Index Galena Road Flood Repair

M.P. 6.4 to M.P. 6.9

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Surface Water Discipline Report
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Index Galena Road Flood Repair
M.P. 6.4 to M.P. 6.9

Snohomish County, Washington

Surface Water Discipline Report

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The Washington State Department of Transportation

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Cooperating Agencies:
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WSDOT
U.S. Forest Service
Snohomish County
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Average Daily Traffic (ADT)
Best Management Practice (BMP)
Certified Erosion and Sedimentation Control Lead (CESCL)
Channel Migration Zone (CMZ)
Department of Ecology (DOE)
Emergency Relief (ER)
Federal Highway Administration (FHWA)
Highway Runoff Manual (HRM)
Milepost (MP)
National Pollutant Discharge Elimination System (NPDES)
Snohomish County Public Works (SCPW)
Spill Prevention Control & Countermeasures (SPCC)
Stormwater Pollution Prevention Plan (SWPPP)
Temporary Erosion and Sediment Control (TESC)
Washington State Department of Transportation (WSDOT)
Chapter 1: Summary of Conclusions

Stormwater runoff would be managed in accordance with the Washington State Department of Transportation’s *Highway Runoff Manual* (HRM). The WSDOT HRM has been specifically developed for public road projects. The proposed approach for flow control is to use natural flow dispersion. Natural flow dispersion uses the existing vegetation, soils, and topography to effectively provide flow control and runoff quality treatment, and generally requires little or no construction activity. The pollutant-removal processes include infiltration into the existing soils and through vegetation root zones; evaporation; and uptake and transpiration by the vegetation. For this to work properly, a minimum width of native vegetation of 100 feet (measured in the direction of the flow path) and the area receiving flow cannot be steeper than 6:1. It is advantageous not to concentrate stormwater to minimize the risk of downstream erosion by allowing stormwater runoff to disperse overland along the length of the project.

Due to the steep onsite slopes, approximately 10% of the receiving slopes on the proposed project site meet all of the design criteria. This site-specific characteristic makes constructing stormwater management facilities within or adjacent to the roadway right of way difficult, if not impossible, using standard Best Management Practices (BMPs). The Highway Runoff Manual presents a method to assist in determining when site-specific factors could make constructing stormwater management facilities within or adjacent to the roadway right of way infeasible. This method is called the Engineering and Economic Feasibility (EEF) Evaluation.

Stormwater Runoff Treatment

The EEF analysis demonstrates that the construction of standard stormwater facilities is not feasible within the majority of the project site. However, the combination of low traffic volumes, deep, mature forest soils, and an abundance of native riparian vegetation make the project site ideal for deviating from standard design criteria. This site-specific characteristic makes constructing stormwater management facilities within or adjacent to the roadway right of way difficult, if not impossible, using standard Best Management Practices (BMPs). The Highway Runoff Manual presents a method to assist in determining when site-specific factors could make constructing stormwater management facilities within or adjacent to the roadway right of way infeasible. This method is called the Engineering and Economic Feasibility (EEF) Evaluation.

Minimization of Impacts Through Project Design

Several design measures have been developed to minimize the project footprint, including wetland and stream impacts. However, construction activity could potentially contribute to
erosion and sedimentation that would pose adverse effects to water quality. The minimization measures include:

- The design team coordinated to gain concurrence from the review agencies to design the roadway in accordance with the AASHTO Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT <400), 1st Edition. These low-volume standards provide for a smaller required roadway section and turning radii that help to reduce the road width and allow tighter curves that facilitate alignment shifts to avoid some of the more sensitive features in the landscape (i.e., rock outcroppings, unsuitable soils, oversteepened slopes). This helps to reduce erosion risks by minimizing the area that is disturbed by roadway construction.

- Several iterations of project alignment shifting were undertaken in an effort to minimize cuts, fills, and reduce overall project footprint. The proposed design reflects a balance between all of the different considerations that contributed to design decision making. The proposed design is expected to result in more feasible constructability that would minimize slope stability erosion risks during construction. This reduces risks for greater erosion and associated sedimentation loads that could adversely affect water quality in the North Fork Skykomish River and slope stream crossed by the proposed relocated roadway.

- The project proposes construction of a bridge to cross a wetland/stream area complex near Station 54+00. Originally, the portions of the roadway that would span the existing wetland/stream were proposed to be constructed on several feet of fill material, with one or possibly two large-span culverts to maintain the existing hydraulic connectivity to the river. However, upon further evaluation of the winter water surface in this area, the wetland/stream complex fish habitat, and the proximity to the existing river channel migration zone, it was determined that a bridge span would better maintain the integrity of both the proposed roadway section and the wetland/stream system. Impact to the wetland has been reduced substantially with the proposed bridge. This would result in less erosion and associated sedimentation risks that would contribute to increased turbidity levels in the stream/wetland system and potential adverse effects to downstream areas where the stream flows to the North Fork Skykomish River.

- Construction of a diversion berm. Originally, the project proposed two box-culvert/vented ford crossings. These crossings would convey 100-year storm flows and associated debris flows to ensure that the roadway prism is not damaged during debris flow events. The roadway embankment would be constructed of concrete buttresses with a large box culvert that has a removable lid. The culvert would be sized to allow the debris to pass through, and the removable lid allows for simple inspection and clearing, if necessary. At the northern proposed crossing of a slide hazard area, it has been proposed that the debris could be better handled by the construction of a diversion berm that directs the flow to the north and into an existing gully that runs parallel with the roadway, rather than conveyance through a box culvert/vented ford and across the roadway. It is felt that this approach and its debris flow route is more naturally occurring, based on topography of the area, and that debris could still be cleared from the gully in proximity to the road if necessary. As a result, future potential debris flows would continue to be deposited in upland areas, reducing the risk for contributing to increased sedimentation to the nearby stream/wetland complex.
As the proposed project restores the roadway connectivity for the area, it relocates the roadway outside the 100-year flood floodplain and the channel migration zone to the extent practicable with roadway geometric constraints. The relocated roadway, by being relocated further landward from the river, is expected to improve water quality compared to the existing roadway alignment, by increasing the riparian buffer area between the roadway and the river. Riparian restoration would occur where the existing damaged roadway would be removed. The increased vegetated buffer that would result would provide more shading closer to the river, provide improved filtration of overland flows for sediments and nutrients, and is expected to improve natural functions presently reduced by the existing roadway. Removing the roadway from the river would also improve the floodplain conveyance by removing roadway fill from the floodplain that has impeded floodplain access for more than 100 years. These are expected to improve floodplain functionality.
Chapter 2: Purpose and Need for the Action

Purpose

The purpose of the proposed Index-Galena Milepost (MP) 6.4 to MP 6.9 project is to restore essential travel and prevent further damage to the roadway. Essential travel includes re-establishing access for property owners with land holdings in the North Fork Skykomish River valley upstream from the town of Index, re-establishing vehicular access for emergency service providers to these properties, re-establishing public recreational access to the North Fork Skykomish River valley, and re-establishing administrative access for the U.S. Forest Service to manage their lands located in the Mt. Baker Snoqualmie National Forest.

Need

In November 2006, a major flood event caused catastrophic damage to Index-Galena Road. High flows from the North Fork Skykomish River washed out multiple sections of the roadway between MP 6.4 and MP 6.9. A side channel of the river now occupies extensive sections of the existing Index-Galena Road roadway alignment. The 2006 flood damage event resulted in Index Galena Road being closed at MP 6.4, just east and upstream of Snohomish County’s Trout Creek Bridge #494 at MP 6.05. (See Exhibit 1: Vicinity Map)

The sole vehicular access to the area east of this point can be reached now only by using Beckler River Road (a U.S. Forest Service Road) located east of the town of Skykomish in northeast King County. The Beckler River Road gains nearly 1,000 feet in elevation in order to cross Jack Pass (also known as Jack’s Pass). Vehicles descend from Jack’s Pass on U.S. Forest Service Road #65 to gain access to the North Fork Skykomish valley and intersect with Index-Galena Road at MP 14.3.

This approximate 40-mile detour route to arrive at the upper end of the Index-Galena Road washout at Milepost 6.9 is typically available only seasonally for five months (usually late May to early November) and provides the sole vehicular access for property owners, emergency service providers, recreational users to camp sites and trailheads, and U.S. Forest Service personnel.

After the 2006 flood damage, Snohomish County determined that Index Galena Road should be repaired or relocated in order to re-establish roadway network connectivity. Snohomish County Public Works (SCPW) has coordinated with the Federal Highway Administration (FHWA) and the Washington State Department of Transportation (WSDOT) to secure Emergency Relief (ER) funding to determine the best method of repairing the road and avoid further flood damage. Additional coordination has also involved the U.S. Forest Service, on whose lands any relocated roadway would need to be constructed.
Exhibit 1: Vicinity Map
To date, the project has conducted an extensive feasibility analysis and developed a preliminary design report to identify a safe, reliable, and cost-effective solution that restores roadway connectivity and essential travel while limiting impacts to the surrounding environment. The proposed project results from the information gathered and design analysis undertaken during the feasibility and design report stages.

The following factors have been identified that contribute to the need for road repair and relocating the damaged road out of the floodplain:

- The Index-Galena Road is a direct and vital transportation link to the upper North Fork Skykomish River area, both for National Forest administrative and public recreational access. Forest recreationists and recreational property owners who live west of Index now must drive approximately 42.5 miles (10.5 miles on gravel road) to reach the Galena area at the Silver Creek/North Fork Skykomish confluence, via US 2 and the Beckler River Road (Forest Road 65) over Jack’s Pass. Aside from the inconvenience and additional fuel consumption and emissions, this extended detour presents a safety risk to the public due to the increased drive time exposure and potential hazards of traffic and road conditions.
- Forest Road 65 over Jack’s Pass is a single-lane gravel road with turnouts, and has steep mountain grades and switchbacks. Although the U.S. Forest Service appreciates that Snohomish County Public Works has partnered with the U.S Forest Service to perform road maintenance to address additional wear and tear, this road is not designed to safely accommodate increased passenger car traffic that was displaced from Index-Galena Road. This access route provides additional challenges for horse recreationist use in the upper North Fork Skykomish valley.
- The Forest Service’s Troublesome Creek and San Juan Creek campgrounds cannot be fully utilized by campers who drive motor homes or pull trailers, due to the inconvenience and hazard of driving the steep narrow grade over Jack’s Pass.
- The Forest Service’s timber sale planning and administration is hampered due to adverse log haul conditions over Jack’s Pass from the North Fork Skykomish drainage. Recent planned timber harvest units and timber sales were dropped because of poor access. In addition, watershed restoration projects, and road maintenance or decommissioning contracts are more expensive to implement due to the detour.
- Since the washout, response times have increased for emergency services, such as vehicle accidents, search and rescues, and fire suppression, due to the long detour.

Reestablishing the connectivity of the Index-Galena Road is important for providing an alternate access route into the North Fork Skykomish and upper Beckler River watersheds in case a major flood event were to wash out the Beckler River Road.

**Use of this Report**

This report will be used by agency reviewers and others involved with the proposed project’s environmental review process to gain an understanding of the project’s potential impacts to surface water, including stream water quality and water quantity, with particular focus on the
effects of roadway stormwater runoff once the roadway would be re-opened to vehicular traffic. A separate drainage report would be prepared for permit submittals.
Chapter 3: Description of Alternatives

The preliminary drainage design analysis was conducted as part of the Design Report prepared for Snohomish County Public Works by H. W. Lochner, Inc. and finalized in March 2011. The design report included the alternatives recommended in the 2009 Route Feasibility Study for further investigation. The major water quality and quantity concerns did not substantially vary between the alternatives. The major differences between the alternatives include the location of the alignment along the hillside, and the overall proportion of walls and reinforced slopes. The slopes are steep in the proposed project area, and the primary focus of concern for surface water revolves around the concentration of stormwater flows with the completed project.

Alternatives evaluated early in the design process

Several alternatives were evaluated during the course of the feasibility analysis and design report stages of the project. The alternatives were developed in an effort to determine the best overall design solution to restore essential travel that was eliminated by the 2006 high flow event that damaged the roadway. Below is a description of the proposed alternative and the no-action alternative. A discussion of alternatives not carried forward and a brief explanation of why they were not considered for further evaluation will be provided in the NEPA Environmental Assessment.

Proposed Alternative

The proposed project would shift the project area roadway alignment to the south and establish a relocated roadway upslope from the existing damaged roadway. The alignment would shift from the existing Index Galena Road approximately 200 feet east from Snohomish County Trout Creek Bridge #494 (near Milepost 6.1, at approximately 841 feet in elevation). The relocated roadway would extend for 0.95 mile and match into the existing roadway approximately 400 feet east of the Milepost 6.9 washout. At the project start, the roadway would ascend the sideslopes at a 9 percent grade in order to raise the roadway out of the 100-year floodplain and channel migration zone. The relocation would enable the roadway to be elevated above the 100-year flood elevation and channel migration zone for most of the project length and to be located landward of the river side channel stream that has formed in the existing roadway alignment. (A map exhibit of the proposed alignment is provided in Appendix A.)

This initial climb would use approximately 700 feet of the existing Trout Creek Road, a gravel road maintained by the U.S. Forest Service. It will be necessary to excavate (cut) into the adjacent upslope areas to accommodate the roadway relocation, and fill would be placed on the downslope area. This type of cut and fill construction would be present for much of the proposed alignment, except where retaining walls, reinforced soil slopes, or other stabilization measures are installed instead of cut and fill slopes. A new Index-Galena Road/Trout Creek Road intersection would be constructed near Station 19+50 to allow for future continued use of Trout Creek Road by the U.S. Forest Service to carry out its long-term land management plans in the Trout Creek sub-basin. Trout Creek Road is presently closed to motor vehicle use until the U.S. Forest Service re-opens it for future use.
After the initial climb from the existing roadway, the roadway grades would be more moderate for the remainder of the project length. The relocated roadway would cross the side slopes and parallel the existing roadway. With slight curves in the alignment, the distance from the relocated roadway to the existing roadway would range from 40-100 feet for most of the project length. At the upper end of the project, extending from Station 39+50 the relocated roadway would more closely parallel the existing road. The highest elevation achieved by the project, 920 feet, would be near Station 35+00. The roadway would begin its descent to the existing roadway near Station 36+00 and would tie back into the existing roadway at Station 59+93, near milepost 7.0 (at approximately 884 feet in elevation).

All culverts would be sized to convey the 100-year flow and associated debris flows and would be constructed where the roadway crosses non-fish bearing slope streams. A concrete box culvert vented ford structure would be installed in proximity to Station 29+00 where there is a debris chute with evidence of historic debris flows. The concrete box culvert vented ford may have a removable top that would facilitate culvert clean out and debris removal by road maintenance crews in the future. More specific design features would be determined during final design.

A 180-foot bridge would be constructed near the project’s east end near Station 54+00 to provide for unimpeded flow of a seasonal stream located in the large wetland located in this area. The proposed bridge would be a steel girder single span structure with a concrete slab deck and concrete parapet. The bridge would be supported by a deep foundation and concrete abutments. There will also be concrete cheek walls at the sides of the abutment. Steel girders would be galvanized and then top coated with paint in accordance with U.S. Forest Service visual quality requirements for structures constructed near recommended wild and scenic rivers. The bridge would maintain existing water levels in the wetland that provides important habitat for wildlife and winter/spring seasonal use by juvenile salmon. The bridge would also help to prevent future blockages that would be anticipated from seasonal high flows and extensive beaver activity in the project area, and prevent blockages that could potentially occur from landslide debris near Station 53+00.

Where the relocated roadway is located adjacent to or within the channel migration zone, from approximately Station 35+00 to 45+00, a buried rock revetment would be placed adjacent to the toe of the roadway embankment slope. Subsurface areas located within the existing undamaged roadway would be overexcavated to remove materials subject to scour erosion and replaced with large rock material in the overexcavated trench. This buried rock revetment is intended to prevent future scour erosion damage to the roadway. In the absence of further migration of the river prior to roadway construction, this would not require in-water work. Some portions of the revetment at its upper extent are likely to require some in-water work. The trench would also be filled with large woody debris on the river side so that in the event of channel migration large woody debris would be launched in place and exposed. A two foot layer of salvaged forest duff and other organic materials would be placed on top of the overexcavated revetment in preparation for riparian restoration planting.
Proposed design standards

The proposed roadway design is based on design standards contained in the 2001 AASHTO Guidelines for Geometric Design of Very Low-Volume Roadways (ADT < 400). The use of these design standards responds to comments made during the NEPA scoping period to consider use of design standards that would help to reduce the footprint of the proposed roadway relocation repair. These design standards enable the project to match the character of the existing roadway and fit in with the forested natural environment in the project area.

The proposed design would include a pavement width of 22 feet that would feature 10-foot travel lanes and 1-foot shoulders. Additional land area would be required to install guardrail where warranted. The roadway posted speed limit would be 35 MPH. Based on these lane width design standards and other design criteria, including laying back of cut slopes, the project would require an estimated 11.8 acres of land disturbance. The project’s design report estimated 9.5 acres of disturbance. The additional two acres of disturbance is associated with design changes, including additional excavation of potentially unstable soils from Station 44+00 to Station 48+00. The increase in area also assumes an additional 10 feet offset beyond the cuts and fills to account for accommodation of equipment access. It was determined based on further geotechnical soil analysis that removal and laying back of slopes could be more feasible and pose less risk than constructing retaining walls in this area of the project, but the final determination would be made in final design. Of the 11.8 acres, approximately 3.2 acres would be permanently impacted for the roadway prism footprint and 8.6 acres would be cleared to accommodate roadway cuts and fills. These 8.6 acres would be restored after construction is completed.

The use of low-volume roadway design standards enables the roadway width to be reduced by 26 percent from the 30-foot width standard identified previously in the design report. The proposed project would require a new right-of-way easement from the U.S. Forest Service due to the newly aligned roadway’s location on U.S. Forest Service lands in the Mt. Baker-Snoqualmie National Forest. The existing damaged roadway would be decommissioned and restored where feasible to natural riparian habitat once the new roadway has been constructed. The restored areas and adjacent areas downslope from the roadway that would be used for roadway stormwater runoff dispersion would be included in the new roadway easement and would be permanently protected from future development.

Design Features

Areas that would be disturbed by clearing and grading in addition to the roadway travel lanes would include cut and fill side slopes, and retaining walls and reinforced soil slopes where necessary, to support the roadway. Reinforced soil slopes in fill sections would typically be 0.5 Horizontal (H):1: Vertical (V), approximately 63 degree slopes, in most areas. Along the cut side of the alignment, slopes would range from 1.5 (H) to 2 (H):1(V) depending on whether the cuts are made through colluvium (landslide) and lacustrine (former glacial lake) deposit areas. Soldier pile retaining walls would be constructed in areas based on geotechnical recommendations, and are currently proposed from Station 42+75 to 44+75, 45+20 to 46+25 and 49+80 to 52+55, subject to change as the design progresses. The remaining retaining walls would be structural earth walls (SEWs). The linear extent of these features may change during final design based on
further analysis of detailed survey, geotechnical, seismic, hydrologic, and hydraulic information and construction considerations. The current estimates for the linear extent (linear feet) of the various types of retaining walls or reinforced slopes includes the following:

- Reinforced Soil Slopes (RSS): 1,255 Linear Feet
- Structural Earth Walls (SEW): 200 Linear Feet
- Soldier Pile: 575 Linear Feet
- Rock Fill Slopes: 1,505 Linear Feet

Near Station 53+00, a diversion berm would be constructed in the upslope area and would tie into the roadway fill. The berm would prevent debris slide deposition onto the roadway in an area where geotechnical investigations have identified a risk for future debris flows.

Asphalt, concrete, and other debris from the decommissioned section of the damaged existing roadway would be removed. Roadway debris would be removed from the river channel to the extent that it would be safe and practicable. The decommissioned roadway would then be restored with soil preparation and plantings where feasible to provide a forested riparian corridor adjacent to the North Fork Skykomish River. Natural stream channel conditions would be restored with the asphalt removal where plantings do not occur. Large woody material would be placed in areas adjacent to the side channel to enhance riparian habitat.

Roadway stormwater runoff quality treatment and flow control would be provided through natural dispersion in accordance with *Highway Runoff Manual* provisions and U.S. Forest Service standards and guidelines. Accordingly, the relocated roadway would be “outsloped” to the areas downslope from the roadway to maintain sheet flow throughout the project length. This requires a deviation from typical roadway design standards where a crown road section would be used and has been requested specifically to improve water quality. Natural dispersion treats stormwater by infiltration into the existing soils and through vegetation root zones; evaporation; and uptake and transpiration by the vegetation. Sheet flow (not concentrated or otherwise channelized) runoff is intercepted without containment or conveyance and uses the infiltration capacity of the roadside soils to effectively infiltrate the stormwater. Those areas that maintain 100 linear feet of flow path through established native vegetation provide both runoff flow control and quality treatment per the state drainage standards. The existing forested slopes downslope from the project, and the area where the existing damaged roadway would be removed and enhanced with riparian restoration, would be preserved to provide the needed area for dispersion. These areas would be protected with permanent protection in the project’s right-of-way easement.

**The no-action alternative**

The no-action alternative proposes that nothing would be done in the areas where the existing roadway is currently washed-out. The existing pavement and other damaged roadway debris would be left in the river channel. Damaged debris includes remnants of concrete associated with an extensive section of concrete-reinforced roadway, and a damaged 90-foot long 8 foot 9-inch diameter aluminum bottomless culvert with concrete footings located at Milepost 6.7. This
culvert is lodged in roadway rubble near the Milepost 6.7-Milepost 6.9 damage area where the river avulsed into a new side channel and formed the upper extent of the washed-out roadway. Other roadway cross culverts are included in damaged roadway portions that would remain. With the no-action alternative, the proposed roadway relocation would not occur and the existing damaged roadway would not be removed from the floodplain and channel migration zone. Roadway connectivity would not be restored to maintain essential travel. No clearing, grading, or other land disturbance would occur. The no-action alternative would not require a new Right-of-Way easement.

**Stormwater Mitigation Measures Considered But Rejected**

In addition to project alignment alternatives that were considered, several stormwater mitigation measures were considered but will not be carried forward. These are identified and discussed below.

According to WSDOT HRM drainage standards, the project is required to have on-site stormwater flow control and water quality treatment facilities. Factors included in the selection of stormwater BMPs include the feasibility of construction, the effectiveness of the BMP, the cost of the BMP and its construction, the environmental impact, the associated maintenance implications, and consideration of the County’s ability to service drainage facilities in this remote area. Facilities with low or no maintenance requirements are highly desirable.

In addition, the U.S. Forest Service has expressed concern about aesthetics and naturalizing the appearance of the proposed road due to its proximity to the North Fork Skykomish River, recommended as a Wild and Scenic River in the Mt. Baker-Snoqualmie National Forest Plan (as amended). Most stormwater BMPs would not aesthetically blend well with the forest.

The following stormwater flow control and water quality options were analyzed but are either insufficient to handle the flow control needs of the entire project, or are generally not recommended for this project:

- **Infiltration or exfiltration.** While there are some limited areas onsite that could potentially be well-draining, they are mostly located at the bottom of the existing slope, very close to or within the flood zone, and a significant distance away from the proposed roadway alignment. Runoff from the roadway could be conveyed to these areas, but it has been determined by the design team, with concurrence from the geotechnical team, that any concentration of flows is undesirable due to increased risk to slope stability.

- **Porous pavement shoulders.** The shoulders of this roadway are proposed to be 1’ wide. This will not be sufficient to handle the stormwater needs of this project, and would be difficult if not impossible to construct. Porous pavement within the roadway is not feasible, as increased exposure to runoff could increase risk of failure of roadway subgrade, especially in remote areas such as this site that receive minimal maintenance.

- **Compost-amended vegetated filter strips, ecology embankments, biofiltration swales.** These water quality BMPs would involve expansion of the roadway footprint, and would not provide flow control. As the project site is located entirely within pristine riparian mature forest, one of the critical design criterion is to minimize project footprint. Given
the pristine nature of the project site, man-made BMPs would not compensate for the impact to the forested areas.

- Bio-infiltration cells, detention ponds, constructed wetlands. In addition to the desire to minimize project footprint, open ponds are not feasible due to constraints involved with excavating a level pond on a steep hill-side. The pond would necessitate high, water impermeable walls on both the cut and fill-side. These types of facilities are also undesirable due to the USFS aesthetic concerns regarding such facilities in proximity to the North Fork Skykomish River.

- Underground vaults and tanks. The site topography would require constructing the level tanks in a stair-type configuration along the road section and a series of tanks would be necessary for each of the basins. The geotechnical engineers stated that this would cause undue hardship during construction and could potentially introduce additional risk to slope stability. This option was also considered infeasible due to the necessity to excavate stable bedrock under the proposed roadway to install the tanks. There would also be a high maintenance requirement associated with either of these options.

- Floodplain restoration projects designed to increase stormwater storage would be difficult if not impossible to design in this area and would not be sufficient to handle the stormwater needs of this project. In addition, opportunities to restore floodplains are limited due to the relatively pristine character of the project area. The one exception is where the existing roadway would be removed from the floodplain. This is proposed as part of the project’s riparian mitigation.
Chapter 4: Studies, Coordination, Methods, and Regulations

The purpose of this chapter is to provide a summary of the surface water background work that has occurred and that has been used to develop the analysis approach undertaken by the project. This includes a review of the applicable rules and regulations that the project would be required to comply with as part of its review and approval process.

Baseline Documentation

All portions of the proposed relocated road alignment, including stream crossings, the existing damaged roadway both in and out of the river channel, were walked multiple times in the field by the project design team over the period from the fall of 2007 through the fall of 2013. All streams have been identified and surveyed and included in design plans. The project design team was accompanied by agency personnel from multiple agencies, including the Federal Highway Administration, the U.S. Forest Service, the Washington State Department of Transportation, and the Washington Department of Fish and Wildlife on several of these trips. Site photographs were collected during field trips. Extensive topographical survey and subsurface geotechnical borings have been undertaken to better understand site conditions. A Channel Migration Zone analysis was also conducted to better understand river dynamics in the project area, and better understand the risk for potential future damage related to high river flows. A HEC-RAS model was developed during the course of early project development to better understand the river flows that would be associated with 100-year flow events, and to assist in determining how far the roadway would need to be relocated to move it from the 100-year floodplain.

Previous studies done for this project include the Design Report and the Preliminary Drainage/Hydraulics Report, prepared in March 2011. This report contains several technical memoranda, including hydrologic and hydraulic analysis. A channel migration zone analysis was also undertaken to better understand the risk for potential river lateral migration that would pose future risks for roadway damage. This information documents baseline conditions and major concerns and recommendations related to surface water resources in the project area. Information from these reports is included below.

Agency Coordination

Several agencies are directly and indirectly involved with this project. The agencies that have provided input on the project design include:

- U.S. Forest Service
- Washington Department of Fish and Wildlife
- Washington State Department of Transportation
Relevant Rules and Regulations

Storm drainage requirements for the project are being designed in accordance with the WSDOT Highway Runoff Manual (HRM), required for FHWA federally funded projects, and WSDOT will conduct the drainage review in coordination with the Washington State Department of Ecology. The proposed drainage design has been prepared in accordance with the 2011 version. However, as construction is not anticipated to begin until 2016 or later, it is anticipated that the design will need to be in compliance with the anticipated 2014 version. The design team does not expect the applicable sections of the manual to change with the new version.

Roadway stormwater runoff quality treatment and flow control would be provided through natural dispersion in accordance with Highway Runoff Manual provisions and U.S. Forest Service standards and guidelines. Accordingly, the relocated roadway would be “outsloped” to the areas downslope from the roadway to maintain sheet flow throughout the project length. This requires a deviation from typical roadway design standards where a crown road section would be used and has been requested specifically to improve water quality. Natural dispersion treats stormwater by infiltration into the existing soils and through vegetation root zones; evaporation; and uptake and transpiration by the vegetation. Sheet flow (not concentrated or otherwise channelized) runoff is intercepted without containment or conveyance and uses the infiltration capacity of the roadside soils to effectively infiltrate the stormwater.

In addition, the roadway design portion of this project would be approved by WSDOT and by the Snohomish County Traffic Engineer to be designed in accordance with the Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT <400), 1st Edition. Additional guidance is provided by the U.S. Forest Service (USFS), as the relocated alignment would be located on USFS land. The project would also comply with Snohomish County regulations. The project’s compliance with the WSDOT review is anticipated to also meet Snohomish County requirements.

U.S. Forest Service

National Forest Management Act

Land use actions occurring in the proposed project area are required to be consistent with the requirements of the National Forest Management Act (USC 1604(g)(3)(E)) and its implementing regulations (36 CFR 219). The proposed project must also conform to the Land and Resource Management Plan (LRMP) for the Mt. Baker-Snoqualmie National Forest, as amended (USDA, USDI 1994, 2001, 2004). The plan and its amendments are referred to collectively as the MBSNF Plan in this study.

Land Use policies and regulations

The following discussion of U.S. Forest Service (USFS) related land use policies and regulations is in accordance with USFS regulations for implementing NEPA, and is tiered to the Final
Environmental Impact Statement (FEIS) for the Mt. Baker-Snoqualmie Land and Resource Management Plan (USDA Forest Service 1990), as amended. Major plan amendments since 1990 include:

- **Final Supplemental Environmental Impact Statement on Management of Habitat for Late Successional and Old-growth Forest Related Species Within the Range of the Northern Spotted Owl**, as adopted and modified by the April 1994 Record of Decision, which provides additional standards and guidelines (USDA, USDI 1994, and commonly known as the ROD, or the Northwest Forest Plan (NWFP)).

- **Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and Other Mitigation Measure Standards and Guidelines** (USDA, USDI 2001).


The 1994 Record of Decision (ROD) includes seven land allocations, which amend the allocations in the 1990 Forest Plan. There is considerable overlap among some allocations, and more than one set of standards and guidelines may apply. Where the standards and guidelines of the 1990 Forest Plan are more restrictive or provide greater benefits to late-successional forest-related species than do those of the 1994 ROD, those existing standards and guidelines apply. The 1994 Forest Plan amendment also includes Forest-wide Standards and Guidelines, in addition to those in the 1990 Plan, and an Aquatic Conservation Strategy (ACS) designed to help improve the health of the aquatic ecosystem. The standards and guidelines that will be applied to the proposed Index-Galena Road project are discussed further in following sections.

**Standards and Guidelines**

An overarching goal stated in the MBSNF Plan with regard to Forest-wide standards and guidelines for land uses directs the Forest Service to "be responsive in the consideration of the use and occupancy of the Forest by private individuals, Federal, State and local governments when such use is consistent with Forest management objectives, is in the public interest, and cannot be reasonably served by development on private land" and "grant needed easements to State and local governments for existing and relocated roads and highways" (MBS 1990 Forest Plan, page 4-137).

Several standards and guidelines are taken into consideration when evaluating proposed projects occurring on MBSNF lands, these include suitability of the proposed use, resource protection, safety, water quality, fish and wildlife habitat, and visual quality. One of the principal guiding elements of the MBSNF Plan in addition to the standards and guidelines identified in Chapter 3 is the Aquatic Conservation Strategy (ACS).

**U.S. Forest Service Standards**

Several U.S. Forest standards and guidelines apply to the project due to its location within the Mt. Baker-Snoqualmie National Forest (MBSNF) and are incorporated into the proposed design.
These requirements are part of the adopted MBSNF Plan. The MBSNF Plan requirements are discussed extensively in the Land Use/Recreation report prepared for the project. Some of the more directly applicable roadway design standards include the following guidelines related to roads management in areas such as the project area that are located in designated riparian reserves. Other requirements include the MBSNF Plan’s Aquatic Conservation Strategy (ACS).

**Aquatic Conservation Strategy**

The Aquatic Conservation Strategy (ACS) is a primary component of the *MBSNF Plan* for the protection of aquatic and riparian-dependent species. The ACS was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained with them on public lands. Designation of land areas as Riparian Reserves along with specific standards and guidelines to protect them are a component of the ACS. Riparian Reserves are lands along streams and unstable and potentially unstable areas where special standards and guidelines direct land use.

There are nine objectives that collectively help to assure protection of the ecosystem functions provided by Riparian Reserve areas. The standards and guidelines are designed to focus review of proposed projects to determine compatibility with ACS objectives. Project consistency determinations are made during review of a proposed project to determine whether projects “meet” ACS objectives. Alternatively, determinations may also conclude that a proposed project “does not prevent attainment.” Projects that do not maintain the existing condition or lead to improved conditions in the long term would be determined to not meet the intent of the ACS and would not be recommended for implementation or approval.

The nine ACS objectives include:

- **Objective 1**: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.
- **Objective 2**: Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to critical areas for fulfilling life history requirements of aquatic and riparian-dependent species.
- **Objective 3**: Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.
- **Objective 4**: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.
• **Objective 5**: Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage and transport.

• **Objective 6**: Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

• **Objective 7**: Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

• **Objective 8**: Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

• **Objective 9**: Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian dependent species.

**Riparian Reserves Standards and Guidelines for Roads Management**

The following Riparian Reserves standards and guidelines for roads management apply to the proposed Index-Galena Road project:

**RF-1** - Federal, state, and county agencies should cooperate to achieve consistency in road design, operation, and maintenance necessary to attain Aquatic Conservation Strategy objectives.

**RF-2** - For each existing or planned road, meet Aquatic Conservation Strategy objectives by:
   a. minimizing road and landing locations in Riparian Reserves.
   b. completing watershed analyses (including appropriate geotechnical analyses) prior to construction of new roads or landings in Riparian Reserves.
   c. preparing road design criteria, elements, and standards that govern construction and reconstruction.
   d. preparing operation and maintenance criteria that govern road operation, maintenance, and management.
   e. minimizing disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flow.
   f. restricting sidecasting as necessary to prevent the introduction of sediment to streams.
   g. avoiding wetlands entirely when constructing new roads.

**RF-3** - Determine the influence of each road on the Aquatic Conservation Strategy objectives through watershed analysis. Meet Aquatic Conservation Strategy objectives by:
   a. reconstructing roads and associated drainage features that pose a substantial risk.
   b. prioritizing reconstruction based on current and potential impact to riparian resources and the ecological value of the riparian resources affected.
   c. closing and stabilizing, or obliterating and stabilizing roads based on the
ongoing and potential effects to Aquatic Conservation Strategy objectives and considering short-term and long-term transportation needs.

RF-4 - New culverts, bridges and other stream crossings shall be constructed, and existing culverts, bridges and other stream crossings determined to pose a substantial risk to riparian conditions will be improved, to accommodate at least the 100-year flood, including associated bedload and debris. Priority for upgrading will be based on the potential impact and the ecological value of the riparian resources affected. Crossings will be constructed and maintained to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure.

RF-5 - Minimize sediment delivery to streams from roads. Outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping is unfeasible or unsafe. Route road drainage away from potentially unstable channels, fills, and hillslopes.

RF-6 - Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams.

RF-7 - Develop and implement a Road Management Plan or a Transportation Management Plan that will meet the Aquatic Conservation Strategy objectives. As a minimum, this plan shall include provisions for the following activities:
   a. inspections and maintenance during storm events.
   b. inspections and maintenance after storm events.
   c. road operation and maintenance, giving high priority to identifying and correcting road drainage problems that contribute to degrading riparian resources.
   d. traffic regulation during wet periods to prevent damage to riparian resources.
   e. establish the purpose of each road by developing the Road Management Objective.

In addition to the requirements identified above, there are several development regulations that evaluate effects to surface water. Below is a list of the regulations that the proposed project will be required to comply with as part of development approval.

Federal Implementation/Issuance

Clean Water Act Section 404 Permit (Corps Permit)
Under Section 404 of the Clean Water Act (CWA), a project requires a permit from the Army Corps of Engineers (Corps) for any discharge of dredged or fill material waterward of the ordinary high water mark (or the mean higher high tide in tidal areas) in waters of the United States, including special aquatic sites such as wetlands (33 U.S.C. §1344). In Washington State, a Section 404 permit is typically applied for with a Joint Aquatic Resources Permits Application (JARPA) and requires drawings meeting Corps specifications and other documentation. Completion of processing for receipt of the Section 404 permit typically requires up to 6 months for a nationwide permit and up to 12 months or more for an individual permit.
For the Index-Galena Road project, proposed project elements would involve both placement/removal of fill materials within the ordinary high water mark (OHWM) of the North Fork Skykomish River, and within wetlands located along the proposed alignment. Thus the project would be subject to Section 404 of the Clean Water Act (CWA), requiring a Corps permit. Based on what is known at this time about the potential alignments, the project would likely require a Nationwide permit.

**Endangered Species Act Section 7 (and Essential Fish Habitat) Consultation**

Section 7 of the Endangered Species Act (ESA) requires that federal agencies ensure any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of designated critical habitat (16 U.S.C.1536 (a)(2)). In addition, when applicable, federal agencies must also evaluate potential impacts to Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (as amended by the Sustainable Fisheries Act of 1996, Public Law 104-267). These provisions also apply to local government activities in which federal funding and/or authorization(s) are involved.

A federal nexus will exist for this project due to FHWA funding, the project’s location on federal land, and the need for a Section 404 permit from the Corps. Compliance with Section 7 of the Endangered Species Act will be required. The project will prepare a Biological Assessment to address ESA-listed species potentially affected by the project. Given the likely substantial construction activities along the river, it is likely that formal consultation will be required for the project. It is also expected that consultation on designated critical habitat for both aquatic and terrestrial species would be a significant component of ESA consultation.

**State Implementation/Issuance**

**Clean Water Act Section 401 Water Quality Certification (CWA)**

Under Section 401 of the CWA, the Washington Department of Ecology (DOE) reviews all projects that require a federal permit or approval, and which might pollute waters of the U.S including wetlands. In order to determine and certify whether projects comply (or would comply given additional conditions) with various water quality standards and plans for preventing pollution. In Washington State, a Section 401 Certification is typically applied for using the JARPA. Because the proposed Index-Galena Road project requires a Section 404 Permit, a Section 401 Certification would be required. It is not known whether, the project would require an Individual Water Quality Certification.

**Coastal Zone Management Certification**

In accordance with the federal Coastal Zone Management Act (CZMA) of 1972 (16 U.S.C. 1451-1456), a project in Washington that affects coastal resources (within Washington’s 15
coastal counties) and which requires federal permits or receives federal funding requires a Coastal Zone Management (CZM) Certification from DOE stating that the project is consistent with Washington’s Coastal Zone Management Program (WCZMP) to the “maximum extent practicable.” Applicants for CZM Certification prepare a Determination of Consistency Checklist and develop a Federal Consistency Document (FCD), which are submitted to the CORPS and DOE.

The Index-Galena Road project’s Corps Section 404 federal nexus requires compliance with the Coastal Zone Management Act. Given the project’s location in direct proximity to water resources, DOE is likely to require certification of compliance if the project requires an individual Water Quality Certification (DOE determines this on a case-by-case basis). Should DOE determine that such certification is necessary, the County would prepare a Coastal Zone Management consistency certification for the project (submitted to DOE) showing it complies with the enforceable policies of Washington’s Coastal Zone Management Program (including the Shoreline Management Act, State Environmental Policy Act, CWA, Clean Air Act). Determination of the project’s effects on Waters of the US, including wetlands, would be required prior to certification of compliance with the CWA.

Hydraulic Project Approval

The Washington Department of Fish and Wildlife (WDFW) requires a Hydraulic Project Approval (HPA) for any project that will use, divert, obstruct, or change the natural flow or bed of fresh waters or marine waters of the State (RCW 77.55.100). Since construction of the Index-Galena Road project would involve in-water work, it would be subject to Hydraulic Project Approval by WDFW.

Local Implementation/Issuance

Critical Area Regulations Review and Compliance Certification

All development activity conducted by a public agency within unincorporated Snohomish County is subject to compliance with Snohomish County Critical Areas Regulations (CAR), and applicable more specifically to the proposed Index-Galena project are SCC 30.62 A– Wetlands and Fish & Wildlife Habitat Conservation Areas and SCC 30.62B Geologically Hazardous Areas. In the area affected by the proposed alignments, CAR regulates activities in streams, wetlands, primary association areas for critical species, and the associated buffers, and geologic hazard areas. Generally, a critical area study is required for development activities that occur within a critical area or associated buffer. A habitat management plan and a mitigation plan that mitigates for project impacts will also be required as part of the critical area study.
Flood Hazard Permit - SCC 30.65 – Special Flood Hazard Areas and SCC 30.43C

Flood Hazard permits regulate all development within the designated floodplains of Snohomish County. Any projects located within the floodplain must examine the potential impacts of proposed activities on floodwater storage and flow. Depending on the proposed activity, a flood hazard permit, variance, or exemption must be granted. The Index-Galena Road project site is located within the 100-year floodplain of the North Fork Skykomish River, and would be subject to Snohomish County Flood Hazard regulations. Provided that the project would result in no net increase in the volume of fill material within the floodplain (in relation to the pre-existing roadway prism), and that the work conducted is considered normal maintenance and repair, the project would be expected to meet the displacement and obstruction thresholds of the flood hazard code and receive a flood hazard permit. However, if the proposed work increases the volume of fill within the floodplain, a detailed hydraulic analysis may be required to support expected effects on flood elevations.

Land Disturbing Activity / Drainage Approval

Snohomish County requires a land disturbing activity permit be obtained prior to implementing projects that would involve clearing, filling, or excavation activities in sensitive locations, along public right-of-ways, or in excess of threshold levels established in the County code. Regardless of whether a permit is required, clearing and/or grading must conform to County requirements, and must incorporate best management practices (BMPs) to protect adjacent properties and critical areas from runoff, erosion and sedimentation.

Shoreline Substantial Development Permit

Pursuant to the Shoreline Management Act of 1971 (RCW 90.58), Snohomish County requires a Shoreline Substantial Development Permit for certain types of development within designated shoreline environments (SCC 30.44 – Shoreline Management). The Index-Galena Road project site is located in proximity to a designated shoreline (North Fork Skykomish River) and its 100-year floodplain, and would be subject to Shoreline Management regulations. A Shoreline Substantial Development Permit would be required for the project, requiring compliance with conditions of the Snohomish County Shoreline Management Master Program.

Total Maximum Daily Loads

Water Quality Improvement Projects, or TMDLs (Total Maximum Daily Loads) determine the amounts of pollutant loading that a given water body (river, marine water, wetland, stream, or lake) can receive and still meet water quality standards. Where water bodies do not meet water quality standards for a particular pollutant, TMDLs are implemented through Waste Load Allocations, inserted as pollutant limits in permits to point source dischargers, and through Load Allocations and non-regulatory programs for nonpoint sources, to ring water quality up to standards. TMDL’s have not been a requirement for the North Fork Skykomish River because it has no water quality violations-it is not a 303 (d) listed water.
Chapter 5: Project Area Then and Now

This chapter describes the natural environment and the corresponding roadway built environment from which impacts will be evaluated and compared. Because the focus for roadway operational impacts with regard to surface water is typically focused on stormwater runoff and how it affect water quality and runoff flow volume quantities, much of the text will describe water quality and runoff flow volume related issues.

For stormwater runoff analysis, the original condition of the existing Index-Galena Road is identified as an all paved, pollution generating impervious surface. (See Exhibit 2: Pre-Developed Conditions). Snohomish County Code (SCC 30.91P.256) defines pollution-generating impervious surface or PGIS as those impervious surfaces considered to be a significant source of pollutants in stormwater runoff. Such surfaces include those which are regularly subject to vehicular use, and which receive direct rainfall or the run-on or blow-in of rainfall. The following surfaces in the project area are considered regularly-used by motor vehicles: Roads, unvegetated road shoulders, bike lanes within the traveled lane of a roadway, driveways, and areas used for parking. A surface, whether paved or not, shall be considered subject to vehicular use if it is regularly used by motor vehicles.

Pre-Existing Conditions

The runoff from intact sections of the existing road alignment sheet flows to the river side (north side of the road) to a vegetated area between the river and the road. The runoff from the hill side (south side of the road) is collected and conveyed across the roadway and dispersed on the north side of the road. Areas of the roadway alignment that were damaged also have the same drainage patterns as described above.

General Site Description, Topography and Soils

Except for the immediate area occupied by the existing roadway, the entire project area is located within a densely forested area. The area upslope from the river valley bottom contains steep slopes. A mix of understory shrubs and forest occupy the riparian habitat area immediately adjacent to the North Fork Skykomish River. There is dense tree cover with a thick, duff forest floor in the upslope areas. There are intermittent areas with large rock boulders that were originally thought to be bedrock outcroppings, but have since been determined to be large boulders deposited on the slopes.

The soils within the project area are mostly comprised of alluvium and colluvium, with some areas of lacustrine deposits, as well as some marshy soils within the wetland area near Station 54+00. Geotechnical analysis has identified several areas within the proposed project alignment that present the potential for landslide hazards, areas of high erosion and/or rockfall potential. There are two areas along the proposed alignment that pose the potential for heavy debris flows. Debris in these areas can consist of different sized materials, including large boulders and trees.
These flows are not anticipated to occur more frequently than approximately once every 20-50 years, but their occurrence would be potentially disruptive to roadway traffic and also can contribute to sedimentation to area surface water bodies if deposited in slope streams or carried downslope to the river.

According to geotechnical information gathered for the project, the areas of the alignment sited within lacustrine deposits are expected to require extensive excavation to ensure slope stability. The project design has evaluated alignment adjustments to avoid these areas to the maximum extent feasible. Further geotechnical information can be found in the Geology, Soils and Groundwater Discipline Report. A geotechnical report with final recommendations will be prepared as part of the final design.

**Project Site Climate**

The Skykomish River watershed climate is characterized as temperate marine due to its year-round precipitation and moderate temperatures (Pentec and NW GIS, 1999). The Pacific Ocean provides both a cooling effect in the summer and a warming effect in the winter, while the Cascade ranges buffer the region from the extreme temperatures of continental air masses.
January has the coldest temperatures, dipping to lows around 33 degrees Fahrenheit (°F), while in July temperatures peak around 77°F (WRCC, 2006b). Winters are wetter than the summers, with snowfall less common than rainfall. Approximately 25-33 % of total precipitation falls between April and September. Annual precipitation increases from west to east across the watershed, from 48 inches in Monroe (in the western portion of the watershed) to 89 inches in Index (in the center of the watershed) (WRCC, 2006a, 2012).

**Upstream Conditions**

Upstream of the project site is a steeply-sloped, high-relief river basin that discharges from the bedrock-lined corridor of the North Fork Skykomish River. Soil properties include alluvium, colluvium, lacustrine, and outcrops of bedrock. Field observation of the area indicates that the hill side drainage channels are numerous and are typically narrow, shallow, and poorly defined. The drainage channels are generally well vegetated. The project site is located near the bottom of the drainage basins adjacent to the river. The entire North Fork Skykomish River basin is about 93,950 acres (about 147 square miles) of which 380 acres are located upstream of the proposed road re-alignment. (See Appendix A: Map of Off-Site Sub-Basin Areas From Design Report.)

<table>
<thead>
<tr>
<th>Off-site TDAs</th>
<th>Off-Site Sub-basins</th>
<th>Drainage Area (acres)</th>
<th>On-site Sub-basins</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5, 17, 19, 22, 25, 28, 32, 38, 40, 41, 45, 47, 48, 51, 58, 56</td>
<td>29.2</td>
<td>A Sta 10+00 to Sta 22+75</td>
</tr>
<tr>
<td>B</td>
<td>3, 9, 11, 12, 18, 23, 29, 31, 33, 36, 37, 39, 44, 46, 55, 59, 63</td>
<td>68.5</td>
<td>B Sta 22+75 to Sta 33+50</td>
</tr>
<tr>
<td>C</td>
<td>2, 6, 7, 8, 13, 15, 20, 21, 26, 27, 34, 35, 42, 49, 54, 57, 60, 61</td>
<td>82.5</td>
<td>C Sta 33+50 to Sta 51+75</td>
</tr>
<tr>
<td>D</td>
<td>1, 4, 10, 14, 16, 24, 30, 43, 50, 52, 53, 63</td>
<td>189.7</td>
<td>D Sta 51+75 to Sta 58+90</td>
</tr>
</tbody>
</table>

**Exhibit 3: Table from Design Report with Offsite TDAs**

**Downstream Conditions**

Downstream of the project site are the lower reaches of the North Fork Skykomish River. Immediately downhill of the new alignment is a side channel of the North Fork Skykomish River that conveys relatively moderate flow during low flow periods but experiences larger flow conveyance during high flow conditions. Based upon observations at the upstream end of the side channel, the mainstem channel could potentially avulse into the side channel at some point in the future. This potential was also determined as part of the channel migration zone analysis that was prepared for the project.
North Fork Skykomish River Conditions

The North Fork Skykomish River flows southwest towards its confluence with the South Fork Skykomish River. It passes the Town of Index before it reaches the confluence. The North Fork Skykomish River is an island-braided system with increasing amounts of woody debris and sediment being stored in the reach over time. As described in the channel migration zone analysis findings included in the 2009 Route Feasibility Study, the river is in a state of recovery from past human intervention and it now occupies a wider section of the valley floor than in recent decades. The frequency of avulsion and other erosion related events is expected to increase during this recovery period which will result in a wider occupation of the river valley in the future. The channel migration zone (CMZ) identified in the report has been included in project design plans to assist design efforts to avoid roadway relocation within the CMZ.

Exhibit 4: Peak Discharge Values Table from Design Report shows the peak discharge values at the mouth of the river referenced from Table 2 of the North Fork Skykomish Hydraulic Model Documentation Memorandum, Anchor QEA, May 18, 2009.

<table>
<thead>
<tr>
<th>Flow Event</th>
<th>Detailed Study Results (2008)</th>
<th>StreamStats Regression Analysis Prediction</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-year</td>
<td>25,300 cfs</td>
<td>22,900 cfs</td>
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<td>36,700 cfs</td>
<td>33,800 cfs</td>
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<tr>
<td>100-year</td>
<td>42,000 cfs</td>
<td>38,100 cfs</td>
</tr>
<tr>
<td>500-year</td>
<td>54,700 cfs</td>
<td>50,800 cfs</td>
</tr>
</tbody>
</table>

Adjacent Land Use

The project area adjacent land uses are primarily undeveloped forest lands, but several private residences, mostly recreational, are located along the river upstream and downstream from the project site. None are located in the proposed project limits. These properties are served by onsite wells for potable water and septic systems for treatment.

Project Sub-basins and Drainage Patterns

Project sub-basins and drainage patterns were identified and are discussed in detail in the Hydrology Memorandum and their Hydraulic Memorandum prepared for the Design Report and Preliminary Drainage/Hydraulics Report. (See Appendix A: Map of Off-Site Sub-Basin Areas From Design Report) These sub-basins were identified as part of the effort to estimate stormwater runoff volumes in the project area and understand conveyance needs to roadway cross culverts that would be needed. Numerous sub-basins were identified that drain down the slopes south of the alignment toward the project site. For purposes of this report, excerpts of these documents have been provided in order to present an overview of the project hydrology and hydraulics. For final design of the project, a drainage report would be prepared and some of
this information will be compiled, reviewed, and incorporated and, if necessary, updated to reflect the final project recommendations.

**Onsite Conditions**

Four on-site sub-basins were established for the purpose of the preliminary project specific drainage analysis. The west portion of the project was identified as Sub-basin A and is approximately 1,175 feet long and has a 400-foot long section with well-draining soil that is suitable for infiltration. Existing groundcover is primarily native forest vegetation. The side slopes in Sub-basin A vary from 10 to 80 percent, with approximately half being greater than 50 percent and the rest less than 50 percent. Sub-basin A is located between Station 10+00 and Station 22+75. The proposed roadway profile is 10 to 15 feet above river level and the base of the infiltration receptor is at least 5 feet above the water table. Part of this sub-basin is located on a mild side-slope, uphill of a side channel of the North Fork Skykomish River.

Sub-basin B is located between Station 22+75 and Station 33+50 with the lowest point at station 25+50. This sub-basin consists of areas with underlying bedrock as well as areas with well drained soils. The side slopes of this sub-basin area are steep and in parts are greater than 50 percent. In some locations the slope is approximately 80 percent. Sub-basin B is 1,075 feet long. Existing groundcover is primarily native forest vegetation.

Sub-basin C is approximately 1,825 feet long. Sub-basin C is located between Station 33+50 and Station 51+75. This sub-basin area also includes steep side slopes that range from 20 to 50 percent. Sub-basin C also consists of a mixture of underlying bedrock and well drained soils, in some places with a shallow cover of topsoil. Existing groundcover is primarily native forest vegetation.

Sub-basin D is located between Station 51+75 and the north end of the project. Most of this sub-basin area is adjacent to an existing wetland. Sub-basin - D is approximately 815 feet long. This sub-basin area is generally level ground in close proximity to the river valley bottom.

Field observation of the project area indicates that the drainage channels are numerous and are typically narrow, shallow, and not well-defined. The drainage channel substrates include large boulders and cobbles, and have well-vegetated riparian corridors, and include debris such as downed timber and forest detritus. Flow observed in these drainages during site visits appeared to be mostly interflow between the large boulders and cobbles.

Field delineations have identified eight streams along the proposed relocated roadway alignment. All are non-fish bearing streams. Most of them run dry or have very low flows during the summer months, with the exception of the stream located near Station 29+00.

**On-site Runoff**

MGS Flood is a continuous flow model for stormwater facility analysis. It was used to calculate the on-site impervious area flow rate. The Anchor QEA Hydrologic Memorandum shows that the post-developed on-site runoff rates for the 100-year storm event can be estimated to be between 1.986 cfs/acre to 2.954 cfs/acre.
Off-site Sub-basins

The preliminary design analysis identifies sub-basins 1 – 63 uphill of the project area. These sub-basins are illustrated in Appendix A: Map of Off-Site Sub-Basin Areas From Design Report and listed in Exhibit 3: Table from Design Report with Offsite TDAs. Hydrologic analysis includes delineation of drainage sub-basins for the project site and analysis of the sub-basins to determine the 25-year and 100-year stormwater runoff flows.

Preliminary Sizing of Roadway Drainage Crossings

Stream channels, for a total of eight streams, have been identified and surveyed and are included in the current project plans. Additional areas that will require roadway drainage cross culverts have also been identified.

The surveyed drainage channels generally coincide with three drainage basins delineated as part of the hydrologic analysis. These drainage channels are identified as A, B, and C as shown in Appendix A: Proposed Culverts Locations and Preliminary Sizing and coincide with the delineated subbasins 4, 2, and 3, respectively. Consequently, subbasins 2, 3, and 4 are the second, third, and fourth largest subbasins in terms of drainage area. Each of the modeled drainages are quite steep, narrow, and have relative shallow flow depths, moderate to high velocities, and have supercritical flow during the estimated 100-year flow. Other smaller subbasins may produce similar results in terms of flow depths and velocities, but with lower flow rates.

Developing the Sizing of Proposed Roadway Drainage Crossings

The effect of sediment transport and debris loading on the sizing of the proposed culverts has become better understood with additional data collection, including field identification of additional streams along the proposed alignment and more integration of onsite geotechnical information, and will be further coordinated with the layout and design of the relocated roadway’s drainage features. Sediment transport and debris loading are important design parameters and need to be taken into account during the final design phase. Sediment transport and debris loading to convey 100-year storm events and associated debris will require larger sized culverts than initially considered for the design report. Onsite drainage courses crossing the proposed alignment have been identified in the field, and flow calculations best fit to the subbasins described in the Anchor QEA Hydrologic Memorandum. The currently proposed locations and sizes of roadway culvert crossings have taken into account the information from previous reports, as well as additional field observation and engineering judgment. While final design has not been completed at the time of this report, the following table in Appendix A: Proposed Culvert Locations and Preliminary Sizing represents the best culvert information available at this time. All of these culverts are also designed to act as emergency runoff conveyance for storms larger than the 100-year event.
Exhibit 5: Proposed Culvert Locations and Preliminary Sizing

<table>
<thead>
<tr>
<th>Culvert No.</th>
<th>Approximate Station</th>
<th>Length (feet)</th>
<th>Culvert size (inch)</th>
<th>Conveyance Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13+28</td>
<td>35</td>
<td>49x33 arch</td>
<td>Not stream</td>
<td>will need re-profiling, up/dn</td>
</tr>
<tr>
<td>2</td>
<td>15+87</td>
<td>39</td>
<td>36</td>
<td>Not stream</td>
<td>lay pipe on existing grade, fill above</td>
</tr>
<tr>
<td>3</td>
<td>17+25</td>
<td>35</td>
<td>36</td>
<td>Not stream</td>
<td>significant grading, reprofile</td>
</tr>
<tr>
<td>4</td>
<td>19+70</td>
<td>56</td>
<td>48</td>
<td>Stream</td>
<td>significant grading, reprofile</td>
</tr>
<tr>
<td>5</td>
<td>26+57</td>
<td>50</td>
<td>36</td>
<td>Stream</td>
<td>lay pipe on existing grade, fill above</td>
</tr>
<tr>
<td>6</td>
<td>28+98</td>
<td>35</td>
<td>120</td>
<td>Stream</td>
<td>Box Culvert/Vented Ford</td>
</tr>
<tr>
<td>7</td>
<td>31+61</td>
<td>39</td>
<td>36</td>
<td>Not stream</td>
<td>lay pipe on existing grade, fill above</td>
</tr>
<tr>
<td>8</td>
<td>33+61</td>
<td>44</td>
<td>48</td>
<td>Stream</td>
<td>mostly within already disturbed areas</td>
</tr>
<tr>
<td>9</td>
<td>35+90</td>
<td>50</td>
<td>36</td>
<td>Stream</td>
<td>soldier pile wall - culv not designed yet</td>
</tr>
<tr>
<td>10</td>
<td>44+84</td>
<td>52</td>
<td>48</td>
<td>Stream</td>
<td>lay pipe on existing grade, fill above</td>
</tr>
<tr>
<td>11</td>
<td>46+39</td>
<td>34</td>
<td>64x43 arch</td>
<td>Stream</td>
<td>lay pipe on existing grade, fill above</td>
</tr>
<tr>
<td>12</td>
<td>47+25</td>
<td>30</td>
<td>48</td>
<td>Stream</td>
<td>some cut, reprofiling upstream</td>
</tr>
<tr>
<td>13</td>
<td>50+20</td>
<td>42</td>
<td>36</td>
<td>Not stream</td>
<td>lay pipe on fill, fill above</td>
</tr>
<tr>
<td>14</td>
<td>51+20</td>
<td>40</td>
<td>36</td>
<td>Not stream</td>
<td>lay pipe on fill, fill above</td>
</tr>
</tbody>
</table>

In addition to typical roadway cross-culverts, the proposed design includes a bridge and a box culvert/vented ford crossing. The proposed bridge would span the wetland/stream located at the north end of the newly aligned portion of the roadway. The wetland is hydraulically connected to the river. It forms a seasonal pool, in part from overland flow and in part by backwater of high river levels. The box culvert /vented ford crossing would handle debris flows as identified by geotechnical analysis. For the box culvert/vented ford crossing, a 100-foot length of roadway would be reinforced with a 10-foot wide concrete channel, potentially covered with a removable lid. This 10-foot channel would be designed to convey hillside stream flow for the 100-year event and associated debris under the road. This culvert would be located at approximately Station 29+00 to convey part of the runoff from sub-basin 4 to flow under the proposed road.

A roadside ditch is proposed on the uphill side of the roadway. This is anticipated to intercept and divert any remaining uphill offsite runoff not currently directed to project roadway drainage crossings. The crossings have been placed solely at locations intercepting observed drainage courses, so as not to introduce any new concentration of flow to the steep hillside. Project low points on sag vertical curves occur approximately at Stations 29+60 and 43+85. The roadside ditch would be graded such that runoff at these low points would be directed to proposed drainage crossings at Stations 29+98 and 44+84, respectively. This would result in approximately 100 lf of ditch flowing contrary to the roadway surface at these two low point locations.
Chapter 6: Environmental Consequences

Project Effects and Mitigation

Summary of Effects and Mitigation

The proposed roadway relocation to restore connectivity of Index Galena Road would include several land disturbing activities such as vegetation clearing and grubbing, excavation, construction of embankments and placement of fill, constructing walls, and installing culverts at stream crossings, and culverts to convey roadway drainage that could potentially adversely affect surface water quality and alter stream flows. Construction activity would pose the most extensive impacts to the landscape, but more long term effects could also adversely affect surface water bodies in the project area once the proposed relocated roadway is open to traffic if surface water considerations are not addressed adequately in the project design.

The exact construction techniques and construction sequencing will not be fully known until the project bidding process is completed and a contractor is selected. However, there are several assumed components of the construction process that have been used to identify potential impacts and mitigation to address the impacts. Once the roadway is open to traffic, operational impacts would be principally focused on providing stormwater quality treatment and flow control so that surface water quality and flow regimes are not adversely affected. When not addressed adequately for quality treatment, roadway stormwater flows can increase pollutant loads for sedimentation that would increase turbidity levels and also contribute to elevated levels of metals typically associated with roadway runoff. If surface flow regimes are not addressed adequately higher peak flows during large rainfall events can increase erosion that adversely affect stream channels.

Impacts of Pollutant Loading on the Receiving Waters

The project’s soil compaction and increased impervious surface area associated with roadway construction would cause increased surface flows relative to subsurface flows. This occurs because increased impervious surface area associated with roadways on land areas that were previously undeveloped changes the way water runs off the property. It removes natural soakage (infiltration) and vegetation that would have previously slowed the run off. Without stormwater BMPs that attenuate the flow, or release the flow in a controlled manner, the impact is that the volume of runoff increases, it runs off more quickly, and the stormwater network, whether it includes pipes, drainage ditches and eventual discharge to streams reaches capacity more often and much more quickly. The effects of increased runoff can result in increased water levels and possible flooding. The increased velocities can also cause erosion to banks that result in environmental damage.

More detailed discussion of effects to surface waters and the proposed mitigation associated with the proposed action alternative and the no-action are provided below. Appendix C addresses
consistency with U.S. Forest Service Aquatic Conservation Strategy (ACS) objectives and Riparian Reserves Standards and Guidelines.

Effects

No Action Alternative

No road construction would occur if the no-action alternative is selected. Index-Galena Road would continue to be blocked to vehicle traffic at MP 6.4. The existing damaged portion of Index-Galena Road that extends from Milepost 6.4 to Milepost 6.9 that closely parallels the North Fork Skykomish River would continue to have portions of the roadway located within a side channel of the river. In other areas, intact remnants would remain located immediately adjacent to the side channel. The damaged roadway would remain situated within the 100-year floodplain and the channel migration zone. Accordingly there would be several locations vulnerable to recurring washouts during river high flow events and floods. Road segments left within the channel migration zone would continue to be at risk of damage as long as the road remains at these locations.

Roads, in general, are known to be chronic sediment sources even when routinely maintained. Leaving the damaged roadway in place and inaccessible would result in continued deterioration, including ditch drainage functions, over time. Non-functional ditches are more likely to cause uncontrolled flow over remaining road surfaces, saturating road fill slopes, and would increase the risk for erosion and roadway embankment failures and thereby increasing sediment input to the river. While natural processes would regenerate vegetation where bare soil areas become available over time, recovery to more natural conditions would be impeded in the areas where intact asphalt road surfaces remain. It is not certain when sediment production would return to natural levels.

Large flow and flood events would continue to erode portions of the remnant roadway sections. Not relocating the road, nor restoring the damaged areas, leaves the damaged sites vulnerable to continued erosion. There is the potential that a major avulsion event could occur where the current side channel is located. This would result in high velocity flows directed to the existing intact roadway segments. These avulsion events would likely cause the release of large amounts of sediment, including asphalt surface area, roadway gravel borrow fill, concrete remnants, and any riprap that remains along the roadway. These releases would cause increases in turbidity and the amount of asphalt and concrete debris in the river.

Channel migration analysis indicates that the roadway in its current location is at great risk of additional damage. The river would incrementally erode portions of the existing roadway and large amounts of sediment would enter the river in short periods of time due to roadway and roadway embankment failures.

The no-action effects of leaving the roadway in the channel would not be expected to support several U. S. Forest Service Aquatic Conservation Strategy Objectives as required by the adopted Mt. Baker-Snoqualmie National Forest Plan, including:
• maintain and restore spatial connectivity including lateral drainage network connections in floodplains, wetlands and upslope areas;
• and maintain and restore the physical integrity of the aquatic system, including shorelines and banks.

The 90-foot long 8 foot 9-inch diameter aluminum bottomless culvert and concrete footings located at Milepost 6.7 would remain in place. This damaged culvert is presently lodged against the damaged roadway along with concrete debris associated with an extensive section of concrete reinforced roadway. Its dislodgement during a high flow event would likely contribute to localized erosion that would contribute roadway fill sediment and asphalt to the river that would contribute to turbidity and create debris blockages that would impede floodplain conveyance.

**Proposed Action Alternative**

**In-Water, Over-Water and/or Near-Water Work Activities**

The project proposes several in-water, over-water and near water activities that could potentially adversely affect surface water quality and flow regimes. These include removing and decommissioning the existing roadway, portions of which are now overtopped by side channel river flows, while other areas are located near the water’s edge of the river side channel. Temporary crossings will be required to access areas on the far side of the side channel to remove damaged roadway asphalt, concrete, and damaged culverts.

Over all, any adverse effects associated with construction to realign the roadway on the channel dynamics and sediment regime of the North Fork Skykomish River are expected to be short-term and minimal. Most construction work, except for removal of damaged roadway portions currently in the river channel, and some revetment work to limit channel migration, would occur landward of the river’s ordinary high water mark (OHWM) and above the floodplain. It is expected that moderate levels of sediment would be transported during construction activities because erosion and sediment control BMPs would be used and construction would be done primarily during the dry season. New roadway cuts and fills would be landward of the river’s OHWM and consist of materials suitable for roadway construction that would be at low risk for erosion that would generate sediment.

Approximately 11.8 acres of ground disturbance and vegetation clearing would occur for roadway construction. It is expected that negligible effects would occur to peak runoff rates or streamside shade/stream temperatures associated with vegetation removal due to use of construction erosion and sedimentation control best management practices and the distance from the river channel.

The existing damaged roadbed would be decommissioned. Asphalt and concrete would be removed, the top layer of gravel borrow would be removed, and roadway soils de-compacted. Organic materials, including salvaged forest duff, would be placed in preparation for site restoration plantings. In portions of the intact roadway to be removed, the area would be
overexcavated to accommodate placement of large rock material for a buried rock revetment that would halt channel migration if an avulsion would occur. This would occur from Station 35+00 to Station 47+00. Differences in these effects compared to the No Action alternative are expected to be substantial, with marked improvement in floodplain connectivity and riparian function expected over time as decommissioned road segments are re-vegetated. Revegetation in close proximity to the river would increase shading over time which would help to maintain river temperatures at lower levels compared to no shading. Vegetation would help to stabilize soils and intercept sediments that would improve water quality.

There is likely to be some sediment generated that would be delivered to the river during the roadway decommissioning construction activity that occurs in close proximity to the river, particularly associated with in-channel work to remove submerged asphalt and revetment excavation in proximity to the side channel. Upslope from the river, there would also be an increased risk for sedimentation releases in proximity to the several stream crossings where ground disturbance would occur for culvert installation. The use of streambypasses would be used in combination with other sedimentation and erosion control measures to control erosion and sedimentation at the proposed culvert installations. Stream bypasses would not be used for the decommissioning of the damaged roadway.

Sediments that pass through BMPs would potentially move downslope to enter the river and project area streams at the upslope stream crossings. It is expected that sediment releases would be minimized because ground disturbance construction would occur at times of low rainfall and lower stream flow conditions (mid to late summer). During the first storm event in the fall, any small amounts of sediment from disturbed areas that are available for transport would be mobilized. Any effects that do occur from site erosion and sedimentation are expected to be minimal and short term.

The introduction of sediment from the proposed road construction is not expected to alter channel processes or aquatic habitat substantially. Any physical changes that do result from transport and deposition of sediment would not materially restrict channel migration, floodplain connections, peak flows, or the natural sediment regime of the river and streams crossed by the roadway. Although some introduced sediment would be transported downstream, with the use of BMPs it is not likely that material generated from construction would cause substantial increases in turbidity in the North Fork Skykomish River downstream from the project site.

The risk for pollutant introduction from oil, gas, diesel, or hydraulics is increased under the action alternative because machinery would be operating near water. BMPs for equipment operations and maintenance would minimize this risk, and contamination impacts are not expected to be substantial.

All spoils (excavated soils in excess of what would be used on site for roadway construction) would be transported and disposed of at a site permitted for material disposal. Offsite disposal avoids direct sediment delivery risks to the river and streams crossed by the relocated roadway.

With the action alternative, through-route access provided by the Index-Galena Road relocation to the entirety of Index-Galena Road would be restored and remain open for future
maintenance. It is expected that once operational, the ability to return to historic levels of ongoing maintenance of drainage ditches and culverts would reduce the longterm risk of road and associated slope failures due to fill saturation and or erosion. The risk of effects due to sedimentation in the river would be reduced as a result.

Roadway relocation would eliminate the potential for floodwaters to overtop road surfaces in the roadway portion that is constructed. This would eliminate the risk for continued erosion of the roadway prism and adjacent roadway embankments that cause related roadway failures and sediment influx to the river. It is expected that the extent or magnitude of the risk reduction would be substantial, ranging from elimination of a minimal localized increase in turbidity to elimination of an acute large sediment input that could have caused chronic turbidity problems and alteration of the riverbank and bed.

Restoration of natural drainage patterns in proximity to the river’s floodplain associated with restoration-related re-establishment of vegetation in the area of the old roadway bed would help to stabilize soils. Restoring natural drainage patterns in combination with plantings would accomplish this by increasing floodplain roughness. Flood plain roughnes provided by vegetation and uneven surfaces helps to reduce flow velocities that accelerate erosion. The increased floodplain conveyance would be able to store more runoff, allow sediment deposition, and potentially increase recharge rather than conveying roadway stormwater directly to the river as was the case with the existing roadway.

Relocation of the road onto adjacent hillside slopes would result in a more stable road that is less vulnerable to river high flow erosional forces. With extensive geotechnical investigation contributing to the roadway design’s consideration of slope stability, there is expected to be a negligible effect on the continuing natural recurrence of slope failures in the project vicinity that could otherwise cause potential increase sedimentation if slope stability was not adequately considered.

Culverts will be sized adequately to convey predicted flows. Adequate culvert sizing would greatly reduce the potential of slope failure due to culvert overtopping, and would be sized to accommodate the increased risk of sediment transport associated with project area soils as well as the 100-year surface water flows and associated debris. Some moderate re-profiling of stream channels is expected at some of the culvert crossings, but the majority of new culverts would be placed to minimize downcutting and other channel hydrogeomorphic alterations that would affect sedimentation and hydrological regimes.

Removal of the damaged roadway would allow for free flow of river within the floodplain, further enabling recruitment of large woody debris and other organic materials, and natural erosion and deposition along the riverbank.

Constructing a 180-foot long bridge span would maintain the natural channel cross section at the stream crossing at Station 54+00. The bridge span allows for natural flow patterns and sediment and large woody debris transport and deposition.
Mitigation

Several measures have been incorporated into the proposed design to minimize permanent impacts. Other measures would be employed during construction to avoid and minimize construction related impacts. They include:

- The proposed relocated roadway would be designed in accordance with the AASHTO Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT <400), 1st Edition. These low-volume standards provide a smaller required roadway section and turning radii, shrinking the road width, and allowing tighter curves to more easily place the alignment to avoid some of the more sensitive features in the landscape. This helps to minimize the ground disturbance footprint and erosion potential that contributes to increased sedimentation that could adversely affect the North Fork Skykomish River and project area streams.
- Several iterations of project alignment shifting were done to minimize cuts, fills, and overall project footprint. Improved constructability that minimizes risk for erosion and sedimentation is expected to avoid and minimize adverse sedimentation effects to water quality, primarily increased turbidity.
- Construction of a bridge over wetland/stream area. Originally, the portions of the roadway that are proposed to span the existing wetland/stream near Station 54+00 were proposed to be constructed on several feet of fill material, with one or possibly two large-span culverts to maintain the existing hydraulic connectivity to the river. However, detailed design efforts included further evaluation of the winter water surface in this area, the associated sensitive fish habitat, and the proximity to the existing river channel migration zone. It was concluded that a bridge span would be much more conducive to ensuring the integrity of both the roadway section, and the wetland/stream high quality habitat. The wetland impact with the construction of a bridge has been substantially reduced, as compared with the amount of fill impacts associated with original design. The elimination of fill within the stream and wetland that would have been associated with culvert installation avoids both construction and long term operational sedimentation impacts.
- Construction of a diversion berm. Originally, the project proposal included two box culvert/vented ford crossings. These crossings were determined necessary in the areas identified as having a risk for large debris flows, and would ensure that the roadway structure is not damaged during large flow events. The roadway embankments would be constructed of concrete buttresses with large box culverts that would potentially have removable lids. At the northern proposed crossing, it has been proposed that the debris could be more effectively handled by the construction of a diversion berm that directs the flow to the north and into a gully that runs parallel with the roadway, rather than across the roadway. It is felt that this route is more naturally occurring, based on topography of the area, and that debris could still be cleared from the gully at the convenience of the maintenance team, rather than immediately after the event.
Construction Erosion and Sedimentation BMPs

Discharge of stormwater during construction would require National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit coverage to be obtained from the Washington State Department of Ecology. Temporary Erosion and Sediment Control (TESC) as well as Spill Prevention Control & Countermeasures (SPCC) BMPs would be implemented and maintained in accordance with the NPDES Construction Stormwater General Permit and in the HRM (2008). BMPs for construction would be employed to avoid and minimize impacts to water quality from grading and construction work that exposes erodible soils and increases storm runoff rates as a result of soil exposure and compaction. To minimize the risks of fuel and hydraulic leaks or spills from construction machinery, an SPCC plan would be developed.

As land disturbing activities occur, there is potential for increased erosion and sedimentation to occur. The project would prepare a Stormwater Pollution Prevention Plan (SWPPP), and BMPs will be installed to minimize the impacts of such activities. With careful monitoring and updating to the project site SWPPP and associated TESC measures, water quality of the receiving waters is not anticipated to be negatively impacted by this project.

The SWPPP will include twelve elements to address erosion and sedimentation:

1. Marking Clearing Limits.
2. Establish Construction Access.
3. Control Flow Rates.
4. Install Sediment Controls.
5. Stabilized Soils.
6. Project Slopes.
7. Protect Drain Inlets.
8. Stabilize Channels and Inlets.
11. Maintain BMPs.
12. Manage the Project.

A menu of applicable BMPs would be employed for each of the twelve elements, and the appropriate site-specific BMPs will be chosen, and shown on the Erosion and Sedimentation Control Plans. BMPs include, but are not limited to, silt fences, straw wattles, seeding and mulching, jute matting, managed project staging, etc. A Certified Erosion and Sedimentation Control Lead (CESCL) would be onsite during construction and will ensure that BMPs installed on the project site are appropriately maintaining acceptable levels of project discharge, in accordance with the rules and regulations set forth by the Department Of Ecology. As site conditions change, the CESCL is anticipated to update the onsite Erosion and Sedimentation Control Plans, ensuring that requirements for all twelve elements of the SWPPP are satisfied.
In-Water, Over-Water and/or Near-Water Work

The proposed compensatory mitigation for this project includes the removal of asphalt in near water existing pavement areas to riparian forested conditions. This entails the removal of asphalt and other roadway features (i.e., culverts, concrete barriers, guardrail, etc.). Some of these features require water crossings to gain access. There has been extensive evaluation of methods for removing these features. Contractors and other construction professionals have been brought onsite to coordinate on potential removal methods.

Some ideas for over-water water crossings include the placement of jersey barriers in the water way, with large containers placed on top that will be large enough to allow construction equipment to cross the river without entering into the water surface. Another potential method would be to construct temporary bridge structures built from trees that will need to be removed from the new roadway alignment. Cranes have been suggested, but their impact is estimated to be greater than the benefit offered by their use. It has also been suggested that rigging could be constructed to carry the roadway features over the water way for removal, but this has been deemed by construction professionals to be infeasible.

The exact construction process will not be fully known until the project bidding process is completed and a contractor is selected. However, the contract will include provisions to ensure that the water quality of the river is not adversely affected during the removal of these roadway features. These provisions would include the containment of potential pollutants, seasonal and fish-window timing conditions, restrictions of what activity would occur at high water levels, and, if necessary, fish isolation practices. Potential staging areas will be identified prior to the start of construction, and would be limited to those areas deemed to provide the most access with the least impact.

Work Near Identified Sensitive Areas

The entirety of the project area has been identified as being environmentally sensitive. The majority of the relocated alignment is located on steep slopes (between 10-80% slopes) with riparian mature forest, while the existing roadway alignment where substantial work would occur would require near water, over water, and in-water work. Portions of the alignment that will also cross several slope streams and span a wetland/stream system.

Construction practices would include strict attention to slope stabilization, project staging, and limiting disturbance to areas that can be completely stabilized prior to the disturbance of new areas.

Work adjacent to potential landslide hazard areas would be closely overseen by construction geotechnical engineers to ensure that adequate stabilization measures are implemented during construction that would ensure that surface drainage is intercepted and diverted away from steep slopes and loose soils. Other slope stabilization measures would include minimizing clearing, installation of straw, woodchips, mulch and seeding, or may even include the use of anchors, rock or ground nailing, containment nets, or other temporary stabilization methods to prevent erosion. Unstable and unsuitable soils would be removed and replaced with more suitable
material, which could include the use of blocks or rockeries. In addition, runoff from the roadway will be dispersed into the adjacent forested area. All practicable measures would be used to avoid concentration of flows that could contribute to increased sedimentation and resultant water quality impacts.

Extensive restoration mitigation would minimize impacts to the maximum extent practicable. Mitigation plans consist of two major categories – providing onsite restoration of the existing damaged roadway, and using offsite mitigation banking to compensate for unavoidable impacts that cannot be adequately mitigated onsite. Mitigation measures for impacts are also identified in the Wetlands discipline report that has been prepared for the NEPA EA.

WSDOT’s *Highway Runoff Manual* also provides stormwater runoff treatment and flow control BMP design criteria. Additional maintenance standards for stormwater BMPs can be found in WSDOT’s *Regional Road Maintenance/Endangered Species Act Program Guidelines* (found at [http://www.wsdot.wa.gov/maintenance/roadside/esa.htm](http://www.wsdot.wa.gov/maintenance/roadside/esa.htm)). These statewide maintenance criteria and guidelines are designated to ensure that all BMPs function at design performance levels and that the maintenance activities themselves are protective of receiving water quality and its beneficial uses.

The proposed mitigation measures are expected to reduce impacts or compensate for unavoidable impacts to environmental resources to less than significant levels. These measures have been evaluated for their ability to eliminate or reduce site specific impacts and cumulative impacts related to overall watershed development. To address impacts, mitigation sequencing was used to identify measures that would:

- Avoid the impact altogether;
- Minimize impacts by limiting the scale of the action;
- Rectify the impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating the impact over time by preservation and maintenance operations; and
- Compensating for the impact by replacing or providing substitute resources or environments. This sequence has been applied to this project in the following ways.

**Avoidance:** Roadway construction on a relocated alignment makes full avoidance not practicable. The restoration of roadway connectivity requires tree clearing, and disturbance of groundcover, soil duff layers, and associated localized wildlife habitat. It is not feasible to rebuild the roadway without impacts. Extensive changes to the alignment were made to avoid impacts to wetlands to the maximum amount feasible.

**Minimizing:** Several measures have been incorporated into the proposed design to minimize project impacts.

- After the design report was completed, it was determined that the project would qualify as a Low-Volume roadway, with Average Daily Traffic measured was less than 400 vehicles per day. The project received concurrence from the review agencies to design the roadway in accordance with the AASHTO Guidelines for Geometric Design of Very Low-Volume Local...
Roads (ADT <400), 1st Edition. These low-volume design standards provide for a smaller required roadway section and turning radii, shrinking the road width, and allowing tighter curves to more easily place the alignment to avoid some of the more sensitive features in the landscape. This has helped to reduce the project’s footprint.

- Several iterations of project alignment shifting were undertaken to minimize cuts, fills, and overall project footprint.
- Construction of a bridge over the wetland/stream area near Station 54+00. Originally, the portions of the roadway that are proposed to span the existing wetland/stream were proposed to be constructed on several feet of fill material, with one or possibly two large-span culverts to maintain the existing hydraulic connectivity to the river. However, detailed design included further evaluation of the winter water surface in this area, the fish habitat provided, and the proximity to the existing river channel migration zone. It was concluded that a bridge span would maintain the integrity of both the roadway section, and the wetland/stream high quality habitat. The wetland/stream impacts are substantially decreased as compared with the amount of fill associated with original design.

Mitigation of project impacts on the onsite Critical Areas is proposed to be addressed by onsite mitigation that includes removing the existing roadway asphalt and restoring natural riparian conditions. In some areas, asphalt would be removed from the river side channel to provide for unimpeded stream flow. In other areas of intact asphalt, the asphalt would be removed and the site prepared for riparian restoration planting. Areas disturbed during construction but not incorporated into the roadway prism would be restored with native duff placement and plantings. Additional mitigation for unavoidable impacts to project area land areas not provided by onsite measures would occur at an approved offsite mitigation bank that provides for mitigation and buffer mitigation.

- Mitigation of project stormwater impacts is proposed to be handled by onsite dispersion. Natural dispersion is the most appropriate BMP for this pristine, riparian mature forest area. The terrain along Index Galena Road is very steep and does not contain the full amount of area that meets the HRM natural dispersion criteria. The project proposes to submit a deviation to allow dispersion to steep slopes that would not otherwise meet the dispersion criteria.

**Stormwater Quality Treatment and Flow Control**

Permanent stormwater flow control and treatment would be provided by dispersion into the existing forested areas, which complies with the Highway Runoff Manual flow control and water quality requirements. This would keep flows from concentrating and causing further erosion.

Best Management Practices and roadway design measures to address water quality and flow control are discussed below. As identified previously, the proposed approach for flow control is to use low impact development (LID) methods, primarily in the form of Natural Dispersion in accordance with the Highway Runoff Manual. Methods such as minimizing clearing and compaction, retaining mature stands of vegetation and soil horizons and dispersion will be used to maximum extent feasible. Soil enhancements will not be needed, as onsite soil quality is high. Salvaged onsite duff will be used for the planting base (per USFS guidance), and minimizing clearing will be much more effective.
The proposed approach for flow control is to use natural flow dispersion. As described previously in this report, natural flow dispersion uses the existing vegetation, soils, and topography to effectively provide flow control and runoff treatment, and generally requires little or no construction activity. The pollutant-removal processes include infiltration into the existing soils and through vegetation root zones; evaporation; and uptake and transpiration by the vegetation. For this to work properly, a minimum width of native vegetation of 100 feet (measured in the direction of the flow path) and the area receiving flow cannot be steeper than 6:1. It is advantageous not to concentrate stormwater to minimize the risk of downstream erosion by allowing stormwater runoff to disperse overland along the length of the project. The Highway Runoff Manual (HRM) provides the following description for this BMP:

**FC.01 – Natural Dispersion**

Natural dispersion is the simplest method of flow control and runoff treatment. This BMP can be used for impervious or pervious surfaces that are graded to avoid concentrating flows. Natural dispersion uses the existing vegetation, soils, and topography to effectively provide flow control and runoff treatment. It generally requires little or no construction activity. Site selection is very important to the success of this BMP. The pollutant-removal processes include infiltration into the existing soils and through vegetation root zones; evaporation; and uptake and transpiration by the vegetation.

The key to natural dispersion is that flows from the impervious area enter the natural dispersion area as sheet flow. Because stormwater enters the dispersion area as sheet flow, it only needs to traverse a narrow band of contiguous vegetation for effective attenuation and treatment. The goal is to have the flows dispersed into the surrounding landscape such that there is a low probability any surface runoff will reach a flowing body of water. Using natural dispersion on projects will result in benefits when determining applicable minimum requirements and thresholds. New impervious surfaces that drain to dispersion areas should be accounted for when determining the project’s total new impervious surface area, but the area should be counted as a noneffective impervious surface (and noneffective PGIS). When modeling the hydrology of the project site and threshold discharge area, the designer should treat natural dispersion areas and their tributary drainage areas as disconnected from the project site because they do not contribute flow to other flow control or runoff treatment BMPs.

**Applications and Limitations**

**Applications**

- Natural dispersion is ideal for highways and linear roadway projects.
- There are two types of natural dispersion: sheet flow dispersion and channelized dispersion.
- Natural dispersion helps maintain the temperature norms of stormwater because it promotes infiltration, evaporation, and transpiration and should not have a surface discharge to a lake or stream.
- Natural dispersion areas meet basic and enhanced runoff treatment criteria set forth in Minimum Requirement 5 (Runoff Treatment) in Section 3.3.5.
• Natural dispersion areas meet flow control criteria set forth in Minimum Requirement 6 (Flow Control) in Section 3.3.6.

**Limitations [only some of the limitations listed in HRM]**

- The effectiveness of natural dispersion relies on maintaining sheet flow to the dispersion area, which maximizes soil and vegetation contact and prevents short-circuiting due to channelized flow. If sheet flow cannot be maintained, natural dispersion will not be effective.
- Natural dispersion areas must be protected from future development. (See the *Site Design Elements* section of this BMP.) WSDOT may ultimately have to purchase right of way or easements to satisfy the criteria for natural dispersion areas, but this should be the last option a designer should choose.

**Design Criteria [only some of the criteria listed in the HRM]**

- The dispersion area should have a minimum width of native vegetation of 100 feet (measured in the direction of the flow path).
- The longitudinal pavement slope contributing flow to a dispersion area should be less than 5%. The lateral pavement slope should be less than 8%.
- Roadway side slopes leading to natural dispersion areas should be 25% (4H:1V) or flatter. Slopes steeper than 25% are allowed if the existing side slopes are well vegetated and show no signs of erosion problems.
- For any existing slope that will lead to a natural dispersion area, if evidence of channelized flow (rills or gullies) is present, a flow spreading device should be used before those flows are allowed to enter the dispersion area.

In addition, the detail for natural sheet flow dispersion provided in the HRM (Figure FC.01.1. Natural dispersion area) shows that the side slopes cannot be steeper than 4:1, and the area receiving flow cannot be steeper than 6:1. It is advantageous not to concentrate stormwater to minimize the risk of downstream erosion by allowing stormwater runoff to disperse overland along the length of the project.

Based on project site investigations, approximately 10% of the receiving slopes on this project meet the criteria. Therefore, a deviation would be sought to allow dispersion to steep slopes that would not otherwise meet the dispersion criteria. Due to the steep onsite slopes, approximately 10% of the receiving slopes on this site meet all of the design criteria. This site-specific characteristic makes constructing stormwater management facilities within or adjacent to the roadway right of way difficult, if not impossible, using standard Best Management Practices (BMPs). The Highway Runoff Manual presents a method to assist in determining when site-specific factors could make constructing stormwater management facilities within or adjacent to the highway right of way infeasible. This method is called the Engineering and Economic Feasibility (EEF) Evaluation.

The EEF was undertaken and demonstrates that the construction of standard stormwater facilities within the project area is not feasible within the majority of the project site. However, the combination of low traffic volumes, deep, mature forest soils, and an abundance of native riparian vegetation make the project site ideal for deviating from standard design criteria.
According to the WSDOT Highway Runoff Program Manager, this is a relatively common deviation for remote forest roads of this nature. This is because it is strongly preferable to avoid any concentration of site runoff in areas of steep slopes, and high soil infiltration rates of undisturbed soils provide effective stormwater dispersion. Geotechnical information confirms that the site-specific conditions make Natural Dispersion a preferable BMP on this site. This is because 1) most of the onsite soils have high infiltration rates, 2) groundwater is not generally found onsite, and 3) overland flows are not observable onsite, even during heavy rain.

Indirect and Cumulative Effects

Indirect Effects

Indirect effects of this project are not considered to be significant. These effects would be those caused by the proposed project, but would occur later in time, making them further removed in distance than direct effects.

The project would not result in any changes in land use patterns that could lead to increased development that would affect water quality with increased non-point pollution sources or increased impervious surface area that would contribute to higher peak stormwater flows. Changes in land use patterns are not expected because the surrounding land areas are National Forest lands managed for multiple use including resource protection. The limited areas of private property are constrained by the lack of utilities and municipal water supply and sewage disposal that could potentially allow for increased development. Adopted land use plans in place do not allow for greater development in the greater project vicinity.

The project would not result in hydrologic impacts due to long-term flow impairment. It is expected that long term flows would be enhanced by reconnection of floodplain areas and unimpeded stream flows resulting from pavement removal of the existing roadway alignment.

The project would avoid an indirect effect of increased stormwater runoff that is directly attributable to the increased impervious surface associated with a project because net new impervious surface area would be reduced with the project.

While localized onsite drainage courses may experience some adjustment in flow path due to roadway modification of the natural channels, culverts and box culvert /vented ford crossings would be appropriately sized to allow for uninterrupted flow of the 100-year event and associated debris. Therefore, this impact is also considered to be negligible.

Cumulative Effects

Secondary and Cumulative Impacts

The proposed project would not contribute to cumulative impacts to adjacent land areas and planned land uses. When considered together with the Index-Galena project, the following
projects would be expected to contribute noise, dust, and traffic congestion to the greater project area during their respective construction periods, which would add to temporary construction impacts to adjacent land uses with no measurable adverse impacts to planned land uses.

**Indirect Effects**

Re-establishing Index-Galena Road in combination with other planned improvements is not expected to indirectly stimulate land use changes in Index and unincorporated communities. The land areas in proximity to the project are primarily under U.S. Forest Service ownership and management and would not experience land use changes associated with residential and commercial development. The limited areas on private land in-holdings are limited by land use regulations and a lack of sewer and municipal water utilities that would be needed to support growth.

These harvest units were originally considered for advertisement. While harvest could have occurred and then delivered to market through the longer Jack Pass route, the harvest was withdrawn due to the increased high costs associated with this sole remaining alternative route since the roadway damage closure. It is expected that re-establishment of through route access would provide for more economically feasible hauling of harvested timber, and that the Forest Service could conceivably reoffer the planned harvest units for sale (estimated 1.2 MMbf of volume on 62 acres) from this previously approved timber sale in the Salmon Creek drainage (approximately 3 miles north of the project site, on FS Road 6330). If the Index-Galena Road is repaired, the Forest Service is expected to re-evaluate those units through NEPA, and potentially offer for sale in a new contract if the timber is still suitable.

Restoring and maintaining long established year-round access to the upper North Fork Skykomish valley is likely to encourage future land uses that focus on services to recreation through traffic. These services are likely to be located in already established settlements such as Index or Skykomish. These may become more prominent than at present once historic recreation use levels are restored after the roadway is constructed. These changes are not expected to result in substantial effects that would exceed recreation use levels already contemplated and addressed by Snohomish County and the U.S. Forest Service as part of their respective adopted plans.
Cumulative Effects

The proposed project represents one of multiple planned Snohomish County roadway capital improvements located on Index-Galena Road identified in the adopted 2013-2018 Six-Year Transportation Improvement Plan (TIP). None of the planned improvements would increase roadway capacity. Other improvements that are currently being evaluated include the following from the adopted TIP:

- **TIP # 41.16** Flood Repair Index-Galena (Milepost 5.8)
  - This FHWA Emergency Relief (ER) funded project would excavate unstable soils and construct a rock buttress to stabilize the roadway embankment. The majority of the work would occur 100 feet or further landward of the river.

- **TIP # F. 41** Howard Creek Bridge #496 Replacement (Milepost 9.014)
  - This planned project with FHWA bridge replacement funds would replace a structurally deficient timber stringer bridge.

- **TIP # F. 50** Trout Creek Bridge #494 (Milepost 6.057)
  - This more long-term planned and currently unfunded bridge replacement project would replace a scour critical concrete span with a longer span with a deep foundation to resist scour.

Past roadway repairs have occurred at multiple locations on Index-Galena Road, including storm damage repairs that required in-water work to maintain roadway connectivity. An extensive repair occurred in the early 1990s near the current Milepost 6.7 washout. Regular road maintenance activities include roadside mowing for brush/weed control, hazard tree removal after wind damage events, snow plowing, and pavement maintenance.

In addition to Snohomish County Public Works multiple planned roadway capital improvements projects, the U.S Forest Service has had past projects and may have future projects in the project vicinity. These are described below.

**Past U.S Forest Projects**

In 2009, a Forest Service contractor performed maintenance on Trout Creek Road 6320 to maintain the road at a Maintenance Level 2 (for high clearance vehicles). The contract work
included constructing water bars and dips, repairing sags, replacing culverts, and adding riprap and surface rock. Closure barriers were also constructed on the road prior to the Wild Sky Wilderness boundary to prevent vehicles from entering the designated wilderness area.

Reasonably Foreseeable projects

Sunset Mine CERCLA Cleanup: The Sunset Mine CERCLA project is located on Forest Road 6320 (Trout Creek), approximately 1 mile southeast of the Index-Galena repair site. A Sampling and Pre-removal Action Inspection and Monitoring Report was completed in July 2011. The proposed Removal Action alternative consists of excavating heavy-metal laden (primarily arsenic and copper) mine and mill waste rock and local soils, then disposing in a constructed repository. Also, a pilot study for passively treating the lower adit's discharge on site is being considered. Subject to funding, in 2014 the Forest Service plans to revise the 2008 Engineering Evaluation/Cost Analysis to include the costs of reconstructing the access route for heavy equipment access. There is no time frame for reconstructing the road or the cleanup, which is subject to CERCLA funding.

With past and reasonably foreseeable future actions taken into consideration, the proposed project is not likely to have substantial, if any, influences on growth and development factors and therefore is not expected to be a major catalyst to future growth in the North Fork Skykomish river valley. In addition to consideration of past and future reasonable foreseeable projects, additional factors such as the recent Wild Sky wilderness designation, the reduced timber harvest from historical levels, and management for recommended wild and scenic river considerations, as well as the various components of the Forest Plan (ACS, riparian reserves, etc.) contribute toward achieving non-significant levels of cumulative impacts. Use of current roadway design standards and implementation of the adopted Forest Plan are expected to promote a net beneficial impact over the long term.

Cumulatively, impacts from the Index-Galena Milepost 6.4-Milepost 6.9 project would not be expected to contribute to impacts associated with other proposed and future changes that may occur in the upper North Fork Skykomish River valley area. The Index-Galena Milepost 6.4-Milepost 6.9 project has been integrated in planning efforts for this area. Efforts on the part of recreation users and others to promote recreation access would likely have a greater influence on the future of this area than would the proposed project alone.
Chapter 7: References


[UPI #06-0150, FEDERAL AID #ER-0701(063), LA6506]


[UPI #06-0150, FEDERAL AID #ER-0701(063), LA6506]


http://www.wsdot.wa.gov/Publications/Manuals/M31-11.htm

http://www.wsdot.wa.gov/Environment/WaterQuality/default.htm#NEPA_SEPA
Appendix A – Proposed Project Alignment Exhibit, Map of Off-Site Sub-Basin Areas From Design Report, Proposed Culverts Locations and Preliminary Sizing
Figure 1: Proposed Index-Galena Road Project Milepost 6.4-6.9

Snohomish County disclaims any warranty of merchantability or warranty of fitness of this map for any particular purpose, either express or implied. Any user of this map assumes all responsibility for use thereof, and further agrees to hold Snohomish County harmless from and against any damage, loss, or liability arising from any use of this map.
Map of Off-Site Sub-Basin Areas From Design Report
Exhibit 8: Off-Site Sub-basin Areas Uphill from North Fork Skykomish River
Appendix B - Project Site Photographs

This photo shows densely forested slope areas prevalent in project area.

The existing damaged roadway can be seen near the toe of slope and adjacent river side channel.
The proposed alignment centerline can be seen traversing steep forested slopes.

The existing damaged roadway near Milepost 6.4 as seen from proposed alignment upslope from the damaged roadway. Relocated roadway would be landward of the channel migration zone and elevated out of the floodplain for most of the project length.
Damaged roadway at Milepost 6.7 where side channel avulsed to form a new channel. Concrete debris, asphalt, and damaged culverts would be removed as part of proposed project.

Damaged existing roadway located between Milepost 6.4-6.7. Existing asphalt would be removed and areas restored with native plantings.
Appendix C - Consistency with USFS Standards


Outlined below are preliminary findings of how the proposed Index-Galena Road Milepost 6.4-6.9 project would be consistent with adopted plans, policies, standards and guidelines. Final findings of consistency and conditions that would be applied to the proposed project would be determined during the respective Snohomish County and U.S. Forest Service reviews that would occur as part of applications for development approval.

Consistency with Mt. Baker Snoqualmie National Forest Plan - Aquatic Conservation Strategies (ACS)

The project as proposed would be consistent with Aquatic Conservation Strategies as provided in the Mt. Baker Snoqualmie National forest Plan, as amended. The following discussion outlines how the proposed Index-Galena Milepost 6.4-6.9 project would not potentially prevent, retard, or contribute significantly to the achievement of the Aquatic Conservation Strategy Objectives at the scale the ACS Objectives were described. A brief description of how the proposed project relates to each objective is provided below in italics:

- **Objective 1**: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

The project would relocate the roadway from the river and its floodplain to restore roadway connectivity. Relocation would contribute to maintaining diversity and complexity of watershed features by relocating the roadway out of the floodplain and restoring free flow of the North Fork Skykomish River. Portions of the roadway would also be located out of the channel migration zone. Relocation enables the existing damaged roadway asphalt to be removed and natural riparian site conditions to be restored. This promotes aquatic restoration including benefits to in-stream habitat, and the adjacent riparian habitat that would provide greater habitat diversity and promote enhanced wildlife habitat conditions in proximity to the river. River flow conditions would also be restored to more natural conditions without the existing roadway’s constrictions to channel migration. Removal of the failing, eroded roadway is expected to maintain the distribution, diversity, and complexity of watershed and landscape scale features by preventing future roadway failure. Incorporation of habitat restoration plantings and LWD placement would add habitat complexity and roughness elements in the channel.

Approximately 1.5 acres of riparian buffer would be enhanced by abandoning the existing roadway. This area would be replanted with native shrubs and trees. This would occur in the in proximity to Milepost 6.1, the area upstream from Milepost 6.4 and extend
to Milepost 6.7, and in some of the area upstream from Milepost 6.9. All temporarily
disturbed areas associated with asphalt removal and access to this area would be treated
with salvaged duff and mulch and planted with native trees and shrubs above the
ordinary high water mark, out of the most flood susceptible zone.

- **Objective 2:** Maintain and restore spatial and temporal connectivity within and between
watersheds. Lateral, longitudinal, and drainage network connections include floodplains,
wetlands, upslope areas, headwater tributaries, and intact refugia. These network
connections must provide chemically and physically unobstructed routes to critical areas
for fulfilling life history requirements of aquatic and riparian-dependent species.

The project would maintain and restore hydrologic connectivity within the watershed.
The damaged roadway would be removed and the roadway relocated further landward of
the North Fork Skykomish River outside of the floodplain and substantial portions out of
the channel migration zone. Effects from vegetation clearing and road construction
would be offset in part by removing the damaged roadway in the river side channel and
adjacent riparian areas that would restore hydrologic connectivity by restoring
floodplain connectivity. The project would restore existing connectivity within the
watershed and would not affect connectivity between watersheds. The proposed action
would maintain and enhance the integrity of the riparian buffer over the long term.
Removal of the existing roadway and relocation further landward is expected to enhance
aquatic refugia as side channel development over time has a positive effect on riparian
connectivity. Similarly, the project is not expected to obstruct the movement of terrestrial
species, dependent upon riparian corridors for their habitat needs or movement between
habitat areas. The long-term improvement in the riparian buffer in the project area
would ultimately result in increased LWD recruitment, which could contribute to an
increase of complex in-stream wood features that, in turn, would enhance the
connectivity of productive rearing and foraging habitats for native fish and aquatic
macroinvertebrates.

- **Objective 3:** Maintain and restore the physical integrity of the aquatic system, including
shorelines, banks, and bottom configurations.

The project would maintain and restore the physical integrity of the river aquatic system,
including shorelines, banks, and bottom configurations with relocation of the damaged
roadway landward from the river. During construction, the physical integrity of the
aquatic system would be maintained with limiting all in-water work associated with the
project to the dry season and containment systems and other measures would be installed
to separate construction activity from the active flow of the river. After construction is
completed, riparian mitigation in proximity to the river would include removing existing
roadway asphalt located both from the channel and adjacent to the river. Restoration
plantings would aid in restoring the overall integrity of the aquatic system. Large woody
debris would be placed as part of the riparian restoration efforts. Restoring this area to
a more natural channel and riparian buffer corridor would maintain and restore the
Objective 4: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

The project’s relocation of Index-Galena Road would aid in prevention of catastrophic failure of the roadway for the long term, eliminating a source of material that could be potentially introduced to the river that does not promote healthy riparian, aquatic ecosystems. Short term water quality impacts associated with construction would be managed by implementing project sedimentation control best management practices. All stormwater runoff on the completed roadway would be dispersed on the downslope adjacent areas, before sheet flowing and infiltrating through vegetated buffer areas. This process would filter and infiltrate the runoff. Thus, no measurable increases in the concentration or loading of stormwater contaminants would be expected to enter the North Fork Skykomish River, and indirect effects to aquatic species would be nonexistent or insignificant.

Although water quality would be maintained over the long term, construction activities may cause minor, short-term increases in sedimentation and turbidity in the river and in sideslope streams crossed by the relocated roadway. However, sediment would be minimized or eliminated because construction will be limited to the dry season and appropriate sediment and erosion control construction best management practices (BMPs) would be employed; and all water quality standards imposed by state and federal laws (e.g., Clean Water Act 404/401) will be met. Temporarily disturbed areas would be mulched and planted to reduce sediment mobilization after construction.

Likewise, the proposed riparian buffer restoration along the damaged portion of Index-Galena Road to be removed would provide improvement in long-term water quality in the river by removing existing impervious surface area adjacent to the river, and replacing it with a vegetated riparian buffer. Short-term effects from asphalt removal could occur. BMPs would be in place to reduce sedimentation levels while conducting in-water work. Therefore, no measurable adverse effects to water quality are expected.

Objective 5: Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage and transport.

The project would not adversely affect the sediment regime in the North Fork Skykomish River, which is greatly influenced by recessional glacial material deposition and subsequent alluvial transport and deposition. The project design would prevent catastrophic failure of the road for the long term and is anticipated to meet Objective 5 at
the project and reach scale, and promote restoration at the watershed scale by improving the long-term sediment filtration process, and by relocating the damaged roadway and converting the existing damaged roadway into native riparian vegetated buffer habitat. An area where debris torrents could be expected will be designed so that debris slide deposition would still occur. Culverts would be designed to maintain current sediment transport processes. Use of appropriate BMPs, management requirements, and mitigation measures would minimize and mitigate potential short-term increases in sediment mobility associated with any soil disturbance from construction activities. At both the reach and watershed scale, changes in the overall sedimentation rates attributable to the project would likely be non-detectable given the high variability in natural rates of sediment input along the river.

**Objective 6:** Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

No effect to in-stream flows for the North Fork Skykomish River is expected from the Index-Galena Milepost 6.4-6.9 project. The project would contribute to maintaining stream flows because stormwater associated with the project is not expected to alter the hydrologic cycle, including low or peak river flows. Relocating the roadway further landward out of the floodplain would reduce the potential for floodwaters to overtop roadway surfaces, erode roadway prisms and associated roadway embankments. There would be a net decrease in impervious surface compared to the pre-damage roadway conditions, and stormwater would be intercepted and filtered by the existing native vegetation buffers as part of the project’s stormwater runoff dispersion with sheet flow. In addition, approximately 1.5 acres of impervious surface would be removed in proximity to the project as part of project mitigation. Therefore, any changes would be negligible and unmeasurable.

**Objective 7:** Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

The current floodplain function would be maintained and conveyance improved with the project due to the removal of the damaged roadway from the floodplain, relocation of the roadway above the floodplain, and restoration of more natural vegetated buffer floodplain conditions. The project would enable more extensive floodplain inundation than currently exists with the existing roadway and would help to restore water table conditions at both the project and the watershed scales. Floodplain connectivity would be enhanced with removal of obstacles and constructions presented by the existing roadway and its roadway prism. This would improve flood conveyance in the project area and not contribute to elevated flood flows. The hydrology of the wetland located near the project’s upstream terminus would be maintained by spanning the wetland with a bridge that maintains hydrological connectivity at the roadway crossing of the wetland. The project has minimized wetland impacts.
- **Objective 8:** Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

  The project would maintain and restore the current plant communities in the riparian areas located where the existing roadway would be removed and restored to natural riparian conditions. The project would contribute to the restoration of Objective 8 over the long term at both the project and watershed scales. While the project would disturb and remove riparian trees and shrubs further landward of and upslope from the river as part of the road relocation, the disturbance and removal would be offset by riparian restoration. The mitigation would contribute to long-term improvement of riparian vegetation that would provide shade, nutrient and sediment filtering, and a source of woody debris and other organic matter.

- **Objective 9:** Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian dependent species.

  The project would maintain and restore the composition and diversity of plant communities in the riparian areas adjacent to the river. The project would contribute to the restoration of Objective 9 over the long term at both the project and watershed scales. While the project would disturb and remove riparian trees and shrubs further landward from the river, restoration in the riparian zone that extends from Milepost 6.4-6.7 would contribute to a long-term improvement of riparian vegetation that would provide shade, nutrient and sediment filtering, and a source of woody debris and other organic matter that promotes beneficial riparian habitat for riparian dependent invertebrate and vertebrate species. Salvage of native duff during construction for placement on disturbed soils after construction is anticipated to promote re-establishment of native plant species and help to restore conditions suitable for invertebrate and vertebrate riparian dependent species.

**Consistency with Riparian Reserves Standards and Guidelines for Roads Management**

The following describes how the proposed Index-Galena Milepost 6.4-6.9 project would be consistent with Riparian Reserves standards and guidelines that apply to the Index-Galena Road project. A brief description of how the proposed project relates to each objective is provided below in *italics*:

**RF-1** - Federal, state, and county agencies should cooperate to achieve consistency in road design, operation, and maintenance necessary to attain Aquatic Conservation Strategy objectives.
The Snohomish County project team has coordinated with U.S. Forest Service, the Washington State Department of Transportation, the Federal Highway Administration and other agencies to ensure that road design and operation and maintenance will promote attainment of Aquatic Conservation Strategy objectives. Specific measures are discussed further below.

RF-2 - For each existing or planned road, meet Aquatic Conservation Strategy objectives by:

a. minimizing road and landing locations in Riparian Reserves.

The project proposes to use the AASHTO Low Volume Roadway Design Standards to minimize the project footprint of the relocated roadway. The use of these design standards enables the proposed project design to match the character of the existing roadway. Use of these standards and incorporation of design features such as retaining walls, structural earth walls (SEW walls), and reinforced slopes have reduced the clearing required for construction. With the proposed design, approximately 3.3 acres would be converted to a new roadway prism footprint, while 8.9 acres would be long term temporary impacts associated with grading cuts and fills that would be restored with placement of native duff and native vegetation planting after construction is completed. The existing damaged roadway would be removed from the river’s side channel and floodplain and natural conditions restored through asphalt removal and revegetation where site conditions are favorable outside of the wetted river channel. When the roadway is relocated, there will be a net reduction of impervious surface compared to the pre-damage roadway prism footprint, and approximately 1.2 acres would be restored that is located within the channel migration zone and 100-year floodplain.

b. completing watershed analyses (including appropriate geotechnical analyses) prior to construction of new roads or landings in Riparian Reserves.

The U.S. Forest Service has completed a watershed analysis for the North Fork Skykomish watershed. The project has completed a channel migration zone analysis that was prepared as part of the project’s early feasibility analysis. Roadway design efforts have been closely integrated and coordinated with extensive geotechnical analysis to determine the best location for the relocated roadway. The proposed design relocates the roadway out of the floodplain, moves most of the relocated roadway out of the channel migration zone, and has been located to minimize disturbance to the slopes located above the floodplain.

c. preparing road design criteria, elements, and standards that govern construction and reconstruction.

The project’s design criteria, project elements, and standards have been closely coordinated with U.S. Forest Service oversight to ensure consistency with the MBSNF Plan.

d. preparing operation and maintenance criteria that govern road operation, maintenance, and management.

Snohomish County will coordinate with the U.S. Forest Service to ensure that long term road operation, maintenance and management are consistent with USFS standards and
guidelines as established in roadway right-of-way easement and special use permit requirements.

e. minimizing disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flow.

The project design has been developed to maintain natural hydrologic flow paths and minimize disruption of natural flow patterns. Removing the damaged roadway from the river, dispersing roadway stormwater flow, maintaining surface flow channels, constructing a bridge to span the wetland and seasonal stream near Milepost 6.9, and minimizing net new impervious surface area as compared to the existing roadway, help to achieve these objectives.

f. restricting sidecasting as necessary to prevent the introduction of sediment to streams.

The project proposes no sidecasting. Excavated spoils would either be incorporated into the roadway prism as part of constructed roadway embankments or exported from the project site to approved disposal sites. Native duff that is salvaged during construction would be placed both upslope and downslope from the finished roadway to help stabilize exposed soils and to provide a good source of organic debris that would promote revegetation and site restoration post construction.

g. avoiding wetlands entirely when constructing new roads.

The relocated road would avoid impacts to most of the wetland areas with the roadway design but roadway geometric constraints would require that wetland impacts occur. The project would compensate for unavoidable wetland impacts (0.02 acre current estimate) in compliance with federal, state, and local regulations.

**RF-3** - Determine the influence of each road on the Aquatic Conservation Strategy objectives through watershed analysis. Meet Aquatic Conservation Strategy objectives by:

a. reconstructing roads and associated drainage features that pose a substantial risk. Relocating the damaged section of Index-Galena Road would reduce risk for catastrophic damage that poses a substantial risk to in-stream and riparian habitat. Reconstructing the roadway above the floodplain would promote better floodplain connectivity by removing asphalt and the roadway prism fill that constrict flood flows. The relocated roadway would be constructed and operated in accordance with U.S. Forest Service standards and guidelines and consistent with management recommendations developed as part of the U.S. Forest Service watershed analysis prepared for the North Fork Skykomish River as part of its Two Forks Watershed Analysis.

b. prioritizing reconstruction based on current and potential impact to riparian resources and the ecological value of the riparian resources affected. The proposed Index-Galena Road reconstruction would provide beneficial impacts and enhance riparian resources by restoring natural floodplain and riparian habitat where the damaged roadway would be removed from the river side channel and adjacent riparian areas. Its reconstruction has been prioritized because reconstructing the
roadway in its current alignment would continue to have adverse effects to riparian resources and the ecological value they provide.

c. closing and stabilizing, or obliterating and stabilizing roads based on the ongoing and potential effects to Aquatic Conservation Strategy objectives and considering short-term and long-term transportation needs.

Relocating the existing damaged roadway and obliterating the asphalt pavement to restore natural riparian conditions would promote Aquatic Conservation Strategy objectives as described above and will promote long-term transportation needs by restoring roadway connectivity that provides access for residents, recreation users, emergency service providers, and U.S. Forest Service personnel.

RF-4 - New culverts, bridges and other stream crossings shall be constructed, and existing culverts, bridges and other stream crossings determined to pose a substantial risk to riparian conditions will be improved, to accommodate at least the 100-year flood, including associated bedload and debris. Priority for upgrading will be based on the potential impact and the ecological value of the riparian resources affected. Crossings will be constructed and maintained to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure.

Proposed roadway culverts and the bridge crossing of the wetland near Milepost 6.9 would be designed to accommodate the 100-year flood including the associated bedload and debris. The box culvert vented ford near Station 29+00 would be designed to withstand flow events greater than the 100-year event and associated debris. In more extreme events greater than the 100-year flow, debris would be conveyed through the ford over the top of the roadway. Road maintenance crews would then remove deposited debris as necessary to restore traffic.

RF-5 - Minimize sediment delivery to streams from roads. Outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping is unfeasible or unsafe. Route road drainage away from potentially unstable channels, fills, and hillslopes.

Outsloping the roadway surface is proposed to promote natural dispersion of roadway stormwater runoff. The project design would minimize sediment delivery to project area streams by dispersing stormwater runoff and providing conveyance at roadway culverts and the proposed bridge to route roadway drainage from unstable channels, fills and hillslopes. A Stormwater Pollution Prevention Plan would be developed and implemented during construction to address construction-related sediment and erosion control.

RF-6 - Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams.

The one road crossing that has a fish-bearing stream, located at the proposed bridge crossing near Milepost 6.9, has been designed to maintain fish passage. All proposed cross-culverts are located at non-fish bearing streams located on steep slopes.

RF-7 - Develop and implement a Road Management Plan or a Transportation Management Plan that will meet the Aquatic Conservation Strategy objectives. As a minimum, this plan shall include provisions for the following activities:
Snohomish County will inspect and maintain Index-Galena Road in accordance with the Regional Road Maintenance ESA Guidelines at or near wetlands and streams, and the following standards and guidelines:

- inspections and maintenance during storm events.
- inspections and maintenance after storm events.
- road operation and maintenance, giving high priority to identifying and correcting road drainage problems that contribute to degrading riparian resources.
- traffic regulation during wet periods to prevent damage to riparian resources.
- establish the purpose of each road by developing the Road Management Objective.

Consistency with Recommended Wild and Scenic River allocation

The project’s proposed relocation of Index-Galena, including roadway pavement removal from the river side channel and restoration of riparian areas to natural conditions, would promote protection from degradation the outstanding remarkable values and wild, scenic, and recreation characteristics of the North Fork Skykomish River. The proposed project would include maintaining natural conditions in streamside bank areas so that water quality can be maintained to keep rivers fishable and swimmable.

The proposed Index-Galena Road relocation would protect and enhance the free-flowing condition, water quality, and outstandingly remarkable values of the North Fork Skykomish River. The relocation is designed to prevent repeated roadway washouts (and resultant effects) that Index-Galena Road has experienced in past events.

With the river channel’s 2006 migration and resultant erosion of the Index-Galena Road pavement, the proposed roadway relocation above the active flood plain would enhance free-flowing conditions by accommodating lateral channel migration that would not adversely affect the road. By relocating the road and enabling river migration to the extent practical (within the project area), there is decreased constriction of the floodplain.

The effects on water quality associated with the relocation construction would be of short duration and minimal when compared to background sedimentation rates that would occur with future roadway washout damage. Long term effects are beneficial for water quality with the roadway located further landward from the active channel flow.

The effects of construction on fisheries would be short-term to accommodate roadway removal, related to short-term increases in roadway construction related noise and sediment. Long term effects are beneficial and in-stream spawning and side channel refugia habitat is expected to be enhanced by roadway removal and restoration of natural riparian conditions.

Changes in wildlife habitat and wildlife populations would be slight due to the relatively small amount of habitat change, and this change occurring in very small areas separated by relatively large distances. There are no significant effects to wildlife beyond a temporary increase in noise during construction.

The roadway and views would be improved relative to the pre-damage condition and the scenery would be enhanced in areas in proximity to the river. Areas upslope from the river...
would have bare soils resulting from construction activities. These would be stabilized and revegetated to minimize erosion potential. At the expected effectiveness for these mitigation measures impacts to scenery would likely be short term.

Impacts to visual quality would be addressed with aesthetics as a consideration. Techniques such as colored and/or textured concrete or rock gabion walls would be considered. Guardrail color would be a muted earth tone color, such as a weathering steel type or a guard rail that has been painted a weathering steel color. Restoration plantings in critical visually sensitive area would also consider placement of earth berming and rock boulder to promote a naturalized appearance for the proposed relocated road. For more discussion of visual quality consideration see, see the Visual Quality Technical Report.