well as four avalanche chutes excavated directly upslope and beneath the bridges that would require removal of some existing vegetation directly above the existing snowshed. These changes would increase the signs of development, slightly reducing intactness. The Bridges would not disrupt visual harmony, resulting in no change in unity.

By comparison, the Snowshed would be nearly as long and tall as the Bridges (approximately 1,100 feet long with an approximate roof elevation of 2,577 feet AMSL) (**Exhibit 4**). The Snowshed would have a similar reduction in intactness as described in the 2007 *Visual Discipline Report Supplement*, but would likely be more memorable for viewers because from this view it is a unique structure in the I-90 corridor, resulting in a slightly higher vividness rating than the Bridges. The Bridges and abutment walls would be colored (exact color not shown in simulation but would be consistent with the Architectural Design Guidelines) to match the existing rock which would help them blend from this distance. The degree of visual impact between the Bridges and Snowshed would be minor from this view.

The total visual quality rating for the Bridges would be a high rating of 5.2, down from 5.5 (existing snowshed) and 5.3 (Snowshed). See **Appendix A** for the visual analysis matrix rating form.

Exhibit 5
Comparison of existing snowshed vs. Bridges from Key View 2007-3



Existing snowshed, as seen from the John Wayne Pioneer Trail.



Bridges, as seen from the John Wayne Pioneer Trail.

Key View 2007-4: Bridges View Eastbound from MP 58.0

This key view could not be visually simulated because it would be located in the proposed westbound lane, approximately 20 feet below the Bridges. The viewer traveling eastbound on I-90 would generally see the westbound Bridge that may be as high as 20 feet above the eastbound bridge at pier 1. The piers, underside of Bridge, and avalanche screen visible from this view would increase signs of development and encroachment, decreasing the intactness rating for the Bridges. These new elements would also disrupt visual harmony, decreasing unity. A higher viewing elevation from the Bridges would provide better views of Keechelus Lake and mountain ranges; however, this would be offset by partial loss of views of the hillside above the westbound bridge, decreasing vividness.

The total visual quality rating for the Bridges would be a moderately high rating of 4.3, down from 5.1 (existing snowshed) and 5.7 (Snowshed).



Key View 2007-4: existing snowshed

Key View 2007-5: Bridges View Westbound from MP 58.3

This key view could not be simulated because it would be located on the proposed eastbound lane shoulder, approximately 15 feet below the Bridges. The viewer traveling westbound would generally see the steep rock slope laid back in the foreground, and the existing snowshed would no longer be visible in the middleground. The absence of the existing or proposed Snowshed would decrease signs of development from this view and result in an increase in the intactness rating for the Bridges. Some vegetation directly above the existing snowshed, and between I-90 and the shoreline, would be removed to construct the eastbound lanes. However, a higher viewing elevation from the Bridges would provide better views of Keechelus Lake and mountain ranges than are visible from the existing snowshed or proposed Snowshed, increasing vividness for the Bridges. The Bridges would not disrupt visual harmony, resulting in no change in unity.

The total visual quality rating for the Bridges would be a high rating of 5.6, up from 4.7 (existing snowshed) and 5.3 (Snowshed).



Key View 2007-5: existing snowshed

In summary, the total visual quality rating from the John Wayne Pioneer Trail would slightly decrease from 5.5 to 5.2 for the Bridges, but would remain high. The total visual quality rating traveling eastbound from MP 58.0 would decrease from 5.1 (high) to 4.3 (moderately high) for the Bridges. The total visual quality rating traveling westbound from MP 58.3 would increase from 4.7 (moderately high) to 5.6 (high) for the Bridges (**Exhibit 6**). The average existing visual quality for these key views is 5.1 and the average visual quality for the Bridges is 5.0. By comparison, the average existing visual quality for the Snowshed is 5.4. WSDOT does not consider a total visual quality rating change of less than 1.0 to be a substantial visual impact (WSDOT 2011a).

Exhibit 6

Total visual quality ratings compared

Key View	Location	Existing	Snowshed	Bridges
2007-3	From the John Wayne Pioneer Trail	5.5	5.3	5.2
2007-4	View Eastbound from MP 58.0	5.1	5.7	4.3
2007-5	View Westbound from MP 58.3	4.7	5.3	5.6

Mitigation

What commitments were made in the Final EIS?

WSDOT will meet the terms of the Project *Architectural Design Guidelines* and project roadside master plan.

Would the design modification require additional commitments?

The design modification for the Bridges would not require additional avoidance, minimization, or compensatory mitigation measures.

What measures are proposed to minimize and mitigate visual impacts?

The Bridges are consistent with the visual character of other bridges in the I-90 project corridor and will not stand out as a new or unique structure.

They would be designed consistent with Appendix X, *Architectural Design Guidelines* (WSDOT 2008) and be colored to match the rock slopes to minimize visual impacts by blending with their surroundings.

Vegetation clearing limits for the avalanche chutes would generally stop at the cut limits. Roadside revegetation (where practicable in non-rock slope areas) would be consistent with the Roadside Classification Plan (WSDOT 2011b).

Conclusion

The design modification for the Bridges would not result in any new substantial visual impacts, consistent with the findings for the I-90 project presented in the Final EIS and Record of Decision. The following conclusions support this determination:

- WSDOT does not consider a total visual quality rating change of less than 1.0 to be a substantial visual impact (WSDOT 2011a).
- The average existing visual quality for these key views is 5.1 and the average visual quality for the Bridges is 5.0. By comparison, the average existing visual quality for the Snowshed is 5.4.

FHWA and WSDOT have reviewed this technical update and concur with the findings.

References

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- . 2011b. *Roadside Classification Plan*, Publication M 25-31. November.

Appendix A: Visual Analysis Matrix Rating Form

VISUAL ANALYSIS MATRIX																					
I-90 Snoqualmie Pass East 2012 Phase 1C CRIP																					
ALTERNATIVE	EXISTING / MITIGATED	ORIENTATION TO FACILITY	ORIENTATION TO FACILITY			VIEWER POSITION			VIVIDNESS					INTACTNESS			UNITY	TOTAL			
			FOREGROUND	MIDDLE GROUND	BACKGROUND	INFERIOR	LEVEL	SUPERIOR	LANDFORM	WATERFORM	VEGETATIVE	MANMADE	AVERAGE	DEVELOPMENT	ENCROACHMENT	AVERAGE	UNITY	TOTAL VISUAL QUALITY			
KEY VIEW 2007-3	EXISTING	Toward	150'	1000'	2500'		a			6	7	8	5	6.0	5	5	5.5	5	5.5		
Snowbridge from trail	MITIGATED									6	7	8	3	5.5	5	5	5.0	5	5.2		
KEY VIEW 2007-4	EXISTING	From	100'	350'	300'		k			6	4	8	5	5.3	5	5	5.0	5	5.1		
Snowbridge EB MP 53	MITIGATED									5	6	5	4	5.0	4	4	4.0	4	4.3		
KEY VIEW 2007-5	EXISTING	From	10'	100'	4 mi		a			5	0	8	5	4.0	5	5	5.0	5	4.7		
Snowbridge WB MP 58 &	MITIGATED									5	3	8	3	4.8	6	6	6.0	6	5.8		
Average of Existing																				5.1	
Average Post Project																					5.0

Vividness:
 7 - Very High
 6 - High
 5 - Moderately High
 4 - Average
 3 - Moderately Low
 2 - Low
 1 - Very Low
 - Non-existent

Intactness:
Development:
 7 - No development
 6 - Little development
 5 - Some development
 4 - Average level of development
 3 - Moderately high development
 2 - High level of development
 1 - Very high level of development
Encroachment (undesirable eyesores):
 7 - None
 6 - Few
 5 - Some
 4 - Average
 3 - Several
 2 - Many
 1 - Very Many

Unity:
 7 - Very High
 6 - High
 5 - Moderately High
 4 - Average
 3 - Moderately Low
 2 - Low
 1 - Very Low
 - Non-existent

Rater's Total Visual Quality Score Breakdown:
 7 - Dramatic, Pristine Natural Environment with water, mountains, and mature vegetation or Superb example of built environment in dramatic physical setting
 6 - Very High
 5 - High
 4 - Moderately High
 3 - Average
 2 - Moderately Low
 1 - Low

The Visual Quality Technical Update supporting the Interstate 90 (I-90) Snoqualmie Pass East Avalanche Structures Supplemental Environmental Impact Statement (EIS) was finalized in June 2012. Since then, additional design data became available and additional analysis was conducted for the Draft Supplemental EIS. This addendum describes the additional information that supplements the findings presented in the technical update.

Why are these changes necessary?

A higher quality photograph was taken from Key View 2007-3 in June 2012. The new photograph shows hillside modifications from ongoing I-90 construction west of the Existing Snowshed. Design visualizations have been revised to incorporate changes in hillside grading for avalanche chutes. Additional discussion has been provided on views from the new roadway, which is important for US Forest Service (USFS) to determine consistency with the Forest Plan. Additional design details show the Cascadian Style application of the Architectural Design Guidelines.

What is the new information for Visual Quality?

Impacts

The design visualizations at Key View 2007-3 for the Snowshed (**Exhibit 4** from the technical update) and Bridges (**Exhibit 5** from the technical update) have been revised to be consistent with WSDOT's Architectural Design Guidelines (WSDOT 2008). They also use the newer higher resolution photograph of more recent conditions that are seen from the John Wayne Pioneer Trail across Keechelus Lake. Also, as a result of design refinements, the clearing limits required for the avalanche chutes would not go as far up the hillside as previously anticipated for the Proposed Bridges. **Exhibit 5** has been revised to reflect less vegetation clearing upslope of the Bridges. These changes in the design visualizations do not change the overall visual quality rating for the three key views combined and, therefore, do not change the conclusions of this technical update.

The USFS manages changes in views for those traveling along this state and National Scenic Byway. The current Forest Plan assigns the corridor to a land use designation of Scenic Travel – Retention. The proposed Forest Plan Revision would maintain a similar management of scenic views. The USFS previously determined that the I-90 project including the Selected Snowshed is consistent with the Forest Plan. Although the Proposed Bridges differ from the Selected Snowshed in appearance and would require more alteration of the adjacent hillside forest, adherence to WSDOT's Architectural Design Guidelines should ensure these structures are also consistent with Forest Plan objectives. Visual quality for travelers within the design modification area would improve. While in the Selected Snowshed, scenic views of mountains, lake and forest would be mostly blocked (WSDOT 2007). For eastbound travelers on the Proposed Bridges, views of the adjacent hillside would be obscured by the higher westbound bridge, but westbound travelers would have unobstructed scenic views up and across the lake

where none previously existed. For either option, the changes in traveler views are relatively brief (12.5 seconds) at the 65 mph design speed of the new roadway.

New Exhibit 4, as seen from the John Wayne Pioneer Trail



New Exhibit 5, as seen from the John Wayne Pioneer Trail



What measures are proposed to minimize and mitigate visual impacts?

No new minimization and mitigation measures are included because the Proposed Bridges would apply the Cascadian Style for design and construction of highway infrastructure per WSDOT's Architectural Design Guidelines. This will maintain and reinforce the motorist's experience in this state and National Scenic Byway. The key elements of the Cascadian Style are integrated into the design through the appearance of natural materials, muted native earth colors, attention to scale, and surrounding context (See two images above). WSDOT's Architectural Design Guidelines require that bridge columns, abutments, walls, and barriers be treated with a stained rock texture (Exhibit 7) that blends with the natural environment (WSDOT 2008b). This will ensure all road facilities repeat form, line, color, and texture of the characteristic landscape.

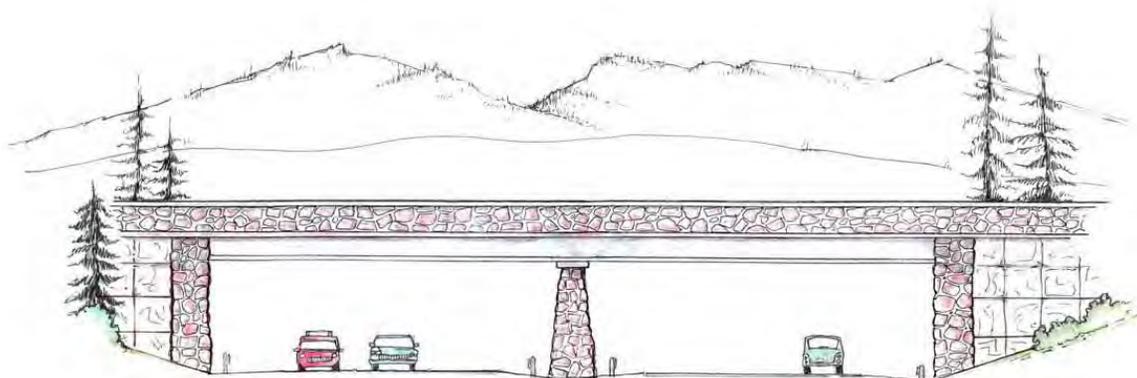


Cascadian Style applied to a column

For the Proposed Bridges, these Cascadian Style features would be applied to the westbound bridge only, as this will be visible by the eastbound traffic. They will not be applied to the eastbound bridge because the bridge face would not be seen by westbound travelers or be apparent from the John Wayne Trail on the opposite side of the lake (e.g., Key View 2007-3).

Visual impacts from slope protection measures will continue to be minimized by coloring shotcrete and cable net slope protection to match the existing terrain.

Exhibit 7. Cascadian Style applied to an overpass



Subject: Socioeconomics Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

Issued/Revised: May 30, 2012

Author: Maggie Buckley, Environmental Planner, David Evans and Associates, Inc.

Signature: 

Approving Manager: Jason Smith, Project Environmental Manager, WSDOT

Signature: 

Introduction

This technical update supports the Limited Scope Supplemental Environmental Impact Statement (EIS) for the Interstate 90 (I-90) Snoqualmie Pass East, Keechelus Lake Avalanche Bridges. David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, prepared this update to supplement the impact analysis for socioeconomics presented in the Final EIS (WSDOT 2008) and supporting documentation, including the Socioeconomics Discipline Report (WSDOT 2003).

The I-90 Snoqualmie Pass East project (I-90 project) includes improvements to the existing highway from Hyak at milepost (MP) 55.1 to Easton at MP 70.3. Planned improvements would reduce road closures due to avalanches, address unstable slopes, replace deteriorating concrete pavement, add capacity, and improve ecological connectivity. The Washington State Department of Transportation (WSDOT) completed the Final EIS for the I-90 project in 2008 and the Federal Highway Administration (FHWA) issued its Record of Decision (ROD) later that same year (FHWA 2008). Construction started in 2009 and has continued in 2010 and 2011.

In fall 2011, the contractor constructing the portion of the I-90 project from MP 57.3 to MP 60.2, Guy F. Atkinson Construction, proposed a design modification to construct eastbound and westbound Bridges at MP 58.1, the Keechelus Lake Avalanche Bridges (Bridges), instead of the expanded Snowshed that was included in the Selected Alternative, described in the ROD (FHWA 2008). WSDOT has granted concept approval for this design modification as a Cost-Reduction Incentive Proposal, intended to promote innovative ideas and result in cost savings to the state.

The 1,200-foot-long Bridges would reduce risks associated with avalanches, rock fall, and landslides through removal and stabilization of loose materials upslope of the highway, and physical separation of the highway from the hillside. A combination of elevating the road surface above the existing grade and excavating up to approximately 50 feet of material below the existing grade would provide a total clearance beneath the Bridges ranging between approximately 40 and 70 feet. This space would accommodate accumulations of snow from snowfall, plowing, and avalanches with adequate freeboard (remaining distance between the

top of the accumulated snow and the Bridges) to protect motorists from additional avalanches, as they occur. The storage area beneath the Bridges has been engineered to act as a series of chutes that would direct sliding snow, rock, and debris away from the bridge piers.

To analyze the impacts of the proposed Bridges, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Bridges compared to the Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were potential socioeconomic impacts analyzed in the Final EIS?

The Socioeconomics Discipline Report (WSDOT 2003) and subsequent Draft and Final EIS analyzed potential impacts on the local economy (both beneficial and adverse) by translating the cost of construction into employment and income data using a model developed by Washington State in 1993. The impact of project construction and operation on the demand for housing was estimated by comparing associated employment projections with the available housing stock. The potential for disruption of existing communities was estimated by reviewing the layout of the proposed project and nearby residences to determine whether the I-90 project would divide any communities, isolate any areas, or adversely affect access to properties.

The analysis gave special consideration to the opportunity cost of I-90 road closures and assessing the personal and commercial cost of weather-related travel delays. The opportunity cost of closing I-90 during periods of bad weather was estimated using two methods in the Socioeconomics Discipline Report and Draft EIS: the Cross-Cascades Corridor Method and the WSDOT Method. The Final EIS presented updated results for the WSDOT method based upon current estimates for traffic counts, percentage of trucks, and current costs for wages and truck operations. Opportunity costs included a multiplier for the additional delay caused by traffic backup as a result of pass closure.

The primary study area for social and economic resources in the Final EIS was Kittitas, King, and Pierce Counties.

What has changed since the Record of Decision was issued?

Cost estimates to construct the I-90 project have been updated based on more detailed design information.

The US Census Bureau released 2010 decennial census data as well as data from the 2005-2009 American Community Survey. However, this new data is not relevant to the analysis conducted for this technical update. Socioeconomic factors that could be affected by this change, such as population and housing, were not evaluated for this technical update, as explained below.

How were potential socioeconomic effects analyzed for this technical update?

Socioeconomic effects presented in the Final EIS for the I-90 project with the Snowshed were compared against the potential socioeconomic impacts of the proposed design modification for the Bridges. Only socioeconomic factors that could be influenced by the design modification were analyzed, including employment and reliability improvements. Other factors that were not

evaluated include population, housing, urban quality, land acquisition, displacement, and community cohesion. The proposed design modification would not influence these factors due to the location of the Bridges in an undeveloped rural area, several miles from the nearest communities of Hyak and Easton.

Separate letters to file were prepared for environmental justice, public services, and utilities, which were presented in Section 3.13 of the Final EIS, Social and Economic Resources. The evaluation conducted for these disciplines determined that the original analysis completed for the Final EIS remains valid and does not require supplementation or amendment for the design modification.

This technical update does not update construction employment estimates provided in the Final EIS. The analysis makes qualitative comparisons between the Snowshed and Bridges based upon the existing estimates. Opportunity cost estimates of I-90 road closure is provided based upon hourly cost estimates provided in the Final EIS and hourly road closure estimates provided in the Avalanche Technical Updates prepared in support of the Supplemental EIS (Dynamic Avalanche Consulting 2012 and DEA 2012). All opportunity cost estimates are provided in 2008 dollars.

The socioeconomic study area for the design modification is the same as the study area documented in the Final EIS.

Impacts

What were the relevant impacts evaluated in the Final EIS?

Construction-Related Employment

The I-90 project as a whole will create a substantial number of construction-related jobs, including approximately 4,800 direct jobs and 7,300 indirect jobs (12,100 total) over the life of the project.

Permanent Employment

After construction is complete, operation and maintenance of the highway could have nominal effects on employment throughout the region or state. WSDOT maintenance staff for the existing I-90 corridor through Snoqualmie Pass consists of 25 full-time employees and an additional 45 seasonal employees during the winter months. WSDOT will need to hire additional maintenance staff for I-90 to accommodate the increased number of structures and to plow the additional lanes during the winter.

The Snowshed would result in some maintenance benefits associated with reduced avalanches and rock falls. However, additional maintenance would be required for the electrical, lighting, and plumbing components of the Snowshed, including preventative maintenance, inspection, and repairs (J. Henderson, pers. comm., April 3, 2012). The Snowshed would also require additional operational staffing for its various electronic equipment and components. The Snowshed would require an estimated four additional staff to operate and maintain its various components, resulting in a slight increase in employment (J. Henderson, pers. comm., May 21, 2012). Once built, the I-90 project would have no impact on overall employment trends within Kittitas County or the state.

Reliability Improvements

Closures of I-90 due to avalanche control, landslides, or bad weather can result in costs to the regional economy. Unexpected closures of I-90 interfere with commerce, disrupt travel, delay delivery of freight, and increase uncertainty for manufacturers and shippers. Closure-related effects on commercial trucking operations may include violation of mandated curfew hours, increased overtime costs, and missed shipping connections. The opportunity cost of a weather-related closure of I-90 includes the value of passenger and commercial drivers' time and costs to operate passenger vehicles or loss of revenue for commercial trucks. The estimated opportunity cost of I-90 closure ranges from \$29,500 for a 1-hour closure, to \$708,000 for a 24-hour closure if an alternative route is available. If no alternate route is available, the estimated opportunity cost is \$7,962,000 per 24 hours.

The longer the closure, the faster opportunity costs accumulate. The nature and duration of weather-related road closures determine the availability of alternate routes and magnitude of opportunity cost. The I-90 project with the Snowshed would reduce the frequency and duration of weather-related road closures and increase the reliability of travel between eastern and western Washington. This would reduce the economic impact of highway closures and congestion by minimizing the accrual of opportunity costs.

The Snowshed would prevent avalanches with less than a 100-year return period from reaching the highway (Dynamic Avalanche Consulting 2012). While the need for avalanche control would be greatly reduced, the Snowshed would also allow controlled avalanche maintenance to be conducted when necessary without closing the highway (DEA 2012). An estimated 1 to 4 hours of annual avalanche-related road closures are anticipated for the Snowshed due to unforeseen conditions (URS and Mears 2007), equating to annual opportunity costs ranging from \$29,500 to \$118,000, assuming that an alternate route would be available.

Would the design modification change the impacts presented in the Final EIS?

Construction-Related Employment

Construction of the Bridges is anticipated to cost essentially the same as the Snowshed (J. Yamaura, pers. comm., March 28, 2012). Construction-related employment is directly proportional to project cost. Therefore, the Bridges would not change the amount of direct labor income to be generated by the I-90 project. Employment benefits as identified in the Final EIS would be unchanged with construction of the Bridges.

Permanent Employment

Maintenance associated with the Bridges is anticipated to be less than the Snowshed. The Bridges contain little to no equipment requiring preventative maintenance (J. Henderson, pers. comm., April 3, 2012). Routine maintenance of the Bridges would be similar to most other bridges and include annual inspections, plowing and de-icing of the bridge deck, and possible clearing of avalanche debris from underneath the Bridges to maintain capacity for avalanches in succession. The Bridges would not require additional maintenance personnel for the first 20 years (J. Henderson, pers. comm., April 3, 2012). Additional staffing may be required once the structures age and require repairs for potential bridge deck and joint problems. Additional staffing may also be required if the Bridges include extensive lighting and/or Intelligent Transportation System equipment.

Reliability Improvements

The Bridges would prevent avalanches with less than a 100-year return period from reaching the highway (Dynamic Avalanche Consulting 2012). While the need for avalanche control would be greatly reduced, the design of the Bridges would also allow controlled avalanche maintenance to be conducted when necessary without closing the highway (DEA 2012). An estimated average of 3 hours of annual avalanche-related road closures are anticipated for the Bridges (Dynamic Avalanche Consulting 2012), equating to an annual opportunity cost of \$88,500, assuming that an alternate route would be available.

Road closures due to avalanches are not anticipated with either design (DEA 2012). Rolling slowdowns may occur with both the Snowshed and Bridges and the associated opportunity cost is expected to be the same for both designs.

Both the Snowshed and Bridges are expected to reduce the frequency and duration of road closures due to rock fall. The design modification proposes a slightly different approach to slope stabilization than the Snowshed. However, both designs are expected to reduce rock fall and associated road closures equally. Therefore, opportunity costs associated with road closures due to rock fall would be the same for both the Snowshed and Bridges.

Both the Snowshed and Bridges would require periodic lane closures for maintenance and inspection. Maintenance activities associated with the Snowshed that may require lane closures include light replacement, servicing ITS components, filling and testing the fire water system, replacement of major mechanical systems, and structural inspections. Maintenance associated with the Bridges that may require lane closures include structural inspections and sweeping. Fewer lane closures would be required for maintenance of the Bridges (T. Kukes, pers. comm., April 16, 2012). Therefore, the Bridges would further reduce the accrual of opportunity costs to personal and commercial travelers.

Mitigation

What commitments were made in the Final EIS?

The Final EIS identified measures to avoid and minimize social and economic impacts, including designing the project to avoid acquiring private property, designing the project so that land owners can have access during construction, and avoiding utilities during design. None of the avoidance and minimization measures were specifically attributed to the Snowshed. No compensatory mitigation measures were included in the Final EIS.

Would the design modification require additional commitments?

The design modification for the Bridges would not require additional avoidance, minimization, or compensatory mitigation measures.

Conclusion

The design modification would not result in any new potentially significant socioeconomic impacts, consistent with the previous findings for the I-90 project presented in the Final EIS and Record of Decision. This conclusion is based upon the following:

- The I-90 project would result in substantial construction-related employment benefits. The Bridges would not change the total project cost. Because employment is directly proportional to project cost, the Bridges would result in the same employment benefits as the Snowshed.
- Permanent employment associated with maintenance of the Bridges would be less than the Snowshed.
- The Snowshed and the Bridges would both reduce the opportunity costs to personal and commercial travelers associated with the closure of I-90. The Snowshed would result in annual opportunity costs from avalanche-related road closures ranging from \$29,500 to \$118,000, compared to \$88,500 for the Bridges.

FHWA and WSDOT have reviewed this technical update and concur with the findings.

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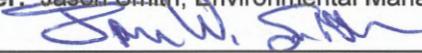
Subject: Public Services Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

Issued/Revised: May 17, 2012

Author: Karen Comings, David Evans and Associates, Inc.

Signature: 

Approving Manager: Jason Smith, Environmental Manager, WSDOT

Signature: 

Introduction

This technical update supports the Limited Scope Supplemental Environmental Impact Statement (EIS) for the Interstate 90 (I-90) Snoqualmie Pass East, Keechelus Lake Avalanche Bridges. David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Atkinson Construction, prepared this update to supplement the impact analysis for public services presented in the Final EIS (WSDOT 2008a) and supporting documentation, including the Public Services Discipline Report (WSDOT 2003).

The I-90 Snoqualmie Pass East project (I-90 project) includes improvements to the existing highway from Hyak at milepost (MP) 55.1 to Easton at MP 70.3. Planned improvements would reduce road closures due to avalanches, address unstable slopes, replace deteriorating concrete pavement, add capacity, and improve ecological connectivity. The Washington State Department of Transportation (WSDOT) completed the Final EIS for the I-90 project in 2008 and the Federal Highway Administration (FHWA) issued its Record of Decision (ROD) later that same year (FHWA 2008). Construction started in 2009 and has continued in 2010 and 2011.

In fall 2011, the contractor constructing the portion of the I-90 project from MP 57.3 to MP 60.2, Guy F. Atkinson Construction, proposed a design modification to construct eastbound and westbound Bridges at MP 58.1, the Keechelus Lake Avalanche Bridges (Bridges), instead of the expanded Snowshed that was included in the Selected Alternative, described in the ROD (FHWA 2008). WSDOT has granted concept approval for this design modification as a Cost-Reduction Incentive Proposal, intended to promote innovative ideas and result in cost savings to the state.

The 1,200-foot-long Bridges would reduce risks associated with avalanches, rock fall, and landslides through removal and stabilization of loose materials upslope of the highway, and physical separation of the highway from the hillside. A combination of elevating the road surface above the existing grade and excavating up to approximately 50 feet of material below the existing grade would provide a total clearance beneath the Bridges ranging between approximately 40 and 70 feet. This space would accommodate accumulations of snow from snowfall, plowing, and avalanches with adequate freeboard (remaining distance between the top of the accumulated snow and the Bridges) to protect motorists from additional avalanches,

as they occur. The storage area beneath the Bridges has been engineered to act as a series of chutes that would direct sliding snow, rock, and debris away from the bridge piers.

To analyze the impacts of the proposed Bridges, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Bridges compared to the Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were potential impacts to public services analyzed in the Final EIS?

Criteria used to evaluate impacts to public services in the Final EIS included the following:

- Response time for police, fire, and emergency services
- Changes to school bus routing
- Changes in demand levels for services
- The Kittitas County Comprehensive Plan was also reviewed to assess potential impacts to the County's public services.

What has changed since the Record of Decision was issued?

The Kittitas County Comprehensive Plan is updated on a regular basis by the County. The most recent version of this comprehensive plan (Kittitas County 2011) was reviewed relative to the design modification. No updates that would change the determination in the Final EIS were identified.

How were potential impacts to public services analyzed for this technical update?

The criteria for evaluating public services remain the same as those used in the Final EIS. In addition, the Kittitas County Comprehensive Plan was reviewed to verify that available public services have not changed (i.e., there are no new schools, fire stations, police stations, or hospitals that would serve the Snoqualmie Pass area).

Impacts

What were the relevant impacts evaluated in the Final EIS?

The Final EIS indicates that the I-90 project will have a beneficial effect on police, fire, emergency medical response, and hospital operations through reduced traffic delay, fewer highway closures, and improved traffic safety. No adverse impacts to public services are documented in the Final EIS.

Would the design modification change the impacts presented in the Final EIS?

The overall I-90 project will provide benefits to public services by reducing highway congestion and closures. The Bridges would not change these benefits. In addition, the Bridges would put fewer demands on emergency service providers than the Snowshed because the Snowshed requires specific training for a tunnel emergency response (WSDOT 2011) that is not required for the Bridges.

Highway closures and lane restrictions during construction also have the potential to impact emergency services but are necessary for construction of either alternative. The timing and duration of closures and lane restrictions is driven by the work that needs to be done and the sequencing of construction, though WSDOT is committed to minimizing closures and lane restrictions as much as possible during construction.

The Snowshed construction would require considerable work above all travel lanes of I-90 for setting girders and pouring concrete. Lanes would need to be closed to accommodate this work. It is anticipated that 158 one-hour long complete closures of I-90 would be required. The Bridges design would not require construction above the travel lanes and, therefore, would require less than half that many closures, reducing impacts to the traveling public and emergency services (K. Dusenberry, pers. comm., May 3, 2012).

Mitigation

What commitments were made in the Final EIS?

Since there will be no adverse impacts to public services, no compensatory mitigation was required in the Final EIS.

Would the design modification require additional commitments?

The design modification would not require any additional commitments.

Conclusion

Impacts to public services from the design modification are consistent and comparable with those documented in the Final EIS for the project with the Snowshed. Both the Bridges and the Snowshed would improve traffic flow and transportation safety that could have a positive effect on emergency services response times.

In addition, the Snowshed would place new demands on emergency service providers for tunnel emergency response training. The Bridges would not require special training. Fewer highway closures would be necessary during construction of the Bridges than for construction of the Snowshed, which increases access for emergency services during construction.

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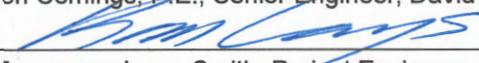


Technical Update Indirect Effects

Subject: Indirect Effects Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

Issued/Revised: July 18, 2012

Author: Karen Comings, P.E., Senior Engineer, David Evans and Associates

Signature: 

Approving Manager: Jason Smith, Project Environmental Manager, WSDOT

Signature: 

Introduction

This technical update supports the Limited Scope Supplemental Environmental Impact Statement (EIS) for the Interstate 90 (I-90) Snoqualmie Pass East, Keechelus Lake Avalanche Bridges. David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Guy F. Atkinson Construction, prepared this update to supplement the impact analysis for Indirect Effects presented in the 2008 Final EIS (WSDOT 2008) and supporting documentation.

The I-90 Snoqualmie Pass East project (I-90 project) includes improvements to the existing highway from Hyak at milepost (MP) 55.1 to Easton at MP 70.3. Planned improvements would reduce road closures due to avalanches, address unstable slopes, replace deteriorating concrete pavement, add capacity, and improve ecological connectivity. The Washington State Department of Transportation (WSDOT) completed the Final EIS for the I-90 project in 2008 and the Federal Highway Administration (FHWA) issued its Record of Decision (ROD) later that same year (FHWA 2008). Construction started in 2009 and has continued in 2010 and 2011.

In fall 2011, the contractor constructing the portion of the I-90 project from MP 57.3 to MP 60.2, Guy F. Atkinson Construction, proposed a design modification to construct eastbound and westbound Bridges at MP 58.1, the Keechelus Lake Avalanche Bridges (Proposed Bridges), instead of the Proposed Snowshed that was included in the Selected Alternative, described in the ROD (FHWA 2008). WSDOT has granted concept approval for this design modification as a Cost-Reduction Incentive Proposal, intended to promote innovative ideas and result in cost savings to the state.

The 1,200-foot-long Proposed Bridges would reduce risks associated with avalanches, rock fall, and landslides through removal and stabilization of loose materials upslope of the highway, and physical separation of the highway from the hillside. A combination of elevating the road surface above the existing grade and excavating up to approximately 50 feet of material below the existing grade would provide a total clearance beneath the Proposed Bridges ranging between approximately 40 and 70 feet. This space would accommodate accumulations of snow from snowfall, plowing, and avalanches with adequate freeboard (remaining distance between the top of the accumulated snow and the Proposed Bridges) to protect motorists from additional

avalanches, as they occur. The storage area beneath the Proposed Bridges has been engineered to act as a series of chutes that would direct sliding snow, rock, and debris away from the bridge piers.

To analyze the impacts of the Proposed Bridges, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Proposed Bridges compared to the Proposed Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were potential indirect effects analyzed in the Final EIS?

Indirect effects of the I-90 project were analyzed by identifying potential effects that could occur either outside of the project area or after the project has been constructed.

What has changed since the Record of Decision was issued?

No substantial changes have occurred that would affect the indirect effects analysis from the 2008 Final EIS.

How were potential indirect effects analyzed for this technical update?

This technical update uses the same methods for evaluating indirect effects as the 2008 Final EIS. Indirect impacts were re-evaluated for those resources that the Proposed Bridges may impact.

Impacts

What were the relevant impacts evaluated in the Final EIS?

The 2008 Final EIS concluded that almost all of the adverse effects of the I-90 project would be direct rather than indirect. This is based on the following:

- The location of the I-90 project, almost completely within the Okanogan-Wenatchee National Forest, will prevent the project from leading to housing growth or traffic growth.
- The unavoidable adverse impacts of the project will be limited to the area of construction and will not result in adverse impacts either away from the project area or later in time.

Where indirect effects would occur, they will be positive. The primary indirect effects of the I-90 project are as follows:

- The project will have positive indirect economic effects continuing for many years throughout the state because of decreased congestion due to new lanes, and fewer highway closures due to new avalanche protection and the removal of rock fall hazards.
- The project's ecological connectivity improvements would result in a gradual increase in wildlife gene flow between the North and South Cascades, as wildlife use the new crossing structures.
- Removal of hydrologic barriers (i.e., undersized culverts) will allow for restoration of wetlands and aquatic habitat, more natural stream movement, and more natural passage of groundwater.

- Increased hydrologic connectivity between groundwater and surface water at stream crossings will have a beneficial effect on water quality and habitat.

Discipline-specific indirect effects from the 2008 Final EIS are listed in **Exhibit 1** for resources the Proposed Bridges may impact. None of these indirect effects are solely attributed to the Proposed Snowshed and none of them are changed by the Proposed Bridges.

Exhibit 1
Beneficial and adverse indirect effects of the I-90 project

Discipline	Beneficial Effects	Adverse Impacts
Aquatic Resources	Removal of barriers would open up currently inaccessible habitat areas and improve fish passage.	None
Geology and Soils	None	None
Land Use	Improved commuting from adjacent areas. It should be noted, however, that this is not expected to lead to substantial additional development east of the project area.	None
Public Services	Improved emergency response times through reduced traffic delay, fewer highway closures, and improved traffic safety.	None
Socioeconomics	Creation of jobs during construction; purchase of goods and services from local, regional, and statewide businesses.	None
Terrestrial Species	Increased wildlife gene flow between the North and South Cascades, as wildlife use the new crossing structures.	None
Transportation	None	None
Visual Quality	None	None
Water Resources	Removal of barriers would allow for the gradual restoration of more natural stream movement and habitat.	None
Wetlands	Removal of barriers would allow for restoration of wetland habitat, more natural stream movement, and more natural passage of groundwater.	Wetlands could be partially filled and the function of the remaining wetland could be compromised because of their smaller size. Impacts would be offset by mitigation.

Would the design modification change the impacts presented in the Final EIS?

The Proposed Bridges would not result in new adverse indirect impacts. However, the Proposed Bridges would provide additional beneficial indirect effects such as the following:

- The cost of operating and maintaining the Proposed Bridges would be less than for the Proposed Snowshed, allowing these funds to be utilized elsewhere.
- The storage capacity of Keechelus Lake would be increased by the excavation for the Proposed Bridges. This would result in additional water stored in the reservoir that could be used for irrigation or flood control.

Mitigation

What commitments were made in the Final EIS?

No commitments or mitigation measures were made for indirect effects in the 2008 Final EIS because no adverse indirect impacts are anticipated.

Would the design modification require additional commitments?

The design modification would not require any additional commitments or mitigation for indirect effects.

Conclusion

The indirect impacts from the design modification are consistent and comparable with those documented in the 2008 Final EIS and the subsequent ROD. FHWA and WSDOT have reviewed this technical update and concur with the findings.

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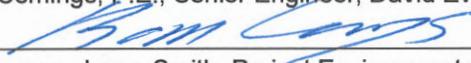
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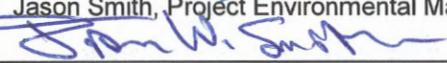
Subject: Cumulative Effects Technical Update in support of the Interstate 90 Snoqualmie Pass East, Keechelus Lake Avalanche Bridges Supplemental Environmental Impact Statement.

Issued/Revised: July 18, 2012

Author: Karen Comings, P.E., Senior Engineer, David Evans and Associates

Signature: 

Approving Manager: Jason Smith, Project Environmental Manager, WSDOT

Signature: 

Introduction

This technical update supports the Limited Scope Supplemental Environmental Impact Statement (EIS) for the Interstate 90 (I-90) Snoqualmie Pass East, Keechelus Lake Avalanche Bridges. David Evans and Associates, Inc. (DEA), acting on behalf of Jacobs Engineering and Guy F. Atkinson Construction, prepared this update to supplement the cumulative effects analysis presented in the 2008 Final EIS (WSDOT 2008) and supporting documentation.

The I-90 Snoqualmie Pass East project (I-90 project) includes improvements to the existing highway from Hyak at milepost (MP) 55.1 to Easton at MP 70.3. Planned improvements would reduce road closures due to avalanches, address unstable slopes, replace deteriorating concrete pavement, add capacity, and improve ecological connectivity. The Washington State Department of Transportation (WSDOT) completed the Final EIS for the I-90 project in 2008 and the Federal Highway Administration (FHWA) issued its Record of Decision (ROD) later that same year (FHWA 2008). Construction started in 2009 and has continued in 2010 and 2011.

In fall 2011, the contractor constructing the portion of the I-90 project from MP 57.3 to MP 60.2, Guy F. Atkinson Construction, proposed a design modification to construct eastbound and westbound Bridges at MP 58.1, the Keechelus Lake Avalanche Bridges (Proposed Bridges), instead of the Proposed Snowshed that was included in the Selected Alternative, described in the ROD (FHWA 2008). WSDOT has granted concept approval for this design modification as a Cost-Reduction Incentive Proposal, intended to promote innovative ideas and result in cost savings to the state.

The 1,200-foot-long Proposed Bridges would reduce risks associated with avalanches, rock fall, and landslides through removal and stabilization of loose materials upslope of the highway, and physical separation of the highway from the hillside. A combination of elevating the road surface above the existing grade and excavating up to approximately 50 feet of material below the existing grade would provide a total clearance beneath the Proposed Bridges ranging between approximately 40 and 70 feet. This space would accommodate accumulations of snow from snowfall, plowing, and avalanches with adequate freeboard (remaining distance between the top of the accumulated snow and the Proposed Bridges) to protect motorists from additional avalanches, as they occur. The storage area beneath the Proposed Bridges has been

engineered to act as a series of chutes that would direct sliding snow, rock, and debris away from the bridge piers.

To analyze the impacts of the Proposed Bridges so that they may be compared to the Proposed Snowshed design, WSDOT initiated an evaluation in a limited-scope Supplemental EIS. This technical update supports the Supplemental EIS and focuses on potential changes in construction and operational impacts of the Proposed Bridges compared to the Proposed Snowshed for a 0.5-mile road section from MP 57.9 to MP 58.4 (the design modification area).

Methods

How were cumulative effects analyzed in the 2008 Final EIS?

Cumulative effects were analyzed in the 2008 Final EIS by considering the direct and indirect effects of the I-90 project in combination with the effects of past, present, and reasonably foreseeable future actions. The study area for cumulative effects was the area within 10 miles of the project area. The timeframe for the cumulative effects discussion covered the post-European history of the I-90 corridor, which began roughly in the mid-1800s. The analysis concentrated on greenhouse gases, land use, wetlands, and terrestrial habitat impacts, as these are the primary resources the I-90 project could impact.

What has changed since the Record of Decision was issued?

Shortly before completion of the 2008 Final EIS, FHWA, the US Environmental Protection Agency, and WSDOT jointly published the *Guidance on Preparing Cumulative Impact Analyses* (WSDOT et al. 2008). As a result of this coincidental timing, WSDOT did not strictly adhere to the process outlined in the joint guidance, but did meet its intent.

The 2008 Final EIS identified past, present, and reasonably foreseeable future actions at the time of publication. Since then, WSDOT identified two additional future actions: the Upper Yakima Restoration Project and the Keechelus to Kachess Pipeline.

How were potential cumulative effects analyzed for this technical update?

Cumulative effects for the design modification were analyzed using the eight steps outlined in the *Guidance on Preparing Cumulative Impact Analyses* (WSDOT et al. 2008).

Impacts and Mitigation

Within the context of the eight steps of the joint cumulative effects analysis guidance (WSDOT et al. 2008), this section summarizes the cumulative effects analyzed in the 2008 Final EIS and evaluates any changes to cumulative effects anticipated from the Proposed Bridges.

1. Identify the resources that may have cumulative effects to consider in the analysis.

The cumulative effects analysis in the 2008 Final EIS focuses on greenhouse gas emissions, wetlands, terrestrial habitat, and land use. Construction of the Proposed Bridges would not change the I-90 project's effects on greenhouse gas emissions, because the Proposed Bridges would not change the traffic volume the I-90 project will accommodate and the two designs have similar construction requirements and timing. The impacts to wetlands would also be the same for both designs. Therefore, the conclusion that there would not be cumulative effects to these resources remains valid for the Proposed Bridges. Land use and terrestrial habitat are analyzed

in this technical update for changes to cumulative effects that could result from the Proposed Bridges.

2. Define the study area and timeframe for each affected resource.

For land use and terrestrial resources, the boundary of the Snoqualmie Pass Adaptive Management Area (SPAMA) was selected as the area that could be subject to potential cumulative effects (**Exhibit 1**). Because of the relatively undeveloped character of the project area, this technical update uses the same timeframe used in the 2008 Final EIS. This period covers the history of the I-90 corridor from the time European immigrants began using the area for transportation and resources in roughly the mid-1800s.

3. Describe the current health and historical context for each affected resource.

Land Use

The lands in and near the project area were ceded to the United States (US) government as a result of the 1855 Yakima Treaty. The first private land holdings in the project area were a result of land grants to the Northern Pacific Railroad beginning in 1864, which established the “checkerboard” pattern of public and private land in the area. The US Forest Service (USFS) owns the majority of the remaining land within the project area as part of the Okanogan-Wenatchee National Forest established in 1908. The US Bureau of Reclamation (USBR) manages the land within Keechelus Lake as part of its management of the Yakima Project irrigation water system.

Between the 1940s and early 1990s, land use in the project area was dominated by timber harvest. In 1994, the national forest land surrounding the project area became part of the 212,700-acre SPAMA established by the Northwest Forest Plan. When SPAMA was established, it marked an important change to federal land management. In place of an earlier emphasis on timber production, the goals of the SPAMA (USFS and USFWS 1997) are to provide mature forests and habitat connection for species moving north and south. Forest Service land within SPAMA is protected and will continue to be managed for the protection of wildlife. The USFS, other agencies, and non-governmental organizations are working toward purchasing the fragmented sections of private land as opportunities become available.

Terrestrial Resources

Forested habitats dominate the SPAMA, with six different forest zones located in or near the I-90 project. This area is recognized as a critical connective link in the north-south movement of species in the Cascade Range. The importance of the SPAMA for wildlife movement is based on its location between large blocks of federal land that are largely protected from development. The construction of I-90 in 1977 introduced a substantial barrier to the movement of wildlife (WSDOT 2008). Around this same time, pressure from timber harvesting further reduced the habitat value of the forest. However, with the adoption of the Forest Plan and the establishment of the SPAMA in 1994, policies governing forest management have changed to support and protect wildlife habitat.

Exhibit 1
The Snoqualmie Pass Adaptive Management Area



Federally Owned Lands

- National Park
- Wilderness
- City Limits
- Forest (non-wilderness)
- State Owned Land
- Major Hydrology
- Snoqualmie Pass Adaptive Management Area (SPAMA)

Disclaimer: Government land holdings are subject to change, and recent activities may not be reflected in this map.

In addition to its value as a wildlife corridor, a wide variety of wildlife species live in the SPAMA. The rain shadow effect of the Cascade Mountains, along with rapid change in elevation, creates a wide variety of habitats within a relatively small area, and this leads to wide diversity of wildlife species (WSDOT 2008). Among the species living in the area are five species that are classified under the Endangered Species Act as either endangered or threatened. These species are the gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos horribilis*), Canada lynx (*Lynx Canadensis*), northern spotted owl (*Strix occidentalis caurina*), and marbled murrelet (*Brachyramphus marmoratus*). According to the US Fish and Wildlife Service (USFWS), these species are either recovering or have a high probability of recovery, which is primarily linked to the preservation of habitat (USFWS 2012).

4. Identify direct and indirect effects that may contribute to a cumulative effect.

The 2008 Final EIS states that almost all of the adverse effects of the I-90 project would be direct rather than indirect. Where indirect effects would occur, they would be positive (WSDOT 2008). This remains true for the Proposed Bridges (DEA 2012a).

Land Use

The I-90 project would require the permanent acquisition of 7.3 acres of private land and 127.2 acres of public land, including a 36.52-acre right-of-way easement from the USFS (WSDOT 2008). The Proposed Bridges would increase the easement area from the USFS by an estimated 1 to 2 acres (DEA 2012b).

Indirect effects to land use are typically a result of local development that occurs as a consequence of improved transportation. The 2008 Final EIS concludes that the I-90 project would not result in indirect increased development because highway congestion is not a major factor in the current level of population growth for the area. Similarly, indirect development growth from the Proposed Bridges is also not anticipated. The Proposed Bridges would not change this conclusion. Furthermore, since the majority of the SPAMA is in federal ownership, future development is unlikely. On sections of private land, development is possible provided zoning regulations and the county comprehensive plan are adhered to.

Terrestrial Resources

WSDOT anticipates benefits to terrestrial habitat from the I-90 project. The largest direct benefit of the I-90 project is the opening of migration corridors for the north-south movement of wildlife across the highway. Beneficial indirect impacts may include increases in wildlife gene flow among species in the wildlife areas north and south of I-90. WSDOT is also working with federal and state partner agencies to acquire habitat preservation areas in the project area (WSDOT 2008).

The Proposed Bridges would increase temporary impacts to mature forest by 0.2 acre and permanent impacts by 2.2 acres. These additional impacts are minor compared to the 75.4 acres of mature forest that will be permanently impacted by the I-90 project as a whole. No new mitigation is recommended for these additional impacts (DEA 2012c). The Proposed Bridges would not change the benefit to terrestrial species from opening migration corridors.

5. Identify other historic, current, and reasonably foreseeable actions that may affect resources.

Exhibit 3-65 of the 2008 Final EIS identified past, present, and reasonably foreseeable future actions in the project area. Since its publication, WSDOT identified two additional reasonably foreseeable future actions:

- Upper Yakima Restoration Project – this is a watershed restoration project for the Upper Yakima Basin encompassing approximately 60,000 acres near Keechelus Lake. The project proposes forest thinning to accelerate old growth forest structure, removal of selected roads, conversion of some roads to trails, restoration of multiple creeks, and treatments for controlling invasive plant populations. The goals of these actions support the SPAMA Plan for restoration (USFS and USFWS 1997). This restoration effort is expected to begin in autumn 2012 (USFS 2011).
- Keechelus to Kachess Pipeline – this pipeline is a USBR project designed to transfer water from Keechelus Lake to Kachess Lake. The ability to transfer water between the lakes would increase the operational flexibility of the federal Yakima Project (for irrigation) and would better utilize the water within the larger Keechelus hydrologic basin by conveying the water to Kachess Lake, which has a smaller hydrologic basin and more available storage capacity (USBR 2011).

6. Assess potential cumulative effects to each resource and determine the magnitude and significance.

Land Use

The cumulative effects analysis in the 2008 Final EIS indicates that the greatest potential for land use changes comes from the possibility of re-zoning to higher development densities. However, it is assumed that development on private land would be consistent with current zoning. The Proposed Bridges would not change traffic demand projections or induce growth, and are, therefore, not expected to change land use.

The Upper Yakima Restoration Project would improve habitat conditions within protected forest areas. Both the Upper Yakima Restoration Project and the Keechelus to Kachess Pipeline are consistent with current zoning and would not be a driving factor for changes to zoning.

The cumulative effects of these actions on land use are, therefore, unchanged from those described in the 2008 Final EIS.

Terrestrial Resources

As reported in the 2008 Final EIS, the I-90 project would have beneficial effects to terrestrial species by providing crossing opportunities for animals to move north-south across the highway, by acquiring habitat preservation areas in the I-90 project area, by restoring wetland and riparian habitat in the I-90 project area, and by reducing wildlife mortality. The Proposed Bridges would increase the extent of forest loss because the Proposed Bridge footprint is slightly larger than that of the Proposed Snowshed. However, this would be a minor change that would not affect the overall health of the forest.

One of the goals for the Upper Yakima Restoration Project is to improve terrestrial habitat. It is, therefore, assumed that only beneficial effects to habitat would result from this restoration. An

assessment of the effects to terrestrial habitat from the Keechelus to Kachess Pipeline is not available at this time. The pipeline runs through currently forested areas that would likely be impacted during construction and retained as an easement above the buried pipe. Although trees would be removed for the pipeline construction, the permanent presence of the pipeline would not create a barrier to migration. Evaluation of this project's impacts to terrestrial species and identification of potential mitigation would be required by the regulating federal agency—the USFS.

While the I-90 project, the Proposed Bridges, and the Keechelus to Kachess Pipeline would contribute to a cumulative loss of forest habitat in the study area, these additional adverse impacts would be less than the overall beneficial cumulative effects of the I-90 project and the Upper Yakima Restoration Project, which would provide improved ecological connectivity, increase riparian habitat, increase preservation of mature forest in the area, and reduce wildlife mortality. Management plans have been adopted that focus on preservation of the forest, and the overall health of the resource is expected to improve over time.

7. Report the results.

The conclusion in the 2008 Final EIS is that while the I-90 project would have some temporary and permanent impacts, these impacts would be mitigated and would not result in a substantial contribution to cumulative adverse impacts. Neither the Proposed Bridges nor the additional reasonably foreseeable future actions would change this conclusion.

8. Assess and discuss potential mitigation issues for all adverse impacts.

The 2008 Final EIS states that since there will be no permanent adverse cumulative impacts, no compensatory mitigation will be required. This conclusion remains valid.

Conclusion

Cumulative impacts from the Proposed Bridges would be consistent and comparable with those documented in the 2008 Final EIS and the subsequent ROD. FHWA and WSDOT have reviewed this technical update and concur with the findings.

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