

# **Environmental Assessment**

## **Thunder Creek Bridge Replacement Ross Lake National Recreation Area**

**March 8, 2005**



**The former Thunder Creek suspension bridge, destroyed by a severe flood in October 2003**

## **PUBLIC REVIEW**

Comments on this Environment Assessment must be submitted no later than April 8, 2005.

We encourage you to comment on-line at the NPS Planning Environment and Public Comment (PEPC) website (<http://parkplanning.nps.gov/noca>). At the PEPC web site, you should select the specific North Cascades National Park Service Complex project for which you wish to comment. You will find the full text document, an on-line comment form and instructions for submitting on-line comments under the Documents and Links tab. Please use the on-line comment form to submit your ideas, questions, or comments.

You may also mail or hand-deliver comments to:

Superintendent  
North Cascades National Park Service Complex  
2105 State Route 20  
Sedro-Woolley, WA 98284

You may also comment via e-mail: NOCA\_ [Superintendent@nps.gov](mailto:Superintendent@nps.gov) or via fax to the Superintendent at (360) 856-1934.

## **FREEDOM OF INFORMATION**

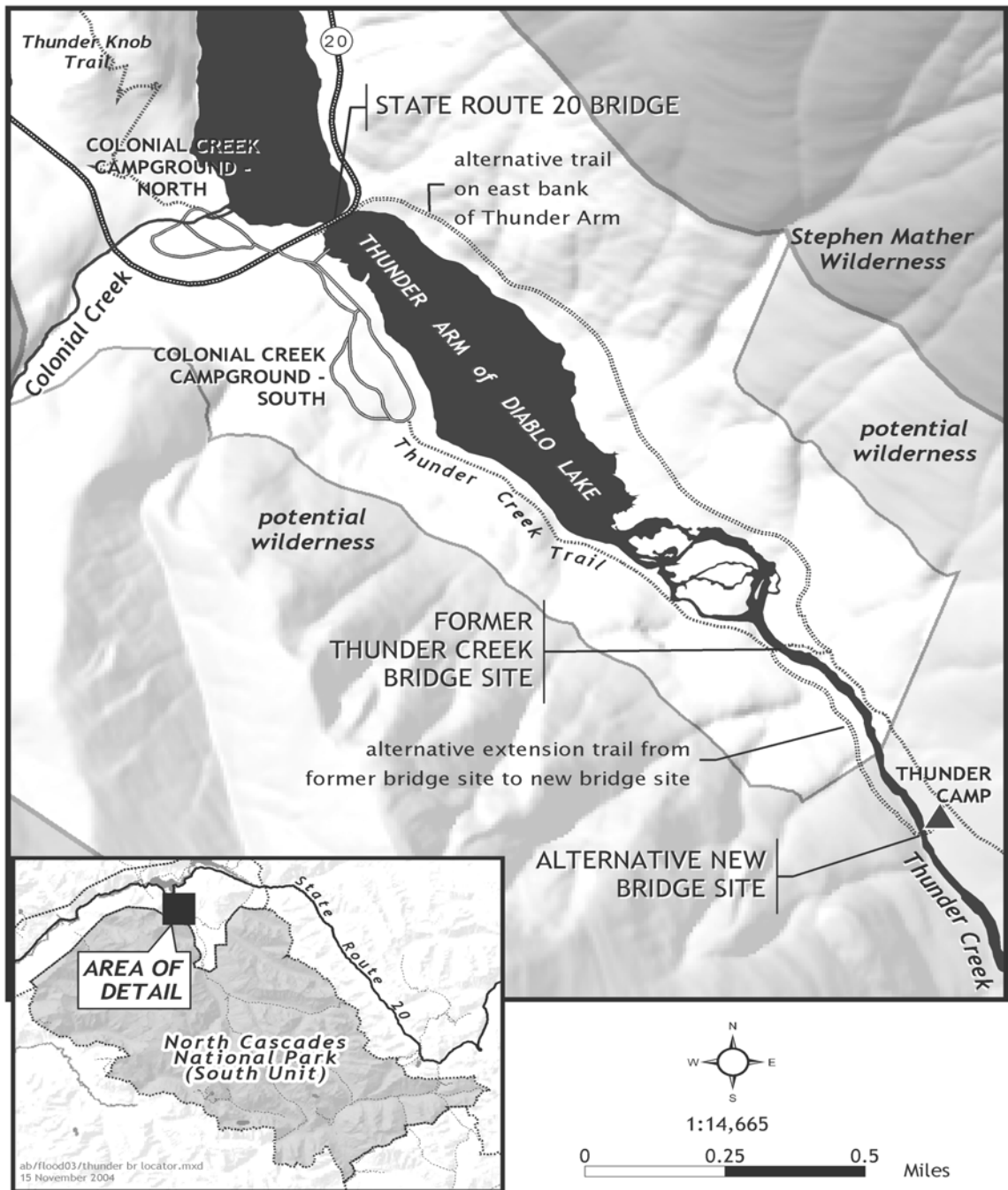
Our practice is to make comments, including names and home addresses of respondents, available for public review during regular business hours. Individual respondents may request that we withhold their home address from the rulemaking record, which we will honor to the extent allowable by law. There also may be circumstances in which we would withhold from the rulemaking record a respondent's identity, as allowable by law. If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comment. However, we will not consider anonymous comments. We will make all submissions from organizations, or businesses, and from individuals identifying themselves as representatives of officials of organizations or businesses, available for public inspection in their entirety.

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# Project Area Map



**Figure 1.** Overview map of the Lower Thunder Creek Drainage. Please refer to the Management Alternative descriptions for further information. Shaded areas represent the Stephen Mather Wilderness (dark gray) and potential wilderness (light gray).

# Chapter I. Purpose and Need for Action

## Purpose

The purpose of this action is to provide visitors in Ross Lake NRA with a safe, sustainable means of access to the popular Thunder Creek Trail.

## Need

The Thunder Creek Trail is one of the most popular trails in North Cascades National Park Service Complex. The trail begins at the southern end of Colonial Creek Campground and leads southward into the Thunder Creek Valley toward Park Creek Pass (18.9 miles) and beyond to the Stehekin River Valley. Along the way, the trail passes several popular backcountry campsites and provides access to a network of popular backcountry trails and mountaineering routes.

The Thunder Creek Trail begins on the western side of the Thunder Creek Valley, then crosses over the creek at mile 1 and traverses the eastern side of the Thunder Creek Valley throughout its remaining length. In October 2003, the suspension bridge at the creek crossing was destroyed by formation of a logjam during a record flood event. The remains of the bridge (Figure 2) were removed in summer 2004, and the trail is now impassable at the former bridge site. To cross Thunder Creek and access the popular Thunder Creek Trail, visitors must either hike cross-country along the eastern side of Thunder Arm (Diablo Lake reservoir) and reconnect with the trail, find a convenient log or ford the creek during low flows (unsafe and not recommended). Visitors may also access the Thunder Creek Valley via the Panther Creek Trail, but this hiking trail adds approximately 9.7 miles and several thousand feet of elevation gain to the approach and does not support stock use.



**Figure 2.** Remains of the Thunder Creek suspension bridge, located approximately 1 mile south of Colonial Creek Campground in Ross Lake NRA.

Formal access to the Thunder Creek Valley from State Route 20/Colonial Creek Campground needs to be retained for several reasons. First, the current informal approaches up the Thunder Creek Valley do not meet NPS standards for public safety. They are unsafe in part because flows on Thunder Creek reach their peak during snowmelt in June and July and are sustained by glacial melt through the summer (Appendix I). Peak flows coincide with the high use, summer season. During that time, the option of fording Thunder Creek is dangerous and very unsafe in most places. The option of hiking up the untrailed, eastern side of Thunder Arm (Figure I) and reconnecting with the Thunder Creek Trail could cause social trail development and potentially unacceptable resource damage. Access via the eastern side of Thunder Arm would also be unsafe, because visitors would have to walk along the shoulder of the North Cascades Highway and cross the highway bridge (narrow shoulder without pedestrian walkway) over Thunder Arm. Finally, the Thunder Creek Trail provides the most efficient and scenic access to the backcountry from the main NPS campground at Colonial Creek (Figure 1). The experience of walking from a campground into a major valley is not duplicated elsewhere in Ross Lake NRA.

## **Decision to be Made**

One of three management alternatives in this Environmental Assessment (EA) will be selected for implementation provided no significant issues are identified through public or agency input. The Superintendent of North Cascades National Park Service Complex will provide a recommendation to the Pacific West Regional Director of the National Park Service. The Regional Director is the deciding official.

## **Issues Considered for Detailed Analysis**

The following section describes various problems and opportunities that need to be considered in this EA. These issues serve to limit irrelevant concerns and focus the impact analysis in Chapter IV “Environmental Consequences”.

### **Visitor Safety**

Thunder Creek is swift, cold and turbulent. In most places, it is too deep and dangerous to ford without a bridge. Flows are highest during snowmelt (May to July; see Appendix I), which coincides with peak times of visitor use. In most areas, there are also no crossings sufficiently shallow for stock to cross, except late in the summer season and winter months when flows are lowest. Given these conditions, the lack of a bridge would present a safety hazard for many visitors.

### **Bridge and Trail Sustainability**

Floods have destroyed several bridges at the former Thunder Creek bridge site. The most recent suspension bridge was built in 1974 (see cover photo). The bridge had been damaged but not destroyed in the past (most recently in 2002) by flooding and falling trees. To minimize the risk of future flood damage, a new bridge must have sufficient freeboard (i.e. height above water) to accommodate high flow volumes and provide passage of woody debris. The bridge abutments must also be built on stable substrate such as bedrock, and located outside of the active creek channel on an alluvial terrace or other stable landform to prevent undermining. The trail approaches to the bridge should be at least above the 10-year floodplain to avoid chronic maintenance problems. The bridge approach ramps must also be low to moderate in slope and relatively straight to accommodate stock. Taken together, these engineering constraints greatly limit the potential location of a new bridge. Further information on bridge location constraints is provided in the landform map in Appendix III).

Old-growth forest blankets the Thunder Creek Valley. Many trees exceed three feet in diameter and are 150 plus feet tall. A bridge could be carefully sited to minimize flood risk, but the potential for damage or destruction from falling trees would remain subject to the vagaries of high winds and unpredictable events.

### **Impacts to Wildlife**

The low elevation, old-growth forest in the lower Thunder Creek Valley provides habitat for a wide variety of wildlife, including sensitive breeding waterfowl and several rare and listed species. To minimize impacts to wildlife and prevent adverse effects on listed species, careful consideration needs to be given to the location of trails and bridges, timing of construction and potential changes in patterns and seasonality of visitor use.

### **Impacts to Vegetation**

Trail construction requires removal of organic matter, woody debris and small vegetation (e.g. saplings, shrubs, groundcover) to establish a durable tread. Larger vegetation and trees can typically be avoided through careful trail alignment. Bridge construction may require cutting down of some larger trees (i.e. > 24” diameter at breast height) to construct abutments, approach ramps and to reduce the risk of hazard

trees (e.g. snags or severely leaning trees) capable of falling on the bridge. Careful survey, design and construction techniques can minimize disturbance to vegetation.

Visitors hiking off trail can trample vegetation and create social trails. These impacts can be minimized through a combination of education such as “Leave No Trace” principles and construction of trails in popular areas.

### **Impacts to Visitor Use in the Thunder Creek Drainage**

The Thunder Creek Trail is one of the most popular hiking trails in the North Cascades Complex given its easy access, moderate grade and spectacular setting. It is a major point of departure for hikers into the southern unit of North Cascades National Park and the Stephen Mather Wilderness. Hiker use of the Thunder Creek Trail and the Thunder backcountry camp was reduced by about 90% in 2004 due to loss of the bridge (see Chapter III, Figure 5). In contrast to hikers, visitors traveling with stock rarely use the Thunder Creek Trail for overnight trips. The backcountry permit database indicates that no visitors with stock have used the trail for overnight trips in at least the last four seasons. The amount of day use by stock parties, while undocumented, is believed to be relatively low.

The alternative location the new bridge under Management Alternative B would place it immediately north (downstream) of the Thunder Backcountry Campground. The approach trail leading to the bridge on the eastern side of Thunder Creek would traverse through one of the campsites. This campsite would need to be relocated to meet campsite standards and protect the wilderness camping experience.

### **Impacts to Wilderness Character in the Thunder Creek Drainage**

The Thunder Creek Trail provides an important link to the southern portion of the Stephen Mather Wilderness. The preferred alternative site for replacing the bridge (Alternative B), along with a portion of new trail leading to the bridge, are located adjacent to the Stephen Mather Wilderness in an area designated as potential wilderness. Should Seattle City Light abandon plans for construction of the Thunder Creek Dam (there is currently no active proposal to build the dam, though the potential remains), this potential wilderness area could become designated wilderness through congressional approval. NPS policies dictate that potential wilderness should be managed as designated wilderness to the extent it is possible to do so. Management actions such as trail and bridge construction should remain sensitive to the potential wilderness character of this area.

### **Park Operations**

Trail crews rely extensively upon stock (horses and mules) to maintain backcountry trails and bridges in the Thunder Creek drainage. A safe means of crossing Thunder Creek with stock is needed because it is the only trail in the Thunder Creek Valley that supports stock use, and the former Thunder Creek bridge was the only established crossing of Thunder Creek. Stock could ford the creek downstream of the former bridge during low flows (Appendix IV), but during high flows (which occur during the maintenance season), or if creek conditions change, fording the creek would be unsafe to impossible.

At the former Thunder Creek Bridge site, the trail leading up to the bridge on the eastern side of the creek floods annually in spring and summer. Crossing this area with stock during high flows is awkward and dangerous because stock can lose their footing and end up swimming while burdened with heavy loads.

Aside from personnel safety, this area is a chronic trail maintenance problem because the trail adjacent to the former bridge along the eastern side of Thunder Creek is located on the floodplain of Thunder Creek (see landform map in Appendix III). Seasonal flooding buries the trail and several small footbridges with muck and woody debris, requiring annual maintenance.

Trail and bridge construction involves many actions with risk to personnel safety, such as lifting of heavy materials, use of heavy equipment and working on steep, unstable surfaces. Mechanized tools and equipment, such as small excavators, toters, chainsaws and helicopters can reduce some safety risks and minimize common occupational hazards such as back injuries, sprains and strains.

### **USGS Stream Gauging Station Operations on Thunder Creek**

The U.S. Geological Survey (USGS) maintains in cooperation with Seattle City Light a stream flow gauging station immediately upstream of the alternative bridge site proposed under Management Alternative B. The gauging station has been located at this site for about 75 years, providing stream flow data for operations of the Skagit River Hydroelectric project and other interested parties (see Appendix I). To calibrate this gauging station during high flows (i.e. flows greater than 800 cfs) when crews cannot safely wade the creek, USGS personnel have relied upon the former Thunder Creek bridge as a platform for measuring stream depth and flow velocity to calibrate discharge at the gauging station. Now that the bridge is gone, the quality of the data provided by the gauging station is poor during high flows because there is no safe means of calibration.

### **Issues Considered but Dismissed**

The following issues were considered but dismissed from further impact analysis in this EA, based on the justification provided.

#### **Impacts to Historic and Prehistoric Cultural Resources**

The Thunder Creek Trail was originally built more than 100 years ago to access mining claims in the Thunder Creek Valley. The earliest written reference to the Thunder Creek Trail dates back to an 1895 report by the Washington Board of State Road Commissioners. Going up Thunder Creek, the surveyors traveled along an established miner's trail noting "...the route is easy, the present narrow trail being fairly well graded, but needing a great deal of work." At the 10-mile point, a "tree" bridge redirected the trail across the creek, where it then continued up toward Thunder Creek Pass (Park Creek Pass today) traversing a steep slope on which a trail had never been built (Luxenberg, 1986).

Over the past century, bridge and trail locations have changed along this historic route. The new bridge and trail alignment considered in Alternatives B and C this EA would not affect potentially important historic elements of the route up Thunder Creek. In addition, the former Thunder Creek Bridge was constructed in 1974 and was not a historic structure. No prehistoric archeological resources have been identified in the project area in spite of fairly extensive surveys, therefore ground disturbance associated with trail and/or bridge construction would not be expected to have an impact on cultural resources. In light of these reasons, impacts to cultural resources were dismissed from further analysis in this EA. However, should an unanticipated discovery of culturally significant resources be discovered upon implementation of the selected alternative, work would cease pending further evaluation of cultural significance and consultation with appropriate agencies and tribes.

#### **Impacts to Surficial Geologic Resources and Soils**

The management alternatives in this EA, if implemented, would have a superficial impact on geologic resources (i.e. landforms, rock and soil) during construction. Instead of addressing this issue as a separate impact topic, impacts are evaluated in as part of the analysis of impacts to water resources and vegetation.

### **Relevant Laws and Policies**

Title II of the enabling legislation for North Cascades National Park Service Complex describes the purpose for creating Ross Lake NRA: *"In order to provide for the public outdoor recreation use and enjoyment of portions of Skagit River and Ross, Diablo, and Gorge Lakes, together with the surrounding*

*lands, and for the conservation of the scenic, scientific, historic and other values contributing to the public enjoyment of such lands and waters.”* To implement this broad congressional mandate for management of Ross Lake NRA, the NPS must consider various laws, regulations and policies that govern the nature and extent of management actions that are acceptable in Ross Lake National Recreation Area, including the portion of the recreation area that is designated as potential wilderness. Relevant sections of these laws, regulations and policies are summarized in the following section.

## **Management of Recreation and Visitor Use**

National Park Service Management Policies (NPS, 2001) is the basic Service-wide policy document of the National Park Service. The following policy statements may apply to the actions considered in this EA:.

NPS Management Policies, Section 9.2.3 Trails and Walks: Trails and walks provide the only means of access into many areas within parks. These facilities will be planned and developed as integral parts of each park’s transportation system, and incorporate principles of universal design. Trails and walks will serve as management tools to help control the distribution and intensity of use. All trails and walks will be carefully situated, designed, and managed to

- *reduce conflicts with automobiles and incompatible uses;*
- *allow for a satisfying park experience;*
- *allow accessibility by the greatest number of people; and*
- *protect park resources.*

NPS Management Policies, Section 9.2.3.9 Trail Bridges: Trail bridges may be used for crossing swift waters, areas prone to flash-flooding, and other places presenting potential safety hazards. Less obtrusive alternatives to bridges, such as culverts, fords, and trail relocations, will be considered before a decision is made to build a bridge. A bridge may be the preferred alternative when necessary to prevent stream bank erosion, or to protect wetlands or fisheries. If a bridge is determined to be appropriate, it will be kept to the minimum size needed to serve trail users, and be designed to harmonize with the surrounding natural scene and be as unobtrusive as possible. (9.2.3.9)

Policy guidance for management of resources, recreation and development is also contained in the General Management Plan (GMP) for Ross Lake National Recreation Area. The GMP, developed in 1988 through extensive discussion and interaction with various stakeholders, describes the degree to which the NPS plans to develop and manage recreation and visitor use.

General Management Plan for Ross Lake NRA, Visitor Use Section: This section states that a trail up the Thunder Creek corridor “...*will continue to be maintained for both horseback rider and hiker use.*”

General Management Plan for Ross Lake NRA, Expansion of Recreational Opportunities: This section of the GMP states that the NPS will “...*strive to afford more people the opportunity to become aware of their surroundings and the wide range of available activities.*” This section also states that the NPS will develop activity sites along the highway to encourage and facilitate recreation. A one-way variation of the proposed Thunder Arm Loop Trail is presented in Management Alternative C as a means of accessing the Thunder Creek Trail.

## **Wilderness Management**

National Park Service Policies, 2001; Section 6.3.1 General Policy: For the purposes of applying these policies, the term “wilderness” will include the categories of suitable, study, proposed, recommended, and designated wilderness. Potential wilderness may be a subset of any of these five categories. The policies apply regardless of category.

National Park Service Policies, 2001; Section 6.2.2.1 Potential Wilderness: The National Park Service will take no action that would diminish the wilderness suitability of an area possessing wilderness characteristics until the legislative process of wilderness designation has been completed. Until that time, management decisions pertaining to lands qualifying as wilderness will be made in expectation of eventual wilderness designation. This policy also applies to potential wilderness, requiring it to be managed as wilderness to the extent that existing non-conforming conditions allow. The National Park Service will seek to remove from potential wilderness the temporary, nonconforming conditions that preclude wilderness designation. All management decisions affecting wilderness will further apply the concepts of “minimum requirements” for the administration of the area regardless of wilderness category. Note: The southern portion of the Project Area is located in Potential Wilderness (see map p. 1).

The Wilderness Management Plan (NPS, 1989) for the Stephen Mather Wilderness in North Cascades National Park Service Complex lays out a framework for managing the Stephen Mather Wilderness in a manner that will “...*pass the wilderness natural resources and spirit of the North Cascades on to the next generation unimpaired.*” The Goals and Objectives section of the Wilderness Management Plan is tied directly to the objectives of the GMP. This section states that wilderness will be managed “...so as to conserve, maintain, enhance or restore the wilderness natural resources and those ecological relationships and processes that would prevail were it not for human influences.” The objective for visitor use of the wilderness and backcountry is to “...ensure maximum freedom of use without sacrificing the quality of the wilderness natural resources.”

Wilderness Management Plan, Bridges in Wilderness: Bridges may be constructed in locations that, without a bridge, would present significant safety hazards under conditions usually present during the normal period of use. Construction material may be cut on site if it does not severely impact the resource. It is more desirable to bring material from outside the park area... The intent is to maintain traditional type and style bridges wherever possible. Cable bridges may be used in place of log stringer bridges if they need to be removed seasonally due to avalanches or high water. Bridge type and size will be commensurate with use.

Wilderness Management Plan, minimum tool use: Non-power tools (e.g. pulaskis and cross-cut saws) will be preferred. The Wilderness District Ranger will have final approval for the use of power tools. Any use of power tools will be limited as far as possible to before the 4th of July and after Labor Day. Power tools will be limited to chain saws, brushers, rock drills, chain saw winches, and explosives. Contractors will be required to meet these standards.

Wilderness Management Plan, Aircraft Use: Aircraft such as helicopters may only be used if stock are not permitted on a particular trail, trail conditions prevent stock use, or there is no other practical way to accomplish the work. Aircraft use will be confined to Monday through Thursday and as much as possible to before the 4th of July and after Labor Day.

## **Water Resources Management**

Floodplain Policy: In compliance with Executive Order 11988, it is National Park Service policy to preserve floodplain values and minimize potentially hazardous conditions associated with flooding. NPS floodplain policy is articulated in more detail in Section 4.6.4 of Management Policies, which states:

*In managing floodplains on park lands, the National Park Service will (1) manage for the preservation of floodplain values; (2) minimize potentially hazardous conditions associated with flooding; and (3) comply with the NPS Organic Act and all other federal laws and Executive orders related to the management of activities in flood-prone areas, including Executive Order 11988*

*(Floodplain Management), NEPA, applicable provisions of the Clean Water Act, and the Rivers and Harbors Appropriation Act of 1899.*

To implement this policy, the National Park Service will:

- Protect and preserve the natural resources and functions of floodplains;
- Avoid the long- and short-term environmental effects associated with the occupancy and modification of floodplains;
- Avoid direct and indirect support of floodplain development and actions that could adversely affect the natural resources and functions of floodplains or increase flood risks; and
- Restore, when practicable, natural floodplain values previously affected by land use activities within floodplains.

NPS Director's Order #77-1: Wetland Protection: Section 2.4 states that the NPS will employ a sequence of: *a) avoiding adverse wetland impacts to the extent practicable; b) minimizing impacts that could not be avoided, and c) compensating for remaining unavoidable adverse wetland impacts via restoration of degraded wetlands.* There are several exceptions to this Director's Order that require special mention. Relevant exceptions for "Water Dependent" Actions or Other Actions with "Minimal Impacts" include:

- a. Scenic overlooks and foot/bike trails or boardwalks, including signs, the primary purposes of which are public education, interpretation, or enjoyment of wetland resources. (Parking lots, access roads, and other associated facilities can not be excepted.)
- b. Minor stream crossings using culverts or bridges that completely span the channel and associated wetland habitat (i.e., no pilings, fill, or other support structures in the wetland/stream habitat).

## **Management of Rare, Threatened and Endangered Species**

Endangered Species Act (ESA) of 1973: The NPS must insure that any action authorized, funded, or carried out is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species. Section 7 of the ESA in particular contains an affirmative mandate for conservation, and includes a requirement for consultation with the US. Fish and Wildlife Service for any NPS action that may affect a listed species or critical habitat.

National Park Service Policies, 2001; Section 4.4.2.3 Management of Threatened or Endangered Plants and Animals: "...The Service will survey for, protect, and strive to recover all species native to national park system units that are listed under the Endangered Species Act. The Service will fully meet its obligations under the NPS Organic Act and the Endangered Species Act to both pro-actively conserve listed species and prevent detrimental effects on these species." To meet these obligations, the Service will: "...Manage designated critical habitat, essential habitat, and recovery areas to maintain and enhance their value for the recovery of threatened and endangered species." The NPS will also "...Cooperate with other agencies to ensure that the delineation of critical habitat, essential habitat, and/or recovery areas on park-managed lands provides needed conservation benefits to the total recovery efforts being conducted by all the participating agencies."

DIRECTOR'S ORDER #77-8: Endangered Species (DRAFT): This Order (currently in draft form), issued by the Director of the National Park Service, further clarifies NPS responsibilities under the Endangered Species Act (ESA) for management of federally endangered, threatened, proposed, candidate, rare, and sensitive species; experimental populations; designated and proposed critical habitat; and state-listed species. D.O. 77-8 requires the NPS to "...survey, protect, monitor, restore, and strive to recover all species listed, proposed, or candidates for listing under the ESA that are native to NPS units." It also requires the NPS to manage, to the greatest extent possible, state and locally endangered and threatened species as federally listed species.

NPS and USFS Interim Policy on Grizzly Bear Recovery: Managing human access in grizzly bear habitat is an important recovery and conservation issue for this federally threatened species. Research indicates roads and high use trails trigger avoidance among grizzlies and can drive them from areas of otherwise suitable habitat. In light of this research, the National Park Service and the U.S. Forest Service have agreed to an interim policy of ‘no net loss’ of core area (defined as areas >500 meters (1,640 feet) from roads or high-use trails) within each of the grizzly Bear Management Units (BMU) in the North Cascades ecosystem. Under this agreement, construction of roads or high use trails in core area requires closure of a road and/or trail of similar size, use level and habitat within the BMU where the loss occurs. This agreement will remain in effect for NOCA until the General Management Plan is revised and long-term measures are formally adopted for grizzly bear recovery.

## Chapter II. Management Alternatives

### Management Alternative A. Do Not Repair the Thunder Creek Bridge (No Action Alternative)

**Description:** Under this alternative, the bridge would not be replaced. Instead, the remaining bridge materials, including the concrete bridge abutment on the right bank and floodplain of Thunder Creek, would be removed. The 0.5 mile trail from the former bridge to Thunder Camp would be restored by removing several log-stringer bridges and trail materials including culverts and turnpike.

The Thunder Creek Valley would remain accessible to hikers via several routes: (a) the North Cascades Highway via the Panther Creek trail and 4<sup>th</sup> of July Pass; (b) from the southeast via Easy Pass on Highway 20; (c) from Park Creek Pass in the Stehekin Valley, or (d) via several unmaintained, informal approaches from Colonial Creek Campground described in the “Need” section of Chapter I.

This “No Action” alternative is required by NPS policies as a means for comparing impacts of other “action” alternatives against a common baseline.

### Management Alternative B. Rebuild the Thunder Creek Bridge at a Secure Location Using Steel Beams and Wood Decking (Preferred Alternative)

#### Description

A bridge site secure from flooding lies about 0.5 miles upstream from the current site (see Map p. 1 and ). The alternative bridge site is more secure from flooding because the channel is narrow (about 100 feet wide), the banks are elevated above the floodplain on a riverine terraces, and underlain with stable rock substrate (gravel, cobbles, boulders; right bank) and bedrock (left bank).

To minimize the risk of damage from future flooding, the superstructure of the new bridge would be at least five feet above the 100 year floodplain to protect the bridge from floating debris and minimize the potential for log jam formation under the bridge. The concrete abutments would be protected from scour by bedrock on the left bank and bioengineering and logs on the right bank. The approximately 100 foot long bridge would be constructed using single span, steel I-beams covered with wooden decking and handrails (Figure 3). Trail and bridge construction would take place in spring 2005 and be completed by early July, just in time for the high use summer season.



**Figure 3.** Example of single span steel bridge with wooden decking and handrails (photo of bridge over Ruby Creek, Eastbank Trail, Ross Lake NRA)

Construction of Thunder Bridge would take approximately 60 days. The bridge abutments would be dug by hand and formed with concrete transported to the site via helicopter. A helicopter would be also used to transport nine, approximately 4000-pound steel I-beams to an assembly area adjacent to the bridge site.

The steel I-beams would be bolted together to form three stringers capable of spanning the entire channel. Approximately two full days of repeated helicopter flights would be needed to transport these materials. A steel cable spanning the channel (i.e. a “high line”) would be used to yard the bridge stringers across the creek channel and place them on the concrete abutments. The steel stringers would be covered with wooden decking and handrails to soften the appearance of the steel substructure. Wooden approach ramps with moderate grades would be constructed on both sides of the bridge. The eastern approach ramp would traverse one (of the three) backcountry campsites at Thunder Camp.

Trail construction from the former bridge to the new bridge would begin in early spring 2005 and take several months. The trail would be constructed according to the following all-purpose standards for accommodating hikers and stock: 24-30” width; 8 foot lateral clearance; 10 foot vertical clearance; and 10% maximum general grade. NPS personnel would construct the trail with various hand tools such as shovels and pulaskis, and power tools including chainsaws, toters (gas powered carts) and a small excavator specifically designed for trail construction. This mechanized equipment would be considered the minimum tools for use in the potential wilderness portion of the project area. Some blasting could be needed to build trail through a couple of potentially unavoidable boulder deposits and bedrock outcrops. In unavoidable wet areas, the trail would be constructed with rock turnpike underlain by culverts to allow water movement. The total area of physical disturbance from trail construction would be approximately 0.5 acres and 0.5 miles in length.

The Thunder backcountry camp has three separate camp sites situated under a stately stand of old-growth Douglas fir and Western red cedar trees on a river terrace landform adjacent to Thunder Creek (Appendix C). To accommodate the new bridge and trail, the northern most campsite (4-person capacity) would be converted into the Thunder Creek Trail. A suitable replacement campsite with the same capacity would be constructed on the same river terrace to the south in 2006.

### **Estimated Project Cost: \$235,000**

### **Mitigation Measures**

Mitigation measures are management actions intended to lessen the impact of a management alternative on a particular resource. The following mitigation measures would be employed under this Alternative:

- To reduce the cumulative impact of trail disturbance, the abandoned section of trail from the old Thunder Creek bridge site to the Thunder Creek campground (approximately 0.5 mile) would be closed and rehabilitated using hand tools and native materials.
- The new trail would be carefully aligned to avoid wet areas when possible and minimize cutting of over story vegetation and roots from large trees.
- The new bridge would be pinned and cabled to its footings to facilitate safe retrieval from the creek in the event of damage from an extreme flood or falling tree. This would also reduce risk to personnel safety during recovery.
- The bridge off-ramps would be carefully aligned to avoid impacting the roots of old-growth trees at the bridge site.
- Obvious hazard trees (e.g. trees with root rot or other obvious physical defects) in the immediate vicinity of the new bridge would be snagged (i.e. climbed and cut to provide a standing snag as opposed to a stump) or felled if too dangerous to climb.
- A combination of hand tools and mechanized equipment would be used as the minimum tools to accomplish the job. This mixed approach would (a) minimize safety risks to personnel from movement of heavy materials and equipment; (b) reduce the duration of construction disturbance in the project area; and (c) ensure completion of the project in a timely fashion to minimize impacts to visitor use of the popular Thunder Creek Trail.

- To minimize disturbance to wildlife including nesting birds, waterfowl (e.g. harlequin ducks, Barrow's goldeneye) and raptors (e.g. goshawks, merlins) during the critical nesting season, there would be no blasting from April through June. A "boulder buster" (i.e. 12-gauge shotgun shell drilled into rock) would not be subject to this restriction. Note: a boulder buster generates a sound equivalent to a muffled gun shot as opposed to traditional blasting which is thunderous. During April, there would also be no chainsaw use, boulder buster use, or other loud noise-producing activity within ¼ mile of the Thunder Creek delta (the former bridge site forms the upstream boundary of the delta).
- Helicopter flights would be staged out of the parking lot on the south side of the Colonial Creek campground to avoid flying over the North Cascades highway with heavy payloads. To minimize disturbance to visitors and wildlife, and to ensure visitor safety, campsites and day use facilities in the vicinity of the staging area would be temporarily closed during flights. The helicopter would remain at least 500 feet above ground level until over the bridge construction site. The flight path would cross Thunder Arm near the highway bridge to gain altitude, then follow the eastern side of the valley to avoid low-level flying over the southern portion of Thunder Arm and the ecologically sensitive delta and riparian zone of Thunder Creek. There would be no flights on weekends or holidays.
- Resources Management staffs would monitor wildlife in the project area to monitor construction disturbance and ensure the mitigation measures were meeting the objective of minimizing disturbance.

## **Management Alternative C. Retrofit the State Route 20 Bridge with a All-purpose Walkway and Construct an All-Purpose Trail along the East Bank of Thunder Arm**

### **Description**

Instead of rebuilding a bridge across Thunder Creek, the trailhead for the Thunder Creek Trail (located on the south side of Colonial Creek Campground) would be combined with the Thunder Knob trailhead at the entrance of Colonial Creek campground along State Route 20. The State Route 20 bridge across the Thunder Arm portion of Diablo Lake reservoir would be retrofitted with an all-purpose (hiker and stock) walkway to provide safe access to the eastern shore of Thunder Arm (Figure 4).

To meet Washington Department of Transportation design standards, the State Route 20 bridge approaches would be modified with rock and fill to widen the embankments and accommodate the all-purpose walkway. The walkway would be 10 feet wide and approximately 210 feet long with a four foot high steel barrier/handrail to protect hikers and stock from bridge traffic. A walkway of this size could not be cantilevered onto the existing bridge. Instead, a substructure of piles or shafts would be required to support the additional deck. The water depth below the bridge exceeds 30 ft at some pier locations, so fairly extensive and costly modifications to the bridge would be needed. The length of time from design through final construction would be a minimum of three years, and perhaps longer given current funding shortages (Lee Conrad, WADOT Mount Baker Area Operations Manager, pers. comm., Nov. 16, 2004).

A new, approximately 1.5 mile trail would be constructed from the North Cascades Highway southward along the eastern shoreline of Thunder Arm. The new trail would reconnect with the existing Thunder Creek Trail just south (upstream) of the former bridge (See Project Area Map, p. 1). The former Thunder Creek Trail would remain open from the south side of Colonial Campground to the former bridge site, to provide visitors with a short day hike to the former bridge site. The trail would be closed and



**Figure 4.** State Route 20 bridge (milepost 130.3) over Thunder Arm, Diablo Lake Reservoir. This bridge could be retrofitted with an all-purpose walkway as an alternative to constructing a bridge across Thunder Creek. A 1.5 mile trail would need to be constructed from the highway corner at the far side of the bridge (right side of photo) southward along the shoreline of Thunder Arm to the existing Thunder Creek Trail.

rehabilitated along the eastern side of Thunder Creek, from the former bridge site to the intersection of the new Thunder Creek Trail leading up the eastern side of Thunder Arm.

Construction of the 1.5 mile all-purpose trail up the eastern side of Thunder Arm would take approximately one summer season. Methods of trail construction would be similar to those in Management Alternative B. However, additional blasting of bedrock outcrops and talus slopes near the highway would be needed, along with construction of several small bridges across unnamed, intermittent stream channels.

The estimated cost of trail construction is \$50,000. The estimated cost of bridge construction is \$950,000, including \$630,000 for the construction and \$320,000 for federal contracting and interagency coordination, including project oversight (Lee Conrad, Washington State D.O.T. Mount Baker Area Operations Manager, pers. comm., Nov. 16, 2004).

**Total Estimated Project Cost: \$1,000,000.**

## **Mitigation Measures**

Mitigation Measures are management actions intended to lessen the impact of management actions. The following mitigation measures would be employed under this Alternative:

- Additional plant surveys along the route of the proposed trail would be conducted to minimize potential impacts to a rare species of fern (state listed) previously documented in the vicinity of the proposed trail.
- Trail construction in the vicinity of Thunder Arm would occur in summer and fall to minimize disturbance to waterfowl known to nest on the southeastern shoreline of Thunder Arm.
- A portion of the new trail would follow an approx. 200 yard section of old roadbed in the forest south of Thunder Arm to minimize impacts to this largely undisturbed area.
- There would be no pile driving or other loud noise-producing activity during the critical nesting period (April-June).

## **Environmentally Preferred Management Alternative**

NPS policies regarding implementation of the National Environmental Policy Act require the identification of the environmentally preferred alternative so the public has a clear understanding of the relative merits of the various alternatives. The Environmentally Preferred Alternative is the alternative that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historic, cultural, and natural resources. Based upon the impact analysis in Chapter 4, Management Alternative A. Do Not Repair the Thunder Creek Bridge would be the environmentally preferred alternative. Alternative A (the “No Action” alternative) would cause the least short-term and long-term adverse impacts to the biological and physical environment compared with the other “Action” alternatives because it would cause the least disturbance. While some social trails would develop, it is assumed that social trails would not proliferate and few people would use them. In addition, removal of a trail and bridge from the riparian zone of Thunder Creek could also benefit various sensitive waterfowl and wildlife by reducing human disturbance in the project area. In comparison, the “Action” alternatives B and C would both involve trail and bridge construction, and facilitate high amounts of visitor use.

## **Management Alternatives Considered but Rejected**

### **Rebuild the Thunder Creek Bridge at its Former Location**

A quarter mile section of Thunder Creek Trail on the eastern side of the former Thunder Creek Bridge traverses the floodplain of Thunder Creek. The trail routinely floods during spring runoff and “rain on snow” events and can be impassible. If the bridge were rebuilt in the same general location, future flooding could damage the bridge abutment on the right bank and possibly destroy the bridge. The trail would also continue to flood several times a year and remain a chronic maintenance problem. Finally, the approach and abutment (now partly in the channel) on the east bank/floodplain of Thunder Creek would continue to affect floodplain processes. These disadvantages demonstrate that this alternative would not meet the purpose of minimizing the risk of flood damage in the future. Therefore, this alternative was considered but preliminarily rejected from further consideration.

### **Rebuild the Thunder Creek Bridge at a Better Location Using Native Materials**

As opposed to building a steel bridge with wooden decking described in Management Alternative B, the option of felling several large-diameter, old-growth Douglas fir trees on site to build the bridge was considered because using native materials and construction techniques are often preferred in wilderness. This concept, however, was considered but rejected for several reasons. First, the trees may have fractures or other undetectable defects that would not lend themselves to accurate engineering of major structural elements. In addition, the trees would decay fairly rapidly (20 year life expectancy) under the onslaught of pests and fungal decay. Finally, park staffs are reluctant to cut down old growth trees to build a bridge. Smaller logs could be airlifted to the site via helicopter, but the life expectancy of the bridge would be even shorter. The bridge would also “bounce” excessively under a heavy load due to the long unsupported span.

### **Retrofit the Highway Bridge with a Pedestrian Walkway and Construct a Stock Ford Downstream of the Former Bridge**

Backcountry permit data and staff observations indicate the Thunder Creek Trail receives a negligible amount of stock use by the public (e.g. no overnight private stock parties are believed to have used the trail in the last four years). Since there appears to be negligible demand for stock use on the Thunder Creek Trail (excluding trail crew operations), the option of (a) retrofitting the highway bridge with a smaller walkway just for pedestrians, and (b) establishing a horse ford about 150 yards downstream (north) of the former bridge site (see photo Appendix IV) was considered but rejected for reasons of cost, logistics and environmental impacts. Notably, D.O.T. engineers estimate that retrofitting the bridge with

a smaller, pedestrian-only walkway would cost roughly the same as an all-purpose walkway because it would still require construction of an extensive substructure. In addition, the stock ford would not be usable during high flows, so visitors with stock and trail crew operations supported by stock would not be able to cross the horse ford during most of the summer season.

### **Construct a Trail and Parking Lot on the Eastern Side of Thunder Arm**

Under this Alternative, a new trailhead with parking for hikers and stock users would be constructed adjacent to the North Cascades Highway on the eastern side of Thunder Arm (this location partly visible in Figure 4). Access to Thunder Arm would then be available via the trail proposed under Alternative C. This action would circumvent the problem of getting pedestrians and stock across Thunder Creek or Thunder Arm by moving the entire trailhead to the eastern side of the valley. This Alternative was rejected primarily because the parking area would be located on a sharp corner with limited site distances for westbound traffic traveling downhill at high speed. In addition, a large number of campers at Colonial Creek Campground take day hiking excursions up the Thunder Creek Trail. To access the Thunder Creek Trailhead, campers at Colonial Creek would have to walk along the shoulder of the North Cascades Highway and cross the narrow bridge over Thunder Arm. This pedestrian approach would not be safe.

# Chapter III. Affected Environment

## Introduction

This chapter describes the resources and values that could be potentially affected by the Management Alternatives considered in this EA. The resource topics described in this Chapter are derived from the issue statements provided in Chapter I, “Purpose and Need”. This information is intended to give the reviewer the necessary background information for evaluating impacts in Chapter IV, “Environmental Consequences”.

## Project Area

The impact analysis area for this EA includes the lower portion of the Thunder Creek Valley in Ross Lake NRA (Figure 2). The affected area extends southward approximately 2 miles from the North Cascades Highway (State Route 20) into the lower Thunder Creek Valley. The project area is bordered to the east by the lower slopes and valley walls of Ruby Mountain and to the west by the lower slopes of Colonial Peak. The elevation of the project area ranges from about 1100 feet to 1250 feet.

## Water Resources

The water resources under consideration for this impact topic include Thunder Creek, its floodplain and several unnamed, seasonal tributaries and riparian wetlands in the lower portion of the Thunder Creek drainage, as depicted in the overview map (Figure 1) and Landform Map (Appendix III).

Thunder Creek is a permanent stream that originates in the glaciated headwaters of the southern unit of North Cascades National Park. The creek flows northward throughout its length, terminating in the tail waters of Diablo Lake reservoir. In the last half mile or so before entering Diablo Lake reservoir, the gradient of Thunder Creek flattens out, the floodplain broadens and the creek enters a network of braided side channels along the seasonally-inundated floodplain. (Note: the former Thunder Creek bridge was placed at the upstream edge of this floodplain area, in the final stretch of creek that was confined to a single channel; see Appendix III).

Thunder Creek empties into the Thunder Arm portion of Diablo Lake reservoir, approximately 1 mile south of State Route 20. Diablo Lake reservoir is one of three reservoirs in Ross Lake NRA that comprise the Skagit River Hydroelectric Project, owned and operated by Seattle City Light. The Thunder Arm portion of Diablo Lake reservoir is generally shallow, except for the now-submerged portion of the former Thunder Creek channel that meanders northward through Thunder Arm. At the State Route 20 Bridge, this former creek channel exceeds 30 feet in depth.

In cooperation with Seattle City Light, the U.S. Geological Survey maintains a stream flow gauging station slightly upstream of the bridge site proposed under Management Alternative B. This gauging station has been collecting flow data for the past 75 years, to help guide management of the Skagit River Hydroelectric Project. A hydrograph (i.e. a chart of stream flow volumes over time) for the past 73 years collected at this gauging station is provided in Appendix I. Gauging station data indicate that stream flows are generally highest in spring when snowmelt peaks and in late fall after heavy rain and “rain on snow” events. Glacial meltwater maintains high flows through summer (Note: Glaciers cover 13% of the Thunder Creek watershed—the highest percent glacial coverage of any major valley in Washington State).

The flooding in October 2003 that destroyed the Thunder Creek Bridge was a rain on snow event. The flood was estimated to be a 100+ year flood event (i.e. probability of occurrence was less than 1 in 100

years, or 1% probability of flooding in any given year). This estimate could not be confirmed, because the floodwaters overwhelmed the gauging station and prevented recording of reliable flow data.

A series of riparian wetlands rest along the eastern floodplain of Thunder creek, from the vicinity of the former bridge northward to Thunder Arm. These wetlands are essentially side channels of Thunder Creek that are seasonally flooded by Thunder Creek, smaller tributaries flowing off Ruby Mountain or filled by groundwater when the water table rises. A few isolated “seep” wetlands are found along the lower slopes of Colonial Peak, in the area of the 0.5 mile trail extension proposed in Management Alternative B.

## Vegetation

Most of the project area is a “classic” old-growth, lowland forest once typical of the west side of the Cascade Mountains. Dominant tree species include Douglas fir, western red cedar, western hemlock and Pacific silver fir. Understory vegetation consists of various young trees, shrubs, ferns, many different species of forbs, mosses and lichens.

The floodplain of Thunder Creek is fairly wide along its eastern banks, with extensive stands of cottonwood and alder interspersed among the braided side channels. The floodplain is barely discernable along the west side of the Creek, as the slopes are moderate to fairly steep in most places. Dominant tree species in the floodplain include black cottonwood, western red cedar, red alder, vine maple and willows.

The Thunder Creek Valley is oriented along a north-south axis, so the eastern side of the valley has a drier, westerly aspect compared to the shaded western side of the valley. The forest along the eastern side of Thunder Creek is generally open, with stately stands of widely spaced old-growth trees and relatively sparse understory vegetation. The portion of forest along the eastern shoreline of Thunder Arm near the North Cascades highway is located along steep terrain interspersed with dry bedrock outcrops and talus slopes. Douglas firs are the dominant tree species, and the understory is sparsely covered with moss, lichens and various other plants that are tolerant of the thin rocky soils and seasonally dry conditions.

The forest along the western side of the project area has a well-developed understory compared to the east side. In the area of the trail extension proposed under Alternative B, there are several old rock slides with dense patches of alder and vine maple that are commonly found on vegetated talus slopes. There are also several intermittently dry streambeds and seeps covered with thick patches of moss, lichens and ferns.

There are no known rare or listed plants on the west side of the valley. On the east side of the project area, however, a population of rare fern (genus *Botrychium*) has been documented in the general vicinity of the trail proposed under Management Alternative C. Additional surveys would be needed to relocate the plants and to determine their proximity to the new trail.

## Wildlife

Old-growth forest blankets the lower Thunder Creek Valley and provides outstanding habitat for many species of wildlife. Thunder Creek is also believed to be an important corridor for wildlife movement, although the North Cascades highway, the Colonial Creek Campground and the Skagit River Hydroelectric Project serve as partial barriers for wildlife movement, especially during high visitor use periods from late spring through early fall.

Wildlife surveys of the project area in advance of this EA documented numerous tracks and game trails in the areas considered for trail construction under Alternatives B and C. Both areas showed evidence of black tail deer, black bear, bobcat and cougar. A pair of barred owls was also documented along the eastern side of Thunder arm. Barred owls have nested in this area for many years.

Over the years, NPS personnel have documented via wildlife observation cards many species of birds and other wildlife, including small mammals, bats, songbirds and amphibians characteristic of low elevation old-growth forest. Notable records of mammals in the area include river otters near the mouth of Thunder Creek and moose slightly south of the project area. Pine martins and mink have also been seen near the former Thunder Creek Bridge and along the trail. A grizzly bear track was recorded and confirmed in 1987.

The Thunder Arm portion of Diablo Lake reservoir and the braided distributaries (i.e. side channels) at the mouth of the Thunder Creek delta provide excellent nesting and forage habitat for birds and waterfowl. Commonly seen species include buffleheads, western and pied-billed grebes, hooded and common mergansers, Canada geese, blue-winged teal, wood ducks and Barrow's goldeneye. Scores of cliff swallows nest under the North Cascades highway bridge over Thunder Arm. In spring and fall, various transient species of waterfowl have occasionally been documented, including trumpeter swans, tundra swans and American white pelicans (State Endangered).

Of the wide variety of waterfowl at the Thunder Creek delta, harlequin ducks (Washington State Priority Species) and Barrow's goldeneye (a cavity nesting diving duck) deserve special mention given their breeding biology. Harlequin ducks are uncommon on the west side of North Cascades: one or two pairs generally nest in the larger drainages, and there are perhaps only two pairs in the Thunder Creek watershed. A pair of Harlequin ducks is believed to nest amongst woody debris in the side channels and wetlands downstream of the former bridge. They have nested in this area for many years.

The Thunder Creek delta has many snags (i.e. standing dead trees) in standing water that provide notable habitat for cavity nesting wildlife, including waterfowl such as the Barrow's goldeneye. Of the only three areas in the Complex where Barrow's goldeneyes are known to nest, the Thunder Creek delta has the best nesting habitat.

### Rare, Threatened and Endangered Species

Various state and federally listed species of wildlife have been either documented or have the potential to inhabit the project area (Table I). Species-specific descriptions are provided in Chapter 4 as part of the Biological Assessment for informal consultation with the U.S. Fish and Wildlife Service.

<b>Table I. State and federal rare and listed wildlife species potentially in the project area.</b>				
*Status: E=Endangered; T=Threatened; C=Candidate Species; S=State Listed Sensitive.				
**Those species that have been observed in the project area are noted as "yes" in the far right column. A "no" indicates that observations and/or surveys (to date) have found no indication that the species is present, although potential habitat exists.				
Common Name	Latin Name	*Status		**Documented in Project Area?
		Federal	State	
Bald eagle	<i>Haliaeetus leucocephalus</i>	T	E	Yes
Bull trout	<i>Salvelinus confluentus</i>	T	C	No
California wolverine	<i>Gulo gulo luteus</i>		C	No
Canada lynx	<i>Lynx canadensis</i>	T	T	No
Common loon	<i>Gavia immer</i>		S	Yes
Gray wolf	<i>Canus lupus</i>	E	E	No
Grizzly bear	<i>Ursus arctos</i>	T	E	Yes
Merlin	<i>Falco columbarius</i>		C	Yes
Northern goshawk	<i>Accipiter gentilis</i>		T	Yes
Northern spotted owl	<i>Strix occidentalis caurina</i> -	T	E	No

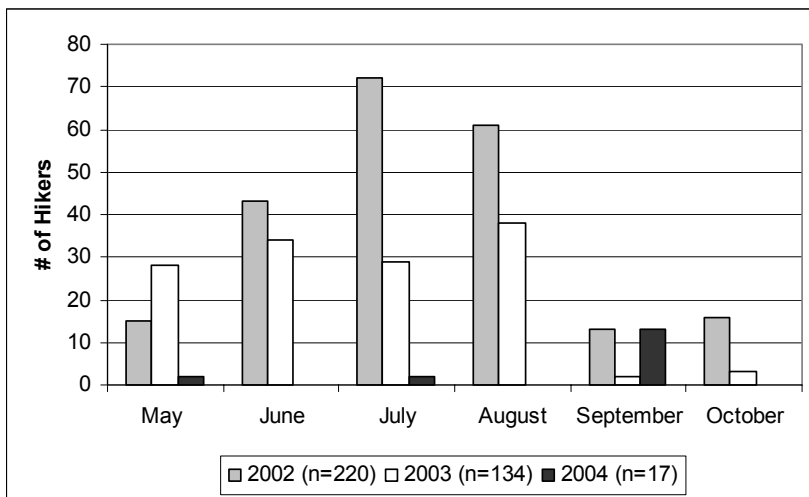
Pacific fisher	<i>Martes pennanti pacifica</i>		E	No
Peregrine falcon	<i>Falco peregrinus</i>		S	Yes
Pileated woodpecker	<i>Dryocopus pileatus</i>		C	Yes
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>		T	No
Vaux's swift	<i>Chaetura vauxi</i>		C	No
Western Grebe	<i>Aechmophorus occidentalis</i>		C	Yes
Western toad	<i>Bufo boreas</i>		C	No

## Visitor Use

Facilities for visitors in the project area include the Colonial Creek Campground, the 0.5 mile Thunder Woods Nature Trail just south of the campground, the Thunder Creek Trail and the Thunder backcountry hiker camp.

The Colonial Creek campground is the most popular campground in Ross Lake NRA. In the summer months, it is often at full-capacity, especially on weekends. Many campers hike the Thunder Woods Nature trail, or take longer day hikes up the Thunder Creek Trail.

The Thunder Creek Trail is primary hub in the North Cascades trail system. The 18.9 mile trail provides access to the southern unit of North Cascades National Park, and to points beyond including the Stehekin River Valley in Lake Chelan NRA. Slightly south of the project area, the Thunder Creek Trail intersects with the 9.7 mile Panther Creek Trail. Following loss of the Thunder Creek Bridge, some visitors have used the Panther Creek trail as an alternative means of access to the lower Thunder Creek Valley.



**Figure 5.** Overnight use of Thunder Camp: 2002 to 2004 season. Use declined significantly in 2004 because the loss of the Thunder Creek limited access. There are no data available for day use.

The Thunder Creek Trail is accessible year round, although in winter it receives very little use. Most use occurs from May through October, with peak use from June through August. The Thunder Creek Trail is an all-purpose trail for hikers and stock. Backcountry permit data and staff observations indicate that since 2002, no private stock parties have used the trail. Although stock use of the trail by visitors is extremely uncommon, the North Cascades Trail Crew routinely uses stock on the trail to transport heavy gear and equipment needed to maintain trails and camps in the Thunder Creek drainage.

The Thunder Camp at the southern end of the project area is a popular backcountry hiker camp because it is easily accessible via a 2 mile hike from the trailhead. The camp is a common destination for slower moving parties such as families with young children. It is also popular among parties that arrive late in the day and do not have time to hike further into the backcountry.

Backcountry permit data indicate that in 2002 at least 220 people camped at the Thunder Camp. In 2003, at least 134 people camped at Thunder Camp. In 2004 however, only 17 people camped at Thunder camp

due to loss of the Thunder Creek Bridge—a decline of more than 90% compared to previous years due to loss of the bridge (Figure 5).

The Thunder camp has three separate sites situated amongst a stately stand of old growth trees on a river terrace adjacent to Thunder Creek. Under Management Alternative B, the northern-most site would be converted into the Thunder Creek Trail, because the alignment of the bridge would direct the trail through the site. There are other potential locations for a replacement camp south of the bridge on the same river terrace landform (Appendix III).

# Chapter IV. Environmental Consequences

## Introduction

This chapter describes the environmental consequences, or impacts, for each of the management alternatives. The impacts topics are based upon the Affected Environment descriptions in Chapter III. Each of the impacts topics describes the resources and/or values that could be affected by management actions.

## Impact Analysis Methods

The types of impacts evaluated include those that are direct, indirect, and cumulative in nature and extent. Cumulative impacts are described by combining the anticipated impacts of each alternative with other past, present and reasonably foreseeable future actions. Impacts are described in terms of their spatial (i.e. site-specific, local, regional) and temporal (short-term vs. long-term) context. Impacts may be beneficial or adverse.

The discussion of direct impacts is limited to the immediate impacts of management actions. When relevant, indirect and cumulative impacts are also discussed.

When possible, quantitative measures are included to provide an objective and measurable approach to assessing impacts. Impacts are also described qualitatively according to the following four categories of intensity and duration:

*Negligible:* The impact is at the lowest level of detection.

*Minor:* The impact is slightly detectable. Individual species could be harmed or killed, but there would be no measurable impacts to the population. Less than 10% of visitors would be affected.

*Moderate:* The impact is readily apparent and measurable. Individual species would be harmed or killed, with slightly measurable impacts to the population or surrounding community. Ten to 50% of visitors would be affected.

*Major:* The impact is either severely adverse or exceptionally beneficial. Entire communities of species would be measurably affected. More than 50% of visitors would be affected.

The duration of adverse or beneficial impacts is also discussed. Short-term impacts would be brief, typically lasting less than one year. Long term impacts would be more than one year. When possible, quantitative measurements of time are provided.

## Impairment

The National Park Service Organic Act of 1916 states that the NPS:

“...shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations hereinafter specified...by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the 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 (emphasis added).” At the end of the discussion of impacts of each alternative, a brief “conclusions” section summarizes all major findings, including whether or not an impairment of resources or values is likely or would occur.

## Summary of Impacts

Impact Topic	Alternative A	Alternative B	Alternative C
<b>Water Resources</b>	Localized, negligible impact to water quality from stream bank trampling. Minor, beneficial impact to hydrology of Thunder Creek from removal of bridge.	Negligible short-term impact to water quality during construction of trail and bridge. Possible minor, short-term impact to water quality and hydrology if bridge were destroyed in the future. Minor, beneficial impact to hydrology of Thunder Creek from removal of former bridge.	Negligible short-term impact to water quality during construction of walkway and trail. Minor, beneficial impact to hydrology of Thunder Creek from removal of former bridge.
<b>Vegetation</b>	Minor, adverse impacts to understory vegetation from limited social trail development.	Minor adverse impacts on vegetation from construction of 0.5 mile new trail and bridge (0.5 acres of physical disturbance).	Minor adverse impacts on vegetation from construction of 1.5 mile new trail (1.5 acres of physical disturbance).
<b>Wildlife</b>	Negligible long term, adverse impact to some wildlife along the eastern side of Thunder Arm. Beneficial impact from reduced human use of the Thunder Creek riparian zone.	Impacts from construction would be negligible to minor and short-term. Negligible, long-term adverse impacts from displacement of some wildlife along 0.5 mile of previously undisturbed forest.	Impacts from construction would be negligible to minor and short-term. Negligible, long-term adverse impacts from displacement of some wildlife along 1.5 mile of previously undisturbed forest.
<b>Threatened &amp; Endangered Species</b>	Beneficial affect for some sensitive species due to reduced human use of the riparian area.	May affect, not likely to adversely affect federally listed species. No net loss of core area grizzly habitat.	May affect, not likely to adversely affect rare or listed species. Loss of approximately 130 acres of core area grizzly habitat.
<b>Visitor Use and Experience</b>	Moderate, adverse and long term impact to hikers in Ross Lake NRA. Negligible adverse affect on stock users. Beneficial impact to aesthetics from removal of bridge remains.	Short term, minor to moderate adverse impacts from construction noise. Long-term, moderate beneficial impact to hikers in Ross Lake NRA. Negligible beneficial affect on stock users.	Short term, negligible to minor adverse impacts from construction. Long-term, moderate, beneficial impact to hikers in Ross Lake NRA. Negligible beneficial affect on stock users.
<b>Park Operations</b>	Least costly, most sustainable alternative. Minor adverse impact to park operations through longer access to Thunder Creek Valley. Reduced efficiency for trails maintenance in the Thunder Creek Valley due to loss of stock support. Minor to moderate adverse impact on NPS search and rescue personnel should hikers get lost of injured while traveling cross country or crossing Thunder Creek.	Least costly action alternative. Less sustainable than Alternative C due to inherent risk of future damage to new bridge. Minor beneficial impact to park operations through longer access to Thunder Creek Valley. Beneficial impact on trails maintenance efficiency with continued stock support.	Most costly action alternative. More sustainable than Alternative B due to negligible risk of damage. Minor beneficial impact to park operations through longer access to Thunder Creek Valley. Beneficial impact on trails maintenance efficiency with continued stock support.

## **Impacts Common to All Alternatives**

The remains of the former bridge were removed in summer 2004, except for the concrete bridge abutment on the right bank of the creek (slightly visible in Figure I). This abutment would be demolished and removed.

The concrete abutment consists of approximately two cubic yards of concrete and rebar. The abutment would be split into small pieces with a “boulder buster” (i.e. small explosive charge) and hand tools, then transported out of the area via boat and toter (gas-powered vehicle designed to carry heavy loads on trails). Demolition and removal would have a very localized impact to the creek bed in the form of removing a manmade structure. The small charge would be contained within the concrete, cracking the concrete but causing no explosive disturbance to the surrounding area. This action would have a beneficial, minor impact on the hydrology of Thunder Creek by enhancing natural river processes of large wood recruitment and side channel formation. This action would also have a beneficial impact on the aesthetics of the former bridge site.

## **Management Alternative A**

### **Water Resources**

Under Management Alternative A, the Thunder Creek Bridge would not be rebuilt and the trail would not be extended or relocated. It is assumed that few visitors would access the Thunder Creek Valley via the Colonial Creek Campground under this alternative because there would be no easy means of crossing Thunder Creek. Those that did choose to cross the creek would have to find favorable spots to cross the creek on logs, or wade the creek during low flows. Over time, these activities would cause localized trampling of the stream bank, causing instability and sediment release at favorable crossings. This would have a long-term, negligible adverse impact on water quality.

### **Vegetation**

Under this alternative, visitors searching for a favorable creek crossing, or hiking up the eastern side of Thunder Arm, would trample understory vegetation and create social trails. Stock users would also trample vegetation while searching for a favorable location to ford the creek. Over time, a few social trails (i.e. informal trails not maintained by the NPS) and single ford would probably develop in the project area given the terrain constraints. Limited social trail development and trampling of stream bank vegetation would cause minor, adverse impacts to understory vegetation.

### **Wildlife**

Under Alternative A, The Thunder Creek Trail would be closed at the former bridge site. It is assumed that few visitors would access the Thunder Creek valley from the Colonial Creek Campground because there would be no formal trail or bridge. Instead, many visitors would probably choose to access the Thunder Creek Valley from the North Cascades highway via the 9.7 mile Panther Creek trail.

Visitors that did choose to access the Thunder Creek valley from Colonial Creek Campground as opposed to the Panther Creek trail would have to hike the Thunder Creek Trail to the former bridge site and find a favorable foot log to cross the creek or wade the creek during low flows (photo of possible ford provided in Appendix IV). Alternatively, visitors could hike cross-country along the eastern side of Thunder Arm (i.e. the route of the trail proposed under Alternative C). These informal means of accessing the Thunder Creek Trail could affect some wildlife by expanding visitor use into previously undisturbed areas along the eastern side of Thunder Arm or the floodplain of Thunder Creek. Nocturnal species of wildlife would probably not be affected because few people hike at night. However, during daylight hours in late spring, summer and early fall (the peak season for visitor use), various species of wildlife that forage during the day (e.g. waterfowl, black bear and black tailed deer) could be temporarily displaced by visitor

disturbance. These adverse impacts, however, would be offset to some degree by the assumed overall decrease in visitor use of the area. Other than temporary displacement of some sensitive wildlife, it is unlikely that wildlife would be harmed or killed, or that wildlife populations would be affected. Therefore, adverse impacts to wildlife would probably be negligible if the bridge were not rebuilt. For some species of sensitive wildlife (e.g. nesting waterfowl), reduced human use of the riparian zone over the long term could be beneficial.

### **Rare, Threatened and Endangered Species**

Reduced use of the area over the long term would potentially enhance the habitat quality for the rare and sensitive species of birds known to inhabit the project area, including goshawks and pileated woodpeckers (Table I). Reduced visitor use of the area could also have a beneficial affect on those species with potential habitat in the project area, although visitor disturbance in the project area is not currently believed to be a habitat-limiting factor.

This alternative would have a beneficial impact on core-area grizzly bear habitat by closing an approximately 0.5 mile section of the Thunder Creek Trail from the former bridge site to the Thunder Creek Backcountry camp (Appendix II). However, the magnitude of beneficial impact to grizzly bears and other large, federally listed mammal (e.g. gray wolves, lynx, and Pacific fisher) would probably be negligible given their large home ranges, the very small length of the trail closure, and the relatively close proximity to the chronic disturbance from the North Cascades highway and the Skagit River Hydroelectric Project.

### **Visitor Use and Experience**

#### **Impacts to Visitor Use**

Under Alternative A, the Thunder Creek Bridge would not be rebuilt, and the NPS would pursue no alternative means of providing formal access to the Thunder Creek Trail from the Colonial Creek Campground. This “No Action” Alternative would affect patterns of visitor use in several ways.

The lower Thunder Creek Valley is a popular destination for many visitors because it is readily accessible from the North Cascades highway. For visitors with short itineraries or limited physical abilities, the Thunder Creek Trail provides an easy opportunity to spend a day or two in the backcountry because access is so straightforward. The trail has an easy to moderate grade, and its low elevation provides hiking opportunities when the higher elevations in the park are snow covered.

The former bridge was a popular destination for day hikers from Colonial Creek Campground. Under Alternative A, day hikers would still be able to hike to the former bridge site, but they would not be able to extend their hike further into the Thunder Creek valley unless they were willing to wade the creek during low flows or cross the creek on a logjam. This reduced access would have a minor adverse impact on some day hikers from Colonial Creek Campground.

Very few visitors use stock (e.g. horses, mules) on the Thunder Creek Trail. As described in chapter 3, there have been no backcountry permits issued to stock users in the past three years. Staff observations indicate that the vast majority of stock use occurs in the Lake Chelan Recreation Area. If the bridge were not rebuilt, these data and observations suggest there would be a negligible impact to stock users in Ross Lake NRA. Instead, the lack of a bridge would primarily affect stock use by NPS personnel performing trail maintenance in the Thunder Creek drainage, as described in the following section on Park Operations.

If the bridge were not rebuilt, then some backcountry visitors would not be able to enjoy hiking in the lower Thunder Creek Valley, and short access to 4<sup>th</sup> of July Pass would also not be available. Those visitors most adversely impacted would be families with young children, visitors with limited physical

abilities, and visitors with short itineraries. These classes of visitors would presumably not seek a cross-country means of accessing the Thunder Creek Valley, or hiking into the Thunder Creek Valley via the 9.8 mile Panther Creek trail. It is assumed that these visitors would either choose to hike in other moderate parts of the North Cascades highway corridor (e.g. the vicinity of Ross Lake Reservoir) or not visit the Complex.

There are currently no primary data to indicate the number of visitors that would be displaced from hiking the lower Thunder Creek Trail. However, based on secondary data from use of the Thunder backcountry campsite (see Figure 5., Chapter 3) it is estimated that approximately 200 to 400 overnight visitors would be displaced from hiking the trail each year, or about 3-7% of total backcountry overnight visitation (n=6000 permits; this number may be higher because some visitors do not obtain permits). For those visitors not displaced, entering the Thunder Creek Valley via the 9.8 mile Panther Creek trail would add an additional day (each way) to the average itinerary. Taken together, the adverse impact caused by visitor displacement would have a minor impact on visitor use when considered Complex-wide. However, if the scale of impact to park visitors is limited to those who would normally visit the Thunder Creek valley, impacts to visitors would be moderate and long-term because a substantial number of visitors to the area would either be displaced to other areas or burdened by longer itineraries.

Finally, loss of formalized access (i.e. trail and bridge) to the Thunder Creek Valley could cause some visitors to get lost and/or injured while traveling cross country or crossing Thunder Creek.

### **Impacts to Wilderness Values**

Reduced use of the Thunder Creek Valley that would result under Alternative A would have a beneficial impact on opportunities for solitude for some visitors. Reduced human use of the area would also have a beneficial impact on the value of naturalness for some visitors, because there would be less evidence of human influence in the area and this could potentially benefit various natural resources including certain species of wildlife that are sensitive to disturbance (e.g. harlequin ducks). However, there could also be adverse impacts to the value of naturalness if informal access caused trampling of vegetation and social trail proliferation in areas previously undisturbed by human activity. Finally, some wilderness advocates especially value *wildness*, or the relative lack of intentional human manipulation in wilderness (Cole, 2001). If the bridge were not rebuilt, the impact on wildness would be mixed. On one hand, there would be one less structure on the verge of the Stephen Mather Wilderness, and this would be a beneficial impact to wildness. On the other hand, lack of a bridge would limit the NPS' ability to use stock as an appropriate minimum tool for administration of the area (refer to Park Operations for stock use constraints). This could result in a greater number of helicopter flights (and other forms of mechanized intrusion) into the Stephen Mather Wilderness for backcountry trails maintenance, scientific research and other administrative activities believed necessary for administration of the wilderness.

### **Park Operations**

Loss of formalized access (i.e. trail and bridge) to the Thunder Creek Valley could cause some visitors to get lost and/or injured while traveling cross country or crossing Thunder Creek. This would impose a minor to moderate, adverse impact on NPS search and rescue staffs.

Trail and bridge closure would benefit trail crew operations primarily by reducing the chronic maintenance burden associated with the section of the Thunder Creek Trail on the floodplain of Thunder Creek.

Loss of a bridge over Thunder Creek would prevent stock access to the Thunder Creek drainage. Instead, trail crews would need to carry all personal gear and equipment for trail work. The heavier loads would contribute to personnel fatigue and potentially have an adverse impact on personnel safety. Loss of stock support would also reduce the efficiency of trail crew operations, and potentially require a greater use of

helicopter support as the minimum tool needed for non-routine trail maintenance functions such as flood and bridge repairs.

The lack of a bridge over Thunder Creek would make calibration of the stream flow gauging station more problematic for USGS personnel. Calibration would also be less safe, because USGS personnel would have to wade the swift creek as opposed to measuring flows from the safety of a bridge. The accuracy of the data produced by the gauging station would also be reduced during higher flows, because the flows could not be adequately calibrated. These adverse impacts would probably prompt USGS and Seattle City Light to seek a cable car crossing of the creek.

### **Cumulative Impacts**

Some sensitive wildlife would experience a negligible to minor cumulative benefit from reduced human use of the lower Thunder Creek valley.

Parks staffs would not have to periodically maintain and repair a large backcountry bridge and a 0.5 mile portion of the Thunder Creek Trail that routinely floods during snowmelt. This would have a minor, beneficial cumulative impact on park operations.

Many visitors would no longer hike the lower Thunder Creek Valley. It is assumed that these visitors would be displaced to other areas. Visitor displacement could have a minor, adverse cumulative impact on other high use areas.

### **Conclusions**

There would be a localized, negligible impact to water quality from visitors trampling stream bank vegetation in search of a cross country route across Thunder Creek. Removal of the Thunder Creek Bridge and closure of the trail on the floodplain would have a minor, beneficial impact to hydrology of Thunder Creek. Visitors seeking cross-country access to the Thunder Creek trail would cause minor, long-term adverse impacts to understory vegetation from limited social trail development. There would be negligible long term, adverse impacts to some sensitive wildlife along the eastern side of Thunder Arm as this would probably be the area most commonly used for cross country access to the Thunder Creek trail from the North Cascades highway. Reduced human use of the Thunder Creek riparian zone from trail and bridge closure would have a negligible, beneficial impact on some sensitive species due to reduced human use of the riparian area. Lack of formalized access (e.g. bridge and trail) would have a moderate, long term adverse impact to hikers in Ross Lake NRA. Lack of a bridge could also pose a risk to visitor safety. There would be a negligible adverse affect on stock users because few visitors use stock on the Thunder Creek Trail. Alternative A would be the least costly, most sustainable alternative for park management and operations. However, there would be minor adverse impacts to park operations due to (a) longer access to Thunder Creek Valley, and (b) reduced efficiency for trails maintenance in the Thunder Creek Valley due to loss of stock support, and (c) the potential for increased search and rescue operations caused by visitors getting lost or falling in the creek.

### **Impairment**

This impact analysis identifies a series of adverse impacts ranging from negligible to moderate intensity. These impacts are not of sufficient magnitude for impairment of park resources.

## **Management Alternative B**

### **Water Resources**

Impacts to water resources under Alternative B would be associated with (1) construction of a 0.5 mile trail from the former Thunder Creek Bridge to the new bridge site, and (2) construction of a single span steel bridge across the channel of Thunder Creek at the new bridge site.

Trail construction would involve two minor crossings of seeps and rock slides with barely perceptible seasonal flows. To mitigate impacts to the hydrology of these features, standard trail construction methods for crossing wet areas would be used in accordance with the NOCA Trails Handbook. Crossings would include construction of rock turnpike underlain by culverts and small foot log bridges to allow water to flow underneath. These standard trail construction methods would have a negligible adverse impact on water quality and hydrology.

Bridge construction would require hand excavation of rock and soil to pour concrete footings on both banks of Thunder Creek. Sediment fencing and weed-free straw bales would be used to prevent sediment and concrete residues from entering Thunder Creek. With these measures in place, direct impacts to water resources from bridge construction would be negligible.

The indirect and cumulative impacts of the bridge on the hydrology of Thunder Creek would largely depend upon the vagaries of severe weather in the future. The flood that destroyed the former bridge was considered a greater than 100 year flood event. According to the stream flow data from the Thunder Creek gauging station, it was the largest magnitude flood in the 74 year history of the gauging station. The flood left scour marks along the banks of the proposed bridge site, leaving a clear indication of the height of the water at the bridge site that would be expected during severe flooding in the future. The superstructure of the new bridge would be at least five feet above the scour line to protect the bridge from floating debris and minimize the potential for logjam formation under the bridge during an extreme flood. The abutments would be protected from scour by bedrock (left bank) and by riprap or a timber deflector on the right bank.

The new bridge would be cabled and pinned to its concrete abutments. Should a flood or falling tree damage the new bridge, the anchor system would help to retain the bridge materials on the site to facilitate repair and to prevent loss of these man-made materials in the creek bed. While these materials remained in the creek bed, however, they could dramatically affect stream flows in the immediate vicinity of the downed bridge by trapping flood debris and redirecting the force of flow against the banks of the creek. The banks would be heavily scoured, potentially undermining the roots of old-growth trees and causing them to fall. The probability of this worst-case scenario is very low<sup>1</sup>. Nonetheless, if it happened it would have a localized, minor impact to the hydrology of Thunder Creek in the immediate vicinity of the bridge. Bank scouring would also impact water quality by releasing fine sediments, although the impact would truly be negligible when compared to the amount of sediment that would be entrained in the creek during an extreme flood event.

## **Vegetation**

A 0.5 mile trail would be constructed through old-growth forest from the former Thunder Creek Bridge to the new bridge site. Understory vegetation would be removed to construct the trail. Some larger vegetation and over story trees would need to be trimmed or cut, although most large trees (i.e. those greater than 24" in diameter) would be avoided through careful alignment of the trail prior to construction. Trail construction would have minor, long-term impacts on approximately 0.5 acres of understory vegetation.

Bridge construction would require limited clearing of understory vegetation and small trees on both sides of Thunder Creek for bridge abutments and off-ramps. Larger trees (e.g. > 24" diameter at breast height) and old-growth trees would be avoided. A few hazard trees (i.e. snags, severe leaners) near the bridge site

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<sup>1</sup> The probability of a similar > 100 year flood event would be at least 1 in 100, or less than 1% percent in any given year.

would be felled prior to bridge construction to minimize the risk of damage to the bridge. These actions would have minor, long term impacts on vegetation in the immediate vicinity of the bridge site.

To replace the 4-person campsite lost to bridge/trail construction, a campsite of similar capacity would be constructed south of the bridge site on the same alluvial terrace landform. A short spur trail from the Thunder Creek trail to the replacement site would also be constructed. Construction of the trail and replacement campsite would have negligible to minor impacts on several hundred square feet of understory vegetation.

## **Wildlife**

Under this Alternative, the Thunder Creek Bridge would be rebuilt approximately 0.5 miles upstream of its former location, and a 0.5 mile trail would be built from the former Thunder Creek Bridge to the new bridge site. Construction in this previously undisturbed area would take place in the spring and early summer months.

Bridge and trail construction could harm or kill various species of less mobile amphibians and small mammals living under rocks and logs on the forest floor. During the nesting season, birds and waterfowl are also less mobile species of wildlife because they must tend to eggs in a nest.

At least one pair of harlequin ducks is known to nest along Thunder Creek. During removal of the former Thunder Creek Bridge, this pair was regularly observed on a gravel bar immediately upstream of the work site. Harlequin ducks return each year to same general area for nesting. Construction activities such as repeated helicopter flights, blasting and other chronic loud noises could drive the ducks from their nests and cause loss of the clutch, especially if this happened during a cold spell. Harlequin ducks have low intrinsic rates of productivity because they reach sexual maturity slowly and are sensitive to human disturbance. To minimize adverse impacts to harlequins, the Washington State Department of Fish and Wildlife recommends minimizing human disturbance during the breeding and brood-rearing season (April-August), including limiting human visibility and disturbance within 50 meters from streams, especially if streams are less than 20 meters wide (Lewis and Kraege, 2004). To mitigate disturbance harlequin ducks (and other sensitive wildlife), there would be no helicopter use over the Thunder Creek delta or riparian zone until directly over the bridge site. There would be no blasting from April through June, and chainsaw use would not be allowed within ¼ mile of the Thunder Creek Delta. With these mitigation measures, this alternative would have a negligible to minor, short-term, adverse impact on harlequin ducks and other birds/waterfowl (e.g. Barrow's goldeneye) nesting in the project area.

Larger species of terrestrial wildlife would probably be temporarily displaced during daylight hours due to construction activities. Surveys of the area of the proposed trail extension and new bridge site found fairly extensive evidence of black bear and deer. In the spring, this low elevation area is probably a very important habitat for these wildlife because browse is abundant and the high country is still covered with snow. During the construction period, larger wildlife would probably avoid the area and simply browse elsewhere, such as on the eastern side of Thunder Creek. Taken together, adverse impacts to wildlife from trail and bridge construction would be negligible to minor and short term.

Upon completion of the proposed trail and bridge, the 0.5 mile section of trail on the east bank of Thunder Creek would be abandoned and rehabilitated. Most of the area around this trail is part of the floodplain of Thunder Creek, with side sloughs, wetland habitat and associated vegetation that would provide important early-season browse. This area would provide excellent substitute habitat for any wildlife displaced from the newly-trailed area along the opposite bank.

## Rare, Threatened and Endangered Species

**Plants.** There are no known federally listed plant species in the Complex, although plant inventories remain incomplete. There are no known state listed plant species in the vicinity of the trail and bridge proposed under Alternative B. Detailed surveys for these species, however, have not been performed. Given the relatively small area of physical disturbance (0.5 acres) that would take place under alternative B, adverse impacts to rare plants would be unlikely. To minimize the risk of potential impacts to a small isolated population of rare plant(s), further surveys in advance of construction could be used as a means of fine tuning the trail alignment to prevent possible adverse impacts to rare plants.

**Bull Trout.** Thunder Creek has been surveyed for the presence of bull trout by the NPS, Washington Department of Fish and Wildlife and the U.S. Fish and Wildlife Service. Dolly varden (a closely related, unlisted species of char) were documented based on genetic analysis, but bull trout were not. This does not mean that bull trout may not be present. Large char have been seen in Diablo reservoir, and these char could be an adfluvial (i.e. life history characterized by regular migrations between a lake and a stream for spawning) population of bull trout that has yet to be documented. In light of this evidence, it is assumed that bull trout may be present in the project area (Mark Downen, Inland Fisheries Biologist for Washington Department of Fish and Wildlife, personal communication). Bridge construction would not affect fish in Thunder Creek because the bridge abutments would be built outside and at least 5 feet above the wetted perimeter of the channel and the bridge would span the entire channel. However, following construction, there would be small risk of bridge failure due to a falling tree or extreme flood. If this happened, the bridge would fall into the creek and have a localized impact on the streambed. This unlikely scenario could potentially have a localized impact on any bull trout redds (i.e. spawning nest) that might be present, although an extreme flood would greatly eclipse the impact of bridge. Given the very low probability of this scenario, alternative B may affect, but is not likely to adversely affect bull trout.

**Western Toads.** Western toads (state Candidate) are found from low elevation forest to subalpine meadows in the North Cascades. They most common near marshes and small lakes. Surveys in the 1970's indicated that toads were widely distributed in the Big Beaver valley, although more recent surveys have found the toads to be patchily distributed. No toads have been documented in the project area, but the habitat is favorable, especially in wetlands and pools along the floodplain of thunder creek and the Thunder Creek delta. Trail construction would be unlikely to affect western toads because they would simply hop away if threatened. Closure of the Thunder Creek trail from the former bridge to Thunder camp could have a minor, beneficial impact on western toad habitat. On the balance, this alternative may have a negligible to minor, beneficial effect on western toads by removing the chronic, localized impacts of the former Thunder Creek bridge/trail in the vicinity of the floodplain.

**Bald Eagles.** Bald eagles (federally Threatened) have been occasionally documented in the project area. No aeries (nests) have been documented in spite of extensive surveys. In the spring and summer months, eagles generally return to nesting areas in Alaska, Canada and Puget Sound, so they are not likely to be present near the project area. Therefore, this action may affect, but is not likely to adversely affect bald eagles.

**Northern Spotted Owls.** Northern spotted owls (federally Threatened) have not been documented in the project area, in spite of repeated surveys. Although there is very favorable habitat in the project area, the presence of nesting barred owls suggests that northern spotted owls may not be present because barred owls are known to displace spotted owls when their territories overlap. This action may affect, but is not likely to adversely affect spotted owls.

**Northern Goshawks and Merlins.** Northern goshawks (state Candidate) and merlins (state Candidate) have been documented in the project area, and the nesting habitat is excellent. No nests have been observed during wildlife surveys, however both species could be nesting in the general vicinity, especially in large old growth trees. Loud construction noise (e.g. helicopters, blasting) during nesting could drive the birds from their nests and cause loss of the clutch. Avoiding loud noise-producing activities over the project area during the nesting season would help to mitigate the potential disturbance to goshawks and merlins that could be nesting in the project area. With this mitigation measure, this action may affect, but is not likely to adversely affect goshawks and merlins.

**Pileated Woodpeckers.** Pileated woodpeckers (state Candidate species) are known to forage and nest in the project area although nest locations and numbers are unknown. Removal of large snags near the new bridge (to avoid damaging the new bridge) could have a localized adverse impact on the habitat quality of pileated woodpeckers and other species dependent upon standing snags for nesting and foraging habitat. Avoiding loud-noise producing activities during the critical nesting period would help to minimize the potential disturbance to pileated woodpeckers that could be nesting/foraging in snags in the project area. Other trail construction activities could probably proceed with a negligible adverse impact to woodpeckers given the limited area of disturbance that would be associated with trail construction. Taken together, these actions may affect, but are not likely to adversely affect pileated woodpeckers given the timing constraints and limited area of physical disturbance.

**Common Loons and Western Grebes.** Common loons (state sensitive) and western grebes (state Candidate) have both been documented on Thunder Arm. Due to fluctuating water levels and perhaps human disturbance, loons are not believed to nest in Diablo Lake reservoir. Western grebes are transient visitors. Ferrying bridge materials via helicopter could adversely affect these and other waterfowl on Thunder Arm. To mitigate this impact, the flight path over Thunder Arm would be restricted, and the height of the helicopter would be at least 500 feet above ground except during takeoff and drop off of materials at the bridge site. With this mitigation measure, this action may affect, but is unlikely to affect common loons or western grebes.

**Vaux's Swift.** Vaux's swift (state candidate) could be present in the project area, as this small, swift bird is a dependent inhabitant of old-growth forests. Vaux's swift usually nests and roosts in old-growth snags and feeds on flying insects. A few snags may need to be cut around the bridge site, but this would have a negligible impact given the large amount of undisturbed forest in the project area. This action may affect, but is not likely to adversely affect Vaux's swift.

**Townsend's Big Eared Bat.** The Townsend's big-eared bat (State Candidate) has yet to be documented in spite of intensive bat surveys in the vicinity of the former bridge. Those surveys found, however, that the riparian zone of Thunder Creek is very productive for bats such as *Myotis volans* and *Myotis californicus*. Given the high quality habitat in the project area, big-eared bats may inhabit the project area but remain undocumented. The insect forage base for bats including Townsend's big-eared would remain unaffected. Construction activities could temporarily displace bats roosting in foliage or snags in the project area, but there is ample habitat for bats in adjacent undisturbed forest. Therefore, this action may affect, but is not likely to adversely affect big-eared bats.

**Grizzly Bear.** The last confirmed sighting of a grizzly bear (federally Threatened) in the project area was in spring of 1987 (Anne Braaten, NPS Bear Biologist, personal communication). Grizzly bears would be highly unlikely in the project area given the close proximity of the highway and campground, and the extremely limited recent evidence of grizzly bears in recent years. Nonetheless, the potential exists for grizzly bears to be traveling through the area, especially in early spring. The NPS has agreed to a policy of "No Net Loss" of core-area grizzly bear habitat as a means of preventing further decline (the details of this agreement are provided in the "Relevant Laws and Policies" section of Chapter 2). A Geographic

Information System (GIS) analysis of impacts to core area grizzly bear habitat under Alternative B indicates that trail and bridge construction would result in loss of about 1 acre of core area habitat (Appendix II). This analysis indicates that Alternative B would effectively result in no net loss of grizzly bear habitat because the loss of habitat from construction of the trail and bridge would be offset by abandonment of the trail along the eastern side of Thunder Creek. Given the extremely low probability of grizzly bears in the project area, the short term duration of construction related disturbance, and the finding of “no net loss” of core area grizzly bear habitat, this action may affect, but is not likely to adversely affect grizzly bears.

**Gray Wolf.** Gray wolves (federally Endangered) have not been documented in the project area. As with grizzly bears, the close proximity of the highway and campground makes their presence unlikely. Therefore, this action may affect, but is unlikely to adversely affect gray wolves.

**Canada Lynx.** Canada Lynx (federally Threatened) have not been documented in the project area. The habitat quality for lynx is very poor, and the closest known location of lynx is further east in drier, more favorable habitat with abundant populations of snowshoe hare. Therefore, this action may affect, but is unlikely to adversely affect, lynx.

**Pacific Fisher.** Pacific fisher (federal Candidate) have not been documented in the project area, in spite of two years of fairly extensive winter carnivore surveys throughout the Complex. In light of these surveys, this action may affect, but is not likely to adversely affect Pacific fisher or wolverines.

## **Visitor Use and Experience**

### **Impacts from Construction**

During construction, some visitors would be exposed to noise and disturbance during daylight hours on weekdays and on weekends. Noise and disturbance would include helicopter flights, chainsaw use, and the noise associated with work crews and hand tools. Limited blasting might also be needed. It is estimated that two to three days worth of helicopter flights would be needed to ferry bridge materials. During this time, a portion of the parking lot on the side of Colonial Creek campground would be closed for 2-3 weekdays to protect visitor safety at the helicopter staging area. Blasting may be needed during trail construction. A “boulder buster” that uses a 12-gauge shotgun shell to crack boulders would be the preferred means of blasting. The noise from blasting would be very loud, but very brief. Construction of the trail and bridge would take several months.

Some construction noise, such as work crews and hand tools, would be masked by the unnatural sounds associated with the highway corridor, and the natural sounds associated with the rushing water in Thunder Creek. Helicopter noise, chainsaws, and blasting (if necessary) would not be masked. These noises, however, would be limited in duration. Adverse impacts to the visitor experience from construction would be short-term, and minor to moderate.

### **Impacts to Visitor Use**

Following construction, visitors would be able to continue hiking in the Thunder Creek Valley as they did prior to loss of the bridge. The length of the hike and the quality of the scenery would also essentially remain the same. In contrast to Alternative A (No Action) Alternative B would have a minor to moderate and beneficial impact on the visitor experience for visitors in Ross Lake NRA because the Thunder Creek Trail is one of the most popular trails in the Ross Lake NRA.

### **Impacts to Wilderness Values**

The project area borders portions of the Stephen Mather Wilderness and the bridge site is located in potential wilderness. Construction of the bridge and trail would have short-term, adverse impacts on wilderness values. These impacts would be limited to the Lower Thunder Creek valley. To minimize impacts to wilderness values, backcountry staffs would inform visitors about construction, and encourage those seeking a pristine wilderness experience to seek more remote settings.

### **Park Operations**

Construction of a new bridge along Thunder Creek would allow continued use of stock in support of trail crew operations. This would maintain the efficiency of trail crew operations, and foster personnel safety by reducing heavy loads. The new bridge location would enhance personnel and stock safety, because the approach trail on the eastern side of the bridge would no longer be submerged during high flows. Various other NPS staffs and affiliated personnel, including backcountry rangers, resources management staffs and scientists would benefit from renewed access to the Thunder Creek Valley via the new bridge.

The new bridge would also be beneficial to USGS personnel, because it would provide a safe platform for calibrating flows, especially during high flows. Stream flow data quality would also be protected, because higher flows could be calibrated accurately.

The new bridge could potentially be damaged or destroyed during an extreme flood in the future, or from a falling tree. The bridge site has been carefully chosen to minimize flood risk, so damage or destruction would be more likely from a falling tree. If this happened, NPS personnel would need to repair or replace the bridge. This action would be costly and potentially unsafe. Construction of a new bridge would also add to the cumulative burden of maintaining structures in the backcountry.

### **Cumulative Impacts**

The construction of a 0.5 mile new trail through previously undisturbed habitat would have a long-term, cumulative impact on understory vegetation and certain sensitive wildlife from loss of physical habitat and disturbance from visitor use. Resident birds would experience long-term nest failure in the vicinity of the trail. There would also be permanent loss of habitat for smaller, less mobile species of wildlife. These cumulative impacts would be negligible to minor, and possibly decline over time as wildlife returned to the abandoned section of trail along the eastern side of Thunder Creek.

The new bridge would have to be periodically maintained and repaired by park staffs. This would have a minor, long-term and adverse cumulative impact on park operations.

### **Conclusions**

There would be negligible, short-term impacts to water quality during construction of the trail and bridge. Following construction, there could be minor, short-term impact to water quality and hydrology if the bridge were damaged in the future from flooding or falling trees. Removal of the former Thunder Creek bridge and closure of the floodplain-portion of the trail would have a minor, beneficial impact on the hydrology of Thunder Creek. Construction of 0.5 mile new trail and bridge (0.5 acres of physical disturbance) would have a negligible to minor, adverse impact on vegetation. There would be negligible long-term adverse impacts from displacement of some wildlife along 0.5 mile of previously undisturbed forest. This Alternative may affect, but is not likely to adversely affect federally listed species. there would be no net loss of core area grizzly habitat. construction noise, disturbance and temporary closures of some areas would cause short term, minor to moderate adverse impacts to some visitors. Following construction, there would be long-term, moderate and beneficial impacts to hikers in Ross Lake NRA and a negligible beneficial affect on stock users. Alternative B would be the least costly action alternative. However, it would be slightly less sustainable than Alternative C due to the inherent risk of damage to the

new bridge from flooding or falling trees. There would be minor, beneficial impacts to park operations through shorter, more efficient access to the Thunder Creek Valley.

## **Impairment**

This impact analysis identifies a series of adverse impacts ranging from negligible to moderate intensity. These impacts are not of sufficient magnitude to trigger concerns for impairment of park resources.

## **Management Alternative C**

### **Water Resources**

Impacts to water resources under Alternative B would be associated with (1) retrofitting the State Route 20 highway bridge with an all-purpose walkway, and (2) construction of a 1.5 mile trail with several intermittent stream crossings.

To construct the all-purpose walkway, steel pilings would be driven into the bottom of Diablo lake reservoir with a pneumatic hammer. Pile driving would stir up sediment in Diablo lake in the local vicinity of the bridge. Concrete abutments would be constructed on both banks. Sediment fencing and similar best management practices would be used to prevent debris from falling into the reservoir during construction of the abutments. Taken together, bridge construction, would have a minor, adverse and short-term impact on water quality in Diablo Lake reservoir.

The 1.5 mile trail would cross several small intermittent streams. To mitigate impacts to the hydrology of these minor features, standard trail construction methods for crossing wet areas would be used in accordance with the NOCA Trails Handbook. Rock turnpike underlain by culverts would be constructed across wet areas such as seeps. Small foot log bridges would be constructed across the entire span of several intermittent creek channels. These standard trail construction methods would have a negligible adverse impact on water quality and hydrology.

### **Vegetation**

A 1.5 mile trail would be constructed through low elevation forest along the eastern side of Thunder Arm. Trail construction would require clearing of understory vegetation along the entire length of the trail. Larger vegetation and trees would be avoided. The adverse impacts of trail construction on vegetation would be minor given the relatively small area of physical disturbance (approximately 1.5 acres).

The Thunder Creek Trail would be closed and rehabilitated from the former bridge to intersection of the new trail near Thunder Camp at the southern end of the project area. The trail would be rehabilitated by breaking up the hardened soil and placing organic matter on the surface to encourage growth of native vegetation. The rehabilitation area would be monitored over time to prevent weeds from growing in the disturbed area. In the long-term, this action would have a minor beneficial impact to native vegetation.

### **Wildlife**

Under this Alternative, the highway bridge would be retrofitted with an all-purpose walkway in lieu of building a bridge over Thunder Creek. A 1.5 mile trail would be built through largely undisturbed old-growth forest from the north Cascades highway to the existing Thunder Creek Trail.

Trail construction could harm or kill various species of less mobile wildlife such as amphibians and small mammals living under rocks and logs on the forest floor. During the nesting season, various forest-dwelling birds would also be less-mobile and could lose their clutch if driven from their nests. However, the overall area of physical disturbance for trail construction would be very small compared to the surrounding undisturbed area, so small wildlife and birds would probably not be affected at the population level and therefore impacts would be negligible to minor and short-term.

Larger species of wildlife would probably be temporarily displaced during daylight hours due from construction activities. At night, these species would probably not be affected because work crews would not be present. Surveys of the area of the proposed trail extension found fairly extensive evidence of black bear and deer. In the spring, low elevation areas such as this are very important habitat for black bears in particular because favorable browse is readily available and the high country is still covered with snow. During the construction period, larger wildlife such as black bears and deer would probably avoid the area and simply browse elsewhere. As with smaller wildlife, this analysis suggests that impacts to wildlife would be negligible to minor and short-term.

Upon completion of the proposed trail and walkway, the 0.5 mile section of trail on the east bank of Thunder Creek (from the former bridge site to the intersection of the new trail) would be abandoned and rehabilitated. Most of the area to the west of this proposed trail is part of the floodplain of Thunder Creek, with side sloughs and wetland habitat that would provide excellent early-season browse for black bears (Lyons, 2003), deer, and other wildlife known to frequent riparian areas. Removal of the Thunder Creek bridge and trail from this area would improve the quality of riparian habitat because visitors would no longer traverse the riparian zone. However, improved habitat quality in the riparian area would be offset by constructing a new trail along the currently undisturbed eastern shoreline of Thunder Arm. The net effect would be beneficial for riparian dwelling species, and adverse for species reliant upon undisturbed forested habitat.

#### **Rare, Threatened and Endangered Species**

There are no known federally listed plant species in the Complex, although plant inventories remain incomplete. Only one state listed plant species, (a moonwort in the genus *Botrychium*) has been documented in the vicinity of the trail proposed under Alternative C. Detailed, recent surveys for this and other potentially rare species, however, have not been performed. Given the relatively small area of disturbance that would take place under alternative C, and the relatively common habitat in this area (i.e. no unusual soils or forest conditions that would favor rare plants), adverse impacts to rare plants would be possible but unlikely. To minimize the risk of potential impacts to a small isolated population of rare plant(s) (e.g. *Botrychium sp.*), further surveys in advance of construction would be used as a means of fine tuning the trail alignment to prevent possible adverse impacts to rare plants.

Thunder Creek has been surveyed for the presence of bull trout by the NPS, the Washington Department of Fish and Wildlife and the U.S. Fish and Wildlife Service. Dolly varden (a closely related, unlisted species of char) have been documented; bull trout have not. However, as described under Alternative B, an adfluvial population of bull trout may be present in Diablo Lake reservoir. Under Alternative C, retrofitting the highway bridge with an all-purpose walkway would require driving steel pilings into the bottom of the reservoir to support the walkway. Pile driving would generate underwater water noise that could displace bull trout in the vicinity of the construction zone. This action may affect, but would be unlikely to adversely affect bull trout because it is assumed they would merely swim away from the area of disturbance.

Western toads (state Candidate) are found from low elevation forest to subalpine meadows in the North Cascades. They most common near marshes and small lakes. Surveys in the 1970's indicated that toads were widely distributed in the Big Beaver valley, although more recent surveys have found the toads to be patchily distributed. No toads have been documented in the project area, but the habitat is favorable, especially in wetlands and pools along the floodplain of thunder creek and the Thunder Creek delta. Trail construction would be unlikely to affect western toads because they would simply hop away if threatened. Closure of the Thunder Creek trail from the former bridge to Thunder camp could have a minor, beneficial impact on western toad habitat. On the balance, this alternative may have a negligible to

minor, beneficial effect on western toads by removing the chronic, localized impacts of the former Thunder Creek bridge/trail in the vicinity of the floodplain.

Bald eagles (federally Threatened) have been occasionally documented in the project area. No aeries (nests) have been documented in spite of extensive surveys. In the spring and summer months, eagles generally return to nesting areas mainly in Alaska, Canada and Puget Sound, so they are not likely to be present or nesting near the project area. Therefore, this action may affect, but is not likely to adversely affect bald eagles.

Northern spotted owls (federally Threatened) have not been documented in the project area, in spite of repeated surveys. Although there is very favorable habitat in the project area, the longstanding presence of nesting barred owls in the project area indicates that northern spotted owls may not be present because barred owls usually displace spotted owls when their territories overlap (Hamer, 1988). This action may affect, but is not likely to adversely affect spotted owls.

Northern goshawks (federal Candidate) and merlins (federal Candidate) have been documented in the project area, and the old-growth forest provides outstanding habitat for these raptors. No nests have been observed during wildlife surveys, however goshawks and merlins could be nesting in the general vicinity because their nest would be difficult to detect amongst the large old growth trees. Trail construction could disturb nesting and/or foraging goshawks and merlins, although disturbance would be limited to the general vicinity of trail construction. Given the vast amount of habitat in the vicinity of the project area, and the limited disturbance that would accompany trail construction, this action may affect, but is not likely to adversely affect goshawks and merlins.

Pileated woodpeckers (state Candidate species) are known to forage and nest in the project area although nest locations and numbers are unknown. Trail construction could disturb nesting and/or foraging woodpeckers, although disturbance would be limited to the general vicinity of trail construction. Given the extensive favorable habitat surrounding the project area, this action may affect, but is not likely to adversely affect woodpeckers.

Vaux's swift (state Candidate) could be present in the project area, as this small, swift bird usually nests and roosts in old-growth snags. No snags would be cut under this alternative, so impacts would be limited to brief disturbance from trail construction activities. This action may affect, but is not likely to adversely affect Vaux's swift.

Common loons (state Sensitive) and western grebes (state Candidate) have both been documented on Thunder Arm. Due to fluctuating water levels and perhaps human disturbance, loons are not believed to nest on Diablo Lake reservoir. Western grebes are transient visitors. Retrofitting the highway bridge, including pile driving and other loud-noise producing activities could have a temporary, adverse impact on these and other waterfowl on Thunder Arm. The impact would probably be relatively small, however, given the chronic disturbance from vehicles traveling on the highway, the large distance between the Thunder Creek Delta and the highway bridge. To mitigate disturbance, bridge construction would not take place during the critical nesting season (April-May). With this mitigation measure, this action may affect, but is unlikely to affect common loons or western grebes.

The last confirmed sighting of a grizzly bear (federal Threatened) in the project area was in spring of 1987 (Anne Braaten, NPS Bear Biologist, personal communication). Their presence would be highly unlikely given the close proximity of the highway and campground. Nonetheless, the potential exists for grizzly bears to be traveling through the project area, especially in early spring. The NPS has agreed to a policy of "No Net Loss" of core-area grizzly bear habitat as a means of preventing further decline (the details of this agreement are provided in the "Relevant Laws and Policies" section of Chapter 2). A

Geographic Information System (GIS) analysis of impacts to core area grizzly bear habitat under Alternative C indicates that trail and bridge construction would result in loss of about 130 acres of core area habitat because there would be a net increase of approximately one mile of new trail (1.5 mile new trail minus 0.5 mile abandoned trail equals 1 mile; see Appendix II). This analysis, however, does not take into account various confounding factors, including (a) the close proximity of the North Cascades highway; (b) the popular Colonial Creek campground; and (c) the physical barrier to wildlife movement created by the Skagit River hydroelectric project. Given the extremely low probability of grizzly bears in the project area, the short term duration of construction-related disturbance, and the relatively minimal loss of core area grizzly bear habitat, this action may affect, but is not likely to adversely affect grizzly bears. If implemented, however, this action would require closure of a similar high-use trail to adhere to the “No Net Loss” interim policy. No trails through similar habitat currently exist.

Gray wolves have not been documented in the project area. As with grizzly bears, their presence is unlikely given the close proximity of the North Cascades Highway and Colonial Creek Campground. Therefore, this action may affect, but is unlikely to adversely affect gray wolves.

Canada Lynx have not been documented in the project area. The closest known location of lynx is further east in the Pasayten Wilderness. The habitat quality for lynx in the project is poor, as lynx prefer drier, more open habitat with abundant populations of snowshoe hare as opposed to mesic low elevation forests. Therefore, this action may affect, but is unlikely to adversely affect, lynx.

Pacific fisher have not been documented in the project area, in spite of two years of fairly extensive winter carnivore surveys throughout the Complex. In light of these surveys, this action may affect, but is not likely to adversely affect Pacific fisher or wolverines.

## **Visitor Use and Experience**

### **Impacts from Construction**

During bridge construction, some visitors would be exposed to noise and disturbance during daylight hours on weekdays and on weekends. Noise and disturbance from bridge construction would be limited to the immediate vicinity of the North Cascades Highway. Compared with Alternative B, this would cause less disturbance to backcountry users.

Trail construction would require limited blasting of bedrock outcrops at the northern end of the trail near the North Cascades highway. A “boulder buster” that uses a 12-gauge shotgun shell to crack boulders would be the preferred means of blasting. The noise from blasting would be very loud, but very brief.

Some trail construction noise, such as work crews with chainsaws and hand tools, would be masked by the unnatural sounds associated with the highway corridor, and the natural sounds associated with the rushing water in Thunder Creek. The noise from chainsaws and blasting (if necessary) would not be masked. These noises, however, would be limited in duration. Taken together, adverse impacts to the visitor experience from construction would be short-term, and minor to moderate. Compared with Alternative B, however, disturbance would be closer to the North Cascades highway and there would be no need for helicopters.

### **Impacts to Visitor Use**

Securing funding to implement Alternative C could take 3-5 or more years, given the high cost, funding uncertainty and the need to coordinate with the Washington Department of Transportation and other agencies. During this time, visitor use of the Thunder Creek Valley would be adversely affected as described under Alternative A.

Following construction, visitors would be able to continue hiking in the Thunder Creek Valley as they did prior to loss of the bridge. In this capacity, Alternative B would have a minor to moderate and beneficial impact on visitors in Ross Lake NRA because the Thunder Creek Trail is one of the most popular trails in the Ross Lake NRA. However, there are several caveats to this conclusion. Compared to Alternative B, the length of the hike would be extended by approximately 1 mile, and the quality of the scenery would be different because the hike would begin along the North Cascades highway as opposed to the calm forested setting at the current Thunder Creek Trailhead. Although the highway bridge would be engineered to provide safe crossing of Thunder Arm, visitors would still need to park along the highway and this could cause safety concerns compared to Alternative B.

### **Impacts to Wilderness Values**

The project area borders portions of the Stephen Mather Wilderness and the southern section of the new trail would be located in potential wilderness. Construction of the trail would have short-term, adverse impacts on wilderness values by disrupting visitor solitude in the Lower Thunder Creek Valley. Retrofitting the highway bridge would not be expected to affect wilderness values because the highway is already present. Similar to Alternative A, no bridge would be constructed across Thunder Creek in potential wilderness. This would be a beneficial impact to some wilderness enthusiasts who believe that large backcountry bridges are not compatible with their wilderness experience.

### **Park Operations**

In contrast to Alternative A, this alternative would allow continued stock support of trail crew operations. Similar to Alternative B, this would have a beneficial impact on the safety and efficiency of trail crew operations in the Thunder Creek drainage.

Retrofitting the highway bridge would be the most sustainable solution for park management, because it would eliminate the need for long term maintenance (or replacement if damaged) of a bridge in the Thunder Creek drainage. However, this alternative would be approximately 4 times more costly than Alternative B (estimated cost: \$234,000), and approximately \$1 million more than Alternative A (no cost).

### **Cumulative Impacts**

The construction of a 1.5 mile new trail through previously undisturbed habitat would have a long-term, cumulative impact on understory vegetation and wildlife from loss of physical habitat and disturbance from visitor use. As described previously, this Alternative would result in loss of 130 acres of core-area grizzly bear habitat. Resident birds would experience long-term nest failure in the vicinity of the trail. There would also be permanent loss of habitat for smaller, less mobile species of wildlife residing in the immediate vicinity of the trail. Taken together, these cumulative impacts to vegetation and wildlife would be adverse, minor and long term.

This Alternative would close abandon approximately 0.5 miles of existing trail, and add approximately 1.5 miles of new trail. The cumulative effect would be approximately 1 more mile of additional trail for long term maintenance. With more than 300 mile of maintained trails in the Complex, the addition of just one mile of new trail have a negligible adverse impact on park operations.

### **Conclusions**

Construction of the walkway over Thunder Arm and 1.5 mile new trail would have a negligible to minor and short-term impact to water quality. There would be minor adverse impacts on vegetation from construction of the 1.5 mile new trail (1.5 acres of physical disturbance). Impacts to wildlife from construction would be negligible to minor and short-term. Following construction, some resident wildlife

would be along 1.5 mile of previously undisturbed forest, causing a negligible to minor and long-term adverse impact to some sensitive wildlife. This Alternative may affect, but is not likely to adversely affect rare or listed species. However, it would result in loss of approximately 130 acres of core area grizzly habitat. Visitors would experience short term, negligible to minor adverse impacts from construction. Following construction, there would be long-term, moderate, beneficial impacts to hikers in Ross Lake NRA. Impacts on stock users would be beneficial yet negligible. This would be the most costly action alternative. this alternative would be more sustainable than Alternative B due to the remote risk of damage to the walkway as compared to the bridge in Alternative B. Minor beneficial impact to park operations through shorter, more efficient access to Thunder Creek Valley.

### **Impairment**

This impact analysis identifies a series of adverse impacts ranging from negligible to moderate intensity. These impacts are not of sufficient magnitude to trigger concerns for impairment of park resources.

# Chapter V. Consultation and Coordination

## Initial Public Scoping

In advance of this EA, a Public Scoping Newsletter was mailed to the following organizations and agencies in November 2004. These organizations/agencies will also receive a copy of this EA:

Adventure Treks, Inc.	Northwest Mountain Guides
Adventures Cross Country	Northwest Mountain School
Alpine Ascents International	Outward Bound West
American Alpine Institute	Pro Guiding Service
American Mountain Guides Association	Reachout Expeditions
Ascent Institute	REI, Inc. Bellingham
Backcountry Horsemen of Washington	REI, Inc. Lynnwood
Base Camp, Inc.	REI, Inc. Redmond
Camp Nor'wester	REI, Inc. Seattle
Camp Thunderbird	Seattle City Light
Cascade Corrals	Sierra Club Cascades Chapter
Cascade Guiding Services LLC	Sierra Club Outing Committee
Deli Lama Wilderness Adventures	Summit Expeditions International
Evergreen Adventure Travel LLC	The Evergreen State College
International Mountain Guides Inc.	The Road Less Traveled
Longacre Expeditions	U.S. Fish and Wildlife Service
McGaw YMCA Camp Echo	USDA Forest Service
Methow Biodiversity Project	Washington Department of Fish and Wildlife
Moondance Adventures	Washington State Department of Transportation
Mountain Madness	Washington Wilderness Coalition
Mountaineers	Wilderness Inquiry
National Outdoor Leadership School	Wilderness Society
National Parks and Conservation Association	Wilderness Ventures
North Cascades Conservation Council	Wilderness Watch
North Cascades Institute	WWU Outdoor Center
North Cascades Mountain Guides	YMCA of Greater Seattle
Northwest Ecosystem Alliance	

The 30-day public scoping period ended on December 10, 2004. Two letters of comment were received via e-mail. One comment letter supported Alternative C as “the option that would best suit our backpacking use and the long term care and management of the park.” The letter also cited the benefit of reduced maintenance cost of a bridge. The second comment letter supported Alternative B. In support of Alternative B, the letter cited (a) reduced impact to previously undisturbed old-growth forest; and (b) “a safer and more aesthetic entrance” compared to hiking across a walkway adjacent to the highway. The letter also stated that the impacts of a helicopter in support of construction would be acceptable provided helicopter use were “scheduled during low use times so as to cause the least impact to visitors and wildlife.”

## Agency Consultation

The Washington Department of Transportation (Lee Conrad, Mount Baker Area Operations Manager) was consulted in November 2004 to determine the feasibility and cost of retrofitting the North Cascades Highway bridge over Thunder Arm with a pedestrian and stock walkway. D.O.T. personnel provided a pro bono cost estimate for retrofitting the highway bridge, along with input on public safety concerns.

The Washington Department of Fish and Wildlife (Mark Downen, Inland Fisheries Biologist) was consulted regarding potential impacts to bull trout habitat. WDFW personnel have extensively surveyed for bull trout in Thunder Creek. Their data and professional opinion indicate that (a) bull trout may be present in the Thunder Creek drainage although they have yet to be documented, and (b) the alternatives evaluated in this EA would not adversely affect bull trout given the limited amount of disturbance to aquatic habitat that would result from Alternatives B or C.

The USDA Forest Service (Peter Wagner, Engineer) provided the NPS with engineering specifications and bridge design for Alternative B.

The U.S. Geological Survey (Darrin A. Miller, Team Leader Sedro-Woolley Field Unit) was contacted in November 2004 regarding operation of the stream flow gauging station on Thunder Creek. The USGS provided input on design of the bridge proposed under Alternative B, and other safety/operational concerns regarding calibration of the gauging station.

## **List of Preparers and Contributors**

This EA was prepared by Roy Zipp, Natural Resources Specialist for North Cascades Complex.

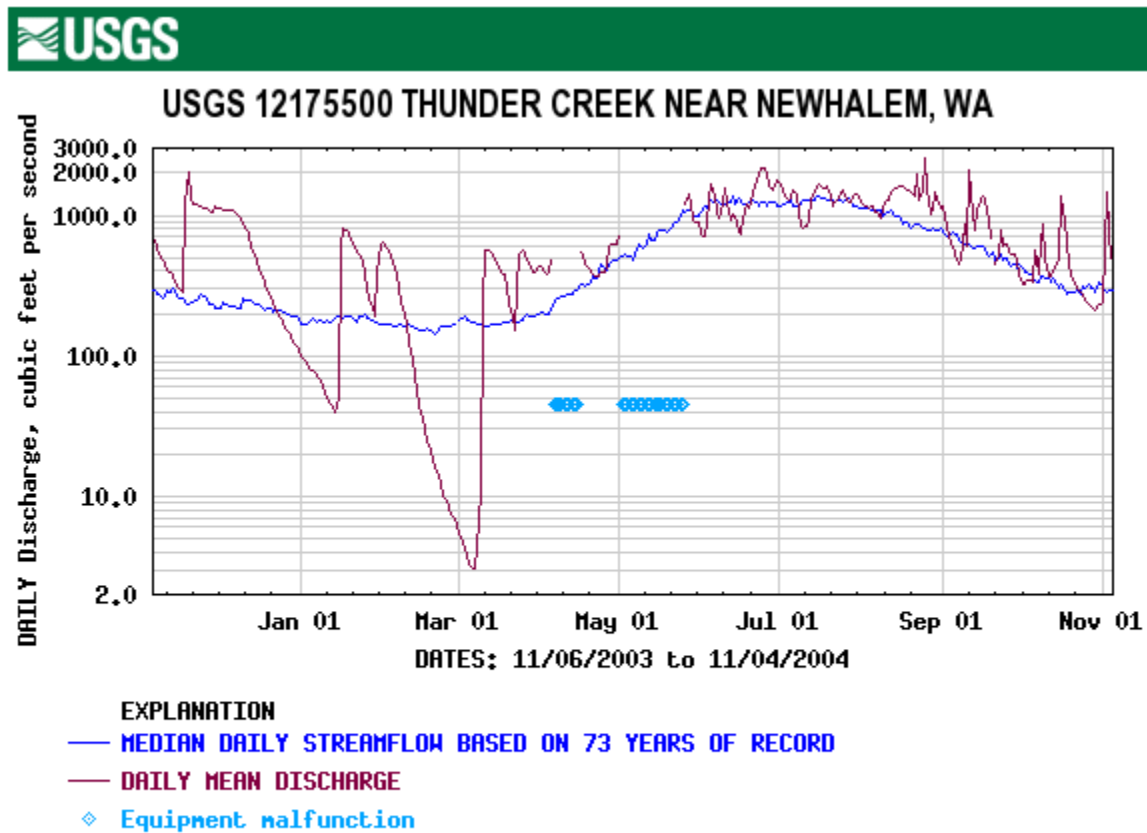
The following Staffs from North Cascades Complex contributed to the content of this EA:

Tom Belcher, Chief of Maintenance; Craig Holmquist, Trails Foreman; Roger Christophersen, Wildlife Biologist; Bob Kuntz, Wildlife Biologist; Anne Braaten, GIS Specialist; Mignonne Bivin, Plant Ecologist; Kelly Bush, Wilderness District Ranger; Jack Oelfke, Chief of Resources Management; Heather Swanson, Stock Packer; Dan Allen, Environmental Protection Specialist; Jon Riedel, Geologist; Jesse Kennedy, Cultural Resources Specialist.

# References

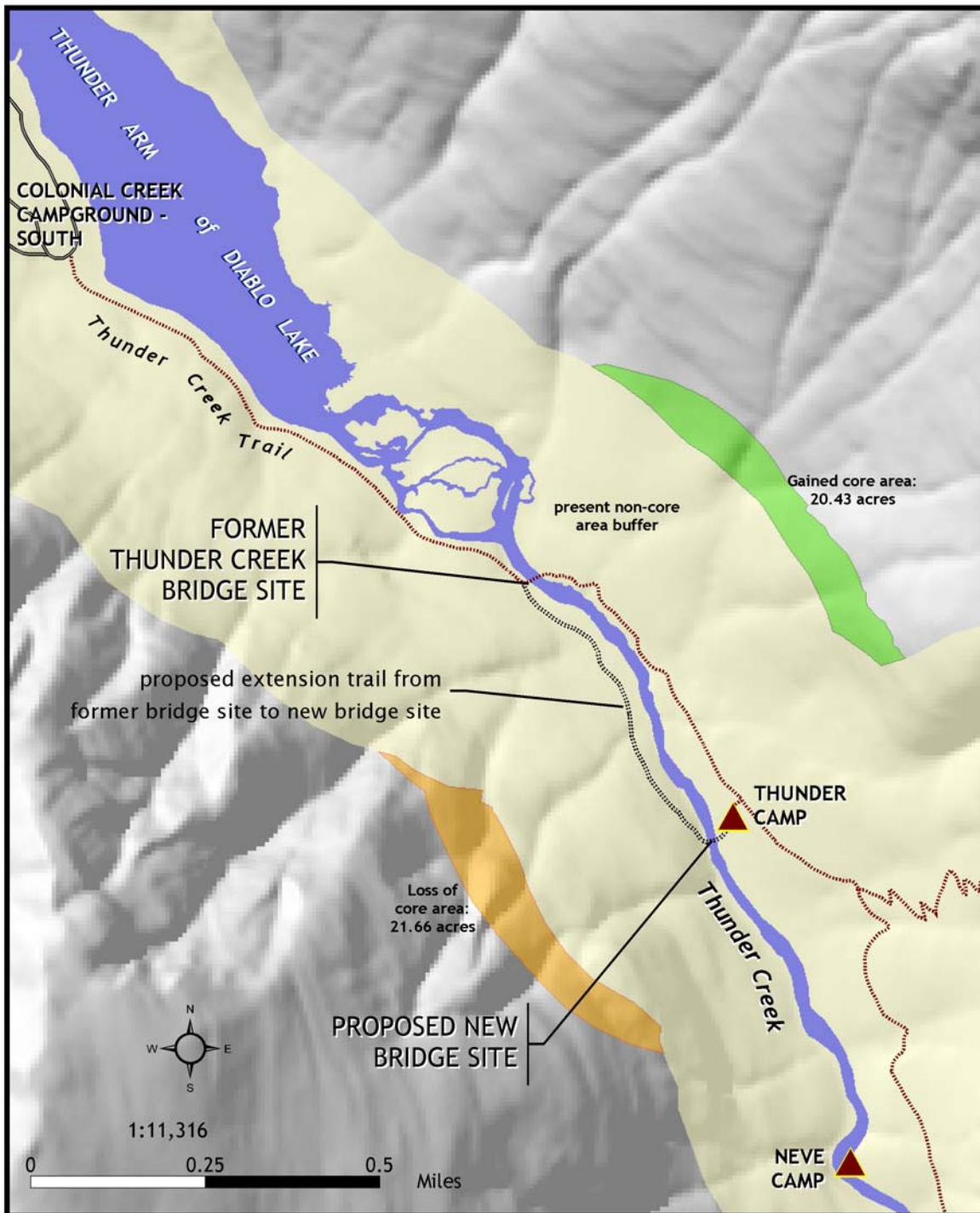
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## Appendix I. Thunder Creek Stream Flow Hydrograph



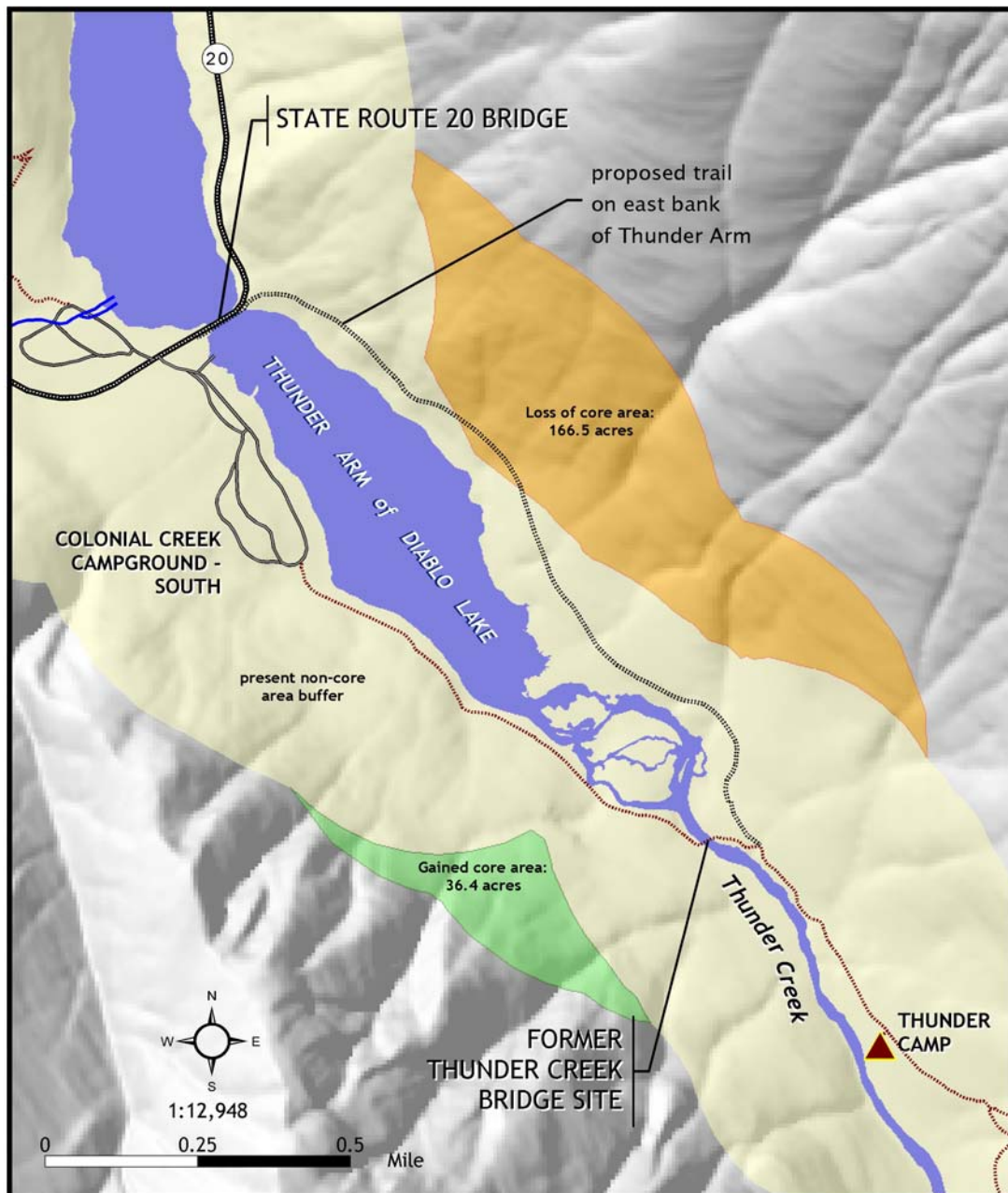
**Provisional Data Subject to Revision**

## Appendix II. Grizzly Bear Core Area Habitat



**Net 1.23 acre-loss of core resulting from proposed extension and rebridging of the Thunder Valley Trail**

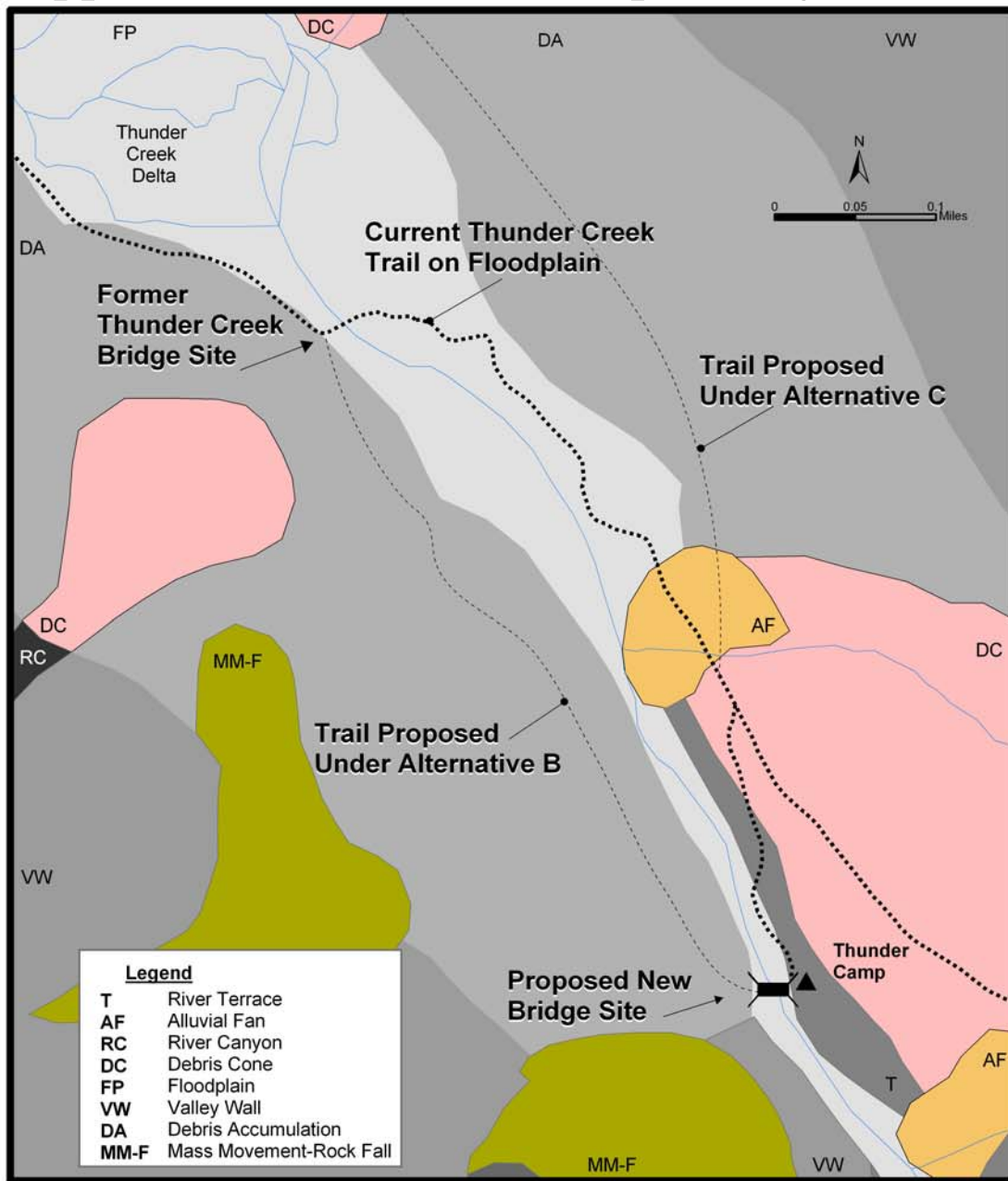
ab/flood03/core extension.mxd  
10 November 2004



ab/flood03/core eastbank.mxd  
10 November 2004

**Net 130 acre-loss of core resulting from  
proposed East bank of Thunder Arm Trail**

### Appendix III. Landform Map of Project Area



This Figure shows the surficial geologic features or “landforms” in the southern portion of the Project Area that limit favorable trail and bridge locations. Note the location of the existing Thunder Creek trail on the floodplain of Thunder Creek. The new bridge and trail proposed under Management Alternative B, and the trail proposed under Management Alternative C, would avoid the floodplain and take advantage drier, relatively flat upland landforms including debris accumulation zones and river terraces. *Landform Descriptions:* Valley Wall (VW) includes steep forested slopes ranging from 20 to more than 60 degrees. Debris Accumulation (DA): Zones where debris accumulates at the base of mountain slopes. River Canyon (RC): A steep gradient stream incised in bedrock creating a V-shaped valley. Mass Movement-Rockfall (MM-F): Rock accumulated by a landslide. Floodplain (FP): area inundated by 100 year flood event. River Terrace (RT): Dissected remnant of former floodplain. Debris Cone (DC): Cone-shaped depositional area greater than 10% gradient composed of debris from avalanches and streams. Alluvial Fan (AF): Low angle debris cone formed by intersecting streams.

## Appendix IV. Possible Stock Ford on Thunder Creek



Possible horse ford, approximately 150 yards downstream of the former Thunder Creek Bridge (location indicated by white arrow). Stock (or hikers) could ford the shallows immediately upstream of the logjam (right side of the photo), then reconnect with the Thunder Creek trail. Fording the creek would only be possible during low flows. The photo was taken in late fall during relatively low flows (approx. 700 cfs) from a logjam looking southward (upstream) toward the former Thunder Creek bridge site.

## Appendix V. Environmental Screening Form

### Project Description and Location:

Thunder Creek Bridge EA

	Yes	No	Data Needed to Determine
<b>Mandatory Criteria (A-M). Would the proposal, if implemented:</b>			
A. Have significant adverse effects on public health or safety?		X	
B. Have adverse effects on such unique characteristics as historic or cultural resources; park, recreation, of refuge lands; wilderness areas; wild or scenic rivers; sole or principal drinking water aquifers; prime farm lands; wetlands; floodplains; or ecologically significant or critical areas, including those listed on the National Register of Natural Landmarks?		X	
C. Have highly controversial effects?		X	
D. Have highly uncertain and potentially significant environmental effects or involve unique or unknown environmental risks? <i>Potential risk of bridge failure from flooding or falling trees.</i>	X		
E. Establish a precedent for future action or represent a decision in principle about future actions with potentially significant environmental effects?		X	
F. Be directly related to other actions with individually insignificant, but cumulatively significant, environmental effects?		X	
G. Have adverse effects on properties listed or eligible for listing on the National Register of Historic Places?		X	
H. Have adverse effects on species listed or proposed to be listed on the List of Endangered or Threatened Species, or have adverse effects on designated Critical Habitat for these species?		X	
I. Require compliance with Executive Order 11988 (Floodplain Management, Executive Order 11990 (Protection of Wetlands), of the Fish and Wildlife Coordination Act? <i>Proposed new bridge would not be in floodplain.</i>	X		
J. Threaten to violate a federal, state, local, or tribal law for requirement imposed for the protection of the environment?		X	
K. Require a permit from a federal, state, or local agency to proceed, unless the agency from which the permit is required agrees that a CE is appropriate? <i>Hydraulic Project Authorization will be needed to construct the new bridge</i>	X		
L. Have the potential for significant impact as indicated by a federal, state, or local agency of Indian tribe?		X	
M. Have the potential to be controversial regardless of its impact?		X	
N. Have the potential to violate the NPS Organic Act by impairing park resources or values?		X	
<b>Are any measurable impacts possible in the following categories relating to physical, natural, or cultural resources?</b>			
A. Geological resources -soils, bedrock, streambank, etc.	X		
B. From geohazards?		X	
C. Air quality, traffic, or from noise?	X		
D. Water quality or quantity?	X		
E. Streamflow characteristics	X		
F. Floodplains or wetlands?	X		
G. Land use, including occupancy, income, values, ownership, type of land use?	X		

H. Rare or unusual vegetation - old growth timber, riparian, alpine, etc.?	X		
I. Species of special concern (plant or animal; state or federal listed or proposed for listing) or their habitat?	X		
J. Unique ecosystems?	X		
K. Unique or important wildlife or wildlife habitat?	X		
L. Unique or important fish or fish habitat?	X		
M. Introduce or promote non-native species (plant or animal)?		X	
N. Recreation resources, including supply, demand, visitation, activities, etc.?	X		
O. Visitor experience, aesthetic resources?	X		
P. Cultural resources, cultural landscape, sacred sites, etc.?		X	
Q. Socioeconomics, including employment, occupation, income changes, tax base, infrastructure?		X	
R. Minority and low-income populations. Ethnography, size, migration patterns, etc.?		X	
S. Energy resources?		X	
T. Other agency or tribal land use plans or policies?		X	
U. Resource, including energy, conservation potential?		X	
V. Urban quality, gateway communities, etc.?		X	
W. Long-term management of resources or land/resource productivity?		X	
X. Other important environmental resources?		X	

**Please answer the following questions:**

1. *Are the personnel preparing this form familiar with the site, and/or has a site visit been conducted? (Attach additional pages noting when site visit took place, staff attending, etc.)*

All personnel involved in this project are familiar with the site based on numerous field visits.

2. *Has consultation with all affected agencies or tribes been completed? (Attach additional pages detailing the consultation, including the name, date, and summary of comments from other agency or tribal contacts.)*

Consultation will be outlined in Chapter V of the EA. Agencies to be consulted include: WA State Dept. of Transportation; Washington Department of Fish and Wildlife; USGS.

**Instructions:**

When you have completed a site visit (or if staff are familiar with the specifics of the site) and consultation with affected agencies and/or tribes, and if the answers in the mandatory criteria checklist above are all "no", you may proceed to the categorical exclusion form if the action is described in section 3-4 of DO-12. If any answers in the checklist are "yes" or "data needed to be determined," or if the action is not described in section 3-4, prepare an environmental assessment or environmental impact statement.

Attach maps, notes of site visits, agency consultation, relevant data or reports, the categorical exclusion form or other relevant information to this form to begin the statutory/administrative record file.

**Signatory**

In signing this form, you are saying you have completed a site visit or are familiar with the specifics of the site, that you have consulted with affected agencies and tribes, and that the answers to the questions posed in the checklist are, to the best of your knowledge, correct.

Roy Zipp  
Interdisciplinary Team Leader

March 2, 2005  
Date