

Chapter 3: Affected Environment & Environmental Consequences

Introduction

The purpose of this chapter is to describe park resources within and adjacent to the Boulder Creek project area in their existing condition, and to evaluate the potential impacts to each resource that would be expected to occur under each of the alternatives described in Chapter 2.

The analysis presented here assumes that the alternatives would be implemented as described, including all mitigation measures identified in Appendix A of this EA. The following impact analyses and conclusions were informed by a review of existing literature and park studies, information provided by subject matter experts within the park and other agencies, consultation with the state historic preservation officer and interested local Tribes, professional expertise, knowledge of park staff, and public input. The end of Chapter 2 also contains a summary of environmental impacts. This chapter is organized as follows:

- **Methodology for Impact Assessment**
- **Impairment of Park Resources and Values**
- **Physical Environment**
 - Geologic Features and Soils
 - Hydrology and Water Quality
 - Air Quality
- **Biological Environment**
 - Vegetation
 - Wildlife and Wildlife Habitat
 - Unique or Important Fish or Fish Habitat
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 - Wetlands
- **Wilderness Values**
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- **Unavoidable Adverse Impacts**
- **Relationship of Short-Term Uses and Long-Term Productivity**
- **Irreversible and Irrecoverable Commitments of Resources**

Methodology for Impact Assessment

The following terms are used to define the nature of impacts associated with project alternatives:

Type: Impacts can be beneficial or adverse.

Context: Context is the setting within which an impact would occur, such as site-specific, parkwide, or regional. The Council on Environmental Quality requires that impact analyses include discussions of context.

Duration: Duration of impact is analyzed independently for each resource because length of effects varies according to the resource being analyzed. Depending on the resource, impacts may last for the construction period, a single year or growing season, or longer. For purposes of this analysis, impact duration is described as short term, long term, and permanent.

Impact Intensity: Impact intensity is defined individually for each impact topic. There may be no impact or impacts may be negligible, minor, moderate, or major. Because definitions of intensity vary by resource, intensity definitions are provided for each impact topic analyzed.

Direct and Indirect Impacts: Effects can be direct, indirect, or cumulative. Direct effects are caused by an action and occur at the same time and place as the action. Indirect effects are caused by the action and occur later or farther away, but are still reasonably foreseeable.

Cumulative impacts: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR §1508.7).

Past, present, and reasonably foreseeable future actions, are listed in appendix B. Relevant plans and actions that could combine with those described for this plan are described below. These actions are then discussed cumulatively under each impact topic.

Olympic National Park

Park Plans and Actions

Olympic National Park Final General Management Plan (GMP) and Environmental Impact Statement (2008)

The GMP provides park managers with long-term direction for achieving the resource protection and visitor experience goals of Olympic National Park and establishes the direction for managing the Boulder Creek Trail and Boulder Creek Campground in the Elwha area of the park. This EA guides implementation of the portions of the GMP that deal with the Boulder Creek Trail and campground. The GMP states, “Road access would be retained to the Boulder Creek trailhead. Trailhead and parking would be improved and may be relocated nearby. The Boulder Creek Trail would be rehabilitated to provide access for

hikers and horseback riders. Trail access would be retained, using methods that minimize adverse effects on river processes and aquatic and riparian habitats, to the extent possible.”

Elwha River Ecosystem Restoration Final Environmental Impact Statement (Elwha FEIS, 1995), and Supplemental Environmental Impact Statement (SEIS, 2005)

The Elwha FEIS determined that the removal of Elwha and Glines Canyon dams has the potential to fully restore the ecosystem and Elwha native anadromous fish and fulfill the purpose of the congressional mandate for full restoration. The SEIS, 2005 identified and analyzed the potential impacts of a new set of water quality and supply-related mitigation measures. Boulder Creek is a tributary of the Elwha River currently entering the Lake Mills Reservoir. The actions identified in these documents are included in the cumulative effects analysis of the Boulder Creek EA.

Other Planned or Ongoing Park Projects

Olympic National Park Wilderness Management Plan

Olympic National Park will begin internal scoping for a Wilderness Management Plan in 2010. This plan will guide the preservation, maintenance, use, and restoration of wilderness in the park. The plan will establish specific goals and objectives, provide guidelines and standards, and designate zones for the Olympic National Park Wilderness.

Ozette Lake Management Plan

The 2008 General Management Plan identified the need to develop an Ozette Lake Management Plan to focus on visitor use, access, and resource protection at Ozette Lake.

Olympic Hot Springs Restoration Plan

The 2008 General Management Plan identified the need to develop a plan to evaluate restoration options for the Olympic Hot Springs area.

Olympic Discovery Trail, Phase 1

Approximately six miles of paved trail was constructed above the north shore of Lake Crescent as part of a planned trail that will eventually link the town of Port Townsend, on Puget Sound, with the community of LaPush on the Pacific Coast. The segment of trail constructed in 2009 will provide an accessible trail with access for hikers, bicyclists, stock users, wheelchairs, and strollers.

Olympic Discovery Trail, Phase 2

Approximately three miles of new trail along the north shore of Lake Crescent are proposed for construction by Clallam County within the park. This new segment would connect to the new trail constructed in 2009.

Replacement of Griff Creek Barrier Culvert

A large culvert on Griff Creek, a tributary to the Elwha River, will be replaced in 2010 to provide fish passage and to expand areas that may serve as refugia for bull trout during the implementation of the Elwha Dam Removal Project.

Rehabilitate Sand Point Trail at Lake Ozette

This project will rehabilitate or replace approximately 2,100 linear feet of failing elevated wood puncheon on the Sand Point Trail at Lake Ozette. This project is anticipated to occur within the next two years. The Cape Alava and Sandpoint trails depart from the Lake Ozette visitor area and extend to the Pacific coast. The ends of the trails are linked by 3 miles of beach, creating a nine-mile triangle. Over 100,000 visitors per year come to Ozette to backpack the trails through primeval forest and camp on the rugged Pacific coast.

Olympic National Forest

Olympic Discovery Trail

Olympic National Forest manages an extensive network of trails, including segments of the Olympic Discovery Trail, a planned trail that will eventually link the town of Port Townsend, on Puget Sound, with the community of LaPush on the Pacific Coast.

County / Community Plans and Activities

Olympic Discovery Trail

Clallam County manages several miles of multiple-use, non-motorized trails, including segments of the Olympic Discovery Trail, a planned trail that will eventually link the town of Port Townsend, on Puget Sound, with the community of LaPush on the Pacific Coast.

Impairment of Park Resources and Values

In addition to determining the environmental consequences of the preferred alternatives, NPS *Management Policies* 2006 and Director's Order #12, require analysis of potential effects to determine if actions would impair park resources and values. The fundamental purpose of the national park system established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or minimize to the greatest degree practicable, adverse impacts to park resources and values. Congress has given NPS managers direction, however, to allow impacts to park resources and values when necessary and appropriate to fulfill the purpose of the park, so long as the impact does not constitute impairment of the affected resources and values.

The prohibited impairment is an impact that would, in the professional judgment of the responsible NPS manager, harm the integrity of park resources or values, including opportunities that would otherwise be present for the enjoyment of those resources or values. An impact would

more likely constitute impairment when it has a major or severe adverse effect upon a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishment legislation or proclamation of the park;
- Key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or
- Identified as a goal in the park's general management plan or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and others operating in ONP. The Chapter 3 includes a determination on impairment in the conclusion statement of the appropriate impact topics for each alternative. Impairment statements are not required for recreational values/visitor experience, park operations, or health and safety topics. In addition, neither NPS policies nor managerial determinations regarding impairment apply to non-NPS land or resources.

Physical Environment

The following section describes the geology and soils, hydrology and water quality, and air quality of the project area. It also includes a description of the methodology used to describe impacts to these resources, followed by an analysis of the impacts anticipated to occur to these resources for each of the Alternatives described in Chapter 2.

Geologic Features and Soils

The National Park Service mapped landforms for this area in 2006. The majority of the project area occurs on three categories of landform:

- 1) *Valley wall*: steep forested slopes ranging from 20° to 60° and consisting of bedrock, till or colluviums
- 2) *Debris apron*: the transitional zone on the base of a valley wall where slope decreases and debris accumulates. Debris aprons are generally composed of deeper, less consolidated colluviums or talus.
- 3) *Debris cone*: usually mapped adjacent to small drainages, debris cones are composed of upslope debris that has been transported by small streams and deposited in multiple events over time to form a conical shaped debris fan. These cones are often reworked and redeposited during subsequent flood events.

Soil data for Olympic National Park is limited. The Natural Resources Conservation Service's (NRCS) Soil Survey of Washington, contains soils maps for the Olympic Peninsula but does not include the areas inside the ONP boundary. Specifically, the NRCS Soil Survey for the Clallam County Area of Washington manual describes the area closest to the Boulder Creek Trail and campground as "soils on mountains" in the Terbies-Louella soil series. However, individual soil

types have not been delineated within the Park boundaries. Soils in the Terbies-Louella series are generally deep and well drained and formed from basalt, sandstone, siltstone, and conglomerate materials. Bedrock in the project area is comprised of mica rich sandstone, shale, slate, and phyllite (Tabor, R.W., 1975, Guide to the Geology of Olympic National Park, University of Washington Press, Seattle).

Soils along the Boulder Creek Trail are highly erodible and unstable, with steep slopes present along the majority of the trail. Erosion is primarily due to surface runoff and stream flow, with increased erosion occurring during periods of heavy rainfall and associated high streamflow events. The Crystal Creek drainage has been highly eroded within the project area. The side slopes of Crystal Creek at the Boulder Creek Trail crossing are comprised of medium to fine gravel that was imported as fill material during construction of the former road. A 60 inch diameter metal culvert installed at Crystal Creek was blocked by a large tree and debris during storm events, resulting in failure of the culvert and the erosion of a large quantity of fill material above and around the culvert. High flow events and associated debris jams at the Crystal Creek culvert caused continuing erosion of this fill material.



Photo 1: Construction of the Olympic Hot Springs Road by the CCC, 1937.

The Boulder Creek Trail, a former road, was constructed by cutting into the slopes. Excavated materials removed from the uphill area were deposited along the length of the road and on downhill slopes in order to form a level road bed. This method of construction resulted in

relatively stable downslopes, but less stable upslopes in steeper areas. Several cut slopes are stable as a result of natural grade and reestablishment of vegetation. However, several steep unstable slopes prompted shallow surface slides less than one foot deep, and large “block” slides up to 5 feet deep. Such slides deposited materials across the trail in several locations, ranging in size from fine silt to 6 inch diameter rocks.



Photo 2: Construction of the Olympic Hot Springs Road by the CCC, 1937.

Slopes below the trail are generally stable with the exception of several areas eroded by surface water runoff patterns in the trail. In these cases, an impervious layer of asphalt channels water runoff to low spots on the trail or areas where constructed drainages failed. In several locations, areas of concentrated drainage undermine the pavement surface. Also, several culverts are undermined on the downslope side of the trail, resulting in a loss of materials immediately beneath the road surface and all around the culvert (see Photo 9).

Soil in some areas of the campground, such as the former road beds, tent pads, and food hanging areas are compacted such that vegetation will not regenerate. Soils in the campground area are generally comprised of gravely silt-loam (K. Kwarsick, pers comm. 2009). Social trails and game trails lead to the ridge top. Slopes of the developed campground area are between 2 and 15 percent. Hillsides above and below the campground are steeper, varying between 40 and 150 percent. Surface flows from the upslope areas quickly channel into limited drainages within the

campground, with little evidence of significant surface erosion channels. These channels are controlled and limited by the placement of culverts (see Hydrology, Figure 21). A wetland in the northwestern area of the campground is expected to contain hydric soils (soils formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part). A wetland survey would be conducted.

Impact Assessment Methodology

Type: Beneficial impacts improve or sustain geologic resources or processes. Adverse effects diminish or degrade geologic resources or processes.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for geologic resources and processes.

Table 22: Geologic Features and Soils Impact and Intensity.

Impact and Intensity	Intensity Description
Negligible	The effects to geologic features or soils would be below or at a lower level of detection. Any effects on soil productivity or erosion potential would be slight.
Minor	Effects to geologic features or soils would be detectable. Soil profile would change in a relatively small area, but would not appreciably increase the potential for erosion of additional soil. Geologic processes would remain intact. If mitigation were needed to offset adverse effects, it would be relatively simple to implement and would likely be successful.
Moderate	An action would result in a noticeable change in geologic features or soils, including the quantity or alteration of the topsoil, overall biological productivity, or the potential for erosion to remove small quantities of additional soil. Changes to localized ecological processes would be limited. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.
Major	An action would result in a highly noticeable change to the park's geologic features, including the potential for erosion to remove large quantities of additional soil or in alterations to topsoil and overall biological productivity in a relatively large area. Key ecological processes would be altered, and landscape-level changes would be expected. Mitigation measures to offset adverse effects would be necessary, extensive, and their success could not be guaranteed.
Impairment	An action would result in the permanent, highly noticeable adverse change to the park's key geologic features, including the potential to create extensive erosion or irreversible impacts to the park's topsoil and overall biological productivity over a broad region in the park. Key ecological processes would be irreversibly altered and landscape scale changes would occur. Mitigation measures to offset adverse effect would be unlikely to succeed.

Environmental Consequences to Geologic Features and Soils

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in adverse, local, long-term, minor to moderate impacts to geologic resources and soils as a result of the continued presence of compacted soils and asphalt along the length and width of the trail (approximately 155,000 square feet of asphalt), and the presence of compacted soils in the campground and former campground parking lot. The presence of asphalt would also contribute to these impacts through increased erosion potential due to the combination of increased surface runoff combined with failed drainage structures.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives. Adverse, site-specific, long-term to permanent minor adverse impacts would occur due to construction of an 80' diameter vehicle turnaround area at the Boulder Creek Trailhead due to clearing, compaction, and paving with asphalt. This would result in approximately 4,750 square feet of newly disturbed area, and paving of approximately 5,100 square feet with asphalt.

Removal of asphalt and culverts from the trail corridor would result in site-specific, short-term negligible to minor adverse impacts during construction due to excavation using heavy equipment, and the associated ground disturbance in an covering approximately 180,000 square feet (including the 148,000-155,000 square feet of asphalt to be removed).

Construction of a temporary large vehicle turnaround area near Crystal Creek would result in adverse, site-specific, short-term minor to moderate impacts due to the excavation of unstable soils that may result in increased erosion and instability until construction is complete and the area is allowed to reach a new state of stability, or angle of repose. Construction of the temporary large vehicle turnaround would affect an area of approximately 2,200 square feet.

Removal of culverts, concrete restroom foundations, and recontouring of compacted soils within the former campground parking lot would result in short-term negligible to minor adverse impacts due to ground disturbance during project implementation. This work would affect an area of approximately 2,000 square feet.

Beneficial, site-specific and local, long-term to permanent minor to moderate impacts would result from the removal of approximately 148,000-155,000 square feet of asphalt from the trail and the decompaction of soils along the rehabilitated trail length, and also in the decompacted areas within the campground and former campground parking lot.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. Alternative 2 would result in adverse, site-specific, long-term to permanent minor adverse impacts due to the expansion of gravel parking on the north side of the existing lot to create a gravel parking surface covering approximately 22,000 square feet. This would require clearing and disturbance to approximately 15,500 square feet. Additional soil compaction would occur within the 18-24 inch wide tread width of the new

trail, although this area is likely compacted due to the presence of the asphalt road surface. Destabilization of uphill slopes would result in adverse, site-specific, short-term and long-term minor to moderate impacts when soils that have slid onto the trail are excavated to allow for complete asphalt removal. These unstable soils would likely continue to slide until soils reach a renewed state of stability after project completion.

Alternative 2 would also result in adverse, site-specific, short-term minor to moderate impacts to soils during construction of the new trail and grading of the trail to match the footlogs placed at three stream crossings. This would include blasting and removal of approximately 1,400 cubic yards of rock at the Crystal Creek stream crossing and cut and removal of approximately 2,500 cubic yards of trail embankment to bring the trail grade to the proposed location of the new footlog and stock ford at this site.

Best management practices would be implemented to prevent material from entering the stream channel, but it is anticipated that approximately 250 cubic yards of material may enter the stream channel during blasting and trail construction. Soil compaction would continue to occur in the seven campsites that would be retained at the Boulder Creek Campground, and along the length of the trail segments retained in this area. This would result in adverse, site-specific, long-term to permanent minor impacts. Excavation of buried utility lines in the campground would also result in adverse, site-specific, minor to moderate adverse impacts due to the extensive ground disturbance (approximately 8,000 square feet) that would be required to locate, excavate and remove buried infrastructure throughout the area of the campground.

Alternative 3 – Moderate Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Alternative 3 would result in adverse, site-specific, long-term to permanent minor adverse impacts due to the expansion of parking on the north side of the existing lot to create a paved, non-asphalt parking surface covering approximately 16,700 square feet. Approximately 5,300 square feet of gravel parking would be retained. Expansion of the parking lot would require clearing and disturbance of approximately 15,500 square feet.

Additional soil compaction would occur within the 24-30 inch tread width of the new trail. Destabilization of uphill slopes would result in adverse, site-specific, short-term and long-term minor to moderate impacts when areas soils that have slid onto the trail are excavated to allow for complete asphalt removal. These unstable soils would likely continue to slide until soils reach a renewed state of stability after project completion.

Alternative 3 would also result in adverse, site-specific, short-term minor impacts to soils during construction of the new trail and grading of the trail to match the footlogs and bridge placed at three stream crossings. This would include blasting and removal of approximately 1,100 cubic yards of rock at the Crystal Creek stream crossing and cut and removal of approximately 400 cubic yards of trail embankment to bring the trail grade to the proposed location of the new 80 foot long steel bridge at this site.

Best management practices would be implemented to prevent material from entering the stream channel, but it is anticipated that approximately 100 cubic yards of material may enter the stream

channel during blasting and trail construction. Soil compaction would continue to occur in the eight campsites that would be retained at the Boulder Creek Campground, and along the length of the trail segments retained in this area.

This would result in adverse, site-specific, long-term to permanent minor impacts. Installation of a day-use stock hitching rail near the Boulder Creek campground former parking lot may result in adverse, site-specific, short to long-term minor impacts due to the concentrated use in this area for pack stock, and the associated soil compaction that would occur in the immediate area.

Alternative 4 – Enhanced Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Alternative 4 would result in adverse, site-specific, long-term to permanent minor to moderate adverse impacts due to the expansion of parking on the north side of the existing lot to create a paved asphalt parking surface covering approximately 23,000 square feet. Approximately 5,300 square feet of gravel parking would be retained. This would require clearing and disturbance of approximately 21,000 square feet. Additional soil compaction would occur within the 24-30 inch tread width of the new trail.

Alternative 4 would also result in adverse, site-specific, short-term negligible to minor impacts to soils during construction of the new trail and grading of the trail to match the footlog and bridges placed at three stream crossings. This would include removal of approximately 20 cubic yards of rock at the Crystal Creek stream crossing and cut and removal of approximately 20 cubic yards of trail embankment to bring the trail grade to the proposed location of the new 150 foot long steel bridge at this site.

Best management practices would be implemented to prevent material from entering the stream channel. Soil compaction would continue to occur in the eleven campsites that would be retained at the Boulder Creek Campground, and along the length of the trail segments retained in this area. This would result in adverse, site-specific, long-term to permanent minor impacts.

Installation of a day-use stock hitching rail near the Boulder Creek campground near the former parking lot, and a campsite with a hitching rail for overnight use for the associated campsite may result in adverse, site-specific, short to long-term minor to moderate impacts due to the concentrated use in this area for pack stock, and the associated soil compaction that would occur.

Cumulative Impacts. The original construction of the Boulder Creek Road resulted in minor to moderate adverse impacts to geologic resources from earthwork, excavation, and asphalt paving. Ongoing regular maintenance and repairs to the trail (former road) would have minor adverse effects to the Boulder Creek watershed, negligible adverse effects to the Elwha River, and minor adverse effects to geologic resources because surface disturbances occur primarily within existing areas of disturbance. The NPS plan to restore the Elwha River may benefit stream geomorphology of Boulder Creek by restoring natural fluvial processes at the mouth of the creek. After the restoration of the Elwha River, sediment and debris from the eroding slopes in the Boulder Creek drainage would flow directly into the Elwha River. Sediment would create an alluvial fan, altering the delta where the creek and the current reservoir meet. No action would contribute long-term beneficial effects as natural geologic processes are reestablished. Cumulative impacts on geologic resources would remain minor to moderate from past and

current activities in the basin even with the slight beneficial effects of the proposed dam removals, which would restore the natural geomorphologic processes of both the Elwha River and Boulder Creek watershed.

Impairment. Geological resources would not be impaired under any of the alternatives considered in this document.

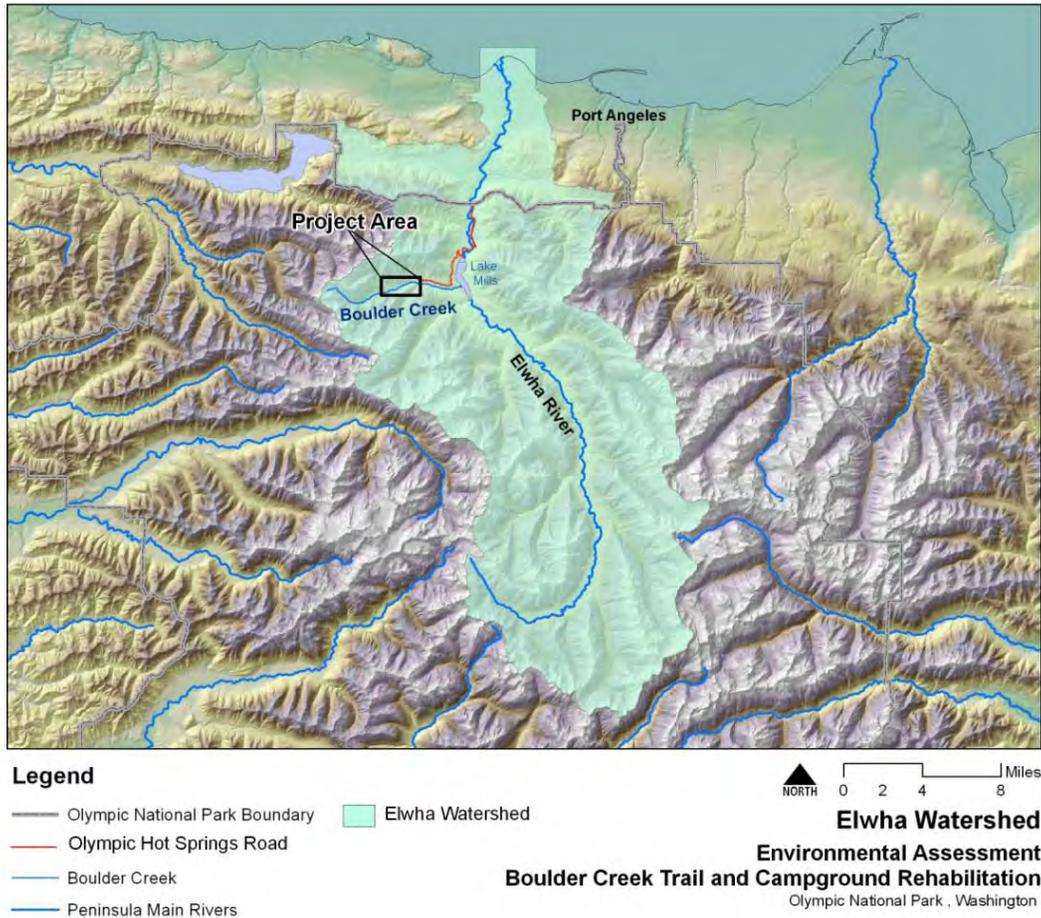
Hydrology and Water Quality

The Boulder Creek drainage is in the Elwha watershed, the largest watershed in Olympic National Park, containing approximately 321 square miles. Average annual precipitation measured at the Elwha Ranger Station is 55 inches, increasing to nearly 100 inches at the headwaters of Boulder Creek. Relatively high rainfall in the area, coupled with periodic rain-on-snow events lead to very high flows during storm events. The park's rivers, streams, creeks, and lakes are relatively pristine, with the exception of the Elwha River, which is impacted by two dams, the Elwha dam and the Glines Canyon dam. The Glines Canyon dam is in the park boundary and Elwha dam is outside the park. It is anticipated that the dams would be removed starting in 2011.

Boulder Creek originates from Boulder Lake, located in Olympic National Park wilderness at approximately 4,400 feet elevation, and drains into Lake Mills, which was formed by the Glines Canyon dam. Boulder Creek supports important habitat for several fish species including rainbow trout, sculpin, cutthroat trout and threatened bull trout. No threatened or endangered fish are present in the project area due to the presence of the downstream fish barrier.

Several tributaries flow into Boulder Creek. The four major tributaries that cross the Boulder Creek Trail are Deer Creek, located at the trailhead; Cougar Creek, Hell Creek, and Crystal Creek (See Figure 21). Of these tributaries, Crystal Creek is the largest drainage and has the highest volume of flows during heavy rainfall events. There is evidence of the stream carrying large downed trees and debris.

Figure 20: Elwha Watershed.



Impact Assessment Methodology

Type: Beneficial impacts improve or sustain hydrologic processes or water quality. Adverse effects diminish or degrade hydrologic processes or water quality.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

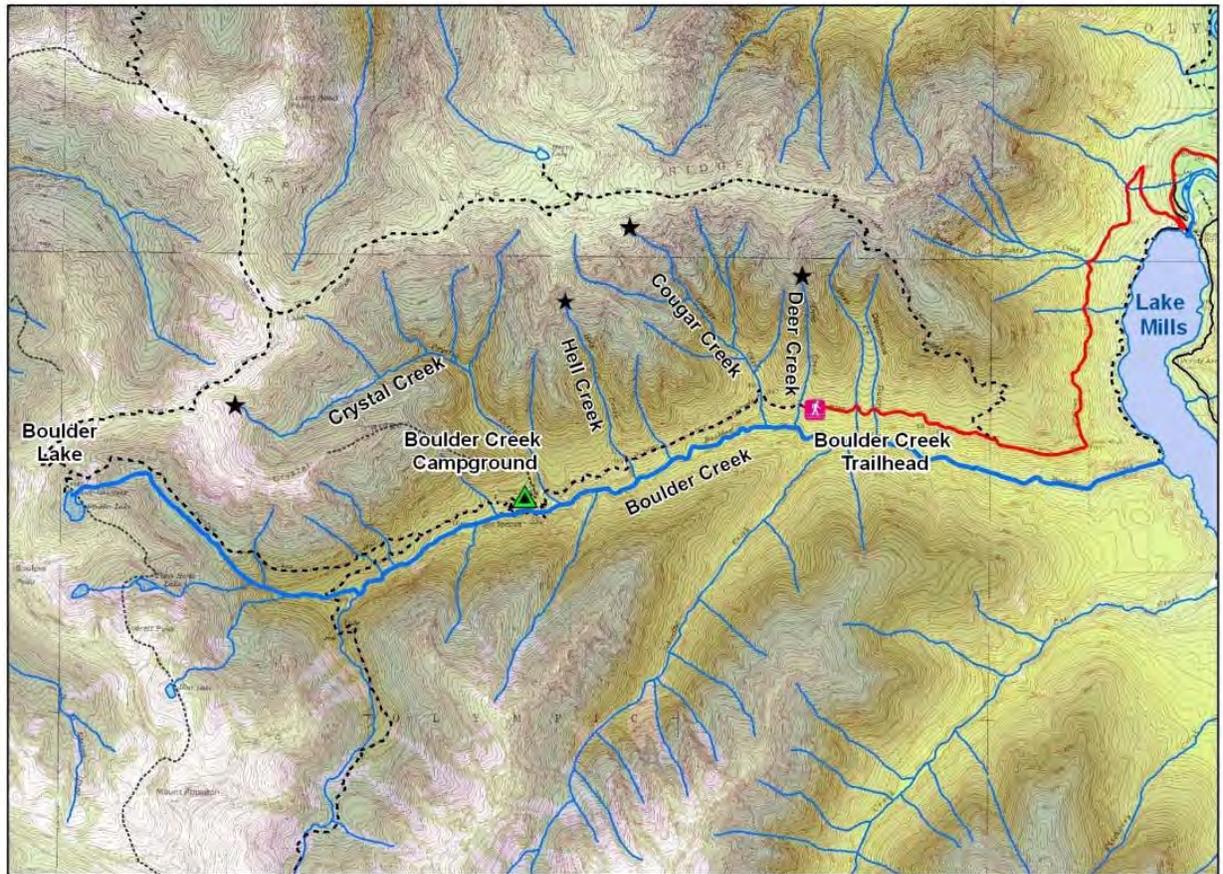
Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for hydrologic processes or water quality.

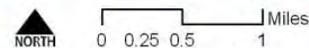
Table 23: Hydrology and Water Quality Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	An action that would result in a change to a hydrologic resource or water quality, but the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	An action that would result in a change to a singular hydrologic resource or water quality, but the change would be small, localized, and of little consequence.
Moderate	An action that would result in a change to a hydrologic resource or water quality; the change would be measurable and of consequence. Mitigation would likely be necessary and would be expected to be successful.
Major	An action that would result in a noticeable change to a hydrologic resource or water quality; the change would be measurable and result in a severely adverse or major beneficial impact with regional consequences. Mitigation would be necessary and success would not be certain.
Impairment	An action would result in a permanent, noticeable, adverse change to a hydrologic resource or water quality within the park to the extent that the ecological integrity of the park would be substantially compromised.

Figure 21: Hydrology.



- Legend**
- Boulder Creek Campground
 - Boulder Creek
 - Olympic Hot Springs Road
 - Boulder Creek Trail
 - Major tributaries crossing the Boulder Creek Trail



Hydrology
Environmental Assessment
Boulder Creek Trail and Campground Rehabilitation
 Olympic National Park, Washington

Environmental Consequences to Hydrologic Processes and Water Quality

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in adverse, local, long-term, minor to moderate impacts to hydrologic resources and water quality as a result of the continued presence of compacted soils and asphalt along the length and width of the trail (approximately 155,000 square feet of asphalt), the presence of compacted soils in the campground and former campground parking lot, and the presence of culverts and fill material that have altered the topography and flow of water in the campground. The presence of asphalt would also contribute to these impacts due to failed drainage structures. The continued presence of failed culverts in the stream channel at several locations would affect channel morphology and hydrology on Hell and Crystal Creeks.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives. Adverse, site-specific, long-term to permanent negligible to minor adverse impacts would occur due to construction of an 80 foot diameter vehicle turnaround area at the Boulder Creek Trailhead. Clearing, compaction, and paving with asphalt, which is not permeable, would alter surface water flow in an area approximately 5,100 square feet. Removal of asphalt and culverts from the trail corridor, and the construction of a temporary large-vehicle turnaround area would result in local, short-term, negligible to minor adverse impacts during construction due to excavation using heavy equipment, and the associated ground disturbance and potential for erosion in the event that a heavy rainfall event occurs that transports construction-generated sediments.

Removal of culverts, concrete restroom foundations, and recontouring of compacted soils within the former campground parking lot would result in short-term negligible to minor adverse impacts due to ground disturbance during project implementation and the associated erosion that may occur if a heavy rainfall event occurs during project implementation. Beneficial, site-specific and local, long-term to permanent minor to moderate impacts would result from improvement of surface water flow along the improved Boulder Creek Trail, and within the recontoured and revegetated areas in the Boulder Creek campground and former campground parking lot.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. Alternative 2 would result in adverse, site-specific, long-term to permanent negligible adverse impacts due to the expansion of gravel parking on the north side of the existing lot to create a gravel parking surface covering approximately 22,000 square feet. Destabilization of uphill slopes would result in adverse, site-specific, short-term minor to moderate impacts when areas where soils have slid onto the trail are excavated to allow for complete asphalt removal. These unstable soils would likely be subject to erosion in the event of a heavy rainfall event prior to disturbed soils reaching a new state of stability after project completion.

Alternative 2 would also result in adverse, site-specific, short-term minor to moderate impacts to water quality during construction of the new trail and grading of the trail to match the footlogs placed at three stream crossings due to blasting and removal of approximately 1,400 cubic yards of rock at the Crystal Creek stream crossing and cut and removal of approximately 2,500 cubic yards of trail embankment to bring the trail grade to the proposed location of the new footlog and stock ford at this site. Best management practices would be implemented to prevent material from entering the stream channel, but it is anticipated that approximately 250 cubic yards of material may enter the stream channel during blasting and trail construction.

Excavation of buried utility lines in the campground would also result in adverse, site-specific, minor adverse impacts to water quality in the event of a heavy rainfall event during construction due to the extensive ground disturbance that would be required to locate, excavate and remove buried infrastructure throughout the area of the campground.

Alternative 3 – Moderate Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Alternative 3 would result in adverse, site-specific, long-term to permanent, negligible adverse impacts due to the expansion of parking on the north side of the existing lot to create a permeable, paved, non-asphalt parking surface covering approximately 16,700 square feet. Approximately 5,300 square feet of gravel parking would be retained. Destabilization of uphill slopes would result in adverse, site-specific, short-term minor to moderate impacts when areas where soils have slid onto the trail are excavated to allow for complete asphalt removal. These unstable soils would likely be subject to erosion in the event of a heavy rainfall event prior to disturbed soils reaching a new state of stability after project completion.

Alternative 3 would also result in adverse, site-specific, short-term minor impacts to water quality during construction of the new trail and grading of the trail to match the footlogs and bridge placed at three stream crossings. This would include blasting and removal of approximately 1,100 cubic yards of rock at the Crystal Creek stream crossing and cut and removal of approximately 400 cubic yards of trail embankment to bring the trail grade to the proposed location of the new 80 foot long steel bridge at this site. Best management practices would be implemented to prevent material from entering the stream channel, but it is anticipated that approximately 100 cubic yards of material may enter the stream channel during blasting and trail construction.

Installation of a day-use stock hitching rail near the Boulder Creek campground former parking lot may result in adverse, site-specific, short-term negligible impacts to water quality due to the concentrated use in this area for pack stock, and the associated soil erosion, and possible runoff from manure that may occur in the immediate area.

Alternative 4 – Enhanced Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Alternative 4 would result in adverse, site-specific, long-term to permanent minor to moderate adverse impacts due to the expansion of parking on the north side of the existing lot to create a paved asphalt parking surface that is not

permeable and would alter surface water flow in an area covering approximately 23,000 square feet. Approximately 5,300 square feet of gravel parking would be retained.

Alternative 4 would also result in adverse, site-specific, short-term negligible impacts to water quality during construction of the new trail and grading of the trail to match the footlog and bridges placed at three stream crossings. This would include removal of approximately 20 cubic yards of rock at the Crystal Creek stream crossing and cut and removal of approximately 20 cubic yards of trail embankment to bring the trail grade to the proposed location of the new 150 foot long steel bridge at this site. Best management practices would be implemented to prevent material from entering the stream channel.

Installation of a day-use stock hitching rail near the Boulder Creek campground near the former parking lot, and a campsite with a hitching rail for overnight use for the associated campsite may result in adverse, site-specific, short-term negligible to minor impacts to water quality due to the concentrated use for pack stock, and the associated potential for soil erosion, and runoff from manure that may occur in the immediate area.

Cumulative Impacts. The original construction of the Boulder Creek Road resulted in minor to moderate adverse impacts to hydrologic processes and water quality from earthwork, excavation, and asphalt paving. Ongoing regular maintenance and repairs to the trail (former road) would have minor adverse effects to the Boulder Creek watershed, negligible adverse effects to the Elwha River, and minor adverse effects to hydrologic resources because surface disturbances and erosion occur primarily within existing areas of disturbance. The NPS plan to restore the Elwha River may benefit stream geomorphology of Boulder Creek by restoring natural fluvial processes. After the restoration of the Elwha River, the sediment and debris from the eroding slopes in the Boulder Creek drainage would flow directly into the Elwha River. Sediment would create an alluvial fan, altering the delta where the creek and lake meet. No action would contribute long-term beneficial effects as natural hydrologic processes are reestablished.

Impairment. Hydrology and water quality would not be impaired under any of the alternatives considered in this document.

Air Quality

The 1963 Clean Air Act, as amended (42 USC 7401 et seq.) requires land managers to protect air quality. Section 118 of the Clean Air Act requires national parks to meet all federal, state, and local air pollution standards. Olympic National Park is designated as a Class I area as defined by the Clean Air Act, as amended. All areas immediately surrounding the park are considered Class II areas. Class I areas are afforded the highest degree of protection under the Clean Air Act. This designation allows very little additional deterioration of air quality. Protecting the overall park visibility and impacts on the views that are most important to park visitors is a management concern. Pristine air quality is important to the visitor experience because it allows the long-range scenic views of the Olympic Mountains. Air quality is also important for human health and the preservation of natural and cultural resources.

Campfires are permitted in the campground year-round with the exception of short dry periods during late summer and fall, when burn bans may occur for fire protection and safety reasons. Campfires, generators, and operation of motor vehicles and equipment all may cause local, temporary air quality impacts in the park.

NPS Management Policies address the need to analyze potential impacts to air quality during planning. In order to assess the magnitude of air quality impacts under the various alternatives, air quality standards governing the Park were examined and compared to expected changes due to construction activities. The thresholds of change that define the impact intensities are discussed below.

Impact Assessment Methodology

Type: Beneficial impacts improve air quality. Adverse effects diminish or degrade air quality.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to five years. Permanent impacts occur for longer than five years.

Intensity: The following table describes intensity benchmarks for air quality.

Table 24: Air Quality Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	Impacts (chemical, physical, or biological) would not be detectable and would be well within air quality standards or criteria, and would be within historical or desired air quality conditions.
Minor	Impacts (chemical, physical, or biological effects) would be detectable, but would be within air quality standards or criteria and within historical or desired air quality conditions.
Moderate	Impacts (chemical, physical, or biological effects) would be readily detectable, but would be within air quality standards or criteria; however, historical baseline or air quality standards would be infrequently and not continuously, exceeded by a small amount.
Major	Impacts (chemical, physical, or biological effects) would be highly noticeable and would be frequently altered from the historical baseline or desired air quality conditions; and/or air quality standards or criteria would be frequently and/or continuously exceeded.
Impairment	Impacts (chemical, physical, or biological effects) would be highly noticeable and would be permanently altered from the historical baseline or desired air quality conditions; and/or air quality standards or criteria would be continuously exceeded to the extent that the purposes of the park could not be achieved.

Environmental Consequences to Air Quality

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in no new impacts to air quality. There would be adverse, local, short-term to long-term, negligible to

minor impacts from vehicular access to the trailhead by visitors and park staff accessing the project area in motorized vehicles.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. Alternative 2 would result in adverse, local, short-term minor to moderate impacts to air quality from blasting, vehicle, and heavy equipment used to implement this alternative. It is anticipated this work would occur over a period of approximately ten weeks.

Alternative 3 – Moderate Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Alternative 3 would result in adverse, local, short-term minor to moderate impacts to air quality from blasting, vehicle, and heavy equipment used to implement this alternative. It is anticipated this work would occur over a period of approximately ten weeks.

Alternative 4 – Enhanced Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Alternative 4 would result in adverse, local, short-term minor impacts to air quality from vehicle and heavy equipment used to implement this alternative. It is anticipated this work would occur over a period of approximately nine weeks.

Cumulative Impacts. The ongoing use of the area would result in adverse, local, short-term to long-term, negligible to minor impacts from vehicular access to the trailhead by visitors and park staff accessing the project area in motorized vehicles. Implementation of this project concurrent with the removal of the Elwha and Glines Canyon dams would likely result in cumulative, adverse, short-term, negligible to minor impacts to air quality during construction due to the use of blasting, vehicles, and heavy equipment.

Impairment. Air quality would not be impaired under any of the alternatives considered in this document.

Biological Environment

Vegetation

Vegetation in the project area is dominated by forest from the North Pacific Maritime Douglas-Fir-Western Hemlock Forest Group. These forests are synonymous with the Western Hemlock Zone of Franklin and Dyrness (1988) and are dominated by Douglas fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and western red cedar (*Thuja plicata*). Western hemlock is the most shade tolerant of these species and thus is the characteristic dominant of mature forests. Douglas-fir is an early, long-lived seral species in this zone. However, due to the longevity of Douglas-fir, even old growth stands have a conspicuous amount of Douglas-fir present. Western red cedar is typically found on moist to wet sites (Crawford et al, 2009).

Representative forested plant associations from this Group which have been documented in the project area include; Douglas-fir-Western Hemlock/Vanilla-leaf, Douglas-fir/Salal-Red huckleberry, Douglas-fir/Salal-Oceanspray, Douglas-fir-Western Hemlock/Salal-Oregon grape, and Douglas-fir-Western Hemlock/Oregongrape/Swordfern. Plant associations not represented in current NPS plot data but also likely to occur in this area have understories dominated by species such as vine maple, oxalis, and Alaska huckleberry. Disturbed areas are likely to have associations from the North Pacific Red Alder-Bigleaf Maple-Douglas-fir Forest Group. (C. Thompson, pers comm. 2009).

There are no known threatened and endangered, rare species, or species of concern in the project area or in the Boulder Creek drainage. Based on the knowledge of the ecology and distribution of these species, it appears unlikely that any occur in the project area. A survey of the area would be conducted during the growing season prior to start of project work.

Exotic species are present in the project area and include herb Robert (*Geranium robertianum*) and everlasting peavine (*Lathyrus latifolius*). In addition oxeye daisy (*Leucanthemum vulgare*), foxglove (*Digitalis purpurea*), St. Johnswort (*Hypericum perforatum*), bull thistle (*Cirsium vulgare*), and Canada thistle (*Cirsium arvense*) are likely to be found. The park's Exotic Plant Management Team (EPMT) has treated herb Robert and everlasting peavine in the Boulder Creek drainage over the past five years. During the 2009 field season, the EPMT will use Garlon 3A to treat herb Robert in the project area and throughout the Elwha Valley. The current accepted herbicide active ingredients used by the park's EPMT are: glyphosate, aminopyradlid, triclopyr amine, triclopyr ester, imazapyr, and imazapic (D. Campbell, pers comm. 2009).



Photo 3: Typical vegetation along the Boulder Creek Trail.

Vegetation in the campground is sparse due to soil compaction from high use in the area. The dominant understory plant species is salal. Throughout the campground area, there is an unusual abundance of trees missing lower limbs; this is likely a result of higher than normal visitor use and the collection of firewood. Also, from late spring and into the fall season dead and downed material from winter storms is absent from the campground; this is likely due to abundant collection for campfire use.

Appropriate genetic stock (i.e. native propagules) would be collected in the Boulder Creek drainage and propagated at the Park's greenhouse facility to be transplanted in the project area under the action alternatives.

Impact Assessment Methodology

Type: Beneficial impacts protect or restore native vegetation or remove non-native vegetation. Adverse effects diminish or remove native vegetation or introduce or spread non-native vegetation.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for vegetation.

Table 25: Vegetation Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	The impacts on vegetation (individuals or communities) would not be measurable. The abundance or distribution of individuals would not be affected or would be slightly affected. The effects would be on a small scale and no species of special concern would be affected. Ecological processes and biological productivity would not be affected.
Minor	The action would not decrease or increase the project area's overall biological productivity. The alternative would affect the abundance or distribution of individuals in a localized area, but would not affect the viability of local or regional populations or communities. Mitigation to offset adverse effects, including special measures to avoid affecting species of special concern, could be required and would be effective. Mitigation may be needed to offset adverse effects, would be relatively simple to implement, and would likely be successful.
Moderate	The action would result in effects to some individual native plants and could also affect a sizeable segment of the species' population and over a relatively large area. Permanent impacts could occur to native vegetation, but in a relatively small area. Some special status species could also be affected. Mitigation measures would be necessary to offset adverse effects and would likely be successful.
Major	The action would have considerable effects on native plant populations, including special status species, and affect a relatively large area within and outside the park. Extensive mitigation measures to offset the adverse effects would be required; success of the mitigation measures would not be guaranteed.
Impairment	The action would have permanent adverse effects on native plant populations, including special status species, to the extent that the biological integrity of vegetation communities within the park would be compromised. Native species would be extirpated from within the park.

Environmental Consequences to Vegetation

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in adverse, site-specific and local, long-term minor to moderate impacts due to the presence of the wide asphalt trail and the compacted soils associated with visitor use patterns that are prohibiting the establishment and maintenance of native plant communities in the denuded sections of the Boulder Creek Campground and the former campground parking lot.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives. The activities common to all Action Alternatives would result in adverse, site-specific, long-term to permanent impacts due to the removal of vegetation in the trailhead parking lot area due to the expansion of the vehicle turnaround area and additional vegetation clearance to expand parking on the north side of the road. Approximately 4,750 square feet of vegetation would be removed due to the expansion of the vehicle turnaround area at the trailhead parking lot. This is not an area with old-growth characteristics, and it appears that the area has been previously cleared in decades past.

Approximately 85% of conifers are between 6” – 16” in diameter, with very few trees 21” in diameter or greater.

Additional adverse, site-specific and local, short-term negligible to minor impacts would also occur during asphalt removal, but no old-growth or rare species would be affected. Beneficial, site-specific and local, long-term, minor to moderate impacts due to the rehabilitation of the trail corridor, campground, and former campground parking lot would occur due to the ban on campfires and wood collection and active revegetation throughout the project area. This would include revegetation of the former road leading to an abandoned trash dump east of the campground near Crystal Creek. Best management practices, such as the mitigation measures identified in Appendix A would be implemented to avoid and minimize the potential for the introduction or spread on non-native plant species due to construction and rehabilitation efforts.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. Alternative 2 would result in beneficial, site-specific and local, long-term, minor to moderate impacts due to the rehabilitation of denuded areas associated with approximately 23 former campsites. Adverse, site-specific, long-term to permanent, minor to moderate impacts would occur due to the loss of vegetation covering approximately 15,500 square feet due to the expansion of the trailhead parking lot. Vegetation is primarily coniferous with size classes as described above.

Alternative 3 – Moderate Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Alternative 3 would result in adverse, site-specific, negligible to minor impacts due to concentrated stock use within the area immediately adjacent to the day-use hitching rail proposed near the former campground parking lot. Beneficial, site-specific and local, long-term, minor to moderate impacts would occur due to the rehabilitation of denuded areas associated with approximately 22 former campsites. Adverse, site-specific, long-term to permanent, minor to moderate impacts would occur due to the loss of vegetation covering approximately 15,500 square feet due to the expansion of the trailhead parking lot. Vegetation is primarily coniferous with size classes as described above.

Alternative 4 – Enhanced Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Alternative 4 would result in would result in adverse, site-specific, negligible to minor impacts due to concentrated stock use within the area immediately adjacent to the new stock campsite with hitching rail, and the day-use hitching rail proposed near the former campground parking lot. Beneficial, site-specific and local, long-term, minor to moderate impacts would occur due to the rehabilitation of denuded areas associated with approximately 19 former campsites. Adverse, site-specific, long-term to permanent, minor to moderate impacts would occur due to the loss of vegetation covering approximately 21,000 square feet due to the expansion of the trailhead parking lot. Vegetation is primarily coniferous with size classes as described above.

Cumulative Impacts. Non-native plants have been intentionally and accidentally introduced to the region, and the project area. Efforts to limit the spread of non-native plants are taking place both

within and outside of the park. Active treatment to reduce the extent of non-native plants is occurring in the project area, the park, and outside park boundaries. However, it is likely that non-native plants will continue to be unintentionally spread both within and outside the park boundaries. Actions will continue to be taken to limit spread and reduce the extent of non-native plants in order to protect native plant communities and the functioning of the ecosystems of which they are a key component. Best management practices would be implemented to avoid the unintentional introduction or spread of non-native plant species as a result of project activities.

Impairment. Vegetation would not be impaired under any of the alternatives considered in this document.

Wildlife and Wildlife Habitat

An abundant array of wildlife species can be found in Olympic National Park. Fifteen types of animals are endemic to the Olympic Peninsula, meaning that they are not found anywhere else on earth. Lands managed by the National Park Service provide havens for wildlife because they are more protected and generally less developed than privately owned lands.

The Columbia black-tailed deer (*Odocoileus hemionus columbianus*) are likely the most common mammal occurring in the project area. Other mammals likely to frequent this area would include Roosevelt elk (*Cervus elaphus roosevelti*), black bear (*Ursus americanus*), cougar (*Felis concolor*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), Douglas squirrel (*Tamiasciurus douglasii*) spotted skunk (*Spilogale putorius*), weasel (*Mustela* sp.), deer mouse (*Peromyscus maniculatus*), and Olympic chipmunk (*Tamias amoenus caurinus*).

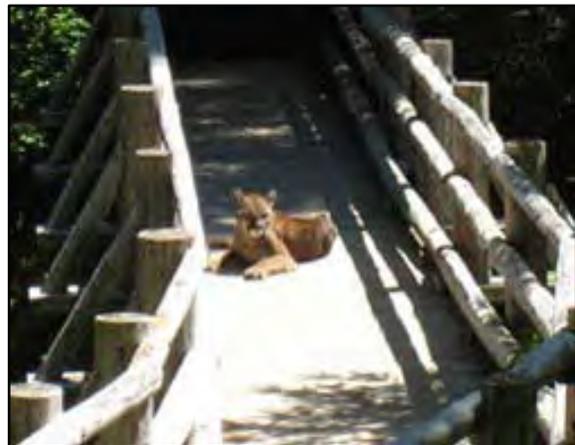


Photo 4: Cougar on the Boulder Creek Hot Springs Bridge – Al Reginato (ONP webpage)

A diversity of resident and migratory bird species can also be found in and around the project location. Bird species common to the area include gray jay (*Perisoreus canadensis*), northern flicker (*Colaptes auratus*), winter wren (*Troglodytes troglodytes*), dark-eyed junco (*Junco hyemalis*), red-breasted sapsucker (*Sphyrapicus ruber*), varied thrush (*Zoothera naevia*), pine siskin (*Carduelis pinus*), northern pygmy owl (*Glaucidium californicum*), and barred owl (*Strix varia*)

Amphibians of Olympic National Park include northwestern salamander, (*Ambystoma gracile*), long-toed salamander (*Ambystoma macrodactylum*), the endemic Olympic torrent salamander (*Rhyacotriton olympicus*), Cope's giant salamander (*Dicamptodon copei*), rough-skinned newt (*Taricha granulose*), Oregon ensatina (*Ensatina eschscholtzi*), western red backed salamander

(*Plethodon vehiculum*), Van Dyke's salamander (*Phethdon vandykei*), western toad (*Bufo boreas*), tailed frog (*Ascaphus truei*), red legged frog (*Rana aurora*), pacific tree frog (*Pseudacris regilla*), and the Cascades frog (*Rana cascadae*).

Due to the cool, maritime climate only a few reptile species are found in Olympic National Park. These species include the northern alligator lizard (*Elgaria coerulea*), rubber boa (*Charina bottae*), common garter snake (*Thamnophis sirtalis*), and the northwestern garter snake (*Thamnophis ordinoides*).

The NPS Organic Act, which directs parks to conserve wild life unimpaired for future generations, is interpreted to mean that native animal life should be protected and perpetuated as part of the park's natural ecosystem. Natural processes are relied on to control populations of native species to the greatest extent possible; they are otherwise protected from harvest, harassment, or harm by human activities. According to NPS Management Policies 2006, the restoration of native species is a high priority (sec. 4.1). Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity, and the ecological integrity of plants and animals. Information on Olympic National Park wildlife was taken from park documents and records. NPS natural resource management staff and the USFWS provided information.

Wildlife is not significantly affected by the presence of the trail corridor. However, the former road does bisect wildlife habitat and creates edges where non-native or exotic plant species germinate and thrive.

Impact Assessment Methodology

Type: Beneficial impacts protect or restore native wildlife presence, distribution, or abundance. Adverse effects diminish native wildlife presence, distribution, or abundance.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for wildlife.

Table 26: Wildlife and Wildlife Habitat Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be well within natural fluctuations.
Minor	Impacts would be detectable and they would not be expected to be outside the natural range of variability of native species' populations, their habitats, or the natural processes sustaining them. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate	Breeding animals of concern are present; animals are present during particularly vulnerable life stages such as migration or juvenile stages; mortality or interference with activities necessary for survival could be expected on an occasional basis, but would not be expected to threaten the continued existence of the species in the park unit. Impacts on native species, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.
Major	Impacts on native species, their habitats, or the natural processes sustaining them would be detectable and would be expected to be outside the natural range of variability. Key ecosystem processes might be disrupted. Loss of habitat might affect the viability of at least some native species. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.
Impairment	Impacts on native species, their habitats, or the natural processes sustaining them would be outside the natural range of variability. Key ecosystem processes would be disrupted on a permanent basis. Loss of habitat would affect the viability of native species to the extent that local extirpation within the park would occur.

Environmental Consequences to Wildlife

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in adverse, site-specific, local, and regional short-term to long-term minor to moderate impacts due to disturbance to wildlife associated with recreational use and ongoing maintenance of the Boulder Creek campground, and the disturbance to habitat resulting from the presence of the trailhead parking area, trail, and campground facilities. Adverse, site-specific, short-term negligible to moderate impacts occur when the presence of people in the project area alters the behavior of individual animals. Adverse, site-specific and local, short-term to long-term, minor to moderate impacts occur when individuals or populations of animals avoid the project area due to the kinds and amounts of visitor and administrative use. Adverse, local and regional, short-term minor to moderate adverse effects occur when periodic maintenance requires the use of helicopters to deliver or remove heavy objects to provide continued infrastructure (privies) for backcountry use, resulting in noise-related harassment to native species.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives. The activities common to all Action Alternatives would result in adverse, site-specific, local, and regional impacts due to the visual and noise-related disturbances from the use of helicopters, heavy equipment, and powered hand-tools during the expansion of the trailhead parking area, removal of asphalt and culverts from 2.2 miles of trail, and the removal of culverts and concrete foundations from the former campground restrooms. It is expected that these actions will alter use of the immediate and surrounding area by individual animals during the period of construction, resulting in animals using other similar habitat within the park until the project work is complete. No direct mortality is anticipated due to construction and rehabilitation activities, although the kinds and amounts of construction

related activities may unintentionally harass native wildlife that are unaccustomed to the proposed actions.

Beneficial, site-specific and local, long-term minor to moderate impacts are anticipated under all action alternatives due to the removal of asphalt and narrowing of the travel corridor. This would minimize the presence of this potential barrier to wildlife movement across the landscape. Additionally, the active revegetation of the trail corridor and areas in the Boulder Creek campground and former campground parking lot will provide increased habitat and improved habitat quality for wildlife when the project is complete.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. In addition to impacts described above, Alternative 2 would result in adverse, site-specific and local, short-term moderate impacts due to noise related impacts from the use of blasting to construct the proposed foot log and stock ford stream crossing at Crystal Creek, and the large number of vehicle trips required to remove approximately 1,400 cubic yards of rock and 2,500 cubic yards of soil and fill materials from the trail embankment at Crystal Creek. Beneficial, site-specific and local, long-term minor to moderate impacts would result from habitat expansion and improvement due to the revegetation of denuded areas associated with approximately 23 former campsites.

Alternative 3 – Moderate Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. In addition to impacts common to all described above, Alternative 3 would result in adverse, site-specific and local, short-term minor to moderate impacts due to noise related impacts from the use of blasting to construct the proposed 80 foot long bridge at Crystal Creek, and the number of vehicle trips required to remove approximately 1,100 cubic yards of rock and 400 cubic yards of soil and fill materials from the trail embankment at Crystal Creek. Beneficial, site-specific and local, long-term minor to moderate impacts would result from habitat expansion and improvement due to the revegetation of denuded areas associated with approximately 22 former campsites.

Alternative 4 – Enhanced Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. In addition to impacts common to all described above, Alternative 4 would result in adverse, site-specific and local, short-term minor impacts due to noise related to install a 50 foot long bridge at Cougar Creek and a 150 foot long bridge at Crystal Creek, and the number of vehicle trips required to remove approximately 20 cubic yards of rock and 20 cubic yards of soil and fill materials from the trail embankment at Crystal Creek. Beneficial, site-specific and local, long-term minor to moderate impacts would result from habitat expansion and improvement due to the revegetation of denuded areas associated with approximately 19 former campsites.

Cumulative Impacts. Human use and development both within and outside of the park has reduced the quantity and quality of wildlife habitat due to changes in species composition, habitat structure, and ecosystem function. Large protected areas like Olympic National Park also provide extensive intact habitat that provide alternate feeding, sheltering, and breeding locations

for many animals in the park and surrounding area when site specific impacts occur that change wildlife use patterns. Active restoration efforts for individual species of wildlife also occur, including the reintroduction of fisher within Olympic National Park. Efforts to restore and improve both terrestrial and aquatic habitat is also occurring both within and outside of park boundaries, including within the Boulder Creek project area.

Impairment. Wildlife would not be impaired under any of the alternatives considered in this document.

Unique or Important Fish or Fish Habitat

There are thirty-seven species of native fish inhabiting the rivers, streams, and lakes throughout Olympic National Park. NPS staff surveyed Boulder Creek and the tributaries in the project area for fish on May 29, 2009. No fish were observed in any the tributaries or the mainstem of Boulder Creek. These findings are consistent with a previous assessment that identified a barrier cascade waterfall upstream from Lake Mills (Hosey and Associates, 1988). The 1,400 foot section of Boulder Creek between Lake Mills and the falls supports spawning habitat for rainbow trout and is also periodically inhabited by bull trout, a species identified as threatened under the Endangered Species Act. This section of the creek also provides habitat for sculpin and cutthroat trout.

Rainbow trout have been observed to spawn in Boulder Creek from April through June. Bull trout spawning has not been documented in Boulder Creek, but bull trout are known to spawn on the delta near the head of Lake Mills from late September through October.

Impact Assessment Methodology

Type: Beneficial impacts protect or restore important fish or fish habitat. This includes presence, distribution, or abundance of native fish species and quality of fish habitat. Adverse effects diminish native fish presence, distribution, or abundance or degrade the quality of fish habitat.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for important fish and fish habitat.

Table 27: Unique or Important Fish or Fish Habitat Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be well within natural fluctuations.
Minor	Impacts would be detectable and they would not be expected to be outside the natural range of variability of native species' populations, their habitats, or the natural processes sustaining them. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate	Breeding animals of concern are present; animals are present during particularly vulnerable life stages such as migration or juvenile stages; mortality or interference with activities necessary for survival could be expected on an occasional basis, but would not be expected to threaten the continued existence of the species in the park unit. Impacts on native species, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.
Major	Impacts on native species, their habitats, or the natural processes sustaining them would be detectable and would be expected to be outside the natural range of variability. Key ecosystem processes might be disrupted. Loss of habitat might affect the viability of at least some native species. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.
Impairment	Impacts on native species, their habitats, or the natural processes sustaining them would be outside the natural range of variability. Key ecosystem processes would be disrupted on a permanent basis over a broad region within the park. Loss of habitat would affect the viability of native species to the extent that native species within the park would be extirpated.

Environmental Consequences to Fish and Essential Fish Habitat

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in no new impacts to fish or essential fish habitat. No fish are located within the project area, although fish do inhabit the downstream portion of Boulder Creek below a cascade that acts as a fish barrier. Adverse, regional, long-term, negligible to minor impacts would continue to occur due to the continuing erosion of asphalt and fill materials from the Boulder Creek trail, particularly at failed culvert locations.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives. Removal of asphalt and failed culverts from 2.2 miles of trail has the potential to contribute sediment into Boulder Creek if a large rainfall event occurs during construction activities near tributary streams. It is anticipated that the implementation of best management practices would prevent adverse impacts, but the potential for adverse, short-term, regional, negligible impacts due to increased sediment exists. However, it is unlikely that the amount of sediment that might enter stream waters in the project area would be detectable above background water quality levels below the fish barrier cascade where increased sediment would otherwise have the potential to adversely impact resident fish.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. Alternative 2 would result in adverse, regional, short-term, negligible impacts to fish and fish habitat due to the potential introduction of approximately 250 cubic yards of material into Crystal Creek due to blasting and excavation required to install the proposed footlog and stock ford at this location. However, it is unlikely

that the amount of sediment that might enter stream waters in the project area would be detectable above background water quality levels below the fish barrier cascade, located over five miles downstream from the Crystal Creek trail crossing, where increased sediment would otherwise have the potential to adversely impact resident fish.

Alternative 3 – Moderate Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Alternative 3 would result in adverse, regional, short-term, negligible impacts to fish and fish habitat due to the potential introduction of approximately 100 cubic yards of material into Crystal Creek due to blasting and excavation required to install the proposed 80 foot long bridge at this location. However, it is unlikely that the amount of sediment that might enter stream waters in the project area would be detectable above background water quality levels below the fish barrier cascade, located over five miles downstream from the Crystal Creek trail crossing, where increased sediment would otherwise have the potential to adversely impact resident fish.

Alternative 4 – Enhanced Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Alternative 4 would result in adverse, regional, short-term, negligible impacts to fish and fish habitat due to the potential introduction of sediment into Crystal Creek due to installation of the proposed 150 foot long bridge at this location. However, it is unlikely that the amount of sediment that might enter stream waters in the project area would be detectable above background water quality levels below the fish barrier cascade, located over five miles downstream from the Crystal Creek trail crossing, where increased sediment would otherwise have the potential to adversely impact resident fish.

Cumulative Impacts. Construction of the Elwha and Glines Canyon dams blocked passage to the upper Elwha watershed for resident and anadromous populations of fish. Changes in human use patterns, including consumption of fish and alteration of fish habitat has reduced the distribution and abundance of native fish species. Removal of the Elwha and Glines Canyon dams will have temporary adverse effects on fish and fish habitat, but will have significant long-term beneficial impacts on anadromous fish and river habitat. Removal of the Griff Creek barrier culvert will also extend suitable fish habitat on the Elwha watershed and will provide refuge for fish during the dam removal project. Due to the distance from fish habitat in the Elwha watershed, it is unlikely that the actions considered for this project would result in a detectable cumulative impact. The potential for negligible impacts associated with project implementation is described for each alternative above.

Impairment. Fish and essential fish habitat would not be impaired under any of the alternatives considered in this document.

Threatened and Endangered Species

Under the Endangered Species Act (ESA) of 1973, as amended, an endangered species is defined as any species in danger of extinction throughout all or a significant portion of its range. No critical habitat has been formally designated within ONP for marbled murrelet and northern

spotted owl, although much of the park contains high quality habitat that is considered important for the recovery of the species. Critical habitat was not designated because habitat in the park is not thought to require special management consideration or protection by virtue of its national park status.

Northern Spotted Owl

The northern spotted owl was federally listed as a threatened and endangered species in July 1990 due to extensive loss of habitat in old-growth and late-successional forest. The survival of the northern spotted owl in the Pacific Northwest depends on maintaining adequate, well distributed nesting, roosting, and foraging habitat. The listing is a result of reductions in northern spotted owl populations, habitat loss, and modifications of old-growth and late-successional forest due to human development, fire, and timber harvest activities in much of its range.

Northern spotted owls generally require large areas of land containing semi-continuous expanses of old growth forest to meet their biological needs for nesting, roosting, foraging, and dispersal. Nesting and roosting habitat typically includes a multiple layer, multiple species, moderate to high closure canopy with large trees. Preferred nesting and roosting habitat also contains open space below the canopy for protected flight, large trees with deformities to provide nesting locations and numerous fallen trees and other ground debris (Thomas, et al.). Foraging habitat used by northern spotted owls is often fragmented and includes open forest. In much of the species' northern range, large dense forests are also chosen as foraging habitat. Foraging habitat in the Elwha River watershed mid-elevation includes the edges of dense forests and open forest. Dispersal habitat is important for owl movement between nesting habitat, both locally and over the range of the northern spotted owl, and provides critical links between owl populations. Northern spotted owls require forest stands with adequate tree size and moderate canopy closure to provide refuge from predators and for occasional foraging. OLYM represents the largest contiguous block of suitable nesting habitat remaining within the listed range of the northern spotted owls.

Habitat in the project area is physically suitable for northern spotted owl nesting and roosting, consisting primarily of mature Douglas-fir, western hemlock, western red cedar and some red alder at approximately 1800- 2200 feet in elevation. While spotted owls are known to have occurred in the project area in the past, with the spread of the Barred Owl (*Strix varia*) into the area in the late 1990's most spotted owl activity has shifted to higher elevations in the Boulder Creek drainage. Spotted owl surveys have been conducted along the Hot Springs trail and campground since the early 1990's as part of the park's long-term spotted owl demography study. Three spotted owl pairs are known to use this section of Boulder Creek. However, no nesting or roosting has been observed within 500 meters of the road or campground in the last 5 years. The most recently occupied activity centers at all three sites have been over 1500 meters from the project area. (S. Gremel, pers comm. 2009)

Marbled Murrelet

On October 1, 1992, the marbled murrelet was designated as threatened under the ESA. The listing is largely due to the loss of nesting habitat from timber harvest and fires; the species is particularly vulnerable to the loss of nesting habitat as evidenced by low breeding success rates and sensitive habitat requirements. The marbled murrelet uses old-growth forests for nesting, and the time span for habitat recovery exceeds 100 years. Declining numbers are documented or suspected throughout most of the species' range. The species is also affected by ocean feeding conditions and direct mortality from net fishery and oil spills.

Marbled murrelets inhabit the Pacific coast of North America from the Bering Sea to central California, just south of San Francisco Bay. In contrast to other seabirds, murrelets do not form dense colonies, but instead nest singly on large limbs of coniferous trees. They may fly as far as 43 miles or more inland to nest, generally in older coniferous forests with a high canopy closure. This habitat requires trees with large branches and deformities found in old-growth forests for nesting platforms. Marbled murrelets have a 30 day incubation period during which adults trade off incubation duties while the other member of the pair forages at sea. Shortly after the chick hatches both adults leave the chick alone while they forage at sea. They return to feed the chick 1-8 times per day, primarily during dawn and dusk. Chicks remain on the nest for 27-40 days until they fledge. The nesting season for marbled murrelets is highly asynchronous, begins on April 1, and lasts up to 182 days, with the peak occurring in June and July (Kim et al 2006). When not nesting, the birds live at sea, spending their days feeding close to shore and then moving several kilometers offshore at night (USFWS 1997).

Portions of this project would take place in suitable habitat for marbled murrelets. The Boulder Creek drainage is one that has not been previously surveyed for murrelets by ONP wildlife staff (P. Happe, pers comm. 2009).

For the purposes of Section 7 consultation, marbled murrelet breeding season is broken into two periods: April 1 through August 5 is the early season, and August 6 through September 15 is the late season, with some chicks hatched and approximately 50 percent fledged as early as August 6.

Bull Trout

All populations of bull trout are designated as threatened in the conterminous United States under the ESA (64 Fed. Reg. 58910 (November 1, 1999)). The decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fishery management practices, and the introduction of nonnative species. Boulder Creek flows into Lake Mills, which is fed by the Elwha River and created by the Glines Canyon dam.



Photo 5: Bull Trout (ONP webpage)

The Boulder Creek drainage (from the mouth at Lake Mills to the barrier falls, approximately 1,400 feet upstream) supports spawning habitat for rainbow trout and is periodically inhabited by threatened bull trout. The Elwha River supports habitat for subpopulations of bull trout (“native char”). The lower and upper Elwha River subpopulations are isolated by the dams (Fed. Reg. Vol. 63, No. 111, 31696). The project would occur approximately 2.5 to 5.5 miles upstream from the barrier falls in the Boulder Creek drainage.

Bull trout appear to have more specific habitat requirements than other salmonids and generally need cold water, complex cover, stable substrate with a low percentage of fine sediments, high channel stability, and stream/population connectivity (Rieman and McIntyre 1993). Adults inhabit cold rivers and large tributary streams with moderate to fast currents. Spawning occurs in small cold streams. These habitat components, as well as valley form, spawning and rearing substrates, and migratory corridors, influence bull trout distribution and abundance (Pratt 1992; USFWS 2004).

Section 7 of the Endangered Species Act (ESA) mandates all federal agencies to determine how to use their existing authorities to further the purposes of the ESA to aid in recovering listed species, and to address existing and potential conservation issues. Section 7(a)(2) states that each federal agency shall, in consultation with the Secretary of the Interior, ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat.

Impact Assessment Methodology

Type: Beneficial impacts protect or restore threatened or endangered species or critical habitat. Adverse effects diminish threatened or endangered species or critical habitat.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for threatened and endangered species.

Table 28: Threatened and Endangered Species Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	The action could result in a change to a population or individuals of a species, but the change would not be of any measurable or perceptible consequence and would be well within natural variability. In the case of federally listed species, this impact intensity equates to a USFWS determination of "may affect, not likely to adversely affect."
Minor	The action could result in a change to a population or individuals of a species. The change would be measurable, but small and localized, and not outside the range of natural variability. Mitigation measures, if needed, would be simple and successful. In the case of federally listed species, this impact intensity typically equates to a USFWS determination of "may affect, not likely to adversely affect."
Moderate	Impacts on special status species, their habitats, or the natural processes sustaining them would be detectable and occur over a large area. Breeding animals of concern are present, animals are present during particularly vulnerable life stages; mortality or interference with activities necessary for survival could be expected on an occasional basis, but is not expected to threaten the continued existence of the species in the park unit or conservation zone. Mitigation measures would be extensive and likely successful. In the case of federally listed species, this impact intensity typically equates to a USFWS determination of "may affect, likely to adversely affect."
Major	The action would result in noticeable effects to the viability of the population or individuals of a species. Impacts on special status species or the natural processes sustaining them would be detectable, both inside and outside of the park. Loss of habitat might affect the viability of at least some special status species. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed. In the case of federally listed species, the impact intensity equates to a USFWS determination of "may affect, likely to jeopardize the continued existence of a species."
Impairment	Actions would result in the extirpation of a listed species from within the park.

Environmental Consequences to Threatened and Endangered Species

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in adverse, site-specific, local, and regional short-term to long-term negligible to moderate impacts due to disturbance to marbled murrelets and northern spotted owls from recreational use and ongoing maintenance of the Boulder Creek campground, and the disturbance to habitat resulting from the presence of the trailhead parking area, trail, and campground facilities.

Adverse, site-specific, short-term negligible to moderate impacts occur when the presence of people in the project area alters the behavior of individual animals. Adverse, site-specific and local, short-term to long-term, minor to moderate impacts occur when individuals or populations of animals avoid the project area due to the kinds and amounts of visitor and administrative use.

Adverse, local and regional, short-term minor to moderate adverse effects occur when periodic maintenance requires the use of helicopters to deliver or remove heavy objects to provide continued infrastructure (privies) for backcountry use, resulting in noise-related harassment to marbled murrelets and northern spotted owls. Helicopter flights are regularly planned to occur after the breeding season for endangered species to avoid adverse effects resulting from noise-related impacts. Occasionally fire management or other emergency actions require use of equipment during the early breeding season, with the potential to adversely affect nesting marbled murrelets and spotted owls.

The No Action Alternative would result in no new impacts to bull trout or bull trout habitat. Adverse, regional, long-term, negligible to minor impacts would continue to occur due to the continuing erosion of asphalt and fill materials from the Boulder Creek trail, particularly at failed culvert locations.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives.

Expansion of the vehicle turnaround at the trailhead parking lot would result in adverse, site-specific, long-term, minor to moderate impacts due to the removal of coniferous forest vegetation from approximately 4,750 square feet of previously disturbed forest. Approximately 85% of trees are between 6" – 16" in diameter, with very few trees 21" in diameter or greater. No trees with structural components, such as large branches with suitable nesting platforms for marbled murrelets would be removed. The surrounding forest would remain intact and would continue to provide suitable nesting, roosting and dispersal habitat for northern spotted owls, although displacement due to the presence of barred owls would likely continue. Construction would occur after the early breeding season to avoid and minimize noise-related impacts to marbled murrelets and northern spotted owls. No effects to bull trout are anticipated from expansion of the vehicle turnaround area.

Removal of asphalt from 2.2 miles of trail, removal of culverts from the trail and campground, and removal of abandoned infrastructure in the campground would not result in the loss of any mature trees. Disturbance would be limited to the removal of young plants that have become established immediately adjacent to the asphalt trail, or on top of fill material that has slumped onto the trail since the road was closed to automobile use in the early 1980s. Visual and noise-related disturbances from the use of helicopters, heavy equipment, and powered hand-tools during the expansion of the trailhead parking area, removal of asphalt and culverts from 2.2 miles of trail, and the removal of culverts and concrete foundations from the former campground restrooms would result in adverse, site-specific to regional, minor impacts. It is expected that these actions may alter use of the immediate and surrounding area by individual marbled murrelets or northern spotted owls during the period of construction, resulting in animals using other similar habitat within the park until the project work is complete. No direct mortality is anticipated due to construction and rehabilitation activities, although the kinds and amounts of construction related activities may unintentionally affect individual birds. All use of heavy equipment and helicopters would occur outside of the early breeding season for marbled

murrelets and northern spotted owls. This is intended to avoid or minimize the potential to adversely affect these species.

Revegetation work would be done by hand, and is not anticipated to result in additional disturbance to marbled murrelets or northern spotted owls above existing levels due to visitor use in the project area. If materials for campsite delineation required helicopter transport of logs or other materials, this work would occur outside of the nesting period for northern spotted owls and marbled murrelets. Beneficial, site-specific, long-term minor impacts are expected due to the restoration of a native vegetation understory due to the planned restoration activities along the trail and in the campground and former campground parking lot.

Removal of asphalt and failed culverts from 2.2 miles of trail has the potential to contribute sediment into Boulder Creek if a large rainfall event occurs during construction activities near tributary streams. It is anticipated that the implementation of best management practices would prevent adverse impacts, but the potential for adverse, short-term, regional, negligible impacts due to increased sediment exists. However, it is unlikely that the amount of sediment that might enter stream waters in the project area would be detectable above background water quality levels below the fish barrier cascade where increased sediment would otherwise have the potential to adversely affect resident bull trout.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. Expansion of the trailhead parking lot would result in adverse, site-specific, long-term, minor to moderate impacts due to the removal of coniferous forest vegetation from approximately 15,500 square feet of previously disturbed forest. Approximately 85% of trees are between 6” – 16” in diameter, with very few trees 21” in diameter or greater. No trees with structural components, such as large branches with suitable nesting platforms for marbled murrelets would be removed. The surrounding forest would remain intact and would continue to provide suitable nesting, roosting and dispersal habitat for northern spotted owls, although displacement due to the presence of barred owls would likely continue. Construction would occur after the early breeding season to avoid and minimize noise-related impacts to marbled murrelets and northern spotted owls. No effects to bull trout are anticipated from expansion of the trailhead parking area.

In addition to impacts described above, Alternative 2 would result in adverse, site-specific and local, short-term minor impacts due to noise related impacts from the use of blasting to construct the proposed foot log and stock ford stream crossing at Crystal Creek, and the large number of vehicle trips required to remove approximately 1,400 cubic yards of rock and 2,500 cubic yards of soil and fill materials from the trail embankment at Crystal Creek. This work would occur after the breeding season for northern spotted owls and marbled murrelets to minimize the potential for adverse effects. Beneficial, site-specific and local, long-term minor to moderate impacts would result from habitat expansion and improvement due to the revegetation of denuded areas associated with approximately 23 former campsites.

Alternative 2 would result in adverse, regional, short-term, negligible impacts to bull trout and bull trout habitat due to the potential introduction of approximately 250 cubic yards of material into Crystal Creek due to blasting and excavation required to install the proposed footlog and

stock ford at this location. However, it is unlikely that the amount of sediment that might enter stream waters in the project area would be detectable above background water quality levels below the fish barrier cascade, located over five miles downstream from the Crystal Creek trail crossing, where increased sediment would otherwise have the potential to adversely affect resident bull trout.

Alternative 3 – Moderate Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Expansion of the trailhead parking lot would result in adverse, site-specific, long-term, minor to moderate impacts due to the removal of coniferous forest vegetation from approximately 15,500 square feet of previously disturbed forest. Approximately 85% of trees are between 6” – 16” in diameter, with very few trees 21” in diameter or greater. No trees with structural components, such as large branches with suitable nesting platforms for marbled murrelets would be removed. The surrounding forest would remain intact and would continue to provide suitable nesting, roosting and dispersal habitat for northern spotted owls, although displacement due to the presence of barred owls would likely continue. Construction would occur after the early breeding season to avoid and minimize noise-related impacts to marbled murrelets and northern spotted owls. No effects to bull trout are anticipated from expansion of the trailhead parking area.

In addition to impacts common to all described above, Alternative 3 would result in adverse, site-specific and local, short-term minor impacts due to noise related to blasting to construct the proposed 80 foot long bridge at Crystal Creek, and the number of vehicle trips required to remove approximately 1,100 cubic yards of rock and 400 cubic yards of soil and fill materials from the trail embankment at Crystal Creek. This work would occur after the early breeding season for northern spotted owls and marbled murrelets to minimize the potential for adverse effects. Beneficial, site-specific and local, long-term minor to moderate impacts would result from habitat expansion and improvement due to the revegetation of denuded areas associated with approximately 22 former campsites.

Alternative 3 would result in adverse, regional, short-term, negligible impacts to bull trout and bull trout habitat due to the potential introduction of approximately 100 cubic yards of material into Crystal Creek due to blasting and excavation required to install the proposed 80 foot long bridge at this location. However, it is unlikely that the amount of sediment that might enter stream waters in the project area would be detectable above background water quality levels below the fish barrier cascade, located over five miles downstream from the Crystal Creek trail crossing, where increased sediment would otherwise have the potential to adversely affect resident bull trout.

Alternative 4 – Enhanced Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Expansion of the trailhead parking lot would result in adverse, site-specific, long-term, minor to moderate impacts due to the removal of coniferous forest vegetation from approximately 21,000 square feet of previously disturbed forest. Approximately 85% of trees are between 6” – 16” in diameter, with very few trees 21” in diameter or greater. No trees with structural components, such as large branches with suitable nesting platforms for marbled murrelets would be removed. The surrounding forest would

remain intact and would continue to provide suitable nesting, roosting and dispersal habitat for northern spotted owls, although displacement due to the presence of barred owls would likely continue. Construction would occur after the early breeding season to avoid and minimize noise-related impacts to marbled murrelets and northern spotted owls. No effects to bull trout are anticipated from expansion of the trailhead parking area.

In addition to impacts common to all described above, Alternative 4 would result in adverse, site-specific and local, short-term minor impacts due to noise related to install a 50 foot long bridge at Cougar Creek and a 150 foot long bridge at Crystal Creek, and the number of vehicle trips required to remove approximately 20 cubic yards of rock and 20 cubic yards of soil and fill materials from the trail embankment at Crystal Creek. This work would occur after the early breeding season for northern spotted owls and marbled murrelets to minimize the potential for adverse effects. Beneficial, site-specific and local, long-term minor to moderate impacts would result from habitat expansion and improvement due to the revegetation of denuded areas associated with approximately 19 former campsites.

Alternative 4 would result in adverse, regional, short-term, negligible impacts to bull trout and bull trout habitat due to the potential introduction of sediment into Crystal Creek due to installation of the proposed 150 foot long bridge at this location. However, it is unlikely that the amount of sediment that might enter stream waters in the project area would be detectable above background water quality levels below the fish barrier cascade, located over five miles downstream from the Crystal Creek trail crossing, where increased sediment would otherwise have the potential to adversely affect resident bull trout.

Cumulative Impacts. Development for human use both within and outside of the park has reduced the extent of suitable habitat for threatened and endangered species, such as the northern spotted owl, marbled murrelet, and bull trout. These changes have affected the composition, structure, and function of species populations and habitat. A programmatic biological opinion was prepared during the preparation of the Olympic National Park General Management Plan. All actions taken in the park must take into account the potential to adversely affect listed species or habitat. Many ongoing activities, including road and trail construction and maintenance have the potential to adversely affect listed species and habitat. Best management practices are implemented to avoid or minimize the potential for adverse impacts associated with park activities.

Removal of the Elwha and Glines Canyon dams has the potential to adversely affect listed species and habitat over the short term, but will significantly improve habitat for threatened and endangered fish species over the long term. Implementation of the fish-barrier culvert removal project on Griff Creek will also result in long-term beneficial effects to bull trout by extending suitable habitat and providing refuge during dam removal activities. Other actions taken both within and outside of the park have the potential to adversely affect, or improve the quality of suitable habitat for threatened and endangered species.

All alternatives considered in this plan were developed to avoid or minimize the potential for adverse effects to threatened and endangered species and habitat. Work with the potential to cause noise related impacts would occur outside of the early nesting season to reduce the

potential for adverse effects to nesting marbled murrelets and spotted owls. No actions are likely to harm individual animals or result in mortality. Distance from project activities with the potential to affect aquatic habitat for bull trout make adverse impacts to this species unlikely due to the presence of a fish barrier cascade over two miles downstream from the nearest project activity.

Impairment. Threatened and Endangered Species would not be impaired under any of the alternatives considered in this document.

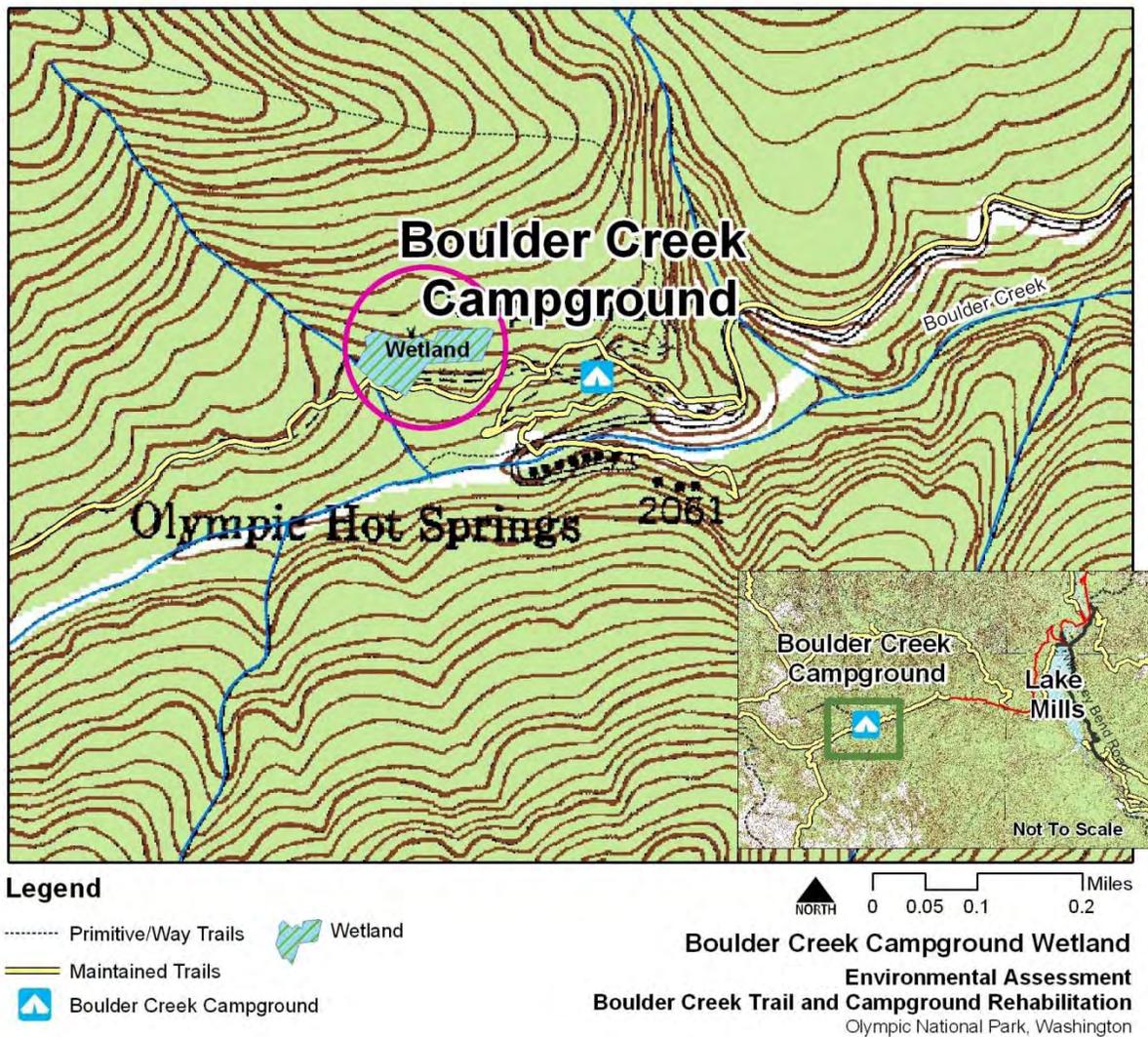
Wetlands

Wetlands include the lands between terrestrial and deep-water habitats, and isolated areas, where the water is at or near the surface. The presence of certain types of soils, plant species, and the presence of water define wetlands. Wetlands provide many essential functions including filtering pollutants which also improves water quality, recharging ground water, controlling erosion, controlling floods, and providing habitat for plants and animals. The functions that an individual wetland performs depend on its location, surrounding topography, subsurface geology, amount and duration of water, and the types of plants present.

Although not shown on the park's geographic information system (GIS) database or on the National Wetland Inventory (NWI) website, a forested wetland is in the northwest area of the Boulder Creek campground. The wetland was likely overlooked because the Park receives information from NWI and NWI's mapping did not include many of the forested wetland areas of the park. Olympic National Park staff conducted several site visits during the summer and a wetland assessment was conducted on November 10, 2009. The assessment was conducted at the end of the growing season, the water table was high, and the ground was covered with snow. Therefore, a future assessment (i.e. wetland determination, classification, and delineation) would be required during the growing season and prior to project work.

Nine data points were collected around the perimeter using GPS. Data indicates that the wetland is approximately 3 acres in size; however, due to snow in the tree canopy, data may need to be collected again to determine accuracy of this measurement.

Figure 22: Wetland at Boulder Creek Campground.



Surface water was present at all nine data point locations. Water runoff from the hillslope west of the campground appears to flow to the lowest point in the wetland. A more detailed assessment would be required to determine if manipulations (i.e. roads, fill material, and culverts) during the construction of the Boulder Creek campground also contributed to the formation of the wetland.

Due to snow cover, soil test pits were not dug during the assessment. However, park staff recorded soils that were mucky and contained sulfidic smells. These are two indicators of wetland (hydric) soils.

Vegetation observed by park staff during the growing season was dominated by skunk cabbage (*Lysichiton americanum*), which is an obligate wetland species. Under natural conditions obligate wetland species occur almost always (> 99% probability) in wetlands. Vegetation recorded during the assessment includes the following:

- Dominate trees: red alder (*Alnus rubra*) and western redcedar (*Thuja plicata*); these are facultative plants that are equally likely to occur in wetlands or nonwetlands (estimated probability 34%-66%).
- Dominate shrub: devils club (*Oplopanax horridus*), a facultative species.
- Dominate forbs: coltsfoot (*Petasites palmatus*), lady fern (*Athyrium filix-femina*) and slough sedge (*Carex obnupta*).

The NPS manages wetlands in accordance with Executive Order 11990 (Protection of Wetlands), the Clean Water Act, the Rivers and Harbors Appropriation Act of 1899, and the procedures described in Director’s Order 77-1 (Wetland Protection). (*Management Policies 2006*).

To protect wetlands and surrounding habitat the park implements a “no net loss of wetlands” policy by providing leadership and taking action to prevent the destruction, loss, or degradation of wetlands and preserve and enhance their natural and beneficial values. A detailed wetland inventory will be conducted during the next growing season.

Impact Assessment Methodology

Type: Beneficial impacts protect or restore wetlands. Adverse effects diminish wetlands.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for wetlands.

Table 29: Wetlands Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	No effects would occur or the effects to wetland conditions would be below the level of detection.
Minor	The effect to wetland conditions would be detectable. Any effects would be small and if mitigation were needed to offset potential adverse effects, it would be simple and successful.
Moderate	Effects to wetland conditions would be detectable, localized and would be small and of little consequence to the surrounding habitat. Mitigation measures, if needed to offset adverse effects, would be successful.
Major	Effects to wetlands would be obvious, with substantial consequences to wetland and surrounding habitat. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.
Impairment	Effects to critical wetlands in the park would be adverse and permanent, and would result in impacts to the park’s biological integrity such that the purposes of the park could not be achieved.

Environmental Consequences to Wetlands

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in no changes in the extent size, species composition, or function of the small wetland located in the Boulder Creek campground.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives. Removal of culverts and fill materials in the Boulder Creek Campground is intended to restore natural topography and associated hydrologic conditions within the project area. If the wetland present in the campground is partially dependent of the presence of fill material and failed culverts to maintain hydric soils and support wetland dependent plant species, the removal of this obsolete infrastructure may improve site drainage and reduce the extent of the wetland. It is not anticipated that this work would alter species composition, or wetland function. However, site rehabilitation does have the potential to result in adverse, site-specific, and short – to long-term, negligible to moderate impacts if site conditions after removal of infrastructure no longer support the wetland in its current condition.

Short term impacts to individual plants within the wetland may occur during project implementation, but natural recovery and active revegetation would mitigate this impact. Restoration of natural topography and vegetation is anticipated to result in beneficial, long-term, site-specific, negligible to moderate impacts to native vegetation, including the plant community within the wetland.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. Alternative 2 would result in additional adverse, site-specific, short-term, minor impacts due to extensive excavation in the Boulder Creek campground to locate and remove the buried utility lines from the former automobile campground development that used to provide water and sewer services. Approximately 10,000 square feet would be disturbed, some of which is located in or adjacent to the wetland.

Alternatives 3 & 4

Direct and Indirect Impacts of the Alternative. Impacts are described above for actions common to all alternatives.

Cumulative Impacts. Construction of the Boulder Creek campground and associated road resulted in the placement of fill materials that altered water flow in the project area. It is possible that this has resulted in the expansion of wetland vegetation and soils in the campground. Development both within and outside of the park has resulted in the reduction in the extent and quality of wetland habitat in the region and across the country. No reasonably foreseeable future projects in the Elwha watershed are designed to fill wetlands. Although the Boulder Creek Trail and Campground Rehabilitation Project does not include filling wetlands, it is intended to restore natural topography and surface water flow. This may result in the diminishment of wetland

vegetation and soils when abandoned infrastructure that may be contributing to the presence and extent of the wetland is removed, and site drainage is improved.

Impairment. Wetlands would not be impaired under any of the alternatives considered in this document.

Wilderness Values

For more than 100 years, the Olympic Mountains have been described as wilderness. Since the early accounts of exploration into the interior Olympics in the late 19th century, wilderness has been the underlying concept in what is now the park. In the early 1900s, development of the Olympic wilderness began with U.S Forest Service construction of trails, shelters, and ranger stations. Private developers made a few roads into the interior Olympics with the construction of hunting chalets, cabins, and access to the Olympic Hot Springs Resort into the 1930s.

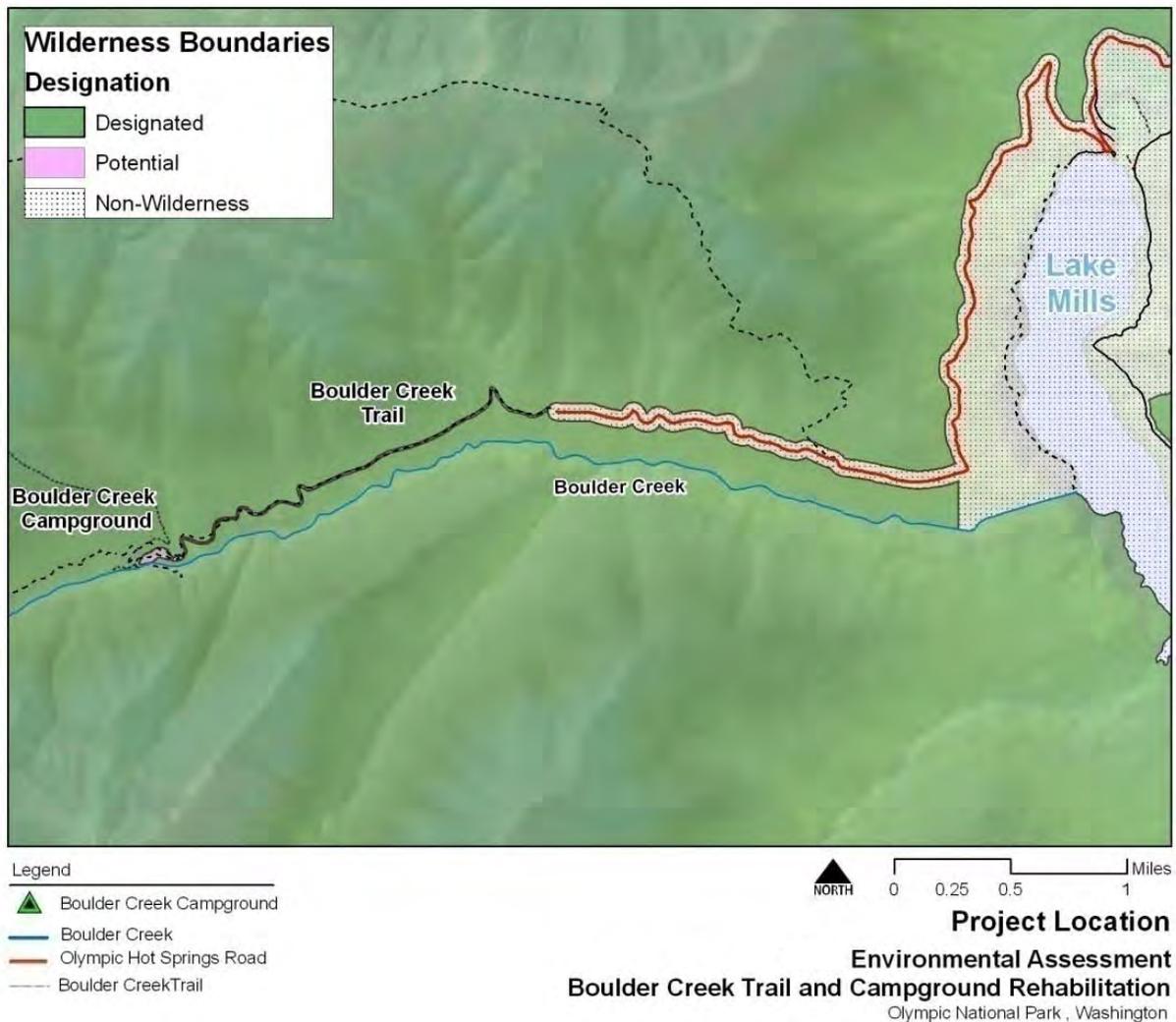
Olympic National Park was created in 1938. In a speech given that year, Secretary of the Interior Harold Ickes stated that the preservation of wilderness conditions within the park would be the primary management objective. The National Park Service inherited from the U. S. Forest Service a system of trails similar to what exists today. Also within these lands were trail shelters, several private cabins on leased lands, ranger stations, and a telephone system.

In 1974, 96% of the park was proposed as a wilderness area. The recommendation was sent to Congress, and a Senate bill was introduced. Although the bill was never acted upon, the proposed lands were managed as de facto wilderness until the wilderness was officially designated by Congress on November 16, 1988 (PL 100-668). Today, Olympic National Park is one of the largest wilderness areas in the contiguous United States, encompassing 876,669 acres (about 95% of the park) of designated wilderness, and 378 acres of potential wilderness additions. The Olympic wilderness is exceptionally diverse, providing experiential benefits such as solitude and quiet, as well as, “ecologic services” such as clean water and air.

Generally, the wilderness includes most of the park’s undeveloped lands. The park’s trails and wilderness camp areas are the most conspicuous human imprint on the wilderness. Several other structures are maintained in wilderness including ranger stations, historic structures, privies, other administrative and emergency facilities (e.g. radio repeaters), and research equipment. More than 1,300 campsites are scattered throughout the wilderness. Major road corridors with 200 foot buffers extending from the centerline, minor road corridors with 100 foot buffers, and other developed areas are not within designated wilderness.

Stock use currently accounts for 1.5% of visitor nights in the wilderness. Stock teams are also used extensively for the administration of the wilderness and support activities such as trail and facility maintenance. Due to the condition of the Boulder Creek Trail (former road) it is currently inaccessible to stock users beyond Crystal Creek.

Figure 23: Wilderness Boundary.



The Boulder Creek Trail, although not currently within the Olympic Wilderness, is immediately adjacent to designated wilderness, as shown in Figure 23. The Boulder Creek Campground was identified through the Washington Park Wilderness Act of 1988 as potential wilderness. Areas that currently do not qualify for designation as wilderness due to temporary nonconforming or incompatible conditions may be authorized by Congress as “potential wilderness” for future wilderness designation. Potential wilderness becomes “designated wilderness” upon the Secretary of Interior’s determination, published in the Federal Register, that they have met the qualifications for designation by the cessation or termination of the nonconforming use.

Impact Assessment Methodology

Wilderness character is evaluated in terms of four elements: untrammled quality, natural quality, undeveloped quality, and solitude or primitive and unconfined recreation quality. These characteristics are used by the National Park Service and other wilderness managing agencies to assess and monitor wilderness conditions. Impacts to Boulder Creek Campground are considered in terms of the potential for impact to these defining elements of wilderness character.

Type: Beneficial impacts protect or enhance wilderness character. Adverse impacts degrade wilderness character.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for wilderness character.

Table 30: Wilderness Values Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	There is little or no change in wilderness character or wilderness experience.
Minor	One or more attributes of wilderness character and wilderness experience change temporarily or in small ways in one or more locations.
Moderate	One or more attributes of wilderness character and wilderness experience changes in substantial ways in a single distinct region, or it affects multiple regions but is not permanent.
Major	One or more attributes of wilderness character and wilderness experience changes substantially across more than one distinct region of the park on either a permanent or frequent but temporary basis.
Impairment	An area of the park designated as wilderness or an area determined suitable for wilderness designation no longer meets the criteria for designation.

Environmental Consequences to Wilderness Character

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in continuing adverse, local, long-term, moderate impacts to wilderness character (including untrammled quality, natural quality, undeveloped quality, and solitude or primitive and unconfined recreation quality) due to the presence of abandoned infrastructure in the Boulder Creek Campground. Continuing use of campfires and the associated collection of woody materials for campfires would result in trampling of vegetation, soil compaction, and denuded areas within the campground.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives. The action alternatives would result in beneficial, long-term, site-specific and local, minor to moderate impacts to wilderness character due to the removal of the asphalt trail surface, removal of infrastructure from the Boulder Creek campground, and active restoration and revegetation along the trail corridor, in the campground, and the former campground parking lot. Implementation of a ban on campfires and wood collection would help restore the natural quality of denuded areas. Construction activities would result in adverse, short-term, local and regional, moderate to major impacts to wilderness character due to noise generated by heavy equipment and helicopter use within potential wilderness and adjacent to designated wilderness areas.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. In addition to impacts described above, Alternative 2 would result in adverse; site-specific, local, and regional; short term and long term; minor to major impacts due to the need to use heavy lift helicopter for the initial delivery of footlogs for the stream crossings at Cougar, Hell, and Crystal Creeks; and also for the subsequent replacement of those footlogs when they deteriorate or are damaged during high water events. Adverse, site-specific and local, short-term minor to moderate impacts would also occur due to noise generated by blasting to remove 1,400 cubic yards of rock and 2,500 cubic yards of trail embankment to construct the footlog and stock ford at Crystal Creek. These noise impacts would affect wilderness character in adjacent wilderness areas.

Alternative 3 – Moderate Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. In addition to impacts described above, Alternative 3 would result in adverse; site-specific, local, and regional; short term and long term; minor to major impacts due to the need to use heavy lift helicopter for the initial delivery of footlogs for the stream crossings at Cougar and Hell Creeks, and the delivery of an 80 foot long bridge to Crystal Creek; and also for the subsequent replacement of those footlogs when they deteriorate or are damaged during high water events. Adverse, site-specific and local, short-term minor to moderate impacts would also occur due to noise generated by blasting to remove 1,100 cubic yards of rock and 400 cubic yards of trail embankment to construct the footlog and stock ford at Crystal Creek. These noise impacts would affect wilderness character in adjacent wilderness areas.

Alternative 4 – Enhanced Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. In addition to impacts described above, Alternative 4 would result in adverse; site-specific, local, and regional; short term and long term; minor to major impacts due to the need to use heavy lift helicopter for the initial delivery of a footlog for the stream crossing Hell Creek, and the delivery of a 50 foot long bridge to Cougar Creek and a 150 foot long bridge to Crystal Creek; and also for the subsequent replacement of the footlog when it deteriorates or is damaged during high water events.

Cumulative Impacts.

Olympic National Park is 95% designated Wilderness. Olympic National Forest also contains extensive lands within the Wilderness Preservation System. Application of the Minimum

Requirements/Minimum Tool decision process has resulted in the installation and retention of various types of infrastructure and uses in Olympic National Park wilderness areas. A Wilderness Management Plan is proposed for Olympic National Park, with work anticipated to start in 2010. There is also legislation pending that may designate the Boulder Creek Trail and surrounding area as wilderness, where it is not already included in the Wilderness Preservation System.

Impairment. Wilderness values would not be impaired under any of the alternatives considered in this document.

Social and Cultural Environment

Cultural Resources

For the purpose of this analysis, the term “cultural resources” refers to all properties potentially eligible for the National Register of Historic Places, as well as resources that are culturally important to tribes and other communities.

The term “historic properties” is a classification used in the National Historic Preservation Act (NHPA). This term is most commonly used in reference to the National Register of Historic Places. Historic Properties categories include: buildings, structures, objects, sites, and districts.

NPS manages its historic properties in five different groups based on disciplines. The five groups are:

- **Archeological resources** are the remains of past human activity and records documenting the scientific analysis of these remains. Archeological resources can be found above and below ground. They are commonly associated with prehistoric peoples, but may be products of a more contemporary society.
- **Pre-historic and historic structures** include constructions that shelter any form of human activity or habitation. The NPS definition of structure includes both a structure and a building.
- **Cultural landscapes** are settings that humans have created in the natural world. They reveal fundamental ties between people and the land, a pattern of things both natural and constructed.
- **Ethnographic resources** are traditional park sites, structures, objects, landscapes and natural resources that traditionally associated people define as significant to their present way of life.
- **Museum objects** are objects, specimens, and archival and manuscript collections that are valuable for the information they provide about processes, events, and interactions among people and the environment. Museum objects can be cultural and natural.

The Boulder Creek Trail and Campground Rehabilitation Project has the potential to primarily affect archeological resources and cultural landscapes. Within the project area, no cultural resources that are not also considered historic properties have been identified.

The Olympic Hot Springs were known by the local Klallam tribes well before the springs were first claimed in 1907. The Klallam used the hot springs and have spiritual beliefs associated with them. The Olympic Hot Springs are outside of the project area, and would not be affected by actions considered in this document.

Historic maps show the location of trash pits and privies in the vicinity of the campground. Surface inspections have confirmed the location of these features along with rock-work associated with campground construction by the Civilian Conservation Corp (CCC), and a large dump that was probably tied to operation of the campground or resort.

Limited subsurface archeological testing in the campground has revealed that an abundance of historic period artifacts are present within several of the campsites, some of these artifacts may be associated with early campground development and use. Because these historic period features are plotted on NPS maps and are visible on the ground surface there has been no formal effort to conduct archeological investigations targeted specifically at quantifying or evaluating them. If such studies were conducted it is very likely that a significant historical archeological component(s) would be identified. Given the campgrounds' association with the Civilian Conservation Corp and early park development it is also likely that these resources would be eligible for the National Register of Historic Places.

Within the last five years, archaeological surveys targeting large, forested terraces along the Elwha River Valley have resulted in the discovery of several new archaeological sites. Five recently recorded archaeological sites exist on high river terraces within five miles of the project area. Prior to this, few archaeological sites were recorded in the forested river valleys, likely due to the difficulty in locating sites within the dense understory and thick organic deposits. Boulder Creek campground is situated on one of these large, south facing terraces adjacent to a unique resource, the hot springs, which are documented to have been used by the Klallam tribes. Taking into consideration the above points, subsurface survey of the campground area was initiated in order to confirm the absence or presence of a concealed archaeological site along this high probability landform.

In total, 51 shovel test pits and one 1 x 1 meter test excavation unit were dug as a means of surveying the underground deposits. These shovel test pits were placed subjectively in areas of bare ground throughout the campground. Two shovel test pits were positive for prehistoric cultural resources with a total of 5 pieces of lithic debitage collected from the screen. These two shovel test pits were adjacent to each other and resulted in the recording of a new archaeological site, ONP-09-01, the Boulder Creek Campground site. One 1 x1 meter test excavation unit was dug within the site boundary and returned no additional artifacts. Additionally the subsurface

survey did confirm a high degree of historic disturbance in the area. Pedestrian and subsurface survey of the project area substantiates the presence of a small lithic scatter within the project area. Terraces along the Elwha valley are known to contain a high density of artifacts and while only a few artifacts have thus far been found, it is likely that more artifacts will be encountered. Depending on the alternative chosen, additional archaeological testing as well as monitoring of ground disturbance may be required during the project.

Information used in this assessment was obtained from relevant literature and documentation, maps, consultation with park archeologist and site visits. The National Historic Preservation Act requires agencies to take into account the effects of their actions on properties listed or eligible for listing in the National Register of Historic Places (NRHP). The process begins with identification and evaluation of cultural resources for NRHP eligibility, followed by an assessment of effects on eligible resources. This process includes consultation with the state historic preservation officer (SHPO). If an action could change in any way the characteristics that qualify the resource for inclusion in the national register, it is considered to have an effect. No adverse effect means there could be an effect, but the effect would not be harmful to the characteristics that qualify the resource for inclusion in the national register. Adverse effect means that action could diminish the integrity of the characteristics that qualify the resource for the national register. For the purposes of this analysis, the intensity of impacts on cultural resources was defined as follows:

Impact Assessment Methodology

Type: Beneficial impacts protect cultural resources. Adverse impacts damage the integrity of cultural resources.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for cultural resources.

Table 31: Cultural Resources Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	The effects on cultural resources would be at the lowest levels of detection, barely measurable without any perceptible consequences, either beneficial or adverse to cultural landscape resources, historic structures, archeological resources, or traditional cultural properties. For the purpose of Section 106 of the National Historic Preservation Act, the determination of effect would be <i>no adverse effect</i> .
Minor	The effects on cultural resources would be perceptible or measurable, but would be slight and localized within a relatively small area. The action would not affect the character or diminish the features of a National Register (NRHP) eligible or listed cultural landscape, historic structures, archeological sites, or traditional cultural properties, and it would not have a permanent effect on the integrity of any such resources. For the purposes of Section 106, the cultural resources' NRHP eligibility would be threatened; the determination of effect would be <i>no adverse effect</i> .
Moderate	The effects would be perceptible and measurable. The action would change one or more character-defining features of a cultural resource, but would not diminish the integrity of the resource to the extent that its National Register eligibility would be entirely lost. For the purposes of Section 106 of the National Historic Preservation Act, the cultural resources' NRHP eligibility would be threatened; the determination of effect would be <i>adverse effect</i> .
Major	The effects on cultural resources would be substantial, discernible, measurable, and permanent. For National Register eligible or listed cultural landscapes, historic structures or archeological sites, the action would change one or more character-defining features, diminish the integrity of the resource to the extent that it would no longer be eligible for listing in the National Register. For purposes of Section 106, NRHP eligibility would be lost; the determination of effect would be <i>adverse effect</i> .
Impairment	Permanent adverse impacts to cultural resources that are identified in the park's enabling legislation or general management plan would occur to the extent that the park would no longer be able to fulfill the purposes of a national park.

Environmental Consequences to Cultural Resources

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in negligible to minor impacts to archeological resources. Continuing adverse, site-specific and local, long-term, negligible to moderate impacts may also be occurring to the cultural landscape associated with the former CCC campground that now constitutes the east-loop of the Boulder Creek Campground.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives. Ground disturbing activities related to the expansion of parking and vehicle turnaround space at the trailhead, removal of asphalt and culverts from the trail, and removal of asphalt, exposed concrete foundations, and soil scarification to prepare the area for revegetation all have the potential to uncover or disturb surface and buried archeological resources. This could result in the physical destruction, damage, or removal of these objects.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. In addition to the impacts described above, additional potential for impact to archeological resources would exist as a result of extensive excavation in the campground area that would occur to locate and remove buried utility lines associated with the former automobile campground infrastructure. There is also the potential to better protect the remaining elements of the former CCC campground loop. Alternative 2 would

re-establish and delineate up to seven campsites within the CCC loop, with the potential to adaptively re-use this area in a manner that restores and protects this cultural landscape.

Alternative 3 – Moderate Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Alternative 3 would re-establish and delineate up to five campsites within the CCC loop, in addition to three sites in the non-historic mid-loop of the campground, with the potential to adaptively re-use this area in a manner that restores and protects this cultural landscape.

Alternative 4 – Enhanced Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. Alternative 4 would re-establish and delineate up to seven campsites within the CCC loop, in addition to four sites in the non-historic mid-loop, with the potential to adaptively re-use this area in a manner that restores and protects this cultural landscape.

Cumulative Impacts. Many projects occurring throughout the park and the Elwha area are occurring that have the potential to affect cultural resources. Actions are evaluated individually pursuant to the National Historic Preservation Act, and are considered cumulatively to ensure that the park does not take actions with the potential to impair cultural resources within Olympic National Park.

Impairment. Cultural Resources would not be impaired under any of the alternatives considered in this document.

Socioeconomics

Olympic National Park hosted 3 million recreation visits in 2007. Park visitors spent \$100.5 million in the local area, generating \$38.4 million in direct personal income (wages and salaries) for local residents and supporting about 2,080 jobs in area tourism businesses (Stynes 2006). In 2000, tourism accounted for approximately 10% of area employment, park visitors accounted for approximately 28% of all tourist spending in the region, and 62% of tourism spending in Clallam and Jefferson counties (Stynes et al. 2001). Access to the Elwha River Valley including the Olympic Hot Springs is popular among dayhikers and backpackers.

Information used in this assessment was obtained through the scoping process. The economic contribution of ONP to the local economies in the gateway communities are enhanced by visitors using the Boulder Creek Trail to access the Olympic Hot Springs, Boulder Lake, or other backcountry areas in the park accessed by this trailhead.

Impact Assessment Methodology

Type: Beneficial impacts sustain or enhance the socioeconomic concerns. Adverse impacts damage the integrity of socioeconomic concerns.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for Socioeconomic concerns.

Table 32: Socioeconomics Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	No effects would occur or the effects to socioeconomics conditions would be below the level of detection.
Minor	The effect to socioeconomic conditions would be detectable. Any effects would be small and if mitigation were needed to offset potential adverse effects, it would be simple and successful.
Moderate	The effects to socioeconomic condition would be readily apparent. Any effects would result in changes to socioeconomic conditions on a local scale. If mitigation is needed to offset potential adverse effects, it could be extensive, but would likely be successful.
Major	The effects to socioeconomics conditions would be readily apparent and would cause substantial changes to socioeconomic conditions in the region. Mitigation measures to offset potential adverse effects would be extensive and success could not be guaranteed.

Environmental Consequences to Socioeconomic Concerns

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in no changes to socioeconomic conditions.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives. Implementation of the Boulder Creek Trail and Campground Rehabilitation project would result in beneficial, short-term, local and regional, negligible to minor impacts due to the increased spending associated with trailhead expansion, asphalt removal, trail development, and trail and campground revegetation. This is due to increased economic activity associated with workers hired to implement the project contributing to the local economy by making use of area lodging, restaurants, grocery stores, and other businesses if the workers are from outside of the area, and also by supporting employment of local residents if work is conducted by people from the adjacent region.

Cumulative Impacts. Implementation of portions of this project as part of the American Recovery and Reinvestment Act (ARRA) would cumulatively generate additional socioeconomic activity in areas where ARRA-funded projects are funded and implemented.

Experiential Environment

Visitor Use and Experience

The Boulder Creek Trail is a year round popular day and overnight use trail. From the Boulder Creek Trail visitors can access Boulder Lake, Happy Lake Ridge Trail, Appleton Pass and the Sol Duc Valley. Few accurate figures are kept on wilderness day use, though is quite significant, probably exceeding overnight use several times over. In 2008, 1640 overnight visitors were recorded at the Boulder Creek Campground. Day use for the area is considerably higher with estimates as high as 72,000 due to the popularity of the Olympic Hot Springs and accessibility to other backcountry destinations from this trailhead. (B. Bell & M. Danisiewicz, pers comm. 2009) Backpacking, day hiking, camping, soaking in the hot springs, and fishing are the primary recreational activities for visitor use in this area of the park. Backcountry camping requires a permit and campers are asked to stay in sites that are previously impacted. Boulder Creek campground is not currently included in the park's overnight limited use program.

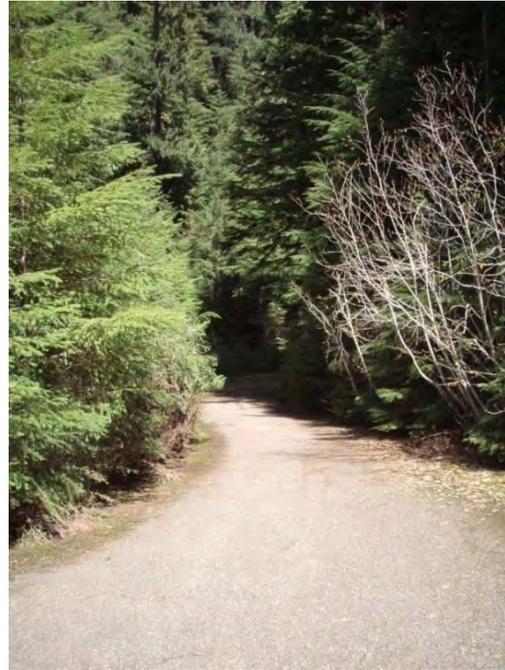


Photo 6: Asphalt along the Boulder Creek trail averages 14 feet wide.

Prior to designation as potential wilderness by the Washington Park Wilderness Act (1988), the Boulder Creek campground was a former CCC campground. Several remnants from this era still exist including the flat compacted area of the former parking lot, several metal corrugated culverts, two concrete comfort station bases, flagstone bases for picnic tables, old community campfire pits, and metal piping.



Photo 7: Part of the Olympic Hot Springs Forest Camp, July 4, 1937.

There are approximately 30 campsites remaining from the era of the old drive-in campground. Campsites are not signed; visitors usually select a site adjacent to an existing campfire ring. Most of the 30 campsites receive some use during the year. A few of the most popular campsites which are located next to trail junctions receive high use. During typical summer weekends, 8-12 campsites may be occupied. Soil in the campground is compacted due to the amount of visitor use; as a result vegetation is sparse. Forested areas adjacent to campsites are also heavily impacted due to visitors exploring and searching for firewood. In the immediate campground area most of the lower limbs on trees are stripped away and smaller living trees and snags cut down; this is likely a result of firewood collection. Visitors often construct campfire rings that exceed the standards for backcountry use and require dismantling by park staff.



Photo 8: Olympic Hot Springs Forest Camp, July 4, 1937.

Managed as an “all purpose trail” that allows for hikers and stock use, the Boulder Creek Trail is annually maintained to a standard width for stock travel. The project area currently includes 2.2 miles of asphalt trail with an average width of 14 feet. Some sections of the former road are overgrown with vegetation and have a dense canopy cover, while other areas are completely eroded due to slope instability and clogged culverts, vegetation in these locations is sparse. Remnants of old rusty culverts, which are exposed through erosion, occur in several locations along the former road bed. There are three creek crossings which require fording or have existing footbridges that need annual maintenance. The trail traverses the side of Crystal Ridge and parallels Boulder Creek. It is a slight grade with the exception of a few sections that cross creek drainages.

Currently visitors accessing the Boulder Creek trailhead park along the roadside. There are approximately 15 spaces for vehicles. A stock hitching post and unloading area is approximately 1/8 mile from the trailhead. Parking in the busy summer months usually exceeds the spaces available and the space for stock trailer turnaround is not adequate. A bulletin board at the trailhead provides visitor information.

A fundamental purpose of all parks is to provide for enjoyment of park resources and values by the people of the United States, and the NPS is committed to providing appropriate high quality opportunities for visitors to enjoy the parks (*NPS Management Policies 2006*). Part of the purpose of ONP is to offer opportunities for recreation, education, inspiration, and enjoyment. Consequently, one of the park’s management goals is to ensure that visitors safely enjoy and are

satisfied with the availability, accessibility, diversity, and quality of park facilities, services, and appropriate recreational opportunities.



Photo 9: Culvert along the Boulder Creek trail.

Public scoping input and observation of visitation patterns, combined with assessment of what is available to visitors under current park management, supported evaluation of effects of the alternatives. The potential for change in visitor experience inherent in the alternatives was evaluated by assessing projected change (increases or decreases) in access and other visitor uses, and determining whether or how these projected changes would affect the desired visitor experience, to what degree, and for how long.



Photo 10: Deteriorating asphalt along the Boulder Creek trail.

Impact Assessment Methodology

Type: Beneficial impacts improve visitor use and experience. Adverse impacts degrade visitor use and experience.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for visitor use and experience.

Table 33: Visitor Use and Experience Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	Changes in visitor experience and public use would be below or at an imperceptible level of detection. The visitor would not likely be aware of the effects associated with the action.
Minor	Changes in visitor experience and public use would be detectable, although the changes would be slight. The visitor would be aware of the effects associated with the action, but the effects would be slight.
Moderate	Changes in visitor experience and public use would be readily apparent. The visitor would be aware of the effects associated with the action and would likely express an opinion about the changes.
Major	Changes in visitor experience and public use would be readily apparent and severely adverse or exceptionally beneficial. The visitor would be aware of the effects associated with the action and would likely express a strong opinion about the changes.

Environmental Consequences to Visitor Use and Experience

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in continued insufficient parking at the Boulder Creek trailhead, and inadequate vehicle turnaround space for vehicle towing trailers. Difficult footlog access would continue at Cougar and Crystal Creeks, and visitors traveling with pack stock would not be able to access the area beyond Crystal Creek due to the lack of a safe stock crossing at this site. The Boulder Creek Trail would retain the deteriorated asphalt surface, and the campground would continue to be subject to trampling, soil compaction, and loss of vegetation due to the presence of approximately thirty undesignated campsites and extensive collection of woody material from the area for burning in campfires. This would result in continuing adverse, site-specific and local, long-term, negligible to major impacts to visitor use and experience.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives. Construction of additional parking and expanded vehicle turnaround space at the trailhead would result in beneficial, site-specific, long-term, minor to moderate effects. Removal of the asphalt and failed culverts from the trail, removal of abandoned infrastructure in the campground, and revegetation along the trail corridor, in the campground, and the former campground parking lot would result in beneficial, site-specific and local, long-term, minor to major impacts. Restoration of stock access to the Olympic Hot Springs area and Boulder Creek Campground would result in beneficial effects to visitors who use pack stock or enjoy sharing the trail with pack stock users. Visitors who consider use of pack stock to be an incompatible use of the trail would consider restoration of stock access as an adverse effect. Implementation of a campfire ban and ban on the collection of firewood would result in adverse, local, short-term, minor to major impacts due to the change in policy and resistance by some visitors to adhere to this requirement. The ban would result in beneficial, local, long-term, minor to major impacts due to the successful restoration of impacted areas within the campground, and the development of a visitor experience more consistent with management of the area as a wilderness area.

Adverse, site-specific and local, short-term, minor to moderate impacts to visitor use and experience would occur during project implementation due to temporary closures and noise impacts in areas adjacent to construction from heavy equipment use and helicopters. It is anticipated that the majority of necessary trail closures related to the Boulder Creek Trail and Campground Rehabilitation Project would occur during the implementation of the Elwha Dam Removal Project. This would eliminate or reduce the amount of time that visitors would be unable to access the Boulder Creek area.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. In addition to the impacts described above, additional beneficial, site-specific, long-term, minor to moderate impacts would occur due to the restoration of 23 out of 30 campsites in the Boulder Creek Campground. Retention of up to seven campsites in the east (CCC) campground loop would allow for continued backpacking use of the area, and would include up to two designated group campsites.

Alternative 3 – Moderate Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. In addition to the impacts described above, additional beneficial, site-specific, long-term, minor to moderate impacts would occur due to the restoration of an estimated 22 out of 30 campsites in the Boulder Creek Campground. Construction of a day-use stock hitching rail near the former campground parking lot would also expand visitor opportunities. Retention of up to five campsites in the east (CCC) campground loop and up to three campsites in the mid-loop would allow for continued backpacking use of the area, and would include up to two designated group campsites.

Alternative 4 – Enhanced Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. In addition to the impacts described above, additional beneficial, site-specific, long-term, minor to moderate impacts would occur due to the restoration of approximately 19 out of 30 campsites in the Boulder Creek Campground. Construction of a day-use stock hitching rail and overnight stock campsite with hitching rail near the former campground parking lot would further expand visitor opportunities. Retention of up to seven campsites in the east (CCC) campground loop and up to four campsites in the mid-loop would allow for continued backpacking use of the area, and would include up to three designated group campsites.

Cumulative Impacts. The Olympic Hot Springs Resort and automobile campground provided relatively easy access for visitors to the area and residents. Establishment of Olympic National Park created visitor expectations that may differ from what people might seek in National Forest recreation areas, or from recreational opportunities on non-federal public lands. Closure of the Olympic Hot Springs Resort and loss of automobile access to the campground altered previous visitor use patterns in the area. Construction of extensive trail networks, such as the Olympic Discovery Trail, provides hikers, bicyclists, and equestrians with varying experiences on the northern Olympic Peninsula. Continued construction of the Olympic Discovery Trail, both within and outside of park boundaries would expand non-motorized, multiple use trail options. Removal of the Elwha and Glines Canyon dams may have some adverse effects on visitor use for some, but would provide a unique visitor experience that others will seek out. Implementation of the Boulder Creek project would improve opportunities for day hikers, equestrians, and backpackers by restoring safe access along the 2.2 mile stretch of the Boulder Creek Trail.

Soundscapes

NPS *Management Policies 2006* require the National Park Service to preserve the natural soundscapes of the park. Natural soundscapes exist in the absence of human caused sound. Olympic National Park is one of the best examples of a natural soundscape found anywhere in the national park system and includes natural sounds that are part of the biological or physical resources of the park. (Olympic National Park Final General Management Plan. Volume 1, page 174. National Park Service. August 2008).

Natural sounds and natural quiet are important parts of the experience that visitors seek in Olympic National Park. Natural sounds generally predominate throughout the wilderness, and therefore through most of the park. Human-caused noise does occur in the wilderness, such as sounds related to visitor use, project activities, and sounds from aircraft overflights. Most human-caused sounds are usually confined to developed areas and along major roads. Noise levels in developed areas vary by location and time of year relative to the number of visitors and seasonal park operations. In certain areas, such as on the beach or beside a major river, natural sound levels exceed and, except for proximity to the source, mask some human sounds.

Some threats to natural soundscapes come from areas adjacent to the park boundaries such as noise from logging operations or construction activities, or aircraft including military, commercial, and private sector aircraft, in addition to NPS project related aircraft.

NPS *Management Policies 2006*, states that “the National Park Service will preserve, to the greatest extent possible, the natural soundscapes of parks.” The policy requires restoration of degraded soundscapes to the natural condition whenever possible, and protection of natural soundscapes from degradation due to unnatural sounds (noise) (NPS *Management Policies 2006*, sec. 4.9). The NPS is specifically directed to “take action to prevent or minimize all noise that, through frequency, magnitude or duration, adversely affects the natural soundscape or other park resources or values, or that exceeds levels that have been identified as being acceptable to, or appropriate for, visitor uses at the sites being monitored” (Management Policies 2006, sec. 4.9). The foundation for this policy is the fundamental purpose of the national park system, established in law (e.g., 16 USC 1 et seq.), which is to conserve park resources and values (NPS *Management Policies 2006*, sec. 1.4.3). NPS managers must always seek ways to avoid or minimize to the greatest degree practicable, adverse impacts on park resources and values (NPS *Management Policies 2006*, sec 1.4.3).

Noise can adversely affect park resources by modifying or intruding upon the natural soundscape, and can also interfere with sound important for animal communication, navigation, mating, nurturing, predation, and foraging. Noise can also adversely affect park visitor experiences by intruding upon or disrupting experiences of solitude, serenity, tranquility, contemplation, or a completely natural or historical environment.

The methodology used to assess noise impacts in this document is consistent with NPS *Management Policies 2006 and Director’s Order #47: Soundscape Preservation and Noise Management*.

Context, time, and intensity together determine the level of impact for an activity. Taken together, these three factors determine the level of noise impact. In some cases an analysis of one or more factors may indicate one impact level, while analysis of another factor may indicate a different impact level, according to the criteria below. In such instances, best professional judgment based on documented rationale is used to determine which impact level best applies to the situation being evaluated.

National literature was used to estimate the average decibel levels of activities proposed by the project alternatives. Personal observations by park staff and monthly use reports identified areas of use by visitors relative to the location of the proposed activities.

Impact Assessment Methodology

Type: Beneficial impacts protect or restore natural soundscapes. Adverse impacts degrade natural soundscapes.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for soundscapes.

Table 34: Soundscapes Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	Natural sound would prevail. Effects to natural sound environment would be at or below the level of human detection and such changes would be so slight that they would not be of measurable or perceptible consequence to the visitor experience. Best available information indicates that effects would not affect biological resources.
Minor	Natural sounds would prevail. Effects to natural sound would be localized, short-term and would be small and of little consequence to the visitor experience or to biological resources. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate	Natural sounds would prevail, but activity noise could occasionally be present at low to moderate levels. Effects to the natural sound environment would be readily detectable, localized, short- or long-term, with consequences at the regional or population level. Natural sounds would be occasionally heard during the day. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.
Major	Natural sound would be impacted by activity noise frequently for extended periods of time. Effects to the natural sound environment would be obvious, long-term, and have substantial consequences to the visitor experience or to biological resources in the region. Extensive mitigation measures would be needed to offset any adverse effects and success would not be guaranteed.
Impairment	Natural sound would be impacted on a permanent basis, to a level and extent that would preclude the park achieving its natural resource and visitor experience goals, and in a manner that would result in the park not fulfilling its duties as identified through enabling legislation and the general management plan.

Environmental Consequences to Soundscapes

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in continued adverse, site-specific, short-term, negligible to moderate impacts due to kinds and amounts of visitor use and administrative management actions occurring in the project area that generate noise.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives. Construction activities would result in adverse, short-term, local and regional, minor to major impacts to soundscapes due to noise generated by heavy equipment and helicopter use adjacent to designated wilderness areas.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. In addition to impacts described above, Alternative 2 would result in adverse; site-specific, local, and regional; short term and long term; minor to major impacts due to the need to use heavy lift helicopter for the initial delivery of footlogs for the stream crossings at Cougar, Hell, and Crystal Creeks; and also for the subsequent replacement of those footlogs when they deteriorate or are damaged during high water events. Adverse, site-specific and local, short-term minor to moderate impacts would also occur due to noise generated by blasting to remove 1,400 cubic yards of rock and 2,500 cubic yards of trail embankment to construct the footlog and stock ford at Crystal Creek. Additional noise would occur due to the use of heavy equipment and dump trucks to remove the excavated materials from the park.

Alternative 3 – Moderate Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. In addition to impacts described above, Alternative 3 would result in adverse; site-specific, local, and regional; short term and long term; minor to major impacts due to the need to use heavy lift helicopter for the initial delivery of footlogs for the stream crossings at Cougar and Hell Creeks, and the delivery of an 80 foot long bridge to Crystal Creek; and also for the subsequent replacement of those footlogs when they deteriorate or are damaged during high water events. Adverse, site-specific and local, short-term minor to moderate impacts would also occur due to noise generated by blasting to remove 1,100 cubic yards of rock and 400 cubic yards of trail embankment to construct the footlog and stock ford at Crystal Creek. Additional noise would occur due to the use of heavy equipment and dump trucks to remove the excavated materials from the park.

Alternative 4 – Enhanced Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. In addition to impacts described above, Alternative 4 would result in adverse; site-specific, local, and regional; short term and long term; minor to major impacts due to the need to use heavy lift helicopter for the initial delivery of a footlog for the stream crossing Hell Creek, and the delivery of a 50 foot long bridge to Cougar Creek and a 150 foot long bridge to Crystal Creek; and also for the subsequent replacement of the footlog when it deteriorates or is damaged during high water events.

Cumulative Impacts.

Natural soundscapes have been altered by the expansion of human use and development both within and outside of the park. The construction of roads and trails, visitor centers, resorts, residential and business areas have all added sounds to the acoustic environment that did not previously exist. Noise related to the removal of the Elwha and Glines Canyon dams will be noticeable during project implementation. Noise from visitor use would be reduced during this time due to less access due to closures during construction. Noise from aircraft outside the park would continue. Noise generated from park activities would also continue. Reduction in the

number of campsites in the Boulder Creek campground may result in a slight improvement to the acoustic environment by reducing the number of people using this site at one time.

Impairment: Soundscapes would not be impaired under any alternative discussed in this document.

Scenery and Visual Resources

The Boulder Creek Trail and campground is located at low-elevation in the Elwha watershed. The trail traverses along the side slope of Crystal Ridge above Boulder Creek in a mostly forested landscape with a few openings to the scenic views of the surrounding peaks and valleys of the Olympic Mountains.

The former road was paved with asphalt for approximately 2.2 miles. Much of the paving still exists today although in some areas the paving has been weathered into pieces and washed away. Remnants of old rusted culverts from the road construction and former automobile campground development have been exposed through erosion. In several areas along the trail culverts were clogged with debris which caused the pavement and road (trail) surface to washout leaving behind small and large holes. Metal piping and concrete foundations for the former comfort stations still exists in the campground. There is a spur trail that contains an old garbage dump from the former Olympic Hot Springs Resort that still remains.

Olympic National Park is renowned for its natural qualities. Visual resources are measured as the potential impact to park scenery a proposed action might have. For the purposes of this document we assume that a visitor in the Boulder Creek drainage expects to have views of pristine landscape minimally influenced by human presence.

Impact Assessment Methodology

Type: Beneficial impacts protect or enhance scenery and visual resources. Adverse impacts degrade scenery and visual resources.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for scenery and visual resources.

Table 35: Scenery and Visual Resources Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	Effects to the visual quality of the landscape would be at or below the level of detection for nearly all visitors; changes would be so slight that they would not be of any measurable or perceptible consequence to the average visitor experience.
Minor	Effects to the visual quality of the landscape would be detectable, localized as would be small and of little consequence to the average visitor experience. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate	Effects to the visual quality of the landscape would be readily detectable, localized, with consequences at the regional level. Mitigation measures, if needed to offset adverse effect, would be extensive and likely successful.
Major	Effect to the visual quality of the landscape would be obvious, with substantial consequences to the visitor experience in the region. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.
Impairment	Adverse impacts to scenic and visual resources would occur over a broad area on a permanent basis to the extent that the park could not fulfill its purpose as identified in the park enabling legislation or general management plan.

Environmental Consequences to Scenery and Visual Resources

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in continued adverse, site-specific and local, long-term, minor to major impacts due to the continued presence of the eroding asphalt trail and culverts, the presence of abandoned infrastructure, failed culverts, trampled or denuded vegetation, and high use levels in the Boulder Creek campground.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives. Removal of abandoned infrastructure and asphalt and active revegetation and restoration of natural contours and native plants along the trail corridor, in the campground, and the former campground parking lot would result in beneficial, site-specific and local, long-term, minor to moderate impacts.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. In addition to impacts described above, Alternative 2 would result in the least infrastructure at the completion of the project. For some visitors the use of footlogs and stock fords would result in a more scenic trail experience.

Alternative 3 – Moderate Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. In addition to impacts described above, Alternative 3 would result in the least dense campsite development at the completion of the project. For some visitors the use of footlogs and stock fords would result in a more scenic trail experience at Cougar and Hell Creeks. For other visitors, the presence of the 80 foot long bridge at Crystal Creek would provide an opportunity to gain a different view of the trail from the bridge deck, for others the steel bridge may be seen as a visual intrusion.

Alternative 4 – Enhanced Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. In addition to impacts described above, Alternative 4 would result in the most campsite development at the completion of the project. For some visitors the use of a footlog and stock fords would result in a more scenic trail experience at Hell Creek. For other visitors, the presence of the 50 foot long bridge at Cougar Creek and the 150 foot long bridge at Crystal Creek would provide an opportunity to gain a different view of the trail from the bridge decks, while for others the steel bridges may be seen as a visual intrusion.

Cumulative Impacts. Scenery and visual resources were impacted by the partial removal of infrastructure associated with the Olympic Hot Springs Resort and automobile campground. Damage to the Boulder Creek Trail due to the loss of the road surface at stream crossings has resulted in a deteriorated asphalt surface that is inconsistent with visitor expectations in a national park backcountry setting. Temporary impacts to scenery and visual resources may be expected during the removal of the Elwha and Glines Canyon dams, and the construction of other projects within the Boulder Creek and surrounding areas. Some visitors enjoy seeing construction activities, while others are distressed by the presence of heavy equipment in what is perceived by some as a pristine natural setting. Following the completion of the dam removal project, many visitors would enjoy seeing the recovery of the Elwha River watershed, particularly the transformation of the former reservoirs into vegetated riparian and upland habitat. Improvements to the Boulder Creek Trail and Campground would contribute to the overall improvement of scenery and visual resources in the area.

Impairment. Scenery and visual resources would not be impaired under any alternative considered in this document.

Unavoidable Adverse Impacts

Implementation of any of the action alternatives considered in this plan would result in temporary impacts related to closures to visitor use during project implementation, and noise impacts related to the use of heavy equipment and helicopters to remove asphalt and abandoned infrastructure, to improve the trailhead parking lot, and to deliver footlogs or bridges at stream crossings. Noise impacts would have short-term adverse effects on wildlife residing in the project area, and on any visitors recreating in park areas adjacent to the project area.

Relationship of Short-Term Uses and Long-Term Productivity

Short term impacts identified above and throughout this document are considered appropriate in order to provide for the long-term improvement of park resources and visitor experience along the Boulder Creek Trail and within the Boulder Creek Campground. Improvements would include the removal of abandoned asphalt road surfacing and obsolete infrastructure, and the long-term restoration of native vegetation and improved visitor experience following construction activities. Implementation of any of the action alternatives would result in improved long-term productivity, although short-term impacts would occur.

Irreversible and Irretrievable Commitments of Resources

No adverse permanent changes are proposed within the project area. Should the National Park Service determine that changes in the design of the Boulder Creek Trail or Campground are

warranted, nothing considered in this plan would preclude future actions from taking place. If new actions are proposed with the potential to adversely affect park resources or values, the decision would require additional planning and public review in accordance with federal law and policy.

Park Operations and Safety

The National Park Service is committed to providing a healthy and safe environment for visitors and employees, and to protect human life and provide for injury-free visits and appropriate responses when accidents and injuries occur. The goals of Olympic National Park include ensuring that basic visitor needs are met in keeping with the Park's purposes, and that visitor and employee safety and health are protected. To the extent feasible, facilities, programs, and services in the Park are accessible to and usable by all people, including those with disabilities (1.9.3 NPS *Management Policies*, 2006). Park operations, for the purposes of this EA, refers to the quality and effectiveness of the infrastructure, and the ability of park staff to maintain the infrastructure used in the operation of the park in order to adequately protect and preserve vital resources and provide for a high quality visitor experience. Facilities analyzed include the Boulder Creek Trail (former road), the trailhead and parking lot, bulletin board, and Boulder Creek campground.

Park operations in the project area include annual maintenance to clear trail debris (i.e. tree wind fall and boulders in unstable sections of the trail), garbage and trash pickup on the trail in the campground, and privy maintenance in the campground. Park staff also responds to lost and injured visitors, and provide a regular law enforcement presence to ensure visitor safety and resource protection needs are carried out.

Each year the Wilderness Resources Office coordinates efforts to monitor, maintain, and restore backcountry campgrounds, including the Boulder Creek Campground. Volunteers evaluate visitor use impacts and conduct minor maintenance projects in the field. Volunteers have provided substantial support to the ongoing management of the Boulder Creek Campground area.

Health and safety concerns associated with the rehabilitation of the trail include blasting into bedrock to construct an appropriate trail grade, removal of rock, soil, and debris, helicopter use, and the use of heavy equipment on sections of the trail that are narrow or highly unstable.

The current Boulder Creek trailhead parking area is located in an area not originally intended for this use. This parking location was established after storms forced the closure of the 2.2 mile section of road that is now managed as a trail. The current parking lot is a widened area of road with little space available for parking, no designated stalls, and the lack of an adequate turnaround area. There is no space designated for accessible parking. Large vehicles and vehicles pulling trailers have difficulty navigating through the trailhead parking area. There are approximately 15 spaces for vehicles to pull off on to the gravel shoulder for parking. During peak visitor season as many as 55 cars can be parked along the roadside. The parking area in its

current state creates potential hazards for pedestrians walking to the Boulder Creek trailhead and vehicles navigating and turning around in the narrow road corridor.

Public health and safety refers to the ability of the NPS to provide a healthy and safe environment for visitors and employees, and to protect human life and provide for injury-free visits and appropriate responses when accidents and injuries occur. Park operations, for the purposes of this EA, refers to the quality and effectiveness of the infrastructure, and the ability of park staff to maintain the infrastructure used in the operation of the park in order to adequately protect and preserve vital resources and provide for a high quality visitor experience.

Members of the park’s planning team who are knowledgeable of the park’s operational issues evaluated the impacts of each alternative. Impact analysis is based on the current description of park operations presented in the “Affected Environment” section of this EA.

Impact Assessment Methodology

Type: Beneficial impacts improve park operations and safety. Adverse impacts hinder park operations and safety.

Context: Site-specific impacts occur only in the immediate vicinity of an action. Local impacts occur only within the project area. Regional impacts occur both within and outside of the project area.

Duration: Short-term impacts occur only during project implementation. Long-term impacts occur over one to ten years. Permanent impacts occur for longer than ten years.

Intensity: The following table describes intensity benchmarks for park operations and safety.

Table 36: Park Operations and Safety Impact and Intensity.

Impact Intensity	Intensity Description
Negligible	The effects would be at low levels of detection and would not have appreciable effects on park operations.
Minor	The effects would be detectable and would be of a magnitude that would not have appreciable effects on park operations. If mitigation is needed to offset adverse effects, it would be simple and likely successful.
Moderate	The effects would be readily apparent and result in a change in park operations that would be noticeable to park staff and the public. Mitigation measures would be necessary to offset adverse effects and would likely be successful.
Major	The effects would be readily apparent, would result in a substantial change in park operations in a manner noticeable to staff and the public, and would be markedly different from existing operations. Mitigation measures to offset adverse effects would be needed and extensive, and success could not be guaranteed.

Environmental Consequences to Park Operations and Safety

Alternative 1 – No Action

Direct and Indirect Impacts of the Alternative. The No Action Alternative would result in continued safety concerns due to inadequate vehicle turnaround space at the trailhead and concerns due to inadequate stream crossings at Cougar and Crystal Creeks. Operationally, ongoing maintenance needs would continue to place a high burden on volunteers who do extensive maintenance within the Boulder Creek campground. Ongoing maintenance by park staff is also required due to continuing erosion along the trail, and the loss of footlogs at stream crossings during periods of high stream flow. Loss of vehicle access to the Boulder Creek campground and former Olympic Hot Springs Resort area resulted in an adverse, local, long-term, minor to major adverse impact on park operations and safety.

Impacts Common to All Action Alternatives

Direct and Indirect Impacts of the Alternatives. Adequate vehicle turnaround space at the trailhead would result in beneficial, site-specific, long-term minor to moderate impacts due to improved access for vehicles with a larger turning radius, and reduced potential for vehicular accidents. Improved safety for recreational and administrative use would result from construction of safe pedestrian and pack stock accessible stream crossings at Cougar, Hell, and Crystal Creeks. Implementation of a campfire ban and a ban on the collection of firewood would require a commitment of park law enforcement resources to ensure compliance with this new requirement. This would require either the hiring of additional law enforcement rangers, or reallocation of ranger patrol time to the Boulder Creek area.

Alternative 2 – Minimum Built Environment, Extensive Restoration

Direct and Indirect Impacts of the Alternative. In addition to impacts described above, Alternative 2 would result in increased annual and cyclical maintenance needs in order to maintain stock fords at Cougar, Hell, and Crystal Creeks. When footlogs deteriorated or were destroyed by high water events it would require location of replacement logs, and transportation of the log to the stream crossing site. This often includes the use of heavy-lift helicopters and the associated risk to staff. Pedestrian crossings at footlogs would only be safe during relatively low-water periods, as placement of the logs would not be expected to provide clearance above the ordinary high water levels. Reduced maintenance would be required in the Boulder Creek campground, where only seven out of an estimated thirty campsite areas would be retained. Extensive work to propagate plants for use in revegetation would be required. Substantial work would also be necessary to scarify compacted soils along the trail and throughout the campground and former campground parking lot in preparation of revegetation.

Alternative 3 – Moderate Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. In addition to impacts described above, Alternative 3 would result in increased annual and cyclical maintenance needs in order to maintain stock fords at Cougar and Hell Creeks. When footlogs deteriorated or were destroyed by high water events, it would require location of a replacement log, and transportation of the log

to the stream crossing site. This may include the use of heavy-lift helicopters and the associated risk to staff. Pedestrian crossings at footlogs would only be safe during relatively low-water periods, as placement of the logs would not be expected to provide clearance above the ordinary high water levels. Reduced maintenance would be required in the Boulder Creek campground, where only eight out of an estimated thirty campsite areas would be retained. Extensive work to propagate plants for use in revegetation would be required. Substantial work would also be necessary to scarify compacted soils along the trail and throughout the campground and former campground parking lot in preparation of revegetation. Increased visitor safety and operational efficiency would be gained by the installation of an 80 foot long bridge at Crystal Creek. The bridge would provide additional clearance during high water events and would require less maintenance.

Alternative 4 – Enhanced Visitor Services, Active Revegetation

Direct and Indirect Impacts of the Alternative. In addition to impacts described above, Alternative 4 would result in increased annual and cyclical maintenance needs in order to maintain a stock ford at Hell Creek. When the footlog has deteriorated or is destroyed by high water events, it would require location of a replacement log, and transportation of the log to the stream crossing site. This may include the use of heavy-lift helicopters and the associated risk to staff. Pedestrian crossings at the footlog would only be safe during relatively low-water periods, as placement of the logs would not be expected to provide clearance above the ordinary high water levels. Reduced maintenance would be required in the Boulder Creek campground, where only eleven out of an estimated thirty campsite areas would be retained. Extensive work to propagate plants for use in revegetation would be required. Substantial work would also be necessary to scarify compacted soils along the trail and throughout the campground and former campground parking lot in preparation of revegetation. . Increased visitor safety and operational efficiency would be gained by the installation of a 150 foot long bridge at Crystal Creek. The bridge would provide additional clearance during high water events and would require less maintenance.

Cumulative Impacts.

Olympic National Park manages an extensive program of natural and cultural resource management while providing for visitor enjoyment. Many projects have occurred over the decades of the park's existence to improve park operations and safety. The Olympic Hot Springs Resort was closed due to operational needs. The current Boulder Creek Trail was constructed as a road to provide automobile access, but was closed when stream crossings washed out to protect visitor safety. Implementation of the proposed activities would improve visitor safety and park operations, primarily through the construction of safe stream crossings.