



Camp Muir Rehabilitation Plan Environmental Assessment July 2012



Mount Rainier National Park
55210 238th Avenue East
Ashford, Washington 98304

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Camp Muir Rehabilitation Plan Environmental Assessment

Executive Summary

The National Park Service has prepared an Environmental Assessment to analyze potential impacts and benefits of proposed alternatives intended to rehabilitate the Camp Muir Historic District, which is located in Mount Rainier National Park. Historic structures would be retained, and non-historic structures would be replaced or removed. The functions of structures would be optimized to improve visitor and employee safety while protecting natural resources, adjacent Wilderness, and the National Historic Landmark District.

Camp Muir is located on a narrow east-west ridge, or "cleaver," at 10,080 feet on the Gibraltar route, long known as the most direct route to the summit of Mount Rainier. It was this route that John Muir, the founder of the Sierra Club, followed in his 1888 climb to the summit with Seattle mountaineer Edward S. Ingraham. Ingraham later proposed changing the site's name to Camp Muir.

Today Camp Muir is the primary base camp for west-side ascents to the summit of Mount Rainier via the Disappointment Cleaver, Gibraltar Ledges, and Ingraham Flats direct routes. Camp Muir is also a destination for day hikers, who access the ridge via the trail from Paradise. Up to 500 climbers and hikers visit Camp Muir per day during peak use months of July and August, and up to 110 people camp at Muir per night during the peak time of year. The annual number of climbers has ranged from approximately 9,000 to 11,000 since 2001. The popularity of Camp Muir as a climbing base camp and destination day hike strains existing toilet and overnight facilities, and has contributed to erosion of the pumice soils on the ridge. Extreme environmental conditions also contribute to the deterioration of structures and challenge Park managers in their efforts to maintain the site and its public facilities.

This Environmental Assessment (EA) evaluates four alternatives: Alternative 1 (No Action), which would result in no change in the facilities available at Camp Muir, Alternative 2, representing minimum development in which structures that are not historic would be removed, Alternative 3, in which non-historic structures are replaced with new structures compatible with the Historic District near their current locations, and Alternative 4, which also replaces non-historic structures with new compatible structures, but with a modified spatial arrangement.

This EA has been prepared in compliance with the National Environmental Policy Act to provide the decision-making framework that (1) analyzes a reasonable range of alternatives to meet objectives of the proposal, (2) evaluates potential issues and impacts to the park's resources and values, and (3) identifies mitigation measures to lessen the degree or extent of these impacts. Resource topics evaluated in detail in this document include air quality, geology and soils, plants and lichens, water resources,

wildlife, historic structures, cultural landscape, wilderness, visitor use and experience and safety, and park operations. All other resource topics were dismissed because the proposed actions would result in discountable effects, or they were analyzed under a separate impact topic. No major effects were identified as a result of this project. The preferred alternative would not adversely affect the Camp Muir Historic District or the Mount Rainier National Historic Landmark District; the project would have no effect on listed species under the Endangered Species Act.

If you wish to comment on this EA, you may post comments online using the National Park Service Planning, Environment and Public Comment (PEPC) website at: <http://parkplanning.nps.gov/muirea> or mail comments to: Superintendent, Mount Rainier National Park, 55210 238th Ave. E., Ashford, Washington, 98304.

This EA will be available for public review and comment for 45 days. Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. Although you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

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CHAPTER I: Purpose and Need

Introduction

The National Park Service has prepared an Environmental Assessment to analyze potential proposed alternatives intended to rehabilitate the Camp Muir Historic District, which is located in Mount Rainier National Park. Non-historic structures would be modified, replaced or removed, and the purposes of structures would be optimized to improve visitor and employee safety while protecting natural resources, adjacent Wilderness, and the National Historic Landmark District.

This Environmental Assessment (EA) evaluates four alternatives: Alternative 1 (No Action), which would result in no change in the facilities available at Camp Muir; Alternative 2, representing minimum development, in which structures that are not historic would be removed; Alternative 3, in which non-historic structures would be replaced with new structures compatible with the Historic District near their current locations; and Alternative 4, which would also replace non-historic structures with new structures, but with a modified spatial arrangement.

Background

Mount Rainier National Park is located on the west slope of the Cascade Range in west-central Washington, about 65 miles southeast of Seattle and 65 miles west of Yakima. Mount Rainier was established as the nation's fifth National Park in 1899. Camp Muir is located on a narrow east-west ridge, or "cleaver," at 10,080 feet on the Gibraltar route, long known as the most direct route to the summit of Mount Rainier. It was this route that John Muir, the founder of the Sierra Club, followed in his 1888 climb to the summit with Seattle mountaineer Edward S. Ingraham. Ingraham later proposed changing the site's name to Camp Muir.

Climbing became increasingly popular in the years following Muir's successful summit attempt, and many other ascents to the summit were realized. As mountaineering on Mount Rainier grew in popularity, a climbing fatality in 1897 prompted calls for the construction of a high-elevation shelter for climbing parties. A decade later the Army Corps of Engineers recommended the construction of a shelter at Camp Muir, funded in part by private donations. The Department of the Interior approved the shelter project in 1911, which did not materialize until after John Muir's death in 1914. The first shelter, originally named the Guide Hut, was constructed in 1916 following a push by the Mountaineers to commemorate Muir (Catton 1996). The Muir Hut, now known as the Public Shelter, was constructed in 1921, and a third stone structure referred to as the Men's Comfort Station was built by the Civilian Conservation Corps in 1936. This structure was converted to storage in 1973.

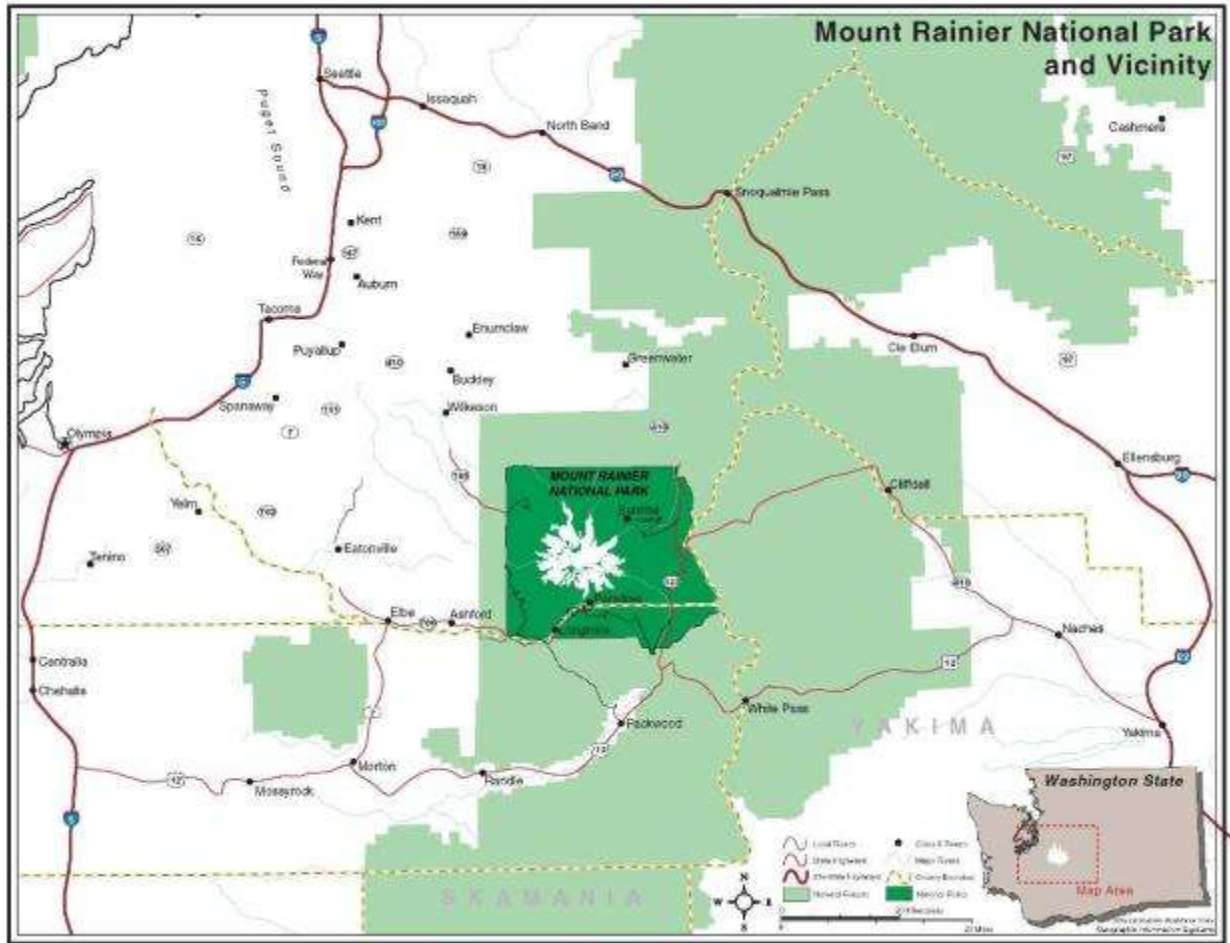


Figure 1. Mount Rainier National Park and vicinity.

Today Camp Muir is the primary base camp for south-side ascents to the summit of Mount Rainier via the Disappointment Cleaver, Gibraltar Ledges, and Ingraham Flats direct routes. Camp Muir is also a destination for day hikers, who access the ridge via the trail from Paradise. As many as 500 climbers and hikers have been observed at Camp Muir per day during peak use months of July and August, and up to 110 people camp at Muir per night during the peak time of year. The annual number of climbers has ranged from approximately 9,000 to 11,000 since 2001. The popularity of Camp Muir as a climbing base camp and destination day hike strains existing toilet and overnight facilities, and has contributed to erosion of the pumice soils on the ridge. Extreme environmental conditions also contribute to the deterioration of structures, and challenge park managers in their efforts to maintain the site and its public facilities.

The Camp Muir Historic District was first listed in the National Register of Historic Places in 1991, recognized for its significance in the early recreational development of the park and for its distinctive method of construction and rustic design. In 1997, Camp Muir and the park's other historic developed areas and their connecting roadways were designated as the Mount Rainier National Historic Landmark District and listed on the

National Register of Historic Places. The 1,362 acre National Historic Landmark District is an outstanding example of early park planning and National Park Service rustic architecture of the 1920s and 1930s.

In 1988, approximately 97 percent of the park was designated as the Mount Rainier Wilderness. Although the Camp Muir developed area was excluded from this wilderness designation, it is surrounded by wilderness, and access to Camp Muir is through wilderness. All alternatives lie within the Camp Muir developed area footprint and are located outside of wilderness.

The park's outstanding wilderness values, natural and cultural resources, and remarkable scenic characteristics were and continue to be its signature features.

Purpose and Need

In order to achieve the goals and directives set forth in federal law, policy, and guidelines, and maintain consistency with the 2002 Mount Rainier National Park General Management Plan, the purpose of this environmental analysis is to establish a long-term plan to rehabilitate the Camp Muir Historic District. Specifically, this plan will identify actions to:

- Restore and preserve the historic character of the Camp Muir Historic District;
- Protect natural resources including unstable soils, rare lichens, and downstream resources;
- Enhance visitor experience for both day users and overnight guests;
- Improve visitor and employee safety by improving waste management and reducing hazards in sleeping and cooking facilities.

Peak use at Camp Muir occurs between July and August, when as many as 500 climbers and hikers visit Camp Muir facilities each day and more than 100 people spend the night. This heavy use strains existing facilities, most critically the toilets, which do not process waste efficiently given the volume of waste and extreme cold environment.

Historic structures including the Public Shelter, Guide Shelter and the Men's Comfort Station have recently been rehabilitated. However, challenges associated with the use of these and other structures at Camp Muir still need to be addressed. In addition, the design of existing non-historic structures is incompatible with the historic district, and the structures are in poor condition. Cooking and sleeping in structures without adequate ventilation and lack of fire separation threatens occupant health and safety. Visitor experience and employee safety are also threatened by declining toilet conditions and persistent odor, inadequate visitor orientation, limited communication capability, and inadequate shelter to protect visitors from the extreme weather. Natural geologic processes and hazards threaten existing structures, while human activity

contributes to erosion, degrades downstream water quality and impacts the surrounding alpine environment at Camp Muir and in the surrounding Wilderness.

Policy and Planning Context

Several established policies and plans provide direction for Camp Muir Rehabilitation Plan. National Parks are to also adhere to applicable federal laws and regulations, such as the Endangered Species Act, the National Historic Preservation Act, the Wilderness Act, and the Wild and Scenic Rivers Act. To articulate its responsibilities under these laws and regulations, the National Park Service Management Policies were established for all units under its stewardship (NPS 2006).

National Park Service Organic Act (*Title 16, United States Code [16 USC] sections 1 through 4; Aug. 25, 1916, ch. 408, 39 Stat. 535*). In 1916, the Organic Act established the National Park Service (NPS) in order to “promote and regulate the use of parks...” The stated purpose of national parks is “to conserve the scenery and natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” The Organic Act establishes the management responsibilities of the National Park Service. While Congress has given the National Park Service the management discretion to allow certain impacts within parks, that discretion is limited by the statutory requirement that park resources and values be left unimpaired. It ensures that park resources and values will continue to exist in a condition that allows future generations to enjoy them. The park’s Determination of Non-Impairment will be documented as an Attachment to the expected FONSI decision.

National Park System General Authorities Act (*as amended by the 1978 Redwood Amendment*) (*16 USC section 1a-1 et seq.; PL 91-383, 94-458, 95-250*). This act prohibits the National Park Service from allowing any activities that would cause derogation of the values and purposes for which the parks have been established except as directly and specifically provided by Congress in the enabling legislation for the parks.

National Environmental Policy Act of 1969 (NEPA) (*42 USC 4321-4370d; PL 91-190*). NEPA requires the identification and documentation of the environmental consequences of federal actions. Regulations implementing NEPA are set by the President's Council on Environmental Quality CEQ Title 40, Code of Federal Regulations Parts 1500-1508. CEQ regulations establish the requirements and process for agencies to fulfill their obligations under the act. In compliance with NEPA, this environmental assessment will evaluate potential project impacts on the human environment. Compliance with the National Historic Preservation Act (see below) is integrated into the NEPA compliance process, using NHPA criteria for the analysis of impacts on cultural resources. The NEPA process is also used to coordinate compliance with other federal

laws, regulations, and orders applicable to this environmental assessment, including but not limited to:

Clean Air Act (CAA) (42 USC 7401 -7671q; PL 88-206)
Endangered Species Act of 1973 (ESA) (16 USC 1531 -1544; PL 93-205)
Wild and Scenic Rivers Act (16 USC 1271-1287; PL 90-542)
Wilderness Act (1964 as amended) (16 USC 1131-1136; PL 88-577)
Washington Park Wilderness Act of 1988 (PL 100-668)
Executive Order 11593: Protection and Enhancement of the Cultural Environment
Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance

National Historic Preservation Act (NHPA) *(1966 as amended) (16 USC 470-470x-6; PL 89-665, 96-515)*. Section 106 of the NHPA directs federal agencies to take into account the effect of any undertaking (a federally funded or assisted project) on historic properties. A "historic property" is any district, building, structure, site, or object, including any resource considered by American Indians to have cultural and religious significance, that is eligible for listing in the National Register of Historic Places because the property is significant at the national, state, or local level in American history, architecture, archaeology, engineering, or culture. Section 106 also provides the Advisory Council on Historic Preservation (ACHP) and the State Historic Preservation Officer (SHPO) an opportunity to comment on assessment of effects anticipated from the undertaking. In compliance with section 106 of the NHPA, this environmental assessment will evaluate potential project effects on historic properties.

Americans with Disabilities Act of 1990 (ADA) *(as amended) (42 USC 12101 12213; PL 101-336)*. ADA requires accessibility to places of public accommodation and to commercial facilities by individuals with disabilities. Compliance with ADA requirements is guided by The Americans with Disabilities Act Accessibility Guidelines (ADAAG). While most historic buildings and landscapes were not designed to be readily accessible for people with disabilities, making these properties and the activities within them more accessible to people with disabilities is a goal of the National Park Service, as detailed in Director's Order 16A, Accessibility for Employees and Job Applicants and Director's Order 42, Accessibility for Park Visitors.

Architectural Barriers Act of 1968 (ABA) *(as amended) (42 USC 4151-4157; PL 90-480)*. The ABA requires access to facilities designed, built, altered, or leased with federal funds. An Access Board develops and maintains accessibility guidelines under this law. These guidelines serve as the basis for the standards used to enforce the law. Federal agencies are responsible for ensuring compliance with the ABA standards when funding the design, construction, alteration, or leasing of facilities. Compliance with ABA guidelines also is an NPS goal, as detailed in Director's Orders 16A and 42.

Secretary of the Interior's Standards for the Treatment of Historic Properties

The Standards are prepared under the authority of NHPA sections 101 (f) (g), and (h), and NHPA Section 110. The Standards are intended to promote responsible preservation practices that help protect irreplaceable cultural resources. The Standards provide four treatment approaches to provide guidance for consistency in the proposed work. The four treatment approaches are Preservation, Rehabilitation, Restoration, and Reconstruction. Preservation places a high premium on the retention of all historic fabric through conservation, maintenance, and repair. Rehabilitation emphasizes the retention and repair of historic features, but more latitude is provided for alterations needed to meet continuing or new uses while retaining historic character. Restoration focuses on the retention of materials from the most significant time in a property's history, while permitting the removal of materials from other periods. Reconstruction establishes limited opportunities to re-create a non-surviving site, landscape, building, structure, or object in all new materials. Decisions regarding which approach to take are made based on a number of factors including the historic significance and integrity of the resource. The proposed treatment for Camp Muir is rehabilitation. This approach recognizes that while the existing non-historic structures detract from the historic character of the district, the buildings serve an important function. The rehabilitation approach provides a framework for the park to replace these structures with more compatible structures.

2006 National Park Service Management Policies

The Management Policies (2006) is the service-wide policy document of the National Park Service. The following excerpts from the Management Policies specifically pertain to the Camp Muir Rehabilitation Plan.

The National Park Service will provide visitor and administrative facilities that are necessary, appropriate, and consistent with the conservation of park resources and values. Facilities will be harmonious with park resources, compatible with natural processes, esthetically pleasing, functional, energy and water efficient, cost-effective, universally designed, and as welcoming as possible to all segments of the population. NPS facilities and operations will demonstrate environmental leadership by incorporating sustainable practices to the maximum extent practicable in planning, design, siting, construction, and maintenance (NPS 2006, Chapter 9).

Through the use of concession contracts or commercial use authorizations, the National Park Service will provide commercial visitor services that are necessary and appropriate for public use and enjoyment. Concession operations will be consistent to the highest practicable degree with the preservation and conservation of resources and values of the park unit. Concession operations will demonstrate sound environmental management and stewardship (NPS 2006, Chapter 10).

Other Chapters of the NPS Management Policies that are relevant to the Camp Muir Rehabilitation Plan include *Natural Resource Management* (Chapter 4), *Cultural*

Resource Management (Chapter 5), *Wilderness Preservation and Management* (Chapter 6), and *Use of Parks* (Chapter 8).

National Park Service Director's Orders

The proposed action is consistent with, but not limited to, the following NPS Director's Orders and President's Executive Order:

- Director's Order 12: Conservation Planning, Environmental Impact Analysis and Decision-making
- Director's Order 16A: Accessibility for Employees and Job Applicants
- Director's Order 28: Cultural Resource Management
- Director's Order 41: Wilderness Preservation and Management
- Director's Order 42: Accessibility for Visitors with Disabilities in National Park Service Programs and Services
- Director's Order 50B: Occupational Safety and Health Program
- Director's Order 58: Structural Fire Management
- Director's Order 80: Real Property Asset Management
- EO13327, Federal Real Property Asset Management

Related Park Planning Documents

Mount Rainier National Park General Management Plan (NPS 2002)

The *Mount Rainier National Park General Management Plan* (GMP) provides the overall guidance for management of the park (NPS 2002). Camp Muir and its structures are considered an *integral part of park operations, and a component of the National Historic Landmark District (NHLD)*. Management of the Camp Muir Historic District is consistent with the General Management Plan direction to manage historic buildings, structures, sites and objects contributing to the significance of the Mount Rainier National Historic Landmark District.

Camp Muir is zoned "Sensitive Resource/Recreation" (GMP p. 59 and 67) in summer and winter, which is defined as follows:

Desired Resource Condition	Desired Visitor Experience	Facilities and Activities
Natural landscape, with no human use visible outside designated trails and use areas.	Experience of park resources generally unimpeded by other visitors and relatively close to developed facilities. A high degree of social interaction.	Facilities and structures in localized areas. Hiking would be the primary activity.

The area surrounding Camp Muir is zoned “High Use Climbing” in summer and winter (p. 65 and p. 59) which is defined as follows:

Desired Resource Condition	Desired Visitor Experience	Facilities and Activities
Natural landscape modified by the presence of wilderness appropriate structures. No visible signs of human use off the routes.	A moderate to high degree of social interaction and few opportunities for solitude.	A few wilderness-appropriate structures such as primitive routes and designated campsites. Activities oriented toward mountaineering.

The GMP also states (p. 46):

Minor developed areas would remain. Aside from changes that would improve the visitor experience in these areas, such as refining trail access, adding signs and parking, and adding vault toilets, no major changes are proposed.

Mount Rainier National Park Commercial Services Plan (April 2005)

The Commercial Services Plan (CSP) provides the following limited vision for Camp Muir:

- Camp Muir (non-wilderness portion) will accommodate 36 clients and guides per night (in addition to its current 74 independent spaces). Administrative staff, such as camp managers for the concessioners, and park staff are not included in this limit.
- Due to changing public health requirements, Camp Muir cannot continue to have a formal water system. Individual groups will need to melt and filter water for their own use.
- Because of its poor and declining condition, the Client Shelter will likely be removed. Clients and guides will be allowed to use temporary shelters such as weather ports and tents. The Camp Muir Rehabilitation Plan Environmental Assessment will evaluate alternatives that may include the construction of new overnight facilities.

Three guided mountaineering concessioners provide services on the Muir Route (Disappointment Cleaver and Ingraham Direct), which passes through Camp Muir. These concession contracts also provide mountaineering day schools, shuttle transportation, guided alpine training, guided winter day use activities, and guided winter overnight trips. Guides operating under individual Commercial Use Authorizations (CUA) also pass through Camp Muir, leading approximately four climbs each year.



Figure 2. Aerial view of Camp Muir, conditions existing in 2002. Rectangular outline denotes wilderness boundary; irregular outlines denote historic district and sensitive vegetation boundaries.

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Designations

Camp Muir Historic District/Mount Rainier National Historic Landmark District: The Camp Muir Historic District encompasses the developed area at Camp Muir. The Public Shelter, Guide Shelter, and Men's Comfort Station are contributing buildings in the district, while the current Client Shelter and Butler Shelter are non-contributing.

The Historic District boundaries at Camp Muir are as follows:

- North boundary: edge of the Cowlitz Glacier;
- South boundary: edge of the Muir Snowfield;
- East boundary: a north-south line 100 feet east of the Public Shelter; and
- West boundary: a north-south line 100 feet west of the Guide Shelter.

Mount Rainier National Park Wilderness Management Plan (1992)

Camp Muir is surrounded by designated wilderness, with the boundary as shown in Figure 2. The Wilderness Management Plan provides a history of backcountry overnight use at Camp Muir. In 1975, the number of independent climbers allowed to camp at Camp Muir increased from 35 to 65. At this same time, most other climbing routes were limited to two parties at a time. Just one year later another 10 independent users were added at Camp Muir and the requirement for parties to camp ½ mile apart was waived temporarily for the Ingraham basin, and then permanently waived for all routes.

Since the 1992 Wilderness Plan was adopted, limits at Camp Muir have been established at 110 people with a maximum party size of 12 people. Guided mountaineering concessioners are limited to the same group size, enforceable through the concession contracts (beginning in 2006).

Planning History and Public Scoping Process

During late summer 2001, The Portico Group (and a team of sub-consultants) was engaged to prepare preliminary design and supplemental services for the rehabilitation of the Camp Muir Historic District in Mount Rainier National Park. Issues that were identified and explored included:

- Repair and stabilization of extensive long term erosion along the area ridgeline;
- Repair/rehabilitation and stabilization of historic structures;
- Replacement of contemporary structures with new structures that are compatible with the alpine environment and the historic district;
- Public and employee health issues of human waste treatment/disposal and water treatment;
- Overnight and day use visitor management;
- Education/interpretive opportunities of this unique historic district and leave no trace wilderness travel ethics.

Subsequent events in the park, including the 2006 flood, required shifting priorities away from the overall planning for Camp Muir. However, repair and stabilization of the historic structures was accomplished (see Chapter 3).

A public scoping letter, which built on the earlier public scoping for the Commercial Services Plan (CSP), was issued on May 25, 2005. Approximately 21 responses were received, most via email. Chapter IV describes the public participation process in detail.

Issues and Concerns

The following issues and concerns have been identified through internal and external scoping during the lifespan of this project.

Safety

- Use of the Public Shelter, Client Shelter, and Butler Shelter for sleeping and cooking presents fire hazard, ventilation (carbon monoxide accumulation), and space issues.
- Visitors may be unaware of continued rock fall from slopes above the camp.
- Many visitors continue to be unaware of the treacherous nature of the route/camp during inclement weather.
- The ranger station and the public shelter are on opposite sides of Camp Muir, which results in a division between the public and the rangers during severe weather conditions. If the public shelter were closer to the ranger station, there would be more interaction between the two groups.
- Climbers and campers using the Public Shelter often urinate on the leeward side of the shelter. Climbers and campers get the snow they melt for drinking water from the same areas.

Utilities, Waste Treatment, and Communication Systems

- Waste: The solar and pit toilets located at Camp Muir do not adequately break down wastes, which results in undesirable odors during high use periods.
- Waste: Existing toilets have inadequate capacity for the number of visitors to Camp Muir.
- Waste: The leach field for the solar toilets is not properly sized for current use.
- Communication: Relaying or sharing important information between and among the staff and public users of Camp Muir is difficult during normal operations and emergencies.



Figure 3. Camp Muir, looking west from the helipad. The historic Guide Shelter is on the right; the Client Shelter is on the left.



Figure 4. Camp Muir, looking east from the helipad. The historic Public Shelter is at the far end, beyond the three toilet buildings.

Cultural Resources

- The Camp Muir Historic District continues to be adversely affected by the presence of incompatible and poorly sited non-historic public and administrative structures.
- The Client Shelter is in poor condition and is an adverse effect on the Camp Muir Historic District because of its incompatible design.
- Solar panels that provide power for administrative radio operations are an intrusion on the Camp Muir Historic District.
- The foundations of historic structures at Camp Muir are being undermined by unstable soils.
- The interior of the historic Public Shelter tends to be wet, dank, and dark, creating unpleasant conditions for visitors and causing damage to the structure. Use of portable cooking stoves blackens the interior walls and occasionally causes scorching to the wooden benches and bins.

Administration

- There is inadequate sleeping and cooking space for concessioner and NPS climbing and maintenance staff.
- As noted above, communication between and among NPS staff, concessioners, and public users is logistically difficult.

Wilderness

- Spillover camping occurs in the wilderness surrounding Camp Muir. In addition, two guide services have two large modular tents (weather ports) set up in the wilderness to provide shelter for melting water, cooking food, and feeding dozens of people.
- To efficiently support the Camp Muir Historic District and its operations, helicopter use is necessary to transport human waste, supplies, and sometimes people to/from Camp Muir.
- The Camp Muir Historic District is surrounded by wilderness, which is affected by these helicopter flyovers. Helicopter use impacts Wilderness values. The increased use of helicopters during construction will cause an increase in Wilderness impacts immediately adjacent to Camp Muir and in Wilderness that lies between Kautz Creek, Fourth Crossing and Camp Muir.

Visitor Experience

- Facilities are inadequate for the high number of overnight and day use visitors that arrive at the camp in peak season.
- Adding structures to support concessions is opposed by some visitors to Camp Muir; some prefer a minimum number of structures and that concessioners camp as they do at most other locations within the park and in other popular climbing destinations.

Natural Resources

- The presence of rare lichens near Camp Muir necessitates more intensive management of visitors in their vicinity.
- Erosion of fine pumice soils has impacted both the longevity of historic structures as well as the circulation routes at the camp.
- The ridge is estimated to have lost a few inches to several feet of material since the construction of the Historic Guide Shelter.
- Concern about importing gravel and rock and potential effects to the environment has been expressed.
- The use of helicopters for construction would impact wildlife, air quality and Wilderness values.

Interpretation

- There is a lack of cohesive interpretive and educational programming for day use visitors and climbers.
- There is very limited climber information on the inside of the Public Shelter.
- Experiences at Camp Muir are not linked to those at Paradise.
- Visitors may be unaware of sensitive vegetation resources in the vicinity of Camp Muir and below along the Muir Snowfield.
- There is no standard sign “theme” used at Camp Muir to identify structures, relay information, or inform of regulations.

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CHAPTER II: Alternatives

Introduction

This Environmental Assessment (EA) evaluates four alternatives: Alternative 1 (No Action), which would result in no change in the facilities available at Camp Muir; Alternative 2, a minimum development alternative in which structures that are not historic would be removed; Alternative 3, which would replace non-historic structures with new structures compatible with the Historic District at or near their existing locations; and Alternative 4, which also replaces non-historic structures with new structures, but with a modified spatial arrangement. Table 1, at the end of this section, displays summaries for each alternative.

Actions Common to All Alternatives

The following actions would be common to all alternatives, including the No Action:

- Historic buildings and sites would continue to be maintained and repaired. Minor interior changes in buildings may occur to accommodate different uses depending on the alternative that is selected. Actions would continue to be planned and analysis of their effects undertaken as needed to ensure actions taken were consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties, in consultation with the SHPO.
- Existing rock walls would be retained and extended as necessary to minimize additional movement of the Camp Muir terraces;
- Existing trails would be improved and defined leading to, from and within the camp (as annual snowpack and adjacent glaciers decline, establishment of pathways will protect resources, establish durable pathways).
- The Historic Guide Shelter would continue to be used for sleeping and cooking (currently by three to four Rangers);
- The helipad would remain unchanged. Supporting rock walls and surface may undergo maintenance and repair when needed.
- Wayside exhibits would be installed at Paradise and Pebble Creek to improve information on orientation, safety and resource protection. To supplement the existing warning sign about going beyond Pebble Creek without proper equipment and knowledge, another wayside is planned for installation at the main Paradise trailhead aimed at getting the same message to general park visitors. This wayside installation was originally part of plans related to the Paradise area restoration and rehabilitation of the trailhead.
- Communications systems for operations at Camp Muir would be improved.
- Instrumentation, including the permitted weather station, would remain (additional proposed installations would require separate environmental documentation).

- Utilities would maintain a similar or smaller footprint as future technology is expected to improve efficiency per unit area (e.g., efficiency of solar panels per unit area may improve; replacement of propane tanks with other energy sources may be possible).
- There are no changes to overnight capacity, day use, or other visitation management actions put into effect under the 2005 CSP.

Alternative 1: No Action (Continue Current Management)

Under the No Action alternative, existing historic facilities would be repaired or rehabilitated as appropriate to facilitate their preservation and to minimize impacts to other park resources. Non-historic structures would continue to be maintained and repaired. Efforts would be made to minimize visual impacts and limit continuing impacts to the resource. Deteriorating non-historic structures may be replaced or removed at a future date, which would require a new decision-making process.

Client Shelter: The Client Shelter (also known as the Bunkhouse and the Gombu shelter) would continue to be used (currently by the guided public and guides) until it becomes unsafe for overnight occupancy, at which time it would be removed. If the Client Shelter were removed, concessioners and clients would sleep in dispersed tents on snow, most likely in or near the location of the shelter.

Guide Service Modular Tents: At present, two of the guide services erect strong steel-framed modular tents to use as seasonal cooking shelters. These tents are set up on the Cowlitz Glacier beyond the first wind-roll. Under Alternative 1, these tents would continue to be used.

Butler Shelter: One guide service would continue to use the Butler Shelter for cooking and storage.

Toilets: One solar and one pit toilet would continue to occupy the west side of the ridge. Two solar (one accessible) toilets and one pit toilet would continue to be prominently located on the southeast side of the ridge, maintained and serviced as they currently are. Wastewater leach fields would not change. Solar toilets are open in the summer and pit toilets in winter. Efforts to develop an improved toilet system at Camp Muir would continue. A prototype is planned for placement between the toilets located closest to the Public Shelter.

Historic Guide Shelter: There would continue to be cooking, sleeping and storage accommodations for three to four NPS rangers per night in the historic Guide Shelter, also known as the Ranger Station. Year-round storage of emergency gear and winter storage of equipment and supplies would continue to be located in the historic Guide Shelter.

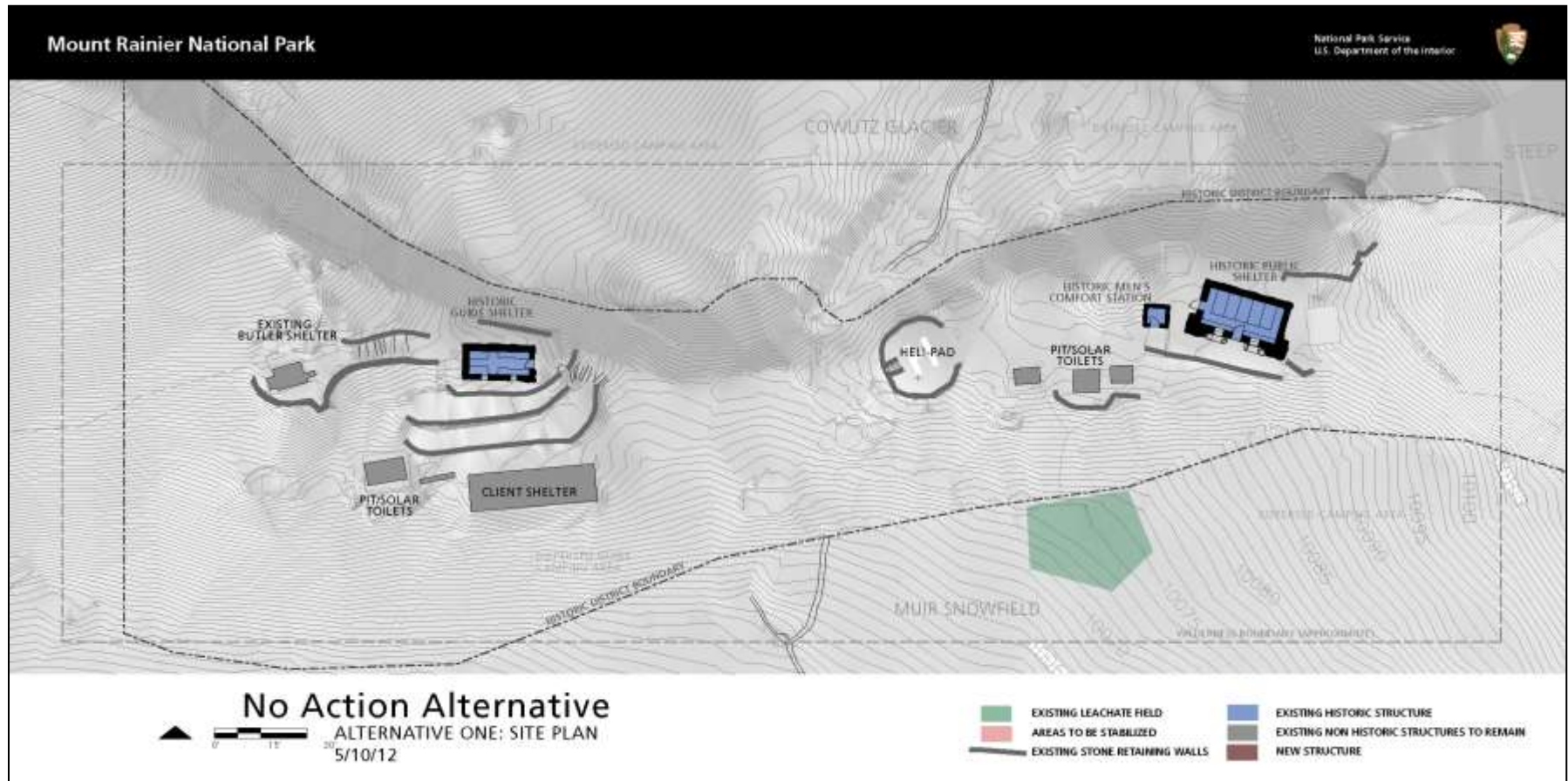


Figure 5. Camp Muir Rehabilitation Plan Environmental Assessment No Action Alternative site plan and existing condition.

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Men's Comfort Station/Storage: The Men's Comfort Station would continue to be used as NPS storage space and as a support facility for the solar toilets.

Historic Public Shelter (Sleeping/Cooking): The Public Shelter would continue to be used for sleeping (16-18 bunks) and cooking space. Independent public climbers currently use the Public Shelter as an emergency shelter.

Storage: There is approximately 200 square feet of storage space during summer at Camp Muir, including within the Butler Shelter, in outside areas adjacent to the Butler Shelter, within the Men's Comfort Station and in the vicinity of the toilets. Storage adjacent to the Butler Shelter and toilets would continue to be in boxes and barrels. Items typically stored in hard-sided containers outside include search and rescue (SAR) and climbing gear, food, personal gear, tents, trash, cleaning supplies, wood, 55-gallon drums and building supplies.

Interior storage for the Guide Services in the Client Shelter would continue to include space for dry food staples, guide personal equipment, group climbing equipment, rescue gear, medical gear, tools for maintenance and off-season storage of all summer support systems (solar, water lines, radio). Exterior storage areas would continue to be used for propane, water, and other large items.

Utilities and Instrumentation: There would be no changes in the configuration or current locations of solar panel arrays or other systems, including radio, telephone and power generation that support operations at Camp Muir. As technologies become more efficient, the solar panel footprint is expected to become reduced, rather than services increased.

The Historic Guide Shelter, Butler Shelter, Toilets, Client Shelter, and Historic Public Shelter have 12-volt, solar-electric systems. The following are powered within each building:

- NPS radio systems
- Public emergency radio (NPS frequency)
- Handheld radio battery charging systems
- General appliance use and battery charging
- Electric lights
- Ventilation Fans
- Weather Station Instruments (Northwest Avalanche Center, NWAC)
- Seismic Instruments (USGS, UW)

There are a total of 16 solar panels at Camp Muir:

- Three 75 W (225 W) on the Butler Shelter for weather and seismic stations
- Two 150 W (300 W) on the Public Shelter for radio and fans during summer;

- Three 75 W (225 W), one on each solar toilet (2 on east toilets, one on west toilet);
- Two 180 W and one 125 W (485 W) on the Historic Guide Shelter for (NPS radio system, battery charging, wireless communications)
- Three 75 W (225 W) on the Client Shelter for the NWAC weather station.

Propane is used to for heating (NPS) and snow melting (NPS and guides). Limited snowmelt via solar heat source is being conducted on an experimental basis, with the hope that it will reduce the need for propane at Camp Muir. NPS Rangers use 5 to 10 gallons of water per day, and concessioners use 10 to 50 gallons per day depending on time of year. The NPS does not provide melted water to the public; guides melt water for themselves and clients.

The NWAC weather station consists of a temperature/humidity sensor, an anemometer, and wind vane. These are placed on a small Roan tower that is braced to the Client Shelter and extends only a few feet above the roof level of the building. There is a radio transmitter and a datalogger mounted on the tower powered by a solar panel and a battery back-up. The battery is mounted inside the Client Shelter and the solar panel is mounted on the roof.

The USGS an UW seismometer is located near the Butler shelter, with the following components attached to or mounted on the shelter: A GPS antenna mounted on a 4-foot pole and cabling that leads to the Butler Shelter, a battery mounted in a container behind the shelter, a solar panel mounted on the shelter roof, and an antenna mounted to the Butler Shelter.

Actions Common to Alternatives 2-4

The following actions would be common to all of the action alternatives (Alternatives 2–4). Each is discussed in more detail below.

- New facilities (constructed as applicable) would comply with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* and would be designed to be compatible with the Camp Muir Historic District and Mount Rainier National Historic Landmark District.
- Circulation areas (pathways) at Camp Muir would be armored by placing a layer of crushed rock (approximately four inches deep) to hold the easily eroding pumice from further wind and trampling associated erosion;
- Clear orientation signage would be provided;
- The Client Shelter would be removed. Under Alternative 2, tent pads would replace the Client Shelter. Under Alternatives 3 and 4, a new structure would replace the Client Shelter, but the current shelter may be maintained until funding is secured for its replacement.
- The five toilets (3 solar and 2 pit) at Camp Muir would be replaced with 4 new toilets;

- A new leach field with adequate capacity would be constructed for wastewater disposal;
- New facilities would be compliant with ADA as appropriate.

Retain Existing Rock Walls and Extend Rock Walls Below Helipad and Public Shelter: New dry laid stone walls would be constructed to infill between existing retaining walls to direct the flow of pedestrian traffic to the stabilized pathways along the ridge. On the southeast side of the camp, rock walls would be extended below the Public Shelter and helipad. An estimated 150 feet of new rock wall would be constructed. The new walls would vary in height from three to six feet. Local rock for walls may be selectively harvested on site from rock fall within the Camp Muir footprint (excluding sensitive lichen areas and wilderness). Existing hard rock (talus deposits consisting of welded tuff) at the site is suitable, according to the *Camp Muir Schematic Feasibility Design Report* (The Portico Group 2002). The rock would need to be moved from the east end of Camp Muir to the proposed wall locations.

Stabilize Public Pathways: Public pathways would be stabilized at Camp Muir. Crushed rock (four inches) would be added to reduce surface erosion on benches adjacent to rock walls. The crushed rock would be imported to the site via helicopter.

Provide Orientation Signage: To facilitate understanding of the site layout in each alternative, clear orientation signage would be provided for day use visitors, independent climbers and guided clients.

Design Compatible New Facilities: New structures would be designed to be compatible with the Camp Muir Historic District/Mount Rainier National Historic Landmark District and primarily designed to fit into existing terraces to minimize the amount of new grading and excavation.

Replace Solar Toilets (3) and Pit Toilets (2) with New Toilets (4): All action alternatives call for the replacement of the existing solar and pit toilets with new, more efficient, toilets. Toilets at the center of the ridge would be relocated to the east side of the ridge. The total number of toilets would be reduced from five to four (two at each location, east and west).

Because the existing toilets have odor and function problems as well as detectable impacts on water resources, all would be replaced with toilets that are designed to improve separation of solid and liquid waste, and more effectively vent odors away from occupied areas. Based on analysis of several composting toilet systems and their existing installation at high elevation in the west, it has been determined that composting and dehydrating functions would not work well at the Camp Muir location. A toilet designed to separate waste and allow complete removal of solid waste would reduce the risk of fecal contamination onsite, and significantly reduce the need for

employees to directly handle waste. Plans are underway to install a prototype toilet in 2012 to test the new design.

Alternative 2: Minimum Structure

The primary objective of Alternative 2 is to consider an option that would remove all non-historic structures at Camp Muir and reduce the structural footprint on the ridge. Under Alternative 2, the Client and Butler shelters would be removed, and three large tent pads would be constructed where the Client Shelter currently sits. The Men's Comfort Station would be converted from NPS storage to public cooking space. A new historically compatible building would be constructed to provide NPS storage space.

Under Alternative 2, the guide services and the NPS would continue to occupy the west side of Camp Muir, and the public would continue to occupy the east side of Camp Muir. The historic Guide Shelter would continue to house NPS climbing rangers. Independent climbers would continue to use the historic Public Shelter and/or camp in tents on the snowfield. The guide services would use the three new tent pads and would also camp in tents on the snowfield or glacier.

Client Shelter/Modular Tents: The existing Client Shelter would be removed and replaced with three tent pads designed to support modular tents. The modular tents would store equipment, provide shelter for cooking and dining, and potentially provide separate sleeping space for the guides. Guides and guided climbers would sleep in tents on the snowfield or glacier. Modular tents would no longer be needed on the Cowlitz Glacier under this alternative.

Butler Shelter: The Butler Shelter would also be removed, as it is not a historic structure and is located in a rock fall area. Cooking and storage space for guides would occur in modular tents.

New NPS Storage Structure: A storage structure similar in size and volume to the Men's Comfort Station would be constructed immediately west of the historic Guide Shelter. This new structure would replace NPS storage space lost due to the conversion of the Men's Comfort Station to public cooking space.

Toilets: Four new toilets would replace the five existing toilets. The three toilets currently situated towards the east end of the ridge would be disassembled and removed from Camp Muir; the two replacement toilets would be installed immediately east of the Public Shelter. The two toilets located on the west end of the ridge would be disassembled and removed from Camp Muir; the two replacement toilets would be installed in the same location. The new toilets would separate liquid waste from solid waste more effectively than the current system. Liquid waste would be routed to a drainage field located on the Muir snowfield. Solid waste would be deposited directly into barrels integrated into the design of the new toilets, eliminating need for excessive

handling and exposure to waste by employees. The barrels would be transported out of Camp Muir with helicopters. Replacement of toilets, including proposed locations, is common to all action alternatives.

Historic Men's Comfort Station: The Men's Comfort Station would be converted to cooking space, separating public cooking from public sleeping spaces. This action would require some internal modification to the structure and installation of venting to the outside.

Historic Public Shelter: The historic Public Shelter would be retained for public use as described in Alternative 1, but cooking in the shelter would be prohibited. All current cooking space would be converted to sleeping space. Sleeping space would increase from 16-18 spaces to 18-20 spaces.

Storage: Guide services would store equipment and supplies in modular tents, except water and propane containers, which would remain outside. NPS rangers would store equipment in a new storage structure located on the ridge immediately west of the historic Guide Shelter. New toilets would be designed to include storage of toilet supplies currently occupying space in the Men's Comfort Station.

Utility Systems: Utilities and associated services necessary to run operations are expected to be similar to other alternatives under Alternative 2; however the NPS would continue to find ways to take advantage of technology that decreases the size of equipment and reduces energy consumption. Because the number of buildings used to mount solar panels and other equipment would be reduced, more equipment would need to be moved to the remaining rigid structures, including historic shelters and the new NPS storage structure.

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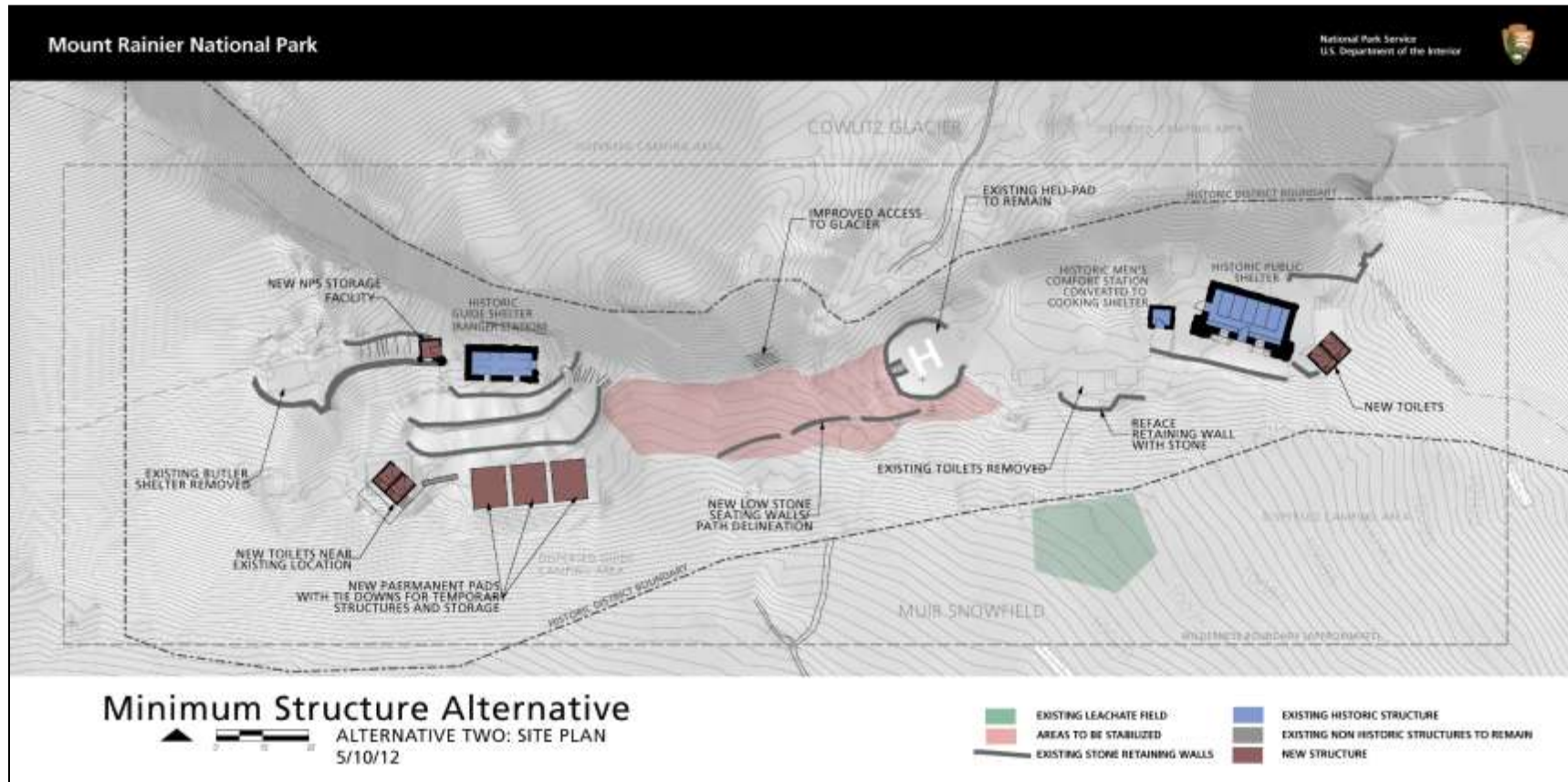


Figure 6. Camp Muir Rehabilitation Plan Environmental Assessment Alternative 2 site plan.

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Alternative 3 (Preferred): Replace Non-Historic Structures

Alternative 3 would replace non-historic shelters with new structures that are compatible with the Historic District. The Client and Butler shelters would be removed and replaced. The new shelters would be designed to consider enclosures for utilities to minimize visual impact to the Historic District. The shelters would also be designed to provide more efficient storage.

Operations are expected to continue as they are, with guides and clients occupying the west side of Camp Muir. NPS rangers would continue to use the historic Guide Shelter, and the historic Public Shelter would continue to be available to independent campers and climbers.

New Guide Shelter: Under Alternative 3, the current Client Shelter would be replaced with a new shelter that would contain 36 beds, as does the current shelter. The interior dimensions of the shelter would be similar to the existing client shelter; however, the outside would be larger due to the thickness of the rock veneer.

New Storage and Cooking Shelter: The Butler Shelter would be replaced by a historically compatible shelter that would provide cooking and storage space for joint use by the guide services. The Butler Shelter would be dismantled and removed from the site. The new structure would be placed further eastward on the ridge toward the historic Guide Shelter to reduce exposure to rock fall. Under this alternative, modular tents would no longer be used.

Toilets: Four new toilets would be constructed to replace existing toilets, as in Alternatives 2 and 3.

Historic Public Shelter: The historic Public Shelter would have a new cooking area partitioned within the building to provide separation between sleeping and cooking functions. The partition would reduce sleeping space in the Public Shelter from a maximum of 18 spaces down to 16.

Storage: New structures, such as the new storage and cooking shelter, would be designed to provide more efficient and convenient storage opportunities. New toilets may be designed to include storage of toilet supplies currently occupying space in the Men's Comfort Station (NPS storage), which would make more equipment space available to NPS rangers.

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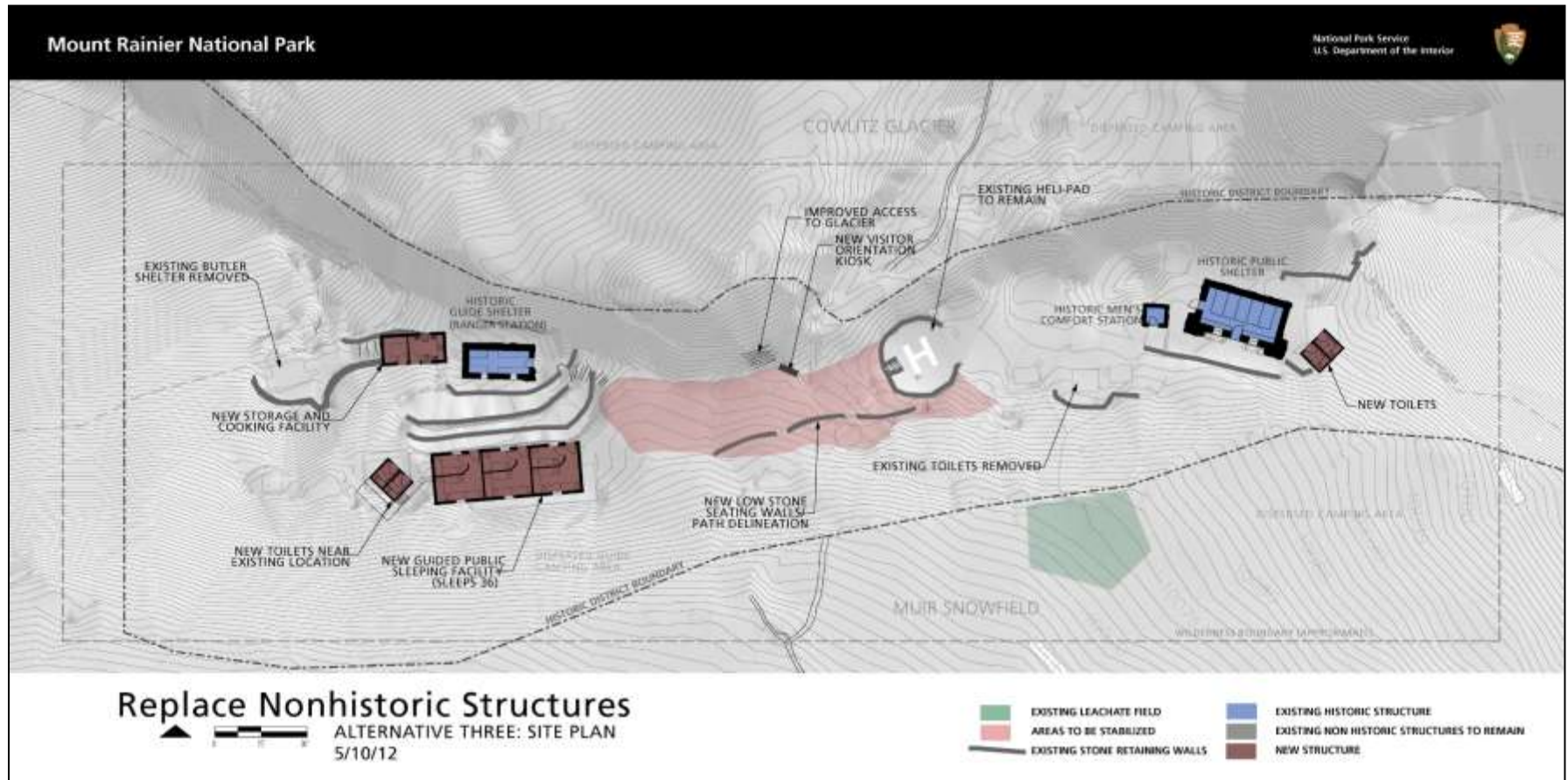


Figure 7. Camp Muir Rehabilitation Plan Environmental Assessment Alternative 3 site plan.

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Utility Systems: Utilities and support infrastructure would be similar to present conditions; however we would continue to find ways to take advantage of technology that decreases the size of equipment and reduces energy consumption. New structures would house and provide physical support for utilities. Design would consider several factors in placement of utilities, including minimizing visual impact, efficient use of space, and ease of management. Utilities would maintain a similar or smaller footprint as future technology is expected to improve efficiency per unit area (e.g., improved efficiency of solar panels per unit area).

Alternative 4: New Independent & Guided Public Shelters

All non-historic structures would be removed under Alternative 4, as with Alternatives 2 and 3. Three new historically compatible buildings would be constructed: two shelters and one storage structure. A new building would replace the Client Shelter within the same footprint, but would be smaller, approximately mirroring the size of the historic Public Shelter. A second new shelter would be constructed on the east side of the ridge to provide additional bed space. A new structure would be constructed on the west side of the ridge to provide NPS storage space.

Under Alternative 4, the NPS would be stationed on the west side of the ridge, and NPS staff would continue to utilize the historic Guide Shelter for sleeping and cooking, as with all alternatives. Independent climbers would use the New West Shelter, and guides and guided climbers would move to the east side of Camp Muir. Guided climbers would stay in the New Guided Shelter, and concessioner guides would share the historic Public Shelter. These changes in configuration would increase cooking and sleeping space on the east side of the ridge near the current Public Shelter.

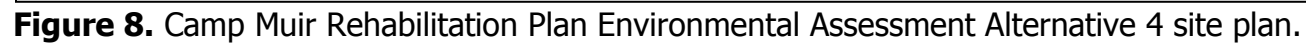
New West (or Public) Shelter: The Client Shelter would be replaced with a smaller shelter that sleeps 18 to 20 and provides a separate cooking space for the general public (independent climbers). This shelter would be located at the existing Client Shelter location, but would have a smaller footprint. This new building would become the new public shelter, or West Shelter.

New NPS Storage Structure: A storage structure similar in size and volume to the Men's Comfort Station would be constructed immediately west of the historic Guide Shelter, as in Alternative 2, to provide storage for NPS rangers. This new structure replaces NPS storage space lost due to the use of the Men's Comfort Station by the guide services.

Toilets: Four new toilets would be constructed as in Alternatives 2 and 3.

Men's Comfort Station: Guides would use the Men's Comfort Station for storage (the new NPS storage shelter would be used for NPS ranger storage requirements).

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Historic Public Shelter and New Guided Sleeping Shelter: A new shelter located east of the helipad and southwest of and adjacent to the historic Public Shelter (current toilet location) would provide 24 sleeping spaces for guided climbers on the east side of Camp Muir. The interior of the Historic Public Shelter would be reconfigured to accommodate cooking for all three guide services and sleeping space for 12 people. Modular tents would no longer be used under this alternative.

Storage: Storage configuration would differ from all other alternatives because new buildings and their functions would be distributed differently on the ridge. Outside storage of supplies including propane and water tanks may shift, but space used is expected to be similar. Under this alternative, goals to manage storage and reduce clutter would be maintained.

Utility Systems: The need for utility systems would be similar in scale to Alternative 3; however the configuration would change to accommodate a new building. Because there are more buildings under this alternative and a portion of power requirements are likely to shift to the east side of Camp Muir, it may be necessary to increase utility infrastructure. The additional new building would provide an opportunity to limit placement of utilities on historic structures. Goals to improve efficiency and reduce footprint may maintain or reduce anticipated utility infrastructure.

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Table 1. Summary of Camp Muir Rehabilitation EA alternative actions.

	Alternative 1	Alternative 2	Alternative 3 (Preferred)	Alternative 4
Action Evaluated	No Action (Continue Current Management)	Remove Non-Historic Structures	Replace Non-Historic Structures	Public Shelter and NPS located West; Client Shelter East
HISTORIC DISTRICT/NHLD				
Rehabilitation and/or modification of historic buildings (Public Shelter, Guide House, Men's Comfort Station)	Historic buildings would be repaired and maintained; there would be no interior modifications	Historic buildings would be repaired and maintained. Cooking would no longer be allowed in the Public Shelter; the Men's Comfort Station would be converted to cooking.	Historic buildings would be repaired and maintained. A separate cooking space would be created in the Public Shelter.	Historic buildings would be repaired and maintained. The Public Shelter would be converted from public use to guide use and include interior modifications that allow cooking. The Men's Comfort Station would be used by guides for storage.
Treatment of existing non-historic buildings (Client Shelter, Butler Shelter, Toilets)	Maintained	All existing non-historic buildings would be removed; toilets would be replaced as described below	All existing non-historic buildings would be removed; toilets would be replaced as described below	All existing non-historic buildings would be removed; toilets would be replaced as described below
Addition of new "historically compatible" structures	None	One new structure for NPS storage to be placed adjacent to Guide Shelter; tent pads to be constructed at existing Client Shelter location for placement of Modular Tents	Butler Shelter replaced with Guide cooking and storage building; Client Shelter replaced with new Client Shelter.	One new structure for NPS storage to be placed adjacent to Guide Shelter; new Public Shelter to be placed at existing Client Shelter location; new Client Shelter to be constructed immediately west of Public Shelter.

	Alternative 1	Alternative 2	Alternative 3 (Preferred)	Alternative 4
Replacement of Toilets	Maintain existing; replace as technology improves. Prototype planned to be placed between east toilets.	Replace west toilets with new "separator" toilets that are more visually compatible with historic district; remove east toilets and place two new toilets east of public shelter.	Replace west toilets with new "separator" toilets that are more visually compatible with historic district; remove east toilets and place two new toilets east of public shelter.	Replace west toilets with new "separator" toilets that are more visually compatible with historic district; remove east toilets and place two new toilets east of public shelter.
EFFICIENCY OF OPERATIONS/USE CONFIGURATION				
NPS sleeping, cooking and storage	No change in configuration; Historic Guide Shelter continued to be used by NPS for cooking, sleeping and some storage; Men's Comfort Station continue to be used as storage	No change in configuration; Historic Guide Shelter continued to be used by NPS for cooking, sleeping and some storage; new storage building located west of Historic Guide Shelter (Ranger Station)	No change in configuration; Historic Guide Shelter continued to be used by NPS for cooking, sleeping and some storage; Men's Comfort Station continue to be used as storage	No change in configuration; Historic Guide Shelter continued to be used by NPS for cooking, sleeping and some storage; new storage building located west of Historic Guide Shelter (Ranger Station)
Public sleeping and cooking	Historic Public Shelter continue sleeping and unpartitioned cooking for unguided public up to 18	Historic Public Shelter sleeping for 18-20; Men's Comfort Station converted to separate cooking for public	Historic Public Shelter sleeping for 16 and partition for separate cooking	New public shelter (478 SF) w/ sleeping for 18 & separate cooking located at current Client Shelter location
Guided public sleeping and cooking	Client Shelter maintained until unsafe, then removed under separate NEPA	Client Shelter removed & replaced with 3 modular tents for guide cooking; clients and some guides sleep in tents on Muir Snowfield	Client Shelter removed & replaced with new structure (815 SF) to sleep 36 and storage for guides and clients	New client shelter (645 SF) w/ sleeping for 24 guided clients; near Historic Public Shelter (which is converted for guide use)

	Alternative 1	Alternative 2	Alternative 3 (Preferred)	Alternative 4
Guide sleeping and storage	Butler Shelter and two modular tents on Cowlitz Glacier (seasonal); some sleeping and storage may occur in existing Client Shelter	Guides sleep in tents on Muir Snowfield and may sleep in modular tent; storage in modular tent	Guides sleep in new Client Shelter; storage and cooking in new building west of Ranger Station (replacing Butler Shelter)	Historic Public Shelter reconfigured for guide sleeping (12) & cooking; Guides use Men's comfort station for storage (64 SF)
Toilets	No change in current configuration or toilet type; pit toilets will continue to be emptied by hand and dehydrator toilets will continue to require direct handling of dehydrated fecal material. Fecal contaminated urine will continue to discharge onto Muir Snowfield.	New toilets designed to deposit solid waste into barrels, and discharge urine onto muir snowfield. Limited handling of waste will occur; barrels will be sealed and flown out.	same as in Alt 2	same as in Alt 2
Utilities and instrumentation	No change in existing utility systems.	Utilities/need for lighting, etc may be slightly reduced because guided public is camping on snowfield. Need for propane for snowmelt, etc. is expected to remain the same.	Utilities same as No Action but centralized/ managed.	Utilities similar to No Action but reconfigured because of new building on east side of ridge; still managed and placed for efficiency.
ENVIRONMENTAL FOOTPRINT				
Historic Structures (sq. ft., total)	1003	1003	1003	1003

	Alternative 1	Alternative 2	Alternative 3 (Preferred)	Alternative 4
Existing Non-historic structures including toilets (sq. ft.)	840	0	0	0
New structures including new toilets (sq. ft.)	0	382	1363	1385
Modular tents	two in wilderness	three at Camp Muir (360 sq. ft. total)	none	none
Pathway improvements/ erosion control	No pathway reinforcement/ erosion control conducted as needed	Pathways delineated, defined with low rock walls, gravel surfacing	Pathways delineated, defined with low rock walls, gravel surfacing	Pathways delineated, defined with low rock walls, gravel surfacing
Wilderness footprint (Including temporary structures and campers)	Modular tents on Cowlitz Glacier 240 sq. ft.	Guided clients may camp outside of the Camp Muir footprint; configuration would be compliant with Wilderness limitations	Modular tents no longer on Cowlitz Glacier	Modular tents no longer on Cowlitz Glacier
VISITOR EXPERIENCE				
Visitor Orientation	Continued as is; no kiosk or wayside for resting	Visitor Orientation Kiosk/Wayside	Visitor Orientation Kiosk/Wayside	Visitor Orientation Kiosk/Wayside
Construction activities (temporary)		One season of construction	3 seasons of construction depending on funding	3 seasons of construction depending on funding. Greater displacement during construction due to rearrangement of functions

	Alternative 1	Alternative 2	Alternative 3 (Preferred)	Alternative 4
Anticipated visitor experience in response to final product	Guide public is currently located in Client Shelter close to Ranger Station (Historic Guide Shelter); unguided public located in Public Shelter on east side of Camp Muir.	Guided public sleeping on snowfield (traditional alpine experience), unguided Public continue to use Public Shelter for sleeping, and move cooking to Men's Comfort Station.	Same configuration as no action, with separated sleeping and cooking arrangements; continued separation of NPS Rangers and unguided public.	Independent public positioned closer to Rangers on west side, guided public positioned on east side. Separated cooking and sleeping.
CONSTRUCTION ACTIVITIES				
Helicopter transport during construction (see Table 4)	None (no. of flights to Camp Muir estimated to be 6-14 flight days per year)	Approx. 31 hours, or 5 flight days	Approx. 64 hours, or 11 flight days	Approx. 67 hours, or 11 flight days
Timing and duration of work	none	One year	Three to four years depending on funding	Three to four years depending on funding

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Actions Considered but Dismissed

Early in the internal scoping phase, three preliminary actions were considered. The concept described as “Guide Services West, NPS Central, Public East” was dismissed. Under this option, concessioners would continue to occupy the west side of Camp Muir, the NPS would be centrally located, and the public would continue to occupy the east side of Camp Muir. This potential option consisted of new guide sleeping quarters, new client shelter, new NPS multi-function (visitor contact/ sleeping/ cooking) facility, and public shelter cooking addition. The historic Guide Shelter (currently used as the NPS Ranger Station) would be used for concessioner cooking; the historic Public Shelter and/or dispersed tents on snow would be used for independent sleeping (with an addition for public cooking); the Butler Shelter would remain to provide additional NPS storage space; and three new facilities would be constructed—one to provide NPS visitor contact, cooking, sleeping and storage functions; one to provide concessioner client sleeping; and one to provide guide sleeping.

The concept described as “Guide Services and NPS West, Public East” was also dismissed. Under this option, the guide services and the NPS would continue to primarily occupy the west side of Camp Muir and the public would continue to occupy the east side of Camp Muir. The historic Guide Shelter would continue to be used for NPS sleeping (and would include a small addition for cooking); the Public Shelter and/or dispersed tents on snow would be used for independent sleeping (with a new addition for public cooking); the Butler Shelter would be removed and a new facility for shared NPS and concessioner storage would be constructed in its place; the historic Men’s Comfort Station would continue to provide NPS storage space; and a new facility would be constructed for guide service cooking and sleeping. There would also be an addition to the historic Public Shelter for independent cooking.

The concept described as “Public and NPS West, Guide Services East” was also dismissed. Under this option, existing functional separations at Camp Muir would be reversed, with the public occupying the west side of Camp Muir and the guide services occupying the east side. NPS staff, however, would remain on the west side. The historic Guide Shelter would be used for NPS cooking, while a new building would be connected to the historic Guide Shelter for NPS sleeping; the historic Public Shelter would then be converted via one of several options for use by the guide services; and a new public shelter would be constructed.

These preliminary options were dismissed because they did not meet the purpose and need to restore and preserve the historic character of the Camp Muir Historic District. The options either exceeded the scale of development that currently exists, retained non-historic incompatible structures, or included modifications such as add-ons to historic structures.

Comparison of the Alternatives

The alternatives presented in this document represent a reasonable range of options for rehabilitation of the Camp Muir Historic District. Table 2 provides a summary comparison of the potential impacts associated with each of the alternatives, based on the environmental analysis provided in Chapter 3. Mitigation measures common to all alternatives are contained in the Appendix.

Identification of the Preferred Alternative

A Choosing by Advantages (CBA) workshop was conducted on February 23, 2012. The workshop team included National Park Service subject matter experts and managers and a historical architect from the Washington State Historic Preservation Office.

Three conceptual design alternatives were presented to the team. Alternative 1 provided the least amount of consistency with the Purpose and Need. Alternatives 2 and 3 provided the most consistency with goals and objectives of rehabilitation of the site, and Alternative 4 was considered least desirable in terms of meeting the Purpose and Need, environmental objectives, and historic rehabilitation objectives. Alternative 2 was considered the most problematic for operations, for both NPS and guide services.

Because Alternative 3 is most successful at meeting all aspects of the Purpose and Need, it has been chosen as the preferred alternative. Alternative 3 would restore and preserve the historic character of the Camp Muir Historic District by maintaining historic structures and minimizing changes to the structures (some interior features would be modified); removing non-historic structures, such as the Client Shelter, the Butler Shelter, and toilets; and where needed, constructing new or replacement buildings or structures that are historically compatible in terms of design and location. Alternative 3 would also protect natural resources by addressing issues related to unstable soils, rare lichens, and downstream resources through pathway designation and stabilization, signage, construction practices, and sanitation improvements. Alternative 3 would enhance visitor experience for both day users and overnight guests, and improve visitor and employee safety by improving waste management and reducing hazards in sleeping and cooking facilities.

Table 2. Summary of Camp Muir Rehabilitation EA alternative actions.

Impact Topic	Alternative 1	Alternative 2	Alternative 3 (Preferred)	Alternative 4
Cultural Resources/Camp Muir Historic District/NHLD	The presence of incompatible structures would continue to have an <i>adverse effect</i> on the character of the historic district.	This alternative would be an improvement over existing conditions, but would likely still have an <i>adverse effect</i> on the Camp Muir Historic District/Mount Rainier NHLD due to the placement of modular tents within the district.	This alternative is most compatible with the Camp Muir Historic District, and would likely have <i>no adverse effect</i> on the Camp Muir Historic District/Mount Rainier NHLD.	This alternative would have the greatest change and degree of impact on the Camp Muir Historic District, resulting in an <i>adverse effect</i> on the Historic District and Mount Rainier NHLD.
Geology and Soils	No change, resulting in continued short-term and long-term <i>minor to moderate</i> adverse impacts to soils and local geology.	* Implementation of Alternative 2 would reduce the footprint at Camp Muir, resulting in <i>beneficial and minor</i> impacts. * Stabilizing trails on the Camp Muir ridge would result in <i>minor beneficial</i> impacts to soils.	* Potential long-term impacts would be <i>minor to moderate</i> due to the increased footprint and disturbance of local soils and geology. * Stabilizing trails on the Camp Muir ridge would result in <i>minor beneficial</i> impacts to soils.	* Potential long-term impacts would be <i>minor to moderate</i> due to the increased footprint and disturbance of local soils and geology. * Stabilizing trails on the Camp Muir ridge would result in <i>minor beneficial</i> impacts to soils.
Vegetation	There would be no change in current use patterns, continuing in <i>minor to moderate</i> local impacts to individual lichen and plant species.	Potential impacts to vegetation in the vicinity of Camp Muir would become <i>negligible to minor</i> due to opportunity to reduce potential for access to sensitive areas during and after construction.		

Impact Topic	Alternative 1	Alternative 2	Alternative 3 (Preferred)	Alternative 4
Water Quality (and Waste Disposal)	No change in existing waste disposal system would continue to result in <i>moderate</i> water quality impacts at Camp Muir and the snowfield below.	Water quality is expected to improve during the life of the new toilets; however, <i>minor to moderate</i> impacts to water quality is expected to continue downstream of Camp Muir.		
Wildlife	Impacts of helicopter flights on wildlife would continue to result in long-term, <i>adverse negligible to minor</i> because the flights occur during two short periods each year.	One season of construction would result in short-term <i>minor adverse impacts</i> associated with the addition of two flight periods during each year. Long-term impacts would drop to <i>negligible to minor</i> following construction.	Three seasons of construction would result in short-term <i>moderate adverse impacts</i> associated with the addition of two flight periods during each year. Long-term impacts would drop to <i>negligible to minor</i> following construction.	Three seasons of construction would result in short-term <i>moderate adverse impacts</i> associated with the addition of two flight periods during each year. Long-term impacts would drop to <i>negligible to minor</i> following construction.
Wilderness	Impacts to Wilderness qualities would continue to be <i>adverse and moderate</i> due to the visual intrusive nature of existing structures (Client Shelter, Butler Shelter and toilets) at Camp Muir.	Impacts to wilderness would range from <i>minor to moderate</i> due to impacts of sound related to construction, and would be short-term, lasting one year (weather permitting). Removing modular tents (semi-permanent features) from wilderness and visually intrusive structures from Camp Muir would have long-term moderate beneficial effects on wilderness character.	Impacts to wilderness would be <i>adverse and moderate</i> due to impacts of sound related to increased helicopter flights, but would be temporary, lasting three years for Alternatives 3. * Removing modular tents (semi-permanent features) from wilderness and visually intrusive structures from Camp Muir would have long-term <i>moderate beneficial</i> effects on wilderness character.	* Impacts to wilderness would be <i>adverse and moderate</i> due to impacts of sound related to increased helicopter flights, but would be temporary, lasting three years for Alternatives 4. * Removing modular tents (semi-permanent features) from wilderness and visually intrusive structures from Camp Muir would have long-term <i>moderate beneficial</i> effects on wilderness character.

Impact Topic	Alternative 1	Alternative 2	Alternative 3 (Preferred)	Alternative 4
Air Quality	No change, <i>negligible to minor</i> impacts related to operations.	Potential impacts related to construction are expected to be short-lived and <i>minor</i> , and then drop to <i>negligible to minor</i> following construction (after 1 year).	Potential impacts related to construction are expected to be short-term and <i>moderate</i> , and then drop to <i>negligible to minor</i> following construction (after 3 years).	Potential impacts to air quality related to construction are expected to be short-term and <i>moderate</i> , and then drop to <i>negligible to minor</i> following construction (after 3 years).
Visitor Experience/Safety Common to all action	See below	Improved visitor orientation, improved visual character and new toilets would contribute to long-term <i>minor to moderate beneficial</i> impacts for all alternatives.		
Visitor Experience/Safety	No change, long-term <i>minor to moderate</i> impact on visitor experience related to unpleasant toilet experience and shared cooking and sleeping areas would continue.	* Guided clients would likely sleep in tents on the snowfield, which may result in a <i>negligible to minor</i> adverse or beneficial effect in summer, depending on perspective of individual. * Proximity of NPS storage adjacent to the Ranger Station would improve NPS responsiveness and potentially improve visitor safety (minor beneficial impact) * Construction impacts would be short-term and adverse minor due to one season of construction and associated inconveniences.	* Public shelter proximity to Ranger Station would result in <i>no change/neutral</i> impact related to visitor contact. * Construction impacts would be short-term and <i>adverse moderate</i> due to three seasons of construction and associated inconveniences.	* Proximity of NPS storage and public shelter adjacent to the Ranger Station would improve responsiveness and potentially improve visitor safety (<i>minor to moderate beneficial</i> impact) * Construction impacts would be short-term and <i>adverse moderate</i> due to three seasons of construction and associated inconveniences.

Impact Topic	Alternative 1	Alternative 2	Alternative 3 (Preferred)	Alternative 4
NPS and Concessioner Operations Common to all Action	See below	* Long-term <i>moderate benefit</i> to park operations by reducing handling of untreated human waste * Helicopter operations associated with the waste may increase (an estimated 0-4 additional flights per year may be needed) because waste is not dehydrated. Additional flights would cause a long-term <i>negligible to minor adverse</i> effect on park operations * Public, employee and guide safety would be improved by separating sleeping and cooking functions, a long-term <i>minor to moderate</i> benefit * The new site orientation and kiosk with delineated paths may slightly ease park operations by informing visitors where to gather, a <i>negligible to minor</i> beneficial impact * The helipad would remain in service without disruption during and after construction (a short- and long-term (<i>neutral/no change</i>) benefit to park Search and Rescue operations, maintenance, and visitor gathering)		

Impact Topic	Alternative 1	Alternative 2	Alternative 3 (Preferred)	Alternative 4
NPS and Concessioner Operations	* Cooking in sleeping quarters would continue to result in long-term <i>minor to moderate</i> adverse effect on park operations and guide/employee safety * Need for park staff to directly handle untreated human waste would continue with a <i>minor to moderate</i> long-term impact. * Impacts to operations related to maintenance needs at Camp Muir (maintenance of dilapidated Client Shelter) would continue to be <i>adverse and minor</i>.	* Use of modular tents and lack of hard sided structure resulting in a <i>adverse and moderate</i> impact on NPS and guide service operations due to the increased amount of helicopter flights each season to fly gear and supplies that cannot be stored at Muir over winter and limited space for placement of utilities and instrumentation. * Construction impacts would be short-term and <i>adverse minor</i> due to one season of construction and associated impact to NPS and concessioner operations.	* Park operations under Alternative 3 are expected to improve and result in <i>minor and beneficial</i> due to benefits of new buildings including reduced maintenance, storage and utility placement improvements. * Construction impacts would be short-term and <i>adverse moderate</i> due to three seasons of construction and associated impact to NPS and concessioner operations.	* Park operations under Alternative 4 are expected to improve and result in <i>minor and beneficial</i> due to benefits of new buildings including reduced maintenance, storage and utility placement improvements. * Public shelter proximity to Ranger Station is expected to be noticeable; impacts to park operations are expected to be <i>minor and beneficial</i>. * Construction impacts would be short-term and <i>adverse moderate</i> due to three seasons of construction and associated impact to NPS and concessioner operations.

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Environmentally Preferable Alternative

Environmentally Preferred Alternative

The Council on Environmental Quality (CEQ) regulations implementing NEPA and the National Park Service NEPA guidelines require that "the alternative or alternatives which were considered to be environmentally preferable" be identified (CEQ Regulations, section 1505.2). Environmentally preferable is defined as "the alternative that causes the least damage to the biological and physical environment and that best protects, preserves, and enhances historic, cultural, and natural resources (46 FR 18026–46 FR 18038)."

Section 101 of NEPA states that: "It is the continuing responsibility of the Federal Government to ...

- 1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;*
- 2. Ensure for all Americans, safe, healthful, productive and esthetically and culturally pleasing surroundings;*
- 3. Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;*
- 4. Preserve important historic, cultural and natural aspects of our natural heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;*
- 5. Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities;*
- 6. Enhance the quality of renewable resources and approach the maximum attainable recycling of depleteable resources."*

Alternative 1 (No Action) would not meet any of the criteria relative to the action alternatives because further historic rehabilitation would not occur as with the action Alternatives. While it is expected that in time toilet facilities may be improved, this would occur at a later time and likely piecemeal as funds become available. Thus this alternative would not best protect, preserve, or enhance cultural or natural resources, nor would it provide for the safety improvements or visitor experience elements proposed under the action alternatives.

Alternatives 2, 3 and 4 would meet criteria no. 1, 2, 3, 4 and 5 through the rehabilitation of the Camp Muir Historic District and Mount Rainier NHL, and through the improvement of toilet facilities intended to reduce environmental impacts. Alternative 2 meets all six criteria, including number 6 through minimum development that requires less energy to construct and uses the least amount of material that would need to be imported. Alternative 3 best meets criteria 2 by replacing the existing

incompatible Client Shelter with a historically compatible structure that also blends into the natural environment, versus the placement of modular tents that would intrude upon the historic character of the site, and interrupt the view to the historic Guide Shelter. Alternative 4, while similar in scope (footprint, cost, materials) to Alternative 3, introduces an additional structure that changes the visual character of Camp Muir including the skyline as a visitor approaches the ridge. Because of this, Alternative 4, while a significant improvement over the No Action Alternative, does not meet criteria 1-4 as well as Alternative 3.

Alternative 2 is believed to cause the least amount of damage to the biological and physical environment, including Wilderness; however, Alternative 3 best protects and preserves the historical and cultural resources, while protecting natural resources second to Alternative 2. Because of this, Alternatives 2 and 3 are equally considered Environmentally Preferable. Alternative 3 is the Preferred Alternative because it meets objectives identified in the purpose and need (Chapter 1) of this analysis supporting public and employee safety, operational improvements and visitor experience.

CHAPTER III: Affected Environment and Environmental Consequences

Introduction

This chapter describes the environment that could be affected by the alternatives of the Camp Muir Rehabilitation Plan and analyzes the potential environmental impacts of the proposed actions within each alternative. The chapter is organized by impact topics that were derived from internal park and external public scoping, other agencies, and to address federal laws, regulations and orders, and NPS policy. A brief rationale for the selection or non-selection of each impact topic is given below. Impacts are evaluated based on context, duration, intensity and whether they are direct, indirect, or cumulative.

In an environmental effects analysis, “no measurable effect” is used in determining whether a categorical exclusion applies or whether impact topics may be dismissed from further evaluation in an EA or EIS. The use of “no measurable effects” in this EA pertains to whether the impact topic is dismissed from further detailed evaluation in the EA. In general, using “no measurable effect” to determine whether impact topics are dismissed from further evaluation provides reasonable basis to concentrate on the issues that are truly relevant to the action in question, rather than amassing needless detail, in accordance with Council of Environmental Quality (CEQ) regulations at 1500.1(b).

In this section of the EA, the NPS provides a limited evaluation and explanation as to why some impact topics are not evaluated in more detail. Impact topics are dismissed from further evaluation in this EA if:

- They do not exist in the analysis area, or
- They would not be affected by the proposal, or the likelihood of impacts are not reasonably expected, or
- Through the application of mitigation measures, there would be minor or less effects (i.e., no measurable effects) from the proposal, and there is little controversy on the subject or reasons to otherwise include the topic.

For issues or impact topics with no effect or no measurable effect, there would either be no contribution toward cumulative effects or the contribution would be low. For each issue or topic presented below, if the resource is found in the analysis area or the issue is applicable to the proposal, then a limited analysis of direct, indirect, and cumulative effects is presented.

Resource Topics Considered in this Environmental Assessment

Resource topics considered were selected based on federal law, regulations, executive orders, NPS management policies, NPS subject matter expertise, and concerns expressed by other agencies or members of the public during scoping and comment periods. Impacts of the alternatives on the following topics are presented in this Environmental Assessment: historic structures and cultural landscapes, soils and geology, water resources (water quality), vegetation, wildlife, wilderness, air quality, visitor experience, and park operations.

Historic Structures/Cultural Landscapes: Consideration of the impacts to cultural resources is required under provisions of Section 106 of the National Historic Preservation Act of 1966, as amended, and the 2008 Programmatic Agreement among the National Park Service, the National Conference of State Historic Preservation Officers, and the Advisory Council on Historic Preservation. It is also required under Management Policies (NPS 2006). Federal land managing agencies are required to consider the effects proposed actions have on properties listed in, or eligible for inclusion in, the National Register of Historic Places (i.e., Historic Properties), and allow the Advisory Council on Historic Preservation a reasonable opportunity to comment. Agencies are required to consult with federal, state, local, and tribal governments/organizations, identify historic properties, assess adverse effects to historic properties, and negate, minimize, or mitigate adverse effects to historic properties while engaged in any federal or federally assisted undertaking (36 CFR Part 800). Requirements for proper management of museum objects are defined in 36 CFR 79.

Soils: Management Policies (NPS 2006) require the NPS to understand and preserve and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil. Under proposed alternatives in this Environmental Assessment disturbance to soils would occur as a result of the proposed actions. Soils are included as part of the Geology discussion.

Geologic/Geothermal Resources/Geological Hazards: National Park Service Management Policies (2006) calls for analysis of geological hazards should they be relevant. Site geology is relevant to the design of proposed actions.

Vegetation: The National Environmental Policy Act (NEPA) calls for examination of the impacts on the components of affected ecosystems. NPS policy is to protect the natural abundance and diversity of park native species and communities, including avoiding, minimizing or mitigating potential impacts from proposed projects. Few plants persist at the high elevation Camp Muir, except a vascular plant; also mosses and what are believed to be sensitive lichens, which are found in the area above the Butler Shelter and to the east of the Public Shelter. While impacts to vegetation are not expected to be

measurable due to best management practices, an evaluation is included to maintain awareness of their existence. The design of the proposed actions will consider and avoid the location of sensitive lichen areas.

Water Quality: The 1972 Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977, is a national policy to restore and maintain the chemical, physical, and biological integrity of the nation's waters, to enhance the quality of water resources, and to prevent, control, and abate water pollution. NPS Management Policies provide direction for the preservation, use, and quality of water in national parks. Section 401 of the Clean Water Act as well as NPS policy requires analysis of impacts on water quality.

Wildlife: The National Environmental Policy Act (NEPA) calls for examination of the impacts on the components of affected ecosystems. NPS policy is to protect the natural abundance and diversity of park native species and communities, including avoiding, minimizing or mitigating potential impacts from proposed projects.

Wilderness: NPS wilderness management policies are based on provisions of the 1916 NPS Organic Act, the 1964 Wilderness Act, and legislation establishing individual units of the national park system. These policies establish consistent service-wide direction for the preservation, management, and use of wilderness and prohibit the construction of roads, buildings and other man-made improvements and the use of motorized vehicles in wilderness. All park management activities proposed within wilderness are subject to review following the minimum requirement concept and decision guidelines. The public purpose of wilderness in national parks includes the preservation of wilderness character and wilderness resources in an unimpaired condition, as well as for the purposes of recreational, scenic, scientific, education, conservation, and historical use. Camp Muir is a non-wilderness enclave surrounded by designated wilderness. Although all construction activities would occur outside of wilderness, proposed actions may have transitory effects on wilderness from construction and helicopter noise or from possible changes in the distribution of guided clients who overnight at Muir.

Air Quality: The park is designated a Class I area under the Clean Air Act of 1977. Class I area designation is granted to national parks greater than 6,000 acres, designated wilderness areas, memorial parks greater than 5,000 acres, and international parks. This designation maintains the highest air quality and allows only small increments of pollutants above the existing park levels. In addition, the designation requires protection of air quality related values (AQRV) important to the overall park visitor experience. Air Quality is relevant to the project because of the need to use motorized equipment to transport materials and supplies to Camp Muir, and the possible use of motorized tools to demolish or build structures.

Visitor Experience and Safety: Dependent on the selected alternative, a variety of impacts to visitor use may occur. Based on Management Policies, impacts to visitors are considered with respect to park undertakings.

Park Operations and Employee Safety: Impacts to park operations and visitor services are often considered in Environmental Assessments to disclose the degree to which proposed actions would change park management strategies and methods.

Impact Topics Dismissed from Further Consideration

The following impact topics were eliminated from further analysis because impacts would be minor or less. The topics either would not be affected or would be affected only negligibly by the alternatives evaluated in this Environmental Assessment. Negligible effects are considered temporary and localized, and would not be measurable over existing conditions. The rationale for dismissing these specific topics is stated for each resource.

Special Status Wildlife Species: The Endangered Species Act (ESA) requires an examination of impacts to all federally listed threatened or endangered species. NPS policy also requires an analysis of impacts to state-listed threatened or endangered species and federal candidate species. Under the ESA, the NPS is mandated to promote the conservation of all federal threatened and endangered species and their critical habitats within the park boundary. Management Policies include the additional stipulation to conserve and manage species proposed for listing. Because no federally listed species or habitats are known to occur in or near the project area, this topic has been dismissed from further consideration. Table 3 lists species or their habitat listed under ESA that may be present within Mount Rainier National Park.

Table 3. Federally listed Endangered, Threatened, Proposed and Candidate Species, Mount Rainier National Park (USFWS 2011, NOAA 2011).

Common Name	Scientific Name	Federal Status	Habitat present in or near project area?	Species documented in or near project area?
Northern spotted owl	<i>Strix occidentalis caurina</i>	Threatened	No	No
Marbled murrelet	<i>Brachyramphus marmoratus marmoratus</i>	Threatened	No	No
Fisher	<i>Martes pennanti</i>	Candidate	No	No
Gray wolf	<i>Canis lupus</i>	Endangered	Yes	No
Canada lynx	<i>Lynx canadensis</i>	Threatened	Yes	No
Grizzly bear	<i>Ursus arctos horribilis</i>	Threatened	No	No
Chinook salmon (Puget Sound Evolutionarily Significant Unit)	<i>Oncorhynchus tshawytscha</i>	Threatened	No	No
Bull trout	<i>Salvelinus confluentus</i>	Threatened	No	No
Steelhead (Puget Sound)	<i>Oncorhynchus mykiss</i>	Threatened	No	No
Dolly varden trout	<i>Salvelinus malma</i>	Proposed	No	No
Coho salmon	<i>Oncorhynchus kisutch</i>	Proposed	No	No

Prehistoric and Historic Archeological Resources: The park's planning efforts must conform to the Archeological Resources Protection Act in protecting known or undiscovered archeological resources. Ongoing analysis of Camp Muir has resulted in no identification of archeological resources.

If present, archeological resources are likely to have been buried by deposits from successive volcanic eruptions or debris flows. It is possible that excavation during construction of building foundations may uncover archaeological resources. Therefore, if prehistoric or historic archeological resources were discovered during implementation of the proposed action, work in the area associated with the find would cease until evaluated by the park archeologist or designated representative. If necessary or possible, relocation of work to a non-sensitive area would occur to enable more site testing and documentation. Long-term actions could include reinitiating the project in the same area (upon effective data collection) or relocating the action (if possible). There would be an emphasis on taking actions that would avoid further disturbance to the site. Because surveys, investigations, and tribal consultation have not affirmatively identified archaeological resource issues associated with Camp Muir, this topic have been dismissed from further consideration.

Ethnography: Mount Rainier National Park and the surrounding area have a long history of use by prehistoric and contemporary Native Americans. Analysis of impacts to known resources is important under the National Historic Preservation Act and other

laws. The National Park Service defines ethnographic resources as any “site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it” (DO-28, Cultural Resource Management Guideline, p. 181).

Based on several investigations into the archeology, history and ethnography of Mount Rainier National Park (Thompson 1981, Catton 1996, Carr 1997, Boxberger 1998, Smith 1964, Burtchard 1998), no specific Native American use of the proposed project area has been documented to date. A project-specific survey of Camp Muir by park archeologists in 2001 (ARR2001-17) also failed to document prehistoric or historical remains beyond the National Register buildings noted elsewhere in this document. It should be noted, however, that (1) archeological and ethnographic surveys have been limited in scope, and (2) Paradise lies within the general traditional use area of the Nisqually Indian Tribe. Furthermore, early historic period travel routes into this quadrant of the park via the Nisqually River suggest at least periodic use during the prehistoric past. Modern Nisqually and Cowlitz tribal members consider Mount Rainier to be of exceptional spiritual and traditional value. However, during consultation with the Cowlitz and Nisqually Tribes regarding plans proposed for Camp Muir, no ethnography concerns were raised about the Camp Muir area. Because surveys, investigations, and tribal consultation have not affirmatively identified archaeological or ethnographic issues associated with Camp Muir, these topics have been dismissed from further consideration.

Collections: Management Policies and other cultural resources laws identify the need to evaluate effects on National Park Service Collections if applicable. The collections at Mount Rainier National Park would not be affected by the proposed project, except by the potential addition of materials for the collections if any are found; therefore, this topic has been dismissed from further consideration.

Wetlands: Executive Order 11990 requires that impacts to wetlands be addressed. There are no wetlands located at Camp Muir; therefore there would be no impacts on wetlands.

Floodplains: Executive Order 11988 (Floodplain Management) requires an examination of impacts to floodplains and potential risk involved in placing facilities within floodplains. NPS Management Policies, DO-2 (Planning Guidelines), and DO-12 (Conservation Planning, Environmental Impact Analysis, and Decision Making) provide guidelines for proposals in floodplains. Executive Order 11988 requires that impacts to floodplains be addressed. There are no floodplains in the vicinity of Camp Muir. Therefore, there would be no effect on floodplains.

Environmental Justice: Executive Order 12898 requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their

programs and policies on minorities and low-income populations and communities. This Executive Order does not apply to the subject of this Environmental Assessment. The actions evaluated in this Environmental Assessment would not affect socially or economically disadvantaged populations.

Prime and Unique Farmlands: No prime or unique farmlands are known from Mount Rainier National Park. There would be no effect on prime or unique farmlands.

Wild and Scenic Rivers: No Wild and Scenic Rivers are designated or proposed within the proposed project area. There would be no effect on Wild and Scenic Rivers.

Safety: The popular near-five-mile hike to Camp Muir attracts many day hikers as well as climbers during peak summer months. The hike to Camp Muir is potentially dangerous, particularly with sudden weather changes that result in whiteouts over much of the snowfield. Because the snowfield may be crevassed (particularly early or late during the climbing season), and because the often highly crevassed and steep Nisqually Glacier lies just to the west of the snowfield, a sudden fall or misstep may result in an injurious or deadly slide. Each year hikers become lost and/or injured on the Muir Snowfield, leading to activation of Search and Rescue (SAR) operations.

A second issue related to visitor safety is the continued use of oxygen-consumptive fuel stoves in the poorly ventilated buildings at Camp Muir (Butler Shelter, Public Shelter and Guide Shelter), although no asphyxiation incidents have been reported.

Safety is addressed through discussions related to Visitor Experience and Operations.

Socioeconomics: Socioeconomic impact analysis is required, as appropriate, under NEPA and NPS Management Policies pertaining to gateway communities. Socioeconomic effects of the proposed alternatives would be localized and short-term and would not affect long-term economic conditions in the vicinity of the park. Rehabilitation and construction costs would be borne by existing concession franchise fees, NPS funds, and other appropriate existing sources of revenue. The order of estimated cost of action alternatives from lowest to highest is: Alternative 2, Alternative 3, and Alternative 4. Cost of construction ranges from \$325,600 to \$753,500, and is proportional to the square footage of constructed elements within each alternative.

Environmental Impact Analysis Criteria

The National Environmental Policy Act (NEPA) requires that environmental documents disclose the environmental impacts of the proposed federal action, reasonable alternatives to that action, and any adverse environmental effects that cannot be avoided should the proposed action be implemented. This section analyzes the environmental impacts of project alternatives on affected park resources. These analyses provide the basis for comparing the effects of the alternatives. NEPA requires

consideration of context, intensity and duration of impacts, indirect impacts, cumulative impacts, and measures to mitigate impacts.

Methodology

The environmental consequences for each impact topic were defined based on the following information regarding context, type of impact, duration of impact, area of impact and the cumulative context.

Context: Setting within which impacts are analyzed, such as the project area or region; or for cultural resources, the area of potential effects.

Type of Impact: A measure of whether the impact will improve or harm the resource and whether that harm occurs immediately or at some later point in time.

Beneficial: Reduces or improves impact being discussed.

Adverse: Increases or results in impact being discussed.

Direct: Caused by and occurring at the same time and place as the action, including such impacts as animal and plant mortality, damage to cultural resources, etc.

Indirect: Caused by the action, but occurring later in time at another place or to another resource, including changes in species composition, vegetation structure, range of wildlife, offsite erosion or changes in general economic conditions tied to park activities.

Duration of Impact: Duration is a measure of the time period over which the effects of an impact persist. The duration of impacts evaluated in this EA may be one of the following:

Short-term: Often quickly reversible and associated with a specific event, lasting no more than one to five years.

Long-term: Reversible over a much longer period, or may occur continuously based on normal activity, or for more than five years.

Area of Impact

Localized: Detectable only in the vicinity of the activity.

Widespread: Detectable on a landscape scale (beyond the affected site).

Cumulative: Cumulative impacts are the effects on the environment that would result from the incremental impacts of the action when added to other past, present and reasonably foreseeable future actions. Impacts are considered cumulative regardless of what agency or group (federal or non-federal) undertakes the action.

Impact Mitigation

Avoid conducting management activities in an area of the affected resource.

Minimize the type, duration or intensity of the impact to an affected resource.

Mitigate the impact by

- * *Repairing* localized damage to the affected resource immediately after an adverse impact.
- * *Rehabilitating* an affected resource with a combination of additional management activities.
- * *Compensating* a major long-term adverse direct impact through additional strategies designed to improve an affected resource to the degree practicable.

Impact Thresholds

Negligible: Measurable or anticipated degree of change would not be detectable or would be only slightly detectable. Localized or at the lowest level of detection.

Minor: Measurable or anticipated degree of change would have a slight effect, causing a slightly noticeable change of approximately less than 20 percent compared to existing conditions, often localized.

Moderate: Measurable or anticipated degree of change is readily apparent and appreciable and would be noticed by most people, with a change likely to be between 21 and 50 percent compared to existing conditions. Can be localized or widespread.

Major: Measurable or anticipated degree of change would be substantial, causing a highly noticeable change of approximately greater than 50 percent compared to existing conditions. Often widespread.

Cultural Resources Impacts: Potential impacts to cultural resources (archeological resources, prehistoric or historic structures, cultural landscapes, and traditional cultural properties) either listed in or eligible to be listed in the National Register of Historic Places were identified and evaluated in accordance with the Advisory Council on Historic Preservation's regulations implementing §106 of the National Historic Preservation Act (36 CFR 800, Protection of Historic Properties) by (1) determining the area of potential effects; (2) identifying cultural resources present in the area of potential effects that are National Register listed or eligible; (3) applying the criteria of adverse effect to affected resources; and (4) considering ways to avoid, minimize or mitigate adverse effects.

Under the Advisory Council's regulations a determination of *no historic properties affected*, *adverse effect*, or *no adverse effect* must be made for affected National Register listed or eligible cultural resources. A determination of no historic properties affected means that either there are no historic properties present or there are historic properties present but the undertaking will have no effect upon them (36 CFR 800.4(d)(1)). An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the National Register, e.g. diminishing the integrity (or the extent to which a resource retains its historic appearance) of its location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably

foreseeable effects caused by the alternatives that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5(a)(1)). A determination of no adverse effect means there is an effect, but the effect would not meet the criteria of an adverse effect, that is, diminish the characteristics of the cultural resource that qualify it for inclusion in the National Register (36 CFR 800.5(b)).

Thus, the criteria for characterizing the severity or intensity of impacts to National Register listed or eligible archeological resources, prehistoric or historic structures, cultural landscapes, and traditional cultural properties are the §106 determinations of effect: no historic properties affected, adverse effect, or no adverse effect. A §106 determination of effect is included in the conclusion section for each analysis of impacts to National Register listed or eligible cultural resources.

- *No Historic Properties Affected:* There are no historic properties within the area of potential effect of the proposed undertaking or there are historic properties present but the undertaking will have no effect upon them.
- *No Adverse Effect:* Historic properties are present, but the proposed actions will not significantly alter characteristics of the property that qualify the property for inclusion in the National Register. The actions are consistent with the Secretary's Standards for the Treatment of Historic Properties.
- *Adverse Effect:* An undertaking is considered to have an adverse effect when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

Affected Environment and Environmental Consequences for Each Impact Topic

Historic Structures/Cultural Landscapes Affected Environment

Mount Rainier National Historic Landmark District (NHL)

Camp Muir is part of the Mount Rainier National Historic Landmark District, which was listed on the National Register of Historic Places in 1997 due to its national significance in landscape architecture and planning. There are 158 features including buildings, structures, roads and trails listed as contributing features in the district. Many more sites, structures and objects have been determined to be or are potentially eligible for the National Register. Together, these resources are considered to be the best example of park master planning in the National Park System. Collectively, they represent an important stage in National Park development history.

At Mount Rainier in the 1920s and 1930s, the NPS Landscape Planning Division invented and defined modern National Park planning. The Master Plan for Mount Rainier, completed in 1929, was one of the first National Park master plans developed by the NPS, and it was and is considered a model of NPS planning. The degree of conformance to the plan still present in the park is outstanding. As a whole, no other collection of park roads, bridges, developed areas and trails is more completely preserved as an intact example of National Park planning and design of the period 1904-1957.

Prior to designation of the Mount Rainier National Historic Landmark District, six historic districts were designated in the park for their rustic architectural significance. The Camp Muir Historic District, designated in 1991, is one of the six.

Camp Muir Historic District

The Camp Muir Historic District was listed in the National Register of Historic Places in 1991 for its significance in architecture and in recreational development at Mount Rainier and was included in the Mount Rainier National Historic Landmark District, designated in 1997. These nominations listed the Guide Shelter, Public Shelter and Men's Comfort Station as contributing buildings. Additional documentation of landscape characteristics and associated features that contribute to the district was provided by the Cultural Landscape Inventory of Camp Muir in 2001, which received SHPO concurrence in 2004. The period of significance for Camp Muir is from 1916 to 1936.

The three historic buildings at Camp Muir are all stone masonry construction with a low profile, and blend with the surrounding rocky context through their form and materials. The Guide (Cook) Shelter, designed by Seattle architect Carl Gould, was built in 1916. The Public Shelter, designed by the NPS, was built in 1921, with a dedication plaque to John Muir. The Men's Comfort Station was built by the Civilian Conservation Corps (CCC) in 1936. The original Women's Comfort Station, built at the same time, later collapsed, and only remnants of the walls remain, since much of that material was used in the retaining walls around the site.

Camp Muir Historic Structures

All the historic structures at Camp Muir were built in the early 20th century. They are all constructed of rough stone and mortared masonry. The character of the stonework can be described as rustic, designed to blend with the natural character of the surrounding environment. The exterior walls on the Guide Shelter and Public Shelter were designed with wider foundations to enhance this rustic character. All three structures have recently been rehabilitated (including moving the Men's Comfort Station to more stable ground), and all have had skylights added.

Over the years, some historic structures with stone walls and rock foundations have lost significant amounts of material as a result of natural erosion processes on sloping terrain. Because of this, all three historic buildings at Camp Muir have undergone some form of foundation stabilization and repair using concrete and/or supplemental rock.

Most of these repairs have occurred on the north sides of each structure where most of the undercutting takes place.

Climatic conditions at Camp Muir, including the prevalence of fierce and sustained winds, result in limited snow accumulations on the roofs of buildings. Snow is typically blown off the roofs rather than accumulating at great depth on top of the structures. This wind-blown effect has protected the structures, since few buildings could otherwise withstand the intense snow loads normally occurring at this elevation.

Historic Guide Shelter (adapted from The Portico Group 2002): The first structure built, known as the Climbers' Shelter (and later known as the Guide Shelter) was completed in 1916. The Guide Shelter is approximately 19½ feet by 7½ feet in interior floor space, and is a bunker-like building with a single door opening and four tiny window apertures in the north and south walls. The one-room interior originally contained two bunk beds and a small kitchen. This small building was constructed of stone rubble walls two to three feet thick, with an almost flat tar and gravel roof with exposed whole log rafters and exposed rafter tails or purlins. The interior walls were covered with cement mortar. The exterior rock walls are currently mortared, but historical photographs indicate that the walls originally were dry-stacked. The foundation is concrete and stone rubble. Rough stone rubble steps lead to the front door. The 7½-foot ceiling has exposed joists. The building also has a concrete floor of indeterminate thickness and reinforcing.

The massive walls in this structure are over four feet thick in some locations around the base, and taper to approximately two feet thick at the top. The stones used in the walls are relatively small, and there is little evidence of the finer art of stone building such as maintaining outward vertical faces, breaking vertical joints with subsequent tiers, maximizing contact between adjacent rocks and laying the walls up with consistent batter, or pitch. The placement of the 12 (five-inch nominal diameter) roof purlins is irregular, as is the pitch of the roof (approximately 1:12).

The Guide Shelter has stood for more than 80 years in a severe environment relatively intact, with erosion around the foundation perimeter the only factor threatening its existence. The structural integrity of the Guide Shelter is a testament to the building's massive bulk. There have been at least two or more significant foundation stabilization efforts below the north face of the building. Some of this work involved mortar and stone masonry, laid up in superior fashion to that of the original building, and at least one notable effort was made using reinforced concrete. Several other notable modifications have been made to the building since construction, including the addition of a small skylight and sheathing the interior walls with an assortment of plywood sheathing over 2 x 4 nailers.

Historic Public Shelter (adapted from The Portico Group 2002): The second structure built is known as the Public Shelter and was completed in 1921. It was designed by the

National Park Service, and closely resembles the Guide Shelter in materials and construction techniques. It is roughly twice the size of the Guide Shelter, approximately 12 feet by 25 feet (approximately 300 square feet), with 18-inch thick dry-stone rubble walls that have stucco interiors. The roof was flat tar and gravel with whole log rafters. Exposed rafter tails and stone finials defined the roofline of this structure. The original door opened in the south wall, which remained in place at least until the 1940s when it was sealed (to avoid snow accumulation) and a new doorway was added in the west wall. Wood bunk platforms provided space for overnight campers. The historic appearance of the south wall was restored in 2005, including restoration of the original door opening, stone steps, and stone and wood benches.

A great level of planning and execution went into the construction of the Public Shelter. The stones in the walls are larger, more angular, and more attention was paid to the orientation of the rock faces in the interior and exterior walls of this building compared to the Guide Shelter. Subsequent tiers consistently break vertical joints between adjacent rocks, and the batter of the walls is relatively consistent around the perimeter. Early architectural drawings of the building exist that predate construction, signed as approved by Daniel Hull, head of the newly formed NPS Landscape Design office.

The base wall thickness of the Public Shelter is about 2½ feet, much less than the Guide Shelter, and the structure has a top-of-wall thickness of approximately 1½ feet. It should be noted that the two prominent buttresses at the southwest and southeast corners of the building are ornamental and serve no particular structural purpose. The interior walls have been plastered and troweled with cement/mortar and painted for sealing against wind and/or snow.

A new concrete floor was poured in 2005 and remains in good condition. A new concrete roof was installed in 2005. The roof is supported by thirteen rafter/purlins (6-inch nominal diameter) that in turn rest on a timber purlin (8-inch diameter) upheld by three vertical timber posts (8-inch diameter) in the east and west end walls. It should also be noted that the base of the north wall has been repaired or buttressed by the addition of reinforced concrete.

Men's Comfort Station (adapted from *The Portico Group* 2002): This structure was constructed by the Civilian Conservation Corps (CCC) between 1935 and 1936, and originally functioned as a men's comfort station. This structure remained in use until 1973, when new toilets were added to the site and the original pit toilets were no longer used. The structure was constructed with methods similar to the other shelters, in that it is comprised of dry-stone rubble masonry, with whole log rafters in the roof. The original construction included a stone wall in front of the entry door as a privacy screen. This was removed in 1973 when the building's use was converted to storage.

The Men's Comfort Station is the smallest of the site's historic structures (49 square feet of interior space) and was originally perched on the north edge of the Muir saddle

above the Cowlitz Glacier. The building's location was a matter of convenience, as the aperture through which human waste passed was directed to expel material over the cliff and onto the glacier below. The perilous location exacted a toll however, as the foundation under the north wall was severely undermined by glacial scour and was patched at least twice, once using native stone and again later by placement of reinforced concrete. Finally, it was relocated closer to the front of the Public Shelter in summer 2005. A companion Women's Comfort Station has since been demolished and its rocks incorporated into other structures. Only remnant walls from the Women's Comfort Station remain on the northeast side of the Public Shelter.

The Men's Comfort Station was constructed during the CCC era in the 1930s. As such it typifies an even more refined approach to stone building, with even larger, rectangular stones, and much more careful attention to masonry techniques including joint breaking between courses, flat faces, plumb walls, and tighter joints. The roof is similar construction to the other historic structures, with log purlins providing support. The interior walls have not been finished with a cement plaster veneer, but instead remain native stone. Minimal mortar was used in construction of the Men's Comfort Station, probably to impart a more rustic and natural exterior appearance.

Historic Structures/Cultural Landscapes Environmental Consequences: Camp Muir Historic District/Mount Rainier National Historic Landmark District

Impacts of Alternative 1: There would be no additional impacts on historic structures or cultural landscapes under Alternative 1. The presence of incompatible structures would continue to have an *adverse effect* on the character of the historic district.

Impacts Common to Alternatives 2-4: Under all action alternatives, new structures, retaining walls, and stairways would be constructed, and selected site pathways given a layer of crushed rock to create more durable, defined limits for foot traffic at the site and to minimize wind erosion of the underlying volcanic pumice. New structures would be designed and constructed to be more compatible with the historic district by incorporating rustic stonework and low profile design to blend in with the natural environment. New structures are proposed to address safety issues associated with using propane and white gas stoves in existing historic structures and to improve resource conditions and visitor use experience for both day users and overnight visitors. Because there is little buildable space at Camp Muir, all alternatives propose construction of new structures within the Camp Muir Historic District and the existing footprint.

Existing character-defining cultural landscape characteristics, including circulation patterns and the massing of buildings at two distinct nodes on each side of the ridge, would be maintained to varying degrees in all alternatives. Where new buildings have

been proposed, effects on the historic district would be diminished by the careful siting of new structures; by encouraging compatible design and the use of appropriate materials; and by minimizing the physical footprint while assuring operational efficiency to meet programmatic needs at Camp Muir. All existing non-historic structures would be removed. New toilets sited on the west side of the ridge would be located in the same place as the former structures. Toilets currently located at the center of the ridge would be removed; the replacement toilets would be sited to the east of the historic Public Shelter. Removal of existing toilets from the center of the ridge would result in a long-term beneficial effect by removing these incompatible structures from their prominent location within the historic district.

Impacts of Alternative 2: Under Alternative 2, all non-historic buildings would be removed. The following new structures would be constructed within the Camp Muir Historic District/Mount Rainier National Historic Landmark District (NHLD) (from west to east): two new toilets, a small NPS storage structure to replace current use of the historic Men's Comfort Station, and two new toilets east of the historic Public Shelter. The historic Men's Comfort Station would be converted to a cooking shelter for public use. The area at the center of the ridge that is currently occupied by three toilets would become open space, restoring historic views to and from the Public Shelter. Three platforms would be constructed where the Client Shelter currently exists. During the primary climbing season, guides would use the platforms to erect up to three modular tents to be used for storage and cooking. During the off-season, the modular tent structures would be removed and the historic appearance of Camp Muir would thus be restored intermittently. As such, there would appear to be more open space at Camp Muir without the Client Shelter or another permanent structure being the first structure seen on the approach, an intermittent minor to moderate beneficial effect. However, during the summer season when most people visit Camp Muir, modular tents would be in place and would detract from the historic character of the district. While this alternative would be an improvement over existing conditions, this alternative would likely still have an *adverse effect* on the Camp Muir Historic District/Mount Rainier NHLD.

Impacts of Alternative 3: Under Alternative 3, all non-historic buildings would be removed and the following new structures would be constructed within the Camp Muir Historic District/Mount Rainier NHLD (from west to east): two new toilets, new guide service storage and cooking facility (east of the former Butler Shelter location), new guided public sleeping facility (near the location of the current Client Shelter), and two new toilets east of the historic Public Shelter. All new structures would be sited to minimize their impact on the historic district. Locating the new guide service storage and cooking facility behind the historic Guide Shelter, rather than at the current location of the Butler Shelter, would minimize the visual impact when approaching the site from the trail below. The new guided public shelter would be shifted slightly toward the ridge from the current location, reducing the visual impact while providing a firmer base for the building. The area at the center of the ridge that is currently occupied by three

toilets would become open space, restoring historic views to and from the Public Shelter. This alternative is most compatible with the Camp Muir Historic District, and would likely have *no adverse effect* on the Camp Muir Historic District/Mount Rainier NHL.

Impacts of Alternative 4: Under Alternative 4, all non-historic buildings would be removed and the following new structures would be constructed within the Camp Muir Historic District/Mount Rainier NHL (from west to east): two new toilets, new NPS storage facility (east of the former Butler Shelter location), new independent public sleeping facility (near the location of the current Client Shelter), new guided public sleeping facility (in the area at the center of the ridge that is currently occupied by three toilets), and two new toilets east of the historic Public Shelter. Unlike the other alternatives, this alternative reverses functional separations at Camp Muir, because the public would occupy the west side of Camp Muir and the guide services would occupy the east side. The historic Public Shelter would become the new center of guide service operations (interior space would be converted to accommodate cooking), along with the new building constructed for additional guided client sleeping. On the west side, a new facility would be constructed to serve as a public shelter (for both sleeping and cooking). The historic Guide Shelter would continue to be used as a ranger station/NPS sleeping facility, and a separate structure would be added for storage behind the Guide Shelter. Changes would occur on the interior of the historic Public Shelter to accommodate the change in use, but the exterior would retain its current appearance. Construction of a large new guided client sleeping shelter between the helipad and the historic Public Shelter would have a considerable impact on the historic district, altering circulation patterns and blocking views to and from the historic Public Shelter. Alternative 4 would therefore likely have an *adverse effect* on the Camp Muir Historic District/Mount Rainier NHL.

Cumulative: Under Alternatives 2–4, removal of all incompatible structures from the Muir Ridge, including replacement of the Client Shelter with either a more compatibly designed structure (Alternatives 3 and 4) or tie-down tent pads (Alternative 2), would have beneficial effects on the Camp Muir Historic District. This would end the cumulative nature of more recent incompatible development at Camp Muir. Continued rehabilitation and preservation of historic structures at Camp Muir and establishment of a standard that maintains the historic integrity of the Historic District will make it less likely that the Camp Muir Historic District and NHL will be compromised again in the future.

Conclusion: Camp Muir is a compact developed site, located on an exposed ridge at high elevation and surrounded by wilderness, factors that create unique challenges for managing and maintaining this site. Listed in the National Register in 1991 and included in the Mount Rainier NHL in 1997, Camp Muir has undergone several changes since the 1930s, including the installation of toilets, addition of the Client Shelter, and the construction of retaining walls. Changes proposed in Alternatives 2–4 are intended to

rehabilitate the site by removing non-compatible structures and by stabilizing the ground plane to reduce erosion that undercuts the stability of all structural components. Proposed changes would also restore historic spatial organization, enhancing views to the district and within the camp. All alternatives were developed in consideration of *The Secretary of the Interior's Standards for the Treatment of Historic Properties*. However, while all three would improve the character of the district to some degree, only Alternative 3 would likely result in *no adverse effect* to the district.

Geology and Soils Affected Environment

Camp Muir is approximately 360 feet long from east to west and varies in width from 60 to 90 feet, with the narrowest part of the ridge about 15 feet wide. The total area is 1.1 acres. The site, like the surrounding topography, varies greatly. Bounded on the north and south sides by the Cowlitz Glacier and the Muir Snowfield, respectively, the ridge is particularly susceptible to erosion through glacial scour, intense winds, freeze/thaw cycles, and human impacts. The poor quality of rock found on the site consists of loose talus, pumice, and poorly sorted rocks deposited along some of the steeper slopes. These unstable surface deposits are generally unconsolidated with open voids caused by repeated freeze-thaw conditions and mass wasting activity. They are estimated to be between 15 and 20 feet thick. The loose, unstable rock on this site has contributed to the loss of the ridge through erosion and use over the past thirty-plus years. The site is also subject to repeated rock fall from the east-facing slope above. Below the loose rock deposits are stable bedrock materials layered with various lava flows.

Camp Muir geology was described by The Portico Group (2002) based on a site investigation completed in September 2001. Camp Muir has undergone several episodes of deposition and erosion and modifications by humans. According to the report, the exposed rocks at Camp Muir have been eroded by active alpine glaciation from the Cowlitz Glacier and perhaps from an active Muir Snowfield, producing the distinctive ridge known as Camp Muir. A thin veneer of non-glacial and glacial soils were deposited on this eroded bedrock surface. The predominant deposits consist of glacial moraine soils, mass wasting deposits (talus and rock fall debris), volcanic ash fall (c. 2000 years ago) and fill soils added to the site by various rehabilitation efforts.

The surficial geology map (Figure 9) produced by The Portico Group (2002) identifies the following areas at Camp Muir: fill soils, talus deposits, pumice and fine gravel deposits, talus and glacial moraine deposits, fine grained bedrock, and basalt bedrock. In addition, that report provided the following descriptions of these areas.

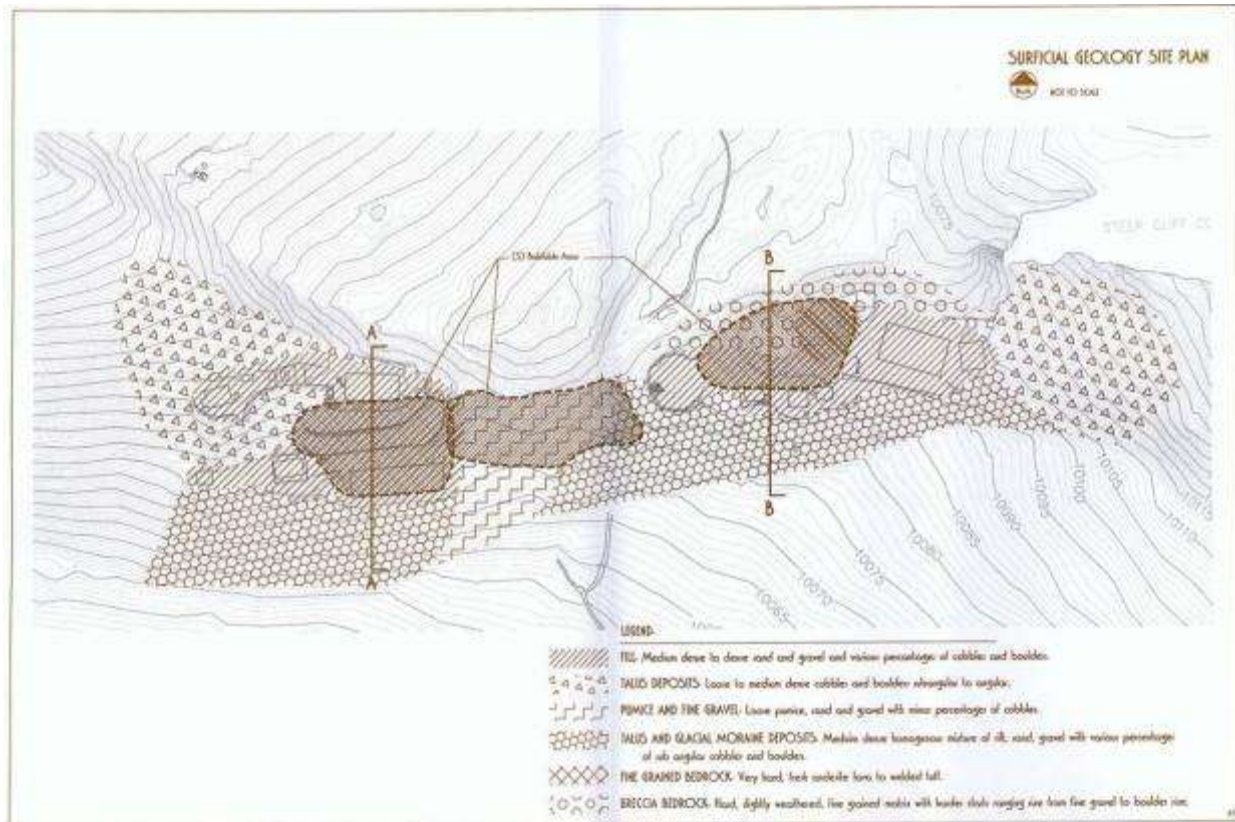


Figure 9: Surficial (Surface) Geology of Camp Muir (*The Portico Group* 2002)

Fill Soils underlie many of the existing structures, rock walls, and the helipad. These soils are granular and consist of medium dense to dense silts, sands and gravels with some cobbles, and boulder-sized rock. Depths of the fill materials range from one to ten feet and are located at the helipad, historic Guide Shelter and Client Shelter.

Talus Deposits consist of angular to subangular rock fragments deposited along some of the steeper slopes. Talus deposits are generally unconsolidated, with open voids between large clasts caused by freeze-thaw and mass wasting activity. Talus deposits are unstable and will shift or cause damage from natural rock fall. The approximate thickness of this deposit is estimated to be from 15–20 feet.

Pumice and Fine Gravel Deposits generally consist of fine pumice fragments loosely mixed with sand and fine gravel. Prevailing winds have concentrated the pumice on the lower portions of the ridge and have covered older soil and rock deposits, including bedrock. The estimated thickness of this deposit may be up to 15 feet.

Talus and Glacial Moraine Deposits consist of homogeneous mixtures of silt, sand and gravels, with cobbles and boulders in a medium dense deposit. These materials were left behind as a lateral moraine from the receding Muir Snowfield Glacier and the advancing Cowlitz Glacier. The deposit is estimated to be between 15 and 20 feet thick and lies directly over a steeply dipping bedrock surface.

Fine Grained Bedrock consists generally of hard, unweathered andesite and welded tuff lava flow. It is moderately to heavily fractured and resistant to weathering.

Basalt Bedrock is a moderately hard, fine-grained matrix containing subrounded clasts interbedded with other lava flows. Fractures are closely spaced. Basalt bedrock is affected by weathering.

Depths of the various deposits and their locations have been estimated based on field observations. The primary weathering process at Camp Muir is the combination of freeze and thaw cycles between winter and summer months. Since the site is covered with snow for approximately nine months of the year, the effects of wind erosion are somewhat limited. Visitors walking over the surfaces account for modifications to the surface, particularly the fine-grained pumice deposits, which are often re-deposited by strong winds.

Summary geologic information contained in the report notes that:

- Rock walls constructed in the 1980s appear to be very stable, with no signs of excessive movement;
- Structures built adjacent to steep slopes show evidence of slope creep and the loss of lateral support due to freeze-thaw action on the unconsolidated bedrock materials; and
- Wind erosion is occurring on the southern part of the site, where loose, fine-grained pumice is exposed and routinely trampled.

As noted in The Portico Group report, natural erosion processes are very severe in this harsh alpine environment. Over the years, it is likely that some parts of the ridge may have lost several feet of material, while other areas have lost only a few inches. While some of this loss is due to natural forces, human impacts and increased human use due to the popularity of climbing has accelerated the process. The loss of the formerly dispersed fractured andesitic stone across the ridge, some of which was used to construct the various structures, has exposed a softer volcanic tuff that is more susceptible to erosion. When this soft material is exposed, and additionally walked upon by climbers (typically wearing metal crampons and plastic climbing boots), it breaks down quickly and is blown like powder onto the Cowlitz Glacier and the Muir Snowfield.

Geology and Soils Environmental Consequences

Impacts of Alternative 1: Without formal hardening of pathways, ongoing erosion of fine pumice soils would continue to occur throughout the Camp Muir area as a result of wind erosion and crushing by foot traffic. Because there would be no new construction under this alternative, no additional excavation or increase in impervious surfaces would occur. Occasional use of rock from Camp Muir would continue to occur as needed to

replace individual stones in existing buildings, foundations, and walls. This continuing impact is considered to be adverse and minor to moderate.

Impacts Common to Alternatives 2-4: To protect public pathways from additional erosion of soil/rock, approximately 2,500 square feet of circulation space would be covered by crushed rock. Crushed rock would be imported from outside the park and compatible in color with the native rock at Camp Muir. Foot traffic would be directed onto the stabilized paths and stairs. Stone retaining walls would block access to less durable areas. Some excavated rock may be available for foundations, rock wall repair, and pathway construction. Stabilizing trails on the Camp Muir ridge would result in minor beneficial impacts to soils.

Impacts of Alternative 2: Of the action alternatives, Alternative 2 would result in the smallest amount of new excavation. New toilets would replace old toilets and would not increase building surface area. A new NPS storage facility (64 square feet) and three new permanent pads with tie downs for temporary guide service storage and cooking structures (360 square feet) would be constructed at Camp Muir. The new tent pads would require construction of retaining walls in the area of the existing Client Shelter; construction of the new NPS storage building would add 64 square feet, but remove 458 square feet—resulting in a net loss of impervious surface. Area soil and rock would be removed, mixed, and replaced to construct rock walls and designated pathways. Building facings would be constructed with imported rock that matches existing rock at Camp Muir in order to reduce impacts to surrounding sensitive alpine resources from local rock gathering. Potential impacts to soils and geology resulting from implementation of Alternative 2 is expected to be beneficial and minor.

Impacts of Alternative 3: Rock wall and pathway armoring would be similar in all action alternatives (as described above). Alternative 3 would result in the construction of a new foundation for the new guided public shelter and the new storage facility located immediately west of the historic Guide Shelter. The new guided public shelter would have a slightly larger footprint in order to reduce the vertical profile of the current structure. This alternative would result in an increase in footprint over existing conditions (existing conditions include the Client Shelter and Butler Shelter). The new facilities would consist of approximately 1,364 square feet, adding 523 square feet over existing conditions. Potential impacts due to implementation of Alternative 3 would be long-term and minor to moderate due to the increased footprint and disturbance of local soils and geology.

Impacts of Alternative 4: Under Alternative 4, a new public shelter would replace the existing Client Shelter. The new structure would be approximately 480 square feet. The new NPS storage shelter would be 64 square feet. The change in impervious surface would be reduced on the west side of the ridge. The new guided public shelter would add 512 square feet to the east side of the ridge, resulting in an overall increase in impervious surface totaling 545 square feet over existing conditions. Long-term

impacts to Alternative 4 would be similar to Alternative 3, with minor to moderate long-term adverse impacts due to the increased area of disturbance over existing conditions.

Cumulative: When the proposals in this Environmental Assessment are added to the effects on geology and soils of development proposals continuing in Mount Rainier National Park, they would comprise a small degree of additional localized impact, with Alternative 4 causing the greatest modifications to the site, followed by Alternative 3 and Alternative 2.

Conclusion: Alternative 1 would result in no new impervious surface area and only occasional use of onsite rock in repair and rehabilitation of historic structures. Nonetheless, it would continue to have the greatest potential for continued erosion of the Camp Muir ridge. Alternatives 2–4 would result in improved erosion control, but there would be some localized adverse effects from excavation, use of native rock and soil, and the covering of native rock and soil with new structures at Camp Muir. Table 4 quantifies approximate surface disturbance and excavation quantity required for each alternative. Alternative 2 would have the least impact (minor), and Alternatives 3 and 4 the greatest (minor to moderate). The constructed footprint would decrease by 5% with Alternative 2 (excluding areas of modular tents), and increase in Alternatives 3 and 4 by 28% and 30%, respectively, over existing conditions (Table 4).

Table 4. Camp Muir estimated excavation volume and ground disturbance.

Alternative	Feature	Area of Disturbance (SF)	Excavation Volume (CF)	Assumptions and Comments	
All Action	Toilets (2 east, 2 west)	800	1600	Two toilets east and west; area for 2 @ approx 20'x20'x2' depth each. Volume likely an overestimate.	
	Remove Butler Shelter and restore site	1125	0	Remove/disperse ~75' of retaining/border rock wall and scarify bench (75' x 15')	
	Low stone seating walls	225	450	~75 linear feet x 3' x 2'	
	Gravel stabilized paths	2500	625	~100 linear feet x 25' x 0.25' (quantity)	
Total all		4650	2675	99	cubic yards
Alt 2	Modular Tent Pads (3)	700	68	disturbance 20' x 45'; 27 footers @ 2.5 CF each	
	New NPS Storage Building	225	26	disturbance 15'x15'; 4 footers @6.5 CF ea	
Total Alt 2		5575	2769	103	cubic yards
Alt 3	New Guided Public Shelter	1375	147	disturbance 55' x 25'; 21 footers @7 CF ea	
	New Storage and Cooking Shelter	375	63	disturbance 25' x 15'; 9 footers @7 CF ea	
Total Alt 3		6400	2885	107	cubic yards
Alt 4	New Public Shelter	700	105	disturbance 35' x 20'; 15 footers @7 CF ea	
	New NPS Storage Building	225	26	disturbance 15'x15'; 4 footers @6.5 CF ea	
	New Guided Sleeping Shelter	1000	105	disturbance 40' x 25'; 15 footers @7 CF ea	
Total Alt 4		6575	2911	108	cubic yards

Table 5. Summary of building square footage as an indication of area of impact.

Summary of Impacts – Based on Structure Area					
	Alternatives				
Total area (sq. ft.)	1	All Action	2	3	4
"Incompatible" buildings	840	0	0	0	0
Total existing historic sq ft	1003	1003	1003	1003	1003
Total new toilets	0	318	318	318	318
Total new hard-sided structures (excluding toilets)	0	64	64	1045	1067
Total new tent pads (temporary shelter)	0	0	360	0	0
Total shelter area (incl. toilets)	1843	1385	1745	2366	2388
Percent change in footprint relative to existing condition (<i>Alternative 2 includes area of tent pads</i>)		1843	-5%	28%	30%

Vegetation Affected Environment

While few plants persist at the high elevation Camp Muir, a vascular plant, some sensitive lichens, and mosses are found in the area above the Butler Shelter and to the east of the Public Shelter. Above tree line, and comprising approximately 19 percent of the park, is the alpine zone, generally consisting of snow, ice, rock, and fragile alpine plants. The elevational range of the alpine zone on Mount Rainier is greater than any other zone in the Pacific Northwest (Edwards 1977). Alpine areas are subject to the harshest growing conditions in the park, with a limited snow-free season, temperature extremes, water runoff during snowmelt, and drying winds that sometimes result in drought conditions.

Edwards (1980) also identified unique characteristics of the primary climbing routes. According to Edwards, sedge-turf terraces on the Muir Route are found nowhere else on the mountain, and the Panorama Point–Moon Rocks fellfields comprise a special and extensive plant community. On the Muir Route, Cathedral Rocks marks the highest elevation for flowering plants.

Notably, the two areas that support the most varied communities (including substrate and species diversity) are also the two most easily accessible and frequented by climbers—the Muir Route and the Emmons Route. Edwards states, “None of the remaining approach routes, confined as they are to steeper, narrower ridges, pass through areas of great floristic density, extent or diversity such as are found on the Muir and Schurman routes.” And, “It is probably not a coincidence that the less steep and easier routes favored by visitors are also favorable to many more plant species” (Edwards 1980:32).

Lichen establishment and diversity at Camp Muir is greatest on the slope immediately behind the Butler Shelter. Around the main parts of camp, disturbance is recent and continual, thus supporting little lichen development. The slope to the east of Camp Muir is habitat for several species; however, disturbance prevents good lichen development there. Good development of some less frequently found species was observed above the Butler Shelter (e-mail L. Kurth, 09/06/2001).

Two species of moss and 11 individuals of *Draba aureola*, a vascular plant in the mustard family, were detected on the slopes above and to the west of the Butler Shelter. *D. aureola* is a vascular plant species that is known from few locations in the park, primarily in rocky outcroppings well above treeline. This species is on the watch list for Washington. It occurs above treeline on volcanic peaks from Mount Rainier south to Mount Lassen. Because of habitat limitations, this species is not common throughout its range. Generally where it is found, there are few individuals. Because it is not generally at risk to development within its range, populations appear to be stable. Currently there are social paths on the rocks above the Butler Shelter. Trampling is a threat to this species and should be minimized (e-mail L. Kurth, 09/06/2001).

Draba aureola is not listed on the Washington State Natural Heritage list as a rare plant species that is tracked; it is listed on their "Watch List." On the Natural Heritage site, watch status is "...assigned to each vascular plant taxon that is more abundant and/or less threatened in Washington than previously assumed."

The PLANTS database shows *D. aureola* as occurring in only two counties in Washington. The occurrences on Mount Rainier are the only ones known in the state, occurring near Camp Muir and above Spray Park (Biek 2000). The species is known to occur on four volcanic peaks (7,000 to 11,000 feet) including Mount Rainier, Three Sisters and Diamond Peak (both in Oregon), and Lassen Peak in California (Jepson 1993). The park recognizes this plant as part of the affected environment that should be protected. Impacts to the Camp Muir population should be avoided (e-mail L. Whiteaker 01/21/2011).

Vegetation Environmental Consequences

Impacts of Alternative 1: Social paths and trampling are the greatest threat to rare lichens and plant species. Exposure and risk of trampling appears to be highest on the west side of Camp Muir, and west of the Butler Shelter. Vegetative growth is minimal; on slopes east of the Historic Public Shelter, which receives heavy foot traffic. Under Alternative 1, current use patterns would continue, resulting in minor to moderate local impacts to individual lichen and plant species.

Impacts of Alternative 2-4: The following measures are recommended to avoid construction impacts to alpine plants, lichens and mosses, and to decrease existing threats to *D. aureola*:

- *Limit development/human activities to the snowfields and areas east of the Butler Shelter. Eliminate all foot traffic on the slope above Butler Shelter.*
- *To avoid rare lichens, their location has been mapped at Camp Muir; the boundary is indicated on all alternative maps. All proposed disturbance would be located within the existing footprint and exclude the lichen areas. User trails that extend onto the ridge above the Butler Shelter will be discouraged through signage and education of employees, guides and visitors.*
- *Removal of the Butler Shelter provides an opportunity to scarify the existing footprint, and block user trails that lead into the sensitive lichen area.*

Implementation of these measures would reduce exposure of rare lichens and the draba plant to construction and post construction trampling and damage. Potential impacts to vegetation in the vicinity of Camp Muir would become negligible to minor.

Water Quality (and Waste Disposal) Affected Environment

Issues related to water quality in the project area are associated with waste treatment and disposal. To reduce the impacts of visitors on water quality in high elevation areas in Mount Rainier National Park, comfort stations were constructed at Panorama Point in 1929 and at Camp Muir in the mid-1930s. Since then, there have been three solar and two pit toilets installed at Camp Muir.

Before 1982, when the park's High Altitude Human Waste Removal Program was implemented, high altitude sanitation and human waste disposal was identified as one of the three most significant threats to the park (Resource Management Plan 1982). During this time, human waste was accumulating on high altitude routes in the park because of poor or inadequate waste disposal facilities. To better manage human waste, the park initiated an aggressive public education program, clean up patrols, research on water contamination, new technology, and a "pack it out" program. The overall objectives of the program were to reduce the volume of waste, maximize its decomposition, minimize the encountering of waste by others, and minimize water contamination.

Beginning in 1982, human waste began to be centrally collected on the upper mountain, and for a year, crevasse disposal was used. From 1983 on, however, the practice of "*pack it in, pack it out*" through use of "blue bags" was initiated. Since that time, climbers and winter wilderness hikers have been issued blue bags for human waste collection and disposal. Blue-bag receptacles (55-gallon drums) have been placed throughout the park along well-used routes.

Full barrels located in remote areas such as Camp Muir are removed via helicopter in autumn, and the waste is transported to a facility in Tacoma and incinerated. Currently, about 12 to 14 barrels of waste from the pit and solar toilets and 6 to 8 barrels of blue-bag waste are removed annually from Camp Muir.

Water Quality Environmental Consequences

Impacts of Alternative 1: The solar dehydrating system currently used at Camp Muir reduces waste volume by separating and/or evaporating liquids. Park employees manually move the waste from the toilet receptacles to the 55-gallon drums used to transport the waste off site. Before treatment, fecal pathogens in the waste represent a significant human health risk to those maintaining the current sanitary system. In addition, the rapid accumulation of waste quickly creates anaerobic (oxygen poor) conditions and results in the production of compounds such as methane, ammonia, and hydrogen sulfide, and their associated undesirable odors.

The current sanitary system at Camp Muir includes a "leach field" that simply drains the liquid component of waste, where it infiltrates the rock substrate under the Muir

Snowfield. The presence of coliform bacteria is a useful indicator for water quality, including likely presence of other pathogens. A study done on the Muir Route in 1982 found snow samples at Crater Rim, Ingraham Flats, and Camp Muir to have moderate levels of viable coliform bacteria. This study also showed that fecal matter bacterial organisms could survive freeze/thaw conditions at high altitudes (Macartney 1982). In addition, preliminary sampling at two sites below Camp Muir in 1994 showed elevated levels of nitrate-nitrite, ammonia nitrogen, and Kjeldahl nitrogen (NPS 2002). Gray water from the current cooking use of chlorinated gray water at the Guide Shelter by the single concessioner is filtered into the Cowlitz Glacier, resulting in an unknown impact (no studies have been undertaken to determine the impacts of this use). Combined, these human waste and gray water lines represent a localized, moderate impact to area resources. The inadequacy of the toilet leach field has also been identified as a potential public health hazard by the U.S. Public Health Service (The Portico Group 2002). According to the same report, the U.S. Public Health Service is less concerned with the gray water leaching into the Cowlitz Glacier.

Impacts of other waste: Park backcountry visitors are encouraged to use the following best management practices:

- Use impact minimization techniques, such as Leave No Trace;
- Use biodegradable soap and dispose of gray water more than 200 feet from water sources;
- Use maintained or established way trails to limit establishment of social trails and consequent soil erosion;
- Use rest stops on snow, or durable or established areas;
- Camp and recreate on snow, rather than in fragile subalpine or alpine plant communities;
- Use blue bags during high elevation travel; and
- Walk on snow, rather than sensitive emerging vegetation, whenever possible.

In addition to the formal disposition of urine and gray water from the concessioner cooking operations at Camp Muir, informal disposition of gray water and food waste from independent climbers and day use visitors may impact water quality locally, despite the encouragement to use the above Leave No Trace and other best management practices.

These impacts coupled with an inadequately designed leach field contribute to a moderate localized odor and moderate water quality impacts at Camp Muir and downstream under the Muir Snowfield below.

Impacts of Alternatives 2-4: More effective separation of urine and fecal components of toilet waste under all action alternatives would reduce the potential for fecal coliform contamination of subsurface water that flows under the Muir Snowfield. In addition, leach field improvements would ensure proper filtration treatment. There

would continue to be long-term negligible to moderate impacts to water quality associated with the action alternatives from on-going park operations and visitor use. Visitor use impacts would primarily be related to non-compliant visitor behavior resulting in sedimentation or unnatural inputs of nutrients to park waters. Downstream detection of fecal coliform would be expected to decline over time to natural levels as the Camp Muir source would be reduced, resulting in a slight improvement on downstream water quality. Visitor use impacts caused by non-compliant behavior would continue to be addressed through enforcement and education. This would have a long-term beneficial impact on water quality; however, there would be continuing minor to moderate impacts to water flowing beneath the Muir Snowfield because urine waste would continue to be deposited there.

Cumulative Impacts: No other projects are planned at Camp Muir or in surrounding areas that would contribute to cumulative impacts; however fecal coliform is considered a water quality issue that is additive, or cumulative in nature. Downstream detection of fecal coliform would be expected to decline over time to natural levels as the Camp Muir source would be reduced, resulting in a slight improvement on downstream water quality over time.

Conclusion: The replacement of five solar and pit toilets with four redesigned toilets, which rely on the principle of separation and then isolation, would decrease the possibility of fecal contaminated urine reaching substrates and subsurface water beneath the Muir Snowfield, resulting in an overall long-term improvement in downstream water quality over the existing condition. While water quality is expected to improve during the life of the new toilets, minor to moderate impacts to water quality is expected to continue.

Wildlife Affected Environment

Mount Rainier National Park is home to a wide variety of animal species. Sixty species of mammals, 229 species of birds (including 80 species known to nest in the park), 21 species of reptiles and amphibians, 18 native species of fish, and a wide variety of known and unknown invertebrates, including insects, spiders, worms, and freshwater mollusks are known to exist in Mount Rainier National Park.

There are four distinct life zones in which animals occur, although some animals may inhabit several of the life zones depending on the time of year. Because the area potentially affected by the proposed action is not below 5,000 feet, only two of those areas are discussed below.

5,000 to 6,500 Feet: The elevational zone in the park, which attracts numerous visitors in the summer is between 5,000 and 6,500 feet (where Paradise and Sunrise are located). This zone is characterized by mixed forest and subalpine meadows. The trees are primarily subalpine fir, mountain hemlock, Alaska yellow cedar, and whitebark

pine, and they tend to grow in clumps. The birds of this zone include the Clark's nutcracker (*Nucifraga columbiana*), common raven (*Corvus corax*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), western flycatcher (*Empidonax difficilis*), rufous hummingbird (*Selasphorus rufus*), mountain bluebird (*Sialia currucoides*), and Lincoln's sparrow (*Melospiza lincolni*). Many of these birds can be found in other zones depending on the season. This is the zone where elk congregate in the summer months, especially in the eastern half of the park. In this zone there are pika (*Ochotona princeps*), snowshoe hare (*Lepus americanus*), Hoary marmot (*Marmota caligata*), golden-mantled ground squirrel and yellow pine chipmunk. In the meadows are numerous pocket gophers (*Thomomys talpoides*). A common carnivore is the pine marten with black bear, coyote, red fox, and mountain lion visiting this zone in the summer and fall. There are some large herds of mountain goats in this zone. There are numerous ponds and lakes, some of which have been stocked with rainbow, cutthroat, and brook trout. Many of the ponds have populations of amphibians including northwestern salamander (*Ambystoma gracile*), long-toed salamander (*Ambystoma macrodactylum*), western toad and Cascades frog (*Rana cascadae*).

Above 6,500 Feet: Within Mount Rainier National Park, an area of more than 80 square miles is above 6,500 feet. Snowfields, glaciers, and bare rock outcrops characterize this zone. Many plant communities are associated with these exposed areas. The common occurrence of insects and spiders at these elevations is due to their wind dispersal onto snowfields and glaciers. These organisms serve as food for numerous birds that visit the snowfields. The white-tailed ptarmigan (*Lagopus leucurus*) can be found in this zone along with the gray-crowned rosy finch (*Leucosticte arctoa*) and the water pipit (*Anthus spinoletta*). A variety of mammals more common in other zones may also visit this area.

Ongoing impacts on wildlife at Camp Muir include human noise and activity during the climbing season and potential habituation of some species (e.g., gray-crowned rosy finches) to human activity. Small mammals using the site may also be conditioned to the presence of food scraps, despite the use of Leave No Trace techniques by many visitors. Occasional visits to the area by black bears, coyotes, and other large and medium-sized mammals have been reported.

Wildlife Environmental Consequences

Impacts of Alternative 1: No additional impacts to wildlife would occur as a result of the implementation of Alternative 1. Existing human use and activity would continue to exert a minor effect by displacing, disturbing, habituating, or attracting area wildlife, particularly the consistently present gray-crowned rosy finches and mice, and to a lesser extent, other wildlife such as black bears, raccoons and foxes that are known to occasionally visit the area. Mountain goats would likely continue to avoid the area. In addition, despite park prohibitions against feeding wildlife and leaving behind trash or food scraps, it is likely that a minor degree of these indirect impacts would continue.

Administrative use of helicopters to remove human waste and to resupply Camp Muir would continue, creating noise and turbulent air disturbances to wildlife during short periods of time. Fall and spring helicopter flights would continue to occur over a span of a few days and have been established as the minimum tool to mitigate the effects of human waste in high elevation areas (snowfields and glaciers) and to prevent its inappropriate disposal. Effects of these flights on wildlife would continue to be long-term, adverse and minor because the flights occur during two short periods each year. Implementation of BMPs that avoid flyovers of wildlife to the extent possible, and follow the shortest possible flight path will continue to limit impacts.

Impacts of Alternatives 2-4: As with Alternative 1, implementation of these alternatives would result in continued human presence and activity, including administrative helicopter use scheduled during spring and fall (shoulder periods of the climbing season). Direct impacts to wildlife habitat from the construction of additional structures would be negligible under Alternatives 3-4 because these areas have existing disturbance and do not comprise major wildlife habitat or linkages. Direct effects of Alternatives 2-4 would include the noise and disturbance associated with rehabilitation and construction activities, and in particular, noise related to delivery and removal of materials via helicopter. During the construction period, materials deliveries by helicopter would increase noise disturbance impacts on wildlife in a wide area surrounding Camp Muir, resulting in a short-term minor impact under Alternative 2 (one season), and a short-term moderate impact under Alternatives 3 and 4 (three seasons). Staging and delivery or removal of materials would take advantage of routine shoulder season flights to minimize impacts, but add two flight periods mid season to deliver components to Camp Muir and remove construction generated waste from the dismantling of the Client and Butler shelters. Short-term helicopter use for construction would be greatest under Alternative 4, slightly less under Alternative 3, and least under Alternative 2 (see additional helicopter analysis below). Under Alternative 2, because of the loss of winter storage space for the guide services once the Client Shelter and Butler Shelter are removed, trips to transport supplies and gear are expected to increase at the beginning and end of each climbing season because modular tents would not be left to overwinter. Additional trips may increase routine helicopter use during the shoulder seasons, slightly increasing impacts on wildlife.

Cumulative: Human activities and existing development occur within the subalpine and alpine environments of Mount Rainier and are concentrated in areas such as Paradise and Sunrise, and to a somewhat lesser extent, along established roads, trails, routes, and wilderness and climbing camps. Planned activities at Camp Muir are not expected to contribute to cumulative wildlife habitat impacts because they would be short-term and would drop to routine levels following the final year of construction. There is a possibility that trail work will occur between Paradise and Panorama Point during the next two to four years; however funding is uncertain.

Conclusion: Under all alternatives, visitor use and routine administrative operations would continue to have negligible to minor long- and short-term localized effects on wildlife because these areas have existing disturbance and do not comprise major wildlife habitat or linkages. Helicopter and human activity in the area during construction would have short-term minor impacts under Alternative 2 and moderate adverse impacts under Alternatives 3 and 4 on wildlife that would temporarily exceed existing impacts incurred by routine activity through the addition of two helicopter flight periods per season of construction.

Wilderness Affected Environment

In 1988, Congress designated approximately 97 percent (228,480 acres) of Mount Rainier National Park as wilderness. Because of its scenic, natural, and historic qualities, the park's wilderness provides opportunity for a range of recreational experiences, including camping, hiking, mountain climbing, backpacking, photography, picnicking, snowshoeing, cross-country skiing, and snowboarding.

The Wilderness Management Plan (WMP, NPS 1989) established management areas to enable operational efficiency in management. WMP areas include trail, cross-country and alpine areas. Cross-country areas have overnight camping limits that specify the number of parties or the allowable number of people and vary from one to five parties (5 to 25 people in summer, 12 to 60 people in winter). The alpine areas, including Camps Muir, Schurman, Curtis, and Hazard, have also have overnight limits, from two parties to 110 people. The Mount Rainier National Park General Management Plan redefined the zoning presented in the WMP, which is how we manage wilderness today.

In the alpine wilderness zones near Camp Muir, up to 36 people may camp in the area above Camp Muir (most of these people camp at Ingraham Flats), and up to 36 people may camp on the snowfield below Camp Muir.

These restrictions have allowed a large number of visitors to camp in the park while protecting the resources they come to enjoy. Through the limits, impacts are concentrated onto durable trailside and alpine camps, while dispersed use in the cross-country and alpine areas increases opportunities for solitude. Camp Muir, a small parcel intentionally omitted from wilderness, serves a purpose of concentrating use to limit impacts to the surrounding fragile landscape.

Camp Muir is a small island of non-wilderness within the park's designated wilderness. Because of Camp Muir's small size and the lack of transition or buffer between wilderness and non-wilderness, human activities, helicopter operations, structures, and activities related to the maintenance of those structures have the potential to directly and indirectly affect surrounding Wilderness and wilderness values. Wilderness values include opportunities for solitude, for primitive and unconfined recreation, and for naturalness (NPS 2002, 2006).

Opportunities for solitude are limited in the wilderness immediately adjacent to Camp Muir because of the use patterns at Camp Muir and the popularity of the area as a day hike destination (up to 500 people have been observed at Camp Muir per day during peak season). As previously stated, overnight camping within Camp Muir is capped at 110 per night, including guided climbers. Primitive and unconfined experiences are generally not available in the immediate vicinity of Camp Muir because of existing development and the need to manage use.

Wilderness Environmental Consequences

Impacts Common to All Alternatives: Of the wilderness values listed above, opportunities for solitude and primitive and unconfined recreation are not likely to change across alternatives. Because of the popularity of Camp Muir and Mount Rainier as a climbing destination, limits on party size and camping site location have become necessary to reduce impacts to wilderness, including protection of natural and cultural resources. There are no actions in Alternatives 1–4 that pertain to party size, guide service activities, or increase or decrease overall capacity at Camp Muir.

Impacts to the wilderness value of “naturalness” are most easily observed and measurable in relationship to the experience of soundscape and the visible indicators of human presence. Impacts on this value vary across alternatives as the noise generated by construction activities and ongoing maintenance would have different levels of duration and intensity under each alternative.

The helicopter is one of the most intrusive sound-producing tool that would be used to implement proposed actions. To gain a sense approximate helicopter use related to routine park operations, SARs and military flights, Mount Rainier National Park Mean annual flight hours for all aviation types (emergency, military, project, surveys, etc) is approximately 155 hours per year (26 flight days per year assuming 6 hours per flight day), ranging from a minimum of 55 to 332 hours. Annual flights vary year to year depending on fire year, number of search and rescue (SAR) operations, number of military flights and need for project work. Adjusted for four fire years and one higher than normal SAR year, the mean number of flights adjusts down to approximately 127 hours per year, park-wide (21 flight days per year). Camp Muir sees 6 to 14 flight days per year (Glenn Kessler, pers. comm.), and assuming 6 hours per flight day, 36 to 84 hours of flights per year.

The visual impact of structures at Camp Muir would also vary by alternative, depending on the location, form, and materials or structures. Under all alternatives, at least some structures, including utility infrastructure, are likely to be visible from points in wilderness on clear days. Removal of non-historic incompatible buildings and the addition of historically compatible buildings that blend with the natural environment (actions common to alternatives 3 and 4) would have minor to moderate beneficial

effects on wilderness.

Impacts of Alternative 1: Activities occurring at Camp Muir that may affect wilderness values in the wilderness area outside Camp Muir include ongoing maintenance, search and rescue (SAR) activities, helicopter use related to routine operations and SARs, and visitor overnight standards that exceed the restrictions allowed in surrounding wilderness.

On clear days, visually obtrusive structures and infrastructure such as the Client Shelter, the Butler Shelter, public toilets, and solar panels would continue to be evident when viewed from the Muir Snowfield and from the Cowlitz Glacier above Camp Muir. Modular tents would continue to be used by the guide services within wilderness on the Cowlitz Glacier, and visible to people as they cross the glacier. Impacts to Wilderness qualities would continue to be moderate due to the visual obtrusiveness of existing structures at Camp Muir.

Impacts of Alternatives 2-4: Noise and other disturbance associated with construction activities at Camp Muir would cause minor to moderate temporary impacts on nearby wilderness. Construction related impacts would likely be greatest in Alternative 4 and least in Alternative 2, correlating to the number of new buildings proposed. Several hours of helicopter flight time would be needed to airlift supplies and materials to Camp Muir and haul dismantled structures back down to Fourth Crossing. Table 4 lists estimated helicopter flight time for each alternative. Flights would occur in mid-May, mid-June, early July, and early September. Table 4 displays approximate helicopter transport needs by alternative. Alternatives 2-4 would add 31 hours (in 2013), 64 hours (2013-2015), and 67 (2013-2015) hours for all alternatives, respectively. Importation of trail tread gravel would approximately double the flights under Alternative 2 during 2013, and increase by more than 60 percent flights scheduled during year three for alternatives 3 and 4.

Because all action alternatives would remove modular tents from the Cowlitz Glacier, the adverse impact of a semi-permanent structure in wilderness would no longer exist. Alternative 2 would result exchanging wilderness impacts related to the modular tent location with tent camping in Wilderness.

Table 6. Camp Muir Construction phasing scenario including helicopter transport estimates by alternative (by round trip from Fourth Crossing to Muir to Fourth Crossing).

Activity by Alternative and Year	Round trips (estimated)	Total Hours (20 min ea RT)
Alternative 1 (No Action)		
Total flights Alternative 1	0	0
Alternative 2		
2013 (one year weather permitting)		
Remove existing Client Shelter and Butler Shelter; construct 3 tent pads and new NPS storage facility; remove existing/build new toilets including rock veneer; Deliver/spread gravel to stabilize ridgeline trails and construct seat walls		
Total flights Alternative 2	92	31
Alternative 3		
2013 – Year one		
Remove Butler Shelter & construct new storage/cooking facility; remove exist toilets & construct new toilets (construct w/o veneer); fly-in rock veneer for new storage/cooking facility and toilets		
<i>Approximate total estimated flights Alt 3 - 2014</i>	<i>62</i>	<i>20</i>
2014 – Year two		
Remove existing Client Shelter and construct new Client Shelter w/o veneer; install rock veneer on new storage/cooking facility; fly-in rock veneer for new Client Shelter		
<i>Approximate total flights Alt 3 2014</i>	<i>84</i>	<i>28</i>
2015 – Year 3		
Install rock veneer on new Client Shelter; deliver/spread gravel to stabilize ridgeline & construct seat walls		
<i>Approximate total flights Alt 3 - 2015</i>	<i>48</i>	<i>16</i>
Grand total flights for Alternative 3	194	64
Alternative 4		
2013 – Year one		
Remove existing toilets & construct new toilets; construct new Guided Sleeping Shelter (add veneer year 2); Fly-in veneer for new Guided Sleeping Shelter & toilets		
<i>Total Flights Alt 4 - 2013</i>	<i>86</i>	<i>29</i>
2014 – Year two		
Remove existing Client Shelter and construct new Public Shelter (w/o veneer); Construct new NPS Storage Facility; remove Butler Shelter; veneer new Client Shelter & toilets; fly-in veneer for new Guided Sleeping Shelter, new NPS Storage Facility		
<i>Total Flights Alt 4 - 2014</i>	<i>67</i>	<i>22</i>
2015 – Year three		
Veneer new Public Shelter and new NPS Storage Facility; deliver/Spread Gravel to Stabilize Ridgeline & Construct Seat Walls		
<i>Total Flights Alt 4 - 2015</i>	<i>48</i>	<i>16</i>
Grand total flights Alternative 4	201	67

Conclusion/Cumulative Impacts: Impacts to wilderness would range from negligible to moderate due to impacts of sound related to construction, and would be temporary, lasting one year (weather permitting) for Alternative 2, and three years for Alternatives 3 and 4. Implementation of action alternatives would increase annual flights by 15-25% at Camp Muir, and 7-19% parkwide annually and over the course of one (Alternative 2) to three years (Alternatives 3 and 4) for Camp Muir.

Removing modular tents (semi-permanent features) from wilderness and visually intrusive structures from Camp Muir would have long-term moderately beneficial effects on wilderness character. There may be a similar or slight increase in the number of flights required to provide and remove supplies to Camp Muir during the shoulder seasons under Alternative 2, and to remove waste from Camp Muir (up to four flights per year) under all action alternatives. Potential long-term impacts to wilderness resources due to additional operational flights are considered negligible.

Air Quality Affected Environment

Mount Rainier National Park has been designated a Class I area under the Prevention of Significant Deterioration of Air Quality program established by the Clean Air Act. Class I areas are afforded the greatest degree of air quality protection. Very little deterioration of air quality is allowed in these areas. Class I area designation is granted to national parks greater than 6,000 acres that were in existence as of August 7, 1977, designated wilderness areas and memorial parks greater than 5,000 acres, and international parks. The Clean Air Act also established a national goal of preventing any future, and remedying any existing, human-caused visibility impairment in Class I areas.

Most of the air pollutants at the park are generated by outside sources such as power plants and paper mills, urban transportation in the Seattle and Tacoma area, and slash burning associated with logging on forest lands surrounding the park. These air pollutants can create haze that obscures or diminishes scenic views. Air pollution such as acid rain can damage soils and vegetation and affect water quality. Air quality in the project area is generally considered good, depending on the time of year and regional conditions. However, relatively high levels of sulfur and nitrogen compounds and low pH levels have been detected in precipitation samples in past years. In addition, contaminants (pesticides, mercury, and other semi-volatile organic compounds) have been documented in park surface waters. Episodic acidification occurs at some lakes in the park during spring snowfall (Clow and Campbell 2008).

Vehicles are the primary source of air pollution within park boundaries. Vehicles contribute particulate and nitrogen oxide pollutants to the air. Nitrogen oxide is converted to ozone in a process that is termed photochemical smog. In this process, nitrogen oxide reacts with sunlight to produce ozone. Ozone and particulate pollution are occasionally measured at high levels in the park. However, the level of vehicle traffic in the park is not considered a major contributor to ambient air pollutant levels.

Other sources of emissions within the park include generators, heating systems, a few wood stoves and fireplaces in park buildings, and campfire smoke.

The NPS is committed to controlling greenhouse gases (GHG) and has developed a Climate Change Response Strategy. In addition, EO 13514, Sustainability and Reduction of GHG, requires that federal agencies reduce GHG in their operations. The NPS has formed a partnership with the EPA to collaborate on controlling GHG and climate change. This program is called the Climate Friendly Parks Program, which provides management tools and resources to address climate change. The program approach involves measuring existing emissions, developing strategies to mitigate emissions and adapt to impacts, sharing information, and educating the public about measures they can use to lessen their effect on climate change.

The NPS has developed a tool called Climate Leadership in Parks (CLIP) to determine the baseline levels of GHG in the national park system. In the park, three GHGs require consideration: carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). Each of these GHGs have a different global warming potential (GWP) per metric ton produced. Nitrous oxide has far greater GWP than methane, which has far greater GWP than carbon dioxide. In order to accurately assess GHG emissions emitted by the park, the metric tons of each gas is converted to metric tons carbon dioxide equivalent (MTCO₂E) using the GWP factor. Using CLIP, it was determined that in the park, the 2006 annual GHG emissions for each of these GHGs was CO₂: 11,954 MTCO₂E; CH₄: 529 MTCO₂E; and N₂O: 203 MTCO₂E. The park uses these estimated figures as the baseline against which it evaluates the effectiveness of its efforts to reduce GHG emissions.

Air Quality Environmental Consequences

Impacts of Alternative 1: Activities currently occurring at Camp Muir that may affect air quality include routine helicopter flights, use of propane and white gas for melting water and cooking, and creation of fugitive dust from walking on erodible surfaces. These impacts are considered short-term and negligible to minor depending on time of year and use levels. Impacts are short-term.

Impacts of Alternatives 2-4: The proposed action alternatives have the potential to affect air quality through use of motorized vehicles to transport supplies to and from Camp Muir and from power tool use. Air quality effects from these operations are expected to be temporary and localized and may be noticeable to visitors and workers. Power tool use to dismantle existing structures may contribute to local GHG. Trucks would transport equipment and materials to the Paradise Fourth Crossing helispot, and helicopters would be used for delivery of these materials between Fourth Crossing and Camp Muir. Helicopter turnaround time would be about 20 minutes per trip, entailing just a few minutes of hover time at the drop and pick-up points and several minutes to cover the distance between Fourth Crossing and Camp Muir. Daily helicopter flight is expected to last approximately 6 hours over a few days during each flight period. Helicopter

operations are not expected to contribute enough emissions locally to cause more than minor impacts. Alternatives 3 and 4 are expected to contribute more GHG emissions than Alternative 1 from use of motorized vehicles/aircraft because of the scale of the construction proposed. That is, under Alternatives 3 and 4, three or four flight operations involving up to 80 flights each would occur over the course of a single construction season (four flight periods, one late spring, two mid-season, and one early fall) for three years.

The following mitigation measures would be implemented to minimize introduction of air pollutants:

- *Impacts would be minimized by not allowing idling of vehicles at Fourth Crossing or Kautz Creek.*
- *The use of chainsaws would be limited to dismantling the Butler Shelter and the Client Shelter, and by making minimum cuts to facilitate helicopter transport off site.*

Conclusion/Cumulative Impacts: Potential impacts to air quality related to construction are expected to be short-lived and minor to moderate, occurring periodically through the dismantling process, which is expected to last no more than a few days for each structure. This work would be conducted early in the season (May), and prior to the busiest months, July and August. Helicopter flights would contribute to emissions during construction of alternatives during four flight periods per year of construction. Impacts are anticipated to be very localized and temporary under all alternatives, minor under Alternative 2, and short-term and moderate under Alternatives 3 and 4 due to the duration of construction. Once construction is complete, potential impacts will drop to levels consistent with Alternative 1: negligible to minor short-term adverse impacts.

Visitor Experience Affected Environment

Visitor Use Opportunities

Park visitors participate in a wide array of recreational activities, including camping, hiking, scenic driving, mountain climbing, skiing, snowshoeing, and walks to nearby viewpoints. The following summary identifies the primary visitor use activities commercial visitors engage in. See the description of Alternative 1 (No Action) for a better understanding of the current range of visitor activities offered by park commercial businesses.

Climbing: Mount Rainier, the tallest and largest glaciated peak in the contiguous 48 states, is considered to be one of the best climbing opportunities in the United States. Looming like “an arctic island in a temperate sea” it beckons climbers from the Seattle area and beyond. Every year, thousands of climbers attempt its 14,410-foot summit. Twenty-five major glaciers, more than 35 recognized climbing routes, and severe weather combine to create superlative climbing experiences. Because of its glaciers,

crevasses, and snow bridges, and its often unpredictable weather, Mount Rainier is considered a training ground for tougher endurance climbs like Mount McKinley and Mount Everest. In 2001, of the park's total estimated annual visitation (1,940,104), 11,688 people (0.6 percent) participated in climbing and of those, 4,165 (36 percent) participated in commercially guided climbing. Similarly, in the 2000 Visitor Use Survey (Simmons *et al.* 2001), 3 percent of respondents identified climbing to the summit of Mount Rainier as an activity they participated in during their park visit.

Visitor Use Access Trends

Origin: Visitors come to Mount Rainier National Park from all over the United States and from other countries. According to a 1990 survey (Johnson *et al.* 1990), the majority of park visitors were from Washington State (59 percent). Others were from California (5 percent), Oregon (3 percent), and other states (30 percent), with about 3 percent from foreign countries. The 2000 Visitor Use Survey (Simmons *et al.* 2001) similarly found that 60 percent were from Washington State, 5 percent from California, 3 percent from Oregon, but about 6 percent were from foreign countries.

Access/Facilities: There are five primary entrances to the park, including the Nisqually entrance on the southwest side, where approximately 54 percent of park visitors enter; the Carbon River and Mowich Lake entrances on the northwest side (Carbon River, 13 percent of visitors; Mowich Lake, 13 percent of visitors); the Highway 410 entrances on the northeast and east sides (26 percent of visitors); and the Stevens Canyon entrance from Highway 123 on the southeast side (16 percent of visitors) (Simmons *et al.* 2001). Developed areas are located throughout the park at Nisqually Entrance, Longmire, Paradise, Carbon River, Mowich Lake, Ohanapecosh, Sunrise, and White River. Minor developed areas are located at Reflection Lakes, Box Canyon, Tipsoo Lake, and Grove of the Patriarchs, among others.

Visitation: Located an hour and a half from metropolitan Puget Sound, Mount Rainier is not only within easy access of over 2 million people, it is also one of the most popular visitor attractions in the Pacific Northwest. About 80 percent of visitor use occurs between May and October (Johnson *et al.* 1990). In 1977, there were 2,437,332 visits to the park, the highest number of visitors recorded. 1992 saw another peak with 2,358,296 visitors. The number of visitors to the park has ranged from 1.5 to 1.9 million during the past 10 years, with the lowest number occurring in 2011 at 1,495,610. Average visitation since 1967 exceeds 1.8 million.

Visitation is highly dependent on regional weather conditions. Visitors are drawn to the park from the surrounding region when the weather is clear and the mountain is visible, particularly on weekends. Visitation figures may also be affected by other external factors, such as road construction or flood damage on major access routes, the price of gasoline, unseasonable weather, or figures may vary due to changes in methods of counting visitors.

Climbing Permits: Day use visitors are not required to have a permit. While no recent studies have been undertaken to determine peak use numbers, day use visitation to Camp Muir may number as high as 500 persons per day during peak season. This large number of day use visitors puts additional strain on the existing infrastructure. Toilets are often used beyond their processing capacity on peak use days.

Overnight use at Camp Muir is by park permit only, and is limited to 110 spaces (36 spaces for the guided public and 74 spaces for independent public visitors).

Group Size: Climbing groups are limited to a maximum of 12 people per party.

Peak Season: Park visitation begins to increase in spring, peaks in July and August, and decreases substantially beginning in October. During the peak season, park visitors regularly represent at least 40 percent and sometimes exceed half of all annual visitors (with over 1 million visitors counted in these two months alone). Visits to Camp Muir follow the same general pattern as overall park visitation.

Summary of Overnight Climbing Visitor Use

Of the climbing routes on Mount Rainier, the Muir Route is the most popular, followed by the Emmons and Kautz routes and others.

In 1985, 2 percent of visitors surveyed reported day hiking to Camp Muir, and 2 percent reported technical climbing (Salvi and Johnson 1985). Less than 1 percent reported engaging in guided technical mountain climbing, 1 percent reported engaging in self-led technical climbing, and 4 percent reported engaging in non-technical mountain climbing (Johnson *et al.* 1990). In 1999, just two percent of wilderness visitors surveyed reported using equipment to mountain climb (Vande Kamp *et al.* 1999). Today, the 10,000 to 11,000 annual climbers comprise a very small number of park visitors—approximately one-half of 1 percent of the park's annual visitation (NPS 2002, 2011).

The majority of Alpine Zone campers travel in parties of two, three and four; larger parties of seven or more accounted for only 11% of the use. Groups using Camps Muir and Schurman traveled mostly in parties of two (40%) and three (25%); only 14% of the total use at these high camps was by parties of six or more (Wilderness Management Plan, NPS 1992).

When climbing statistics began to be recorded, climbing use of Mount Rainier increased from 238 climbers in 1950 to a high of 11,700 people in 2000. During the period 1992-2011, summit attempts regularly exceeded 9,000 per year (mean 10,145), with the exception of 2005, when they dropped to 8976.

In 2011, there were 10,828 summit attempts. Climber access via the Muir Route was 6,647, use of the Emmons Route was 1,816, and use of the Kautz Route was 553. The Fuhrer's Finger and Liberty Ridge routes followed with 160 and 137 summit attempts,

respectively. In general, summit attempts have remained relatively strong over time, trending independently from overall Park visitation statistics.

Summary of Wilderness Visitor Use

According to visitor use studies, most wilderness visitors take walks or hikes (98.9 percent), but of these, only 8 percent camp or backpack overnight in wilderness (Vande Kamp *et al.* 1999). The other 92 percent do not spend the night, or they camp in the front country. Of the total number of wilderness visitors, 25.4 percent also reported staying in a developed campground. In the 2000 Visitor Use Survey, 79 percent of visitors reported taking a hike. Of those, 89 percent reported hiking near developed areas and 32 percent in wilderness (Simmons *et al.* 2001). When this data is combined with information on the length of hike (shorter than two hours, between two and four hours or more than four hours), 41 percent of hikers report taking a hike shorter than two hours, 44 percent reported hiking between two and four hours, and 30 percent hiked longer than four hours. There may be a lack of understanding about the park wilderness boundary since most hikes longer than two hours would likely have entered wilderness, except perhaps in the Paradise area. In general, the park wilderness boundary is 200 feet from the centerline of paved roads and edges of developed areas and 100 feet from the centerline of unpaved roads.

Visitor Experience Environmental Consequences

Impacts of Alternative 1: Under Alternative 1, a variety of impacts on visitor experience would continue, including some related to safety. Visitor facilities would continue to include the historic Public and Guide shelters, solar and pit toilets, and space for public tent camping. NPS facilities would consist of the Historic Guide Shelter and the historic Men's Comfort Station. Guide service facilities would consist of the current Client Shelter until it outlived its life cycle, the Butler Shelter, and two seasonal modular tents on the Cowlitz Glacier. Unpleasant toilet odor and leakage from the existing waste storage configuration would continue, as would confusion regarding visitor opportunities in the Camp Muir area. These conditions would continue to constitute a long-term minor to moderate impact on visitor experience.

To facilitate materials deliveries and other work at the site, including safe Search and Rescue operations, the helipad would remain in service. During the times it was not being used for materials deliveries or removal, it would continue to be available for visitor gathering space, maintaining current conditions, a long-term minor beneficial effect.

Health and safety impacts would include the continued use of inadequately ventilated historic buildings for sleeping/cooking; the continued need to store untreated human waste on site; and continued propane storage near areas of potential rock fall hazard. These impacts would continue to cause long-term moderate impacts on visitor experience.

Impacts Common to Alternatives 2-4: As in Alternative 1, the helipad would remain in service and would also continue to be available for visitor gathering space during the times it is not being used for helicopter operations. With the improvement of pathways and site orientation signing, erosion is expected to diminish. Placement of a kiosk would serve to orient visitors and is intended to serve as the focal point of a public gathering space. Additional interpretive information to warn visitors of the hazards of traveling between Camp Muir and Paradise during inclement weather would add a measure of safety to action alternatives. Rock retaining walls constructed to stabilize and delineate pathways would also serve as seating. As a result, visitors to Camp Muir would find more delineated paths and site improvements, reducing confusion about the use of various site features, a long-term minor to moderate beneficial effect.

New toilets (including the new location of toilets on the east side of the ridge) would remove or diminish anaerobic decomposition odors, resulting in a more pleasant visitor experience during late summer, and a reduction in safety hazards associated with the interim storage of untreated human waste, a long-term moderate beneficial effect. Placement of new toilets east and downwind of sleeping spaces (i.e., east of the historic Public Shelter) would improve visitor experience. The design would incorporate a stack that draws air through the toilet and sends odors aloft 15 feet above ground level, adding to the effectiveness of odor “dispersal.”

Visitor health and safety at Camp Muir would be enhanced with the separation of sleeping and cooking areas under all action alternatives, which would result in long-term beneficial and moderate impacts.

Impacts of Alternative 2: Under Alternative 2, cooking facilities would be relocated from the historic Public Shelter to the historic Men's Comfort Station; the Client Shelter would be dismantled and replaced by tent pads and modular tents that would serve as cooking facilities for the guide services; guided clients would camp in tents on the snowfield or glacier, and a new NPS storage shelter would be constructed near the historic Guide Shelter.

Relocating cooking space for independent climbers/overnight visitors from the historic Public Shelter to the historic Men's Comfort Station would result in a long-term, localized moderate beneficial impact on visitor safety due to the physical separation of cooking and sleeping quarters. Because there is a risk that the public would be tempted to cook and heat water in the Public Shelter during periods of inclement weather, park rangers would need to monitor and enforce usage rules.

The existing Client Shelter would be replaced with tent pads and seasonally deployable modular tents, which would be used as cooking and storage space for the guide services. The temporary modular tents would likely also provide sleeping space for

guides at times. Because there would no longer be a sleeping facility for guided clients, guided clients would camp in tents on the snowfield or glacier.

In general, guide service access to storage and cooking space on the Muir ridge would be slightly improved over current conditions; however the lack of hard-sided sleeping space and the newly decentralized overnight camping of clients would result in reduced advantages for guides and the guided public. This change may result in a negligible to minor adverse or beneficial effect in summer, depending on the desired experience of guided clientele, and a moderate adverse effect in winter and during off-season inclement weather, when shelter would more likely be needed. As noted above (under Historic Structures/Cultural Landscapes), the sense of open space would be increased when the seasonal structures are not erected.

NPS staff would continue to use the historic Guide Shelter, and a new storage building would be built just west of the Guide Shelter. The proximity of climbing and safety gear storage to the center of NPS operations is expected to improve the responsiveness of NPS staff to visitor needs, particularly in the case of Search and Rescue operations, resulting in a long-term beneficial minor effect.

A disadvantage of reducing hard-sided buildings within Camp Muir is the consequential reduction in placement opportunities for communication equipment and solar panels, and as base stations for search and rescue support. While this is an operational issue, it is also a visitor and employee safety issue and may have adverse minor impact on visitor safety if responsiveness in the event of a SAR operation is negatively impacted.

Climbers who prefer fewer buildings and minimal services at Camp Muir would likely prefer this alternative from an aesthetic perspective and based on a principle of minimizing permanent structure footprint. While temporary shelters placed on the tent pads would be visually obtrusive to some, others may find the fact that they are temporary, and are not sited in wilderness, a beneficial effect on their experience.

Impacts of Alternative 3: This alternative would result in improved independent public and guided public facilities. The historic Public Shelter would be modified on the interior to separate cooking from sleeping space. Independent visitors would be able to use propane and white gas stoves without fear of increasing the carbon monoxide content of air where people are sleeping, resulting in a long-term localized moderate to major beneficial impact on visitor safety. Facilities for guides services and clients would be improved with a new guide/client sleeping facility taking the place of the old Client Shelter. A separate cooking and storage facility would be constructed east of the existing Butler Shelter. The improved storage facilities would be designed to accommodate storage of equipment that has typically been stashed outside, resulting in less clutter, a minor beneficial impact on visitor aesthetic experience. New buildings would be designed and sited to blend in with the natural environment making them less obtrusive, a long-term moderate beneficial impact on visitor aesthetic experience.

Impacts of Alternative 4: Unlike other alternatives, Alternative 4 provides a new sleeping facility for the independent public, and switches the orientation of use at Camp Muir to opposite its present arrangement. The public would be located on the west end of the ridge, and the guide services would be located on the east. As with Alternatives 2 and 3, visitor safety is improved through the separation of sleeping and cooking space. As in Alternative 3, space is allocated for equipment storage for both NPS and guide services near their centers of operation, a minor beneficial effect on visitor experience.

The Men's Comfort Station would become storage for the guide services. A new guided client sleeping shelter and the historic Public Shelter, with interior modifications, would provide sleeping accommodations for the guide services. NPS staff would continue to use the historic Guide Shelter, and a new storage building would be built just west of the Guide Shelter. The proximity of climbing and safety gear storage to the center of NPS operations is expected to improve the responsiveness of NPS staff to visitor needs, particularly in the case of Search and Rescue operations, resulting in a long-term beneficial minor effect.

The independent public would gain a new shelter and be located in close proximity to the NPS ranger station, which is considered a negligible to minor beneficial effect in terms of safety. Opportunities for visitor contact with NPS rangers would also improve, a particular benefit during inclement weather. These are considered long-term minor to moderate beneficial effects. New buildings would be designed to blend in with the natural environment making them less obtrusive, but the location of the new client shelter near the center of the ridge reduces this benefit, making this alternative a long term minor beneficial impact on visitor aesthetic experience.

Conclusion/Cumulative: Most impacts to visitor experience associated with Alternatives 2-4 would be long-term, beneficial and negligible to moderate, primarily due to the separation of cooking and sleeping quarters for the independent and guided public, improved storage facilities, and overall improved appearance of the site. Alternatives 3 and 4 replace dilapidated structures with hard-sided shelters, which would continue to provide safe haven during severe weather and emergency situations. Public gathering space and overall orientation for visitors would be greatly improved due to the removal of toilets from the center of the ridge, delineation of pathways, and the addition of an information kiosk. Alternative 4 is expected to result in a slight improvement over Alternatives 2 and 3 for some of the independent public because independent climbers would be located closer to the NPS. However, alternative 4 would reduce the amount of open gathering space for day hikers on the ridge. Minor to moderate adverse impacts would continue to occur with Alternative 1 and depending on the target audience (NPS, independent public, or guided clientele) with some alternatives.

Park Operations Affected Environment

During summer, Camp Muir is typically staffed by one to three climbing rangers, and one maintenance person.

Climber Management: Each evening and as feasible during the day, climbing rangers contact the parties camped at Camp Muir to provide information about climbing conditions, ascertain the plans of the various parties, and determine whether they possess climbing permits.

Potable Water: Snow melting for use by staff is conducted as needed, using both solar radiation and propane heaters. Boiling is the primary method of achieving disinfection. Approximately 5 to 10 gallons of water are melted each day for rangers; approximately 10 to 50 gallons are melted each day for the guide services, depending on time of year.

Building and Equipment Maintenance: Climbing Rangers also conduct ongoing maintenance of existing buildings and utility equipment, and clean up, organize, and maintain climbing and rescue equipment.

Human Waste Management: Solar heat is used to dry out and reduce the weight/volume of waste. Solar toilets are equipped with several fabric and steel mesh baskets. As each fills with waste, it is moved to the side of the enclosure and a new basket is placed. The baskets remain in the enclosure to allow drying and leaching of liquid before they are removed and emptied, approximately 3 to 8 times per week. Upon drying, the waste is emptied into covered 55-gallon drums and stored nearby (where they contribute to existing anaerobic decomposition odors). To manage liquid waste, the collection pans below the drying baskets within the public solar toilets have an outlet piped to a drain field below Camp Muir. Liquid waste from the guide service solar toilet is piped to the adjacent pit toilet. Leaks in the vicinity of the toilet are common and difficult to remedy.

Park Operations Environmental Consequences

Impacts of Alternative 1: Alternative 1 impacts would continue to result in a number of adverse effects on park operations, primarily as a result of unimproved safety issues; resource degradation or poor visitor experiences caused by lack of information; the continued inadequacy of administrative and other facilities; incremental or piecemeal improvements that are likely to occur without implementation of a comprehensive rehabilitation plan; and long-term increased costs related to continuous maintenance of dilapidated structures.

The historic structures are currently in good condition, having recently undergone interior and exterior maintenance and repair of buildings and foundations. However, because these buildings are now tighter and more weatherproof than they were prior to

these repairs, safety hazards associated with the use of oxygen-consumptive propane and white gas stoves in enclosed spaces has likely increased. Without the separation of cooking and sleeping areas as proposed in the action alternatives, a relatively high degree of hazard associated with this practice would continue. Much of this situation is also true of the non-historic Butler Shelter, which is also used for these dual purposes. Although carbon monoxide monitors have been installed in the buildings, there continues to be a potential for major adverse consequences of asphyxiation to occur, and park staff must regularly monitor these conditions. This condition continues to result in a long-term minor to moderate adverse effect on park operations.

The continued inadequacy of the toilet facilities to handle the degree of human use at Camp Muir, and the resultant malodorous conditions, and the need for park staff to handle untreated human waste would continue to result in a minor to moderate adverse impact on park operations. The ongoing storage of a large number of 55-gallon drums of human waste at the site would also continue to contribute to these conditions.

While the cost of this alternative would be much less in the short-term, over the long-term it is assumed maintenance of non-historic structures such as the existing Client Shelter would be more costly than maintenance of a new shelter. Currently volunteers conduct some repairs on the Client Shelter, carrying supplies such as plywood up the mountain. It is difficult to quantify this assumed difference in cost, which may be very slight. Impacts to operations related to maintenance needs at Camp Muir would be adverse and minor.

Impacts Common to Alternatives 2-4: All action alternatives would result in improved conditions in terms of operations for NPS and concessioners, including the following:

- The three solar and two pit toilets would be replaced by four toilets that operate on the principle of urine separation and solid waste isolation (a long-term moderate benefit to park operations by reducing handling of untreated human waste, reducing resource impacts associated with human waste, and reducing the odors).
- Helicopter operations associated with the waste may increase (an estimated 4 additional flights per year may be needed) because waste is not dehydrated; however, if methods to separate urine from solids are successful, the same level of helicopter operations may continue. Additional flights would cause a long-term negligible to minor adverse effect on park operations.
- Public, employee and guide safety would be improved by separating sleeping and cooking functions in administrative, public, and guide service facilities (a long-term minor to moderate benefit).
- Adding a kiosk would be helpful in supplying information at Camp Muir (a long-term negligible beneficial effect). The new site orientation and kiosk with delineated paths may slightly ease park operations by informing visitors where to gather, a negligible to minor beneficial impact.

- All action alternatives would result in a similar degree of improvement on visitor experience. Assuming that when the public is more satisfied, NPS staff would likely have fewer public complaints and issues to manage or resolve. These improvements would result in a negligible beneficial impact on park operations.
- The helipad would remain in service without disruption during and after construction (a short- and long-term benefit to park Search and Rescue operations, maintenance, and visitor gathering).

Impacts of Alternative 2: Alternative 2 would improve facilities to a lesser degree for the NPS, guide services, and the public, although all would benefit from the removal of dilapidated structures and poorly functioning toilets. NPS climbing rangers would benefit by having a new storage structure placed next to the Guide Shelter (ranger station) to replace storage space that was previously located in the Men's Comfort Station.

Modular tents would replace hard-sided shelters under Alternative 2, creating an impact on current guide service operations at Camp Muir. Guides would use modular tents for cooking and storage, and possibly sleeping; guided clients would be distributed on the Muir Snowfield and Cowlitz Glacier. Operations would become more logistically complex due to the need to assist clients with daily camp setup. While this is typical of most guided alpine climbing operations, climbing guides at Mount Rainier National Park have relied on hard-sided sleeping shelters since the historic Guide Shelter was constructed in 1916. By providing sleeping quarters to clients, guides are able to focus on teaching and preparing climbers for a safe summit attempt. The availability of hard-sided shelter at Camp Muir has also allowed continued and reliable support from the guide services during Search and Rescue (SAR) operations, which has greatly benefited the general public and the NPS. While the NPS would continue to benefit from the skills and services of professional guides under Alternative 2, it is expected that their availability for management and SAR support at Camp Muir would decline under Alternative 2.

While issues would be different, impacts to NPS operations under Alternative 2 are likely to be equal to Alternative 1 due to removal of hard-sided structures and the anticipated need to fly and/or carry more equipment and supplies to Camp Muir more frequently.

Alternative 2 would have a lower capital cost than all other action alternatives, but may have a higher long-term operating cost than Alternatives 3 and 4 (and equal to or higher operating cost than No Action, Alternative 1), resulting in a moderate impact on NPS and guide service operations due to the increased amount of helicopter flights each season to fly gear and supplies that cannot be stored at Muir over winter. Alternative 2 would also have a moderate adverse impact on guide service operations due to substantial change in business practices that would have to occur due to lack of hard-sided structures for client sleeping quarters.

Construction impacts to operations under Alternative 2 would be less than under Alternatives 3 and 4 due to short duration (one construction seasons). Because of this, impacts to routine operations would be adverse, short-term, and minor.

Impacts of Alternative 3: Park operations under Alternative 3 are expected to improve and result in negligible to minor beneficial impact over Alternative 1 and 2 due to decreased maintenance and improved storage conditions. Impacts to NPS operations related to public contact would be similar to existing conditions and equal to or slightly greater than under Alternative 4 (because the independent public would be located closer to NPS staff in Alternative 4 than in Alternative 3).

The availability of hard-sided shelter at Camp Muir has allowed continued and reliable support from the guide services during Search and Rescue (SAR) operations, which has greatly benefited the general public and the NPS. The NPS would continue to benefit from the skills and services of professional guides under Alternative 3.

Construction impacts to operations under Alternative 3 would be greater than under Alternatives 1 and 2 due to the multiple construction seasons. Impacts to routine operations would be adverse, short-term, and moderate, lasting approximately three years.

Impacts of Alternative 4: This alternative would have a slightly higher degree of construction impact than Alternative 3. Alternative 4 would have more external surface area to construct and maintain because there are two buildings performing the function of one building (Client Shelter) under Alternative 3. Potential impacts of Alternative four would be similar to Alternative 3, though with the advantage that NPS would be located with unguided climbers. Because of this, and because the change in configuration is expected to be noticeable, impacts to park operations is expected to be minor and beneficial. Construction impacts to routine operations would be adverse, short-term, and moderate, lasting approximately three years, as in Alternative 3.

The availability of hard-sided shelter at Camp Muir has allowed continued and reliable support from the guide services during Search and Rescue (SAR) operations, which has greatly benefited the general public and the NPS. Similar to Alternative 3, the NPS would continue to benefit from the skills and services of professional guides under Alternative 4.

Alternative 4 (similar to Alternative 3) exerts the greatest degree of temporary construction impacts on Camp Muir over the longest period of time as it is phased in over three seasons, weather permitting, and thereby inhibiting park operations at the site. In addition, changing use of structures and one additional building site would add complexity to operations during construction phasing. Construction impacts would result in short-term moderate adverse effects on park operations under Alternative 4, and slightly greater than under Alternative 3.

Cumulative: The proposed actions would not increase or decrease capacity at Camp Muir, nor would they encourage increased use – therefore adverse long-term cumulative impacts are not anticipated. Improvements at Camp Muir would also reduce maintenance needs in the longer term (Alternatives 3 and 4), as new structures and toilets would require less maintenance. Construction impacts in the short-term may or may not create a strain on current park staffing levels; funding cycles and implementation of larger scale projects typically do not overlap – so it is unlikely this would be an issue. This potential impact would be short-term, lasting the duration of construction. In general, the long-term cumulative impact to park operations is expected to be beneficial, and negligible to minor.

Conclusion: In the long-term, implementation of Alternative 2 would result in an increased operational cost related to set up and breakdown of modular tents at the beginning and end of climbing season, and have limited opportunities for placement of utilities and instrumentation, and limited space for overwinter storage, resulting in an adverse moderate impact on operations. Short-term construction impacts to operations under Alternative 2 would be minor.

Alternatives 3 and 4 would result in long-term and minor beneficial impact on park operations because structures are new, and intended to improve efficiency of operations through design of buildings that consider the location of storage, utilities and instrumentation. This longer-term beneficial impact would maintain or improve NPS responsiveness to emergency situations and SAR operations. Three years of construction would create short-term adverse and moderate impacts on NPS and concessioner operations.

CHAPTER IV: Consultation and Coordination

Mount Rainier National Park conducted internal scoping with appropriate NPS staff, and external scoping with the public and interested and affected groups, agencies, and tribes to determine the range of issues to be discussed in this Environmental Assessment. Mount Rainier National Park planners and design contractors met to identify initial issues and program requirements. This interdisciplinary process defined the early purpose and need, identified potential actions to address the need, determined the likely issues and impact topics, and identified the relationship of the preferred alternative to other planning efforts in the park. Information used for the preparation of the Environmental Assessment included public comments made on the Commercial Services Plan that related to Camp Muir (received during the public comment period on the *Commercially Guided Visitor Use and Other Services Environmental Assessment*).

A press release initiating the public scoping process and comment period was issued on May 25, 2005. Twenty-one comment letters with comments or questions were received as a result of issuing this press release, which was published in the local newspapers, including the News Tribune from Tacoma, Washington, The Seattle Times, the Seattle Post-Intelligencer, and the Dispatch from Eatonville, Washington.

One letter notifying the Washington State Historic Preservation Officer (SHPO) was sent on January 14, 2003 to solicit comments on the Camp Muir Rehabilitation Schematic Design Facility Report (Portico 2002). Additional consultation with the SHPO has been ongoing. A letter was sent to the Washington SHPO on July 10, 2012 requesting formal concurrence with the NPS determination of no adverse effect on historic resources resulting from the preferred alternative presented in this EA. The proposed project was shared with local tribes during the annual tribal meeting at the Park in 2011 and 2012.

This Environmental Assessment will be available for a 45-day public review period beginning the date it is published to the park's website. At that time, a press release will be distributed to people and businesses that have expressed an interest in the project. The press release will also be mailed to a list of persons, organizations and agencies that have expressed interest in Mount Rainier National Park proposed actions and events. Included among those on the mailing list are local and regional advocacy organizations such as the Wilderness Society, the Sierra Club, The Mountaineers, Mount Rainier National Park Associates, local and regional public libraries, Governmental organizations including Native American Tribes, federal, state and local agencies.

The following public agencies, tribes and libraries, in addition to individuals and private or non-governmental organizations have received notice and electronic copies of the EA (which is available in hard copy upon request):

Washington State Office of Archaeology & Historic Preservation

Washington State Department of Fish and Wildlife
Washington Natural Heritage Program, Department Of Natural Resources
Washington State Department of Transportation
Washington State Parks & Recreation Commission
Washington State Dept. of Ecology
U.S. Environmental Protection Agency
U.S. Army Corps of Engineers
U.S. Fish & Wildlife Service, North Pacific Coast Ecoregion
NOAA Fisheries Service (National Marine Fisheries Service)
Federal Highway Administration, Western District Federal Division
Cowlitz Indian Tribe
Muckleshoot Indian Tribe
Nisqually Indian Tribe
Puyallup Tribe of Indians
Squaxin Island Indian Tribe
Yakama Indian Nation

The following libraries have received hardcopies of the EA: Buckley Library, Eatonville Library, Enumclaw City Library, Tacoma Public Library (Tacoma Branch), and Yakima Valley Regional Library.

This document will also be posted on the park's website, located at <http://parkplanning.nps.gov/muir>, choosing Mount Rainier National Park from the drop down menu. Comments on this Environmental Assessment should be submitted via the park's website, or directed to:

Superintendent, Mount Rainier National Park
55210 238th Avenue East
Ashford, Washington 98304

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment - including your personal identifying information - may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so. The NPS will always make submissions from organizations or businesses, and from individuals identifying themselves as representatives of or officials of organizations or businesses, available for public inspection in their entirety. If reviewers do not identify significant environmental impacts in the EA, this environmental assessment will be used to prepare a Finding of No Significant Impact (FONSI), which will be sent to the Regional Director, Pacific West Region for approval. During the public review period, additional consultation will occur to affirm determinations of effect with the Washington State Historic Preservation Office. Notice of the concurrence with these determinations of effect will be identified in the FONSI for this Environmental Assessment, if prepared

(see above).

For more information concerning this Environmental Assessment, please contact Sueann Brown, Historical Architect at 360-569-6715, or Karen Thompson, Environmental Protection Specialist, 360-569-6507. For a copy of this document, please call Mount Rainier National Park at 360-569-6501.

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APPENDICES

Appendix A: Resource Protection Measures

Appendix B: Agency Correspondence

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APPENDIX A. Resource Protection Measures Common to All Alternatives

General Measures

- Construction limits would be clearly marked with stakes prior to the beginning of ground disturbing activities. No disturbance would occur beyond these limits other than protection measures for erosion/sediment control.
- All tools, equipment, barricades, signs, surplus materials, and rubbish would be removed from the project work limits upon project completion. All demolition debris would be removed from the project site. Construction debris would be hauled from the park to an appropriate disposal location.
- Materials, including removed unusable materials would be disposed of outside the park, according to local, county, state, and federal regulations.
- Debris would not be burned or buried in the park.
- Use of BMPs in the project area for drainage area protection would include the following actions, depending on site-specific requirements:
 - Disturbed areas would be kept as small as practical to minimize exposed soil and the potential for erosion.
 - Excavated materials would be covered with water-repellent, breathable material during storage to prevent erosion/sedimentation.
 - Silt fences, sediment logs, temporary earthen berms, temporary water bars, sediment traps, stone check dams, or other equivalent measures would be installed to limit movement of excavated soil and construction materials from leaving the worksite. Erosion-control measure should be monitored to ensure they are properly installed and are functioning effectively.
- All imported materials including gravel, rock veneer, and erosion-control materials that are capable of harboring plant seed would be certified weed-free according to North American Weed Management Association (NAWMA) standards to ensure that it is free of noxious weeds. Consult with park Plant Ecologist to ensure imported materials are weed-free. Consultation may include an inspection of the rock source, and control of storage locations so weed seed is not picked up in transport.
- All vehicles that haul materials for the project must be inspected by the Plant Ecologist for mud, weeds, and other unwanted substances prior to entering the park. All vehicles would be pressure-washed before their first entry into the park. Hauling vehicles that have previously transported weed-contaminated material would be pressure-washed before transporting clean material.
- Proposed locations (Kautz Creek or Fourth Crossing) for soil and rock stockpiles, and turnaround areas would be inspected and approved by the park Resource Advisor or Plant Ecologist. New locations or treatment may be prescribed.
- Additional measures may be added pending public review and comment and consultation with other agencies.

Vegetation

- Limit development/human activities to the snowfields and areas east of the Butler Shelter. Eliminate all foot traffic on the slope above Butler Shelter.
- To avoid rare lichens, their location has been mapped at Camp Muir; the boundary is indicated on all alternative maps. All proposed disturbance would be located within the existing footprint and exclude the lichen areas. User trails that extend onto the ridge above the Butler Shelter will be discouraged through signage and education of employees, guides and visitors.
- Removal of the Butler Shelter provides an opportunity to scarify the existing footprint, and block user trails that lead into the sensitive lichen area.

Wildlife and Special Status Species

- Park staff would inform construction personnel of the occurrence and status of special status species within the project area, the potential impacts construction activities might have to the species and the potential penalties for taking or harming a special status species.
- Night work is not permitted.
- Any flights over the park and in particular marbled murrelet habitat and Northern spotted owl habitat must maintain an elevation of at least 500 feet over tree canopy. This will be necessary as helicopters fly from outside the park to the Fourth Crossing.
- All motor vehicles and equipment would have mufflers conforming to original manufacturer specifications that are in good working order and are in constant operation to prevent excessive or unusual noise.
- Use of unmuffled compression brakes would be prohibited within the park boundaries.
- The use of air horns within the park would not be allowed except for safety.
- Any roadkill or wildlife collisions would be reported to the park immediately.
- Feeding or approaching wildlife would be prohibited.
- The park Wildlife Ecologist would be notified if bear or fox loiter in the project areas.
- A litter control program would be implemented during construction to eliminate the accumulation of trash. All food items would be stored inside vehicles, trailers, or wildlife-resistant receptacles except during actual use to prevent attracting wildlife.

Cultural Resources

- In the event of the inadvertent discovery of historic properties such as archaeological resources, suspected human remains, funerary objects, sacred sites, or objects of cultural patrimony, the park archaeologist and Superintendent would immediately be notified. The park would follow the *Archaeological Inadvertent Discovery Plan approved by the SHPO. Work in the affected area(s) would stop immediately until the historic properties are reviewed by the park.*
- Historic structures and landscapes would be protected by following the *Secretary of the Interior Standards for the Treatment of Historic Properties.*

- Measures recommended by the SHPO would be added to this list.

Air Quality

- Impacts would be minimized by not allowing idling of vehicles at Fourth Crossing or Kautz Creek.
- The use of chainsaws would be limited to dismantling the Butler Shelter and the Client Shelter, and by making minimum cuts to facilitate helicopter transport off site.

Visitor Experience, Health, Safety and Park Operations

- The helipad would remain in service without disruption during and after construction (a short- and long-term benefit to park Search and Rescue operations, maintenance, and visitor gathering).
- The status of construction will be communicated via the park website, regional newspapers, radio, entrance stations, visitor centers, news releases, local newspapers, media outlets, and postings in local businesses.
- The Lead Climbing Ranger will participate in and approve final construction sequencing and implementation planning efforts to minimize impacts and ensure safety for the public, concessioners and park operations at Camp Muir.
- Construction workers would wear appropriate attire such as hard hats, gloves, and goggles to protect themselves during construction activities. They will also wear attire, equipment and apply other protective measures appropriate to the environment as advised by the climbing ranger staff.

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APPENDIX B. Agency Correspondence