

# Spirit Lake Tunnel Intake Gate Replacement and Geotechnical Drilling Project Environmental Assessment

Gifford Pinchot National Forest, Mount St. Helens National Volcanic Monument, Skamania County, Washington



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**Cover photos:** Spirit Lake and Mount St. Helens (top), Spirit Lake tunnel intake gate (bottom left), engineer reading piezometer in previously drilled bore hole (bottom center), log debris mat floating on Spirit Lake near the tunnel intake gate (bottom right).

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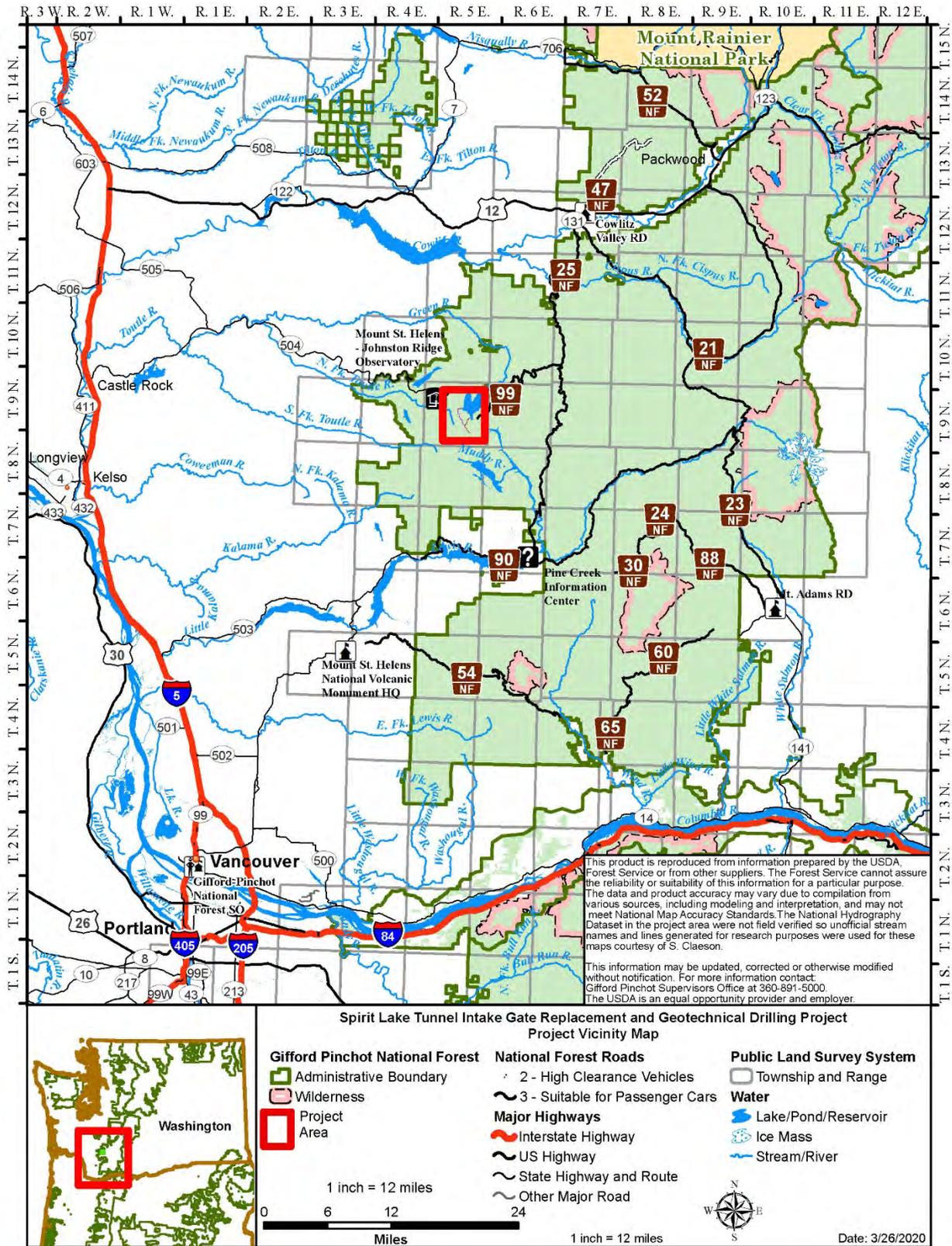


Figure 1. Spirit Lake Tunnel Intake Gate and Geotechnical Drilling Project vicinity map.

# Section 1: Introduction and Need for Action

## 1.1 Introduction

The purpose of this environmental assessment is to disclose and document the anticipated environmental effects of the proposed Spirit Lake Tunnel Intake Gate Replacement and Geotechnical Drilling Project within Mount St. Helens National Volcanic Monument, in Skamania County, Washington (figure 1).

This analysis complies with the National Environmental Policy Act of 1969, as amended [42 USC 4321–4347], the National Forest Management Act, the Council of Environmental Quality regulations, and Forest Service regulations 36 Code of Federal Regulations (CFR) 220.4. This analysis is not intended to serve as a land or resource management document for the Gifford Pinchot National Forest.

The Gifford Pinchot National Forest Supervisor is the responsible official who will determine if there are no significant<sup>1</sup> impacts based on this environmental assessment, and associated project record, and then prepare a draft decision notice and finding of no significant impact, which will be published for a 45-day objection period. Following the 45-day objection period, the Forest Service may publish a final decision notice.

The project is located in Township 9 North, Range 5 East, Sections 10, 15, 22, and 27 (see figure 1).

## 1.2 Background

The eruption of Mount St. Helens in 1980 resulted in a massive debris avalanche and pyroclastic flow causing sweeping changes to the watershed. The eruption delivered approximately 3 billion cubic yards of sediment into the Toutle, Cowlitz, and Columbia rivers, killed 57 people, and drastically changed the physical and socio-economic landscape. The eruption material formed a natural dam that blocked the outlet of Spirit Lake, where it had previously flowed into the North Fork Toutle River. Blown-down timber that entered the lake resulted in a floating log mat that still occupies about 25 percent of the lake surface. A catastrophic break of the blockage by high water in Spirit Lake could release more than 300,000 acre-feet of water and 2.4 billion cubic yards of sediment, rivaling the devastating mudflows of the 1980 eruption (NASEM 2017).

In 1982, at the direction of the President and the Federal Emergency Management Agency, the U.S. Army Corps of Engineers (the Corps of Engineers) in consultation with the Forest Service, responded to the potential threat of a catastrophic breach or overtopping of the debris avalanche by establishing an interim pumping station in the southwest corner of Spirit Lake. This temporary measure to stabilize the lake level included a barge-mounted pumping facility, an access road from Windy Ridge (across the debris avalanche), workshops and short-term housing, and an area for storage of thousands of gallons of fuel (figure 2).

To assess possible lake-level control measures, the Corps of Engineers completed an environmental impact statement in April 1984. The selected alternative was the current tunnel through Harry's Ridge, which drains Spirit Lake water into South Fork Coldwater Creek, a tributary of the North Fork Toutle River.

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<sup>1</sup> The term “significant,” as used in the environmental analysis process, requires consideration of both context and intensity (40 CFR 1508.27).

Work on the tunnel began in July 1984 and was completed by April 1985. The constructed tunnel, built under emergency conditions, is approximately 1.6-miles long and 11 feet in diameter, with a slightly narrowed diameter in areas of tunnel lining reinforcement. To construct the tunnel intake gate at Spirit Lake, the Corps of Engineers once again used the road from Windy Ridge (across the debris avalanche) to access the lake shore near the pumping station, then barged the cranes and other heavy equipment across the lake (figure 3).



**Figure 2. Temporary pump station and facilities at Spirit Lake in the early 1980s.**



**Figure 3. Short-term location of pumping pipeline (early 1980s) on the debris blockage. The access road (now Truman Trail) is pictured in the center of photo.**

As the agency responsible for managing the Mount St. Helens National Volcanic Monument, the Forest Service also operates and maintains the aging tunnel system. Despite the overall success of the existing tunnel, major repairs in 1995, 1996, and 2016 required extended closures of the tunnel gate and outlet flow, which allowed the lake to rise to the maximum safe operating level.

The Gifford Pinchot National Forest initiated the Spirit Lake Motorized Access Environmental Assessment in March of 2017. The 2017 project originally had two purposes: (1) provide motorized utility-terrain vehicle access to the lake shore where Forest Service personnel access their workboat for tunnel operations and maintenance, and (2) provide motorized access and allow for geotechnical investigations including ground penetrating radar and core sampling (drilling). After the draft decision notice and objection review period, Gifford Pinchot National Forest staff determined the best approach was to split the decision, and in the summer of 2018 issued a signed decision notice to provide motorized utility-terrain vehicle access to the lake shore where Forest Service personnel access their workboat for tunnel operations and maintenance (purpose 1). The Gifford Pinchot National Forest then issued a second draft decision notice focused on motorized access and drilling (purpose 2). After reviewing the objections received in response to the second draft decision, Forest Service leadership determined it was prudent to undertake additional analysis related to the impacts to research, alternative access methods for drilling, and Gifford Pinchot National Forest Land and Resource Management Plan consistency.

Throughout the summer and fall of 2019, Spirit Lake managers researched various (11 plus) access options (see Appendix A: Alternatives Considered but Eliminated from Detailed Study). During that time, Gifford Pinchot National Forest and Regional Forest Service leadership were also briefed on recent damage at the tunnel inlet structure and the necessary repairs and maintenance to the inlet structure predicted in the upcoming years. After reviewing the information, Forest Service leadership determined to combine, into one project, the access needs for the core sampling (drilling) and access and repair work for the intake gate replacement, since they would overlap in time and space. In addition to the need for these actions to occur as soon as possible, it was clear that there would be overlapping access needs for each action. An interdisciplinary team was assembled in September 2019 to address this Regional priority project. In order to address the need for the project and effectively analyze the environmental effects, the team was purposefully comprised of multi-agency interdisciplinary team members from the Gifford Pinchot National Forest, U.S. Forest Service Pacific Northwest Research Station, U.S. Forest Service Regional Office for the Pacific Northwest Region, U.S. Forest Service Washington DC Office and Enterprise Program, and the U.S. Army Corps of Engineers.

### 1.3 Need for Action

There is a need to ensure the protection of public safety, health, property, and the environment from a catastrophic breach of the Spirit Lake natural debris blockage caused by the 1980 debris avalanche. Currently there is inadequate data to inform risk management decisions and an increasing risk of failure of the existing outlet infrastructure (tunnel intake gate system), which could lead to a catastrophic failure of the debris blockage.

The Forest Service must adhere to its policy that instructs the agency to execute activities associated with geological resources and hazards for public health and safety. Specifically, policy direction from Forest Service Manual 2880 directs the Forest Service to “manage geologic hazards on National Forest System lands to ensure the protection of public safety, health, property, and the environment.”

During its nearly 35-year lifespan, the tunnel infrastructure for controlling the water level of Spirit Lake has deteriorated due to age. A rock heave from external pressures in portions of the tunnel (figure 4) has reduced capacity and demonstrates an increased risk of failure (NASEM 2017, Grant et al. 2017). There is currently no secondary outflow or spillway to serve as a back-up if the existing tunnel fails to function.



**Figure 4. Rock “heave” restricting the 11 feet high tunnel to a 6 feet high passage.**

The cast iron tunnel intake gate is designated as a fracture-critical hydraulic steel structure as per the Corps of Engineers regulations (ETL 1110-2-584 and ER 1110-2-8157). Absence of redundancy in the gate system and inability to isolate the gate prevents a thorough inspection of all aspects of the intake gate structure as required by the Corps of Engineers regulations and creates an elevated risk of uncontrolled water release to tunnel inspectors and workers. Consequently, the tunnel intake gate does not meet current design standards. To address the worsening tunnel component situation, the Forest Service has worked with Cowlitz County to prepare a Spirit Lake Emergency Response Plan for monitoring, communicating, and potentially evacuating people downstream should a tunnel outlet failure occur.

The physical properties of the debris blockage are not well understood because there is currently insufficient geologic, hydrogeological, and seismic data to characterize the debris blockage. The current outdated and incomplete data prevents accurate determination of a safe water level in Spirit Lake. Due to the lack of current information about safe water levels, the Forest Service and the Corps of Engineers are constrained in their abilities to plan and schedule implementation of monitoring and quality control of the current tunnel infrastructure and long-term outflow resiliency.

Updated information is needed to map the contact boundaries between the overlying pyroclastic deposits, debris avalanche, and underlying rock. Subsurface exploratory drilling, along with other ongoing geophysical investigations, will provide a more complete three-dimensional picture of the character of the blockage and vulnerabilities to vertical incision and internal erosion.

Previous models and studies by the U.S. Geological Survey and the Corps of Engineers provide incomplete and inconsistent information with respect to the risk of liquefaction and erosional failure within the debris blockage, and the impact of future decisions related to geologic hazard management (figure 5).



**Figure 5. Forest Service engineer surveys exposed borehole casing from 1980s drilling effort, illustrating erosion effects at the debris blockage area near Spirit Lake. Casing was originally two feet above ground.**

There is a continued and increasing need to perform risk mitigation actions on the tunnel system, debris blockage, and surrounding area to better understand and stabilize water containment and reduce to an acceptable level the risk of a debris blockage breach.

Two recently published scientific reports emphasize the inadequacy of current information and the need to characterize the debris blockage. The National Academy of Science, Engineering, and Medicine completed a report in 2017 titled: *A Decision Framework for Managing the Spirit Lake and Toutle River System at Mount St. Helens*. The report states, “The Spirit Lake debris blockage consists of a poorly characterized (from a geotechnical point of view) chaotic, permeable mixture of sand, gravel, boulders, and organic materials. The boundaries of the blockage do not easily lend themselves to clear definition, or even to identification of exactly where the blockage begins and ends... At its crest the blockage ranges from 200 feet to more than 500 feet in thickness. Both the avalanche sediment and the overlying pyroclastic sediment are highly erodible” (NASEM 2017, page 35). The report reiterates the weakness of relying on outdated information when it states that “assessments were made of the hydrology and stability of these deposits with respect to piping, liquefaction, failure during seismic loading, and erosion soon after the 1980 eruption, but no follow-up analysis has been conducted to determine how the hydrologic and hydraulic settings have changed, or how such possible changes affect the long-term geotechnical stability of the debris blockage” (NASEM 2017, pages 38–39).

Also in 2017, the U.S. Geological Survey and U.S. Forest Service Pacific Northwest Research Station produced a general technical report focused on the geologic, geomorphic, and hydrologic context underlying options for long-term management of the Spirit Lake outlet near Mount St. Helens, Washington (PNW-GTR-954; Grant et al. 2017). Grant et al. found “...that the elevation of the contact between the debris avalanche and overlying pyroclastic deposits at the crest of the blockage sets the safety limit for ensuring that a breakout flood does not occur. Although previous studies have provided a sound technical foundation for establishing safe operating elevations of the lake, a refined three-dimensional picture of how this contact is arrayed spatially would provide increased confidence for

any management action” (page 109). The report also stated that “...additional drilling to provide a more completed three-dimensional picture of the character of the blockage at depth would help better understand what might happen if the blockage began to break. Specifically, are there regions within the blockage where the size of sub-surface material in the debris-avalanche deposit might be expected to resist vertical incision if a breakout were to occur” (Grant et al. 2017, page 111).

The downstream communities of Toutle, Silver Lake, Toledo, Lexington, Castle Rock, Kelso, and Longview, Washington, depend on the Forest Service for safe management of the Spirit Lake water level and outflow. Currently, the safety of downstream communities relative to the stability of the debris blockage is built on assumptions, based on other assumptions, from almost 35-year old data. Residents of these communities are living and working downstream from a poorly understood natural debris dam that utilizes a dated tunnel outlet infrastructure system that is documented to be in poor condition and subject to failure. Forest Service leadership determined the current risk situation generated by the Spirit Lake tunnel intake gate and the debris blockage is unacceptable. The Forest Service is solely responsible for the management of the Spirit Lake outflow as a geologic hazard and must take necessary action.

In response to the need, the Gifford Pinchot National Forest Supervisor is analyzing proposals to enhance protection to the communities downstream of Spirit Lake, increase safety for agency maintenance personnel, and reduce the risk of economic hardship to the region as a result of a breakout flood from Spirit Lake. Two important actions toward satisfying these goals are: (1) obtain geotechnical subsurface drilling data to more accurately determine and predict safe conditions for existing and possible future alternate systems to control water levels in Spirit Lake; and (2) replace the tunnel intake gate structure to improve lake level management, safety, and monitoring (inspection) of the gate.

## **1.4 Protecting Downstream Communities**

The U.S. Geological Survey estimated the communities of Toutle, Silver Lake, Toledo, Lexington, Castle Rock, and the cities of Kelso and Longview, Washington, are within the projected impact area (inundation area) if a Spirit Lake outburst flood were to occur. Forest Service managers continue to work with local emergency managers to prepare for a potential flood and to practice the emergency response.

A catastrophic break of the blockage by high water in Spirit Lake could release more than 300,000 acre-feet of water and 2.4 billion cubic yards of sediment, rivaling the devastating mudflows of the 1980 eruption (NASEM 2017). A flood of this magnitude would likely inundate the Port of Longview for several months and temporarily close the ports of Portland, Vancouver, and Kalama. The railroad and Interstate 5 are also within the inundation area. There is approximately \$3.65 billion of property value within the inundation area (figure 6). The Port of Longview alone generates \$1.5 billion and employs approximately 10 percent of workers in Cowlitz County. The Forest Service recognizes a flood at this scale would be economically devastating to the region and threaten the life and safety of the public and emergency response workers.



Figure 6. May 1980 flooding in Cowlitz County.

## 1.5 Analysis Framework

The Gifford Pinchot National Forest Supervisor is the responsible official who will determine if the proposed activities will have a finding of no significant impact, based on this environmental assessment and public comments. The Forest Supervisor's decision would then be documented in a decision notice. The decision notice will include rationale for the alternative selected.

### Public Law 97-243

The Forest Service is managing the Monument consistent with the intent of the enabling legislation (Public Law 97-243, 1982). This law directs that, "The Secretary [of Agriculture] acting through the Forest Service shall administer the Monument as a separate unit within the boundary of the Gifford Pinchot National Forest, in accordance with the appropriate laws pertaining to the National Forest System, and in accordance with the provisions of this Act." (Public Law 97-243, Section 4(a)).

The enabling legislation Section 4(b)(1) states, "The Secretary shall manage the Monument to protect the geologic, ecologic, and cultural resources, in accordance with the provisions of this Act allowing geologic forces and ecological succession to continue substantially unimpeded."

The enacting legislation includes multiple provisions within the administration section of the Act related to taking action or measures to control (mitigate) damage to resources adjacent to the Monument (downstream communities), public safety, and preventing loss of life and property. Below are listed the provisions, in order, from the administration section of the law, which is the primary guidance for the Monument.

*"Section 4(b)(1) The Secretary shall manage the Monument to protect the geologic, ecologic, and cultural resources, in accordance with the provisions of this Act allowing geologic forces and ecological succession to continue substantially unimpeded.*

*Section 4(b)(2) The Secretary may take action to control fire, insects, diseases, and other agents that might (A) endanger irreplaceable features within the Monument or (B) cause substantial damage to significant resources adjacent to the Monument.*

*Section 4(b)(3) Nothing in this Act shall prohibit the Secretary from undertaking or permitting those measures within the Monument reasonably necessary to ensure public safety and prevent loss of life and property” (Public Law 97-243).*

The Monument Act, within the Scientific Study and Research subsection of the Administration section, goes on further to state:

*“Section 4(c) The Secretary shall permit the full use of the Monument for scientific study and research, except that the Secretary may impose such restrictions as may be necessary to protect public health and safety and to prevent undue modification of the natural conditions of the Monument.*

*Section 4(d) In order to protect the significant features of the Monument, reduce user conflict, and ensure visitor safety, the Secretary is authorized to control time and means of access and use of the Monument or parts thereof: Provided, that nothing in this section shall be construed as to prohibit the use of motorized vehicles, aircraft or motorboats for emergency and other essential administrative services, including those provided by State and local governments, or when necessary for authorized research” (Public Law 97-243).*

## **Forest Plan and Comprehensive Management Plan**

Guidance for management of the legislated Monument comes from the Mount St. Helens National Volcanic Monument’s Comprehensive Management Plan (comprehensive management plan), which is fully incorporated into the Gifford Pinchot National Forest Land and Resource Management Plan (forest plan), as amended by the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl. The forest plan provides over-arching goals, objectives, and project-level standards and guidelines forestwide and within the Monument. Proposed projects are required to be in compliance with the forest plan, and therefore, the comprehensive management plan, or a plan amendment is required.

## **Forest Service Manual 2880**

Forest Service Manual 2880 contains legal authorities, objectives, policies, responsibilities, instructions, and guidance for Forest Service line officers and primary staff to plan and execute assigned programs and activities associated with geological resources, hazards, and services.

Specifically, Forest Service Manual 2880 directs the Forest Service to “manage geologic hazards on National Forest System lands to ensure the protection of public safety, health, property, and the environment.” Direction within Forest Service Manual 2880 also recognizes mitigating actions may involve corresponding policy, such as Forest Service Manual 7500 Water Storage and Transmission (Dam Safety).

## **1.6 Resources and Issues Dismissed from Detailed Analysis**

National Environmental Policy Act regulations require the agency to identify and eliminate from detailed study those issues that are not significant or that have been covered by prior environmental review, to narrow the scope of the analysis. Reasons for eliminating issues from detailed study include when the issues are related to the following:

- General opinions or position statements not specific to the proposed action;
- Items addressed by other laws, regulations, or policies;
- Items not relevant to the potential effects of the proposed action, or otherwise outside the scope of this analysis; and/or
- Items that have no or negligible effects.

Although changes in management direction could influence the nature of future projects, the timing, location, and details of future projects are currently unknown. Impacts of future projects would need to be assessed on a project-by-project basis as they are proposed.

Eliminated issues are not addressed beyond the rationale provided below.

### **General Wildlife**

The action alternatives have the potential to affect individuals of general wildlife species, but the activities are not anticipated to affect any wildlife populations as a whole.

### **General Botany**

The action alternatives have the potential to affect individuals of general botanical species, but the activities are not anticipated to affect any botanical populations as a whole.

### **General Aquatic Species**

The action alternatives have the potential to affect individuals of general aquatic species, but the activities are not anticipated to affect any aquatic populations as a whole.

### **Water Quality**

No activities under any alternatives will result in any streams being listed on the 303(d) list for impaired water quality.

### **Floodplains, Executive Order 11988 of May 24, 1977**

The action alternatives will not affect the quality of existing floodplains owing to the temporary nature of the proposed activities. The action alternatives are consistent with Executive Order 11988 since the proposed activities conforms to Washington State's floodplain protection standards.

### **Essential Fish Habitat**

Essential fish habitat is designated under the Magnuson-Stevens Fishery Conservation and Management Act of 1976 to protect waters and substrates necessary for Chinook, coho, and pink salmon (*Oncorhynchus tshawytscha*, *O. kisutch*, and *O. gorbuscha*, respectively) spawning, breeding, feeding, and growth to maturity (National Marine Fisheries Services 2002). There is no designated essential fish habitat for pink salmon on the Gifford Pinchot National Forest, and there is no essential fish habitat for Chinook or coho salmon within the project area. Therefore there will be **No Effect** to essential fish habitat for any of the alternatives.

### **Wild and Scenic Rivers**

There are no designed wild and scenic rivers within the project area, therefore there are no effects to designated wild and scenic rivers.

### **Wilderness and Wilderness Study Areas**

There are no designed wilderness areas or wilderness study areas within the project area, therefore there are no effects to designed wilderness and wilderness study areas.

### **Inventoried Roadless Area**

The project area is not located within any designated inventoried roadless area under the 2001 Roadless Rule, therefore there are no effects to designated inventoried roadless areas.

## **Parklands and Prime Farmlands<sup>2</sup>**

There are no parklands or prime farmland within the project area, therefore there are no effects to parklands or prime farmlands.

## **Social and Economic Resources**

The action alternatives are not anticipated to create any full-time equivalent positions, nor is it anticipated to create any impacts to social resources (county services, school systems, etc.) within the Skamania County communities. The project would have short-term economic impacts due to construction related activities.

## **1.7 Key Issues**

Key issues are generated by the public, other agencies, organizations, and the Forest Service and are in response to the proposed action. Key issues provide focus for the analysis of environmental effects and may influence alternative development, including development of project design criteria. Key issues serve to highlight effects or unintended consequences that may occur from the proposed action and alternatives, giving opportunities during the analysis to reduce adverse effects and compare trade-offs for the responsible official and public to understand. Key issues are statements of cause and effect, linking environmental effects to actions, including the proposed action (Forest Service Handbook 1909.15, 12.4).

The creation of additional alternatives, including those dismissed from detailed study, and the development of project design criteria was driven by the following identified concerns:

- Current and future research;
- Visual and recreation resources;
- Access options; and
- Invasive species introduction and spread (aquatic and terrestrial).

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<sup>2</sup> Prime farmland is a designation given by the National Resources Conservation Service for land use and cover, whose criteria for national legislation is concerned with the environment and with agricultural commodity production (U.S. Department of Agriculture Handbook Number 18).

## Section 2: Proposed Action and Alternatives

In response to the need, identified above, the Gifford Pinchot National Forest Supervisor has analyzed alternatives to enhance protection to the communities downstream of Spirit Lake, increase safety for agency maintenance personnel, and reduce the risk of economic hardship to the region as a result of a breakout flood from Spirit Lake. Two important actions toward satisfying these goals are: (1) obtain geotechnical subsurface drilling data to more accurately determine and predict safe conditions for existing and possible future alternate systems to control water levels in Spirit Lake; and (2) replace the tunnel intake gate structure to improve lake level management, safety, and monitoring (inspection) of the gate.

To meet these two goals the Forest Service has proposed to:

- Replace the intake gate structure of the spirit lake tunnel;
- Reconstruct portions of National Forest System road 99;
- Construct temporary access roads, staging areas, and a barge loading facility;
- Conduct geotechnical investigation and core sampling within the debris blockage; and
- During and after the project there will be stabilization and rehabilitation activities.

The alternatives in this environmental assessment were developed to respond to the need for action within the decision framework for the Forest Service.

The Spirit Lake outflow refers to the whole system that removes water from Spirit Lake. The Spirit Lake outflow was referred to as the Spirit Lake outlet in previous documents. The Spirit Lake tunnel is currently the only way for water to leave Spirit Lake and has a tunnel intake gate structure to control water flow.

### 2.1 Alternative A: No Action

This alternative represents reasonably foreseeable conditions that would be expected if the Forest Service does not perform geotechnical drilling in the Spirit Lake debris blockage, does not replace the Spirit Lake tunnel intake gate structure, and does not move the excavated rock debris spoils pile located in front of the intake channel. The spoils are within Spirit Lake and left over from the original tunnel construction.

The Spirit Lake outflow would continue to not meet current dam safety standards to include alternate, redundant gates or additional methods of closure in case of an operations failure; and would not allow for positive (complete) gate closure for personnel safety during inspection, repair, or maintenance activities.

The excavation spoils pile located in front of the intake channel in Spirit Lake would continue to accumulate log debris mats and obstruct administrative lake access for inspection, repair, and maintenance, which could result in an elevated level of lake water and increase the geohazard risk. The excavation spoils pile is composed of rock, soil, and woody debris generated during original tunnel construction. The Spirit Lake outflow would be less able to safely maintain lake levels or fully contribute to controlled release of water during the summer season. Controlled release is important for active management of the lake level, especially during maintenance and operations. The existing, aged fracture-critical intake gate, identified in the October 2016 comprehensive Spirit Lake tunnel inspection report as a gate that cannot be thoroughly inspected, would not be replaced and would continue to deteriorate.

Geotechnical investigation, core sampling, and installation of monitoring instruments would not occur within the debris blockage. Decisions related to the management of Spirit Lake water levels will not be informed by a current characterization of the debris blockage damming the lake; the location and behavior

of groundwater in the blockage; a quantified characterization of risks posed by volcanic activity on Spirit Lake water levels; or the response of the debris blockage to local and regional seismic events. Existing elevated lake levels and potential future Spirit Lake outflow alternatives would be difficult or impossible to assess without geotechnical investigation and core sampling.

The no-action alternative does not reduce the risk presented by the Spirit Lake and Toutle River system at Mount St. Helens. Spirit Lake outflow breach models suggest that a full-catastrophic breach of the debris blockage could inundate substantial portions of cities along the Toutle and Cowlitz rivers including Kelso and Longview, Washington. These models were conducted in early 1980 by the U.S. Geological Survey and are public record.

## 2.2 Activities Common to Action Alternatives B and C

### **Replacement of the Intake Gate Structure of the Spirit Lake Tunnel**

Alternatives B and C propose to dredge approximately 7,100 cubic yards of spoils material from the existing spoils pile in front of Spirit Lake tunnel intake channel. Dredged material includes woody debris, excavated rock, ash, pumice, and sand. Dredged material would first be placed onto a scow barge.

Approximately 2,700 cubic yards of suitable dredged material could be used to construct a permanent access ramp from the lake to the existing helipad adjacent to the tunnel intake. The remaining dredged material would be moved up to 900 feet away from the Spirit Lake tunnel intake and placed onto the lake bottom. Figure 7 provides an overview map of both action alternatives.

The access ramp adjacent to the tunnel intake would have positive drainage and would remain in place to be utilized for future management activities. Water would be directed across the ramp as a ford or rerouted adjacent to the ramp. The ramp would be stabilized after implementation to limit the need for future maintenance.

Construction of a cofferdam<sup>3</sup> is proposed to stop water flow through the intake channel and allow access to the tunnel intake gate and intake structure at Spirit Lake. Cofferdam construction may consist of materials such as large sandbags filled with gravel and sand material or pile installation. A pump would be used as needed to evacuate water from the dewatered intake structure area. Additional pumps would maintain the lake level during construction by pumping water from the lake to downstream of the intake gate structure. Estimated pumping capacity is approximately 25,000 gallons per minute for 10 to 12 hours per day to offset average summer water inflow to Spirit Lake.

Alternatives B and C propose demolition, removal, and disposal of the existing trash rack and gate at the intake structure of the Spirit Lake tunnel.

Construction of a new intake-control structure at the remaining intake wall would include concrete formwork and a cast in-place rehabilitated concrete structure. A new trash rack, intake gates and service platform would be fabricated and installed.

Boats and barges carrying equipment and/or crews will need to traverse through the floating log mat at Spirit Lake. To manage travel through the logs, crews may utilize log broncs or buoy systems to keep floating logs away from equipment and boats.

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<sup>3</sup> Cofferdam: A watertight enclosure pumped dry to permit construction work below the waterline.

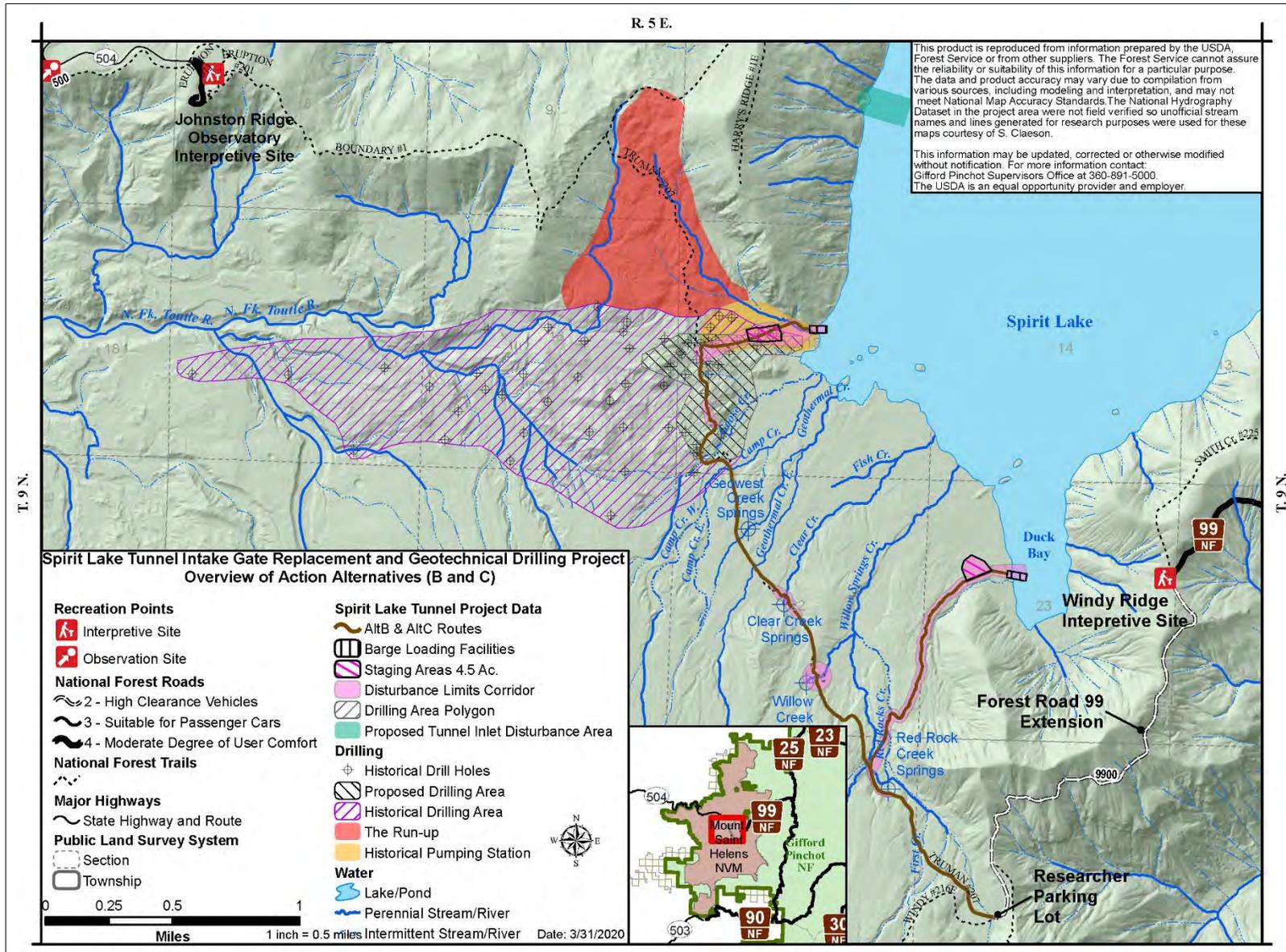


Figure 7. Overview map of action alternatives (B and C).

The sequencing described below would occur during summer and early fall. Winter-like conditions in late fall, winter, and spring create unsafe conditions for construction.

### **Gate Sequencing Phase 1**

(1 to 2 seasons, each season is estimated at 122 days)

- Construction of temporary access road;
- Construction of staging area near lake;
- Removal of spoils pile at tunnel intake;
- Large equipment (over 50,000 pounds) would be mobilized once each season;
- Crews would travel from Windy Ridge and across the lake by boat daily to complete work;
- Estimated 1,980 passenger vehicle passes per season;
- Estimated 84 passes of truck-tractors per season; and
- Estimated 464 single-unit truck passes per season.

### **Gate Sequencing Phase 2**

(1 season, each season is estimated at 122 days)

- Maintenance on temporary access road as needed;
- Construction of coffer dam;
- Removal and replacement of intake gate; must occur in single season;
- Large equipment (over 50,000 pounds) would be mobilized once each season;
- Crews would travel from Windy Ridge and across the lake by boat daily to complete work;
- Estimated 1,980 passenger vehicle passes per season;
- Estimated 84 passes of truck-tractors per season; and
- Estimated 464 single-unit truck passes per season.

## **Reconstruct Existing National Forest System Road 99 and Construct Temporary Roads,<sup>4</sup> Staging Areas, and Barge Loading Facility**

Specific locations and details of implementation can be found in the separate sections for alternative B and alternative C.

Construction of a staging area could occur at the Windy Ridge recreation site or the Smith Creek Picnic recreation site, or at both locations. Improvement of the National Forest System road 99 extension from the Windy Ridge recreation site to the researcher parking lot is proposed in order to allow safe passage for trucks that could include lowboy trailers. The terminus of National Forest System road 99 extension, known as the researcher parking lot, may be increased in size by an estimated 0.2 acre for use as a staging area during implementation and material disposal after the completion of project work.

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<sup>4</sup> 36 CFR 212 definitions: Temporary road or trail – a road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a National Forest System road or trail and that is not included in a National Forest System transportation atlas.

Construction of temporary roads would include new materials, road building activities, stream crossings, drainage features, and other road structures to support safe access by equipment. The temporary access road would be a single lane road with intervisible<sup>5</sup> turnouts and periodic turnarounds. The road surface would generally be 16 feet wide. Some horizontal curves would require curve widening to allow passage of a truck with a lowboy trailer. Resource specialists considered a corridor for ground disturbance limits typically of 33 to 100 feet from the proposed centerline of the temporary access road alignment. See alternatives B and C for locations. Only a portion of the disturbance limits corridor would actually experience ground disturbance. The final temporary access road alignment could be adjusted within the disturbance limits corridor to avoid or limit impacts to sensitive features. Seasonal maintenance may be necessary.

Stream crossings such as culverts or bridges would be used to separate live stream flow from the temporary road surface. Stream crossing structures would be sized based on time periods to remain in place. Non-overwintering stream crossings would be sized for expected peak summer flows and all structures and road fill would be removed from the floodplain at the end of each summer season and placed in a stable location. Road fill would be separated from existing streambed through use of geosynthetic<sup>6</sup> material to avoid contamination of and minimize disturbance to existing streambed. Stream crossing structures left in place over winter would be sized for 100-year peak flow with consideration for debris. All crossings would be installed and maintained to avoid negative channel changes such as inlet scouring or erosion of the streambed or downstream banks.

Construction would include a 4.5 acre equipment and material staging area in a non-vegetated area approximately 500 to 700 feet away from Spirit Lake. The staging area would connect to a barge loading facility by a temporary road with a 25 feet wide road surface. Construction would include a 1.4 acre barge loading facility on the shore of Spirit Lake. Construction activities may include new materials, earthwork, pile installation, shore ties and clearing vegetation. See alternatives B and C for locations.

Implementers may be permitted to plow National Forest System road 99 and road 99 extension to remove snow from the roadway and access the project site.

## **Geotechnical Investigation and Core Sampling**

Implementation would begin either immediately by helicopter access or when the temporary access road is complete depending on the action alternative selected. Implementation is estimated to take up to five field seasons. Non-helicopter temporary access roads would be maintained for the duration of project implementation.

Once at the drilling area, drill vehicles would traverse from hole to hole. It is estimated that 3 to 5 drill vehicles would be used during the operations with approximately 30 personnel onsite. Core sampling would occur at approximately 30 locations within the footprint of the 1982–1983 drilling site. Total area is approximately 104 acres (figure 7) however, the estimated area of disturbance would be closer to five acres. Core samples would be generated from drill holes approximately 100 to 350 feet deep, and approximately 4 inches inside diameter.

Each drill site location would occupy an approximately 100 to 200 square yard area (or up to 1,800 square feet) during drilling operations.

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<sup>5</sup> Intervisible is defined as visible to or from one another.

<sup>6</sup> Geosynthetic is defined as a planar product manufactured from a polymeric material that is used with soil, rock, or other geotechnical-related material as an integral part of a civil engineering project, structure, or system.

A temporary submersible pump or floating pump may be installed in Spirit Lake (in the area of the historical pump station). The pump would feed a hose and fill a tank near the lake shore. The pump would be installed manually. Any pumping or water transfer activities would be consistent with Washington State guidance on aquatic invasive species. Water for drilling operations may be brought in on the temporary access road with a truck or via helicopter.

A limited quantity of water during drilling operations would be disposed as surface run-off. A portion of the water (used in permeability pump tests) would end up in the ground. Drillers would follow all State of Washington requirements for protecting groundwater from contaminants.

Disposal of drilling mud would occur in one or multiple small pits within the drilling area polygon. Drilling mud is a non-toxic product used for lubrication and preventing collapse of drill holes during the drilling process. The mud would be composed of bentonite or biodegradable polymer products. The final location of the pits will be coordinated with resource specialists and researchers as necessary.

Compliant with Forest Service and the State of Washington Department of Ecology standards, crews will be permitted pit, vault, or temporary toilets within the drilling polygon.

### **Geotechnical Drilling Sequencing**

See alternatives B and C for details. If drilling and gate temporary access roads overlap, drilling operations may be delayed to avoid traffic hazards.

Each season of work is estimated to be 122 days, dependent on weather conditions.

### **Public Access**

Public trail access in the vicinity of activities will be limited during project implementation. A portion of the Truman Trail (approximately 3 miles) will be administratively closed or partially closed to the public during implementation (summer months).

National Forest System road 99 extension would continue to be maintained as an administrative use only road that is closed to public motorized vehicles. Access to the Windy, Loowit, and Abraham trails may be limited during the summer months dependent on the phase of project implementation and the ability of operators to coordinate for public safety.

Individuals with Tribal or cultural rights, permitted researchers, and permitted special uses and events would be able to coordinate necessary access with the Monument Ranger.

### **Stabilization and Rehabilitation**

(1 season depending on project design criteria)

After implementation is complete, rehabilitation work would generally consist of restoring natural ground contours and natural drainage patterns affected by project work. As necessary, non-native material brought to the site during implementation would be removed.

Select areas may be revegetated after the project is complete to increase site recovery and reduce visual impacts.

### **Forest Plan Amendment**

Proposed projects are required to be in compliance with the relevant forest plan, or a plan amendment is required. The preliminary assessment for the proposed project identified that the visual quality objective designated in the forest plan and the Monument's comprehensive management plan for the project area

would be inconsistent with the action alternatives (alternatives B and C). As such, alternatives B and C both propose a site-specific amendment to the forest plan (36 CFR 219.16(b)). This project-specific amendment would allow the Spirit Lake Tunnel Intake Gate Replacement and Geotechnical Drilling Project to exceed the designated visual quality objective of the project area from retention to partial retention. However, the assigned visual quality objective of retention would not change for future actions. This amendment is proposed to take effect for the life of the project and will expire when project activities have been completed and the area has returned to a visual quality objective of retention (5-10 years). For details about the proposed amendment and the substantive requirements (36 CFR 219.8-11) related to the amendment see Section 5: Proposed Forest Plan Amendment.

## Project Design Criteria

Project design criteria were designed to minimize environmental impacts of the action alternatives. Table 1 details the specifics of project design criteria, what resources it was developed for, and to what elements of the action alternative the criteria will apply. There are a handful of project design criteria that are specific to either alternative B or C, and are noted as such. These project design criteria have been taken into account for the anticipated environmental effects disclosed within the resource sections in Section 3: Analysis Measures and Environmental Effects.

**Table 1. Project design criteria to minimize the environmental impacts of the project**

Element(s) of Action Alternative(s)	Project Design Criteria
<b>Aquatics</b>	
All elements	<p>For all tasks involving work “that will use, divert, obstruct or change natural flow, bed or banks of any perennial or intermittent water body” utilize the design and implementation standards in appendix A of the Washington Department of Fish and Wildlife and U.S. Forest Service Memorandum of Understanding (Forest Service Agreement No. 17-MU-11062754-049) (project record) and follow the processes laid in the other appendices to address aspects not laid out in appendix A. This includes:</p> <ul style="list-style-type: none"> <li>- Timing for implementation of in-water work periods based on location and the process for modifying the work period based on sight specific and annual conditions;</li> <li>- Specific requirements intended to protect fish and other aquatic species during construction;</li> <li>- Requirements for aquatic passage during and after construction; and</li> <li>- Oversight of plan creation, construction, and post-construction conditions by qualified resources specialists.</li> </ul>
All elements	<p>Refueling: Develop and implement project specific spill prevention and control plan in accordance with state and federal laws. This plan would include:</p> <ul style="list-style-type: none"> <li>- All equipment working in waterways or over water for extended periods should use bio-based fuels and lubricant when practicable;</li> <li>- Ensure that appropriate spill prevention plans are in place, including placement of containment tray and absorbent pads;</li> <li>- Refuel 150 feet or more from any waterbody (wetted or dry waterbody) or as far away from water as possible given the topography. For example, refueling at the tunnel inlet will not be able to be 150 feet away from the lake and/or tunnel outflow;</li> <li>- Containment systems need to be level. If necessary, move soil to level the area and restore it to its original condition when water withdrawal is completed;</li> <li>- The edges of the containment tray shall be held upright to prevent gasoline or other fuels from leaking;</li> <li>- Gas absorbent pads will be checked and replaced at least daily. If there is a rain event expected or precipitation has begun, the absorbent pads will immediately be checked and, if necessary, replaced and additional absorbent pads will be placed around the inside edges of the containment tray;</li> </ul>

Element(s) of Action Alternative(s)	Project Design Criteria
	<p>- If water with a gas or oil sheen accumulates within the containment tray, place an absorbent pad on the surface to absorb the sheen (10-15 min). Discard the pad in a plastic bag, pour residual water into a bucket or carefully carry the containment tray at least 300 feet away from any waterbody (wetted or dry) or as far away from water as possible given the topography, and pour water on the ground. Used absorbent pads must be discarded in plastic bags and at an appropriate facility off of the national forest.</p>
Temporary road construction, stream crossings	<p>Streams and waterways: Minimize disturbance to riparian vegetation to the greatest extent practicable. At live water crossings, utilize Forest Service approved erosion control measures, such as placing wood strand bales or sediment fences to intercept mobilized sediment prior to its entering the stream and lake. Erosion control measures must be in place, maintained, and cleaned for the duration of construction activities.</p>
Temporary road and Barge Loading area (Applies only to alternative B)	<p>Compensatory mitigation required to offset impacts to wetlands during construction. Document efforts to avoid and minimize impacts to wetlands. The amount of compensatory wetland mitigation that will be required is based on coordination with the State of Washington Department of Ecology and the Seattle District for the U.S. Army Corps of Engineers, per Sections 401 and 404 compliance under the Clean Water Act.</p>
All elements	<p>Implement Level II Decontamination Protocols provided in Washington Department of Fish and Wildlife Invasive Species Management Protocols, draft version 3 (or most recent).</p>
Dredging, barge activity	<p>Minimize turbidity during dredging to maintain water quality; maintain highest possible water quality to minimize impacts to surface waters. For example, avoid pumping into the tunnel during dredging operations to minimize turbidity downstream.</p>
Ramp construction, gate construction	<p>Isolate work area at the tunnel intake to minimize impacts to fish and aquatic organisms. For ramp and gate construction minimize size of the work area.</p>
All elements	<p>Pumping- follow fish protection screen guidelines for Washington State including:</p> <ul style="list-style-type: none"> <li>- All pump intakes must be screened with material that has openings no larger than 5/64 inch for square openings (measured side to side) or 3/32 inch diameter for round openings, and the design approach velocity shall not exceed 0.33 feet per second (screen must have the equivalent suction pressure of at least one square inch of function screen area for every gallon per min (gpm) of water drawn through it). For example, a 100 gpm-rated pump would require at least a 100 square inch screen.</li> <li>- Screens will be maintained and cleaned at least once a day in order to prevent injury or entrapment of fish. The screens will remain in place whenever water is withdrawn through the pump intake. Where water withdrawal is needed to support construction activities, draft water such that the location, pumping rate, and duration of water withdrawals adheres to the following criteria: Location where water is withdrawn is stable (not visibly eroding) for vehicle access; Pumping does not reduce total instream flows by more than 50% unless stream is being dewatered for construction.</li> </ul>
<b>Soils, Botany, and Visuals</b>	
All elements	<p>Where removal of top soil, if present, or vegetation occurs, conserve material for restoration and rehabilitation efforts.</p>
<b>Soils, Botany, and Wildlife</b>	
Temporary road	<p>Where hardwood vegetation such as alder and willow occur on temporary road alignment, it shall be cleared (cut off at ground level) but not grubbed (root system removed from the ground) where practicable. The intent of this treatment is to minimize time to reestablish vegetation. There may be site specific exceptions where grubbing is required to lower temporary road grade such as descending from a tall streambank.</p>

Element(s) of Action Alternative(s)	Project Design Criteria
<b>Soils</b>	
All elements	Avoid mixing soil or rock/pumice layers during post implementation earthwork
Earthwork cut and fill, especially Red Rock Spring area	To limit losses to geologic features, minimize excavation of rock outcrop near Red Rock Spring and similar natural features. Limit to upslope excavation is 20 meters from existing centerline.
<b>Recreation</b>	
All elements	Sign closure areas and additional information at the high-use areas, trailheads and facilities within or adjacent to the project area that would be affected in advance of operations.
Temporary road	After implementation, minimize visual evidence of the project (temp road and staging areas) from existing trail systems.
All elements	Minimize closure of the 99 road extension/Truman Trail (207), Windy Trail (216E), and Abraham Trail (216D) to facilitate public access.
Applies only to alternative C	Minimize drilling equipment use of the Truman Trail (207). Also minimize the number of locations where vehicles can cross the trail while also considering and balancing ground disturbance and parallel tracking.
<b>Botany</b>	
All elements	To prevent the introduction of noxious weeds into the project area, all heavy equipment, or other off- road equipment used in the project is to be cleaned to remove soil, seeds, vegetative matter or other debris that could contain seeds. Cleaning should be done before entering National Forest Lands, and when equipment moves from or between project sites or areas known to be infested into other areas, infested or otherwise. Cleaning of the equipment may include pressure washing. An inspection will be required to ensure that equipment is clean before entering project area.
All elements	To prevent the introduction of invasive species or non-monument organisms to the Pumice Plain, require all passenger or service vehicles to be washed at a temporary weed wash station prior to entering project area.
All elements	Education and awareness training for crews working in the research area. The Monument Staff will provide information and expectations to all agency and contract personnel working in the Pumice Plain. For example, clean boots, clothes, and tools are required. No disposal of any food waste, especially fruit pits, seeds, etc.
All elements	Inspect active gravel, fill, sand stockpiles, quarry sites, and borrow material for invasive plants before use and transport. Treat or require treatment of infested sources before any use of pit material. Use only gravel, fill, sand, and rock that is determined to be weed free by a Forest Service weed specialist.
All elements	In accordance with the designation as a Class 1 Research area, rock sources will be treated, developed, and managed in a way to prevent all native and non-native plants or other organisms from being introduced into the Pumice Plain, as much as feasible.
All elements	Prior to project implementation, botanist will inventory and initiate treatment of priority invasive species populations in the project area. Monitor and treat invasive species during and after project completion. (Forest Service will lead effort).
All elements	All sites where vegetation and soil disturbance has occurred as a result of proposed actions will be returned to a natural contour and revegetated with plant material saved from initial construction. Only plants native to the Monument and occurring naturally within the ecosystem of the disturbed area will be used for revegetation or landscaping.

Element(s) of Action Alternative(s)	Project Design Criteria
<b>Wildlife</b>	
All elements	If practical, to mitigate the effect of construction of temporary access roads and barge staging areas where they cross riparian areas with hardwood shrubs, removal of shrub cover would occur outside of the nesting season, which would be from April through June. If construction occurs during the nesting season then, if practical, the proposed temporary access roads where they occur in riparian shrub habitat could be surveyed (by Forest Service personnel) prior to ground disturbance to identify breeding bird sites and potentially avoid those sites.
Temporary road construction	After the project is completed, the road should be restored to pre-project condition to the maximum extent possible and not be accessible to motorized vehicles.
<b>Research</b>	
All elements	Designate research implementation lead(s) to support the monitoring of implementation activities. Research lead(s) could communicate concerns or issues directly with the Forest Service leadership. After an alternative is selected, consider field visits with active researchers to examine the proposed temporary access road and staging areas.
All elements	Limit road width and disturbance corridor for temporary road in high density research plot areas (locations will be designated on map and include in project file). Restrict turn outs or turn arounds in these high-density areas. Keep the road width to a minimum to allow for equipment transport. Where possible in the designated high-density areas, install erosion barrier at the edge of the road prism to prevent additional erosion, dust and accidental incursion.
All elements	Where possible, spray temporary road, staging areas and helicopter landing zone with water to limit dust. Magnesium chloride or other additives will not be authorized. This would be especially important on hot and windy days. Consider allowing temporary hard surfaces to be installed in select locations to limit need for dust abatement. Consider this at helispot (alternative C) where there could be multiple trips to the same location per day.
Temporary road	Where possible, work with research implementation lead to avoid and protect key research plots or areas. Two currently documented areas include 1) the original lupine site and 2) Red Rock creek and spring.
All elements	Harvest any plant seeds ahead of project implementation where feasible. Where feasible keep harvesting activities within the designated disturbance limit corridor and as close to the actual temporary road or staging area location. Limit gathering seeds from plants in areas that will not be directly impacted by project activities. Coordinate with research implementation lead prior to collection. If there is not enough seed bank within the disturbance limit corridor, any new harvest locations will be coordinated with the research implementation lead.
All elements	Document pre-project conditions of proposed disturbance areas prior to any implementation activities.
Lake travel and log mat	Minimize large scale corralling of log mat to reduce impacts to log mat studies.
All elements	Encourage crews to minimize the number of vehicles and number of trips.
Red Rock spring area	Use full bench construction techniques where stable fill construction is not possible. Do not permit side-casting in riparian areas, such as springs, to protect research sites and habitat. Identify suitable, stable areas away from waterbodies to stage waste rock.
Applies only to alternative C	Maintain an undeveloped boat launch for researchers throughout the project implementation and rehabilitation efforts to limit impacts on lake-related studies.

Element(s) of Action Alternative(s)	Project Design Criteria
<b>Visuals</b>	
Temporary road	Follow the contour of the land, use curvilinear alignment, and minimize straight lines and sharp angles to keep temporary road visually subordinate to the characteristic landscape.
Temporary road	Minimize cuts and fills and minimize road widths to minimize unnatural forms and contrasting colors.
All elements	If available, utilize aggregate of similar color to existing adjacent landscape, when possible, to maintain visual sub-ordinance.
All elements	Excavation shall be minimized to the greatest degree possible to minimize changes to form, line, color and texture.
All elements	Where ground disturbance and contouring have occurred, re-contour area to pre-project ground lines. The intent of this treatment is to make the road prism visually subordinate to characteristic landscape and provide for positive drainage while avoiding alteration of any soil or vegetation that was undisturbed by this project. If sharp angles and unnatural linear features or forms are created during temporary road construction, the area from road surface to cut slope and fill slope shall be slope rounded.
All elements – Focus near Red Rock Springs	Excavation for realignment that exposes un-weathered rock faces along the route shall be excavated in a manner that limits the creation of large flat planes of unnatural appearance. In order to remain visually subordinate on the landscape, the excavation shall mimic the natural texture of the existing and adjacent rock face to the extent practicable.
All elements	Replace topsoil, if present pre-construction and leave area with texture similar to adjacent areas.
All elements	Rehabilitation treatment is to include non-uniform placement of native rocks and conserved vegetation to break up visual effects of disturbance. Native material shall be placed to mimic the adjacent texture, and color.
All elements	Restore trail width walking surface to pre project conditions
Drilling	Disposed drilling mud will not be visually evident from viewpoints after project completion.

## 2.3 Alternative B: Windy Ridge to Pump Station (Proposed Action)

In addition to the activities listed in Section 2.2 Activities Common to Action Alternatives B and C, alternative B (figure 8) would reconstruct a temporary access road (estimated 3.4 miles total length) from the researcher parking lot to where lake drainage pumping occurred in the 1980s, henceforth referred to as the pumping station. Where possible the temporary access road would follow the access route, currently known as the Truman Trail, used by the previous pumping and construction operations.

A staging area near the lake and barge landing would be constructed. This would occur within the area disturbed by the previous pumping station and construction efforts at the base of Harry’s Ridge.

Drilling access for equipment and personnel would be accomplished via the temporary access road following the alignment of the Truman Trail (historical 1980s route). Personnel would drive in daily to the work site.

- Personnel transport: Approximately 30 people within an estimated 1,000 single-unit truck or utility-terrain vehicle passes per season.
- Equipment transport: 3 to 5 drill vehicles, 2 passes per season.

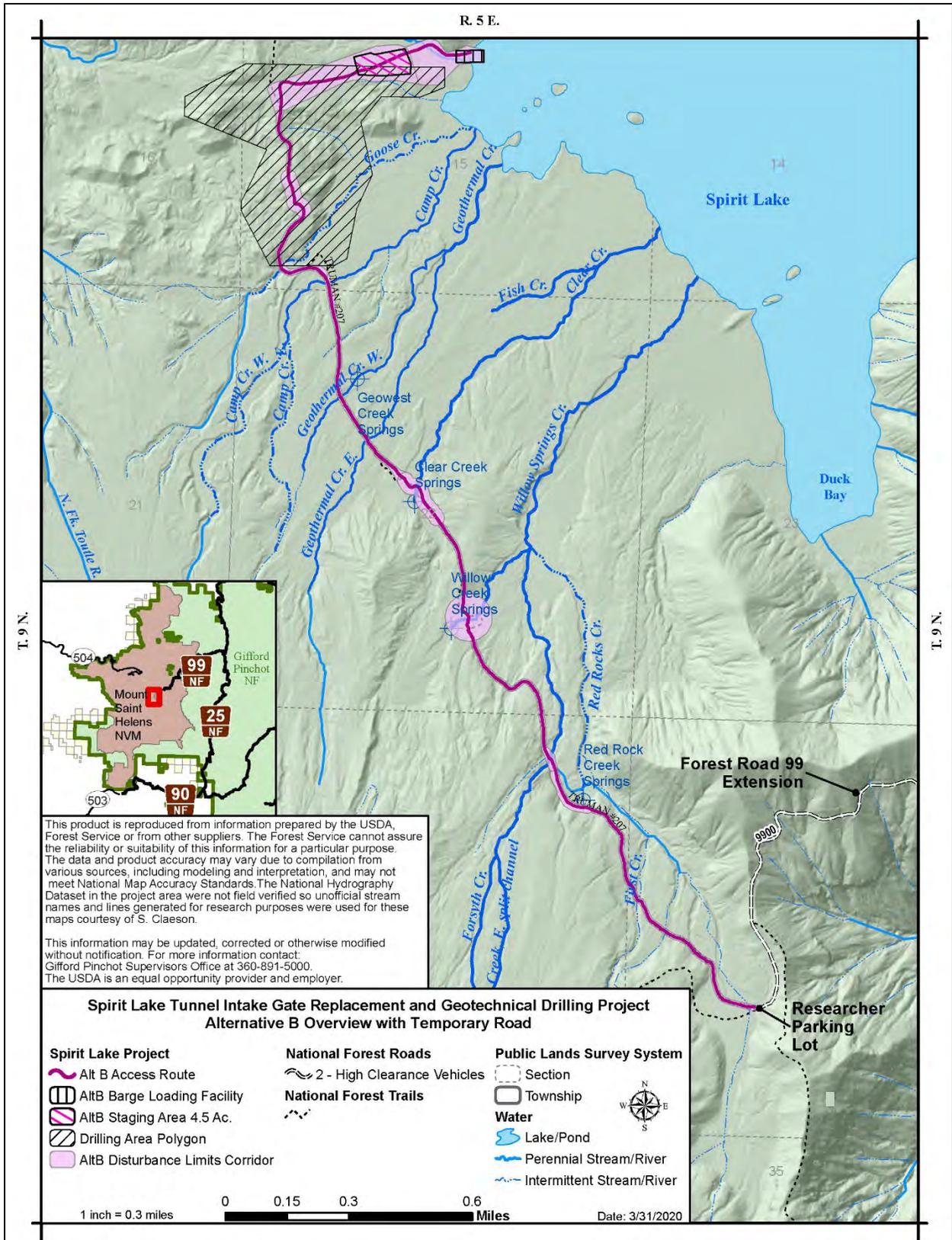


Figure 8. Alternative B: Windy Ridge to Pump Station (proposed action) overview map.

## 2.4 Alternative C: Windy Ridge to Duck Bay (Intake Gate) and Helicopter Use (Geotechnical Drilling)

In addition to the activities listed in Section 2.2 Activities Common to Action Alternatives B and C, alternative C (figure 9), would construct a temporary access road (estimated 2.0 miles total length) from the researcher parking lot towards Duck Bay. The temporary access road would be reconstructed along the existing disturbed area over the Truman Trail (approximately 0.85 mile) and then depart northeast over the Pumice Plain towards Duck Bay. The connecting portion of the temporary access road from Truman Trail to the existing utility-terrain vehicle trail would be new disturbance (approximately 0.25 mile). The last segment of the temporary road would follow a similar alignment to the existing administrative utility-terrain vehicle trail (approximately 0.90 mile). The existing utility-terrain vehicle trail is not a road and was not designed with road prism components such as aggregate, compaction, or road grades that are necessary for non-utility-terrain vehicle travel. Therefore while portions of the temporary access road would be on the utility-terrain vehicle trail, project access on this temporary access road segment is effectively new construction.

A staging area near the lake and barge landing at Duck Bay would be constructed.

Drilling access for equipment and personnel in alternative C would be accomplished by helicopter. A designated area, most likely the Coldwater gravel yard, would be secured for helicopter staging. Helicopters would transport drilling vehicles to the work site (some vehicles are transported in multiple components) at the beginning of the work season and at the end of the work season. Personnel would be transported daily to and from the work site by helicopter. Equipment and personnel would traverse overland within the work site.

- Personnel transport: Approximately 20 to 30 people transported via daily helicopter flights, 10 to 15 trips daily per season. This equates to an estimated 350 flight hours, which is 23 times greater than the no-action alternative and 12 times greater than alternative B.
- Equipment transport: About 3 to 5 drilling vehicles, transported via helicopter to the project area at the start and end of each field season and assembled and disassembled on site. Due to weather conditions in and around the project area and the time needed for flights, alternative C will likely take additional field seasons for completion, when compared to alternative B.

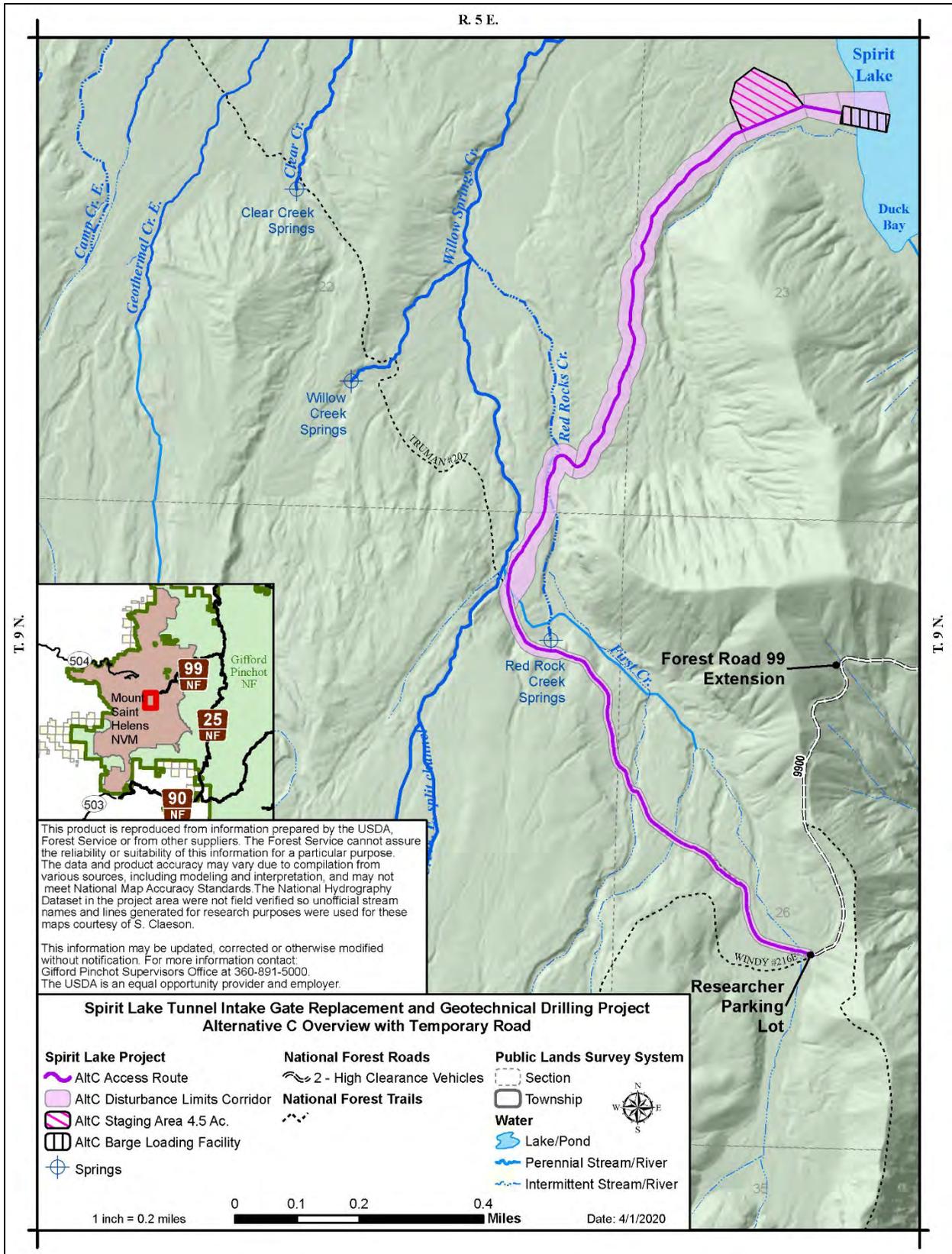


Figure 9. Alternative C: Windy Ridge to Duck Bay (intake gate) and helicopter use (geotechnical drilling) overview map.

## 2.5 Alternatives Considered but Dismissed from Detailed Analysis

The alternatives development process was conducted in accordance with the Council on Environmental Quality regulations (46 Federal Register 18026, 36 CFR 220.5, and Forest Service Handbook 1909.15). Alternatives and project design criteria are “developed incrementally in an open and transparent process.” Development of alternatives is an iterative process. As more information on environmental conditions became available, additional alternatives were developed.

More information about the dismissed alternatives can be found in Appendix A: Alternatives Considered but Eliminated from Detailed Study. Appendix A describes how the potential alternatives and options were evaluated and the rationale for why they were considered but not carried forward as a component of the action alternatives. A summary of information contained in appendix A is provided below.

### **Gathering of Information and Coordination**

The Forest Service reviewed input from the 2017 motorized access analysis and spoke directly with members of the research community and previous objectors. The Forest Service used information obtained in these efforts to help guide research and data gathering for additional implementation options.

The Forest Service coordinated and consulted with the following individuals and groups to gather additional information for the line officer to determine a reasonable range of alternatives:

- Forest Service, Region 6, Geotechnical Engineers;
- Forest Service, Enterprise Program (national resource), Geotechnical Engineer;
- Forest Service, Region 6, Fire and Aviation Management;
- Forest Service, Gifford Pinchot National Forest, Fire Management;
- Forest Service, Gifford Pinchot National Forest, Forest Hydrologist;
- Forest Service, Region 6, Road System Specialist;
- U.S. Army Corps of Engineers, Portland District, Senior Geotechnical Engineer;
- U.S. Army Corps of Engineers, Omaha District, Chief of Geology; and
- Regional private drilling companies (Crux Subsurface Incorporated, Salisbury Associates).

After the release of the notice of proposed action for this project, two additional alternatives were proposed that were modified versions of alternative C. One suggested alternative came from a Forest Service Pacific Northwest Research Station employee; this alternative was considered and added to Gate Replacement 6 (PNW modified in appendix A). The other suggested alternative was derived from several comments received during the official comment period; this alternative was already incorporated in the analysis as Drilling 6 (appendix A), and was re-evaluated but eliminated from detailed study.

### **Evaluation Criteria**

The following criteria was used to develop and evaluate a range of reasonable alternatives:

- Does the component alternative meet the need of the project?
- Would the component alternative potentially reduce environmental effects to at least one resource<sup>7</sup>?
- Is the component alternative feasible?

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<sup>7</sup> The Mount St. Helens National Volcanic Monument Comprehensive Management Plan emphasizes the importance of research studies within the Monument. For this reason, the line officer reviewed research studies within this analysis.

## **Drilling Component Alternatives**

- Drilling 1: Ground-based historical route – carried forward as part of alternative B.
- Drilling 2: Ground-based Johnston’s Ridge Observatory – not carried forward for future consideration due to feasibility and environmental concerns.
- Drilling 3: Helicopter use – carried forward as part of alternative C.
- Drilling 4: Helicopter blend, hiking or camping – not carried forward for future consideration due to feasibility and environmental concerns.
- Drilling 5: Helicopter blend, utility-terrain vehicle crews – not carried forward for future consideration due to feasibility and environmental concerns.
- Drilling 6: Duck Bay utility-terrain vehicle and boat – not carried forward for future consideration due to feasibility and environmental concerns.
- Drilling 7: Duck Bay and utility-terrain vehicle along shoreline – not carried forward for future consideration due to feasibility and environmental concerns.
- Drilling 8: Duck Bay barge – not carried forward for future consideration due to feasibility and environmental concerns.
- Drilling 9: Winter operations – not carried forward for future consideration due to feasibility and inability to meet the need of the project.
- Drilling 10: West Toutle River – not carried forward for future consideration due to feasibility and environmental concerns.

## **Intake Gate Replacement Component Alternatives**

- Gate Replacement 1: Historical route to pump station – carried forward as part of alternative B.
- Gate Replacement 2: Historical route and Duck Bay utility-terrain vehicle temporary access road – carried forward as part of alternative C.
- Gate Replacement 3: Duck Bay utility-terrain vehicle temporary access road – not carried forward for future consideration due to feasibility and environmental concerns.
- Gate Replacement 4: Helicopter – not carried forward for future consideration due to feasibility and inability to meet the need of the project.
- Gate Replacement 5: Johnston’s Ridge Observatory – not carried forward for future consideration due to feasibility and environmental concerns.
- Gate Replacement 6: Duck Bay utility-terrain vehicle temporary access route (PNW modified) – not carried forward for future consideration due to feasibility and environmental concerns.

## **Section 3: Analysis Measures and Environmental Effects**

This section summarizes the analysis measures, current condition (affected environment) and potential effects of the alternatives on specific resources. For further details about these resources see specialist input write-ups within the project record.

For numerous resources, alternative A (no action), is the same as the current condition. Without implementing the proposed project the current condition would continue as it is now. The no-action alternative serves as a baseline for comparison against the effects of the action alternatives B and C.

However, if the Forest Service does not manage the geologic hazard and existing infrastructure at Mount St. Helens there is a heightened risk of tunnel failure and subsequent debris blockage failure. If the tunnel intake structure does not address critical needs, it will not successfully manage the water level at Spirit Lake (NASEM 2017). Without a spillway or secondary outlet, Spirit Lake will continue to rise and exert pressure on the natural dam (debris blockage located on the Pumice Plain). Managers would attempt emergency pumping operations to lower the lake level (NASEM 2017); however there is no fully assured method to deploy and operate pumping. An emergency pumping operation would use the same footprint of the 1980s emergency response operations, including the Truman Trail and the base of Harry's Ridge. In emergency conditions to protect life and property downstream, managers may not be able to account for protection of any resource areas including research.

If the proposed geological investigation and core sampling of the debris blockage does not occur, decisions related to the management of Spirit Lake water levels will not be informed by a current characterization of the debris blockage damming the lake; the location and behavior of groundwater in the blockage; a quantified characterization of risks posed by volcanic activity on Spirit Lake water levels; or the response of the debris blockage to local and regional seismic events.

### **3.1 Research**

Researchers from around the world come to Mount St. Helens to better understand volcanos and the impacts of volcanic eruptions. Research efforts have been led by the Forest Service Pacific Northwest Research Station over the nearly four decades since the eruption. The Pacific Northwest Research Station has been joined by dozens of scientists from universities and other research organizations to document the ways that species and ecological processes respond to disturbance. Research at Mount St. Helens has led to more than 300 peer-reviewed publications on ecosystem responses to volcanism. Categories of research include (but are not limited to) disturbance ecology, succession, biological community assembly, biological organization, biotic interactions, stream development, soils, and small mammals.

### **Analysis Measures**

#### **Land and Resource Management Plan for the Gifford Pinchot National Forest**

All of the Monument falls within "Category A" detailed within the forest plan. The goal of this management area category is to "... protect the geologic, ecologic, and cultural resources, allowing geologic forces and ecological succession to continue substantially unimpeded. Permit scientific study, research, recreation, and interpretation, consistent with the provisions of the Act" (forest plan, page IV-99).

## **Environmental Effects**

### **Alternative A: No Action**

#### *Direct, Indirect, and Cumulative Effects for Research*

No new actions would be authorized under the no-action alternative. There are currently 30 different studies occurring in the area, totaling 992 individual research “plots” varying in size, shape, and distribution. Ongoing research would continue with limited impacts from hikers, researchers, and Spirit Lake managers.

### **Alternative B**

#### *Direct and Indirect Effects for Research*

Within the 16 feet wide temporary access road of alternative B, 25 individual research plots would be directly impacted. These 25 plots will see the largest amount of disturbance and impact. The 25 research plots that would be directly impacted include studies in Ecology of Exotic Plant Species, Stream Amphibian Ecology, Stream Fish Ecology Lines, Lentic Amphibian Ecology, and Avian Ecology.

An additional 58 individual research plots are within the access corridor area and may see direct or indirect effects if the temporary access road were to shift and may see indirect effects from the temporary access road construction and use.

In general, impacts within the corridor area may include surface erosion, sediment deposits, dust, animal habitat and behavior disturbance, altered hydrology or soil moisture, and invasive species introduction or spread. Based on the Pumice Plain landscape, the project area is naturally subject to considerable scouring and depositing of sediment from volcanic activity, large flood events, spring run-off and wind erosion.

The physical environment is expected to return to the pre-project conditions 2 to 15 years after project implementation. Depending on the nature of the study, plots in the project area may be used again or reintroduced into research as the surrounding natural environment returns to the dynamic volcanic landscape. Plots related to botanical species and natural succession could be impacted for a longer period of time (estimated up to 15 years). Some impacted plots may not be utilized again and would no longer contribute to their corresponding study. If plots are used again for research, their disturbance history will differ from plots outside the project area and their developmental pathways (successional trajectories) may differ in subtle or unpredictable ways.

Researcher’s access to their research plots may be limited within the project area. For safety reasons, there will be short periods during mobilization and demobilization (at the beginning and end of each season) when researchers will not be able to travel on National Forest System road 99, road 99 extension, or the Truman Trail. For the majority of the season, researchers will have access to all research areas on the Pumice Plain but will need to follow the project implementation safety plan guidelines. Even if the Truman Trail is temporarily closed to the public, researchers will be permitted access. Project activities may cause a slight delay in accessing plots, however it is unlikely that researcher access would be considerably changed.

There are approximately 30 active research studies on the Pumice Plain totaling 992 individual plots. There are 19 research studies that have at least one plot within the disturbance limit corridor. Of those 19 studies, there are a total of 85 plots potentially directly impacted. Fifteen of the 19 studies have three or less plots impacted per study. The number of impacted plots is approximately 8.5 percent of the total number of documented plots on the Pumice Plain, however, if certain key plots are affected within a study, the entire study may be impacted. Individual plots are primarily valuable within the context of their

current study. The majority of research studies on the Pumice Plain are outside the project area (91.5 percent) on the Pumice Plain are outside of the project area and will not be directly or indirectly impacted.

Additional indirect impacts may occur farther away from the project area. For example, impacts may occur downstream from the temporary access road stream crossings. Sediment pulses in the summer may occur from the proposed activities when sediment transport wouldn't typically occur. This could impact studies on fauna (immature insects or amphibians) that emerge from the streams before naturally high flows move sediment in the fall. Alternative B may cause dust and ash plumes that settle in plots outside of the corridor, potentially impacting studies on soil characteristics, insect populations, and plant reproduction. Visual and auditory disturbance from alternative B could impact the movement of elk impacting studies on herbivory, plant community compositions and tree development.

Alternative B and the specific project design criteria designed to minimize impacts to research are consistent with the forest plan and the Monument's comprehensive management plan. This alternative will allow geologic forces and ecological succession to continue substantially unimpeded while protecting the health and safety of communities downstream.

#### *Cumulative Effects for Research*

The existing Duck Bay utility-terrain vehicle route does overlap in time and space with the project area. There is currently one research plot impacted by the Duck Bay utility-terrain vehicle route. The impacts to that plot in addition to alternative B do not lead to any additional measurable cumulative effects. Alternative B is predicted to increase helicopter flight hours by double. This could have minor effects on dust, invasive weed spread, and noise effecting to vertebrates. Therefore, cumulative effects are the same as the direct and indirect effects described for this alternative.

### Alternative C

#### *Direct and Indirect Effects for Research*

Within the 16 feet wide temporary access road of alternative C, 17 individual research plots would be directly impacted. These 17 plots will see the largest amount of disturbance and impact. The 17 research plots that would be directly impacted include studies in Plant Ecology, Ecology of Exotic Plant Species, and Stream Amphibian Ecology.

An additional 37 individual research plots are within the access corridor area and may see direct or indirect effects if the temporary access road were to shift and may see indirect effects from the temporary access road construction and use.

In general, impacts within the corridor area may include surface erosion, sediment deposits, dust, animal habitat and behavior disturbance, altered hydrology or soil moisture, and invasive species introduction or spread. Based on the Pumice Plain landscape, the project area is naturally subject to considerable scouring and depositing of sediment from volcanic activity, large flood events, spring run-off and wind erosion.

The physical environment is expected to return to the pre-project conditions 2 to 15 years after project implementation. Depending on the nature of the study, plots in the project area may be used again or reintroduced into research as the surrounding natural environment returns to the dynamic volcanic landscape. Plots related to botanical species and natural succession could be impacted for a longer period of time (estimated up to 15 years). Some impacted plots may not be utilized again and would no longer contribute to their corresponding study. If plots are used again for research, their disturbance history will differ from plots outside the project area and their developmental pathways (successional trajectories) may differ in subtle or unpredictable ways.

Due to the lake travel under alternative C, there are 7 research plots, 6 for a limnology study and one for a water temperature study, located in the potential pathway of boats and barges traveling to the intake gate structure. During project implementation, these plots may be inaccessible or directly impacted by lake travel. These plots may be relocated or resume productivity after implementation is complete.

Researcher's access to their research plots may be limited within the project area. For safety reasons, there will be short periods during mobilization and demobilization (at the beginning and end of each season) when researchers will not be able to travel on National Forest System road 99, road 99 extension, or the Truman Trail. During times when personnel shuttles are taking place via helicopter (start of day and end of day) access may be limited along the flight path. These daily shuttles are estimated for two to three seasons. For the majority of the season, researchers will have access to all research areas on the Pumice Plain but will need to follow the project implementation safety plan guidelines. Even if the Truman Trail is temporarily closed to the public, researchers will be permitted access. Project activities may cause a slight delay in accessing plots, however it is unlikely that researcher access would be considerably changed.

Current researchers using Duck Bay to access a boat and travel around the lake will be impacted during project implementation. Project implementation is predicted to occur June through October for 2 to 5 years. The staging area was intentionally located north of the current researcher boat storage location; however, due to boat and barge traffic in the lake there will be minor impacts to those researchers.

There are approximately 30 active research studies on the Pumice Plain totaling 992 individual plots. There are 17 research studies that have at least one plot within the disturbance limit corridor. Of those 17 studies, there are a total of 63 plots potentially directly impacted. Fourteen of the 17 studies have three or less plots impacted per study. The number of impacted plots is approximately 6.3 percent of the total number of documented plots on the Pumice Plain, however, if certain key plots are affected within a study, the entire study may be impacted. Individual plots are primarily valuable within the context of their current study. The majority of research studies on the Pumice Plain are outside the project area (93.7 percent) on the Pumice Plain are outside of the project area and will not be directly or indirectly impacted.

Additional indirect impacts may occur farther away from the project area. For example, impacts may occur downstream from the temporary access road stream crossings. There are fewer stream crossings with alternative C, therefore, there would be less downstream effects. Sediment pulses in the summer may occur from the proposed activities when sediment transport wouldn't typically occur. This could impact studies on fauna (immature insects or amphibians) that emerge from the streams before naturally high flows move sediment in the fall. Alternative C may cause dust and ash plumes that settle in plots outside of the corridor, potentially impacting studies on soil characteristics, insect populations, and plant reproduction.

Alternative C is predicted to have 23 times the amount of helicopter use, compared to the no-action alternative, and 12 times the amount of helicopter use compared to alternative B. Visual and auditory disturbance from alternative C could impact the movement of elk effecting studies on herbivory, plant community compositions and tree development.

Alternative C and the specific project design criteria designed to minimize impacts to research are consistent with the forest plan and the Monument's comprehensive management plan. This alternative will allow geologic forces and ecological succession to continue substantially unimpeded while protecting the health and safety of communities downstream.

### *Cumulative Effects for Research*

Alternative C is predicted to increase helicopter flight hours by 23 times (from 15 hours to 350 hours). This increase in flight hours is covered under direct/indirect effects. Taken cumulatively with the current helicopter use there could be an additional minor effect on dust, invasive weed spread, and noise effects to vertebrates. Therefore, cumulative effects are the same as the direct and indirect effects described for this alternative.

## 3.2 Visual Resources

The visual resource of the area is dominated by the massive up close view of the erupted volcano and the dynamic change caused by the volcanic activity. The sheer impact of this event has created a landscape that is visually dramatic. It can reveal to the viewer to imagine the intense power of the event. The area is dominated by the effects of the volcanoes' blast on local resources, the landscape, regrowth and recovery of vegetation across the Pumice Plain.

## Analysis Measures

### Visual Quality Objectives

The forest plan includes requirements for consideration, treatment, and protection of resources such as scenery and aesthetics, and assigns a visual quality objective for designated management area categories. The visual quality objective assigned in each management area category should be the minimum level acceptable and should be met by all activities (forest plan, page 65). Visual quality objective classifications range from modification to preservation and are based on the sensitivity level of the area, the variety class, and by distance zones from viewing platforms (USDA FS 1974). The Monument contains two visual quality objective classifications: preservation and retention. The proposed project area contains only the "retention" visual quality objective. Under the retention visual quality objective activities may repeat form, line, color, and texture which are frequently found in the characteristic landscape. Changes in their qualities of size, amount, intensity, direction, pattern, etc., should not be evident.

Key viewing platforms and routes are places from which most visitors view an area. The area being viewed from these platforms and routes are known as viewsheds. Distance zones from viewing platforms are divisions of a particular landscape being viewed. They are used to describe the part of a characteristic landscape that is being inventoried or evaluated. These zones are foreground (zero to one-half mile), middleground (one-half mile to 3 miles), and background (3 to 5 miles or from middleground to infinity)" (USDA FS 1974). Key viewing platforms selected for this analysis are: Windy Ridge Interpretive Site, Johnston's Ridge Observatory, and the Truman Trail. Figure 10 through figure 13 are representative photos taken from the three key viewing platforms.



**Figure 10.** View from Windy Ridge interpretive site looking west. Spirit Lake and the shore area known as “Duck Bay” are in view along the lower portion of the photo, with the current administrative utility-terrain vehicle trail on the left, and Pumice Plain is in the middle.



**Figure 11.** View from Johnston Ridge Observatory amphitheater, with the Pumice Plain visible in the middleground and background.



Figure 12. Hikers traversing along the Truman Trail, looking north.



Figure 13. Truman Trail near Red Rock Springs, showing evidence of blasting or excavation for road building in the 1980s.

## Environmental Effects

### Alternative A: No Action

Under alternative A, no new ground disturbing activities associated with the proposed project would take place other than those already permitted within the project area. Scenic impacts would likely continue with little effect on how visitors visually experience the area. Administrative use of the utility-terrain vehicle route to Duck Bay would continue. Approximately 5 to 10 trips with the utility-terrain vehicle occur each year and approximately 3 to 7 boat trips from Duck bay to the tunnel inlet. The yearly tunnel and gate inspections would still occur via a handful of administrative helicopter flights (approximately 3 to 6 flight days per year, 12 to 15 flying hours total). The U.S. Geological Survey would continue to have

fly several times per year to the tunnel inlet and to areas on the debris blockage and within the blast zone. There would be no new direct or indirect effects to lead to cumulative effects.

## **Alternative B**

Alternative B would not be consistent with the management area category standard (forest plan, pages 126–127) designated visual quality objective of retention for the project area, without the proposed plan amendment (see section 2.2). Retention, as a visual quality objective, is defined as “The most restrictive visual quality objective, wherein, management activities are not evident to the casual forest visitor” (comprehensive management plan, appendix P). The retention designation applies to approximately 110,990 acres within the Monument.

For the proposed work to be accomplished, the visual quality objective of retention would be exceeded for the project area because project activities will be evident to the casual forest visitor.

Visual impacts will be minimized as much as possible by project design criteria (table 1). However, the presence of machinery and workers during the construction, reconstruction, and maintenance of the temporary access road, as well as drilling activities would draw attention to the work and temporarily detract from the natural-appearing landscape and would be evident to the casual forest visitor. As such, this project includes a forest plan amendment to provide a project-specific variance to allow the Spirit Lake Tunnel Intake Gate Replacement and Geotechnical Drilling Project to exceed the designated visual quality objective of retention. This variance would be for approximately 475 acres, which is less than 0.5 percent of the Monument’s total designated retention area. The assigned visual quality objective of retention would not change for future actions or elsewhere within the Monument. See Section 5: Proposed Forest Plan Amendment (Alternatives B and C) for details about the substantive requirements directly related to the proposed project-specific variance.

### *Effects to Views from Windy Ridge Interpretive Site*

It is expected that approximately 20 to 30 percent of the project activities associated with alternative B would be visible from the Windy Ridge viewing platform at a distance of 1.5 to 2 miles (middleground) (see figure 14). These views to the proposed temporary access road are largely oblique and would be screened by patches of vegetation and topographic features, which would diminish the proximity of the temporary access road. The broken view of the temporary access road and the distance from which it is viewed would likely reduce the visual impact and would meet a partial retention visual quality objective in the short term (implementation of project).

Rehabilitating the temporary access road, returning the grade to its former repose, and revegetating the disturbed soils with native plants would reduce the visual impact upon the views from Windy Ridge to the degree that it is likely the resource would meet the retention visual quality objective in the long term (5 to 10 years).

### *Effects to Views from Johnston Ridge Observatory*

The proposed activities would be visible from Johnston Ridge Observatory at a distance of 2.5 to 4.5 miles (middleground and background) (see figure 15). From middleground distances, the temporary access road would likely be minimally visible and the view of the linear feature would be broken up/not contiguous due to the topography and vegetation. A linear feature may be recognized as a non-natural element (a manmade feature) if there are not already linear features on the landscape. Most visitors would not notice the minor changes on the landscape with the direct view of Mount St. Helens in front of them. The broken view of the temporary access road and the distance from which it is viewed would likely reduce the visual impact and would meet a partial retention visual quality objective in the short term (implementation of project).

Rehabilitating the temporary access road, returning the grade to its former repose, and revegetating the disturbed soils with native plants would reduce the visual impact upon the views from Johnston Ridge Observatory to the degree that it is likely the resource would meet the retention visual quality objective in the long term (5 to 10 years).

#### *Visibility from the Truman Trail*

The Truman Trail is the proposed temporary access road for alternative B for transportation of equipment and personnel. The temporary access road with its cut and fill slopes would only be visible in the immediate foreground (0.5 miles). Alternative B's temporary access road would be built on relatively flat ground so the cuts and fills would be minimal along much of the temporary access road. In some areas there are cuts and fills that would be visible from the trail users' viewpoint, and not be natural appearing.

The visual effects of disturbed (regraded and revegetating) soils, as seen from the Truman Trail, would likely take time to diminish to the degree that the effects would be naturally appearing or not evident. Disturbed soils often cause visual effects due to the contrasting color of the disturbed soils adjacent to the undisturbed soils that retain organic material and vegetation. It is not expected that the disturbed Pumice Plain soils would create much contrast to the adjacent "undisturbed by the project" soils, so it is likely that these effects would not be visible from Windy Ridge or Johnston Ridge Observatory. Therefore, it is expected that the absence of vegetation in the immediate foreground for the viewer on the Truman Trail would be the greatest source of visual effect. After rehabilitation (regrading and revegetation) is completed, it is expected that the rate of vegetation regrowth would be longer than a growing season or one year (short term), and could take up to 5 to 10 years (long term) to fully recover the natural appearance or not be visually evident. It is likely the resource would meet the retention visual quality objective in the long term (5 to 10 years).

#### *Effects to All Views during Construction, Use of Access Road, and Geotechnical Drilling*

The effects of alternative B would be consistent with a partial retention visual quality objective during the implementation of the project. The presence of machinery and workers during the construction, reconstruction, and maintenance of the temporary access road, as well as, drilling activities would draw attention to the work and temporarily detract from the natural-appearing landscape.

#### *Effects after Rehabilitation of Temporary Access Road*

The rehabilitation of the temporary access road, including returning the grade to its former repose, removing base rock and aggregate, recontouring the needed cuts and fills, and revegetating the areas of disturbance, with native plants would reduce impacts upon the views from Windy Ridge and Johnston Ridge Observatory to the degree that it is likely the resource would meet the visual quality objective of retention in the long term (5 to 10 years). There may be areas of noticeable sparse revegetation, but in regard to the form, line, color and texture objectives, it will be similar to adjacent areas.

#### *Cumulative Effects for Visual Resources*

The use of the administrative utility-terrain vehicle route and the double increase in helicopter flights, compared to the no-action alternative, have potential to have a low impact on the viewsheds for the analysis area. Because these impacts are consider low the cumulative effects are anticipated to be the same as direct and indirect effects. There are no other reasonably foreseeable projects that overlap in time and space.

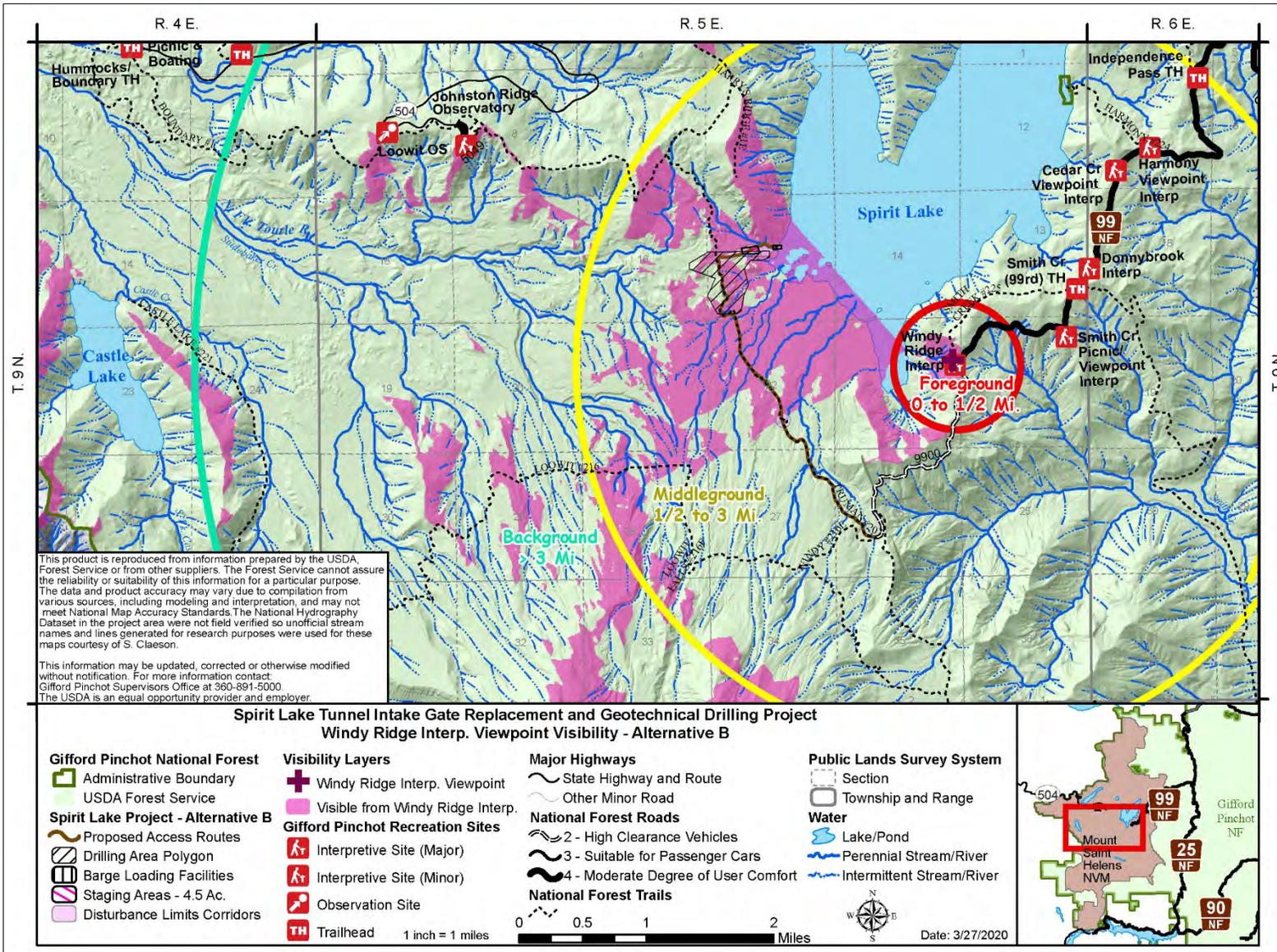


Figure 14. Seen Area map displaying areas that can be seen from Windy Point within foreground (0 to 0.5 mile) and middleground (0.5 to 3 miles) for the temporary access road proposed under alternative B

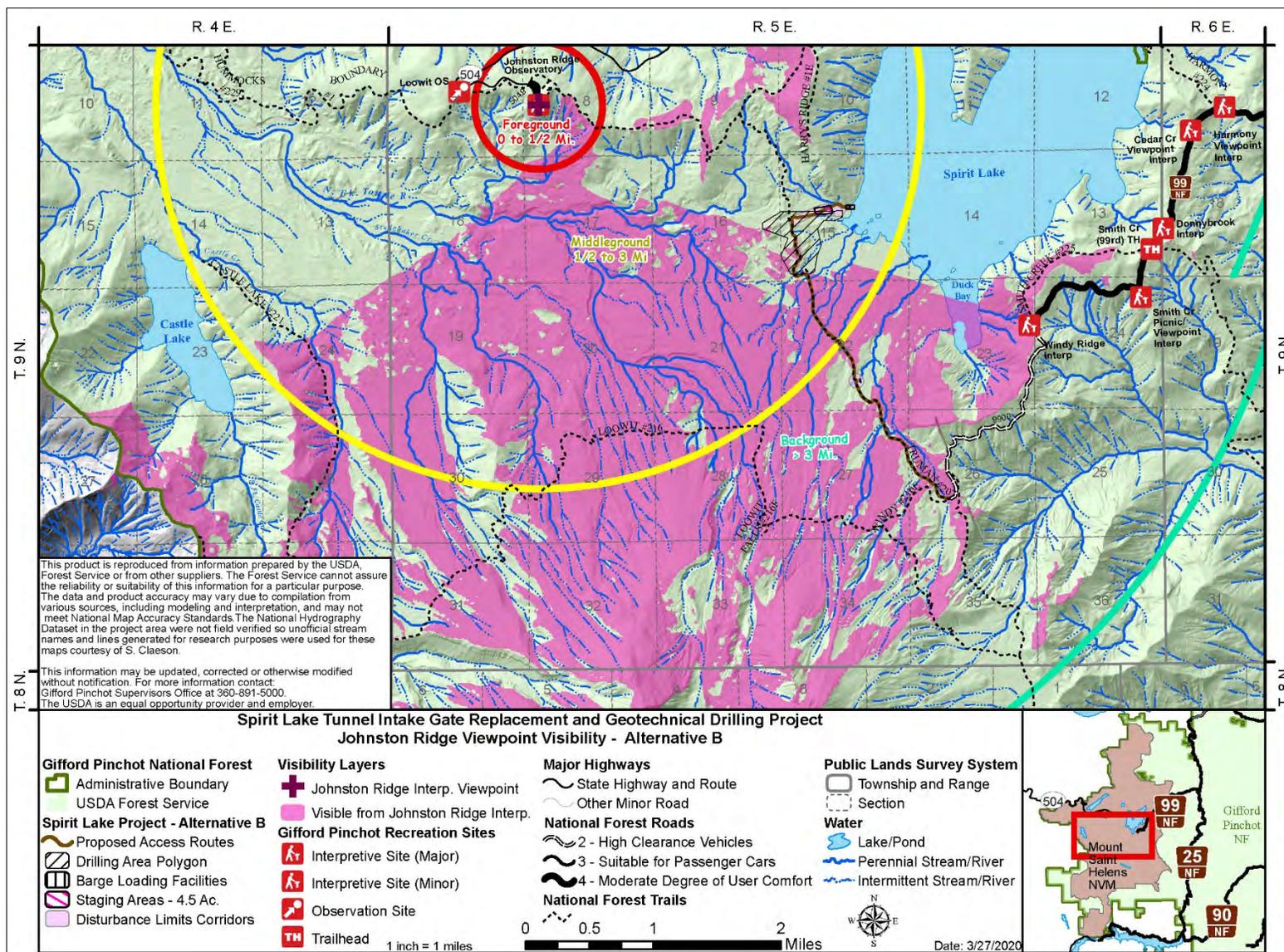


Figure 15. Seen Area map displaying areas that can be seen from Johnston Ridge within foreground (0 to 0.5 mile) and middleground (0.5 to 3 miles) for the temporary access road proposed under alternative B

## Alternative C

Alternative C would not be consistent with the management area category standard (forest plan, pages 126–127) designated visual quality objective of retention for the project area, without the proposed plan amendment (see section 2.2). Retention, as a visual quality objective, is defined as “The most restrictive visual quality objective, wherein, management activities are not evident to the casual forest visitor” (comprehensive management plan, appendix P). The retention designation applies to approximately 110,990 acres within the Monument.

For the proposed work to be accomplished, the visual quality objective of retention would be exceeded for the project area because project activities will be evident to the casual forest visitor.

Visual impacts will be minimized as much as possible by project design criteria (table 1). However, the presence of machinery and workers during the construction, reconstruction, and maintenance of the temporary access road, as well as drilling activities would draw attention to the work and temporarily detract from the natural-appearing landscape and be evident to the casual forest visitor. As such, this project includes a forest plan amendment to provide a project-specific variance to allow the Spirit Lake Tunnel Intake Gate Replacement and Geotechnical Drilling Project to exceed the designated visual quality objective of retention. This variance would be for approximately 525 acres, which is less than 0.5 percent of the Monument’s total designated retention area. The assigned visual quality objective of retention would not change for future actions or elsewhere within the Monument. See Section 5: Proposed Forest Plan Amendment (Alternatives B and C) for details about the substantive requirements directly related to the proposed project-specific variance.

### *Helicopter Access*

Using a helicopter to access the drilling area would minimize roadway effects but increase effects to the landing areas and visual components during the twice daily crew shuttles of worker for the drill equipment. A Forest Service aviation expert estimated helicopter flights hours based on 30 passengers needing transport in and out, 3 passengers per trip, each trip taking around 0.2 hour of flight time. This would lead to approximately two hours total to get folks in and another two to get personnel out (four hours per day). At up to four hours per day, assuming 90 days of flight, there would be approximately 350 hours of flight time per year. Drilling activities are anticipated to take 1 to 3 seasons with helicopters.

These activities would be seen from all the viewpoints. The helicopter activity would create active visual and auditory disruption to the natural appearance. This anticipated amount of helicopter use is 23 times greater than that of the no-action alternative and 12 times greater the amount predicted under alternative B.

### *Effects to Views from Windy Ridge Interpretive Site*

It is expected that approximately 10 to 20 percent of the project activities associated with alternative C would be visible from the Windy Ridge viewing platform at a distance of 1.5 to 2 miles (middleground) (figure 16). Although a shorter amount of the temporary access road would be visible under alternative C, the effects are much closer to the interpretive site. Due to the location of the barge loading facility in Duck Bay, the distance from the lake shore is nearly twice as far to the tunnel inlet and within the middleground and potentially foreground. The temporary access road, staging area, and barge loading area may also introduce form, line, or texture inconsistent with the natural landscape, but these would remain subordinate to the visual strength of the characteristic landscape thus meeting partial retention visual quality objective in the short term (implementation of project).

Rehabilitating the temporary access road, returning the grade to its former repose, and revegetating the disturbed soils with native plants would reduce the visual impact upon the views from Windy Ridge to the degree that it is likely the resource would meet the retention visual quality objective in the long term (5 to 10 years).

#### *Effects to Views from Johnston Ridge Observatory*

The Duck Bay temporary access road would be visible from Johnston Ridge Observatory at a distance of over 5 miles (background) (figure 17). From the viewpoint, the temporary access road would likely be minimally visible and would likely not be contiguously apparent as to create a linear feature. The topography and vegetation would likely break up an oblique view of the access road to the degree that the feature would not visually read as a contiguous line.

Rehabilitating the temporary access road, returning the grade to its former repose, and revegetating the disturbed soils with native plants would reduce the visual impact upon the views from Johnston Ridge Observatory to the degree that it is likely the resource would meet the retention visual quality objective in the long term (5 to 10 years).

#### *Visibility from the Truman Trail*

Alternative C's temporary access road would align/overlap with approximately 0.85 miles of the Truman Trail and every aspect of the roadbed and its cut and fill slopes would be in the immediate foreground. Another approximately 0.25 miles of the temporary access road going northeast may be visible from the trail. The last portion of the temporary access road (approximately 0.9 miles) would likely not be visible from the trail due to topography. The rehabilitation of this temporary access road, including removing base rock and aggregate, recontouring the needed cuts and fills, and revegetating the areas of disturbance will meet a visual quality objective of retention in the long term (5 to 10 years). There may be areas of noticeable sparse revegetation, but in regard to the form, line, color and texture objectives, it will be similar to adjacent areas.

This temporary access road would be built on relatively flat ground so the cuts and fills would be minimal along much of the temporary access road. In some areas there are cuts and fills that would be visible from the trail users' viewpoint, and not be natural appearing.

The visual effects of disturbed (regraded and revegetating) soils, as seen from the Truman Trail, would likely take time to diminish to the degree that the effects would be naturally appearing or not evident. Disturbed soils often cause visual effects due to the contrasting color of the disturbed soils adjacent to the undisturbed soils that retain organic material and vegetation. It is not expected that the disturbed Pumice Plain soils would create much contrast to the adjacent "undisturbed by the project" soils, so it is likely that these effects would not be visible from Windy Ridge or Johnston Ridge Observatory. Therefore, it is expected that the absence of vegetation in the immediate foreground for the viewer on the Truman Trail would be the greatest source of visual effect. After rehabilitation (regrading and revegetation) is completed, it is expected that the rate of vegetation regrowth would be longer than a growing season or one year (short term), and could take up to 5 to 10 years (long term) to fully recover the natural appearance or not be visually evident. It is likely the resource would meet the retention visual quality objective in the long term (5 to 10 years).

#### *Effects to All Views during Construction, Use of Access Road, and Geotechnical Drilling*

Under alternative C much of the temporary access road from the researcher parking lot would not be visible from Windy Ridge, as it would be hidden behind the ridge. This temporary access road would be minimally visible from Johnston Ridge Observatory because it is far (background – greater than 3 miles) from the viewpoint, and from that distance would not detract from the natural appearance of the broader

landscape view. The staging area at Duck Bay would be visible from Windy Ridge. The occurrence of drilling activities would draw attention to the work and temporarily detract from the natural-appearing landscape. The presence of machinery and workers during the construction, reconstruction, and maintenance of the temporary access road would draw attention to the work and temporarily detract from the natural-appearing landscape. The effects of alternative C, would be consistent with a partial retention visual quality objective in the short term (implementation).

#### *Effects after Rehabilitation of Temporary Access Road*

The rehabilitation of the temporary access road, including returning the grade to its former repose, removing base rock and aggregate, recontouring the needed cuts and fills, and revegetating the areas of disturbance, with native plants would reduce impacts upon the views from Windy Ridge and Johnston Ridge Observatory to the degree that it is likely the resource would meet the visual quality objective of retention in the long term (5 to 10 years). There may be areas of noticeable sparse revegetation, but in regard to the form, line, color and texture objectives, it will be similar to adjacent areas.

#### *Cumulative Effects for Visual Resources*

The use of the administrative utility-terrain vehicle route and the 23 times increase in helicopter flights, compared to the no-action alternative, have potential to have a low impact on the viewsheds for the analysis area. Because these impacts are consider low the cumulative effects are anticipated to be the same as direct and indirect effects. There are no other reasonably foreseeable projects that overlap in time and space.

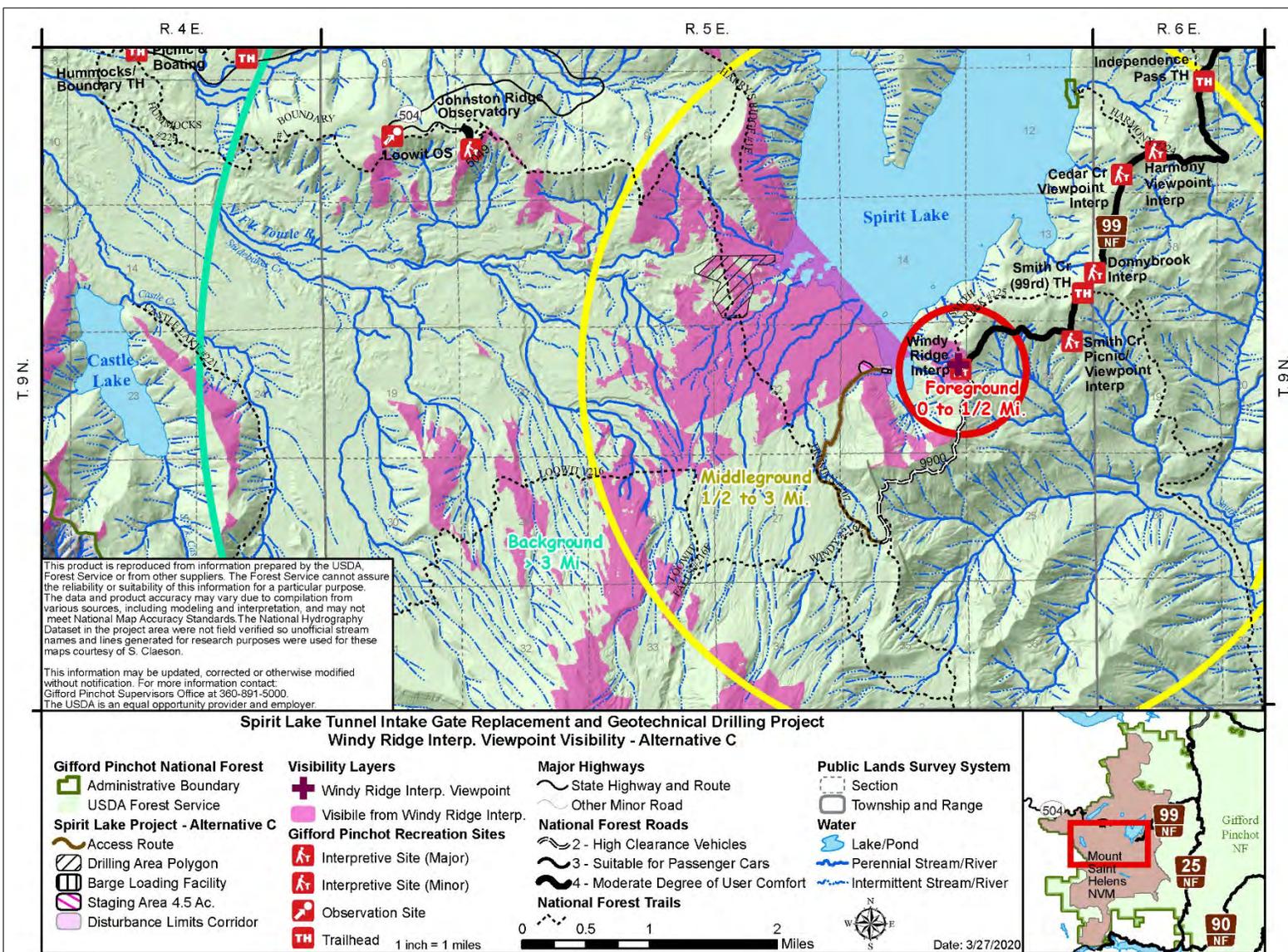


Figure 16. Seen Area map displaying areas that can be seen from Windy Point within foreground (0 to 0.5 mile) and middleground (0.5 to 3 miles) for the temporary access road proposed under alternative C

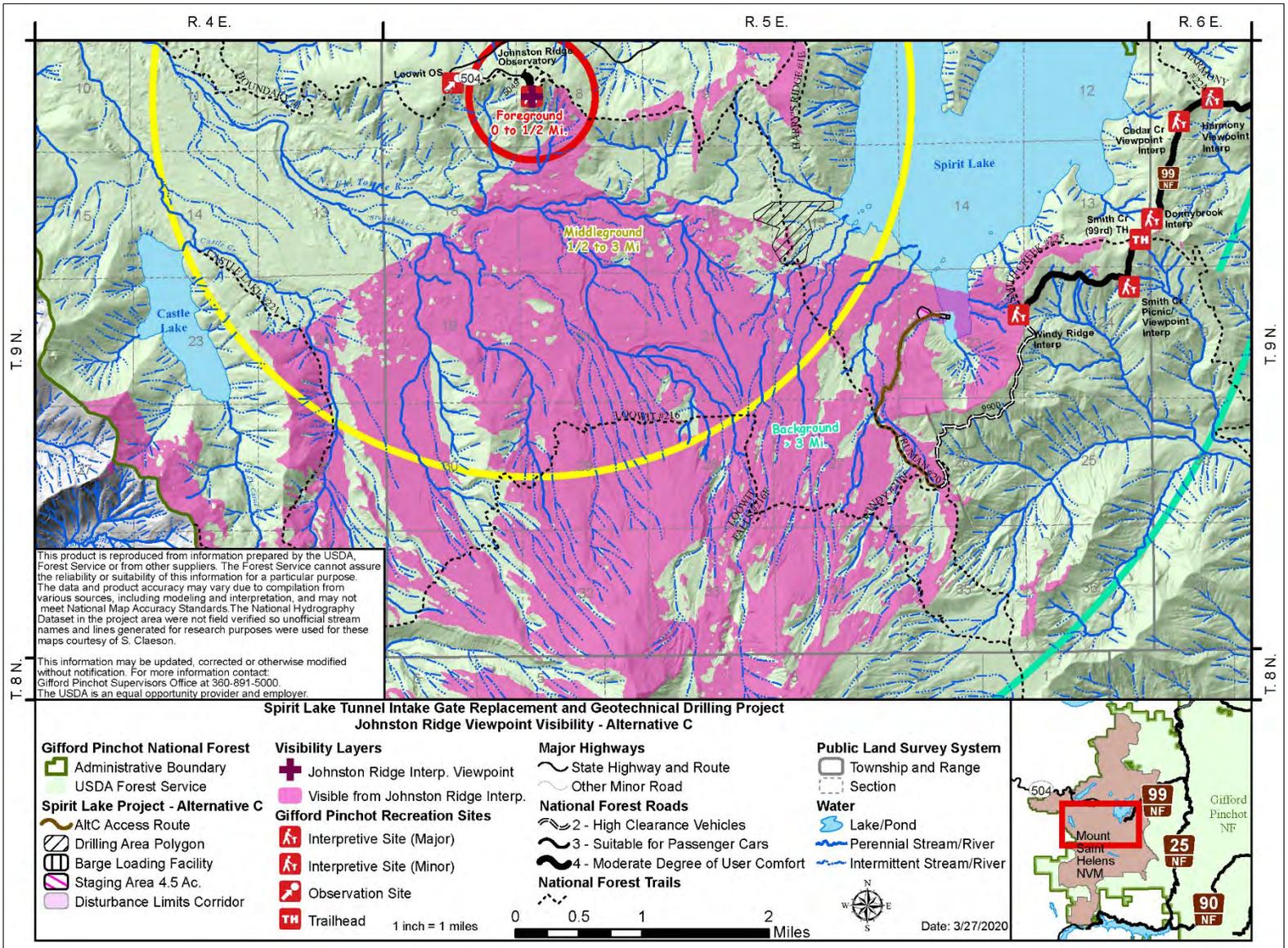


Figure 17. Seen Area map displaying areas that can be seen from Johnston Ridge within foreground (0 to 0.5 mile) and middleground (0.5 to 3 miles) for the temporary access road proposed under alternative C

### 3.3 Recreation

Hiking in within the project area this area allows visitors to the monument to engage themselves in the distinctive landscape that the volcanic eruption created in 1980. The Truman, Windy, and Loowit Trails are identified as Trail Class 2<sup>8</sup>, which are moderately developed. Trails in this class are single lane and have continuous and discernable tread. All three of these trails are currently closed to bicycle and stock use. Abraham Trail is identified as a Trail Class 3<sup>9</sup> and open to bicycle use, but not stock use.

The area is closed to hunting except by special elk tag holders, which are obtained from Washington Department of Fish and Wildlife. Additionally, hunters must also have a permit from the Monument to leave the designated trails. There are two outfitter and guide permits within the project area, and three recreation event permits.

### Analysis Measures

#### Recreation Opportunity Spectrum

The recreation opportunity spectrum offers a framework for understanding relationships and interactions, having to do with people and recreation options. Forest plans define and classify areas with specific recreation opportunity spectrums. The proposed project area falls within “Category A” of the Monument’s comprehensive management plan and has been classified with a recreation opportunity spectrum of semi-primitive non-motorized, with a small portion of the National Forest System road 99 extension within the roaded natural recreation opportunity spectrum.

Semi-primitive non-motorized recreation opportunity spectrum areas are characterized by predominately natural or natural-appearing landscapes. The size of these areas gives a strong feeling of remoteness compared to the more heavily used and developed areas. Within these settings, there are ample opportunities to practice wildland skills and to achieve feelings of self-reliance. In non-motorized settings, the presence of roads are tolerated provided they are closed to public use, they are used infrequently for resource protection and management, and the road standards and locations are visually appropriate for the physical setting. In many cases, old roads are acceptable as non-motorized travel ways so long as they do not reflect miss-use or poor stewardship of the land.

Areas designated as roaded natural are characterized by a predominately natural-appearing environment with moderate evidence of the sights and sounds of people and modification. Such evidence can be prevalent and usually harmonizes with the natural environment. Encounters between users are common but not constant. Resource modification and utilization practices are evident, but also harmonize with the natural environment.

### Environmental Effects

#### Alternative A: No Action

##### *Direct, Indirect, and Cumulative Effects for Recreation*

Under alternative A, no new ground disturbing activities associated with the proposed action would take place other than those already permitted within the project area. Administrative use of the utility-terrain vehicle route to Duck Bay would continue. Approximately 5 to 10 trips with the utility-terrain vehicle would

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<sup>8</sup> Trail Class 2: designed tread width 6–16 inches (USDA FS 2016).

<sup>9</sup> Trail Class 3: designed tread width 12– 24 inches; exceptions may be 36–48 inches at steep side slopes (USDA FS 2016).

occur each year and approximately 3 to 7 boat trips from Duck bay to the tunnel inlet. The yearly tunnel and gate inspections would still occur via a handful of administrative helicopter flights (approximately 3 to 6 flight days per year, 12 to 15 flying hours total). The U.S. Geological Survey would continue to have several helicopter flights per year to the tunnel inlet and to areas on the debris blockage and within the blast zone. There would be no new direct or indirect effects to lead to cumulative effects for recreation resources within the project area.

## Alternative B

### *Direct and Indirect Effects for Recreation*

The proposed temporary access road would be consistent with the semi-primitive non-motorized recreation opportunity spectrum classification, as well as, the roaded natural recreation opportunity spectrum area. The proposed temporary access road would not alter the predominately natural or natural-appearing landscapes and the proposed activities on the National Forest System road 99 extension will not alter the current condition. The area would still give a strong feeling of remoteness from the more heavily used and developed areas elsewhere within the Monument. There will still be ample opportunities to practice wildland skills and to achieve feelings of self-reliance. In addition, the proposed temporary access road would be closed to public use and the temporary access road would be used for resource protection and management.

Alternative B would require National Forest System road 99 extension to be closed at times in order to allow large equipment trucks to access the staging area. Access to multiple trails and viewpoints would be suspended during these times. However, timing of these closures could minimize visitor impact, especially if done in the early morning.

Approximately three miles of the Truman Trail would be closed to the public during project implementation. Under this alternative, portions of the old roadbed that now serves as the Truman Trail would be reclaimed in order to accomplish drilling operations and tunnel maintenance. The Truman Trail is currently managed and maintained as a hiker and pedestrian trail class 2 (moderate development). Even though evidence of the old roadbed exists (old cut banks, etc.), most of the trail meets the management objectives of a trail class 2 and provides a natural and relatively unmodified recreation experience.

In addition to the temporary Truman Trail closure, access to the Windy, Loowit, and Abraham trails would be limited to outside of the project area. Access to these trails would technically still be possible from the other direction, but would change the distance and experience, in the short term.

Temporary trail closures to provide for health and safety during construction, reconstruction, and maintenance activities of the temporary access road or portions of the temporary access road may be required. Trail closures would be posted on the Gifford Pinchot National Forest website and at trailheads that provide access to the area, and usage would likely shift to other trails in the short term.

The two current outfitter and guide permits would be impacted by the project. These permits would need to be reevaluated, as their purpose is to provide access via the Truman Trail to areas within the volcanic blast zone and crater rim. Some impacts could be potentially mitigated if access to the Truman Trail was opened on weekends. Monument staff and members of the Spirit Lake team will make every effort to work with the existing permit holders to facilitate access. Each phase of the project will require specific coordination with each permit holder. If access cannot be facilitated within the project area then staff will work with permit holders to amend permits and allow comparable use in other areas of the Monument/Forest for the duration of the project. Requests for new recreation special use permits including outfitting and guiding and recreation events will not be approved within the boundaries of the project area during implementation.

Depending on how long the implementation seasons last, this project would overlap with elk hunting seasons. Access to portions of Elk Area 5063 and 5064 from Windy Ridge would be potentially impacted, in the short term, and prohibited if construction work continued into the later months of the season. Access to both special hunt units would be possible from other locations outside of the project area but the distance hunters would need to travel and overall experience would be affected.

### *Cumulative Effects for Recreation*

The continued use of the administrative utility-terrain vehicle route and helicopter flights have potential to have a low impact on recreation visitation for the analysis area. Because these impacts are considered low the cumulative effects are anticipated to be the same as direct and indirect effects. Cumulatively, the effects of Alternative B's short-term effects are not likely to have a long-term adverse effect to Monument visitors accessing the area, or in the recreational experience they seek when coming to or travelling through the area. Visitor use is anticipated to increase, but not at a differing rate than overall visitation trends. There are no other reasonably foreseeable projects that overlap in time and space.

## Alternative C

### *Direct and Indirect Effects for Recreation*

The proposed temporary access road would be consistent with the semi-primitive non-motorized recreation opportunity spectrum classification, as well as, the roaded natural recreation opportunity spectrum area. The proposed temporary access road would not alter the predominately natural or natural-appearing landscapes and the proposed activities on the National Forest System road 99 extension will not alter the current condition. The area would still give a strong feeling of remoteness from the more heavily used and developed areas elsewhere within the Monument. There will still be ample opportunities to practice wildland skills and to achieve feelings of self-reliance. In addition, the proposed temporary access road would be closed to public use and the temporary access road would be used for resource protection and management.

Alternative C would require National Forest System road 99 extension to be closed at times in order to allow large equipment trucks to access the staging area. Access to multiple trails and viewpoints would be suspended during these times. However, timing of these closures could minimize visitor impact, especially if done in the early morning.

A smaller portion of the Truman Trail (0.85 mile) would be directly impacted and closed to the public during project implementation. However, approximately 3 miles of the Truman Trail would be closed to the public during project implementation. This is partially due to the frequent helicopter flights required for the drilling equipment and personnel. Due to the restrictions with the helicopter use the drilling is anticipated to take two to three seasons longer than under alternative B. In addition to the temporary Truman Trail closure, access to the Windy, Loowit, and Abraham trails would be limited to outside of the project area. Access to these trails would technically still be possible from the other direction, but would change the distance and experience, in the short term.

Temporary trail closures to provide for health and safety during construction, reconstruction, and maintenance activities of the temporary access road or portions of the temporary access road may be required. Trail closures would be posted on the Gifford Pinchot National Forest website and at trailheads that provide access to the area, and usage would likely shift to other trails in the short term.

The two current outfitter and guide permits would be impacted by the project. These permits would need to be reevaluated, as their purpose is to provide access via the Truman Trail to areas within the volcanic blast zone and crater rim. Some impacts could be potentially mitigated if access to the Truman Trail was

opened on weekends. Monument staff and members of the Spirit Lake team will make every effort to work with the existing permit holders to facilitate access. Each phase of the project will require specific coordination with each permit holder. If access cannot be facilitated within the project area then staff will work with permit holders to amend permits and allow comparable use in other areas of the Monument/Forest for the duration of the project. Requests for new recreation special use permits including outfitting and guiding and recreation events will not be approved within the boundaries of the project area during implementation.

Depending on how long the implementation seasons last, this project would overlap with elk hunting seasons. Access to portions of Elk Area 5063 and 5064 from Windy Ridge would be potentially impacted, in the short term, and prohibited if construction work continued into the later months of the season. Access to both special hunt units would be possible from other locations outside of the project area but the distance hunters would need to travel and overall experience would be affected.

#### *Cumulative Effects for Recreation*

The continued use of the administrative utility-terrain vehicle route and helicopter flights have potential to have a low impact on recreation visitation for the analysis area. Because these impacts are consider low the cumulative effects are anticipated to be the same as direct and indirect effects. Cumulatively, the effects of alternative C's short-term effects are not likely have a long-term adverse effect to Monument visitors accessing the area, or in the recreational experience they seek when coming to or travelling through the area. Visitor use is anticipated to increase, but not at a differing rate than overall visitation trends. There are no other reasonably foreseeable projects that overlap in time and space.

### **3.4 Aviation Use**

Helicopter use is highly dependent on weather conditions. The Spirit Lake project area sits in an area where low clouds, fog, winds, and summer storms can limit helicopter access to the site during summer months, and weather windows in the spring, fall, and winter are often extremely limited as well. Weather conditions at the site can change rapidly, which can potentially disrupt or interrupt planned or ongoing transport efforts.

### **Analysis Measures**

#### **Flight Hours and Safety Exposure**

For this resource, alternatives will be compared by flight hours and safety exposure. For this analysis the Forest Service has used their guidelines for helicopter use and analyzed the alternatives as though, the Forest Service, has operational control. Some of the below detailed plans and operations may be different depending on the type and kind of helicopter utilized and contracted, however, the overall flight hours and safety exposure would be relatively the same. The Forest Service has a duty to reduce and mitigate, where possible, the safety of its employees and visitors to their National Forest System lands, this includes contracted personnel.

### **Environmental Effects**

#### **Alternative A: No Action**

##### *Direct, Indirect, and Cumulative Effects for Aviation Use*

Under alternative A, no new ground disturbing activities associated with the proposed action would take place other than those already permitted within the project area. The yearly tunnel and gate inspections would still occur via a handful of administrative helicopter flights (approximately 3 to 6 flight days per

year, totaling 12 to 15 flying hours). Each of these flights would require an aviation operations and safety plan be developed along with daily flight plans, load calculations, and pay load manifests. As part of the daily flight plan, military operations and training routes would need de-confliction protocols. There would be no new direct or indirect effects to lead to cumulative effects.

## Alternative B

### *Direct and Indirect Effects for Aviation Use*

The yearly tunnel and gate inspections would still occur via a handful of administrative helicopter flights (approximately 3 to 6 flight days per year) plus an estimated 5 to 6 flight days per year for inspection and monitoring of the project activities. Each of these 8 to 12 flights (totaling approximately 30 flight hours per year) would require an aviation operations and safety plan be developed along with daily flight plans, load calculations and pay load manifests. As part of the daily flight plan, military operations and training routes would need de-confliction protocols. Safety issues that will require mitigation include midair collisions with other aircraft and construction of appropriate helipads.

This increase in flights and flight hours would be double what is anticipated under the no-action alternative. This is increase the safety exposure of personnel by double compared to the no-action alternative. These types of inspection and monitoring flights would be similar in nature to the current flights and no external hauls loads are expected at this time. The Forest Service would follow the same protocol they currently use for notification of helicopters flying into the air space, and landing, within the Monument.

### *Cumulative Effects for Aviation Use*

When taken together with the current estimated flights (no action) the cumulative effect would be double the current condition, in the short term. Private site seeing tours that are not authorized or controlled by the Forest Service could impact safety and use of the contracted helicopters. There are no other reasonably foreseeable projects that overlap in time and space.

## Alternative C

### *Direct and Indirect Effects for Aviation Use*

Helicopter use for the geotechnical drilling presents a distinctive safety hazard for construction personnel, pilots, ground support, and Monument visitors. There would be an estimated 23 times the helicopter use (350 hours per field season) compared to the no-action alternative and 12 times the helicopter use compared to alternative B.

An aviation operations and safety plan would need to be developed along with daily flight plans, load calculation and pay load manifests. As part of the daily flight plan, military operations and training routes would need deconfliction protocols. Safety issues that will require mitigation include dropped external loads, hazardous materials (moving the fuel for drill vehicles), midair collisions with other aircraft, and construction of appropriate helipads.

Since crews will be dropped off and left on site there will need to be in place an emergency plan in case the helicopter cannot return to retrieve the crew in the afternoon. This emergency plan will need to incorporate a shelter for overnight temperatures, with rations, sanitary facilities, and first aid requirements.

Due to the weather conditions around the Spirit Lake geographical area, often it takes until late morning for fog to burn off. Transportation of equipment and crews would not always occur first thing in the day. Daylight to dusk flight requirements would mean crews would have to begin demobilizing well before

dark due to the number of flights. Because of the weather and the time needed for flights, alternative C will likely take additional field seasons for completion, when compared to alternative B, this increase in field seasons could affect other resources such as visuals, recreation, heritage, terrestrial wildlife, invasive species spread, research, and soils.

Increasing flight hours by 23 times, when compared to the no-action alternative, or by 12 times, when compared to alternative B, increases the safety exposure of personnel by a similar amount. The types of helicopters needed to transport the drilling equipment to and from the sites, at the start of the field season, and at the end are much larger than the general crew transportation helicopter. These heavy lift helicopters are much louder, require large landing pads, and have a larger area of dust spread when landing and taking off. External (sling loads) often times require additional loading zones due to the nature of the unstable load.

The Forest Service would need to develop a safety protocol for notification of helicopters flying into the air space, and landing, within the Monument.

#### *Cumulative Effects for Aviation Use*

When taken together with the current estimated flights (no action) the cumulative effect would be double the current condition and 12 times that under alternative B, in the short term. Private site seeing tours that are not authorized or controlled by the Forest Service could impact safety and use of the contracted helicopters. There are no other reasonably foreseeable projects that overlap in time and space.

### **3.5 Soils**

Volcanic activity drastically changed soil conditions by burying, displacing, and searing soils in the project area. New soils formed from three types of new surface material: pyroclastic flow rock of andesite and dacite; volcanic tephra deposits of ash and pumice; and transported material including alluvium, lahar (volcanic mudflow), and landslide debris. Soil building and natural recovery continues through biological, physical, and chemical activity acting on the soils.

### **Analysis Measures**

#### **Soil Formation**

A soil indicator, also a process, described in the Monument's comprehensive management plan is Soil Formation. Soils in the activity area are considered "young" because they are in the process of adjusting to the environment after a significant disturbance, and actively developing toward a dynamic equilibrium. The process warrants protection because ecological capacity or hydrologic function of soils can be altered unnaturally in response to human caused disturbances by changing physical, chemical, and biological properties.

#### **Erosion**

This analysis assumes a disturbance to soils with high potential for erosion would be affected when exposed by displacement. Relative estimates of amounts of soil disturbed are used to compare the alternatives, not give an empirical measure of erosion.

#### **Pyroclastic Flow Features**

Pyroclastic Flow Features are documented in the Monument's comprehensive management plan as needing care during development and use. Features of concern include fluvial features, sink holes and phreatic explosion pits, and distinctive surface textures.

## Environmental Effects

### Alternative A: No Action

#### *Direct, Indirect, and Cumulative Effects for Soils*

Management induced erosion, increased detrimental soil disturbance, and resulting negative off-site effects would be avoided because the no-action alternative would not allow soil disturbance related to Geotechnical investigation and core sampling of the debris avalanche deposits.

Soil Formation and 1980 eruption-influenced ground conditions would continue to develop naturally in the project area. Further delay of soil recovery on existing roads in the Pumice Plain and debris avalanche deposits would be avoided because existing roads would not be reconstructed or improved. Erosion would continue at background rates. Erosion rates are higher on remaining pyroclastic flow deposits because of their sensitivity to wind and water forces. Effects to distinctive Pyroclastic Flow Features would be preserved naturally, for the same reasons as the Soil Formation discussion.

There would be no new direct or indirect effects to lead to cumulative effects.

### Alternative B

#### *Direct and Indirect Effects for Soils*

Development and reuse of the old Pumping Station area would cause less impacts (to soils) than alternative C at the Spirit Lake shore interface. Compared to the Development Category rating for Biophysical Area, reuse of the pumping station would minimize soil impacts because previous soil disturbance already damaged soil features. New disturbance is estimated to be approx. 6.5 acres and total disturbance of 25 acres.

Erosion and minor earth movement (settling) would potentially occur for 2 to 5 years after mitigation (use of project design criteria) and soil recovery restoration actions, based on experience with soil disturbance in timber sale logging and burned area rehabilitation. Impacts would likely be highest immediately following actions and lessen over time. Because the landscape is historically active geomorphologically, recovery rates would be subject to natural events that may obscure the duration and magnitude of impact from management actions. Heavily impacted areas may not return to pre-project soil quality and restored areas are likely to be less developed than undisturbed areas.

Extent of impacts due to dock construction and use is less than half of a tenth of a percent (approximately 1.5 acres) of the 7,300 acre Debris Avalanche Biophysical Area, and confined to a general area that was previously disturbed. Offsite effects such as erosion would be mitigated or lessen over time.

Impacts to soils would be lessened by project design criteria, such as installing structures at stream crossings.

Compaction, vegetation disturbance, and displacement from connecting trails and drill pads would impact soil formation on areas not previously disturbed. Three bore holes (SL-17, 19, and 21) could impact wet soils south of the old pumping station. The extent of total disturbance would be minor, up to 15 acres<sup>10</sup> of the 7,300 acre Debris Avalanche Biophysical Area (VII-D). These 15 acres of ground disturbance would be located within the 100 acre drilling area.

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<sup>10</sup> Project engineer estimates 5 acres (1.25 acres of 30 sites x 1800 square feet + 3.75 acres of access 2.6 miles x 12 feet wide); however, 15 acres was utilized for the soils portion of this analysis.

Temporary access road construction and vehicle traffic would further delay soil recovery and drill sites in the Pumice Plain and debris avalanche deposits, although original soil layers and properties are permanently altered. Soil Formation and 1980 eruption-influenced ground conditions would be impacted at stream crossings to build temporary access to drill areas and old existing travel routes elsewhere. Compaction, vegetation disturbance, and displacement from connecting trails and drill pads would impact soil formation on areas not previously disturbed.

Potential effects would be management induced erosion, increased detrimental soil disturbance, and resulting negative off-site effects such as sediment deposition downstream. Erosion would potentially increase at stream crossings and areas of earthwork because soils in the area have high potentials for erosion. Erosion would continue at background rates elsewhere not disturbed by project activities, especially on pyroclastic flow deposits.

Distinctive Pyroclastic Flow Features would be affected for the same reasons and similar in nature to the Soil Formation effects discussion. Losses due to disturbance would be temporary due to drilling on flat open areas, but long lasting at areas where large amounts of soil materials are moved for steep slopes.

The proposed activities would comply with the forest plan, the Monument's comprehensive management plan, and Forest Service management direction. The comprehensive management plan did not establish soil standards; however, mitigation measures were prescribed in the record of decision for the comprehensive management plan and this project would comply with those measures (see table 1 in section 2.2).

#### *Cumulative Effects for Soils*

Past effects, including past use of a temporary road constructed (now the Truman Trail) in the early 1980s to access the former pump station near Spirit Lake, past core drilling, past maintenance of National Forest System road 99 and development of the researcher parking lot, have been taken into account for the baseline to which to compare alternative B against. When combining the relatively minor effects of the present and ongoing erosion control work, route signing and trail maintenance, visitors trail to Johnston Ridge Observatory Crater View hiking route, and the continued access to research plots, with the effects of alternative B, the cumulative effects are similar to those described under the direct and indirect effects section.

### **Alternative C**

#### *Direct and Indirect Effects for Soils*

The anticipated effects of alternative C to soils resources differ in two areas from alternative B: 1) impacts to the Spirit Lake lakeshore from the dock and staging area and 2) impacts to soils on the Debris Avalanche from large capacity road construction to access the dock facility.

The new development and use of the lakeshore area at Duck Bay would have long-term impacts over a larger area than alternative B. The dock would exceed Development Category rating for this 300 acre Biophysical Area (IX-B), however, it is not a permanent feature. New disturbance is estimated to be approximately 12.8 acres and total disturbance of 18 acres.

Erosion and minor earth movement (settling) would potentially occur for 2 to 5 years after mitigation (use of project design criteria) and soil recovery restoration actions, based on experience with soil disturbance in timber sale logging and burned area rehabilitation. Impacts would likely be highest immediately following actions and lessen over time. Because the landscape is historically active geomorphologically, recovery rates would be subject to natural events that may obscure the duration and magnitude of impact

from management actions. Heavily impacted areas may not return to pre-project soil quality and restored areas are likely to be less developed than undisturbed areas.

Alternative C proposes to construct a new temporary access road to Duck Bay to accommodate heavy equipment such as lowboys. This temporary access road has not had the same type and duration of past impact like the Truman Trail (1980 access route for pump station and tunnel). As such, the impacts to this newly compacted area would be greater in intensity, when compared to alternative B.

Extent of impacts due to dock construction and use is less than half of a tenth of a percent (approximately 1.5 acres) of the 7,300 acre Debris Avalanche Biophysical Area, and confined to a general area that was previously disturbed. Offsite effects such as erosion would be mitigated or lessen over time.

Impacts to soils would be lessened by project design criteria, such as installing structures at stream crossings.

Compaction, vegetation disturbance, and displacement from connecting trails and drill pads would impact soil formation on areas not previously disturbed. Three bore holes (SL-17, 19, and 21) could impact wet soils south of the old pumping station. The extent of total disturbance would be minor, up to 15 acres<sup>11</sup> of the 7,300 acre Debris Avalanche Biophysical Area (VII-D). These 15 acres of ground disturbance would be located within the 100 acre drilling area.

Temporary access road construction and vehicle traffic would further delay soil recovery and drill sites in the Pumice Plain and debris avalanche deposits, although original soil layers and properties are permanently altered. Soil Formation and 1980 eruption-influenced ground conditions would be impacted at stream crossings to build access to drill areas and old existing travel routes elsewhere. Compaction, vegetation disturbance, and displacement from connecting trails and drill pads would impact soil formation on areas not previously disturbed.

Potential effects would be management induced erosion, increased detrimental soil disturbance, and resulting negative off-site effects such as sediment deposition downstream. Erosion would potentially increase at stream crossings and areas of earthwork because soils in the area have high potentials for erosion. Erosion would continue at background rates elsewhere not disturbed by proposed activities, especially on pyroclastic flow deposits.

Distinctive Pyroclastic Flow Features would be affected for the same reasons and similar in nature to the Soil Formation effects discussion. Losses due to disturbance would be temporary due to drilling on flat open areas, but long lasting at areas where large amounts of soil materials are moved for steep slopes.

The proposed activities would comply with the forest plan, the Monument's comprehensive management plan, and Forest Service management direction. The comprehensive management plan did not establish soil standards; however, mitigation measures were prescribed in the record of decision for the comprehensive management plan and this project would comply with those measures (see table 1 in section 2.2).

### *Cumulative Effects for Soils*

Past effects, including past use of a temporary access road constructed (now Truman Trail) in the early 1980s to access the former pump station near Spirit Lake, past core drilling, past maintenance of National Forest System road 99 and development of the researcher parking lot, have been taken into account for the baseline to which to compare alternative C against. When combining the relatively minor effects of

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<sup>11</sup> Project engineer estimates 5 acres (1.25 acres of 30 sites x 1800 square feet + 3.75 acres of access 2.6 miles x 12 feet wide); however, 15 acres was utilized for the soils portion of this analysis.

the present and ongoing erosion control work, route signing and trail maintenance, visitors trail to Johnston Ridge Observatory Crater View hiking route, and the continued access to research plots, with the effects of alternative C, the cumulative effects are similar to those described under the direct and indirect effects section.

## **3.6 Hydrological Resources**

Numerous stream channels feed into Spirit Lake, including perennial spring sources (for example, Forsyth Spring, Willow Springs) which are active even during the summer months. Most of the identified springs are located near the Truman Trail. There is no natural outlet for Spirit Lake which was blocked by a landslide created after the Mount St. Helens eruption in 1980. Spirit Lake drains through a tunnel on the north end of the lake. The tunnel was constructed by the U.S. Army Corps of Engineers in 1985 to help control the lake level.

### **Analysis Measures**

#### **Clean Water Act**

The State of Washington Department of Ecology is responsible for enforcing the Clean Water Act of 1972 and subsequent amendments establish the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The State of Washington Department of Ecology regulates wetlands regardless of federal jurisdiction. The Forest Service is the Designated Management Agency for meeting Clean Water Act requirements on National Forest System lands. A memorandum of agreement exists between the Forest Service and the State of Washington Department of Ecology and outlines the Forest Service's Water Quality Management Plan for Washington State.

#### **Wetlands, Executive Order 11990 of May 24, 1977**

This executive order is intended to avoid adverse impacts associated with destruction or modification of wetlands. Wetlands are defined by this order as, “. . . areas inundated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds.”

#### **Northwest Forest Plan Aquatic Conservation Strategy**

Proposed projects must be consistent with the Aquatic conservation Strategy objectives per the Northwest Forest Plan.

### **Environmental Effects**

#### **Alternative A: No Action**

##### *Direct, Indirect, and Cumulative Effects for Hydrological Resources*

Under alternative A, no new ground disturbing activities associated with the proposed action would take place other than those already permitted within the project area. No temporary access road for the gate inlet repair and replacement would mean putting at risk the current integrity of the Spirit Lake Tunnel until a new plan is developed and implemented or until failure of the tunnel which would enact emergency measures.

Water temperature is expected to remain unaffected under the no-action alternative. Natural processes of Spirit Lake and contributing channels would continue to occur.

Natural processes of sediment delivery would continue to occur along with sediment delivery from trails and abandoned road. Risk of the accidental introduction of petroleum products into Spirit Lake from motorized boats would remain very low. Use of motorized boats by researchers and engineers to access tunnel inlet remain unchanged since the mid-1980s. Natural channel processes and riparian zones would continue unaltered by this project.

There would be no new direct or indirect effects to lead to cumulative effects.

## **Alternative B**

### *Direct and Indirect Effects for Hydrological Resources*

There are a total of 10 riparian channel crossings containing riparian vegetation along the 3.4 miles of the proposed temporary access road, which overlaps with the previously disturbed road bed from the 1980s. Removal of vegetation from stream edges or banks to allow for the construction of stream crossings may result in direct insolation of the sun's rays to exposed perennial stream segments. Such actions may cause water temperatures to increase on limited stream segment during the summer months.

Temporary access road construction activities and use increases the risk of displaced/disturbed soils entering streams. Increases of sediment delivery at stream crossings and from roads may occur. Sediment delivery via surface flows from the proposed temporary access road may filter into some nearby riparian vegetated areas. Excavation of bank edges may become prone to erosion from high stream flows. Changes in bank slope and integrity may potentially result in increased erosion, stream widening, and reduced ability of streams to dissipate energy on floodplains. The amount of sediment delivery to Spirit Lake from the proposed temporary access road construction activities and use would be limited in size and scope due to project design criteria (see table 1 in section 2.2) and known best management practices.

Alternative B's temporary access road crosses approximately 17 channels (3 perennial channels, 7 seasonal channels and 7 seasonal/perennial channels). Other smaller ephemeral channels or minor drainages exist but are not mapped by the National Hydrography Dataset. Four active spring sources have been identified near the proposed temporary access road, as well as one other a spring source (Geo-West lower) located at 300 feet from the temporary access road.

There would be an estimated relocation of 3 to 4 acre-feet of spoils into Spirit Lake's bottom associated with dredging activities at the tunnel intake. Which would make up 0.0012 percent of the total volume of Spirit Lake (239,000 acre-feet). Relocation of the spoils in the lake is expected to produce short-term turbidity issues limited to the area of the relocation disposal site.

Post-implementation stabilization activities are expected to produce some minor sediment movement as areas are stabilized and winterized, including the maintenance of asphalt (National Forest System road 99) and aggregate roads, restoring drainage structures, cleaning debris and waste generated during implementation periods or maintenances of infrastructures for winterization preparation. Post-project rehabilitation work activities will consist of restoring natural ground contours and natural drainage patterns affected by work and may include removing non-native materials brought to the site during implementation.

Maintenance and use of structural stream crossings would generate less sediment delivery potential. Alternative B includes the construction of an equipment and material staging area including a marine ramp leading from staging area to Spirit Lake. This would generate some potential sediment delivery but on a smaller scale compared to the construction/reconstruction of temporary access road.

Risk of the accidental introduction of petroleum products into Spirit Lake from motorized equipment is considered to be low. The risk would be higher than the no-action alternative due to increase use of mechanized equipment and use of barges to transport cranes, people, and spoils across the lake. This includes the continued use of mechanized boat for access to the tunnel inlet via Spirit Lake. Adhering to the Temporary Environmental Controls guide specifications such as the Spill Control Plan, Releases and Spills of Oil and Hazardous Substances and Stream Crossings substantially reduces the risk of an accidental spillage.

Temporary access road construction in upland locations away from stream channels are not likely to affect channel processes. Although stream crossing locations are more likely to see interactions during high flows, which may influence some channel processes to occur.

Alternative B's proposed temporary access road does not cross any wetland<sup>12</sup> areas. Wetlands identified were either above or below the temporary access road. However, the construction of the 25 feet wide marine access ramp will cross a wetland feature along parts of the western shore of Spirit Lake. This 21 acre wetland area is identified in the U.S. Fish and Wildlife Service National Wetlands Inventory using the wetlands mapper tool. Construction of the ramp would impact approximately 0.4 acre, or 1.6 percent of shoreline wetlands. If the site is validated as a jurisdictional wetland, mitigation will be required (and adhered to) to offset these minimal impacts to wetlands during construction and will be coordinated with the State of Washington Department of Ecology and the Seattle District for the U.S. Army Corps of Engineers, per Sections 401 and 404 compliance with the Clean Water Act.

Alternative B is consistent with the Northwest Forest Plan Aquatic Conservation Strategy. For details see Appendix B: Northwest Forest Plan Aquatic Conservation Strategy Consistency for Action Alternatives.

#### *Cumulative Effects for Hydrological Resources*

Past effects, including past use of a temporary access road (now Truman Trail) in the early 1980s to access the former pump station near Spirit Lake, past core drilling, past maintenance of National Forest System road 99 and development of the researcher parking lot, have been taken into account for the baseline to which to compare alternative B against. When combining the relatively minor effects of the present and ongoing erosion control work, route signing and trail maintenance, visitors trail to Johnston Ridge Observatory Crater View hiking route, and the continued access to research plots with the effects of alternative B, the cumulative effects are similar to those described under the direct and indirect effects section.

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<sup>12</sup> As defined under the Clean Water Action Section 404 wetlands are "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

## Alternative C

### *Direct and Indirect Effects for Hydrological Resources*

Removal of vegetation from stream edges or banks to allow for the construction of stream crossings may result in direct insolation of the sun's rays to exposed perennial stream segments. Such actions may cause water temperatures to increase on limited stream segments during the summer months.

Temporary access road construction activities and use increases the risk of displaced/disturbed soils entering streams. Increases of sediment delivery at stream crossings and from roads may occur. Sediment delivery via surface flows from the proposed temporary access road may filter into some nearby riparian vegetated areas. Excavation of bank edges may become prone to erosion from high stream flows. Changes in bank slope and integrity may potentially result in increased erosion, stream widening, and reduced ability of streams to dissipate energy on floodplains. The amount of sediment delivery to Spirit Lake from the proposed temporary access road construction activities and use would be limited in size and scope due to project design criteria (see table 1 in section 2.2) and known best management practices.

Alternative C's temporary access road crosses multiple small, low-lying, braided channels near the researcher parking lot, three seasonal channels and one seasonal/perennial crossing downstream of Red Rock spring. Other smaller ephemeral channels or minor drainages exist but are not mapped by the National Hydrography Dataset. One spring source (Red Rock, located 1,960 feet up stream) was identified near alternative C's proposed temporary access road.

There would be an estimated relocation of 3 to 4 acre-feet of spoils into Spirit Lake's bottom associated with dredging activities at the tunnel intake. Which would make up 0.0012 percent of the total volume of Spirit Lake (239,000 acre-feet). Relocation of the spoils in the lake is expected to produce short-term turbidity issues limited to the area of the relocation disposal site.

Post-implementation stabilization activities are expected to produce some minor sediment movement as areas are stabilized and winterized, including the maintenance of asphalt (National Forest System road 99) and aggregate roads, restoring drainage structures, cleaning debris and waste generated during implementation periods or maintenances of infrastructures for winterization preparation. Post-project rehabilitation work activities will consist of restoring natural ground contours and natural drainage patterns affected by work and may include removing non-native materials brought to the site during implementation.

Maintenance and use of structural stream crossings would generate less sediment delivery potential. Alternative C includes the construction of an equipment and material staging area including a marine ramp leading from staging area to Spirit Lake. This would generate some potential sediment delivery but on a smaller scale compared to the construction/reconstruction of temporary access road.

Risk of the accidental introduction of petroleum products into Spirit Lake from motorized equipment is considered to be low. The risk would be higher than the no-action alternative due to increase use of mechanized equipment and use of barges to transport cranes, people, and spoils across the lake. This includes the continued use of mechanized boat for access to the tunnel inlet via Spirit Lake. Adhering to the Temporary Environmental Controls guide specifications such as the Spill Control Plan, Releases and Spills of Oil and Hazardous Substances and Stream Crossings substantially reduces the risk of an accidental spillage.

There are no anticipated effects to channel processes from the temporary access road constructed in upland locations away from stream channels. Although stream crossing locations that end up running parallel to stream channels are likely to see interactions during high flows which may influence how

channel processes occur. Approximately 120 feet of channel below Red Rock Spring may have some effect to channel flow processes. Owing to the limited length of channel involvement, it is likely the effect would be minor.

Alternative C's temporary access road does not cross any wetlands. Construction of the proposed equipment and staging area with a marine ramp to Spirit Lake (Duck Bay) is not in any identified wetland features. No nearby wetland features were identified in the immediate area of the proposed staging area.

Alternative C is consistent with the Northwest Forest Plan Aquatic Conservation Strategy. For details see Appendix B: Northwest Forest Plan Aquatic Conservation Strategy Consistency for Action Alternatives.

### *Cumulative Effects for Hydrological Resources*

Past effects, including past use of a temporary access road (now Truman Trail) in the early 1980s to access the former pump station near Spirit Lake, past core drilling, past maintenance of National Forest System road 99 and development of the researcher parking lot, have been taken into account for the baseline to which to compare alternative B against. When combining the relatively minor effects of the present and ongoing erosion control work, route signing and trail maintenance, visitors trail to Johnston Ridge Observatory Crater View hiking route, and the continued access to research plots with the effects of alternative C, the cumulative effects are similar to those described under the direct and indirect effects section.

## 3.7 Aquatic Species

### Analysis Measures

#### Endangered Species Act

Section 7 of the Endangered Species Act directs all federal agencies to use their existing authority to conserve threatened and endangered species and, in consultation with the U.S. Fish and Wildlife Service or National Marine Fisheries Services, to ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat. Section 7 applies to management of federal lands as well as federal actions that may affect listed species.

There are currently no federally listed threatened or endangered aquatic species, designated critical habitat, or proposed critical habitat occurring within the project area, therefore there will be **No Effect** for any of the alternatives to Endangered Species Act listed fish species or any designated critical habitat.

The Forest Service is aware and understands a DNA investigation is currently on going to determine the Spirit Lake rainbow trout species origin. This DNA study is still in its infancy and implementation of the proposed project will likely occur before peer review and a determination has been made. On March 25, 2020, the Forest Service sent a letter to National Oceanic Atmosphere Administration requesting concurrence that the project area contains no federally proposed or listed threatened or endangered fish species present. It has presumed by many that rainbow trout were illegally stocked in Spirit Lake following the eruption of Mount St. Helens. Rainbow trout is a management indicator species for the Gifford Pinchot National Forest and will be discussed under that section.

#### Forest Service Sensitive Species (Regional Forester Sensitive Species List)

Sensitive species are defined as "those plant and animal species identified by a Regional Forester for which population viability is a concern." There are no fish species listed as sensitive within the project area. Therefore, there will be **No Impact** for any of the alternatives to sensitive fish species.

## Forest Plan Management Indicator Species

Forest Service Manual 2620.5 defines management indicator species as “plant and animal species, communities or special habitats selected for emphasis in planning, and which are monitored during forest plan implementation in order to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent” (FSM 2620).

Regulations at 36 CFR 219.19(a)(1) require that certain vertebrate and/or invertebrate species present in the area be identified as management indicator species within the planning area (Gifford Pinchot National Forest) and that these species be monitored, as “their population changes are believed to indicate the effects of management activities.” Monitoring of management indicator species and determinations of population change occurs at the forest planning level. Rainbow trout are managed as a management indicator species under the forest plan. Other than the resident rainbow trout, there are no other fish species present in the project area.

## Invasive Species, Executive Order 13112 of February 3, 1999

Executive order 13112 (February 3, 1999) addresses the prevention of the introduction of invasive species and provides for their control and minimization of the economic, ecological, and human health impacts the invasive species causes. This executive order establishes the Invasive Species Council, which is responsible for the preparation and issuance of the National Invasive Species Management Plan, which details and recommends performance-oriented goals and objectives and specific measures of success for federal agencies.

### *New Zealand Mud Snails*

New Zealand mud snails (*Potamopyrgus antipodarum*), are present in the project area, including Spirit Lake and streams flowing into the lake where project activities are proposed. New Zealand mud snails are highly adaptable to diverse climates and can tolerate a broad range of aquatic conditions such as temperature, salinity, turbidity, water velocity, and stream productivity. Because New Zealand mud snails can tolerate high levels of turbidity, they are distinctively adapted to conditions present in the project area, making spread and establishment across the project area highly likely.

## Environmental Effects

### Alternative A: No Action

#### *Direct, Indirect, and Cumulative Effects for Aquatic Species*

Under alternative A, no new ground disturbing activities associated with the proposed action would take place other than those already permitted within the project area. There would be no impacts to invasive species in the project area from this proposed project, including New Zealand mud snails, because management actions would not influence the abundance or distribution of existing populations in the project area. New Zealand mud snails would continue to occur in the project area, expanding into areas currently unoccupied. There would be no new direct or indirect effects to lead to cumulative effects.

### Alternative B

#### *Direct and Indirect Effects for Aquatic Species*

Rainbow trout has been detected (Blackman 2014) in four perennial streams that would be impacted by alternative B’s temporary access road along the Truman Trail. These perennial streams are, Camp Creek, Geothermal Creek West, Geothermal Creek East, and Clear Creek. The proposed temporary access road also crosses Forsyth Creek. However, recent survey data indicates fish occur downstream of the proposed temporary access road. Willow Springs Creek is a tributary of Forsyth Creek and is crossed by the

proposed temporary access road but is not known to be fish bearing. Similarly, Goose Creek is also crossed by the proposed temporary access road but is not known to be fish bearing.

As a result of the proposed stream crossings, water withdrawal, and in-water construction activities, turbidity, water temperatures and chemical inputs at and downstream of the impacted area would increase. Withdrawing water from Spirit Lake or its tributary streams could result in juvenile fish becoming entrapped in equipment, impacting individual survival. Removing vegetation adjacent to streams to facilitate construction of stream crossings would result in higher instances of solar radiation along the waterway for the duration of project work, increasing overall water temperatures until vegetation re-establishes in the project area. As a result, fish would be temporarily exposed to marginally higher temperatures which could cause individuals to avoid an area or inhibit upstream or downstream passage. Removing vegetation from the site of stream crossings would also decrease the amount of organic materials entering the waterway which support primary and secondary production, which influence overall aquatic ecology support fish and other organisms, including invertebrates. As a result, there could be a temporary loss of food availability for rainbow trout. The intensity of direct effects from alternative B is not expected to result in permanent impacts to water quality.

The activities proposed under this alternative associated with the temporary access road, gate repairs, and geotechnical drilling **may affect individuals or habitat** (rainbow trout) **but will continue to maintain viable populations of these species within the Gifford Pinchot National Forest.**

Direct effects from increasing the spread and establishment of New Zealand mud snails in the project area includes increased competition or displacement of native snails, mussels, and aquatic insects which support resident fish populations. Disrupting the food web within the project area can indirectly reduce the overall biodiversity of the invertebrates in the project area, reduced growth rates, and lower populations of native species. Because New Zealand mud snails are currently present in Spirit Lake and associated waterways, the proposed construction activities are not expected to substantially increase the distribution and abundance of the local population. Due to the ephemeral and perennial streams draining into Spirit Lake, it is anticipated that any streams not yet infested with New Zealand mud snails would likely become infested in the near future as individuals spread into unoccupied streams naturally. However, streams that are not yet infested may become infested at a faster rate as a result of construction activities if decontamination protocols are not strictly adhered to.

Project design criteria included with alternative B contain strict adherence to Level 2 decontamination protocols for high risk situations as prescribed in the Washington Department of Fish and Wildlife protocols, version 3 (WDFW 2016). Level 2 decontamination protocols are required whenever moving across Water Resource Inventory Area boundaries; when leaving known infested waters; before entering protected or highly sensitive sites; or when moving between still-water habitats (lakes, marshes or ponds) that have no surface water connection to streams or other aquatic habitats.

### *Cumulative Effects for Aquatic Species*

The use of the administrative utility-terrain vehicle route and helicopter flights have potential to have a low impact on aquatic species for the analysis area. Because these impacts are considered low the cumulative effects are anticipated to be the same as direct and indirect effects. Impacts to aquatic resources resulting from these activities and natural evolution of the sediment plain would be a continuation of existing impacts and would include decreased water quality as a result of elevated water temperatures, incidental erosion, increased turbidity, and the spread and establishment of New Zealand mud snails. It is anticipated that any streams not yet infested with New Zealand mud snails would likely become infested in the near future as individuals spread into unoccupied streams naturally.

Long-term population viability for rainbow trout is not expected to be adversely impacted from cumulative effects in the project area.

## Alternative C

### *Direct and Indirect Effects for Aquatic Species*

Alternative C's proposed temporary access road has fewer stream crossings than alternative B. As a result, water withdrawal, and in-water construction activities, turbidity, water temperatures and chemical inputs at and downstream of the impacted area would still increase when compared to the no-action alternative, but would be less than alternative B. The intensity of direct effects from alternative C is not expected to result in permanent impacts to water quality.

The activities proposed under this alternative associated with access, gate repairs, and geotechnical surveys **may affect individuals or habitat (rainbow trout) but will continue to maintain viable populations of these species within the Gifford Pinchot National Forest.**

Since there are still stream crossings there would be risk of increasing the distribution and establishment of New Zealand mud snails within the project area. This increase would be of a lesser degree under alternative C because there are fewer stream crossings along the temporary access road to Duck Bay, than under alternative B. Because New Zealand mud snails are currently present in Spirit Lake and associated waterways, the proposed construction activities are not expected to substantially increase the distribution and abundance of the local population. Due to the ephemeral and perennial streams draining into Spirit Lake, it is anticipated that any streams not yet infested with New Zealand mud snails would likely become infested in the near future as individuals spread into unoccupied streams naturally. However, streams that are not yet infested may become infested at a faster rate as a result of construction activities if decontamination protocols are not strictly adhered to.

Project design criteria included with alternative C contain strict adherence to Level 2 decontamination protocols for high risk situations as prescribed in the Washington Department of Fish and Wildlife protocols, version 3 (WDFW 2016). Level 2 decontamination protocols are required whenever moving across Water Resource Inventory Area boundaries; when leaving known infested waters; before entering protected or highly sensitive sites; or when moving between still-water habitats (lakes, marshes or ponds) that have no surface water connection to streams or other aquatic habitats.

Alternative C proposes an increase in helicopter use by 23 times the current condition (no action) to transport drilling equipment, as well as, personnel to the geotechnical survey sites. There are no anticipated impacts to fish or aquatic habitats from transporting the drilling equipment and personnel. Water withdrawal would occur in a manner consistent with alternative B and would adhere to the same project design criteria and best management practices discussed above. The potential effects to fish and their habitat from these actions would be consistent with those described above.

Overall, the potential direct and indirect effects to aquatic resources under alternative C are consistent with the type and range of effects described under alternative B, but the scale of effects are expected to be of a lesser intensity.

### *Cumulative Effects for Aquatic Species*

The use of the administrative utility-terrain vehicle route and helicopter flights have potential to have a low impact on aquatic species for the analysis area. Because these impacts are considered low the cumulative effects are anticipated to be the same as direct and indirect effects. Impacts to aquatic resources resulting from these activities and natural evolution of the sediment plain would be a continuation of existing impacts and would include decreased water quality as a result of elevated water

temperatures, incidental erosion, increased turbidity, and the spread and establishment of New Zealand mud snails. It is anticipated that any streams not yet infested with New Zealand mud snails would likely become infested in the near future as individuals spread into unoccupied streams naturally.

Long-term population viability for rainbow trout is not expected to be adversely impacted from cumulative effects in the project area.

### 3.8 Terrestrial (Wildlife) Species

A distinctive assemblage of species that are associated with the open, early seral habitat conditions that were created by the eruption of Mount St. Helens have been documented over the past decades. Many of these species, such as horned lark, that are associated with barren or sparsely vegetated habitats, are not common on the west side of the Cascade crest but are common in eastern Washington. The project area is in an early seral stage of vegetative succession with a scattering of small conifers, fairly extensive hardwood shrub cover in mesic and riparian areas, and in general very sparse ground cover vegetation.

#### Analysis Measures

The indicators for effects are the type and number of species affected and/or the direction of changes in acres of habitat impacted. Species are grouped into categories based on their status: species that are federally listed with the Endangered Species Act, species considered sensitive by the Forest Service, management indicator species identified in the forest plan, and migratory birds identified in the Migratory Bird Treaty Act.

#### Endangered Species Act

Section 7 of the Endangered Species Act directs all federal agencies to use their existing authority to conserve threatened and endangered species and, in consultation with the U.S. Fish and Wildlife Service or National Marine Fisheries Services, to ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat. Section 7 applies to management of federal lands as well as federal actions that may affect listed species.

There are currently no federally listed threatened or endangered terrestrial species, designated critical habitat, or proposed critical habitat occurring within the project area. Suitable habitat for gray wolf and wolverine (proposed Endangered Species Act species) is present within the project area. Although there are no known occurrences, potential effects to these species are briefly discussed below.

**Gray Wolf**—There is potential habitat for gray wolf within the project area. At this time there is no known occupancy by wolves at the Monument, therefore there will be **No Effect** to gray wolves under any alternative.

**North America Wolverine**—Wolverines are associated with montane environments and sub-alpine habitats in Washington and typically avoid areas of high human use. No wolverines have been documented recently on the Monument. Recent surveys around Mt. Adams, Goat Rocks, and William O. Douglas wilderness areas have established that wolverines occur in the South Cascades. The habitat within the vicinity of the project area is not alpine or sub-alpine (preferred wolverine habitat) with elevations ranging from approximately 3,500 to 4,000 feet, therefore there will be **No Effect** to gray wolves under any alternative.

## Forest Service Sensitive Species (Regional Forester Sensitive Species List)

Sensitive species are defined as “those plant and animal species identified by a Regional Forester for which population viability is a concern.” Two Regional Forester Sensitive Species—mountain goat and Van Dyke’s salamander—are known to occur in the project area.

### *Mountain Goat*

Mountain goat numbers on the Monument have seen a steady increase in recent years and currently there are over 150 goats.

### *Van Dyke’s Salamander*

The Van Dyke’s salamander is a rare species with few historical sites known to exist on the Cowlitz Valley Ranger District (north of the Monument on the Gifford Pinchot National Forest). This species occurs in high gradient streams, waterfall splash zones, moist talus associated with adjacent old growth forest and abundant large woody debris and cave entrances. The Van Dyke’s salamander has been documented to occur on the Pumice Plain. In the proposed project area the Van Dyke’s salamander occur primarily in headwater seeps. Thus in general project activities will not occur directly in Van Dyke’s habitat since they are downstream of the headwater seeps. However, there are known populations in the proximity of the riparian crossings and the project area may be important as dispersal habitat.

## Forest Plan Management Indicator Species

Forest Service Manual 2620.5 defines management indicator species as “plant and animal species, communities or special habitats selected for emphasis in planning, and which are monitored during forest plan implementation in order to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent” (FSM 2620). Regulations at 36 CFR 219.19(a)(1) require that certain vertebrate and/or invertebrate species present in the area be identified as management indicator species within the planning area (Gifford Pinchot National Forest) and that these species be monitored, as “their population changes are believed to indicate the effects of management activities.” Monitoring of management indicator species and determinations of population change occurs at the forest planning level.

Identified wildlife management indicator species for the Gifford Pinchot National Forest are: northern spotted owl, pine marten, pileated woodpecker, cavity excavators, wood duck, goldeneye duck, mountain goat, deer, and elk. Many of the management indicator species, such as the northern spotted owl, pine marten, and pileated woodpecker are associated with older forest structure and large snags which do not exist within the project area, therefore there will be **No Impact** to these species under any alternative. Goldeneye ducks may be wintering on Spirit Lake, as they were sighted at Duck Bay during a November 2019 field visit.

## Bald Eagle

Bald eagles may use Spirit Lake as foraging habitat but are not known to nest in the project area vicinity. They have been observed at nearby Coldwater Lake.

## Migratory Birds, Executive Order 13186 of January 10, 2001

Executive order 13186 (January 10, 2001) requires federal agencies to consider management impacts to migratory birds to further the purposes of the Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, and other laws. Federal agencies need to identify whether unintentional take will occur, and if so, whether such take would have a measurable negative effect on migratory bird populations. Take is defined to mean “... to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue” (50 CFR 10.12).

## Environmental Effects

### Alternative A: No Action

#### *Direct, Indirect, and Cumulative Effects for Terrestrial (Wildlife) Species*

Under alternative A, no new ground disturbing activities associated with the proposed action would take place other than those already permitted within the project area. There would be **No Impacts** to wildlife species in the project area from this proposed project, because management actions would not influence the abundance or distribution of existing populations in the project area.

In the no-action alternative, there would be no potential for further disturbance to neotropical migratory bird habitat or ground nesting species to occur as a result of the development of the proposed temporary access roads, and therefore **No Impacts** to these species.

There would be no new direct or indirect effects to lead to cumulative effects.

### Alternative B

#### *Direct and Indirect Effects for Terrestrial (Wildlife) Species*

##### **Forest Service Sensitive Species**

###### *Mountain Goat*

The geotechnical drilling operations has the potential to disturb mountain goats and may cause them to avoid habitat in the project vicinity for up to five field seasons. In addition, development of the temporary access road and the use of motorized vehicles would have the potential to impact mountain goats and also disturb habitat at the stream crossings.

Therefore, the determination for mountain goats as a result of implementing alternative B is **may impact individuals or habitat but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.**

###### *Van Dyke's Salamander*

Alternative B's proposed temporary access road across the Pumice Plain may contain habitat that would be suitable for dispersal for Van Dyke's salamanders. Since the project area may contain suitable dispersal habitat, this species may be impacted by ground disturbing activity. Implementation of this alternative will result in constructing multiple riparian-crossings for the temporary access road, as well as, additional unimproved riparian-crossings needed to reach geotechnical drilling sites, each of which may have negative effects to this species. These activities may expose subsurface rock that could potentially cause mortality due to increased warming and drying or could adversely affect individuals due to the erosion and sedimentation filling interstitial spaces of microhabitats. The removal of willow shrub cover and other vegetation in riparian areas may negatively impact the salamander's habitat by increasing microhabitat temperatures and decreasing moisture conditions. Riparian crossings for the temporary access road may change existing hydrological patterns, altering potential habitat for these salamanders. Physical damage to the salamanders from constructing riparian crossings may result from crushing and entrapment.

Implementation of this alternative **may impact individuals or habitat, but would not contribute to a trend towards federal listing or loss of viability of the population or species.**

### **Forest Plan Management Indicator Species**

Since there is no suitable habitat there should be **No Impacts** to spotted owl, pine marten, or pileated woodpeckers. Breeding habitat for wood ducks and goldeneye ducks would not be affected by alternative B. Project activities will primarily occur during the summer season and therefore are expected to have **No Impact** on goldeneye ducks that may be wintering on Spirit Lake.

The project activities will have **No Impacts** to cavity excavator species because suitable habitat for these species is largely absent and the project would not alter or affect standing dead wood habitat.

Alternative B would directly affect up to 160 acres, but indirectly effect a larger area causing habitat avoidance for deer and elk. Given that there are thousands of acres of early seral habitat for deer and elk within the monument, the degradation of approximately 160 acres will not be substantial and **will not affect the deer and elk populations on the Monument but may impact individuals.**

As a result of implementing this project there would be an increase in human use in an area that currently receives very low use. However, given the large area of undisturbed habitat that is available to deer and elk on the Monument the proposed temporary access road may impact individual deer and elk but should not have substantial impacts to habitat because of the relatively small area affected.

### **Bald Eagle**

There would be **No Impact** to bald eagles, since there would be no potential for disturbance to foraging habitat from this alternative.

### **Migratory Birds**

Alternative B could result in the removal of a small amount of riparian hardwood species (willows) but in general the temporary access road will be located around the existing vegetation. Species associated with hardwoods, such as the orange-crown warbler, may lose a minimal amount of habitat due to the clearing of shrubs for stream crossings. The willow flycatcher is another species documented to occur on the Pumice Plain that may be impacted by changes to riparian shrubs at the stream crossings. The amount of habitat that would be affected at stream crossings is a small amount of the habitat that is available; therefore impacts to landbirds that are associated with early seral habitat from this alternative will be minimal. Alternative B's temporary access road could impact ground nesting species such as the common nighthawk (observed in project area on 6/8/2017), but should have a minimal effect.

An unintentional take will not occur for migratory birds under alternative B.

### *Cumulative Effects for Terrestrial (Wildlife) Species*

The use of the administrative utility-terrain vehicle route and administrative helicopter flights have potential to have a low impact on wildlife species for the analysis area. Because these impacts are consider low the cumulative effects are anticipated to be the same as direct and indirect effects.

For mountain goats the effects of additional disturbance from alternative B would accumulate to the disturbance from current recreational use on the monument which is primarily hiking, as well as, the effect of human presence from ongoing research. These activities may cause some habitat avoidance by mountain goats primarily during the summer season. Therefore, the disturbance caused by alternative B would be cumulative to the disturbance effect of current human use, which in general is relatively low during most times of the year.

For deer and elk the effects of additional disturbance from the alternative B would accumulate to the disturbance from current recreational use on the monument which is primarily hiking, as well as, the effect of human presence from ongoing research. These activities may cause some habitat avoidance by

deer and elk primarily during the summer season. Therefore, the disturbance caused by this alternative would be cumulative to the disturbance effect of current human use, which in general is relatively low during most times of the year.

## Alternative C

### *Direct and Indirect Effects for Terrestrial (Wildlife) Species*

#### **Forest Service Sensitive Species**

##### *Mountain Goat*

The geotechnical drilling operations would have the potential to disturb mountain goats and may cause them to avoid habitat in the project vicinity for up to five field seasons. In addition, development of the temporary access road and the use of motorized vehicles would have the potential to impact mountain goats and also disturb habitat at the stream crossings.

Alternative C's use of helicopters for delivery of the geotechnical drilling equipment and twice daily personnel shuttles to the work sites is predicted to cause disturbance of a higher intensity to mountain goats within the Harry's Ridge area. It is estimated for alternative C that the flight time of helicopters would be 23 times greater than the no-action alternative and 12 times greater than that of alternative B, each season. This disturbance could take place for up to two to three field seasons, rather than one season (alternative B) and would likely cause mountain goats to completely avoid habitat in that area.

The determination for mountain goats as a result of implementing alternative C is **may impact individuals or habitat but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.**

##### *Van Dyke's Salamander*

Because the temporary access road for gate construction in alternative C is shorter and has fewer stream crossings than alternative B it would have fewer impacts to riparian habitat and less potential to impact Van Dyke's salamanders. Therefore, although there is less potential for effect in alternative C, the determination of a **may impact individuals or habitat, but would not contribute to a trend towards federal listing or loss of viability of the population or species** is the same as alternative B.

#### **Forest Plan Management Indicator Species**

Since there is no suitable habitat there should be **No Impacts** to spotted owl, pine marten, or pileated woodpeckers. Breeding habitat for wood ducks and goldeneye ducks would not be affected by alternative C. Project activities will primarily occur during the summer season and therefore are expected to have **No Impact** on goldeneye ducks that may be wintering on Spirit Lake.

The project activities will have **No Impacts** to cavity excavator species because suitable habitat for these species is largely absent and the project would not alter or affect standing dead wood habitat.

Alternative C would directly affect up to 160 acres, but indirectly effect a larger area causing habitat avoidance for deer and elk. Given that there are thousands of acres of excellent early seral habitat for deer and elk within the monument, the degradation of approximately 160 acres will not be substantial and **will not affect the deer and elk populations on the Monument but may impact individuals.** As a result of implementing this project there would be an increase in human use in an area that currently receives very low use. However, given the large area of undisturbed habitat that is available to deer and elk on the Monument the proposed temporary access road may impact individual deer and elk but should not have substantial impacts to habitat because of the relatively small area affected.

### **Bald Eagle**

The use of helicopters to access the drilling sites and the use of barges on Spirit Lake would likely disturb bald eagles foraging in the project vicinity and cause habitat avoidance. Therefore, alternative C **may impact individuals but would not impact habitat or lead to a reduction in population viability for this species.**

### **Migratory Birds**

Alternative C could result in the removal of a small amount of riparian hardwood species (willows) but in general the temporary access roads will be located around the existing vegetation. Species associated with hardwoods, such as the orange-crown warbler, may lose a minimal amount of habitat due to the clearing of shrubs for stream crossings. The willow flycatcher is another species documented to occur on the Pumice Plain that may be impacted by changes to riparian shrubs at the stream crossings. The amount of habitat that would be affected at stream crossings is a small amount of the habitat that is available; therefore impacts to landbirds that are associated with early seral habitat from this alternative will be minimal. Alternative C's temporary access road could impact ground nesting species such as the common nighthawk (observed in project area on 6/8/2017), but should have a minimal effect.

An unintentional take will not occur for migratory birds under alternative C.

### *Cumulative Effects for Terrestrial (Wildlife) Species*

The use of the administrative utility-terrain vehicle route and administrative helicopter flights have potential to have a low impact on wildlife species for the analysis area. Because these impacts are considered low the cumulative effects are anticipated to be the same as direct and indirect effects.

For mountain goats the effects of additional disturbance from alternative C would accumulate to the disturbance from current recreational use on the monument which is primarily hiking, as well as, the effect of human presence from ongoing research. These activities may cause some habitat avoidance by mountain goats primarily during the summer season. Therefore, the disturbance caused by alternative C would be cumulative to the disturbance effect of current human use, which in general is relatively low during most times of the year.

For deer and elk the effects of additional disturbance from the alternative C would accumulate to the disturbance from current recreational use on the monument which is primarily hiking, as well as, the effect of human presence from ongoing research. These activities may cause some habitat avoidance by deer and elk primarily during the summer season. Therefore, the disturbance caused by this alternative would be cumulative to the disturbance effect of current human use, which in general is relatively low during most times of the year.

## **3.9 Botanical Species**

Early seral vegetation creates a sparse ground cover on the Pumice Plain. Little soil development or stabilization has occurred in the 39 years since the eruption and pyroclastic flows created a new landscape, barren and devoid of plant life. The existing vegetation cover, estimated at about 25 percent, creates a thin protective mat over the highly erodible and droughty pumice substrate. Species richness has increased slowly, due to a harsh environment and isolation from more diverse plant communities.

### **Analysis Measures**

Species are grouped into categories based on their statuses: species that are federally listed with the Endangered Species Act, species considered sensitive by the Forest Service, and invasive weed species.

## Endangered Species Act

Section 7 of the Endangered Species Act directs all federal agencies to use their existing authority to conserve threatened and endangered species and, in consultation with the U.S. Fish and Wildlife Service, to ensure that their actions do not jeopardize listed species. Section 7 applies to management of federal lands as well as other federal actions that may affect listed species. There are no known or suspected Endangered Species Act listed botanical species within the project area, as such there is **No Effect** to this category of botanical species.

## Forest Service Sensitive Species (Regional Forester Sensitive Species List)

Sensitive species are defined as “those plant and animal species identified by a Regional Forester for which population viability is a concern.” Current research<sup>13</sup> in the Pumice Plain (project area) has not documented any of these species of concern, as such there is **No Impact** to this category of botanical species.

## Invasive Species, Executive Order 13112 of February 3, 1999

Executive order 13112 (February 3, 1999) addresses the prevention of the introduction of invasive species and provides for their control and minimization of the economic, ecological, and human health impacts the invasive species causes. This executive order establishes the Invasive Species Council, which is responsible for the preparation and issuance of the National Invasive Species Management Plan, which details and recommends performance-oriented goals and objectives and specific measures of success for federal agencies. Table 2 contains information about the known invasive weed species to occur within or near the project area.

**Table 2. Invasive plant species known to occur in or near Spirit Lake project area**

Scientific Name	Class	Location	Common Name	Priority for Treatment
<i>Centaurea stoebe</i> L. ssp. <i>micranthos</i>	B	National Forest System road 99	Spotted knapweed	High
<i>Chrysanthemum leucanthemum</i>	C	National Forest System road 99	Oxeye daisy	High
<i>Cirsium arvense</i>	C	National Forest System road 99	Canada thistle	High
<i>Cytisus scoparius</i>	B	Pumice Plain	Scotch broom	High
<i>Hieracium caespitosum</i>	B	National Forest System road 99, utility-terrain vehicle trail	Meadow hawkweed	High
<i>Hieracium pilosella</i>	B	National Forest System road 99, suspected on Pumice Plain	Mouseear hawkweed	High
<i>Hieracium lachenalii</i>	B	National Forest System road 99	Common hawkweed	High
<i>Hypericum perforatum</i>	C	Pumice Plain, National Forest System road 99	Common St. Johnswort	Low
<i>Hypochaeris radicata</i>	C	Ubiquitous	Catsear	Low
<i>Senecio jacobaea</i>	B	Pumice Plain, National Forest System road 99	Tansy ragwort	High
<i>Tussilago farfara</i>	B	Pumice Plain	European coltsfoot	High

<sup>13</sup> One sensitive species was reported, but has not been validated with a specimen voucher.

## Environmental Effects

### Alternative A: No Action

#### *Direct, Indirect, and Cumulative Effects for Botanical Species*

Under alternative A, no new ground disturbing activities associated with the proposed action would take place other than those already permitted within the project area. Potential invasive weed species would likely continue due to the sustained public trail use, administrative use of the utility-terrain vehicle route to Duck Bay, and the yearly tunnel and gate inspections would still occur via a handful of administrative helicopter flights (approximately 3 to 6 flight days per year, 12 to 15 flying hours total). There would be no new direct or indirect effects to lead to cumulative effects.

### Alternative B

#### *Direct and Indirect Effects for Botanical Species*

The temporary access road construction from the researcher parking lot to the old pump station (3.25 miles), associated staging area, and lake access ramp will cause about 15 acres of vegetation loss. This temporary access road follows the old road and the current Truman Trail, so the vegetation loss would be less than if this was a wholly new ground disturbing activity.

Material and equipment storage areas, lake access ramps, and drill sites will lose vegetation and create areas of disturbance. These areas will also be vulnerable to invasive species. These actions would cause about 13 acres of vegetation loss.

Rock sourcing, road construction, material storage, heavy equipment and other vehicle use, work crews, vegetation loss, ground disturbance, soil compaction, increased erosion potential, and ultimately restoration efforts, all create vectors and increased risk of introducing new invasive species or other organisms, or spreading the known invasive species within the project area. The loss of up to 28 acres of vegetation and the ground disturbance and soil compaction caused by heavy equipment will also increase the risks of invasive species. Restoration efforts and other project design criteria will help restore an early seral plant community.

Increased erosion potential and vegetation loss from this project area are expected to last for 15 years or more. Project design criteria will minimize the effects of vegetation loss and erosion and reduce the potential for introducing new species.

#### *Cumulative Effects for Botanical Species*

The effects of the past work at the pump station, tunnel, the old roadbed and core sampling area, are still visible, but the ecological effects have blended into the existing condition. The use of administrative utility-terrain vehicle route and helicopter flights, sightseeing, recreational hiking, and research, create vectors for spread of invasive or native species propagules into the Pumice Plain and have a low potential to impact invasive weed species for the analysis area. Because these impacts are consider low the cumulative effects are anticipated to be the same as direct and indirect effects. There are no other reasonably foreseeable projects that overlap in time and space.

### Alternative C

#### *Direct and Indirect Effects for Botanical Species*

The temporary access road construction from the researcher parking lot to Duck Bay (1.8 miles), associated staging area, and lake access ramp will cause about 15 acres of vegetation loss. This temporary access road follows the old road for 0.8 mile and then an existing utility-terrain vehicle trail.

The geotechnical drilling operation would be accomplished using helicopter support to transport drill vehicles, gear and crews from a site near Coldwater Lake to the drilling area. A helipad will be constructed within the debris blockage area. The mobile drill vehicles and workers will traverse the debris blockage area to obtain approximately 30 core samples. This would reduce the road construction on the Pumice Plain, and impacts to botanical resources. However, rotor wash from helicopters can move pumice and plant seeds a long distance. The drill vehicles would travel via helicopter twice per season and the crews would fly in daily. This could lead to 15 helicopter trips within the drilling area polygon daily. Within the drilling area, about 6 acres of vegetation loss is expected.

Rock sourcing, road construction, material storage, heavy equipment and other vehicle use, work crews, vegetation loss, ground disturbance, soil compaction, increased erosion potential, and ultimately restoration efforts, all create vectors and increased risk of introducing new invasive species or other organisms, or spreading the known invasive species within the project area. The loss of up to 21 acres of vegetation and the ground disturbance and soil compaction caused by heavy equipment will also increase the risks of invasive species. Restoration efforts and other project design criteria will help restore an early seral plant community.

Increased erosion potential and vegetation loss from this project area are expected to last for 15 years or more. Project design criteria will minimize the effects of vegetation loss and erosion and reduce the potential for introducing new species.

#### *Cumulative Effects for Botanical Species*

The effects of the past work at the pump station, tunnel, the old roadbed and core sampling area, are still visible, but the ecological effects have blended into the existing condition. The use of administrative utility-terrain vehicle route and helicopter flights, sightseeing, recreational hiking, and research, create vectors for spread of invasive or native species propagules into the Pumice Plain and have a low potential to impact invasive weed species for the analysis area. Because these impacts are considered low the cumulative effects are anticipated to be the same as direct and indirect effects. There are no other reasonably foreseeable projects that overlap in time and space.

### **3.10 Heritage Resources**

The eruption of Mount St. Helens in 1980 removed most of the cultural resources that were once in the project area. The remaining cultural resources are of importance to Indian Tribes and will be referred to as cultural resource use areas (this includes the listed Traditional Cultural Property). Due to confidentiality requirements those cultural resource areas will not be disclosed within this document. Government to Government consultation (U.S. Department of Agriculture, Departmental Regulation 1350-002, 2013) is covered in Section 4: Agencies and Individuals Contacted and Consulted – 4.1: Tribal Partners.

### **Analysis Measures**

#### **National Historic Preservation Act**

The National Historic Preservation Act and its implementing regulations require federal agencies to consider the effects of their undertakings on historic properties. Regulations at 36 CFR 800 outline a set of procedures established by the National Historic Preservation Act that federal agencies must follow before implementing an action that may affect historic properties. In carrying out the responsibilities under Section 106 of the National Historic Preservation Act, the Forest Service is required to consult with any tribe that attaches religious and cultural significance to such properties when any federal undertaking may affect them [16 USC 470a(d)(6)(A)].

The project was initiated with a cultural resources area of potential effect (which includes the Traditional Cultural Property) uploaded to the Washington Information System for Architectural and Archaeological Records Data (WISSARD) on March 6, 2020. The Washington Department of Historic Preservation was briefed on the project on March 9, 2020, and asked to concur with the area of potential effect. Final Section 106 consultation will be completed prior to implementation of either of the action alternatives.

### **Lawetlat'la Traditional Cultural Property**

In September 2013, an area above the tree line on Mount St. Helens, also known by the Tribal name Lawetlat'la, was listed on the National Register of Historic Places as a Traditional Cultural Property. This relatively rare designation for an undeveloped natural feature recognizes the importance of Lawetlat'la to local Native American peoples including the Cowlitz Indian Tribe and the Confederated Tribes and Bands of the Yakama Nation. The boundary of the designated area is defined by the Loowit Trail 216, and it encompasses a total area of 12,501 acres (Lawetlat'la Traditional Cultural Property Memorandum of Understanding 2018).

Following the National Register of Historic Places listing, the Forest Service and the Cowlitz Indian Tribe recognized and developed a memorandum of understanding that describes the formal, government-to-government relationship between the Monument and the Cowlitz Indian Tribe in the context of managing Lawetlat'la. It designates the Monument Manager as the government representative to the tribe on matters directly concerning the Traditional Cultural Property (Lawetlat'la Traditional Cultural Property Memorandum of Understanding 2018).

## **Environmental Effects**

### **Alternative A: No Action**

#### *Direct, Indirect, and Cumulative Effects for Heritage Resources*

Under alternative A (no action), no new ground disturbing activities would take place other than those already permitted within the project area. There would be no change to cultural resources with this alternative. There would be no new direct or indirect effects to lead to cumulative effects.

### **Alternative B**

#### *Direct and Indirect Effects for Heritage Resources*

The temporary access road, staging, and barge loading facility proposed in alternative B is within the existing footprint of the U.S. Army Corps of Engineers 1982–1985 efforts to stabilize the lake level. In many places, the road or traces of the road is evident. This alternative would minimize new disturbance on the Monument.

Under alternative B there would be short-term visual (during implementation) impacts to portions of cultural resource use areas. Visual analysis estimates up to 50 percent of the temporary access road would be visible, within the background (5 miles to infinity, USDA FS 1974) from cultural resource use areas and that the intake gate construction activities would be visible, within the background, from anywhere within cultural resource use areas for the duration of the implementation of the project. Visual impacts include increased visible presence of equipment and human activity. Short-term visual impacts due to helicopter use would be increased two times from the no-action alternative, with the possibility of 30 hours of flight time per year.

Within the Visual Resources section of this environmental assessment, visual impacts from alternative B in middleground (1.5 to 2 miles) are described as the views of the “proposed temporary access road are largely oblique and would be screened by patches of vegetation and topographic features, which would diminish the proximity of the temporary access road. The broken view of the temporary access road and the distance from which it is viewed would likely reduce the visual impact...” This suggests that since cultural resource use areas are within a distance of background, the impacts would be lessened from those described in the Visuals Resource section.

Long-term (up to 5 years post project) visual impacts would become obsolete once implementation is complete, personnel and equipment are removed, restoration of disturbed areas is completed and activities are no longer visible to a casual observer from cultural resource use areas. Long-term visual impacts due to helicopter use would be the same as other under the no-action alternative.

The use of heavy ground-based equipment, and associated personnel, have the potential to cause short-term increased noise levels and could add mechanized sounds to an area that is normally uninhabited by modern technology. Noise would be present for the duration of implementation but would be contained to a reasonable hearing distance within the areas of the core drilling, the temporary access road, and the intake gate area. Short-term audible impacts due to helicopter use would be increased two times from the no-action alternative, with the possibility of 30 hours of flight time per year, for an estimated two to five field seasons. These audible impacts could disturb cultural resource use areas and cause avoidance of the project area in the short term.

Long-term noise impacts would become obsolete once implementation is complete, personnel and equipment are removed, and restoration of disturbed areas is completed. Long-term audible impacts due to helicopter use would be the same as under the no-action alternative.

Although it is anticipated to be minimal, restricted access along Truman Trail and locations in and around the project area to Tribal members could disrupt the use of cultural resource use areas by Native Americans. Protocols for requesting access will be established between interested tribes and the Forest Service to limit the disruption to cultural resource use areas. Impacts to Tribal access are anticipated to be short term in duration during project activities.

There are no additional heritage resources within the area of potential effect that may be impacted by alternative B.

#### *Cumulative Effects for Heritage Resources*

The current and ongoing use of the administrative utility-terrain vehicle route and helicopter flights have potential to have a low impact on the heritage resources for the analysis area. Because these impacts are considered low the cumulative effects are anticipated to be the same as direct and indirect effects. There are no other reasonably foreseeable projects that overlap in time and space.

### Alternative C

#### *Direct and Indirect Effects for Heritage Resources*

Under alternative C there would be short-term visual (during of implementation) impacts to portions of cultural resource use areas. Visual impacts of road based equipment would be reduced compared to alternative B, since the temporary access road to Duck Bay is almost completely hidden from cultural viewpoints. The intake gate construction activities would be visible, within the background, from anywhere within cultural resource use areas for the duration of the implementation of the project. Visual impacts include increased visible presence of equipment and human activity.

Short-term visual impacts due to helicopter use would be increased by 23 times from the no-action alternative and 12 times from alternative B, with the possibility of 350 hours of flight time per year. The increased helicopter use would be visible and distracting to the use of cultural resource use areas. While the helicopter is highly visible and would be distracting, the impacts would only occur during helicopter operations and would not create visual intrusions that would persist past completion of the drilling operations. However, these impacts are predicted to affect the area for two to three seasons, compared to the single season for drilling operations under alternative B. This increase of implementation seasons due to the limitations of the helicopters and weather requirements.

Long-term (up to 5 years post project) visual impacts would become obsolete once repairs are complete, personnel and equipment are removed, restoration of disturbed areas is completed and activities are no longer visible to a casual observer from cultural resource use areas. Long-term visual impacts due to helicopter use would be the same as under the no-action alternative.

The use of heavy ground-based equipment, and associated personnel, have the potential to cause short-term increased noise levels and could add mechanized sounds to an area that is normally uninhabited by modern technology. These impacts could have an effect over a smaller area, since the temporary access road to Duck Bay is shorter than the temporary access road under alternative B. Noise would be present for the duration implementation but would be contained to a reasonable hearing distance within the areas of the core drilling, the temporary access road, and the intake gate area. Short-term audible impacts due to helicopter use would be increased by 23 times from the no-action alternative and an increase of 12 times from alternative B, with the possibility of 350 hours of flight time per year. These audible impacts associated with helicopter use are predicated to affect the area for two to three seasons, compared to the single season for drilling operations under alternative B, due to the limitations of the helicopters and weather requirements. These audible impacts could disturb cultural resource use areas and cause avoidance of the project area in the short term.

Long-term noise impacts would become obsolete once implementation is complete, personnel and equipment are removed, and restoration of disturbed areas is completed. Long-term visual impacts due to helicopter use would be the same as other under the no-action alternative.

Although it is anticipated to be minimal, restricted access along Truman Trail and locations in and around the project area to Tribal members could disrupt the use of cultural resource use areas by Native Americans. Protocols for requesting access will be established between interested tribes and the Forest Service to limit the disruption to cultural resource use areas. Impacts to Tribal access are anticipated to be short term in duration during project activities.

There are no additional heritage resources within the area of potential effect that may be impacted by alternative C.

#### *Cumulative Effects for Heritage Resources*

The current and ongoing use of the administrative utility-terrain vehicle route and helicopter flights have potential to have a low impact on the heritage resources for the analysis area. Because these impacts are considered low the cumulative effects are anticipated to be the same as direct and indirect effects. There are no other reasonably foreseeable projects that overlap in time and space.

## **Section 4: Agencies and Individuals Contacted and Consulted**

Invitations to comment on the notice of proposed action and this environmental assessment were extended to organizations on the forestwide mailing list. Such organizations include officials of county governments within or adjacent to the project area, state agencies concerned with land and natural resource management, other federal agencies, watershed councils, industry groups, and environmental groups known to have an interest in federal lands management within the project area. Additionally, public news releases regarding the opportunity to comment were distributed to local media outlets for the 30-day combined scoping and comment period. A complete list of agencies and individuals contacted or consulted is available in the project record.

### **4.1 Tribal Partners**

In regularly scheduled meetings with the Yakama Nation (05/09/2019) and the Cowlitz Indian Tribe (10/30/2019), the initial project design was discussed. Project consultation letters were sent to the Yakama Nation and Cowlitz Indian Tribe on October 21, 2019, and again on December 8, 2019. Phone calls were made to Chairman William Iyall of the Cowlitz Indian Tribe and Phil Rigdon of the Yakama Nation. The Cowlitz Indian Tribe voiced interest in the project and requested formal government-to-government consultation, which occurred on February 4, 2020.

A government-to-government meeting took place February 4, 2020, at the offices of the Cowlitz Indian Tribe. The Deputy Forest Supervisor, Monument Ranger, Gifford Pinchot National Forest Heritage Program Manager, Chairman William Iyall, Interim Cultural Resource Department Manager, Tribal Historic Preservation Assistant, and the Policy Analyst Forest Liaison were in attendance. Information about the project was provided to the Cowlitz Indian Tribe. A further meeting between the Interim Cultural Resource Director and the Gifford Pinchot National Forest Heritage Program Manager was planned and took place February 28, 2020, to gather more information about cultural resources. This follow-up meeting between the Interim Cultural Resource Department Manager, Tribal Historic Preservation Assistant, and Gifford Pinchot National Forest Heritage Program Manager took place at the new Cultural Department offices. Further information was requested.

The Yakama Nation requested a staff-to-staff meeting, which occurred March 4, 2020. Forest Service staff briefed Yakama Nation staff on the project and provided materials for the Yakama Nation staff to review.

Conversations with both the Yakama Nation and Cowlitz Indian Tribe will be ongoing through the life of this project.

### **4.2 Washington State Department of Archaeology**

Compliance with the National Historic Preservation Act, Section 106 was initiated with a cultural resources area of potential effect uploaded to the Washington Information System for Architectural and Archaeological Records Data on March 6, 2020. The Washington Department of Archaeology's Historic Preservation Officer was briefed on March 9, 2020, and asked to concur with the area of potential effect. Final National Historic Preservation Act Section 106 consultation will be completed prior to implementation of either of the action alternatives.

### 4.3 U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (the Corps of Engineers) is a key partner in the management of all protective works at Mount St. Helens. The Corps of Engineers built the Spirit Lake tunnel and intake gate then subsequently transferred ownership to the Forest Service in 1985. Today, the land base and tunnel infrastructure is entirely owned and operated by the Forest Service. The Gifford Pinchot National Forest has an interagency agreement with the Corps of Engineers where the Forest Service accomplish critical operations and maintenance work, however, all work is funded and directed by the Forest Service. The Corps of Engineers has no technical decision making authority in relation to this project.

Four employees from the Corps of Engineers Portland District were integrated into the interdisciplinary team and served a key role as a technical expert. By participating in interdisciplinary team meetings, they were able to explain potential proposed activities in detail, designs, and potential tradeoffs. They were also able to share their experience implementing similar projects across the region. Corps of Engineers employees also met with members of the research community and members of the public to enhance their understanding of debris blockage characterization.

Through an interagency agreement, the Corps of Engineers is leading the effort to design and contract the tunnel intake gate replacement work. If alternative B is selected, Corps of Engineers drilling production centers will manage the geotechnical drilling program. For alternative B or C, the Corps of Engineers will utilize the data collected during drilling operations to complete the final phase of the debris blockage characterization.

### 4.4 Research Community

An important focus for the Gifford Pinchot National Forest was strengthening communication and coordination with the Mount St. Helens researcher community for Spirit Lake outflow operations, maintenance, and repair projects. Focused engagement supports durable decisions allowing the Gifford Pinchot National Forest to move forward in a way that positively affects communities support.

An integral part of this effort has been the Gifford Pinchot National Forest's investment in its 40 year relationship with the Pacific Northwest Research Station. Additionally, Gifford Pinchot National Forest staff invested in enhancing communication and coordination with university based researchers, and interested stakeholders at the Monument.

Beyond the benefits of improved communication and coordination of ongoing projects and research efforts, the investment into relationship building contributes to safer operations at this remote location.

#### **Weekly Deputy Regional Forester and Research Station Director Update**

Beginning in summer 2018, the Spirit Lake weekly update to the Regional Forester's Team included the Pacific Northwest Research Station Director. The intent of the weekly call is to ensure the Regional Forester's Team is aware of key tasks, events, and issues. The Pacific Northwest Research Station Director's participation supports efforts to coordinate ongoing Spirit Lake outflow operations, maintenance, and repair tasks with the research station's ongoing investment into research at Spirit Lake and the Pumice Plain.

#### **Monthly Coordination Call with the Research Station Land and Watershed Management Program**

Beginning in spring 2019, the Gifford Pinchot National Forest initiated a recurring coordination call with the Pacific Northwest Research Station Land and Watershed Management Program. This call includes the

program manager, aquatic ecology team leader, and research ecologist based at the Monument. The call includes the Monument Ranger and Spirit Lake project staff. The intent of the monthly call is to communicate National Forest System efforts and Pacific Northwest Research Station's research efforts at the national volcanic monument. This includes the Monument's preparations for recognition of the 40 years since the 1980 eruption of Mount St. Helens, and the research station's science pulse gathering held every 5 years at Mount St. Helens, with both events coinciding in 2020.

### **Interdisciplinary Team Member**

To further include ongoing research interests in the analysis of the Spirit Lake Tunnel Intake Gate Replacement and Geotechnical Drilling Project, the environmental analysis interdisciplinary team includes a research ecologist from the Pacific Northwest Research Station. The environmental analysis effort and involvement began in the fall of 2019.

### **Mount St. Helens National Volcanic Monument Implementation and Monitoring Working Group**

The Monument Ranger established a research community information working group to support communication between the Forest Service and National Forest System management at the Monument and the research community and the ongoing research at Spirit Lake, Pumice Plain, and other areas within the Monument.

## **Section 5: Proposed Forest Plan Amendment (Alternatives B and C)**

Per the National Forest Management Act and its implementing regulations at 36 CFR 219 (2012 Planning Rule), a plan may be amended at any time. Plan amendments may be broad or narrow, depending on the need for the change. The deciding official has the discretion to determine whether and how to amend the 1990 Gifford Pinchot National Forest Land and Resource Management Plan (forest plan) and to determine the scope and scale of any amendment. The 1985 Mount St. Helens National Volcanic Monument's Comprehensive Management Plan was fully incorporated into the forest plan.

Although the forest plan was developed using the 1982 Planning Rule procedures, the proposed project-specific amendment is under the 2012 Planning Rule. The section 5.2 describe how the procedural requirements of the 2012 Planning Rule would be applied to the proposed amendment.

### **5.1 Purpose of the Amendment**

There is a need to ensure the protection of public safety, health, property, and the environment from a catastrophic breach of the Spirit Lake natural debris blockage caused by the 1980 debris avalanche. In response to this alternatives B and C propose to:

- Replace the intake gate structure of the spirit lake tunnel;
- Reconstruct portions of National Forest System Road 99;
- Construct temporary access roads, staging areas, and a barge loading facility;
- Conduct geotechnical investigation and core sampling within the debris blockage; and
- Apply stabilization and rehabilitation activities during and after project implementation.

For the needed work to be accomplished, the visual quality objective of retention would be exceeded for the project area because project activities will be evident to the casual national forest visitor.

The purpose of this plan amendment is to provide a project-specific variance to allow the Spirit Lake Tunnel Intake Gate Replacement and Geotechnical Drilling Project to exceed the designated visual quality objective of retention. The assigned visual quality objective of retention would not change for future actions or elsewhere within the Monument.

### **5.2 Substantive Requirements of the Rule**

#### **Scope and Scale of the Amendment**

The variance from the designated retention visual quality objective applies only to the Spirit Lake Tunnel Intake Gate Replacement and Geotechnical Drilling Project decision. This variance would result in a visual quality objective of partial retention in the short term (project implementation). The effects of the Spirit Lake Tunnel Intake Gate Replacement and Geotechnical Drilling Project on visual resources would be localized from specific viewpoints within the Monument and would affect a small proportion of areas in the Monument (less than 0.5 percent for both alternative B and C) that have the mapped visual quality objective of retention. Visual resources of the Gifford Pinchot National Forest would continue to meet the forestwide goal for scenery by "Provid[ing] natural-appearing scenery from the high use (most important) recreation travel routes and use areas. On other areas of the forest, management activities may be visible, but should blend with the natural conditions to the extent practicable" (forest plan, page 30). The scope and scale of the amendment is limited to the Spirit Lake Tunnel Intake Gate Replacement and Geotechnical Drilling project area; thus, a project-specific amendment, rather than a programmatic amendment, is appropriate.

## Application of Substantive Requirements

The plan amendment process requires determining which substantive requirements are directly related to project-specific variance and applying the requirements within the scope and scale of the amendment. The determination must be made based on the purpose for the amendment and the effects (beneficial or adverse) of the amendment.

Considering the scope and scale described above, there are two related substantive requirements based on the purpose and effects of the amendments.

The requirements of 36 CFR 219.8(b)(2) *Sustainable recreation, including recreation settings, opportunities, and access; and scenic character* and 36 CFR 219.10(a)(1) *Aesthetic values, air quality, cultural and heritage resources, ecosystem services, fish and wildlife species, forage, geologic features, grazing and rangelands, habitat and habitat connectivity, recreation settings and opportunities, riparian areas, scenery, soil, surface and subsurface water quality, timber, trails, vegetation, viewsheds, wilderness, and other relevant resources and uses* are directly related to the effects of allowing a variance to the designated visual quality objective of retention. By allowing the visual quality objective to exceed retention for the project area will not substantially impact the plan area's overall contribution to social and economic conditions related to scenic resources. The change in visual quality objective would not affect those activities (or their outputs and values) on the Gifford Pinchot National Forest that contribute to the economy. Overall, the Gifford Pinchot National Forest scenic resources would continue to complement the recreation settings and experiences across broad areas of the national forest.

Allowing the visual quality objective to exceed retention, in the short term, will not substantially impact the plan's overall integrated resource management direction for multiple use as it relates to aesthetic values. The forestwide goal for Gifford Pinchot National Forest scenic resources is to provide natural-appearing scenery from the high use (most important) recreation travel routes and use areas, and to allow other areas of the national forest to allow management activities to be visible, but should blend with the natural conditions to the extent practicable would remain unchanged. Therefore, no change to the amendment or additional plan direction is necessary to apply this substantive requirement to the amendment.

## 5.3 Using the Best Scientific Information to Inform the Amendment

The project-specific amendment considered the best available scientific information to inform the amendment. Analyses of the potential intensity of effects to scenic resources were derived from available information regarding views within the project area, staff records, and past observations of the effects to those desired views from development, visitor use, and area operations, including construction activities.

To determine the visibility of potential changes that could occur within the project area, "seen area maps" were produced for each action alternative (B and C) to determine where these lands and effects could be seen from two of the three identified viewpoints: Windy Ridge and Johnston Ridge Observatory. The seen area maps were prepared by generating specific viewshed points within and overlooking the project area, and using digital terrain data for the existing topography to determine areas that would be seen from existing overlooks. Seen areas were determined using bare-earth digital elevation models without consideration of vegetation that might obscure a view, but is transient in nature. Other information considered included: a review of the appropriate Forest Service policy; goals, objectives, standards, and guidelines of the forest plan and comprehensive management plan; an analysis of the visual quality objective standards and thresholds; project site visits and photos; and a review of the U.S. Department of Agriculture, Forest Service literature related to scenery management.

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