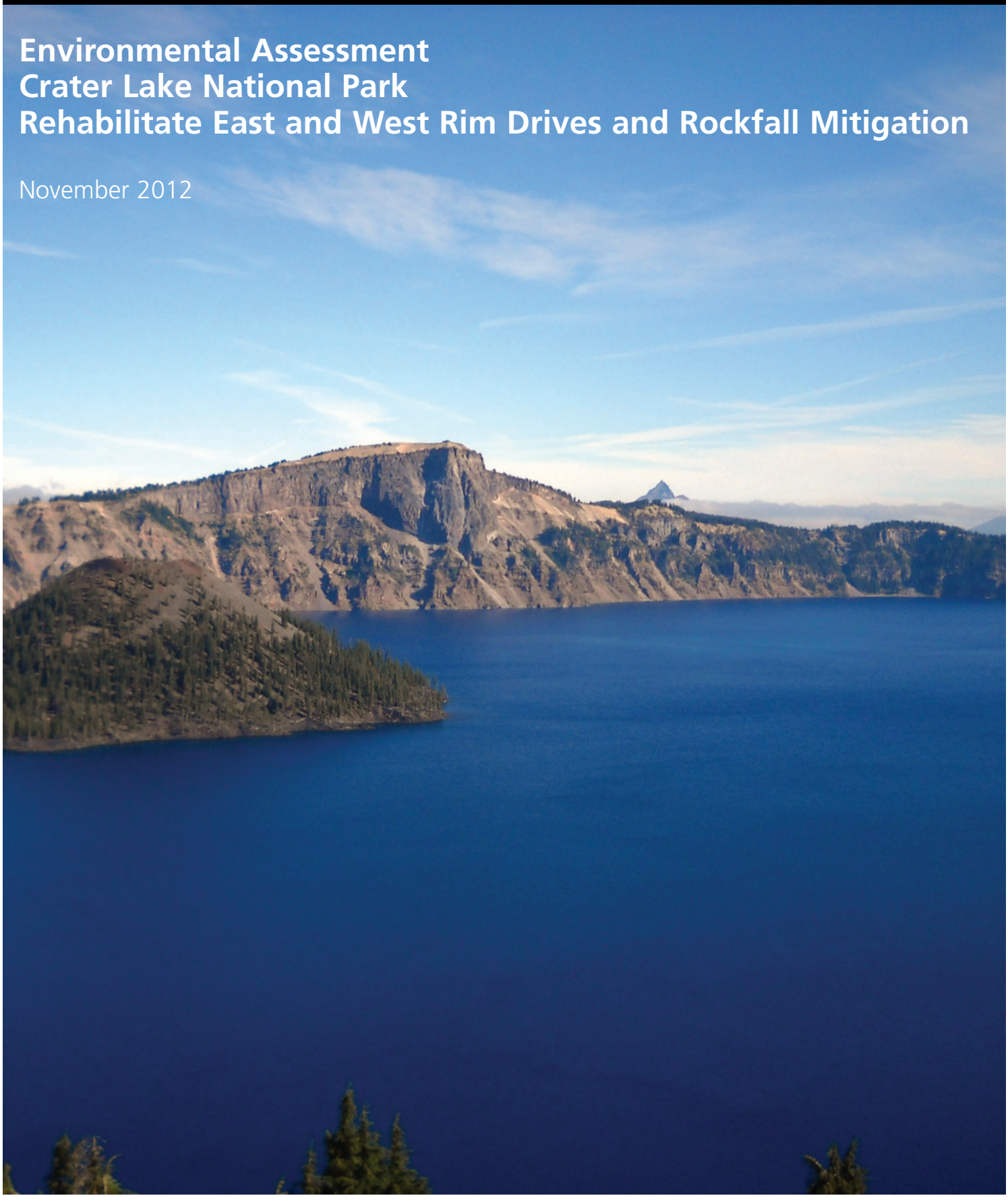
National Park Service
U.S. Department of the Interior

Crater Lake National Park
Oregon

Environmental Assessment
Crater Lake National Park
Rehabilitate East and West Rim Drives and Rockfall Mitigation

November 2012



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Rehabilitate East and West Rim Drives and Rockfall Mitigation

SUMMARY

The National Park Service (NPS), in cooperation with Western Federal Lands Highway Division of the Federal Highway Administration (FHWA), proposes actions at Crater Lake National Park (Crater Lake or park) to rehabilitate East and West Rim drives, improve a number of pullouts and parking areas, and implement rockfall mitigation. Rim Drive was originally completed in 1941 and has periodically needed repairs to address structural deficiencies and normal wear that has led to deterioration of the road, and road damage caused by rockfall. Road rehabilitation is being considered because the existing pavement on both East and West Rim drives has exceeded its service life and has developed ruts, lateral cracking, and severe raveling of the road pavement edge. The roads have suffered from incremental narrowing of the roadway bench supporting the pavement due to the erosion of the soft underlying pumice soils and rock. Stone retaining walls and guardwalls (also called guardrails) are failing in some locations due to erosion and age and require stabilization to prevent further damage to these historic features. Numerous steep rock cliffs and cut slopes along East and West Rim drives are eroding, resulting in rock falling onto the road; and measures are being considered to reduce the potential for rock falling on the road. Improvements to the parking lot at Cleetwood Cove, as well as various pullouts along Rim Drive, are also proposed. The proposed rehabilitation work would improve the efficiency of park operations by correcting structural deficiencies and reducing maintenance requirements, as well as improving visitor enjoyment and safety while protecting park scenic, natural, and cultural resources.

This environmental assessment (EA) evaluates: a no action alternative (Alternative 1) and three action alternatives. Under the no action alternative, the road would not be rehabilitated or improved. The road pavement and structural integrity would continue to deteriorate and problems with rockfall would persist. Park staff would continue routine road maintenance and repairs as it has in the past and would continue manual scaling operations in rockfall areas, as funding is available. All of the action alternatives include resurfacing, restoring, and rehabilitating 29.4 miles of Rim Drive including 5.9 miles of West Rim Drive and 23.5 miles of East Rim Drive. Alternatives 2, 3, and 4 include different levels of treatment at rockfall locations along Rim Drive. The action alternatives include measures to rehabilitate and improve the condition of the road, parking, pullouts, and related infrastructure, as well as techniques to reduce the potential for rockfall. Alternative 3 presents the NPS's preferred management action and defines the rationale for the action in terms of resource protection and management, visitor and operational use, cost, and other applicable factors.

This EA has been prepared in compliance with the National Environmental Policy Act (NEPA) to provide the decision-making framework that 1) analyzes a reasonable range of alternatives to meet objectives of the proposal, 2) evaluates potential issues and impacts on

the park's resources and values, and 3) identifies mitigation measures to lessen the degree or extent of these impacts. Resource topics evaluated in detail in this document are geology and soils, vegetation and special status plant species, wildlife and special status wildlife species, historic structures, cultural landscapes, visitor use and experience, visual resources, natural soundscapes, public health and safety, and park operations. All other resource topics were dismissed because the project would result in less than minor effects. No major effects were identified as a result of this project. Because the project will be implemented in phases and effects to the Rim Drive historic property remain unknown, National Historic Preservation Act compliance would be addressed by a Programmatic Agreement (PA) between the park and the Oregon State Historic Preservation Office. The PA includes stipulations for the continued identification of related features of the road and National Register of Historic Places evaluation of those features as potential contributing elements. Public scoping was conducted to assist with the development of this EA and comments were received and considered in the evaluation of effects.

Public Comment

If you wish to comment on this EA, you may post comments online using the NPS Planning, Environment and Public Comment (PEPC) website at: http://parkplanning.nps.gov or mail comments to: Superintendent, Crater Lake National Park, PO Box 7, Crater Lake, Oregon 97604.

This EA will be on public review for 30 days. It is the practice of the NPS to make all comments, including the names and addresses of those who comment, available for public review in their entirety after the close of the NEPA process. However, individuals not representing businesses or organizations may request that the NPS withhold their names and/or addresses from the record. The NPS will honor this request to the extent allowable by law, but you should be aware that your comment—including your personal identifying information—may be made publicly available at any time.

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Acronyms and Abbreviations

ACHP	Advisory Council on Historic Preservation
BMP	best management practice
CEQ	Council on Environmental Quality
Corps	U.S. Army Corps of Engineers
DO	Director's Order
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact
GHG	greenhouse gases
GMP	General Management Plan
JHA	Job Hazard Analysis
MP	milepost
NAGPRA	Native American Graves Protection and Repatriation Act
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPS	National Park Service
NRCS	Natural Resources Conservation Service
PA	Programmatic Agreement
park	Crater Lake National Park
PEPC	Planning, Environment and Public Comment
PWA	Public Works Administration
RHRS	Rockfall Hazard Rating System
SHPO	State Historic Preservation Officer
SWPPP	Stormwater Pollution Prevention Plan
USFWS	U.S. Fish and Wildlife Service

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Environmental Assessment
Rehabilitate East and West Rim Drives and Rockfall Mitigation

CRATER LAKE NATIONAL PARK

INTRODUCTION

The National Park Service (NPS), in cooperation with Western Federal Lands Highway Division of the Federal Highway Administration (FHWA), proposes actions at Crater Lake National Park (Crater Lake or park) to rehabilitate Rim Drive and implement rockfall mitigation at the park. East and West Rim drives are the primary routes serving the park's largest feature, the caldera, and are used by the majority of Crater Lake's 500,000 annual visitors. West Rim Drive (5.9 miles) begins at the junction with Munson Valley Road and ends at the junction with the North Entrance Road, and East Rim Drive (23.5 miles) completes the loop around Crater Lake from the North Junction to its intersection with the Munson Valley Road at Park Headquarters (Figure 1).

Rim Drive was originally completed in 1941 and has periodically needed repairs to address structural deficiencies, normal wear, and damage from rockfall that have led to deterioration of the road. Road rehabilitation is being considered because the existing pavement on both East and West Rim drives has exceeded its service life and has developed ruts, lateral cracking, and severe raveling of the road pavement edge. The roads have suffered from incremental erosion of the roadway bench supporting the pavement due to the soft underlying pumice soils and rock. Stone masonry retaining walls and guardwalls (also called guardrails) are failing in some locations due to erosion and age and require stabilization to prevent further damage to these historic features. Numerous steep rock cliffs and cut slopes along East and West Rim drives are eroding, resulting in falling rock onto the road; and measures are being considered to reduce the potential for rockfall. In addition, the Cleetwood Cove parking area does not have sufficient capacity under current operations and needs improvements. If approved, the work is expected to begin in 2015, depending on available funding, and would require several years to complete.

Rim Drive is the hub of the park's road system and provides the only access to some of the park's most popular features including several overlooks such as Discovery Point, Skell Head, Grotto Cove, Watchman Overlook, and North Junction (Glacial Valleys); Cleetwood Cove boat launch and parking area; Crater Lake Lodge and Rim Village; and several visitor centers, campgrounds, day use areas, and trailheads. The road is vital to park operations and local economies, and contributes greatly to visitor use and enjoyment. In addition, East and West Rim drives are listed on the National Register of Historic Places (National Register).

FIGURE 1. PROJECT LOCATION

This Environmental Assessment (EA) was prepared to evaluate potential environmental, socioeconomic, and cultural resource effects from the three alternatives to rehabilitate the road and implement rockfall mitigation; and a no action alternative that would not rehabilitate or improve the road or implement rockfall mitigation beyond the manual scaling currently being performed by park staff. This EA was prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 and implementing regulations, 40 Code of Federal Regulations (CFR) Parts 1500-1508, and NPS Director's Order (DO)–12 and Handbook, Conservation Planning, Environmental Impact Analysis, and Decision-making. This EA would determine whether significant impacts would occur as a result of the proposed project and if an environmental impact statement (EIS) or finding of no significant impact (FONSI) would be required. The documents related to the National Historic Preservation Act (NHPA), in accordance with the Advisory Council on Historic Preservation's (ACHP) regulations implementing section 106 (36 CFR Part 800), are being completed as a separate submittal to the Oregon State Historic Preservation Office (SHPO). This includes a NHPA Section 106 Agreement Document (Programmatic Agreement [PA]) that describes the cultural resources in detail and outlines recommendations to protect the cultural and historic resources of the road. The SHPO has determined that a PA is appropriate because the project would be phased and effects on historic properties are long-term and unknown. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification and assessment of effect for historic properties and any needed mitigation.

BACKGROUND

Located in south-central Oregon, Crater Lake National Park is a part of the Cascade Range. The park's main feature, Crater Lake, is the deepest volcanic lake in the world. Framed by jagged, steep-walled cliffs of a caldera produced by the climactic eruption and collapse of Mount Mazama approximately 7,700 years ago, Crater Lake is renowned for its clarity and intense blue color. The rim rises anywhere from 500 feet to almost 2,000 feet above the lake's surface.

Crater Lake National Park was established in 1902 and currently encompasses 183,224 acres and ranges from the summit of Mount Scott at 8,929 feet above sea level to a point on the park's southwest corner where the elevation is 3,980 feet. About 67% of the park area is formally recommended as wilderness.

More than 75% of park visitors come during the four summer months (June, July, August, and September). Annual totals reached a plateau of 500,000 in the early 1960s and have remained close to that figure since, although these numbers can fluctuate as much as 20% from one year to the next. Visitor services and access are restricted during the winter months when snow removal is necessary to maintain a road connection from the west or south entrance to an observation point at Rim Village. Approximately 70% of the annual precipitation in the park falls from November through March. Snow depths of 100 to 200 inches are common at park headquarters (on average, 100 to 140), and the total annual snowfall is approximately 520 inches (Crater Lake Institute n.d.). Winter weather over this period of eight months thus forces closure of roughly two-thirds of the park's road system.

The park's southern entrance station is at Mazama Village, which is 76 miles from Medford and 56 miles from Klamath Falls, and can be reached by Oregon State Route (OR) 62. During summer the park can also be reached from the north by OR 138. The south and north access roads lead to Rim Drive (Route 7), which is 29 miles long. A portion of Munson Valley Road (Route 4) intersects with Rim Drive and completes the loop around the caldera rim. The road circuit around the rim has been used since 1918. The construction of Rim Drive took place from 1931 to 1941and the road has been in continuous use since 1941. Rim Drive is in service today as originally constructed with few exceptions. Rim Drive was listed on the National Register in 2008. It also has been designated as part of an All American Road, along with south OR 62, Munson Valley Road, and the North Entrance Road. Winter access is maintained only from the south and west on OR 62 through the Munson Valley headquarters area and up to Rim Village. Road closures, particularly between park headquarters and the rim, are common during the winter because of frequent snowstorms.

PROJECT PURPOSE AND NEED

Project Purpose

The purpose of the proposed project is to correct road and associated parking and pullout deficiencies to improve safety for park visitors and personnel, reduce maintenance requirements and costs, and extend the useful life of the road.

Project Need

Portions of the existing pavement on both East and West Rim drives have exceeded their service life and have developed ruts, lateral cracking, and severe raveling of the road pavement edge. These roads are the primary routes accessing the park's most prominent feature, the lake, and are used by the majority of Crater Lake's summer visitors. The roads have suffered from incremental erosion of the roadway bench supporting the pavement due to the soft underlying pumice soils and rock. In many areas along this 29.4-mile two-lane route, there is no longer any shoulder, and steep fill slopes drop away off the pavement edge. In several areas, the eroded road has resulted in slumping and narrowed lanes, increasing driving hazards to visitors and park staff. Historic masonry guardwall, a contributing element to the National Register listing of Rim Drive, are failing in some locations due to erosion and age and require stabilization to prevent further damage to these historic features. Parking at Cleetwood Cove is insufficient to accommodate the volume of visitors to that area of the park and poses a safety hazard as some visitors park in undesignated areas along the road. Deteriorating pavement and poor drainage at the Rim Village parking lot also require improvements.

Numerous steep rock cliffs and cut slopes along East and West Rim drives are eroding, resulting in rock falling onto the road. Many of the rockfall events occur in the spring prior to opening the road to the public, but in some locations, occasional rockfall occurs in the summer requiring park staff to remove fallen rock from the roads. Eroding rock may fall unpredictably from steep slopes adjacent to the road, which poses a hazard to park visitors and maintenance crews and can interfere with the visitor experience from road closures and

delays necessitated by rock removal and road repair. The potential for damage or injury is exacerbated at locations with limited sight distance due to the potential of vehicles colliding with recently fallen material. Historic stone guardwalls, a contributing element to the historic landmark status of the road, also have been heavily damaged by falling rock and require repair.

Deteriorating road conditions and rockfall increase the cost and amount of time park staff need to repair and maintain the road. This diverts park resources from other maintenance needs in the park.

Project Objectives

In addition to the project purposes described above, project objectives have been identified. While project purposes serve as the driving forces for the proposed project, project objectives provide additional goals that the proposed action should meet. In consultation with partner agencies, tribes, environmental resource and regulatory agencies, the public, and other stakeholders, the following project objectives are identified:

1) Manage rockfall along the road to promote visitor and park staff safety and reduce ongoing maintenance costs, while protecting park resources

2) Preserve water quality by redirecting stormwater runoff away from Crater Lake

3) Efficiently implement construction activities while minimizing impacts on visitors and protecting resources

4) Because Rim Drive is listed on the National Register and nominated as a cultural landscape, all proposed design and implementation will follow guidelines set forth for rehabilitation and restoration under the *Secretary of the Interior's Standards for the Treatment of Cultural Landscapes* and NPS DO–28: *Cultural Resource Management*

PURPOSE AND SIGNIFICANCE OF CRATER LAKE NATIONAL PARK

An essential part of the planning process is to understand the purpose, significance, and mission of the park for which this EA is being prepared.

Park Purpose

Crater Lake National Park was established in 1902, dedicated and set apart forever as a public park or pleasure ground for the benefit and enjoyment of the people of the United States (NPS 2005). In managing this park, the NPS was originally charged with "the protection and preservation of the game, fish, timber, and all other natural objects therein." In 1980, Congress updated the park purpose "to preserve for the benefit, education, and inspiration of the people of the United States certain unique and ancient volcanic features,

including Crater Lake, together with significant forest and fish and wildlife resources" (Public Law 96-553).

Park Significance

Park significance statements capture the essence of the national park's importance to the natural and cultural heritage of the United States of America. Significance statements do not inventory park resources; rather, they describe the park's distinctiveness and help place the park within the regional, national, and international context. Defining park significance helps park managers make decisions that preserve the resources and values necessary to accomplish the purpose of the national park. The significance of Crater Lake National Park is:

- Crater Lake is one of the most renowned lakes on earth, principally because of the beauty imparted by its large size, blue color, mountain setting, and ever-changing character.
- Crater Lake lies in a caldera that was left by the climactic eruption and collapse of Mount Mazama more than 7,700 years ago. The circular lake, which formed in the caldera, is considered by scientists to be a unique model for how small calderas evolve in geologic time. At a depth of 1,943 feet, Crater Lake is the seventh deepest lake in the world, and holds the world record for clarity among lakes.
- In addition to the lake, most of the forests that surround Crater Lake have never been logged and are largely preserved in their pristine condition. These mature forests harbor a variety of plant and animal life that are characteristic of higher elevations in the Cascade Range. Because extensive alteration of forestland has taken place elsewhere in the Cascade Range, some of these plants and animals are rare. Those forests within the park boundary add unique opportunities for solitary and wilderness experiences.
- Some of the nation's best examples of blending rustic architecture and other built features within a national park setting can be seen at Rim Village, park headquarters in Munson Valley, and along Rim Drive. Much of Rim Village, park headquarters, and Rim Drive are within districts listed on the National Register.
- Crater Lake is of enduring importance to contemporary members of American Indian tribes because of its centrality to longstanding cultural traditions and resource-harvesting activities, as well as its symbolic significance as a sacred site. The park is part of a larger cultural landscape that extends well beyond the park boundaries.
- Crater Lake has been the object of scientific study for more than a century, and is unique for the scientific research related to its pristine waters, associated geothermal activities, and unusual aquatic organisms.
- The unique natural and cultural resources of Crater Lake National Park provide exemplary opportunities for students and educators.

Park Mission

Park purpose describes the specific reason the park was established. Park significance is the distinctive features that make the park different from any other. Together, purpose and significance lead to a concise statement—the mission of the park. Park mission statements describe conditions that exist when the legislative intent for the park is being met.

The 1916 Organic Act directs the Park Service to "conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." The following mission statement for Crater Lake National Park articulates the broad ideals and vision that the Park Service is striving to achieve: "The mission of Crater Lake National Park is to forever preserve the beauty of Crater Lake National Park, its unique ecological and cultural heritage, and to foster understanding and appreciation through enjoyment, education, and inspiration."

RELATED PLANNING DOCUMENTS

Crater Lake National Park General Management Plan

The Crater Lake National Park General Management Plan (GMP) provides the overall guidance for management of the park (NPS 2005). Rim Drive is an integral part of park operations and a component of the GMP is to create new opportunities along Rim Drive to allow visitors to directly experience the primary resource of Crater Lake in ways other than driving. Any new uses around the rim would be nonmotorized and low impact. Opportunities to experience the lake by hiking and biking in a quieter setting would be explored by experimental seasonal road closures of East Rim Drive. Other frontcountry opportunities, such as short trails and picnic areas, would be available along the roads. Motorized winter access to Rim Drive would remain the same through the use of snowmobiles and snow coaches. Parking and road congestion at the park would be managed by improving existing pullouts, parking areas, and overlooks.

Management Policies 2006

NPS *Management Policies 2006* provides guidance for management of all national park units. Road systems are addressed in section 9.2.1, which states "park roads will be well constructed, sensitive to natural and cultural resources, reflect the highest principles of park design, and enhance the visitor experience."

The purpose of park roads is to enhance visitor experience by providing access to park facilities, resources, and recreational opportunities. Park roads are not intended to provide fast and convenient transportation, but rather to access areas of recreation while being sensitive to the natural and cultural resources in the area (section 9.2.1.1 *Management Policies 2006*). Park roads provide access for the protection, use, and enjoyment of the resources that constitute the park. East and West Rim drives provide important connections to scenic vistas

and recreation areas throughout the park and access connections to other spur roads in the park, as well as regional connections to other state highways and communities.

1984 NPS Park Roads Standards

The 1984 NPS Park Roads Standards state that roads in national parks serve a distinctly different purpose from most other road and highway systems. Among all public resources, those of the national park system are distinguished by their unique natural, cultural, scenic, and recreational qualities. Park roads are to be designed with extreme care and sensitivity to provide access for the protection, use, and enjoyment of the resources that constitute the national park system.

Director's Order–87A: *Park Roads and Parkways*

DO–87A states that park roads are constructed only where necessary to provide access for the protection, use, and enjoyment of the natural, historical, cultural, and recreation resources that constitute our national park system. Park roads should enhance the visitor experience while providing safe and efficient accommodation of park visitors and to serve essential management action needs. Park roads are designed with extreme care and sensitivity with respect to the terrain and environment through which they pass—they are laid lightly onto the land.

SCOPING

Scoping is an early and open process to determine the breadth of issues and alternatives to be addressed in an EA. Park staff, FHWA, and resource professionals of the NPS Denver Service Center conducted internal scoping. This interdisciplinary process defined the purpose and need, identified potential actions to address the need, determined likely issues and impact topics, and identified the relationship of the preferred alternative to other planning efforts at the park.

On September 19, 2011, the park initiated public scoping with a press release to provide the public and potentially interested parties an opportunity to comment on the proposed project (Appendix A). The park sent letters to more than 240 interested individuals; organizations; state, county, and local governments; federal agencies; local businesses; and media outlets describing the alternative actions and asking for comments. In addition, scoping letters were sent to the Oregon SHPO and American Indian tribes traditionally associated with the park. More information regarding external scoping and American Indian consultation can be found in the "Consultation and Coordination" section on page 117.

During the 30-day scoping period that ended October 19, 2011, the park received 14 comment letters from the public by email and the Planning, Environment and Public Comment (PEPC) site. A majority of the comment letters (12) were related to the addition of bicycle lanes for all or part of Rim Drive. Ten commenters support the addition of bicycle lanes to Rim Drive to improve safety for bicyclists, while two commenters were opposed to

the addition of bicycle lanes and/or one-way vehicle traffic. One commenter in favor of bicycle lanes also requested the addition of signs encouraging motorists to watch for bicycles, more restrooms, and the addition of water fountains. Another commenter in favor of bicycle lanes mentioned the addition of a bicycle lane would increase visitor use and benefit the local economy.

Eight of the comment letters indicated overall support for road improvements and rockfall mitigation, and one comment letter indicated support for the project "for local economic recovery, sightseeing, for training for premier bicycle riders and safety for all." Cascadia Wildlands expressed support for the improvements but within the existing footprint of the road to avoid impacts on wildlife habitat, scenic values, and visitor enjoyment, while considering options to reduce traffic. One commenter questioned whether the road would be kept open.

The Crater Lake Trolley service emphasized the need for road safety improvements, particularly the desire to see the road become a one-way route for vehicle traffic. The trolley service stated that a one-way road would reduce the possibilities of traffic accidents. The trolley service reported several "near-misses" between their drivers and vehicles that crossed the center line to avoid the dropoffs on the edge of the road. It was suggested that a one-way road would facilitate traffic management and reduce the amount of time needed for roadwork. The same commenter believes additional shuttle services should be offered, in line with the park's Travel Management Plan. The comment letter also points to the 2005 GMP, Alternative 2, which calls for shuttles or other alternative transportation systems to address crowding conditions. Two other comments supported one-way vehicle traffic on Rim Drive to increase vehicle, bicycle, and pedestrian safety on the road.

Scoping comments were considered in the choice of impact topics and the development and evaluation of alternatives discussed in this EA. Scoping issues or impact topics that were considered, but not evaluated further, are discussed below in "Impact Topics Dismissed from Further Analysis."

The public, agencies, and American Indian tribes traditionally associated with park lands also will have an opportunity to review and comment on this EA.

IMPACT TOPICS RETAINED FOR FURTHER ANALYSIS

Issues and impact topics for this project have been identified on the basis of federal laws, regulations, and orders; NPS *Management Policies 2006*; and NPS knowledge of resources at the park, as well as the questions and comments brought forth during scoping. Impact topics that are carried forward for further analysis in this EA are listed below in Table 1, along with the reasons the impact topic is further analyzed.

TABLE 1. IMPACT TOPICS RETAINED FOR FURTHER EVALUATION AND RELEVANT LAWS, REGULATIONS, AND POLICIES

Impact Topic	Reasons for Retaining Impact Topic	Relevant Laws, Regulations, and Policies
Geology and Soils	Proposed actions to manage rockfall would affect areas of rock outcrop adjacent to the road. Road rehabilitation activities have the potential to disturb soils adjacent to the road, but also to address existing erosion problems.	NPS Soil Resource Management Guidelines (NPS-77); NPS *Management Policies 2006*
Vegetation and Special Status Plant Species	Implementation of structural measures to correct bench erosion such as shifts in road alignment, rockfall mitigation, drainage improvements, and other road rehabilitation activities have the potential for impacting vegetation adjacent to the road. In addition, several sensitive plant species are found in the project area. Roadside vegetation disturbance and the introduction of invasive nonnative species are possible from ground-disturbing activities.	NPS Organic Act; NPS *Management Policies 2006*; (4.4.2.3 Management of Threatened or Endangered Plants and Animals; including state-listed species); 16 USC 1535 section 7(a)(2); Resource Management Guidelines (NPS-77); Federal Noxious Weed Control Act; Executive Order (EO) 13112; Invasive Species (1999); Endangered Species Act
Wildlife and Special Status Wildlife Species	Proposed actions would have limited direct effects on wildlife habitat because activities would occur within areas of previous disturbance, but wildlife could potentially be affected by disturbance from noise and activities during construction. Federally threatened northern spotted owls are present in the park. Sensitive species such as pika, peregrine falcons, and eagles are found in the project area.	Endangered Species Act; NPS *Management Policies 2006*; (4.4.2.3 Management of Threatened or Endangered Plants and Animals, including state-listed species); 16 USC 1535 section 7(a)(2)
Historic Structures	Rim Drive, Rim Village Historic District, and associated historic structures are listed on the National Register. Construction activities such as new walls, repair of existing historic structures, and other structural measures have the potential to affect features associated with Rim Drive and Rim Village National Register listing.	NPS Organic Act (1916); the Antiquities Act of 1906; the NHPA of 1966 (1992, as amended); NEPA; the National Parks and Recreation Act of 1978; the Archaeological Resources Protection Act of 1979; Native American Graves Protection and Repatriation Act (NAGPRA) of 1990; and the Curation of Federally Owned and Administered Archaeological Collections (1991). Applicable agency policies relevant to cultural resources include Chapter 5 of NPS *Management Policies* and DO–28: *Cultural Resource Management*, as well as other related policy directives such as the NPS Museum Handbook (2005), Interpretation and Visitor Services Guidelines (1986), and *The Secretary of the Interior's Standards for the Treatment of Historic Properties* (1992).

Impact Topic	Reasons for Retaining Impact Topic	Relevant Laws, Regulations, and Policies
Cultural Landscapes	Rim Drive and associated historic structures comprise a historic designed landscape. The park has identified Rim Drive as one of 13 cultural landscapes in the park. There is concern that any new structural features or modifications to existing structures should maintain the historic character of the highway.	Section 106 of the NHPA; NPS *Management Policies 2006*; DO–28
Visitor Use and Experience	The quality of the visitor experience would be temporarily affected during construction from traffic delays and short-term road closures, closed parking areas and pullouts, increased noise, and a change in scenic quality from construction equipment and disturbances. The proposed improvements would result in long-term benefits to the visitor experience by ensuring access to the park and addressing rockfall areas along the road and deterioration of the road and erosion.	NPS *Management Policies 2006*
Visual Resources	The proposed project would result in visual changes from new pavement and striping, new walls, modified fill slopes, drainage improvements, disturbance and treatment of rock slopes, and other actions. Road rehabilitation and rockfall mitigation work would be designed to protect and preserve the visual quality of the road corridor, although some of the proposed rockfall mitigation techniques may impact visual resources.	NPS *Management Policies 2006*
Natural Soundscapes	Noise associated with road rehabilitation and rockfall mitigation from equipment operation and truck traffic would result in a temporary increase above ambient sound levels.	NPS *Management Policies 2006*; DO–*47: Sound Preservation and Noise Management*
Public Health and Safety	Deteriorating road conditions and rockfall pose potential safety risks to vehicle travel and increase the potential for accidents. Crews performing rock scaling and other rockfall mitigation work would be exposed to safety hazards. The proposed road improvements and rockfall mitigation would be designed to improve road conditions and safety.	NPS *Management Policies 2006*
Park Operations	Construction activities and rockfall mitigation work would require temporary changes in park operations to address traffic control and keep the public informed about road conditions. Road improvements and rockfall mitigation would be designed to reduce road maintenance, repairs, and rockfall clearing; and improve snow removal activities.	NPS *Management Policies 2006; OMB Circular A-123; Federal Managers Financial Integrity Act of 1982* (31 USC 3512(d)); *Government Performance and Results Act of 1993* (GPRA)

IMPACT TOPICS DISMISSED FROM FURTHER ANALYSIS

In this section of the EA, the Park Service provides a limited evaluation and explanation as to why some impact topics are not evaluated in more detail. Impact topics were dismissed from further analysis if it was determined that the project did not have the potential to cause substantial change to these resources and values. In addition, impact topics were dismissed from further evaluation in this EA if:

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

The NPS defines "measurable" impacts as moderate or greater effects. It equates "no measurable effects" to minor or less effects. "No measurable effect" is used by the NPS in determining if a categorical exclusion applies or if impact topics may be dismissed from further evaluation in an EA or EIS. The use of "no measurable effects" in this EA pertains to whether the NPS dismisses an impact topic from further detailed evaluation in the EA. The reason the NPS uses "no measurable effects" to determine whether impact topics are dismissed from further evaluation is to concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail in accordance with Council on Environmental Quality (CEQ) regulations at 1500.1(b).

The regulatory context and baseline conditions relevant to each impact topic were analyzed in the process of determining if a topic should be retained or dismissed from further analysis. Because there would be no effects or no measurable effects, there would either be no contribution toward cumulative effects or the contribution would be low. Following is an overview of impact topics that were considered, but ultimately dismissed, along with the reasons for dismissing each topic from further analysis.

Air Quality and Climate Change

The Clean Air Act of 1963 (42 USC 7401 et seq.) was established to promote the public health and welfare by protecting and enhancing the nation's air quality. The act establishes specific programs that provide special protection for air resources- and air quality-related values associated with national park system units. Section 118 of the Clean Air Act requires a park system unit to meet all federal, state, and local air pollution standards.

The 1977 amendments to the Clean Air Act declared Crater Lake National Park a mandatory Class I airshed and charged the superintendent with the responsibility to protect air quality-related values, including visibility. The quality of air plays a vital role in visitor enjoyment, the preservation of cultural resources, and the perpetuation of natural systems. Crater Lake National Park is known for its clean air and spectacular vistas. Visitors standing on the summits of Mt. Scott, Watchman, and Llao Rock can see south to Mt. Shasta in California and north to the summits of the Three Sisters and beyond.

Under the action alternatives, road rehabilitation activities, earthwork, and rockfall treatment measures would temporarily increase dust from exposed soil and surface disturbance and vehicle emissions from construction equipment. Particulate matter and emissions during construction activities would result in localized effects on air quality. Hydrocarbons, nitrogen oxide, and sulfur dioxide vehicle emissions would be rapidly dissipated and would not exceed air quality standards. Visibility, deposition, and other air quality-related values in the park are not expected to be appreciably affected. These effects would be short-term, negligible, and adverse. Road rehabilitation would not result in a long-term increase in traffic or vehicle emissions. Neither overall park air quality nor regional air quality would be more than negligibly affected by the short-term increase in emissions. Rockfall treatment under Alternative 4 would have a slightly greater effect on air quality than Alternatives 2 and 3 from the additional equipment operation time required to implement rockfall mitigation at more sites. The no action alternative would have a short-term negligible adverse effect on air quality from ongoing road maintenance and rock scaling by park staff.

Climate change refers to any significant change in average climatic conditions (e.g., mean temperature, precipitation, or wind) or variability (e.g., seasonality and storm frequency) lasting for an extended period (decades or longer). Recent reports by the U.S. Climate Change Science Program, the National Academy of Sciences, and the United Nations Intergovernmental Panel on Climate Change provide evidence that climate change is occurring as a result of rising greenhouse gas (GHG) emissions and could accelerate in the coming decades. While climate change is a global phenomenon, it manifests differently depending on regional and local factors. General changes that are expected to occur in the future as a result of climate change include hotter, drier summers; warmer winters; warmer water; higher ocean levels; more severe wildfires; degraded air quality; more heavy downpours and flooding; and increased drought. Climate change is a far-reaching, long-term issue that could affect the park, its resources, visitors, and management. Although some effects of climate change are considered known or likely to occur, many potential impacts are unknown. Much depends on the rate at which the temperature would continue to rise and whether global emissions of GHGs can be reduced or mitigated. Climate change science is a rapidly advancing field and new information is being collected and released continually.

Construction activities associated with implementation of the action alternatives would contribute to increased GHG emissions, but such emissions would be short-term, ending with the cessation of construction. Any effects of construction-related GHG emissions on climate change would not be discernible at a regional scale, as it is not possible to meaningfully link the GHG emissions of such individual project actions to quantitative effects on regional or global climatic patterns. The no action alternative would have short-term negligible adverse effects on GHG emissions from road maintenance and rock scaling by park staff. Because the action alternatives would result in short-term negligible adverse effects on air quality during construction and it is not possible to meaningfully link the GHG emissions from the project to climate change, air quality and climate change were dismissed as impact topics in this EA.

Water Resources and Water Quality

The Clean Water Act and NPS *Management Policies 2006* direct the NPS to protect park waters and avoid pollution of park waters by human activities. Crater Lake is within the project area and protection of this resource and its water quality is one of the park's top priorities. The existing road layout is designed to direct runoff away from the lake in most locations; however, at several roadway pullouts and parking areas, runoff from paved or gravel areas drain toward the lake. This has caused erosion of the embankments and undermining of pavement and walls. Proposed drainage improvements include measures to redirect stormwater runoff, wherever feasible, away from the lake or allowing water to drain as sheetflow off paved surfaces to reduce velocity and erosion to protect lake water quality. Drainage improvements in the Rim Village parking lot would include best management practices (BMPs) for stormwater discharge. The resource protection measures noted in Table 3 would be implemented to control erosion and protect water quality during construction. A component of the protection measures is a stormwater pollution prevention plan (SWPPP), which would be implemented during construction to prevent or minimize the potential for erosion and transport of sediments to the lake or drainages near the road. Revegetation of disturbed areas and other erosion-control measures would minimize the potential for long-term adverse effects on water quality.

Impacts on water quality from the action alternatives with implementation of measures to redirect stormwater flow away from the lake would have a long-term beneficial effect on water quality. With implementation of resource protection measures during construction, impacts on water quality from surface disturbances would be local, short-term, negligible, and adverse. Existing drainage deficiencies and erosion adjacent to Rim Drive would not be corrected under the no action alternative, which would continue to provide a source of sediment that would have a local long-term negligible adverse effect on water quality. Water resources were dismissed as an impact topic in this EA because effects would be less than minor under any of the alternatives.

Wetlands

EO 11990, "Protection of Wetlands" requires federal agencies to avoid, where possible, adversely impacting wetlands. In accordance with NPS *Management Policies 2006* and DO–77-1: *Wetlands Protection,* the NPS strives to prevent the loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In addition, section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers (Corps) to prohibit or regulate, through a permitting process, discharge of dredged or fill material or excavation within waters of the United States. The only wetlands in the project area potentially affected by the project are primarily found within short sections of a narrow roadside ditch near Dutton Cliff on East Rim Drive. Any incidental impact on these wetlands from road improvements or rockfall treatment under the action alternatives would be less than 0.1 acre and temporary. Temporary fencing or other barriers would be used to protect wetlands during construction. Disturbed wetlands would be revegetated following construction and the NPS would request a Nationwide 404 Permit as applicable. There would be no impacts on wetlands under the no action alternative. Because impacts on wetlands would be temporary and negligible, this topic was dismissed from detailed discussion in this EA.

Floodplains

EO 11988, "Floodplain Management" requires an examination of impacts on floodplains and potential risks involved in placing facilities within floodplains. NPS *Management Policies 2006* and DO–77-2: *Floodplain Management* provides guidelines for proposed actions in floodplains. No areas of flooding have been identified in the project area (FEMA 2012). No proposed work activities would occur in a floodplain. Because there would be no impact on floodplains under any of the alternatives, floodplains was dismissed as an impact topic in this EA.

Archeological Resources

Section 106 of the NHPA of 1966, as amended (16 USC 470 et seq.) and its implementing regulations under 36 CFR 800 require all federal agencies to consider effects of federal actions on cultural properties eligible for or listed in the National Register. In order for an archeological site to be listed in the National Register, it must be associated with an important historic event or person(s), embody distinctive characteristics or qualities of workmanship, or have the potential to provide information important to history or prehistory. Previous archeological surveys, including a recent inventory of portions of East and West Rim drives (NPS 2010a) indicate very few archeological resources in the Crater Lake area. No archeological resources potentially eligible for listing on the National Register are located in the area of potential effect. Because archeological sites would not be affected by the no action or action alternatives, and because appropriate steps would be taken to protect any archeological features that are inadvertently discovered (according to a NHPA Section 106 Agreement Document with the Oregon SHPO), archeological resources was dismissed as an impact topic in this EA.

Indian Trust Resources

Secretarial Order 3175 requires that any anticipated impacts on Indian trust resources from a proposed project or action by Department of the Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights. The order represents a duty to carry out the mandates of the federal law with respect to American Indian and Alaska Native tribes. The lands comprising the park are not held in trust by the secretary of the interior for the benefit of Indians due to their status. Therefore, Indian trust resources were dismissed as an impact topic in this EA.

Ethnographic Resources

The NPS defines ethnographic resources as any "site, subsistence, or other significance in the cultural system of a group traditionally associated with it" (NPS DO–28). The interaction of people with Crater Lake has occurred at least as far back as the eruption of Mount Mazama (NPS 2010a). European contact was fairly recent, starting in 1853. A Native American connection with this area has been traced back to before the cataclysmic eruption

of Mount Mazama. Archeologists have found artifacts buried under layers of ash, dust, and pumice from this eruption approximately 7,700 years ago. To date, there is little evidence indicating that Mount Mazama was a permanent home to people. However, it was used as a place for vision quests and prayer, but also hunting and gathering (NPS 2010a).

There are no known ethnographic resources in the project area or general vicinity. The American Indian tribes traditionally associated with the lands of the park were apprised of the proposed project by letter. No comments from the tribes were received during the scoping period. Copies of the EA will be forwarded to each associated American Indian tribe for review and comment. If subsequent issues or concerns are identified, appropriate consultations would be undertaken. Because it is unlikely that ethnographic resources would be affected under any alternative, and because appropriate steps would be taken to protect any human remains, funerary objects, sacred objects, or objects of cultural patrimony inadvertently discovered, ethnographic resources was dismissed as an impact topic in this EA.

Museum Collections

According to DO–24: *Museum Collections*, the NPS requires the consideration of impacts on museum collections. Museum collections include historic artifacts, natural specimens, and archival and manuscript material. These collections may be threatened by fire, vandalism, natural disasters, and careless acts. The preservation of museum collections is an ongoing process of preventive conservation, supplemented by conservation treatment, when necessary. The primary goal is preservation of artifacts in the most stable condition possible to prevent damage and minimize deterioration. The action and no action alternatives would not affect museum collections; therefore, museum collections were dismissed as an impact topic in this EA.

Lightscape

In accordance with NPS *Management Policies 2006*, the NPS strives to preserve natural ambient lightscape, which are natural resources and values that exist in the absence of human-caused light. The park strives to limit the use of artificial outdoor lighting to that necessary for building security and human safety. The park also strives to ensure that all outdoor lighting is shielded to the maximum extent possible to keep light on the intended subject and out of the night sky. No new permanent outdoor lighting is proposed as part of the action alternatives. No night work or night lighting would occur near the Lost Creek campground or Crater Lake Lodge. No other visitor facilities are near the project area that would be adversely affected by night construction activities and lighting. Temporary lighting for night work would result in a local short-term negligible adverse impact on the night sky under the action alternatives. Downcast shielded lighting would be used for night work to minimize the impacts to lightscape. There would be no impact on the lightscape or night sky from the no action alternative. Because impacts on the lightscape would be minor or less under all alternatives, this topic was dismissed from further analysis in this EA.

Prime or Unique Farmland

In 1980, the CEQ directed federal agencies to assess the effects of their actions on farmland soils classified as prime or unique by the United States Department of Agriculture, Natural Resources Conservation Service (NRCS). Prime or unique farmland is defined as soil that particularly produces general crops such as common foods, forage, fiber, and oil seed; and unique farmland produces specialty crops such as fruits, vegetables, and nuts. There are no prime or unique farmlands associated with the project area; therefore, prime or unique farmland was dismissed as an impact topic in this EA.

Socioeconomics

Implementation of the action alternatives would result in construction-related spending. Construction expenditures would be used for labor, supplies, equipment, and other services. Labor would likely come from regional communities in Klamath, Douglas, Jackson, and other surrounding counties. Secondary economic effects from construction-related spending also would generate economic benefits to the region. Construction-related spending would have a short-term beneficial effect on the regional economy.

Construction activity and traffic delays may deter some visitors from coming to the park and/or traveling on Rim Drive. As described in Table 3 – Visitor Use and Experience, the park would implement a number of actions to minimize impacts on park visitors during construction. Chief among these measures would be clearly and accurately communicating to the public the status of construction work and the timing of traffic delays or suspensions. While some park visitors may be inconvenienced during construction, no substantial change in visitor attendance is anticipated. The action alternatives would result in regional short-term minor adverse effects on the economy if visitor numbers decrease during construction. Maintaining the quality of the road and the visitor experience over the long term would contribute to sustaining park visitation and tourist-related spending. Over the long term, road improvements would provide beneficial economic effects on regional businesses from actions that increase the quality of the visitor experience and support continued visitation to the park. The no action alternative would have regional long-term minor adverse effects on socioeconomic effects from increased road maintenance costs and potential adverse effects on visitor attendance and regional businesses if the road deteriorates and park attendance drops. Because impacts on socioeconomics would be minor or less under all alternatives and the action alternatives would result in beneficial effects on socioeconomics, this topic was dismissed from further evaluation in this EA.

Environmental Justice

EO 12898, "General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing the disproportionately high and/or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. According to the U.S. Environmental Protection Agency, environmental justice is the

> . . .fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

The goal of "fair treatment" is not to shift risks among populations, but to identify potentially disproportionately high and adverse effects, and identify alternatives that may mitigate these impacts.

Medford, Fort Klamath, Klamath Falls, and surrounding communities near Crater Lake contain minority and low-income populations; however, environmental justice was dismissed as an impact topic for the following reasons:

- The park staff and planning team actively solicited public participation as part of the planning process and gave equal consideration to all input from persons regardless of age, race, income status, or other socioeconomic or demographic factors.
- Implementation of the preferred alternative would not result in any identifiable adverse human health effects. Therefore, there would be no direct or indirect adverse effects on any minority or low-income population.
- The impacts associated with implementation of the preferred alternative would not disproportionately affect any minority or low-income population or community.
- Implementation of the preferred alternative would not result in any identified effects that would be specific to any minority or low-income community.

The impacts on the socioeconomic environment resulting from implementation of any action alternative may have short-term minor adverse economic effects, but over the long term, effects would be beneficial. In addition, the park staff and planning team do not anticipate the impacts on the socioeconomic environment to appreciably alter the physical and social structure of nearby communities.

Wilderness

In 1974, Crater Lake National Park recommended 122,400 acres of lands within its boundaries be designated wilderness. Although the legislative process has not been completed for the park's wilderness designation proposal, it is NPS policy (2006 *NPS Management Policies*, "Chapter 6: Wilderness Preservation and Management") to manage recommended wilderness as wilderness until this process is complete. All proposed project work would occur within the existing road corridor and adjacent sideslopes within 100 feet of the centerline of the highway. Proposed elements of the project would not encroach into proposed wilderness area; therefore, there would be no direct disturbance to wilderness and

no future needed maintenance actions. Construction-related noise and disturbance would result in a local short-term negligible adverse effect on the natural quiet typically found in wilderness areas, but would have no long-term effects. The no action alternative would have no effect on wilderness. Because of the short-term negligible adverse effects on wilderness during construction and the absence of direct adverse effects on wilderness resources and values, this topic was dismissed from further evaluation in this EA.

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ALTERNATIVES

INTRODUCTION

This chapter describes the range of alternatives considered to address the problems described in Chapter 1. A "no action" alternative (alternative 1) is considered, as required by law, in order to establish a baseline against which the effects from the action alternatives will be compared. There are three action alternatives, of which there are two components: 1) a road component and 2) a rockfall mitigation component. The elements being considered in the road component are the same for all three action alternatives (2, 3, and 4). The rockfall mitigation component differs in each alternative by the level of effort implemented, ranging from only technical rock scaling in Alternative 2 to the most comprehensive level of effort in Alternative 4.

Should the no action alternative be selected, the NPS would continue to manage, operate, and maintain the road and rockfall slopes at the current level and would not rehabilitate the road. Under the no action alternative, rockfall areas would continue to be addressed by periodic manual scaling of lower slopes by park staff.

Alternative 3 presents the NPS's preferred management action and defines the rationale for the action in terms of resource protection and management, visitor and operational use, cost, and other applicable factors. The preferred management action is rehabilitation of Rim Drive and associated improvements, along with selective rockfall mitigation. The no action and action alternatives are also described in this section. In addition, other alternatives that were considered but eliminated from detailed analysis in this EA are discussed on page 46. Also included in this chapter is a comparison of how well the alternatives meet project objectives and a summary comparison of the environmental effects of both.

ALTERNATIVE 1 – NO ACTION

Under the no action alternative, the NPS would respond to future needs and conditions without major actions or changes in the present course. No work would be done apart from the road maintenance, asphalt patching and sealing, minor repairs, and snow removal as is currently being done. Road pavement and structural integrity would continue to deteriorate and the safety issues associated with narrow sections of road; non-uniform road width; bench erosion; lack of foreslopes; sharp dropoffs; and failing pavement would persist. Prevention of road failures would continue to rely on maintenance of the infrastructure including pavement, retaining walls, guardwalls, culverts, and ditches. Park staff would conduct periodic manual scaling of loose rocks on lower slopes bordering the road to reduce rockfall hazards. Scaling operations would be limited to sites that could be easily and safely reached from lifts due to the limitations of park equipment and personnel. Rock that falls on the road during winter and spring would be removed during snow removal operations. No Federal Lands Highway Program Funds would be expended for road rehabilitation, improvements, or rockfall treatment.

ROAD REHABILITATION COMMON TO ALL ACTION ALTERNATIVES

The following components for resurfacing, restoring, rehabilitating, and reconstructing Rim Drive are common to all three action alternatives — Alternatives 2, 3, and 4.

Design Elements

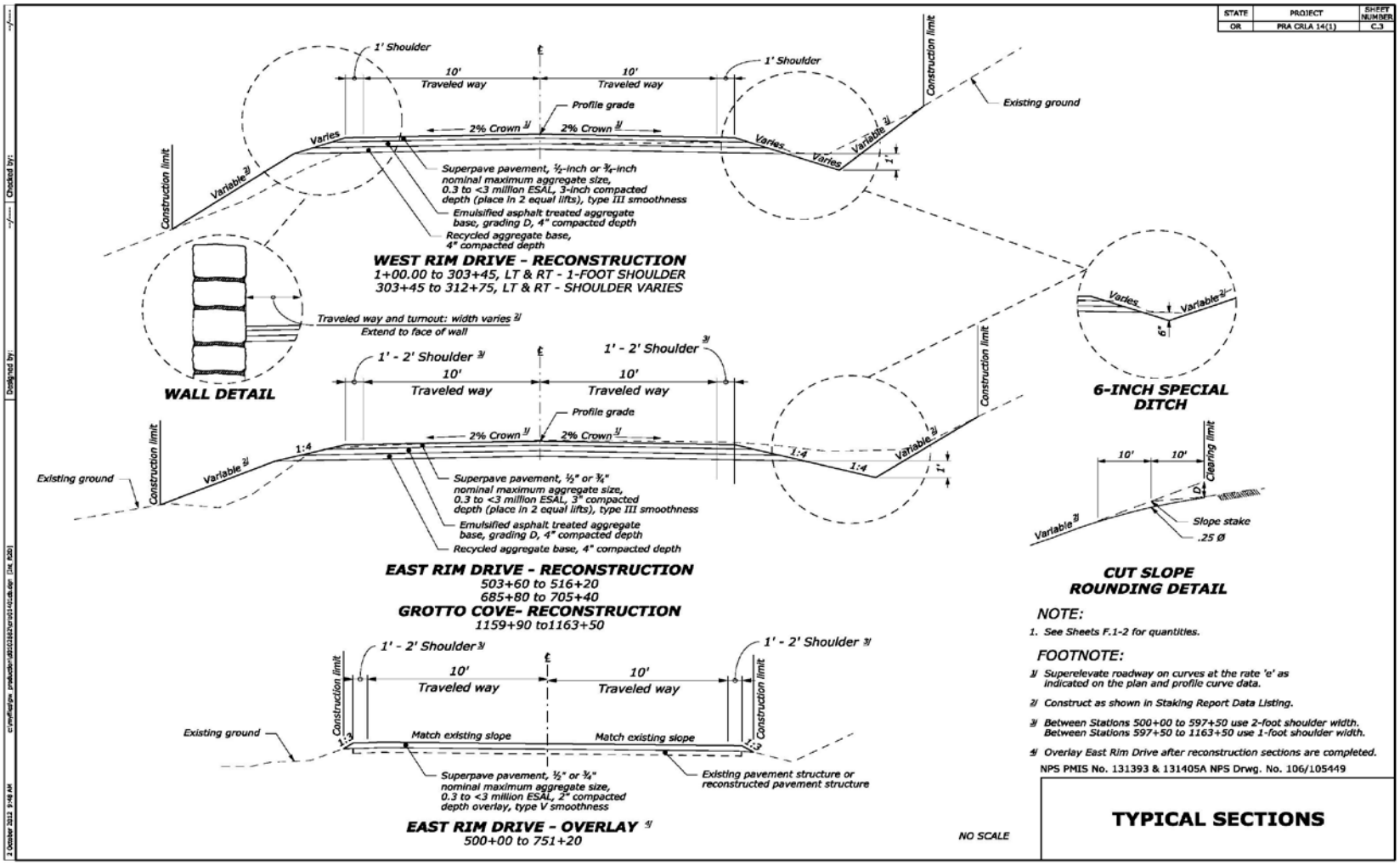
Road Width

The existing Rim Drive was originally constructed to a paved width of 22 to 24 feet. Erosion of the foreslope and raveling of the pavement edge has reduced the road width and created steep dropoffs in a number of locations. The proposed road rehabilitation includes restoring the paved width of the road to the original design of 22 or 24 feet (Figure 2).There would be two paved travel lanes with paved shoulders. Where the road is 22 feet wide, the travel lanes would be 10 feet wide with 1-foot shoulders, and where the road is 24 feet wide, the travel lanes would be 10 feet wide with 2-foot shoulders. The paved shoulders would be defined by a painted white edge line. The defined shoulders would not be wide enough to be considered a dedicated bicycle lane. To address erosion of the foreslopes, the slopes would generally be constructed at a ratio of 1 foot vertical to 3 or 4 feet horizontal, but may be steeper in some locations where needed to fit on the existing road prism. Additional fill material may be used at some locations to achieve sufficient foreslope width. The "Bench Erosion" section (page 24) provides additional discussion on measures that would aid in achieving adequate foreslopes. Proposed measures to improve safety on sharp curves may include a slight shift in the road alignment and widening pavement inside or outside of the curve as appropriate.

Road Subgrade Improvements

Several areas on Rim Drive have settled and downslope fill movement has caused subsidence and cracking in the pavement. To improve road stability at these locations, a section of deep patch would be installed prior to road paving. Deep patches require excavation anywhere from 1 to 6 feet of the subsiding section and replacement with compacted granular backfill with geosynthetic reinforcement. Each layer of reinforcement is wrapped around the overlying layer of backfill, and the free end is reembedded into the backfill.

FIGURE 2. ROADWAY TYPICAL SECTIONS



Road Realignment

Slight road realignment is proposed for three locations. First, at Slope 17, an approximate 10-foot shift onto the existing gravel pullout is proposed to increase the catchment area for rockfall (Figure 3). This would allow sufficient space to maintain a gravel pullout. Second, at Watchman Grade (Slope 30) (Figure 3), the fill slope is too narrow for the width of the pavement and the pavement is eroding on the inside of the curve. At this location, the road realignment would be shifted approximately 5 feet into the talus slope to the south, including lowering the grade to eliminate the need for extensive fill slopes to the north. Third, at Pumice Point, the road would be shifted approximately 10 feet into the cutslope, further away from two historic masonry walls at the bottom of the fill slope. Soil erosion and undermining of the masonry walls at the base of the slope has resulted in an unstable fill slope. Emergency repairs were implemented in September 2012 to provide temporary support to these masonry walls until the longer-term solution of a road realignment, addressed in this document, can be environmentally cleared and implemented. Slight shifts in road alignment, often in conjunction with profile adjustments, may be necessary at other locations along East and West Rim Drives to fit the proposed road template on the existing road prism.

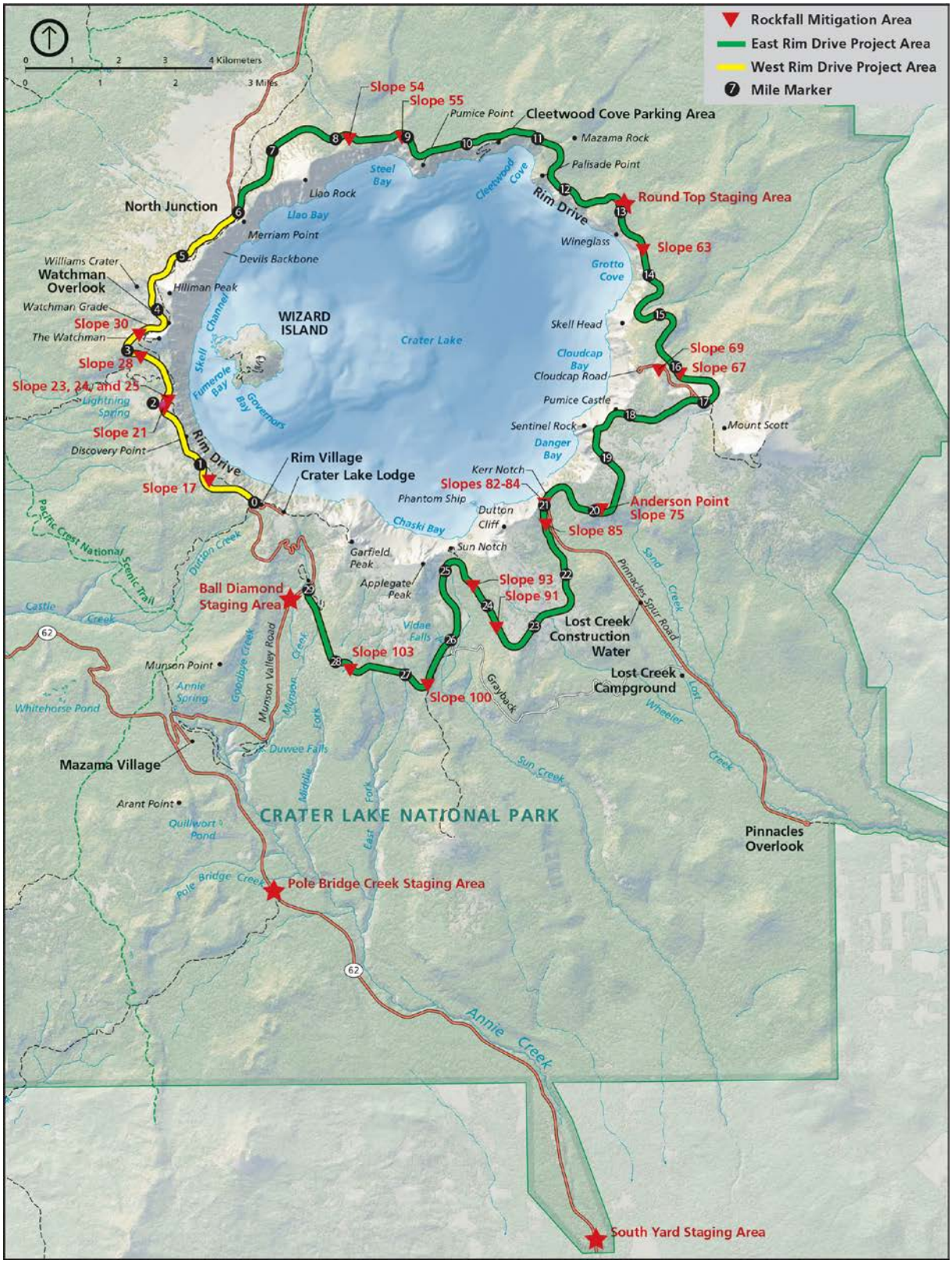
Bench Erosion

Multiple locations of roadway bench erosion have been identified along Rim Drive (FHWA 2010). Roadway bench is a general term that describes the excavated area on which the pavement structure (base aggregate and pavement) is placed. Bench erosion areas are those locations with reduced roadway bench width, resulting in broken pavement edges, and include areas with steep raveling slopes below the road. Bench erosion is caused by surface water runoff, wind erosion, and pedestrian traffic. Bench erosion also includes locations outside of the road prism where the stability of stone guardwalls or retaining walls has deteriorated because of erosion of the foundation material. Pavement edge break occurs at multiple locations on West Rim Drive because the roadway bench has eroded and is no longer wide enough to support the pavement surface.

A number of corrective actions to address bench erosion have been identified and the appropriate action depends on the site-specific conditions. All of the proposed work would be conducted to preserve the integrity, design characteristics, and craftsmanship of structural features. Repairs would meet the *Secretary of the Interior's Standards for Rehabilitation*, including reuse of original material, repairing and replacing features in-kind, and using compatible designs when adding new features. Following is an overview of the corrective actions anticipated for use in the project area.

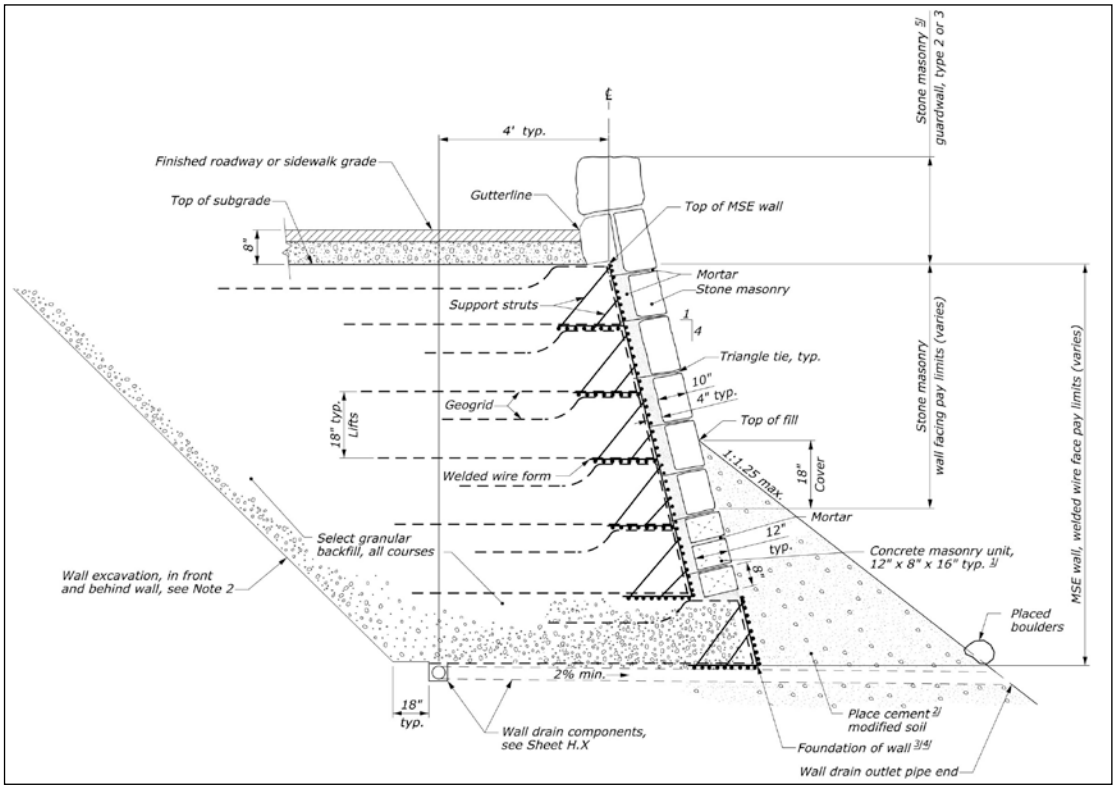
1. Micropile underpinning of stone masonry walls/guardwalls. This technique provides masonry wall deep foundation support by installing micropiles below future anticipated erosion depths.

FIGURE 3. RIM DRIVE PROJECT AREA



2. Mechanically stabilized earth (MSE) walls. MSE walls create lateral confinement and earth retention. Typically, MSE walls are constructed behind existing stone masonry walls, or native stone masonry facing is attached to MSE walls; thus the existing walls would have to be rebuilt (Figure 4).

FIGURE 4. MECHANICALLY STABILIZED EARTH WALL TYPICAL



3. Shoulder stabilization. Shoulder stabilization includes a variety of techniques including use of a rock inlay/blanket, which consists of course, angular cobbles and boulders set below the existing slope surfaces to create an erosion-resistant and confining mass. Usually larger rock (18-inch or larger diameter) is required at the base of the blanket. The blanket thickness varies from 3 to 15 feet. Shoulder stabilization could also include the use of a buried gabion basket or baskets covered with coarse rock and/or native soils (Figure 5). Native rock materials salvaged from rock clearing or scaling operations would be used whenever possible.

4. Concrete underpinning of stone masonry walls. The intent of this work is to fill in the undermined areas and provide vertical support. This is generally done by hand excavating a support bench beneath the wall footing and filling it with shotcrete ("shot concrete") or concrete. Solid contact is developed between the bottom of the wall and the soil bench. Stone masonry facing is typically placed in front of the shotcrete or concrete.

5. Stone guardwall / retaining wall construction. Walls are used for lateral confinement and earth retention. The wall relies on self-weight to resist overturning and sliding due to the lateral stresses of the retained soil and is generally several stones wide at their base and one or

two stones wide at the top. These walls are constructed from stone in horizontal layers. The stone sizes are variable but would be similar in size to existing walls in the park. In locations where additional structural stability is needed or to improve crash worthiness, a wall may be constructed of a cast-in-place concrete core with a native stone veneer.

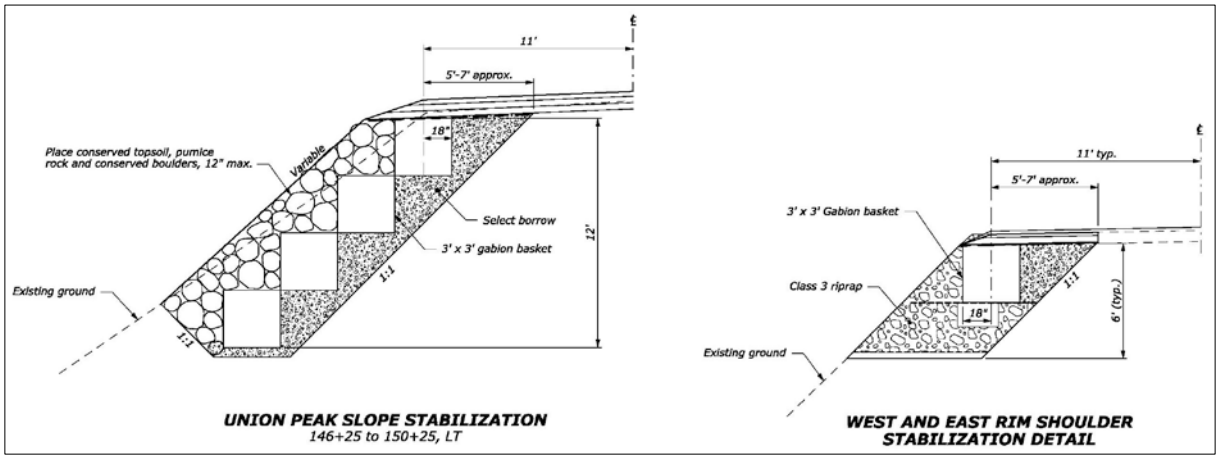
6. Rock fills. Rock fills are similar in function to a rock inlay. Embankments are widened with rock fills to provide more road width overall to support new shoulders and also to provide confinement of the existing slopes.

7. Lower road grade. This technique involves lowering the existing road grade through excavation in order to obtain the needed width for the road and the necessary support. Lowering the road grade reduces the need for expanding the fill slope to achieve adequate width for the road base.

8. Alignment shift. The intent is to move the road centerline away from problematic slopes. As previously described, road alignment shifts are proposed for Slope 17, Watchman Grade, and Pumice Point. Additional road alignment shifts may be necessary in conjunction with profile adjustments to best fit the road template while minimizing fills.

9. Mortar repointing. Mortar repointing may be needed at some sites. This consists of chiseling away deteriorated and debonded mortar from wall/guardwall joints. Fresh mortar is then placed in the wall joints and raked to match the original wall construction.

FIGURE 5. SHOULDER STABILIZATION



Skell Head Overlook Retaining Wall

The Skell Head Overlook is at the top of a west-facing slope above Crater Lake at a pullout off East Rim Drive (Figure 3). The overlook is bordered by a historic stone masonry retaining wall where erosion at the toe of the wall is undermining the foundation and causing distress that could result in wall failure. The primary distress to the retaining wall appears to be due to undermining of the foundation (Cornforth Consulting 2012a). The existing stone masonry structure has undergone settlement and has cracked. The pumice and sand that comprises much of the slope below the wall is easily eroded by wind and flowing water. To

address these issues, the foundation for the existing masonry wall needs to be deepened or protected by other means to prevent erosion from undermining it, and surface drainage improvements are needed to direct snowmelt away from the retaining wall.

The proposed measures to protect the wall include periodic inspections to identify undermined locations and underpin as-needed to restore support to the masonry wall foundation. A deep patch would be constructed to a depth of approximately 5 feet behind the existing wall to reduce earth pressures. The underpinning would be performed by stone masons filling foundation cavities with new stone. The appearance of the wall face would continue to be inconsistent with the historic upper portion of the wall. There is a risk of wall collapse if undermining or excavation causes stones to detach. Repairs could be necessary every 5 to 10 years. The majority of the work would be constructed using the portion of the access road southeast of the overlook to minimize disturbance to vegetation and sensitive plant species. The surface area disturbance, including existing paved areas, would be about 18,000 square feet with about 1,800 square feet of subsurface disturbance.

Proposed work on the Skell Head retaining wall would involve the following steps:

- Excavate and construct a deep patch behind the wall, with possible use of a chemical jet grouting in the exposed foundation to solidify the materials beneath the existing wall.
- Reconstruct the sidewalk impacted by deep patch construction. Slope the sidewalk away from the wall to prevent surface water from infiltrating behind the retaining wall.
- Excavate below the wall in small sections by hand to insert new stone into undermined cavities, with possible use of shotcrete flashcoat for each excavation segment. Apply mortar between underpinning stones.
- Repoint existing masonry as needed.
- Restore the appearance of slopes disturbed by construction activities.

Drainage

Some of the existing culverts are rusted, damaged, and clogged with debris. Culverts, inlets, and stone masonry headwalls would be cleaned and inspected to restore drainage where required. Riprap splash pads, riprap-lined chutes, or drain pipes would be installed, as needed, on culvert outlets to control erosion. New culverts may be installed or existing culverts replaced where culverts are damaged or drainage deficiencies have contributed to road foundation instability, road embankment erosion, or traffic safety hazards. Culvert linings may also be installed where culverts are deep (more than 15 feet).

At several roadway pullouts and parking areas, runoff from large paved or gravel areas drain toward the lake. The runoff is typically collected and concentrated along graded low points, curbs, or wall faces. The concentrated runoff is then released down the steep embankments near the ends of the pullouts and parking areas, or at the ends of curbs and walls. The higher flow velocities produced by the concentrated runoff has caused erosion of the embankments at these locations. This has resulted in undermining of pavement and walls

which has been a continual park maintenance issue. Pullouts and parking areas would be regraded where possible to redirect runoff away from the lake or allow water to sheet flow off the paved areas at much slower velocities to reduce erosion toward the lake. At the Discovery Point parking area and the Steel Bay pullout, interceptor ditches and cross drains would be added at the ends of the walls and curbs to redirect existing concentrated runoff away from the lake to the other side of the road. As the design progresses, other cross-culverts directing stormwater discharge away from the caldera may be incorporated as appropriate.

New culvert installation would maintain historic design and materials according to the *Secretary of the Interior's Standards for the Treatment of Cultural Landscapes*, including similar stone blocks for headwalls and endwalls. Any repair of existing culvert headwalls and endwalls would retain the original materials whenever possible, and replacement blocks would be of the same or similar material. Headwalls located down the fill slope would be reconstructed in-kind, if necessary. In some cases, a headwall may be heightened to match the new vertical grade that is higher than the existing road. New stone would match the type and color used in existing stone structures; exposed surfaces would be clipped and feathered and the edges rounded to match the historic finish.

Pullouts and Parking

Existing pullouts along Rim Drive would either be maintained or obliterated and reclaimed. Approximately 15 pullouts on West Rim Drive and 10 on East Rim Drive would be obliterated and the areas would be scarified and revegetated. All other existing paved pullouts would be repaved as part of the road improvements. Existing gravel pullouts would remain gravel, with the exception of the Lightning Springs trailhead pullout and the pullout across from the Watchman Overlook visitor area, which would be paved. In some locations, pullouts would be shortened or narrowed as appropriate. No new pullouts are proposed because of the potential for resource impacts.

The Rim Village and Crater Lake Lodge parking lots would be repaved, accessible parking stalls installed adjacent to roads and parking areas, access routes updated to current standards, and appropriate drainage measures employed to treat stormwater discharge. Several additional improvements may be included, if there are sufficient funds. These additional improvements include: 1) replacing existing stone curbing, 2) replacing existing signs, and 3) reconstructing sidewalks. For stone curb replacement, stone curbing design elements and materials would be conserved during refurbishment or replacement. Cracked or broken existing stone curbs would be replaced with conserved and stockpiled materials. Signs would also be replaced in-kind. Parking lot construction would occur over one season. To better accommodate visitors to Rim Village, construction would be limited to no more than two months during the peak season periods of either June and July or August and September. To facilitate work in the Rim Village parking lot, visitor traffic would be routed through the picnic area southwest of Crater Lake Lodge.

Cleetwood Cove (Figure 3) is the only location in the park that provides access for visitors to reach the lake via a hiking trail. Scenic boat tours are also operated from the lake access at this location. Currently the Cleetwood Cove parking lot has about 98 parking

spaces, which is inadequate to meet demand during the peak visitor season. Studies in 2001 indicated the Cleetwood Cove parking lot remains at or above capacity from about 11:00 a.m. to 3:00 p.m. during peak visitor use periods in August (NPS 1999). As a result, cars frequently park along the shoulder of Rim Drive, which damages natural resources, creates a safety concern, and diminishes the scenic driving experience.

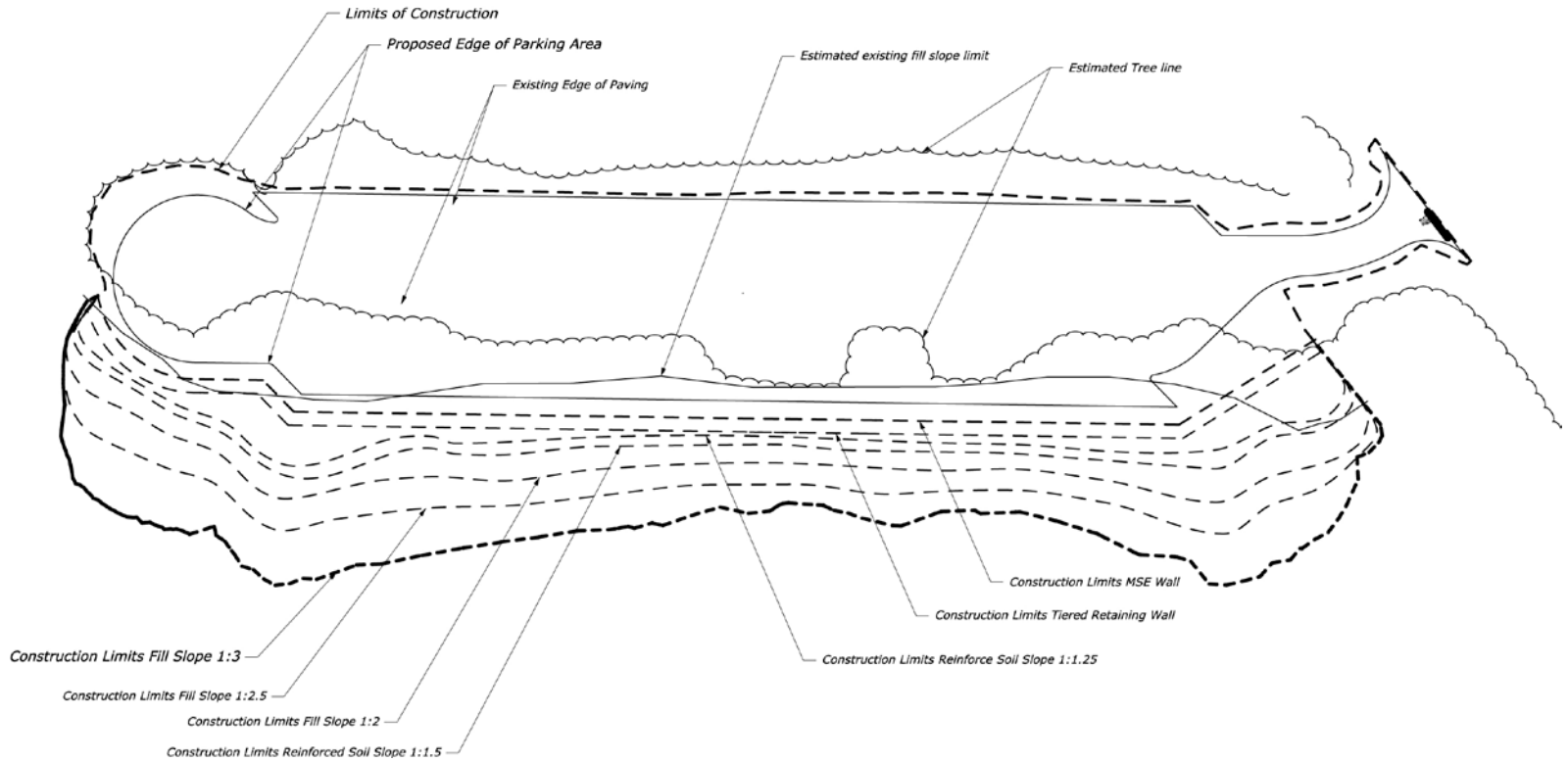
The existing Watchman Overlook parking area would be fully to partially rehabilitated to address pavement deterioration, damaged curbs, sidewalks, drainage, and accessibility. Two accessible parking spaces would be added. The entire parking area would be repaved with appropriate drainage improvements incorporated. Relocation of an interpretative kiosk may be required. All work would be conducted within the footprint of the existing parking area.

To address these issues, the park proposes to improve the parking capacity at Cleetwood Cove by enlarging the parking lot. Proposed improvements include an enlargement of the parking lot on a fill slope to the south to accommodate a total of 151 standard parking spaces and 6 accessible parking spaces (Figure 6). Four rows of angled parking would be used with one-way traffic circulation. Improvements would include measures to improve traffic and pedestrian circulation, and accessibility. The return loop at the end of the parking lot would be large enough to accommodate a turnaround by recreational vehicles and buses. The existing temporary ticket booth and restroom facilities would be replaced by permanent structures. Informal parking areas on the shoulder of Rim Drive immediately east and west of the Cleetwood parking entrance would be reclaimed and future parking in these areas discouraged.

Several design options for embankment treatment are being considered. All options would provide about the same parking capacity, but include different fill slope treatment and possible use of tiered retaining walls or an MSE wall. The area of new disturbance for the different embankment treatments ranges from about 0.25 to 1.6 acres (Figure 6). Options with a small steep fill slope reduce the area of tree removal, but are harder to revegetate, while larger, gentler fill slopes impact more trees, but are easier to revegetate. Retaining wall options are more expensive than fill slope options. The 1:3 Soil Embankment option would have the greatest area of impact to previously undisturbed areas and would be used for resource analysis purposes. Under this option, parking lot expansion would disturb about 1.6 acres outside of the existing parking lot footprint. The fill slope would be revegetated with native plant species following construction. Small trees and shrubs would be salvaged, as feasible to aid in revegetation of disturbed areas. The proposed improvements to the Cleetwood Cove parking area were designed to provide adequate parking for visitors, improve safety, and restore the historic driving experience by eliminating overflow car parking along Rim Drive. An embankment treatment option would be determined during final design.

FIGURE 6. CLEETWOOD COVE PARKING AREA PLAN

Embankment Type	Total Construction Area (Acre)	Estimated Area of new Disturbance (Acre)	Estimated Area of Tree Vegation impacted (acre)
1:3 Soil Embankment	3.58	1.6	2.05
1:2.5 Soil Embankment	3.16	1.17	1.63
1:2 Soil Embankment	2.87	0.88	1.34
1:1.5 Granular Rock Slope	2.62	0.64	1.09
1:1.25 Corse Rock Slope	2.51	0.52	0.97
Tiered Retaining wall with rockery facing	2.33	0.38	0.79
MSE Retaining Wall with masonry facing	2.18	0.25	0.65



Pavement

The surface asphalt of the 29.4-mile Rim Drive is deteriorating and exhibits lateral cracking, ruts, and severe raveling of the road pavement edge. To repair West Rim Drive, the existing pavement would be removed and stockpiled. Base rock would be placed after the roadbed is shaped to the appropriate grade. The removed and stockpiled pavement would be recycled into a stabilized base layer with appropriate additives to provide a stable cohesive mixture and then placed on top of the base rock. A final driving surface of hot mix asphalt would then be placed. East Rim Drive would have localized distress areas repaired and have an overlay of hot mix asphalt. Paving would conform to the guidelines in the Cultural Landscape Report (Mark and Watson 2009), which stipulates for bituminous paving that is distinct in color between the road surface (gray) and parking areas. East Rim Drive would include areas of subsurface reconstruction prior to milling or pulverizing the existing asphalt in place and a new asphalt overlay. Treatment options and asphalt depth would vary with site-specific conditions. A topsoil aggregate mix would be selectively applied along the foreslope of repaved road segments where revegetation is appropriate. Road shoulders would then be revegetated with native plant genotypes. Similar paving techniques would be applied to Cloudcap Road (Figure 3), parking areas, and pullouts. Road repavement would be conducted after all other road repairs and rockfall treatment is completed, but may be conducted in phases, depending on completion of other road rehabilitation and rockfall treatment work.

Signage

Existing signs within the project area would be removed and reset on new posts or removed and replaced as appropriate. All signs would use high-visibility material and breakaway posts for safety. Standard centerline and edge striping would be used for all road segments.

Staging Areas

Temporary staging areas for storage of equipment and materials, as well as areas for rock crushing, would be needed during construction. The principal staging areas would be located within areas of existing disturbance at Pole Bridge Creek, South Yard, Ball Diamond, and Round Top Quarry, an inactive quarry site (Figure 3). These areas are currently being, or have been, used in the past for storing material from rock scaling operations and other material in support of park maintenance operations. Pullouts and parking areas along Rim Drive may be used to temporarily store equipment or materials. Existing paved areas at Skell Head would be used for construction staging during retaining wall repairs, which would require closure of visitor access during construction. To facilitate rehabilitation work of the Rim Village parking lot, the adjacent Picnic Hill parking lot would be developed as a detour to access Crater Lake Lodge.

Construction Water

Water would be needed during construction for dust control and other construction operations. Pole Bridge Creek, Lost Creek, or developed sources of water would be used for construction activities and could include water from the municipal water supply that feeds into a point in Mazama Village, or water would be transported from sources outside of the park.

Lost Creek provides a potable water supply for the Lost Creek campground. A recently completed potable water line serves the campground and a separate nonpotable pipeline was installed in the same trench to provide a construction water supply for work on Rim Drive. A permanent gravel pad approximately 20 feet by 50 feet would be constructed to provide a location for tanker trucks to fill at the nonpotable water outlet. The gravel pad would be constructed in an area of low-density lodgepole pine forest off the Pinnacles Spur Road (Figure 3).

Water for work on the north section of Rim Drive may be trucked in from Diamond Lake or other developed sources outside the park.

Construction Phasing

Roadwork on the 29.4-mile Rim Drive would not take place all at once, but would occur in phases over several years, depending on available funding. Construction work on West Rim Drive and East Rim Drive from North Junction (MP 5.9) to Cleetwood Cove (MP 10.7) is the highest priority because of the condition of the road and the greater volume of visitor traffic (Figure 3). Rehabilitation of the remainder of East Rim Drive may not occur for up to 7 to 10 years. Rockfall mitigation would be conducted prior to road rehabilitation work for any given segment as described for Alternatives 2, 3, and 4.

Traffic Control and Scheduling

East and West Rim drives would remain open during road rehabilitation and rockfall treatment work, subject to temporary traffic delays and periodic closures. High annual snowfall in the park limits most of the road construction and rockfall mitigation work to the period between June and October. It may be possible to work on some sections of the road in early summer where snow is cleared early prior to opening the road to the public. Otherwise, most of the work would be conducted during the summer and early fall, which coincides with the highest park visitation. Much of the road construction work would require closure of one lane. Deep patch work, wall and structural embankment construction, and some of the rockfall mitigation work would necessitate temporary closures. The combination of the relatively steep adjacent topography with the size of construction equipment needed necessitates temporary road closures to ensure the safety of the traveling public and park staff in some locations. To minimize the potential impact on visitors traveling through the park while still implementing road and rockfall work as efficiently as possible, the park would use the following traffic control guidelines.

East and West Rim drives and access to Rim Village and Crater Lake Lodge would remain open during construction subject to the following restrictions:

- Roadwork and rockfall mitigation would be conducted to the extent practicable with one lane closure and alternating one-way traffic. One-way traffic may be used as a temporary measure on East Rim Drive. Delays would be no more than 30 minutes on each of the East and West Rim drives.
- Temporary road closures may be needed for some areas of rockfall treatment or roadwork where closure of both lanes is necessary to complete the work. Road closures would be limited to Monday through Thursday and would be announced to the public well in advance.
- Night work may be implemented throughout the project area. If night work involves full road closure, the road may be closed up to a maximum of 10 consecutive hours at a time.
- In the event that full road closure is implemented (either day or at night), a signed detour would be used for travelers and a pass-through would be required for emergency vehicles.
- No night work would be allowed within 1 mile of Crater Lake Lodge or between mileposts 19 to 22 to avoid impacts on visitors at the Lost Creek campground.
- Existing road shoulders wide enough to accommodate traffic would be used as feasible to route traffic around work zones.

The park would implement a number of steps to provide timely and accurate information to visitors during roadwork to maintain a quality visitor experience. The park would provide clear and concise information on the status of construction work and any traffic delays. To facilitate visitor planning, the status of roadwork and traffic delays would be advertised one to two weeks in advance and updated daily. The status of road construction and travel restrictions would be communicated via a number of outlets: the park website, regional newspapers, radio, entrance stations, visitor centers, news releases, local newspapers, media outlets, and other locations.

Sustainability

The NPS has adopted the concept of sustainable design as a guiding principle of facility planning and development (NPS 2010c). The objectives of sustainability are to design park facilities to minimize adverse effects on natural and cultural values, to reflect their environmental setting, and to maintain and encourage native biodiversity; to construct and retrofit facilities using energy-efficient materials and building techniques; to operate and maintain facilities to promote their sustainability; and to illustrate and promote conservation principles and practices through sustainable design and ecologically sensitive use. Essentially, sustainability is living within the environment with the least impact on the environment. The action alternatives subscribe to and support the practice of sustainable planning, design, and use of Rim Drive by limiting and mitigating resource impacts and promoting conservation

principles by recycling pavement materials. In addition, the use of native stone in the construction and rehabilitation of guardwalls reduces the fossil fuels needed to haul in rock from outside sources and limits the spread of noxious weeds.

ROCKFALL TREATMENT

A rockfall hazard engineering study was conducted by the Western Federal Lands Highway Division for East and West Rim drives and adjacent spur roads in the park (FHWA 2010) to identify areas of persistent rockfall and recommend treatment. The study provided an inventory of slopes and assigned a hazard rating to each based on the Rockfall Hazard Rating System (RHRS) developed by the Oregon Department of Transportation (Pierson 1991). The RHRS assigns a numerical value to each slope based on the level of risk for rockfall. The higher the numerical rating, the greater the risk for rockfall. The RHRS employs a systematic procedure that includes such features as slope height and length, geologic factors, rock or block size, ditch width, road width, sight distance in both directions from the rockfall site, average daily traffic, and maintenance history of rockfall to rate rockfall hazards. The RHRS score provides a basis for prioritizing slopes for mitigation.

The engineering study evaluated 106 slopes in the park and classified 15 slopes as high rockfall hazard areas, 10 as medium rockfall hazard areas, and the remainder as low or very low rockfall hazard areas. Some of the rated slopes are outside of the proposed project area and would be addressed by the park with standard rock scaling or other measures as a separate project.

Several levels of treatment are being considered to address rockfall areas. Alternative 2 includes conducting technical rock scaling operations at high and medium hazard rockfall sites. Alternative 3 includes the same scaling measures as Alternative 2, plus a combination of additional rockfall mitigation techniques at two select locations that were identified as high risk areas. Alternative 4 includes the same scaling measures as Alternative 2, plus implementing FHWA-identified treatment actions at 21 high and medium risk rockfall hazard slopes in the project area (Figure 3). Rockfall mitigation would be conducted prior to initiating adjacent road rehabilitation work because of the potential for rockfall work to damage the road.

Additional rockfall mitigation would be provided by the lane shift described previously for rehabilitation work at Slope 17. In this location, the road would be shifted approximately 10 feet onto the existing gravel pullout, allowing the creation of a wider catchment ditch at the base of the slope to contain rockfall and reduce the potential for rocks to reach the road. The following section provides a description of the rockfall treatments proposed for each of the action alternatives.

Alternative 2 – Rehabilitation of Rim Drive with Rock Scaling

Components for resurfacing, restoring, rehabilitating, and reconstructing Rim Drive are identical to those described above as common to all action alternatives beginning on page 22.

Rock scaling is defined as the removal of loose, broken, and detached or partially detached rock from a slope. Scaling is typically slow, labor-intensive work and the results of scaling operations are somewhat proportional to the skill and experience of the scalers. It is usually not possible to remove all of the loose rock that is present on a slope by scaling and, depending on the geology and weathering of the rock being scaled, slope aspect, and climatic factors affecting a slope, loose rock may regenerate within a period of a few years, requiring the slope to be scaled again.

Manual rock scaling can be performed using hand tools such as picks, pry bars, and shovels. Manual scaling is typically conducted by laborers supported on ropes or cables anchored at the top of the slope (Figure 7). Mechanical rock scaling includes use of excavators, cranes, or other machines capable of providing access to rock slopes and prying, pushing, or lifting loose and broken rock from the surface of a slope. Scaling large blocks that are too high to reach with mechanical equipment may be accomplished during manual scaling by placing a rubber bladder in an open fracture and filling it with air to expand the bladder and push the block away from the slope.

FIGURE 7. MANUAL ROCK SCALING

Periodic scaling is needed in the park on many of the rock slopes adjacent to Rim Drive. In order to be effective, the FHWA recommends periodic scaling of individual slopes every six years. Under Alternative 2, manual and mechanical rock scaling would be used, in addition to the ongoing scaling of lower slopes conducted by park maintenance staff, to reduce potential rockfall. Rock scaling would be performed at approximately 21 high and medium hazard slopes along Rim Drive within the project area (Figure 3). Rock scaling at these locations is more technical than the park is able to conduct under their routine manual scaling as described for the no action alternative, and would require larger equipment and specialized skills.

Alternative 3 – Rehabilitation of Rim Drive with Selective Rockfall Mitigation

Components for resurfacing, restoring, rehabilitating, and reconstructing Rim Drive are identical to those described above as common to all action alternatives beginning on page 22.

Alternative 3 includes the rockfall scaling measures described for Alternative 2 plus implementation of specialized rockfall mitigation measures to stabilize eroding slopes at two locations. Additional rockfall mitigation measures for this alternative include the use of rock bolts, colored and sculpted shotcrete, buttressing, and anchored wire mesh. A combination of these treatments would be used at Anderson Point (slope 75) and Dutton Cliff (slope 82) to assess the effectiveness of these techniques (Figure 3). If these measures prove effective at

these locations, the park may consider use of these techniques at other locations in the future. Additional environmental compliance would be conducted, if rockfall mitigation techniques are expanded to other locations. Following is a description on the use of these rockfall mitigation measures for the two sites.

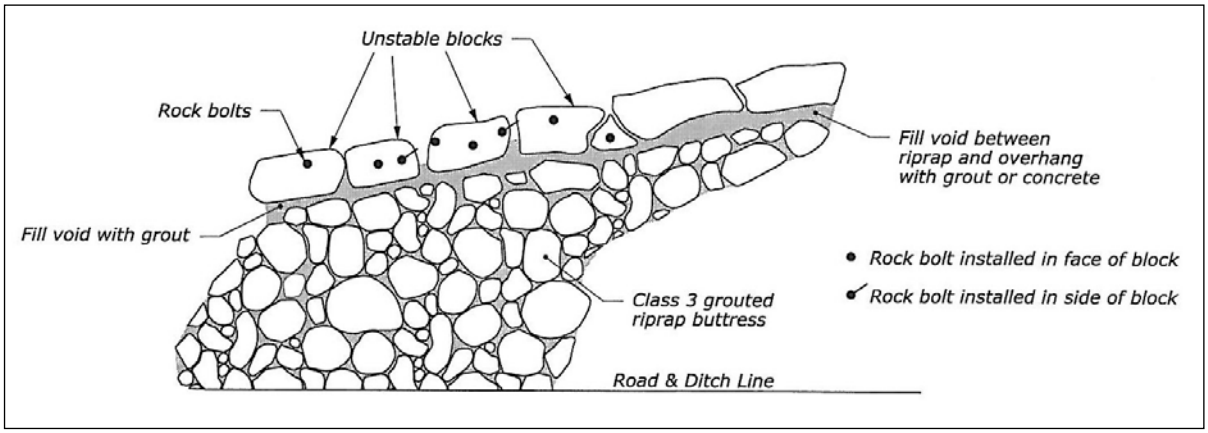
FIGURE 8. ANDERSON POINT ROCKFALL MITIGATION TREATMENTS

Anderson Point (Slope 75)

Anderson Point consists of a vertically fractured and jointed, blocky andesite lava flow that is underlain by a layer of volcanic agglomerate that extends down to the ditch ((Figure 3 and Figure 8). Erosion of the agglomerate has left a large unsupported rock overhang several feet above the ditch. Unless stabilized, there is a high potential for one or more of the blocks to fall out of the slope, which could result in the collapse of a large portion of the overlying rock mass, causing damage to Rim Drive. The proposed treatment for this site includes installing a grouted riprap buttress against the backslope beneath the overhanging rock from the bottom of the ditch up to the underside of the overhang to reestablish support of the undermined blocks.

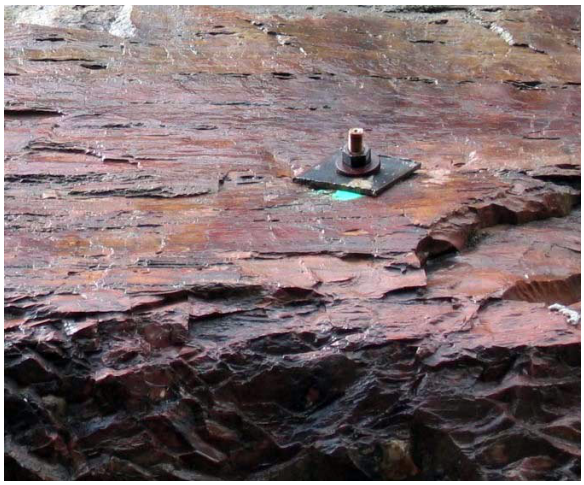
Buttressing is a technique used to stabilize the rock slope where a ledge of potentially unstable rock has developed as a result of erosion of the underlying support material. The space beneath the rock to be buttressed would be filled in with a grouted rock mass in such a manner that the buttress is in contact with the underside of the ledge to be supported (Figure 9). Following rock placement, grout would be injected into the voids in the face of the buttress rock to bind the rock as a uniform mass. The space between the top of the buttress rock and the underside of the ledge being supported would also be filled with grout to create a positive contact between the buttress and the overlying rock. Native rock, similar in color and texture to surrounding material, and colored grout would be used in construction of the buttress.

FIGURE 9. ROCK BUTTRESS DESIGN FOR ANDERSON POINT SLOPE 75



In addition, there are multiple locations at Anderson Point where large and potentially unstable blocks of rock would be stabilized with rock bolts. **Rock bolts** are steel tendons that are installed through blocks of rock that are separated, or could become separated, from the rock mass behind or below. Rock bolts serve to hold the blocks in place on the slope and help stabilize the surrounding rock mass. Rock bolts are typically 15 to 30 feet long and are installed by drilling a hole slightly larger than the diameter of the bolt to a depth equal to the length of the bolt plus several inches. The bolt is inserted into the hole and the length of bolt behind the joint or fracture separating the block from the main rock mass behind is grouted into place (Figure 10). After the bolt has been grouted, a steel plate and nut are attached to the end of the bolt protruding from the face of the block being stabilized, and the bolt is tensioned to a predetermined stress designed to permanently hold the block in place. Following tensioning, the remaining length of bolt is grouted to permanently hold tension in the bolt and protect the bolt from corrosion. Because they are tensioned, rock bolts provide active support of rock blocks. In highly visible locations rock bolts would be concealed by removing the nut and bearing plate from the bolt and cutting the exposed end of bolts flush with the rock surface. Any ungrouted annular space around and on top of the bolt would be filled with grout colored to match the surrounding rock (Figure 11).

FIGURE 10. EXPOSED ROCK BOLT



Anchored wire mesh would be used on a section of upper slope in an area where active erosion is causing cobbles and boulders to roll down the slope and launch into the road from the top of the cliff. **Anchored wire mesh** uses a blanket of wire mesh held tightly against a slope with soil or rock anchors (Figure 12). The anchors are installed into predrilled holes to depths of 10 feet or more and subsequently filled with cement grout or epoxy resin to hold them permanently in place. Blankets of wire mesh fabric are attached to the nails and tensioned tightly against the slope so that loose rock or granular materials are held in place. The wire mesh can be coated or colored to help blend in with the slope, and vegetation that grows through the mesh can be established after the mesh is installed to help conceal it from view. Depending on site conditions, an erosion-control mat can be placed beneath the wire mesh to help prevent loss of small-sized material and promote vegetation.

FIGURE 11. GROUT COVERED ROCK BOLT

FIGURE 12. ANCHORED WIRE MESH EXAMPLE

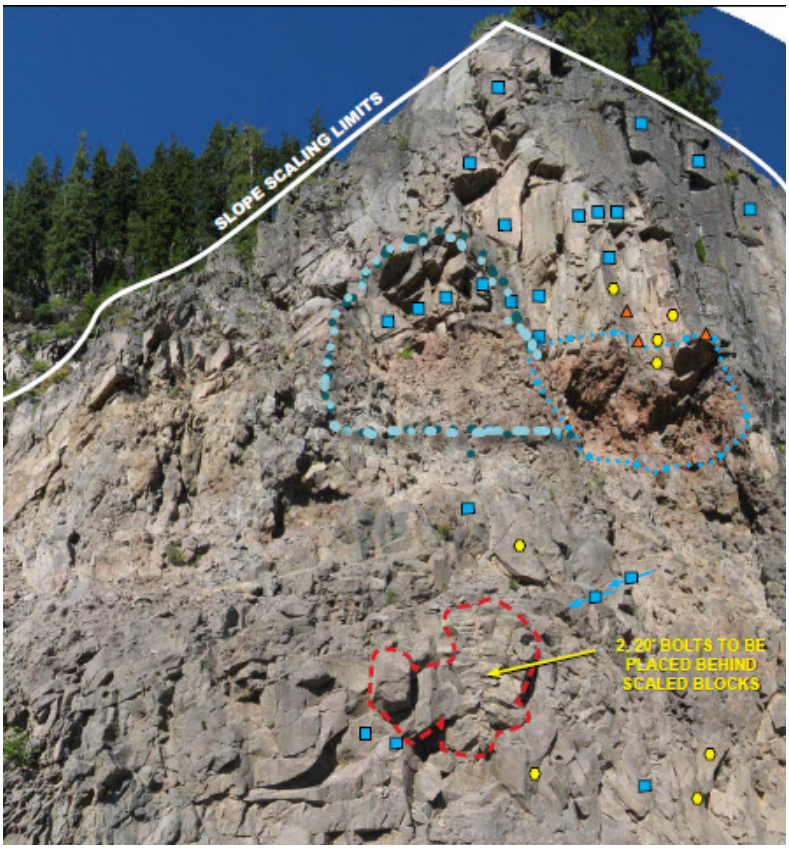
Dutton Cliff (Slope 82)

Dutton Cliff is a 2,300-foot-long section of steep rock cliffs rising several hundred feet above East Rim Drive (Figure 3). The road at Dutton Cliff occupies a narrow bench between the base of the cliffs above the road and a steep slope below the road that extends downhill several hundred feet to Pinnacles Road. A stone guardwall along the outside shoulder of the road has been damaged by rockfall and many sections of the wall are broken or missing completely. Slope 82 is an approximate 350-foot section along Dutton Cliff with a high hazard rating for rockfall (Figure 13). The proposed treatment for this section includes installation of multiple rock bolts to stabilize large blocks that are separated from the main rock mass by open fractures. Rock bolt installation would be similar to that described previously for Anderson Point.

In addition, about 1,000 to 1,500 square feet of colored shotcrete would be applied to a pocket of reddish volcanic agglomerate about 60 to 70 feet above the road to stabilize an area where deeply weathered and highly fractured erodible materials is undermining competent rock. Shotcrete is used to stabilize localized areas of broken and fractured or deeply weathered rock. Shotcrete would be applied, or "shot," under pressure from a pump onto the surface to be stabilized. An architectural layer would be applied to the surface of the

shotcrete and would be colored and textured to match the surrounding rock or ground. The shotcrete is usually applied as a 3- to 4-inch-thick structural layer overlain by the 1- to 3-inch-thick architectural, textured layer (Figure 14). Small weep holes would typically be drilled through the shotcrete to allow water to drain from behind the coating.

FIGURE 13. DUTTON CLIFF ROCKFALL MITIGATION TREATMENTS



Implementation of rockfall mitigation at Dutton Cliff is expected to take approximately three to four weeks. Road closures would be necessary during rockfall work at Anderson Point and Dutton Cliff because of the need for a large crane that would occupy both travel lanes. Closures would be timed to minimize impacts on trolley service commercial tours. Thus, work would likely occur in the early season (early June and before) and/or late season (late September and after) depending on the weather. See page 33 for further information on traffic control and scheduling.

Alternative 4 – Rehabilitation of Rim Drive with Extensive Rockfall Mitigation

Components for resurfacing, restoring, rehabilitating, and reconstructing Rim Drive are identical to those described above as common to all action alternatives beginning on page 22.

Under Alternative 4, the park would implement a complete program of rockfall mitigation treatments at all of the high and medium hazard slopes in the project area (Table 2 and Figure 3). This would include first conducting the manual technical rock scaling measures described for Alternative 2 and then systematically implementing additional rockfall mitigation techniques such as rock bolting, buttressing, anchored wire mesh, and colored and sculpted shotcrete at approximately 21 slopes, including those described for Alternative 3. The number of sites involved would require several years to implement all of the rockfall mitigation treatments.

FIGURE 14. SHOTCRETE EXAMPLE

TABLE 2. ROCKFALL LOCATIONS AND TREATMENTS UNDER ALTERNATIVE 4

Slope Number	Slope Name	Slope Length (feet)	Treatment
17	Before Discovery Point	296	Scaling, rock bolts
21	—	465	Scaling
23 – 25	Wizard Island Overlook	243	Scaling, rock bolts, shotcrete
28	Union Peak Grade	1,568	Scaling, rock bolts
30	Watchman Cut	676	Scaling, rock bolts
54	—	417	Scaling, rock bolts
55	—	169	Scaling
63	Above Skell Head	364	Scaling, rock bolts
67	—	676	Scaling, rock bolts
69	Cloud Cap	338	Scaling
75	Anderson Point	449	Scaling, rock bolts, anchored wire mesh, buttressing
82-85	Dutton Cliff	1,610	Scaling, rock bolts, shotcrete, buttressing (buttress only at slope 84)
91	Upper Sun Grade	1,368	Scaling, rock bolts
93	Lower Sun Grade	2,260	Scaling, rock bolts
100	Old Crater Peak Trail	539	Scaling, rock bolts
103	—	306	Scaling, rock bolts

MITIGATION MEASURES AND BEST MANAGEMENT PRACTICES

To prevent and minimize potential adverse impacts associated with the action alternatives, mitigation measures and BMPs would be implemented during the construction and post-construction phases of the project (Table 3). General and resource-specific BMPs and mitigation measures for the project are listed below in Table 3. (Note: This list is not all-inclusive, as there would be additional mitigation measures included in the contractor's specifications.)

TABLE 3. MITIGATION MEASURES AND BEST MANAGEMENT PRACTICES

General Measures
• The FHWA Project Engineer would ensure the project remains within the construction limits and parameters established in the compliance documents and that mitigation measures are properly implemented. • Construction zones would be signed at approach points. No construction activities would be permitted outside the construction limits. • All protection measures would be clearly stated in the construction specifications/special construction requirements, and workers would be instructed to avoid conducting activities beyond the construction limits as defined by construction plans or marked limits. • Garbage, trash, and other solid waste associated with construction operations would be disposed of in bear-proof trash bins and disposed of weekly, or sooner if warranted, outside the park. • All tools, equipment, barricades, signs, surplus materials, and rubbish would be removed from the project work limits upon project completion. Any asphalt surfaces damaged during construction of the project would be repaired to original conditions. All demolition debris would be removed from the project site, including all visible concrete and metal pieces. This material would be disposed of outside the park at an approved location. • Contractors would be required to properly maintain construction equipment (i.e., mufflers) to minimize noise from equipment use. • Down cast lighting would be used for night work to minimize the impacts to lightscape. • A hazardous spill plan would be in place, stating what actions would be taken in the case of a spill, notification measures, and preventive measures to be implemented, such as the placement of refueling facilities, storage, and handling of hazardous materials. • All equipment on the project would be maintained in a clean and well-functioning state to avoid or minimize contamination from mechanical fluids. All equipment would be checked daily. • BMPs for drainage and sediment control, per a Stormwater Erosion and Sediment Control Plan, would be implemented to prevent or reduce nonpoint source pollution and minimize soil loss and sedimentation in drainage areas. Use of BMPs in the project area for drainage area protection would include all or some of the following actions, depending on site-specific requirements: o Keeping disturbed areas as small as practicable to minimize exposed soil and the potential for erosion. o Locating waste and excess excavated materials outside of drainages to avoid sedimentation. o Installing silt fences, temporary earthen berms, temporary water bars, sediment traps, stone check dams, or other equivalent measures (including installing erosion-control measures around the perimeter of stockpiled fill material) prior to construction. o Conducting regular site inspections during the construction period to ensure erosion-control measures were properly installed and are functioning effectively. o Storing, using, and disposing of chemicals, fuels, and other toxic materials in a proper manner.

Vegetation

- Orange construction fencing would be used around large trees and special status plant species and their habitat within construction limits to minimize the potential for inadvertent impact from heavy equipment during construction. Large trees and special status plant species would be avoided to the extent possible during construction.
- Ground surface treatment would include grading to natural contours, conserving and replacing topsoil, and, where necessary, hand seeding or planting. In some locations, topsoil placement and mulching with litter and duff would be the primary treatment. If insufficient litter and duff is salvaged from the project area, additional litter and duff may be gathered from adjacent areas on a small scale where approved by the NPS.
- A revegetation plan would be developed for disturbances outside of the existing road pavement.
- Remedial actions would include installing erosion-control structures, reseeding, conserving and replacing topsoil and/or replanting the area, and controlling nonnative plant species.
- Impacts on pumice grapefern, Crater Lake rockcress, and whitebark pine would be minimized through reseeding or salvage of existing plants in areas with favorable soils, sunlight, and other growing conditions, or other methods found to be effective.
- Reclaimed areas and propagation efforts for the pumice grapefern and Crater Lake rockcress would be monitored after construction to determine if reclamation efforts are successful or if additional remedial actions are necessary, as outlined in the revegetation plan developed by the NPS.
- Introduction of nonnative/noxious plant species would be minimized by implementing several BMPs, including:
    - Minimizing soil disturbance.
    - Ensuring construction personnel make daily checks of clothing, boots, laces, and gear to ensure no invasive plant propagates and/or off-site soil is transported to the worksite.
    - Pressure washing and/or steam cleaning all construction equipment to ensure all equipment and machinery are cleaned and weed free before entering the park. Construction equipment would be inspected by FHWA staff prior to entering the park to ensure compliance with cleanliness requirements; inadequately cleaned equipment would be rejected.
    - Covering all haul trucks bringing fill materials (excluding asphalt) from outside the park to prevent seed transport and dust deposition along the road corridor.
    - Limiting vehicle parking turnouts to existing roads, parking lots, or access routes.
    - Limiting construction staging to existing roads, parking turnouts, and other designated areas – no machinery or equipment should access areas outside the construction limits.
    - Obtaining all fill, rock, or other earth materials from the project area, if possible. If not possible, obtaining weed-free earth materials from approved sources outside the park or sterilizing imported soils through heat treatment.
    - No hay or straw bales would be used during revegetation or for temporary erosion control.
    - Initiating revegetation of disturbed sites immediately following construction activities.
- To maximize vegetation restoration efforts after completion of construction activities, the following measures would be implemented:
    - Salvaging available topsoil or the top several inches of native soil from construction areas for reuse during restoration of disturbed areas.
    - Incorporating native litter and duff layer in forested sites for replacement over salvaged topsoil.
    - The NPS would survey for and treat invasive plants prior to and three years after construction.

Wetlands

- Impacts on wetlands would be avoided and minimized to the extent practicable. No wetland fill would occur without authorization from the Corps and appropriate permitting under the Clean Water Act.
- Appropriate permits (404 permit and 401 certification) would be acquired should there be any impacts on wetlands.

Water Quality

- Sediment traps, erosion checks, and/or filters would be constructed above or below all culvert drains (if such drains are required) and in all other ditches before the water (runoff) leaves the project construction limits.
- At all cut and fill areas, erosion and sediment control would be implemented to minimize impacts on water quality.
- Stormwater presently discharged into the caldera would be redirected away from the caldera provided that this does not result in more than minor additional physical impacts.
- Surface restoration and revegetation of disturbed soils would be implemented to minimize long-term soil erosion.
- Water needed for construction and dust control would come from Pole Bridge Creek, Lost Creek, or existing developed water systems within the park or sources outside the park.

Soils

- Erosion and sediment control would be required (see the "General Measures" section).
- Topsoil or native soil would be removed from areas of construction and stored for later reclamation use. The topsoil would be redistributed as near the original location as possible and supplemented with scarification, mulching, seeding, and/or planting with native genotypes.

Wildlife

- NPS staff would inform construction personnel of the occurrence and status of special status species and would be advised of the potential impacts on the species and penalties for taking or harming a special status species.
- To reduce noise disturbance and limit impacts on breeding avian and mammalian species, all tree removal would be conducted from August 15 to March 1, where feasible. If trees need to be removed outside of this time frame, they would be identified for removal and evaluated for nesting or roosting use. If nesting or roosting is found, the tree would be left in place or removed outside of the breeding season.
- Construction personnel are prohibited from feeding or approaching wildlife.
- Construction personnel would report to park personnel any wildlife collisions within 24 hours of an incident.
- The construction contractor would implement a litter-control program during construction to eliminate the accumulation of trash. All food would be stored either within a secured vehicle (e.g., windows up or in a toolbox) or a bear-proof container on-site. Spilled food would be cleaned up quickly. Visitors in traffic delays would be instructed by NPS staff, when available, to not approach or feed wildlife.
- The clearing limits (construction limits) outside of the existing road prism would be clearly marked or flagged prior to construction. All construction activities, including staging areas, would be located within previously disturbed areas and fenced, if necessary.
- The following measures would be taken to limit noise and disturbance from vehicles and construction equipment:
    - All motor vehicles and equipment would have mufflers conforming to original manufacturer specifications that are in good working order and are in constant operation to prevent excessive or unusual noise, fumes, or smoke.
    - Use of air horns within the park would be limited to emergencies only.

Air Quality

- Dust control would occur, as needed, on active work areas where dirt or fine particles are exposed using water from Pole Bridge Creek, Lost Creek, developed sources, and sources outside the park.
- The contractor would not leave vehicles idling.
- Asphalt plants would be located outside the park. Small quantities of asphalt may be stored short term only at the designated staging areas.
- Construction debris would be hauled from the park to an appropriate disposal location.
- Visitors would be asked to not idle their vehicles while waiting for the traffic delay to be reopened.

Cultural Resources

- Known historic sites and isolated occurrences would be flagged and avoided during construction, and a NPS archeologist would be on-site during the entire ground disturbance near the site.
- All new stone masonry features or rehabilitation of an existing historic stone masonry feature would be in accordance with the *Secretary of the Interior Standards for the Treatment of Historic Properties* (1992), Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings per the PA.
- Contractor-selected, noncommercial areas outside of the project limits including, but not limited to, material sources, disposal sites, waste areas, haul roads, and staging areas, would not encroach upon sites listed or eligible for listing in the National Register. Written proof satisfactory to the NPS and the Oregon SHPO shall document, for compliance with section 106, that no historic properties would be affected because:
    - there are no historic resources present, or
    - there is no effect on historic properties.
- Should unknown archeological resources be uncovered during construction, work would be halted in the discovery area, the site would be secured, and the appropriate park staff would consult with the Oregon SHPO and affiliated tribes, if necessary, according to 36 CFR 800.13 and, as appropriate, provisions of NAGPRA.
- In compliance with NAGPRA, the NPS would also notify and consult concerned American Indian tribal representatives for the proper treatment of human remains and funerary and sacred objects should these be discovered during project construction.
- Archeological resources found within the construction area would be removed only by the NPS or their designated representatives.

Visitor Use and Experience

- A detailed traffic control plan, as described in the "Traffic Control and Scheduling" section of the "Alternatives" chapter would be implemented to minimize impacts on visitors and complete construction work as quickly and efficiently as feasible.
- Rim Drive would remain open throughout construction, subject to temporary delays or closures under Alternatives 2, 3, and 4.
- Access to Rim Village, Cleetwood Cove, trailhead parking lots, and other park attractions would remain open during construction, subject to traffic delays and parking limitations, although temporary closure of the Skell Head Overlook would be required for work on the retaining wall.
- The park would provide information (e.g., brochures, signs, telecommunication, and interpretive programs) to inform visitors, concessioners, and employees of alternative routes and the project schedule.
- Visitors would be notified when road closures or traffic delays would occur and information would be posted in neighboring communities, on the park website, at visitor centers, and at entrance stations.
- At the traffic delay locations and if conditions warrant, a NPS interpreter would be present to answer questions from visitors and advise them of procedures and construction expectations.

Park Operations

- Once the winter season halts construction, the turnouts would be cleared of all construction storage equipment and materials.
- Delays for emergency response vehicles would be kept to a minimum by having the emergency responders notify the traffic monitors via park radio/frequency immediately when the vehicle is dispatched, thus allowing approximately 10 minutes to clear the road before the arrival of the emergency vehicle.
- Roadwork and rockfall mitigation would be conducted to the extent practicable with one lane closure and alternating one-way traffic. One-way traffic may be used as a temporary measure on East Rim Drive. Delays would be no more than 30 minutes on each of the East and West Rim drives.
- Temporary road closures may be needed for some areas of rockfall treatment or roadwork where closure of both lanes is necessary to complete the work. Road closures would be limited to Monday through Thursday and would be announced to the public well in advance.
- Night work may be implemented throughout the project area. If night work involves full road closure, the road may be closed up to a maximum of 10 consecutive hours at a time.
- In the event that full road closure is implemented (either day or at night), a signed detour would be used for travelers and a pass-through would be required for emergency vehicles. No night work would be allowed within 1 mile of Crater Lake Lodge or between mileposts 19 through 22 to avoid impacts on visitors at the Lost Creek campground.
- Existing road shoulders wide enough to accommodate traffic would be used as feasible to route traffic around work zones.

Health and Safety
• Traffic monitors would have park radios with the appropriate park frequency, appropriate safety clothing, and reflective signs. • Visitors and NPS staff would not be allowed to stop/park in a pullout or on the road in the construction zone. Emergency vehicles would be allowed on an as-needed basis.

ALTERNATIVES CONSIDERED, BUT ELIMINATED FROM DETAILED ANALYSIS

Resurface Existing Road

Minor improvements to the road surface, such as milling and overlay or chip and seal, would not address issues associated with bench erosion, restoring the original road width, structural deficiencies, and other issues contributing to the deteriorating condition of the road. Resurface-only options were eliminated because they would not meet the project purpose and need.

Addition of Bicycle Lanes

As stated in "Chapter 1: Purpose and Need," the primary objective of this project is to make the existing road safer and reduce maintenance costs. Constructing bicycle lanes goes beyond this objective by not just treating the existing facility but by adding development. Narrowing the travel lanes for motor vehicles to allow a one-way bike lane would not leave sufficient width for safe vehicle travel. Design standards for bicycle lanes require a 5-foot width, which would only leave 8.5-foot travel lanes for motor vehicles. This would be inadequate to safely accommodate passenger and recreational vehicles that travel the road. Adding sufficient width to the roadway bench for both 10-foot vehicle lanes and 5-foot bicycle lanes would require extensive walls, fill slopes, and cuts and the resource impacts and financial costs are not feasible. The addition of bicycle lanes, while partially addressing the objective of improving safety for all road users, would require the park to consider broader operation and management issues, as well as other alternatives that have no bearing on the current purpose and need. Thus, for the above reasons, this alternative was eliminated from detailed analysis in this EA.

Converting Part of Rim Drive to One-Way Travel

Portions of Rim Drive have previously operated as a one-way road and this was reconsidered as part of the 2005 GMP (NPS 2005). A one-way system around much of Rim Drive was used for a period beginning in 1971; however, visitors complained of having to travel longer distances and the park noticed that average speeds increased with one-way traffic, as did traffic accidents (NPS 2009). Converting part of Rim Drive to one-way travel was not the selected alternative approved in the Record of Decision on the GMP. Thus, converting part of Rim Drive to one-way travel was dismissed from consideration in this EA.

Maintain Road Width Beyond the Original 22-Foot Width on West Rim Drive

While a number of locations throughout West Rim Drive are currently paved to a width greater than 22 feet, West Rim Drive was originally designed as 22 feet wide. The additional width accumulated over the years from overlays and other maintenance activities, which extended the top width. These accidental extensions created oversteepened foreslopes. Most of these locations do not have an adequate base to support this extra width. Left in place, wind, surface water, and snowmelt runoff erosion will continue to deplete the structural road base (foreslopes and fill slopes) and continue to oversteepen the road edge. The asphalt edges will continue to fail, leaving narrower road sections and greater vertical dropoffs; hazards to both motorists and bicycle/pedestrian visitors. Maintaining a road width greater than 22 feet would require construction of a wider road base. This would require a variety of treatments including lowering the subgrade, shifting the road alignment, constructing retaining walls, and implementing other structural measures. The primary objective of the proposed project is to make the existing road facility safer and reduce maintenance costs. Maintaining the original 22-foot road width preserves the integrity of the historic district. Constructing the structural support to maintain a road width beyond 22 feet is beyond the purpose and need for this project to address deteriorating road conditions and safety concerns. Thus, this alternative was eliminated from detailed analysis in this EA.

Addition of a Parking Lot Adjacent and Downslope of the Existing Cleetwood Cove Parking Area

As a part of the overall parking lot and pullout improvements, an additional "overflow" lot below the Cleetwood Cove parking area was considered to create additional parking opportunities. Construction of a parking area at this location would require a new road access, substantial earthwork, and clearing of old growth forest. The presence of old growth forest and the need for substantial earthwork to create the parking area would have substantially greater resource impacts than the Cleetwood Cove parking layout described on page 29. The proposed Cleetwood Cove parking layout provides adequate parking spaces with substantially less disturbance to natural resources. In addition, another parking area would create greater maintenance issues for park staff, such as snow removal and asphalt maintenance, which is in conflict with the purpose and need for the project. For these reasons, this alternative was dismissed from further consideration in this EA.

Repairs to Skell Head Retaining Wall

The park evaluated six options to repair the Skell Head Overlook retaining wall. Erosion of the toe of the masonry stone wall is undermining the foundation and causing distress that could result in wall failure. Options to repair and/or maintain the wall included a range of measures: 1) total reconstruction, 2) use of micropile wall underpinnings, 3) construction of a new masonry lower-tiered wall adjacent to the existing wall, 4) use of a temporary support wall while installing concrete underpinning and new masonry, 5) reconstructing the wall along a new alignment, and 6) a partial underpinning and reinforced backfill, the preferred

alternative as described on page 27. The park and FHWA conducted a value analysis to compare the relative cost and benefits of the six options (NPS 2012d). Option 6 scored second highest in the evaluation criteria and was the least expensive option. Option 6 was selected as the preferred alternative because it maintains the existing wall face alignment, preserves the integrity of the historic wall, reduces earth pressures acting on the masonry wall, confines disturbance to the outboard of the wall, is fairly low cost, and would take less time to construct. Thus, other options were dismissed from consideration in this EA.

Addition of a Shuttle System for Park Visitors at Cleetwood Cove

A shuttle transportation system was considered as an option to address inadequate parking at Cleetwood Cove. A shuttle system would require visitors to park their cars in designated lots and ride the shuttle to Cleetwood Cove. While this option would fulfill the purpose and need of the project by improving safety for park visitors and reducing maintenance requirements, it would result in other logistical issues, resource impacts, and increased maintenance costs. It would be expensive to purchase a fleet of shuttle vehicles and hire drivers for a short and unpredictable season. There is no excess parking capacity at other locations in the park to support shuttle operations and construction of a new parking area away from the Cleetwood Cove lot would have greater resource impacts than expansion and reconfiguration of the existing lot. For these reasons and because a shuttle system is outside the scope of this project, this option was dismissed from further consideration in this EA.

ENVIRONMENTALLY PREFERABLE ALTERNATIVE

According to the CEQ regulations implementing NEPA (43 CFR 46.30), the environmentally preferable alternative is the alternative "that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified upon consideration and weighing by the park superintendent of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative."

Alternatives 2, 3, and 4 each provide very similar environmental advantages because all of these alternatives include the same road rehabilitation activities. The different levels of rockfall treatment included in these alternatives have both short-term impacts and long-term benefits to the environment. Alternative 2 would have the least amount of disturbance, but Alternatives 3 and 4, while having more short-term impacts, include rockfall mitigation measures that would improve long-term slope stability, which would protect stone guardwalls and retaining walls. Overall, Alternative 2 would be considered environmentally preferable compared to Alternatives 3 and 4 because it can be implemented in the least amount of time with fewer disturbances to the environment than the more extensive rockfall mitigation measures. The additional time required to implement Alternatives 3 and 4 and the associated noise would be more disruptive to wildlife and the soundscape. While all of the action alternatives provide greater environmental advantages compared to the no action alternative, Alternative 2 is environmentally preferable.

By contrast, the no action alternative is not the environmentally preferable alternative because although no construction or ground-disturbing activities would damage previously undisturbed elements of the biological and physical environment 1) it would not protect park natural and cultural resources as the road would continue to deteriorate without rehabilitation; 2) rockfall damage to the road and historic structures along the road would continue and likely increase over time; 3) bench erosion and inadequate drainage could lead to impacts on roadside vegetation, soils, and water quality; and 4) continued high maintenance requirements would not be energy efficient.

ALTERNATIVES COMPARISON TABLE

The park selected Alternative 3 as the preferred alternative after consideration of how each alternative met the project purpose and objectives and consideration of the potential environmental consequences. All of the action alternatives would implement the needed road repairs and improvements. Alternative 3 also includes use of specialized rockfall mitigation measures at select locations to determine the effectiveness of these types of treatments. Should these measures prove effective, the park may consider additional rockfall treatment in the future. A comparison of the alternatives and the degree to which each alternative fulfills the needs and objectives of the proposed project is summarized in Table 4.

TABLE 4. ALTERNATIVES COMPARISON

Alternative 1 – No Action Alternative	Alternative 2 – Road Rehabilitation with Rock Scaling	Alternative 3, Preferred Alternative – Road Rehabilitation with Selective Rockfall Mitigations	Alternative 4 – Road Rehabilitation with Extensive Rockfall Mitigation
Under the no action alternative, the NPS would not implement road rehabilitation or improvements. Routine road maintenance would continue, but the road pavement and structural integrity would continue to deteriorate. There would be no improvements to surface pavement, subgrade, drainage, walls, parking, or pullouts, and no widening. Park staff would continue with limited rock scaling of the lower slopes.	Under Alternative 2, the NPS would implement the rehabilitation, repairs, and improvements necessary to restore the condition of Rim Drive. The proposed improvements would repair structurally deficient areas of the road, correct bench erosion and drainage issues, restoring road width, implement minor realignments, repair retaining walls, pave pullouts and parking areas, improve Cleetwood Cove parking, repave the road, replace signs, and make other improvements. Mechanical and technical manual rock scaling would be conducted.	Alternative 3 would implement the same road rehabilitation work as described for Alternative 2. In addition, select rockfall treatments such as rock bolting, buttressing, shotcrete, and anchored wire mesh would be applied to rock slopes at Anderson Point and Dutton Cliff.	Alternative 4 would implement the same road rehabilitation work as described for Alternative 2. In addition, more extensive rockfall mitigation measures would be implemented at 21 locations along Rim Drive including the two sites in Alternative 3.
Meets Project Purpose and Objectives?			
The no action alternative would not fulfill project objectives. Road maintenance requirements and costs would not be improved because deteriorating road conditions would not be addressed. Visitor enjoyment and safety objectives would not be achieved. Park natural and cultural resources and the scenic quality of the road would be compromised by deteriorating road conditions. Rock scaling by park staff would reduce the potential for damage to natural and cultural resources to some degree.	Alternative 2 fulfills the project objectives by implementing needed road repairs and improvements to correct road deficiencies and provide a safer road. Road maintenance requirements and costs would be reduced. Rock scaling would reduce the potential for rockfall. Park natural and cultural resources would be protected and visitor impacts minimized.	Alternative 3 fulfills the project objectives by implementing needed road repairs and improvements to correct road deficiencies and provide a safer road in the same manner as Alternative 2. Additional selective rock fall mitigation measures would further improve the potential for reducing rockfall damage to the road, reducing maintenance costs and promoting visitor, and park safety, while protecting park resources. Alternative 3 was selected as the preferred alternative.	Alternative 4 fulfills the project objectives by implementing needed road repairs and improvements to correct road deficiencies and provide a safer road in the same manner as Alternative 2. Extensive rockfall mitigation at 21 locations would provide the greatest potential for reducing rockfall damage to the road, reducing maintenance costs and promoting visitor, and park safety, while protecting park resources.

IMPACT SUMMARY

A summary of potential environmental effects for the alternatives is presented in Table 5.

TABLE 5. IMPACT SUMMARY TABLE

Resource	Alternative 1 – No Action	Alternative 2 – Road Rehabilitation with Scaling	Alternative 3, Preferred Alternative – Road Rehabilitation with Selected Rockfall Mitigation	Alternative 4 – Road Rehabilitation with Extensive Rockfall Mitigation
Geology and Soils	The no action alternative would not correct deterioration of Rim Drive and associated structural features. Bench erosion, slumping, accelerated soil erosion, and rockfall would continue to have local long-term minor to moderate adverse effects on geology and soil resources.	Road rehabilitation would result in local short-term minor adverse impacts on geology and soil resources during construction, with a long-term beneficial effect by reducing the potential for slumping and accelerated erosion. Improvements to the Cleetwood Cove parking area would have a local long-term minor adverse effect from the loss and disturbance of soils. Rock scaling would have a local long-term moderate adverse effect on geology and soil resources and possible beneficial effects where scaling operations reduce the potential for accelerated or more damaging rockfall.	Road rehabilitation would result in local short-term minor adverse impacts on geologic and soil resources during construction, with a long-term beneficial effect by reducing the potential for slumping and accelerated erosion. Improvements to the Cleetwood Cove parking area would have a local long-term minor adverse effect from the loss and disturbance of soils. Rock scaling would have a local long-term moderate adverse effect on geologic and soil resources. Rockfall treatments at Anderson Point and Dutton Cliff would have a long-term beneficial effect on geologic resources and erosion by reducing the potential for rockfall.	Road rehabilitation would result in local short-term minor adverse impacts on geologic and soil resources during construction, with a long-term beneficial effect by reducing the potential for slumping and accelerated erosion. Improvements to the Cleetwood Cove parking area would have a local long-term minor adverse effect from the loss and disturbance of soils. Rock scaling would have a local long-term moderate adverse effect on geologic and soil resources. The additional rockfall treatments at 21 locations along Rim Drive would have a local long-term beneficial effect on geologic resources and erosion by reducing the potential for accelerated or more damaging rockfall.

Resource	Alternative 1 – No Action	Alternative 2 – Road Rehabilitation with Scaling	Alternative 3, Preferred Alternative – Road Rehabilitation with Selected Rockfall Mitigation	Alternative 4 – Road Rehabilitation with Extensive Rockfall Mitigation
Vegetation and Special Status Plant Species	The no action alternative would have local long-term negligible to minor adverse effects on vegetation and special status plant species adjacent to the road from erosion, inadequate drainage, and vehicles parking on the road shoulder at Cleetwood Cove. Pumice grapefern (a state threatened species) and the Crater Lake rockcress (a federal species of concern and a state candidate species for listing) would experience long-term minor adverse impacts from pedestrians walking outside of paved areas and occasional off-pavement vehicle trespass at Skell Head Overlook.	Alternative 2 would have local short-term minor adverse effects on vegetation from road rehabilitation disturbances that are estimated to temporarily affect about 3.2 acres of vegetated roadside slopes and less than 0.2 of an acre for repair work on retaining walls. Road and wall repairs and other structural measures would reduce erosion and promote soil stability, which would have long-term beneficial effects on vegetation and special status plant species. Removal and revegetation of 1.33 acres of existing pullouts would have a local long-term beneficial effect on vegetation. Improvements to the Cleetwood Cove parking lot would have a local long-term moderate adverse effect on up to 1.6 acres of forest. Road rehabilitation disturbances would have a local, long-term, moderate and adverse impact on special status plant species in the project area. Rock scaling would have a negligible effect on vegetation and special status plant species because of the limited vegetation present on treatment slopes.	Rehabilitation of damaged and deteriorating sections of the road, improvements to the Cleetwood Cove parking area, and rock scaling would have local short- and long-term negligible to moderate adverse effects on vegetation, as well as long-term beneficial effects. Additional mechanical rock scaling and application of specialized rockfall treatment measures at Anderson Point and Dutton Cliff because of the low vegetation cover on these steep slopes would have a local long-term negligible effect on vegetation and special status species. Rockfall mitigation treatment that reduces the potential for accelerated slope erosion would have a local long-term beneficial effect on vegetation.	Rehabilitation of damaged and deteriorating sections of the road, improvements to the Cleetwood Cove parking area, and rock scaling would have local short- and long-term negligible to moderate adverse effects on vegetation, as well as long-term beneficial effects. Additional mechanical rock scaling and application of specialized rockfall treatment measures at 21 locations on Rim Drive because of the low vegetation cover on these steep slopes would have a local long-term negligible effect on vegetation and special status species. Rockfall mitigation treatment that reduces the potential for accelerated slope erosion would have a local-long term beneficial effect on vegetation.

Resource	Alternative 1 – No Action	Alternative 2 – Road Rehabilitation with Scaling	Alternative 3, Preferred Alternative – Road Rehabilitation with Selected Rockfall Mitigation	Alternative 4 – Road Rehabilitation with Extensive Rockfall Mitigation
Wildlife and Special Status Wildlife Species	The no action alternative would have a local long-term negligible adverse effect on wildlife and wildlife special status species from periodic road repairs and rock scaling.	Alternative 2 would have local short-term minor adverse effects on wildlife from habitat disturbance during construction and the elevated noise levels and construction activities that can displace wildlife near Rim Drive. The loss of up to 1.6 acres of forest for Cleetwood Cove parking lot improvements would have a local long-term minor effect on bird and small mammal habitat. There would be no impact on federally listed northern spotted owl, lynx, or bull trout because of a lack of suitable habitat in the project area. Rock scaling operations would have a negligible effect on pika habitat, but a local short-term minor adverse effect from possible displacement from nearby habitat because of noise and human presence.	Rehabilitation of damaged and deteriorating sections of the road, improvements to the Cleetwood Cove parking area, and rock scaling would have local short- and long-term minor adverse effects on wildlife and special status wildlife species. Additional mechanical rock scaling and application of specialized rockfall treatment measures at Anderson Point and Dutton Cliff would have a local short-term minor adverse effect on wildlife from construction-related noise and disturbance. Pika may also be displaced from nearby habitat during construction, but no long-term adverse effect is likely.	Rehabilitation of damaged and deteriorating sections of the road, improvements to the Cleetwood Cove parking area, and rock scaling would have local short- and long-term adverse minor effects on wildlife and special status wildlife species. Additional application of specialized rockfall treatment measures at 21 locations along Rim Drive would have a local short-term minor adverse effect on wildlife from construction-related noise and disturbance. Pika may also be displaced during construction from nearby habitat, but no long-term effect is likely.

Resource	Alternative 1 – No Action	Alternative 2 – Road Rehabilitation with Scaling	Alternative 3, Preferred Alternative – Road Rehabilitation with Selected Rockfall Mitigation	Alternative 4 – Road Rehabilitation with Extensive Rockfall Mitigation
Historic Structures	Effects on historic structures are anticipated to be local, long-term/permanent, and negligible for typical maintenance work. Should there be a failure of a structural feature of the highway, adverse effects on historic structures would be local, short- to long-term, and minor to moderate.	Road rehabilitation work would address deteriorating road conditions and would maintain and protect the historic features that contribute to the Rim Drive Historic District. Effects on historic structures are anticipated to be local, long-term, and negligible to minor with implementation of the provisions of the PA. Rock scaling would have no direct effect on historic structures. This work would reduce potential effects from unanticipated rockfall on downslope historic structures. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification and assessment of effect for historic properties and any needed mitigation through the development of a treatment plan.	Road rehabilitation work would address deteriorating road conditions and would maintain and protect the historic features that contribute to the Rim Drive Historic District. Effects on historic structures are anticipated to be local, long-term, and negligible to minor with implementation of the provisions of the PA. Rock scaling and additional technical treatment of rockfall areas at Anderson Point and Dutton Cliff would have no direct effect on historic structures and treatments would not introduce elements incompatible with the Rim Drive Historic District. This work would reduce potential effects from unanticipated rockfall on downslope historic structures. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification and assessment of effect for historic properties and any needed mitigation through the development of a treatment plan.	Road rehabilitation work would address deteriorating road conditions and maintaining and protecting the historic features that contribute to the Rim Drive Historic District. Effects on historic structures are anticipated to be local, long-term, and negligible to minor with implementation of the provisions of the PA. Rock scaling and technical treatment of rockfall areas at 21 locations would have no direct effect on historic structures. This work would reduce potential effects from unanticipated rockfall on downslope historic structures. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification and assessment of effect for historic properties and any needed mitigation through the development of a treatment plan.

Resource	Alternative 1 – No Action	Alternative 2 – Road Rehabilitation with Scaling	Alternative 3, Preferred Alternative – Road Rehabilitation with Selected Rockfall Mitigation	Alternative 4 – Road Rehabilitation with Extensive Rockfall Mitigation
Cultural Landscapes	Effects on the cultural landscape are anticipated to be local, long-term, and negligible to minor from deterioration of the road, typical maintenance work, and manual rock scaling. However, should there be a failure to the road or related structural features, effects on the cultural landscape would be local, long-term, minor to moderate, and adverse under Section 106. Manual rock scaling would have no effect on historic structures and would protect downslope features from rockfall.	Effects on the cultural landscape are anticipated to be local, long-term, and negligible to minor for stabilization and rehabilitation work, while mechanical rock scaling would reduce the potential for rockfall damage to historic structures that contribute to the cultural landscape. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification and assessment of effect for historic properties and any needed mitigation through the development of a treatment plan.	The effects on the cultural landscape would be local, long-term, and negligible to minor for rehabilitation work on Rim Drive. Rockfall mitigation treatments would reduce the potential for damage to historic elements of the landscape, but would introduce short- to long-term audio and visual effects on the cultural landscape from the introduction of permanent rockfall mitigation elements such as rock bolting, buttressing, and anchored wire mesh. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification and assessment of effect for historic properties and any needed mitigation through the development of a treatment plan.	Effects on the cultural landscape are anticipated to be local, long-term, and negligible to minor for rehabilitation work on Rim Drive. Rockfall mitigation would reduce the potential for rockfall damage to historic structural elements of the cultural landscape, but would introduce short- to long-term audio and visual effects on the cultural landscape from the introduction of permanent rockfall mitigation elements such as rock bolting, buttressing, and anchored wire mesh. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification and assessment of effect for historic properties and any needed mitigation through the development of a treatment plan.

Resource	Alternative 1 – No Action	Alternative 2 – Road Rehabilitation with Scaling	Alternative 3, Preferred Alternative – Road Rehabilitation with Selected Rockfall Mitigation	Alternative 4 – Road Rehabilitation with Extensive Rockfall Mitigation
Visitor Use and Experience	The no action alternative would have local long-term moderate to major adverse effects on visitor use and experience from ongoing deterioration of the road and structural features that contribute to the quality of the visitor experience, and that provide access to recreation resources. Although the road would remain open to visitor access, as road conditions deteriorate, periodic maintenance projects or road failure would require traffic delays or road closure at random times and locations, which would inconvenience visitors.	Rehabilitation of damaged and deteriorating sections of the road would have a long-term beneficial effect on visitors traveling on Rim Drive. A short-term minor to moderate adverse effect on the quality of the visitor experience would occur at the local and parkwide level during periods of construction. Rock scaling would result in local short-term minor to moderate adverse effects on the visitor experience.	Rehabilitation of damaged and deteriorating sections of the road would have a long-term beneficial effect on visitors traveling Rim Drive. Selective rockfall treatments at Anderson Point and Dutton Cliff, in addition to manual and technical rock scaling, would result in local short-term minor to moderate adverse effects on the visitor use and experience.	Rehabilitation of damaged and deteriorating sections of the road would have a local short-term minor to moderate adverse effect on visitors traveling on Rim Drive and a long-term beneficial effect due to a smoother, safer road. Extensive rockfall mitigation at 21 locations, in addition to manual and technical rock scaling, would result in parkwide short-term moderate adverse effects on the visitor use and experience.

Resource	Alternative 1 – No Action	Alternative 2 – Road Rehabilitation with Scaling	Alternative 3, Preferred Alternative – Road Rehabilitation with Selected Rockfall Mitigation	Alternative 4 – Road Rehabilitation with Extensive Rockfall Mitigation
Visual Resources	The no action alternative would have a local long-term minor to moderate adverse effect on the visual character of the road corridor if deteriorating road infrastructure is not rehabilitated.	Rehabilitation of damaged and deteriorating sections of the road would have a short-term minor adverse effect and a long-term beneficial effect on the visual quality of the road. Expansion of the Cleetwood Cove parking area would have a local long-term moderate adverse impact from tree removal and additional asphalt parking. Rock scaling would result in local short-term minor adverse effects on visual resources.	Rehabilitation of damaged and deteriorating sections of the road would have local short-term minor adverse effects on the visual quality of Rim Drive during construction, with a long-term beneficial effect by protecting and preserving the scenic and visual character of the road. Additional rockfall mitigation applied at Anderson Point and Dutton Cliff would have a local short-term minor adverse effect on visual quality during construction and negligible to minor adverse effect over the long term because most treatment measures would blend with the existing environment.	Rehabilitation of damaged and deteriorating sections of the road would have local short-term minor adverse effects on the visual quality of Rim Drive during construction with a long-term beneficial effect by protecting and preserving the scenic and visual character of the road. Additional rockfall mitigation applied at 21 sites around Rim Drive would have a local short-term minor adverse effect on visual resources during construction and negligible to minor adverse effects over the long term because most treatment measures would blend with the existing environment.

Resource	Alternative 1 – No Action	Alternative 2 – Road Rehabilitation with Scaling	Alternative 3, Preferred Alternative – Road Rehabilitation with Selected Rockfall Mitigation	Alternative 4 – Road Rehabilitation with Extensive Rockfall Mitigation
Natural Soundscape	The no action alternative would have a local long-term minor adverse impact on the natural soundscape along Rim Drive from traffic and routine road maintenance, including rock scaling by park staff.	Rehabilitation of Rim Drive and mechanical rock scaling operations would have a local short-term moderate adverse effect on the natural soundscape from equipment and vehicle operations.	Road rehabilitation would have a local short-term moderate adverse effect on the natural soundscape along Rim Drive. Rock scaling and selective rockfall mitigation at Anderson Point and Dutton Cliff also would result in local short-term moderate adverse effects on the natural soundscapes at two locations.	Road rehabilitation would have a local short-term moderate adverse effect on the natural soundscape along Rim Drive. Rock scaling and extensive rockfall mitigation at 21 locations along Rim Drive also would result in local short-term moderate adverse effects on the natural soundscape.

Resource	Alternative 1 – No Action	Alternative 2 – Road Rehabilitation with Scaling	Alternative 3, Preferred Alternative – Road Rehabilitation with Selected Rockfall Mitigation	Alternative 4 – Road Rehabilitation with Extensive Rockfall Mitigation
Public Health and Safety	The no action alternative would result in local long-term minor to moderate adverse effects on public health and safety by not addressing safety issues and needed road rehabilitation and repairs. The potential for accidents would be similar to existing conditions and may increase as the road and guardwalls continue to deteriorate, and the need for maintenance and potential for road failure increases. Rock scaling operations by park staff would continue to have a beneficial effect by partially reducing the potential for rockfall, while using methods to protect worker safety.	There would be local short-term minor adverse effects on public health and safety due to risks from construction work and rock scaling activities. Proposed road rehabilitation, Cleetwood Cove parking lot improvements, and rock scaling would address public health and safety concerns associated with Rim Drive and associated facilities. Improvements to road pavement, minor road realignments, curve widening, guardwall/retaining wall repair, and drainage work would improve safety and driving conditions. Alternative 2 would result in local short-term minor adverse effects on public health and safety during construction and local long-term beneficial effects from improvements to the structural features of the road and safety measures, such as rock scaling, that reduce the potential for rockfall.	There would be local short-term minor adverse effects on public health and safety due to risks from construction work and rock mitigation work. Proposed road rehabilitation, Cleetwood Cove parking lot improvements, and rock scaling would address public health and safety concerns associated with Rim Drive and associated facilities. Improvements to road pavement, minor road realignments, curve widening, guardwall/retaining wall repair, and drainage work would improve safety and driving conditions. Alternative 3 would result in local short-term minor adverse effects on public health and safety during construction and local long-term beneficial effects from improvements to the structural features of the road and selective rockfall treatments at Anderson Point and Dutton Cliff that reduce the potential for rockfall.	There would be local short-term minor adverse effects on public health and safety due to risks from construction work and rockfall mitigation work. Proposed road rehabilitation, Cleetwood Cove parking lot improvements, and rock scaling would address public health and safety concerns associated with Rim Drive and associated facilities. Improvements to road pavement, minor road realignments, curve widening, guardwall/retaining wall repair, and drainage work would improve safety and driving conditions. Alternative 4 would result in local short-term minor adverse effects on public health and safety during construction and local long-term beneficial effects from improvements to the structural features of the road and selective rockfall treatments at 21 locations on Rim Drive that reduce potential rockfall.

Resource	Alternative 1 – No Action	Alternative 2 – Road Rehabilitation with Scaling	Alternative 3, Preferred Alternative – Road Rehabilitation with Selected Rockfall Mitigation	Alternative 4 – Road Rehabilitation with Extensive Rockfall Mitigation
Park Operations	The no action alternative would result in local long-term moderate or greater adverse effects on park operations by creating greater maintenance needs for the road and associated structures. Inadequate parking at Cleetwood Cove would not be addressed, requiring additional park staff presence during peak visitation. Maintenance requirements and costs would increase over time as the road and associated infrastructure continues to deteriorate.	The proposed road rehabilitation and improvements would address road maintenance concerns along Rim Drive. Minor road realignments, wider shoulders, structural repairs, new pavement, parking area improvements, bench stabilization, drainage work, and other repairs would improve driving conditions and would reduce the risk of future road failure. Additional mechanical rock scaling would likely reduce the need for park scaling operations. Construction work and associated traffic delays would cause a disruption in normal traffic patterns, parking, and visitor activities in the park; and would place a greater demand on park staff. Alternative 2 would result in local and parkwide short-term minor to moderate adverse impacts during construction and parkwide long-term beneficial effects on park operations by improving the road surface and decreasing maintenance requirements.	Alternative 3 would result in local and parkwide short-term minor to moderate adverse effects on park operations from road rehabilitation activities and minor adverse effects during selective rockfall treatments at Anderson Point and Dutton Cliff, but would have beneficial effects over the long term.	Alternative 4 would result in local and parkwide short-term minor to moderate adverse effects on park operations from road rehabilitation activities and moderate adverse effects from extensive rockfall mitigation, but would have parkwide and beneficial effects over the long term.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter provides a description of the resources potentially impacted by the alternatives and the likely environmental consequences. The chapter is organized by impact topics that were derived from internal park and external public scoping. Impacts are evaluated based on context, duration, intensity, and whether they are direct, indirect, or cumulative. More detailed information on resources in the park may be found in the GMP (NPS 2005).

GENERAL METHODS

This chapter contains the environmental impacts, including direct and indirect effects, and their significance for each alternative. The analysis is based on the assumption that the mitigation measures identified in the "Resource Protection Measures" section in the "Alternatives" chapter would be implemented for the preferred alternative. Overall, the NPS impact analyses and conclusions were based on the review of existing literature and park studies, information provided by experts within the park and other agencies, professional judgment and park staff insights, and public input.

The following terms are used in the discussion of environmental consequences to assess the impact intensity threshold and the nature of impacts associated with each alternative.

Type: Impacts can be beneficial or adverse.

Context: Context is the setting within which an impact would occur, such as local (in the project area near the road), parkwide (in the park outside of the project area), or regional (in Klamath County, Oregon).

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.

Duration: Duration of impact is analyzed independently for each resource because impact duration is dependent on the resource being analyzed. Depending on the resource, impacts may last for the construction period, a single year or growing season, or longer. For the purposes of this analysis, impact duration is described as either short-term or long-term.

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.

Threshold for Impact Analysis: The duration and intensity of effects vary by resource. Therefore, the definitions for each impact topic are described separately. These definitions

were formulated through the review of existing laws, policies, and guidelines; and with assistance from park staff and regional NPS specialists. Impact intensity thresholds for negligible, minor, moderate, and major adverse effects are defined in a table for each resource topic.

CUMULATIVE EFFECTS

Cumulative effects are defined as "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 nonfederal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time. The CEQ regulations that implement NEPA require an assessment of cumulative effects in the decision-making process for federal projects.

Methods for Assessing Cumulative Effects

Cumulative effects were determined by combining the impacts of the action and no action alternatives with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects in the park or the surrounding region that might contribute to cumulative effects. The geographic scope of the analysis includes actions along Rim Drive and spur roads leading into the park, as well as other actions in Crater Lake National Park where overlapping resource impacts are possible. The temporal scope includes future projects within a range of approximately 10 years.

Past, present, and reasonably foreseeable future actions were then assessed in conjunction with the impacts of the alternatives to determine if they would have any added adverse or beneficial effects on a particular natural or cultural resource, park operation, or visitor use. The impact of reasonably foreseeable actions varies for each of the resources. Cumulative effects are considered for each alternative and are presented in the environmental consequences discussion for each impact topic.

Past Actions

Past actions include activities and events that have influenced and affected the current condition of the environment in the project area. Since original construction of Rim Drive began in 1913 and was completed in 1941, there have been numerous reconstructions and upgrades and more recently the ongoing maintenance and repair of the road and facilities that have contributed to the condition of the biological, physical, and cultural features in the project area. Construction of Rim Village, Crater Lake Lodge, parking areas, trails, and other amenities used by park visitors have also affected the environment. Park maintenance staff conducted rock scaling at multiple locations around Rim Drive in 2010 to 2011 that required closure of one lane for short periods.

Current and Future Actions

Several actions are occurring or are planned in or near the Rim Drive corridor in the future that could contribute to the cumulative effects from road rehabilitation and rockfall mitigation. These actions include road maintenance and repairs, forest thinning and fuel reduction projects, and emergency stabilization of the visitor center.

Routine Road Maintenance and Repairs

Park staff performs periodic maintenance and repairs to Rim Drive as needed, such as repairs to the road from rockfall events and routine patching and repairs of the road. At times, these activities require temporary one-lane closures on isolated portions of Rim Drive.

Forest Thinning and Fuels Reduction Projects

An ongoing NPS forest thinning project began in 2011 and will continue through the 2012 visitor season. Roadside tree thinning to reduce encroachment was conducted on the south side of the park along OR 62 in 2011 and will continue on the west side in 2012. Temporary one-lane closures are necessary in isolated locations during thinning operations, and flaggers are being used for traffic control. In addition, fire crews will be conducting thinning operations for the purpose of fuel reduction in targeted areas around the park during the 2012 season.

Emergency Stabilization of Visitor Center

The park is currently in the process of structurally modifying the visitor information center near park headquarters. The project was initiated as an emergency stabilization measure due to severe structural deficiencies in the visitor center. This project would likely be completed prior to any construction that would take place for Rim Drive rehabilitation.

Disturbed Lands

Crater Lake contains approximately 25 acres of disturbed land that is deserving of ecological restoration through site preparation, erosion mitigation, and revegetation efforts. Throughout the park, various efforts to upgrade park facilities, roads, and/or trails have either failed to plan for sufficient ex post facto restoration, or when restoration has been planned it has been ineffective. This has rendered sections of the park in a quasi-permanent denuded state, either from continued trampling in high visitor use areas or insufficient revegetation and/or site preparation efforts. These disturbed areas have no current source of funding available for their rehabilitation. Disturbed sites occur around the park and include past efforts to rehabilitate picnic areas, social trails, campgrounds, and facilities; historic sites of disturbance including old quarries, dumps, and construction sites; and actively used sites that suffer from heavy foot and/or vehicle traffic such as backcountry campsites, parking areas, trailheads, maintenance yards, and overlooks. Often past restoration efforts have failed to document project objectives and methods and conduct post-restoration monitoring, which has hindered efforts to assess efficacy of restoration techniques. The park plans to complete a comprehensive Restoration Plan in the near future, which will outline park goals,

priorities, and methods for restoration of disturbed sites and will serve as a vehicle for obtaining necessary funds to complete restoration work.

GEOLOGY AND SOILS

Affected Environment

Crater Lake lies inside the collapsed remnants of an ancient volcano known as Mount Mazama. Its greatest eruption, about 7,700 years ago, was the largest to occur in North America for more than half a million years. The present landscape at Crater Lake is dominated by the lake-filled caldera and the pumice and ash-covered flanks of truncated Mount Mazama. A major eruption about 7,700 years ago covered much of Oregon and the rest of the northwest with a layer of pumice and ash (NRCS 2002). The massive eruption emptied the magma chamber under Mount Mazama, and the mountain collapsed. A 4,000-foot-deep caldera formed in the collapsed mountain. The caldera has partially filled with water, creating Crater Lake.

Exposed in and around the caldera is andesitic and dacitic bedrock from previous eruptions. Over the course of thousands of years following the creation of the caldera, rain and snow filled the basin and today, Crater Lake is the nation's deepest lake. Construction of Rim Drive around the lake resulted in changes in the natural topography from the cuts and fills required to build the road. Road construction in steep terrain frequently resulted in exposure of steep slopes containing consolidated and unconsolidated rock formations. Natural erosion processes have resulted in instability on some of these slopes that requires periodic maintenance to scale loose rock or remove rock that reaches the road.

Soils bordering Rim Drive are primarily comprised of a variety of volcanic-derived parent material. Predominant soils bordering West Rim Drive are part of the Cleetwood-Llaorock-Dyarock soil map unit (NRCS 2002). These soils are derived from ash, pumice, cinders, and andesite fragments and have a gravelly ashy loamy sand surface texture. Soils along East Rim Drive are comprised of several map units. Timbercrater-Castlecrest-Llaorock soils, found on ridges and mountain sides, are comprised of pumice and ash with ashy loamy sand textures. Castlecrest-Umak soils are found in low lands and mountain sides and are derived from ash and pumice with loamy sand and sandy loam surface textures. Unionpeak-Castlecrest soils are found along the northern, eastern, and southern flanks of the caldera rim. These soils are derived from pumice, ash, andesite, and dacite and have ashy loamy sand or sandy loam surface textures. Most of the soils in the project area have rapid infiltration rates and are excessively drained.

Pumice soils are generally light with high water infiltration rates. Pumice slopes have virtually no cohesion and the seasonal drying cycles cause the pumice soils at Crater Lake to become light and very susceptible to wind and water erosion. Many of the slopes that are eroding or unstable at Crater Lake are the result of prevailing winds coming from the west and blowing to the east and drying out the surface and blowing the lighter material away (FHWA 2010). In general, the East Rim Drive slopes have higher pumice content and, therefore, lighter and more erodible slopes than West Rim Drive. Slopes along West Rim Drive have a higher percentage of sand, silt, and rock and, therefore, are reasonably stable

with localized erosion. Forest and low-growing herbaceous vegetation is present on most of the coarse-textured soils bordering Rim Drive.

Impact Intensity Threshold

Potential impacts on geology and soils were based on professional judgment and the expected degree of disturbance for the alternative. The threshold for the intensity of an impact on geology and soils is defined in Table 6.

TABLE 6. GEOLOGY AND SOILS IMPACT AND INTENSITY THRESHOLDS

Impact Intensity	Intensity Description
Negligible	An action that would result in a change in a geologic feature or process, but the change would be so small that it would not be of any measurable or perceptible consequence. The effects on soils and erosion would be below or at a very low level of detection.
Minor	An action that would result in a change in a geologic feature or process, but the change would be small, localized, and of little consequence. An action's effects on soils would be detectable. The effects would change a soil's profile in a small area, but would not appreciably increase the potential for erosion.
Moderate	An action that would result in a noticeable change in a geologic feature or process, and the change would be measurable and of consequence. An action would result in a change in quantity or alteration of the topsoil, overall biological productivity, or the potential for erosion to remove small quantities of soil. Changes to localized ecological processes would be limited.
Major	An action that would result in an extensive change in a geologic feature or process, and the change would be measurable and result in a severe adverse impact. An action would result in a change in the potential for erosion to remove large quantities of 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.

Short-term soil impact—recovers in less than one year.
Long-term soil impact—takes more than one year to recover.
Note: All impacts on geologic resources are long-term.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts. Under the no action alternative, normal geologic processes and erosion would continue to occur. Deterioration of the Rim Drive pavement edge, bench erosion, and undermining of guardwall and other stone walls from erosion would continue. Inadequate drainage in some locations also would continue to contribute to erosion and soil loss. Areas of road instability where subsidence is a concern would not be addressed and may lead to further slumping and road damage. Not addressing the various sources of erosion and instability would lead to accelerated rates of erosion and geologic instability that would have a local long-term minor to moderate adverse effect on geologic resources and the loss of soil resources. Continued park scaling of lower rock slopes would allow for more control over naturally occurring erosion processes while reducing the potential for road damage.

Cumulative Impacts. Past and ongoing road maintenance and other improvement projects to Rim Drive have resulted in periodic disturbances to the physical environment from earthwork, grading, and changes in topography. Accelerated erosion on steep cut and fill slopes and poor drainage have continued to affect the condition of the geology and soil

resources in the project area. Forest thinning and fuel reduction operations may temporarily disturb soils, but could reduce the potential for damaging wildfire. Previously disturbed sites that have not been reclaimed often experience accelerated erosion. The combined effects of past, present, and reasonably foreseeable actions on geology and soil resources would be parkwide, long-term, minor, and adverse. The overall cumulative effects on geology and soils from the no action alternative in combination with past, present, and reasonably foreseeable future actions would be parkwide, long-term, minor, and adverse, with a long-term minor to moderate adverse contribution from the no action alternative.

Conclusion. The no action alternative would not correct deterioration of Rim Drive and associated structural features. Bench erosion, slumping, accelerated soil erosion, and rockfall would continue to have local long-term minor to moderate adverse effects on geology and soil resources. Cumulative effects would be parkwide, long-term, minor, and adverse.

Alternative 2 – Rehabilitation of Rim Drive with Rock Scaling

Direct and Indirect Impacts. Road rehabilitation activities such as excavating, road widening, minor realignments, grading, and paving would occur primarily within areas of existing disturbance. Rehabilitation of Rim Drive would have limited disturbance to geologic resources. Drainage improvements and culvert replacements would result in disturbances to soils in ditches and embankments. Construction disturbance outside of the existing road prism would occur on about 3.2 acres – 2.85 acres on West Rim Drive, 0.32 acre on East Rim Drive, and about 0.02 acre for disturbance associated with work on the pullout at the Palisades Point Turnout and 0.4 acre for shoulder stabilization at Grotto Cove. Repair to the retaining wall at Skell Head Overlook would occur within an area of about 0.4 acre, most of which is previously disturbed. Most of the disturbances associated with roadwork would occur in areas with minimal or poorly developed soils with little vegetation. Soil material exposed during construction would be subject to erosion until stabilized or revegetated. Obliteration of 25 existing pullouts – 15 on West Rim and 10 on East Rim – would allow reclamation of about 1.33 acres of existing disturbed areas, which would reduce the potential for future erosion and restore soil productivity and vegetation.

Improvements to the Cleetwood Cove parking area would require disturbance up to about 1.6 acres of an existing fill slope and native soils on the south side of the parking lot. There would be a loss of soil productivity, but topsoil from the disturbed area would be salvaged and used in the revegetation of the fill slope. Best management practices would be used to control erosion during construction and revegetation, and drainage structures would protect soils over the long term.

Rock scaling would result in the removal of loose rocks from steep slopes adjacent to Rim Drive. Most of these slopes are currently eroding and would continue to erode with or without scaling. Scaling operations may accelerate the erosion for a period of time or create instabilities leading to the loss of rock or soil material. Because most of these slopes are nearly vertical, soil disturbance would be limited.

Road rehabilitation would result in local short-term minor adverse impacts on geologic and soil resources. Planned measures to address bench erosion, slope instability, drainage problems, and other improvements would have a long-term beneficial effect by reducing the

potential for slumping and accelerated erosion. There would be a local long-term minor adverse effect from the loss of soil productivity within the footprint of an improved Cleetwood Cove parking area. Planned use of temporary and permanent erosion-control BMPs and revegetation of temporarily disturbed areas would reduce the potential for erosion and soil loss. Rock scaling would have a local long-term moderate adverse effect on geologic and soil resources and possible beneficial effects where scaling operations reduce the potential for more damaging rockfall.

Cumulative Effects. Past and ongoing road maintenance and other improvement projects to Rim Drive have resulted in periodic disturbances to the physical environment from earthwork, grading, and changes in topography. Accelerated erosion on steep cut and fill slopes and poor drainage have continued to affect the condition of the geology and soil resources in the project area. Forest thinning and fuel reduction operations may temporarily disturb soils, but would reduce the potential for damaging wildfire. Previously disturbed sites that have not been reclaimed often experience accelerated erosion. The combined effects of past, present, and reasonably foreseeable actions on geology and soil resources would be parkwide, long-term, moderate, and adverse. The overall cumulative effects on geology and soils from Alternative 2 in combination with past, present, and reasonably foreseeable future actions would be parkwide, long-term, moderate, and adverse with both long-term beneficial and moderate adverse contributions from Alternative 2.

Conclusion. Road rehabilitation would result in local short-term minor adverse impacts on geology and soil resources during construction, with a long-term beneficial effect by reducing the potential for slumping and accelerated erosion. Improvements to the Cleetwood Cove parking area would have a local long-term minor adverse effect from the loss and disturbance of soils. Rock scaling would have a local long-term moderate adverse effect on geology and soil resources and possible beneficial effects where scaling operations reduce the potential for accelerated or more damaging rockfall. Cumulative effects would be parkwide, long-term, moderate, and adverse.

Alternative 3 – Rehabilitation of Rim Drive with Selective Rockfall Mitigation

Direct and Indirect Impacts. Road rehabilitation and rock scaling would have the same effect on the geologic and soil resources along Rim Drive as described for Alternative 2. Rockfall mitigation techniques at Dutton Cliff and Anderson Point would result in additional rockfall treatment measures, such as rock bolting, buttressing, and shotcrete, which would aid in stabilizing eroding rock slopes. These measures would have a long-term beneficial effect on geologic features by reducing the potential for large volume rockfalls and further erosion of the slope. Installation of anchored mesh on Anderson Point would help with erosion of the upper slope. Effects on soil resources from rockfall mitigation treatments would be negligible because of the limited soil resources on these slopes.

Cumulative Effects. Original construction of Rim Drive required substantial earthwork, cut and fill of native rock and soil material, grading, and changes in topography. Ongoing road maintenance and natural and accelerated erosion processes have continued to affect the condition of the geologic and soil resources in the project area. Forest thinning and fuel reduction operations may temporarily disturb soils, but would reduce the potential for damaging wildfire. Previously disturbed sites that have not been reclaimed often experience

accelerated erosion. The combined effects of past, present, and reasonably foreseeable actions on geologic and soil resources would be parkwide, long-term, moderate, and adverse. The overall cumulative effects on geology and soils from Alternative 3 in combination with past, present, and reasonably foreseeable future actions would be parkwide, long-term, moderate, and adverse with both long-term beneficial and minor to moderate adverse contributions from Alternative 3.

Conclusion. Road rehabilitation would result in local short-term minor adverse impacts on geologic and soil resources during construction, with a long-term beneficial effect by reducing the potential for slumping and accelerated erosion. Improvements to the Cleetwood Cove parking area would have a local long-term minor adverse effect from the loss and disturbance of soils. Rock scaling would have a local long-term moderate adverse effect on geologic and soil resources. Rockfall treatments at Anderson Point and Dutton Cliff would have a long-term beneficial effect on geologic resources and erosion by reducing the potential for rockfall. Cumulative effects would be parkwide, long-term, minor, and adverse.

Alternative 4 – Rehabilitation of Rim Drive with Extensive Rockfall Mitigation

Direct and Indirect Impacts. Road rehabilitation and rock scaling would have the same effect on the geologic and soil resources along Rim Drive as described for Alternative 2. Rockfall mitigation treatment at 21 locations along Rim Drive primarily include rock scaling and rock bolts along with the measures described for Alternative 3 at Anderson Point and Dutton Cliff. These measures would have a long-term beneficial effect on geologic features by reducing the potential for large volume rockfalls and further erosion of the slope at multiple locations. Effects on soil resources from rockfall mitigation treatments would be negligible because of the limited soil resources on these slopes.

Cumulative Effects. Original construction of Rim Drive required substantial earthwork, cut and fill of native rock and soil material, grading, and changes in topography. Ongoing road maintenance and natural and accelerated erosion processes have continued to affect the condition of the geologic and soil resources in the project area. Forest thinning and fuel reduction operations may temporarily disturb soils, but would reduce the potential for damaging wildfire. Previously disturbed sites that have not been reclaimed often experience accelerated erosion. The combined effects of past, present, and reasonably foreseeable actions on geologic and soil resources would be parkwide, long-term, moderate, and adverse. The overall cumulative effects on geology and soils from Alternative 4 in combination with past, present, and reasonably foreseeable future actions would be parkwide long-term, moderate, and adverse with both long-term beneficial and minor to moderate adverse contributions from Alternative 4.

Conclusion. Road rehabilitation would result in local short-term minor adverse impacts on geologic and soil resources during construction, with a long-term beneficial effect by reducing the potential for slumping and accelerated erosion. Improvements to the Cleetwood Cove parking area would have a local long-term minor adverse effect from the loss and disturbance of soils. Rock scaling would have a local long-term moderate adverse effect on geologic and soil resources. The additional rockfall treatments at 21 locations along Rim Drive would have a local long-term beneficial effect on geologic resources and erosion

by reducing the potential for accelerated or more damaging rockfall. Cumulative effects would be parkwide, long-term, moderate, and adverse.

VEGETATION AND SPECIAL STATUS PLANT SPECIES

Affected Environment

Vegetation in the park is comprised primarily of coniferous forest. At lower elevations white fir, Douglas fir, and ponderosa pine forests are common. At higher elevations forests of lodgepole pine, Shasta red fir, and mountain hemlock occur. Subalpine woodlands of whitebark pine mixed with pumice meadows are found at the highest elevations. Fire suppression and historic logging activities have altered forest structure and species composition throughout portions of the park and surrounding areas.

At the higher elevations found in the project area, forests and woodlands of mountain hemlock and whitebark pine are present. Mountain hemlock stands become dominant along the western rim at about 6,000 feet in elevation. Whitebark pine encircles the caldera rim but gains dominance within the Cloudcap and Mt. Scott areas. Whitebark pine is in decline within the park and throughout its range due to multiple stressors including the nonnative pathogen white pine blister rust, mountain pine beetle-caused mortality, dwarf mistletoe infection, fire suppression, and climate change. The project area also contains plant communities adapted to steep, rocky slopes and arid pumice meadows. Abundant seeps and roadside ditches in the Dutton Cliff area support vegetation adapted to wet conditions such as sedges, willows, and alders.

Special status plant species include federally listed threatened, endangered and species of concern; state-listed threatened, endangered, and rare species; and other species monitored by the park. No federally listed threatened or endangered plant species are known in the park, although whitebark pine is a candidate species for listing. Whitebark pine borders Rim Drive in many locations. Candidate species are plants and animals for which the U.S. Fish and Wildlife Service (USFWS) has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act, but for which development of a proposed listing regulation is precluded by other higher priority listing activities.

Three special status plant species – pumice grapefern (*Botrychium pumicola*), Shasta arnica (*Arnica viscosa*), and Crater Lake rockcress (*Boechera horizontalis*) – are known to occur in isolated populations along the rim of Crater Lake. Pumice grapefern is listed as threatened by the state of Oregon and is endemic to raw pumice gravel substrates that are subject to harsh climatic extremes such as intense sunlight, desiccating winds, and cold nights. The NPS conducted surveys in the project area in 2011 and identified pumice grapefern near the project area at Skell Head Overlook and Grotto Cove (Beck 2011, 2012). Crater Lake rockcress is listed as a federal species of concern and is a candidate for listing by the state of Oregon. Crater Lake rockcress is found in dry, rocky pumice and intermixed with sparse, open, whitebark pine woodland. Crater Lake rockcress was found growing along roadsides and pavement edges and within sidewalk cracks and rock walls in several locations in the project area, including Grotto Cove, Skell Head Overlook and an area south of Skell

Head, Sentinel Rock Overlook, and a pullout slated for obliteration near Watchman Peak, as well as both sides of West Rim Drive for several hundred feet south of the pullout (Beck 2011, 2012). Shasta arnica is not federally or state listed as threatened or endangered, but it is monitored by the park. A single individual has been found near the pavement edge on West Rim Drive. This species is found on dry talus slopes, often with an eastern aspect. Shasta arnica is known to occur on several east-facing slopes near the project area.

Within the last decade, the park has experienced an increase in invasion by nonnative plant species primarily at lower elevations, along roadsides, in burned areas, and within the Crater Lake caldera. Routine surveys have found nonnative plants within the project area concentrated at Rim Village, but with isolated roadside populations found along the entire Rim Drive. Invasive species encountered within the project area include St. John's wort (*Hypericum perforatum*), sheep sorrel (*Rumex acetosella*), yellow rocket (*Barbarea vulgaris*), oxeye daisy (*Leucanthemum vulgare*), common dandelion (*Taraxacum officinale*), and spotted knapweed (*Centaurea stoebe* ssp. *micranthos*).

Impact Intensity Threshold

Predictions about impacts were based on the expected disturbance to vegetation communities and professional judgment and experience with previous projects. The thresholds of change for the intensity of an impact on vegetation and special status plant species are defined in Table 7.

TABLE 7. VEGETATION AND SPECIAL STATUS PLANT SPECIES IMPACT AND INTENSITY THRESHOLDS

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 special status plants would be affected. Ecological processes and biological productivity would not be affected.
Minor	The action would not necessarily decrease or increase the project area's overall biological productivity. The action 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 special status plants, would 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 on some individual native plants, and also would affect a sizeable segment of the species' population over a large area. Permanent impacts would occur to native vegetation, but in a small area. Some special status plants also would 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 would affect a large area within and outside the park. Extensive mitigation measures to offset the adverse effects would be required; the success of the mitigation measures could not be guaranteed.

Short-term impact—following project completion, recovery takes less than two years.
Long-term impact—following project completion, recovery takes more than two years.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts. There would be no specific ground disturbance with the potential to adversely impact vegetation or special status plant species. Vegetation adjacent to the existing road could be affected by deteriorating road conditions that contribute to erosion and sediment deposition. Periodic maintenance activities to repair road damage could result in vegetation disturbance or introduction of invasive plant species. The lack of adequate parking at Cleetwood Cove would continue to result in vehicles parking on the road shoulder, which damages roadside vegetation. Pumice grapefern and the Crater Lake rockcress would continue to experience periodic damage from pedestrians walking outside of paved areas and off-pavement vehicle trespass. Periodic rock scaling by park staff would have a negligible effect on vegetation because most of the treated slopes are sparsely vegetated. The potential impacts on vegetation and special status plant species would be local, long-term, negligible to minor, and adverse.

Cumulative Effects. Original construction of Rim Drive required substantial earthwork and vegetation clearing. Ongoing road maintenance, deterioration of the road and associated erosion, and visitor use has continued to affect the condition of vegetation resources in the project area. Forest thinning and fuel reduction operations change vegetation composition and density, but reduce the potential for damaging wildfire. Previously disturbed sites that have not been reclaimed remain sparsely vegetated and increase the potential for nonnative plant species invasion. The combined effects of past, present, and reasonably foreseeable actions on vegetation and special status plant species would be parkwide, long-term, minor, and adverse. The overall cumulative effects on vegetation and special status plant species from the no action alternative in combination with past, present, and reasonably foreseeable future actions would be parkwide, long-term, minor, and adverse, with a negligible to minor adverse contribution from the no action alternative.

Conclusion. The no action alternative would have local long-term negligible to minor adverse effects on vegetation and special status plant species adjacent to the road from erosion, inadequate drainage, and vehicles parking on the road shoulder at Cleetwood Cove. Pumice grapefern (a state threatened species) and the Crater Lake rockcress (a federal species of concern and a state candidate species for listing) would experience long-term minor adverse impacts from pedestrians walking outside of paved areas and occasional off-pavement vehicle trespass at Skell Head Overlook. Cumulative effects would be parkwide, long-term, minor, and adverse.

Alternative 2 – Rehabilitation of Rim Drive with Rock Scaling

Direct and Indirect Impacts. Road rehabilitation activities from excavating, road widening, minor realignments, grading, and paving would occur primarily within areas of existing disturbance. Construction disturbance outside of the existing paved surface on adjacent cut and fill slopes would occur on about 3.2 acres along Rim Drive. Much of this disturbance would occur in areas of rock, windblown soils, and herbaceous vegetation cover. Whitebark pine trees adjacent to the Pumice Point road rehabilitation project would be protected by construction of retaining walls. Several small whitebark pine and western white

pine trees adjacent to the road, and potentially impacted by construction, would be salvaged and transplanted as feasible. Removal of rock walls at the Glacial Valleys pullout would be conducted by hand to reduce impacts on whitebark pine tree roots. Temporarily disturbed areas would be revegetated or stabilized following construction. Work on the pullout at the Palisades Point Turnout and shoulder stabilization at Grotto Cove would temporarily impact about 0.4 acre of herbaceous vegetation. Retaining wall repair at Skell Head Overlook would temporarily disturb about 0.4 acre of mostly paved or disturbed areas.

Road rehabilitation activities at Grotto Cove may impact one pumice grapefern plant. Impacts on Crater Lake rockcress would occur at Grotto Cove (up to seven plants), Watchman Grade (up to 739 plants – the entire population), and Sentinel Rock Overlook (up to 206 plants – the entire population). Work on the retaining wall at the Skell Head Overlook may impact some of the rockcress present within the vegetated area of the overlook, but would be avoided to the extent possible. Placement of additional curbing along the traffic circle would provide a long-term beneficial effect to rockcress present in this area. Roadwork near the Skell Head area may impact a population of 393 plants and on East Rim Drive south of Skell Head, may impact up to 95% of a population of 306 rockcress plants. Impacts to special status species would be local, long-term, moderate and adverse. Mitigation measures would be implemented to minimize impacts and may include reseeding, transplantation of existing plants in areas with favorable soils, sunlight, and other growing conditions, or other propagation methods found to be effective (see Table 3). Obliteration of 25 existing pullouts – 15 on West Rim and 10 on East Rim – would allow reclamation and revegetation with native plant species on about 1.33 acres of existing disturbed areas.

Improvements to the Cleetwood Cove parking area would require disturbance up to about 1.6 acres of an existing fill slope and undisturbed native forest on the south side of the parking lot depending on the angle of the enlarged fill slope and use of retaining walls (Figure 6). Vegetation clearing for the expanded parking lot would remove a mix of conifer species, including mountain hemlock, Shasta red fir, lodgepole pine, and western white pine (Table 8). The majority of trees removed would be less than 6 inches in diameter at breast height (DBH); however, approximately 60 trees larger than 24 inches DBH would be removed. Options to steepen the fill slope or use of retaining walls would reduce the impact area to 0.25 to 1.2 acres of vegetation, and tree removal would be reduced. Steeper fill slopes would be more difficult to revegetate, but would reduce impacts on existing vegetation. Use of retaining walls would require minimal tree removal and the least impact on existing vegetation. Parking lot layout and construction methods would be decided during the final design. A new fill slope and temporarily disturbed areas would be revegetated with native plant species, but there would be a local long-term moderate adverse impact from the loss of forest vegetation with the fill slope options.

TABLE 8: TREE SPECIES WITHIN THE 1.6-ACRE DISTURBANCE AREA FOR CLEETWOOD COVE PARKING LOT EXPANSION

SPECIES	6-12 in	12-24 in	24-40 in	40+ in
Mountain hemlock (*Tsuga mertensiana*)	102	119	47	4
Shasta red fir (*Abies magnifica x procera*)	35	10	8	1
Lodgepole pine (*Pinus contorta var latifolia*)	50	2	0	0
Western white pine (*Pinus monticola*)	2	0	0	0
Standing dead trees (DBH >24 inches)	0	3	7	1

Note: sizes are approximate.

Mechanical rock scaling would result in the removal of loose rocks from steep slopes adjacent to Rim Drive. Most of these slopes are dominated by rock outcrops and eroding cut slopes with sparse vegetation (Figure 8). Scaling operations would have a negligible adverse effect on vegetation because most of these slopes are nearly vertical with only incidental vegetation in some locations.

Construction of an approximate 20-foot by 50-foot gravel pad at the Lost Creek construction water supply source along the Pinnacles Spur Road would impact an area of low density lodgepole forest. Up to about 15 lodgepole pines about 8 to 10 inches DBH and 20 lodgepole pines less than 6-inches DBH would be removed.

To minimize impacts on native vegetation and special status species and to avoid the introduction of invasive species, areas of disturbance would be limited to the minimum amount necessary to complete construction. The introduction and spread of invasive nonnative plants is possible from construction activities. Many invasive plant species have a competitive advantage relative to native species under environmental conditions created by human activities. A number of BMPs, as listed in Table 3, would be implemented to protect vegetation, minimize the potential for weed establishment, and ensure restoration of disturbed and reclaimed areas. Revegetation of disturbed areas to match natural vegetated background cover is expected to take more than one year because of the poor quality soils and short growing season.

Overall, road rehabilitation would result in local short-term minor adverse impacts on vegetation from temporary construction disturbances, with negligible effects from rock scaling operations. Improvements to the Cleetwood Cove parking lot would have a local long-term moderate adverse effect on forest vegetation from tree and vegetation removal. Impacts to plant species of special concern would be local, long-term, moderate and adverse from road rehabilitation activities. Placement of additional curbing along the traffic circle at Skell Head Overlook would provide a long-term beneficial effect. Avoidance and use of protective rock walls at Pumice Point would minimize impacts on whitebark pine.

Cumulative Effects. Original construction of Rim Drive required substantial earthwork and vegetation clearing. Ongoing road maintenance, deterioration of the road and associated erosion, and visitor use has continued to affect the condition of vegetation resources in the project area. Forest thinning and fuel reduction operations change vegetation composition

and density, but reduce the potential for damaging wildfire. Previously disturbed sites that have not been reclaimed remain sparsely vegetated and increase the potential for nonnative plant species invasion. The combined effects of past, present, and reasonably foreseeable actions on vegetation and special status plant species would be parkwide, long-term, minor, and adverse. The overall cumulative effects on vegetation and special status plant species from Alternative 2 in combination with past, present, and reasonably foreseeable future actions would be parkwide, long-term, minor, and adverse, with Alternative 2 contributing local short- and long-term minor and moderate adverse effects, as well as long-term beneficial effects.

Conclusion. Alternative 2 would have local short-term minor adverse effects on vegetation from road rehabilitation disturbances that are estimated to temporarily affect about 3.2 acres of vegetated roadside slopes and less than 0.2 of an acre for repair work on retaining walls. Road and wall repairs and other structural measures would reduce erosion and promote soil stability, which would have long-term beneficial effects on vegetation and special status plant species. Removal and revegetation of 1.33 acres of existing pullouts would have a local long-term beneficial effect on vegetation. Improvements to the Cleetwood Cove parking lot would have a local long-term moderate adverse effect on up to 1.6 acres of forest. Road rehabilitation disturbances would have a local, long-term, moderate and adverse impact on special status plant species in the project area. Rock scaling would have a negligible effect on vegetation and special status plant species because of the limited vegetation present on treatment slopes. Cumulative effects would be parkwide, long-term, minor, and adverse.

Alternative 3 – Rehabilitation of Rim Drive with Selective Rockfall Mitigations

Direct and Indirect Impacts. Road rehabilitation, Cleetwood Cove parking lot improvements, and rock scaling would have the same effect on vegetation and special status plant species along Rim Drive as described for Alternative 2. Rockfall mitigation techniques applied at Anderson Point and Dutton Cliff, such as rock bolting, buttressing, anchored wire mesh, and shotcrete, would aid in stabilizing eroding rock slopes. These measures would have a negligible effect on vegetation and special status plant species because of low vegetation cover on these steep rocky slopes. Rockfall treatment would have a local long-term beneficial effect where accelerated erosion is reduced and vegetation at the top of the slope is protected from slope failure.

Cumulative Effects. Original construction of Rim Drive required substantial earthwork and vegetation clearing. Ongoing road maintenance, deterioration of the road and associated erosion, and visitor use has continued to affect the condition of vegetation resources in the project area. Forest thinning and fuel reduction operations change vegetation composition and density, but reduce the potential for damaging wildfire. Previously disturbed sites that have not been reclaimed remain sparsely vegetated and increase the potential for nonnative plant species invasion. The combined effects of past, present, and reasonably foreseeable actions on vegetation and special status plant species would be parkwide, long-term, minor, and adverse. The overall cumulative effects on vegetation and special status plant species from Alternative 3 in combination with past, present, and reasonably foreseeable future actions would be parkwide, long-term, minor, and adverse, with Alternative 3 contributing

local short- and long-term minor and moderate adverse effects, as well as long-term beneficial effects.

Conclusion. Rehabilitation of damaged and deteriorating sections of the road, improvements to the Cleetwood Cove parking area, and rock scaling would have local short- and long-term negligible to moderate adverse effects on vegetation, as well as long-term beneficial effects. Additional mechanical rock scaling and application of specialized rockfall treatment measures at Anderson Point and Dutton Cliff because of the low vegetation cover on these steep slopes would have a local long-term negligible effect on vegetation and special status species. Rockfall mitigation treatment that reduces the potential for accelerated slope erosion would have a local long-term beneficial effect on vegetation. Cumulative effects would be parkwide, long-term, minor, and adverse.

Alternative 4 – Rehabilitation of Rim Drive with Extensive Rockfall Mitigation

Direct and Indirect Impacts. Road rehabilitation, Cleetwood Cove parking lot improvements, and rock scaling would have the same effect on vegetation and special status plant species along Rim Drive as described for Alternative 2. Rockfall mitigation techniques applied at 21 locations along Rim Drive, such as mechanical rock scaling, rock bolting, buttressing, anchored wire mesh, and shotcrete, would aid in stabilizing eroding rock slopes and would have a long-term beneficial effect by reducing erosion and vegetation loss from slope failure. Implementation of rockfall treatment measures would have a negligible effect on vegetation and special status plant species because of the low vegetation cover on these steep rocky slopes. Rockfall treatment would have a local long-term beneficial effect where accelerated erosion is reduced and vegetation at the top of the slope is protected from slope failure.

Cumulative Effects. Original construction of Rim Drive required substantial earthwork and vegetation clearing. Ongoing road maintenance, deterioration of the road and associated erosion, and visitor use has continued to affect the condition of vegetation resources in the project area. Forest thinning and fuel reduction operations change vegetation composition and density, but reduce the potential for damaging wildfire. Previously disturbed sites that have not been reclaimed lack vegetation and increase the potential for invasion of exotic plant species. The combined effects of past, present, and reasonably foreseeable actions on vegetation and special status plant species would be parkwide, long-term, minor, and adverse. The overall cumulative effects on vegetation and special status plant species from Alternative 4 in combination with past, present, and reasonably foreseeable future actions would be parkwide, long-term, minor, and adverse, with Alternative 4 contributing local short- and long-term minor and moderate adverse effects, as well as long-term beneficial effects.

Conclusion. Rehabilitation of damaged and deteriorating sections of the road, improvements to the Cleetwood Cove parking area, and rock scaling would have local short- and long-term negligible to moderate adverse effects on vegetation, as well as long-term beneficial effects. Additional mechanical rock scaling and application of specialized rockfall treatment measures at 21 locations on Rim Drive because of the low vegetation cover on these steep slopes would have a local long-term negligible effect on vegetation and special status species. Rockfall mitigation treatment that reduces the potential for accelerated slope

erosion would have a local-long term beneficial effect on vegetation. Cumulative effects would be parkwide, long-term, minor, and adverse.

WILDLIFE AND SPECIAL STATUS WILDLIFE SPECIES

Affected Environment

Approximately 151 species of birds, 54 species of mammals, 8 species of amphibians, 4 species of reptiles, and 5 species of fish are known to inhabit or potentially inhabit the park.

The forested and meadow habitat along Rim Drive provides habitat for seasonally common bird species such as red-tailed hawk, American kestrel, great horned owl, rufous hummingbird, northern flicker, cordilleran flycatcher, Steller's jay, American robin, hermit thrush, and western bluebird. Other bird species present in the park year-round include blue grouse, hairy woodpecker, gray jay, common raven, Clark's nutcracker, mountain chickadee, and dark-eyed junco.

Large mammals commonly found in the park include Roosevelt elk, black-tailed deer, mule deer, and black bear. Other mammals in the park include golden-mantled ground squirrel, Townsend's chipmunk, yellow pine chipmunk, Douglas squirrel, northern flying squirrel, Sierra pocket gopher, porcupine, snowshoe hare, American marten, long-tailed weasel, coyote, and red fox. Based on surveys, eight bat species are documented or suspected to inhabit the park including long-eared myotis, long-legged myotis, Yuma myotis, little brown myotis, California myotis, silver-haired bat, hoary bat, and big brown bat (Duff 2005).

A 2003 survey of reptiles and amphibians in the park documented the occurrence of coastal tailed frog, Cascades frog, long-toed salamander, Pacific tree frog, western toad, and sagebrush lizard (Bury and Wegner 2005). Most of these species are unlikely to be found at the higher elevations in the project area because of the lack of aquatic habitat along Rim Drive. Fish species present in the park include bull trout, brook trout, rainbow trout, brown trout, and kokanee salmon; however, no fishery habitat is in the project area.

Special status wildlife species include federally listed threatened, endangered, and species of concern; state-listed threatened, endangered, and rare species; and species monitored by the park. No federally listed endangered wildlife species are in the park. Federally listed threatened species inhabiting or potentially inhabiting the park include Canada lynx, northern spotted owl, and bull trout. The fisher and wolverine are candidate species for federal listing, and potentially inhabit the park. The bald eagle is a state-listed threatened species present in the park. Pika and peregrine falcons are not federally or state-listed as sensitive species, but are monitored by the park due to concerns about their possible decline.

The park has extensive suitable habitat for Canada lynx that consists of old growth stands, lodgepole pine forest, and meadow habitat. Despite historic records indicating this species may have formerly inhabited the park, extensive surveys for lynx in the park have found no evidence of this species. As a result, park biologists have concluded it is unlikely a viable population of lynx resides in or near the park.

The northern spotted owl is an old-growth forest dependent species near the eastern edge of its range in the park. Surveys conducted in 1995 and 1996 identified suitable habitat for this species scattered throughout the lower elevations, occurring mostly in the southern and western portions of the park. There are 17 identified spotted owl activity centers in the park. All currently known nest locations have been found on the west and south sides of the park, but occasional sightings have been documented outside of these areas. The park conducts an annual monitoring program to assess the nesting and reproductive status of owl pairs living in the park. The nearest spotted owl activity centers are approximately 1.8 miles south of the project area in the Grayback Ridge and Crater Peak areas.

Bull trout is the only fish species native to the park, found only in Sun and Lost creeks. Annie Creek also is within bull trout range and is considered suitable habitat, although bull trout are not currently known to occur there. The headwaters of Sun Creek are in the southern edge of the project area, near Sun Notch. There is no suitable aquatic habitat in the project area to support bull trout.

Fishers and wolverines have large home ranges and avoid areas with human activity or development. Although information on these two species in the park is limited, the high-elevation coniferous forests of the park may provide foraging, denning, and travel habitat for these species. The only known population of fishers in Oregon is to the southwest of the park and is comprised of a breeding population of formerly reintroduced animals. Park records indicate lower elevation areas on the east and west fringes of the park have been used by fishers, but the project area is near the center of the park, at a much higher elevation, and is comprised primarily of mountain hemlock and lodgepole pine stands, making it very unlikely this species or associated habitat is within the project area. Past surveys for wolverines in the park have not detected that species; however, a reliable sighting of a wolverine in the park occurred in 2000.

Bald eagles are known to nest near the project area. A historic nest site is on Wizard Island and an active nest site is present along the shoreline of Crater Lake. Tour boats are restricted from areas on the lake that are near the nest site. The Klamath Basin has more than 160 bald eagle nest sites and these birds forage in the park. Bald eagles may be observed in the park from April through October. None are present during the winter months.

Peregrine falcons nest on cliffs, often near water, and prey on other birds. Most peregrine falcon habitat and reported activity in the park are from within the caldera. One active peregrine nest site exists within the caldera as determined by NPS annual monitoring surveys. Tour boats are restricted from areas on the lake that are near the nest site. Many potential nest sites are available on the cliffs in the caldera.

Although not listed as a special status species by the USFWS or state of Oregon, pika populations in the park are monitored by the park because of concern over the possible decline of this species from global warming (Erb et al. 2011). Pikas are in the park in talus habitat at higher elevations. Surveys in 2010 and 2011 documented pika occupancy within habitat adjacent to the project area, including talus slopes along East Rim Drive in the Watchman area from mile markers 2 through 5 (Figure 3), along West Rim Drive in the Anderson Point and Kerr Notch areas from mile markers 19 through 22, in the Sun Notch

and Applegate Peak area from mile markers 24 through 26, and in several other locations scattered along the project area.

Impact Intensity Threshold

Predictions about impacts were based on the expected disturbance to wildlife and special status wildlife species and professional judgment and experience with previous projects. The thresholds of change for the intensity of an impact on wildlife and special status wildlife species are defined in Table 9.

TABLE 9. WILDLIFE AND SPECIAL STATUS WILDLIFE SPECIES IMPACT AND INTENSITY THRESHOLDS

Impact Intensity	Intensity Description
Negligible	The action would result in a change to a population or individuals of a species, but the change would not be of 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 "no effect."
Minor	The action would 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 equates to a USFWS determination of "may affect, not likely to adversely affect."
Moderate	Impacts on species, their habitats, or the natural processes sustaining them would be detectable and would 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 would 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 equates to a USFWS determination of "may affect, likely to adversely affect."
Major	The action would result in noticeable effects on 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."

Short-term impact—following project completion, recovery takes less than one year.
Long-term impact—following project completion, recovery takes more than one year.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts. There would be no new impacts on wildlife and special status wildlife species or habitat from the no action alternative. Existing impacts from traffic and human activity in the area would continue unchanged. Periodic road maintenance and repairs to deteriorating roads would result in local short-term negligible adverse impacts on wildlife and special status wildlife species. Rock scaling of lower slopes by park staff would have negligible impact on pika habitat because most of the treatment slopes are too steep to provide the talus habitat preferred by pika.

Cumulative Effects. Original construction of Rim Drive resulted in vegetation removal and substantial changes in the habitat available for wildlife. Traffic, visitor use, and ongoing road maintenance affects wildlife use and habitat near Rim Drive. Forest thinning and fuel reduction operations affect vegetation composition and density for wildlife use, but reduce the potential for damaging wildfire. Previously disturbed sites that have not been reclaimed lack vegetation and provide limited wildlife habitat. The combined effects of past, present, and reasonably foreseeable actions on wildlife and special status wildlife species would be parkwide, long-term, minor, and adverse. The overall cumulative effects on wildlife and special status wildlife species from the no action alternative in combination with past, present, and reasonably foreseeable future actions would be parkwide, long-term, minor, and adverse, with a negligible adverse contribution from the no action alternative.

Conclusion. The no action alternative would have a local long-term negligible adverse effect on wildlife and wildlife special status species from periodic road repairs and rock scaling. Cumulative effects would be parkwide, long-term, minor, and adverse.

Alternative 2 – Rehabilitation of Rim Drive with Rock Scaling

Direct and Indirect Impacts. Proposed road rehabilitation and rock scaling under Alternative 2 would have limited direct effects on wildlife habitat because activities would occur primarily within areas of previous disturbance. However, wildlife could potentially be affected by construction disturbance and noise. Construction disturbance to about 3.2 acres adjacent to Rim Drive and outside of the existing road prism would have negligible effects on wildlife because the sparsely vegetated slopes adjacent to the road have limited value for wildlife use. Revegetation of temporary disturbances and restoration of 1.33 acres of obliterated pullouts would have limited wildlife value. Temporary disturbances associated with work on the pullout at the Palisades Point Turnout and shoulder stabilization at Grotto Cove may displace or cause small mammals to avoid these areas during construction. The improvements to the Cleetwood Cove parking lot would result in the loss of up to 1.6 acres of forest vegetation that provides suitable habitat for a variety of birds, squirrels, and small mammals. The current value of this habitat during the summer season is somewhat diminished due to its proximity to an area with high visitor presence and traffic. Revegetation of the parking lot fill slope would replace forested vegetation with native herbaceous vegetation. Additionally, mechanical rock scaling would have a local short-term minor adverse effect on pika. Although rock scaling would occur primarily on steep rocky slopes with limited habitat, pika on nearby slopes may be displaced by the noise and activities during scaling operations.

There are no known federally listed threatened or endangered wildlife species in the project area that would be affected by the proposed road rehabilitation, Cleetwood Cove parking lot improvements, and other proposed improvements. Northern spotted owl protected activity centers are at lower elevations 1.8 miles from Rim Drive and no adverse effects would occur to nesting or foraging owls. There are no streams in the project area supporting bull trout. While portions of the forest habitat bordering Rim Drive may provide suitable habitat for lynx, there are no known populations of lynx in the park.

No adverse impacts on fishers are anticipated because they are typically associated with lower elevations in the park and are unlikely to be present near the project area. Wolverines

are wide-ranging species that would not be adversely impacted by the minor vegetation impacts from the road rehabilitation and Cleetwood Cove parking lot improvements, but they may be temporarily displaced from activities near Rim Drive from construction-related noise and disturbance. There would be no direct impact on the bald eagle or peregrine falcon nesting sites and construction-related noise would be sufficiently distant or buffered by terrain and vegetation so that no adverse effect on nesting or foraging activity is expected.

Cumulative Effects. Original construction of Rim Drive resulted in vegetation removal and substantial changes in the habitat available for wildlife. Traffic, visitor use, and ongoing road maintenance affect wildlife use and habitat near Rim Drive. Forest thinning and fuel reduction operations affect vegetation composition and density for wildlife use, but reduce the potential for damaging wildfire. Previously disturbed sites that have not been reclaimed lack vegetation and provide limited wildlife habitat. The combined effects of past, present, and reasonably foreseeable actions on wildlife and special status wildlife species would be parkwide, long-term, minor, and adverse. The overall cumulative effects on wildlife and special status wildlife species from Alternative 2 in combination with past, present, and reasonably foreseeable future actions would be parkwide, long-term, minor, and adverse, with a minor adverse contribution from Alternative 2.

Conclusion. Alternative 2 would have local short-term minor adverse effects on wildlife from habitat disturbance during construction and the elevated noise levels and construction activities that can displace wildlife near Rim Drive. The loss of up to 1.6 acres of forest for Cleetwood Cove parking lot improvements would have a local long-term minor effect on bird and small mammal habitat. There would be no impact on federally listed northern spotted owl, lynx, or bull trout because of a lack of suitable habitat in the project area. Rock scaling operations would have a negligible effect on pika habitat, but a local short-term minor adverse effect from possible displacement from nearby habitat because of noise and human presence. Cumulative effects would be parkwide, long-term, minor, and adverse.

Alternative 3 – Rehabilitation of Rim Drive with Selective Rockfall Mitigations

Direct and Indirect Impacts. Road rehabilitation and rock scaling would have the same effect on wildlife and special status wildlife species along Rim Drive as described for Alternative 2. Rockfall mitigation techniques applied at Dutton Cliff and Anderson Point such as mechanical rock scaling, rock bolting, buttressing, anchored wire mesh, and shotcrete would aid in stabilizing eroding rock slopes. These measures would have a negligible effect on wildlife because of the lack of suitable habitat. As with rock scaling, implementation of these measures could temporarily displace wildlife in the project area from noise and construction disturbance. Areas of pika habitat and occupancy are recorded near Anderson Point and Dutton Cliff, which could also displace pika during implementation of rockfall treatments. Rock bolting, buttressing, and other specialized treatments would not directly impact pika habitat. There would be no adverse impact on other special status wildlife species or federally listed threatened or endangered species because of a lack of suitable habitat. Thus, rockfall treatments would have a local short-term minor adverse effect on wildlife from construction-related noise and possible displacement of pikas.

Cumulative Effects. Original construction of Rim Drive resulted in vegetation removal and substantial changes in the habitat available for wildlife. Traffic, visitor use, and ongoing

road maintenance affect wildlife use and habitat near Rim Drive. Forest thinning and fuel reduction operations affect vegetation composition and density for wildlife use, but reduce the potential for damaging wildfire. Previously disturbed sites that have not been reclaimed lack vegetation and provide limited wildlife habitat. The combined effects of past, present, and reasonably foreseeable actions on wildlife and special status wildlife species would be parkwide, long-term, minor, and adverse. The overall cumulative effects on wildlife and special status wildlife species from Alternative 3 in combination with past, present, and reasonably foreseeable future actions would be parkwide, long-term, minor, and adverse, with a short-term minor adverse contribution from Alternative 3.

Conclusion. Rehabilitation of damaged and deteriorating sections of the road, improvements to the Cleetwood Cove parking area, and rock scaling would have local short- and long-term minor adverse effects on wildlife and special status wildlife species. Additional mechanical rock scaling and application of specialized rockfall treatment measures at Anderson Point and Dutton Cliff would have a local short-term minor adverse effect on wildlife from construction-related noise and disturbance. Pika may also be displaced from nearby habitat during construction, but no long-term adverse effect is likely. Cumulative effects would be parkwide, long-term, minor, and adverse.

Alternative 4 – Rehabilitation of Rim Drive with Extensive Rockfall Mitigation

Direct and Indirect Impacts. Road rehabilitation and rock scaling would have the same effect on wildlife and special status wildlife species along Rim Drive as described for Alternative 2. Rockfall mitigation techniques applied at 21 locations along Rim Drive such as mechanical rock scaling, rock bolting, buttressing, anchored wire mesh, and shotcrete would aid in stabilizing eroding rock slopes. These measures would have a negligible effect on wildlife habitat because of the lack of suitable habitat; however, as with rock scaling, these measures would have a short-term minor adverse impact from temporary displacement of wildlife in the project area from noise and construction disturbance. Areas of pika habitat and occupancy are recorded near most of the rockfall mitigation sites, which could also displace pika during implementation of rockfall treatments. Rock bolting, buttressing, and other specialized treatments would not directly impact pika habitat. There would be no adverse impact on other special status wildlife species or federally listed threatened or endangered species because of a lack of suitable habitat. Thus, rockfall treatments would have a local short-term minor adverse effect on wildlife from construction-related noise and possible displacement of pikas.

Cumulative Effects. Original construction of Rim Drive resulted in vegetation removal and substantial changes in the habitat available for wildlife. Traffic, visitor use, and ongoing road maintenance affect wildlife use and habitat near Rim Drive. Forest thinning and fuel reduction operations affect vegetation composition and density for wildlife use, but reduce the potential for damaging wildfire. Previously disturbed sites that have not been reclaimed lack vegetation and provide limited wildlife habitat. The combined effects of past, present, and reasonably foreseeable actions on wildlife and special status wildlife species would be parkwide, long-term, minor, and adverse. The overall cumulative effects on wildlife and special status wildlife species from Alternative 4 in combination with past, present, and

reasonably foreseeable future actions would be parkwide, long-term, minor, and adverse, with a local short-term minor adverse contribution from Alternative 4.

Conclusion. Rehabilitation of damaged and deteriorating sections of the road, improvements to the Cleetwood Cove parking area, and rock scaling would have local short- and long-term adverse minor effects on wildlife and special status wildlife species. Additional application of specialized rockfall treatment measures at 21 locations along Rim Drive would have a local short-term minor adverse effect on wildlife from construction-related noise and disturbance. Pika may also be displaced during construction from nearby habitat, but no long-term effect is likely. Cumulative effects would be parkwide, long-term, minor, and adverse.

HISTORIC STRUCTURES

Affected Environment

"Historic properties," as defined by the implementing regulations of the NHPA (36 CFR 800), are a prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register. This term includes artifacts, records, and the remains that are related to and located within such properties, as well as traditional and culturally significant Native American sites and historic landscapes. The term "eligible for inclusion in the National Register" includes both properties formally determined eligible and all other properties that meet National Register listing criteria.

The significance of historic properties is generally judged against a property's ability to meet, at a minimum, one of the four criteria for inclusion on the National Register (36 CFR 60):

a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
b) that are associated with the lives of persons significant in our past; or
c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
d) that have yielded, or may be likely to yield, information important in prehistory or history.

Properties may be eligible for the National Register for contributions at the national, state, or local level. Ordinarily, properties achieving significance within the last 50 years are not considered eligible unless they are integral parts of historic districts or they are of exceptional importance. Additionally, in order for a structure or building to be listed in the National Register, it must possess integrity to convey its significance (i.e., location, design, setting, workmanship, materials, feeling, and association).

Authorized by the NHPA of 1966, the National Register is the nation's official list of districts, sites, buildings, structures, and objects in both public and private ownership that are significant in American history, architecture, archeology, engineering, and culture.

The Rim Drive Historic District, comprised of the entire circuit beginning at Rim Village and ending at park headquarters, was listed on the National Register in 2008 under criteria A and C for its association with events that made a broad contribution to American history and for its contributing structures that represent distinctive characteristics of Public Works Administration (PWA) construction and NPS rustic design elements (NPS 2009). The Rim Drive Historic District includes 31 miles of road, nearly all of which (except for 0.25 mile) are within its original alignment. Ten historic structures and seven sites are contributing elements to the historic district (NPS 2008), including the five segments of road built in different stages (segments A through E), four trails, and eight parking lots that serve as pullouts, observation points, or trailheads (NPS 2008, 2009). Of the 6 miles of Segment A Road, 5.9 miles have been widened from its original 18-foot width to 24 feet (NPS 2009). Three parking lot/trailheads are noncontributing features to the Rim Drive Historic District including the Watchman Overlook, North Junction, and Cleetwood Cove (NPS 2008, 2009). These areas have lost their historic integrity from previous rehabilitation work that did not conform to NPS rustic design standards. Historic circulation features such as guardwalls, slope retaining walls, paved ditches, and culvert headwalls were not individually described on the Rim Drive Historic District nomination form, but all are related features to contributing road segments, trails, and parking lots. However, some of these features were tallied under the Rim Drive Guardwall/Rail Inventory Program conducted by the FHWA-NPS (FHWA-NPS n.d.; NPS 2009) and Rim Drive Cultural Landscape Report (NPS 2009). Forty stone masonry guardwalls and one timber rail and post guardwall were included in the GIP report, all of which appear to conform to NPS rustic design standards.

The Rim Village Historic District was listed on the National Register in 1997 under criteria a and c for its association with the development of Crater Lake National Park and for its association with significant NPS rustic design building and landscape architecture (NPS 1997). Twelve individual elements (buildings and features) contribute to the period of significance (1909 to 1942). The district is also considered a historic designed landscape as described in the "Cultural Landscape" section on page 88. Contributing features to the Rim Village Historic District include roads and parking areas (vehicular circulation), walkways and associated elements such as curbing.

Impact Intensity Threshold

The thresholds of change for the intensity of an impact on historic structures are defined in Table 10.

TABLE 10. HISTORIC STRUCTURES IMPACT AND INTENSITY THRESHOLDS

Impact Intensity	Intensity Description
Negligible	The impact is at the lowest levels of detection with neither adverse nor beneficial consequences. The determination of effect for section 106 would be no adverse effect.
Minor	The alteration of a feature(s) would not diminish the overall integrity of the resource. The determination of effect for section 106 would be no adverse effect.
Moderate	The alteration of a feature(s) would diminish the overall integrity of the resource. The determination of effect for section 106 would be adverse effect. A PA is executed among the NPS and applicable state or tribal historic preservation officer and, if necessary, the advisory council in accordance with 36 CFR 800.6(b). Measures identified in the PA to minimize or mitigate adverse effects reduce the intensity of impacts under NEPA.
Major	The alteration of a feature(s) would diminish the overall integrity of the resource. The determination of effect for section 106 would be adverse effect. Measures to minimize or mitigate adverse effects cannot be agreed upon between the NPS and applicable state or tribal historic preservation officer and/or advisory council, and they are unable to negotiate and execute a PA in accordance with 36 CFR 800.6(b).

Long-term impact— all impacts to historic structures are long-term because they are irreplaceable resources.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects. Under the no action alternative, manual rock scaling would be undertaken by park personnel, but rehabilitation of Rim Drive and the Rim Village parking area would not take place. Effects on contributing elements to the historic district, including the road and associated appurtenances, are anticipated to be negligible in the short term; however, it is likely that in the long term, as erosion continues unchecked, the road and/or adjacent features would experience deterioration, and possibly failure, resulting in a minor to moderate adverse effect on the historic district. In accordance with Section 106 of the NHPA, failure to properly maintain a historic property constitutes an adverse effect (36 CFR 800.5(a)(2)(i) and (vi)). If rock scaling were to occur above a historic structure, protective measures would be implemented to prevent unanticipated effects from rockfall.

Cumulative Effects. Past actions such as road maintenance and parking lot reconstruction have affected the historic integrity of elements along Rim Drive. Previous actions that have added new structural features such as nonconforming guardwalls or road widening have contributed to the current condition of the Rim Drive Historic District. Previous rehabilitation of other sections of Rim Drive such as the Watchman Overlook, North Junction, and Cleetwood Cove parking areas have resulted in unintended adverse effects on the historic district from the introduction of nonconforming design changes and the introduction of nonconforming structural elements such as asphalt curbing and steel guardwalls. Past maintenance activities have removed some of the historic stone masonry structures that could not be incorporated into the required road design, or that were repaired or rebuilt with materials or workmanship not compatible with their historic design (NPS 2008, 2009).

The overall cumulative effect on historic structures from the no action alternative in combination with past and reasonably foreseeable future actions would be local, long-term, and minor. For purposes of Section 106, the determination of effect would be no adverse effect. The no action alternative would contribute negligible to minor effects on historic

structures from continued deterioration of the road and ongoing maintenance activities, and a minor to moderate effect if deterioration is significant or road failure occurs. For purposes of Section 106, the determination of effect would be an adverse effect if road failure occurs.

Conclusions. Effects on historic structures are anticipated to be local, long-term/permanent, and negligible for typical maintenance work. Should there be a failure of a structural feature of the highway, adverse effects on historic structures would be local, short- to long-term, and minor to moderate. Cumulative effects would be parkwide, long-term, and minor.

Alternative 2 – Rehabilitation of Rim Drive with Rock Scaling

Direct and Indirect Effects. Proposed road rehabilitation work would be conducted in a manner to preserve the integrity, design characteristics, and craftsmanship of structural features. To ensure appropriate treatment of historic features, the NPS and the Oregon SHPO would prepare a PA that stipulates for the continued identification, evaluation, and assessment of effect for known and unknown historic properties and provides stipulations for the treatment of historic properties that may be adversely affected by project implementation. Road rehabilitation would be conducted in accordance with the stipulations provided for in the PA (NPS 2012c) and the treatment plan contained in the Rim Drive Cultural Landscape Report (NPS 2009). In addition, rehabilitation would be conducted in accordance with the *Secretary of the Interior's Standards for Treatment of Historic Properties with Guidelines for Treatments of Cultural Landscapes (1996)*, including reuse of original material, repairing and replacing features in-kind, and using compatible designs when adding new features.

Road rehabilitation and paving includes measures to maintain the structural integrity of the road. Construction activities such as stabilizing slopes, minor realignments, repaving, repairing or adding retaining walls and guardwalls, and improving parking lot drainage would add new elements to the landscape or reinforce existing structural features adjacent to the road, pullouts, and parking lots. Construction of new walls would match the historic PWA, NPS workmanship, and design of structural elements as detailed in the Rim Drive Cultural Landscape Report (Mark and Watson 2009). Treatment of the retaining wall at Skell Head Overlook includes underpinning the existing wall and drainage improvements. Stabilization of existing historic structures would conform to the treatment plan provided for in the cultural landscape report (NPS 2009). Miscellaneous culvert repairs, replacement, and new drainage would maintain the historic integrity of structural elements by using original materials whenever possible.

Rehabilitation work for the Rim Village parking area (a contributing element to the Rim Village Historic District) includes repaving the parking lot; installing concrete valley gutters adjacent to stone curbing to facilitate drainage, while retaining curbing design elements and materials; and replacing cracked or broken stone curbs with conserved and stockpiled materials. Curb work would be done as long as funds permit.

There would be local long-term negligible to minor effects on historic structures from proposed road rehabilitation, including the Rim Village parking lot, with implementation of stipulations provided for in the PA. Road rehabilitation and stabilization of historic

structures would address deteriorating road conditions and would maintain and protect the historic features that contribute to the Rim Drive Historic District. For purposes of Section 106, the determination of effect would be no adverse effect.

No direct effects on historic structural elements of the Rim Drive Historic District would result from mechanical rock scaling. Measures would be implemented to protect any historic structures below or downslope during rock scaling activities. Mechanical rock scaling would reduce the potential for future rockfall that could affect downslope historic stone masonry guardwalls, culvert headwalls, stone curbing, retaining walls, and the road itself.

Cumulative Effects. Past actions such as road maintenance and parking lot reconstruction have affected the historic integrity of elements along Rim Drive. Previous actions that have added new structural features such as nonconforming guardwalls or road widening have contributed to the current condition of the Rim Drive Historic District. Previous rehabilitation of other sections of Rim Drive such as the Watchman Overlook, North Junction, and Cleetwood Cove parking areas have resulted in unintended effects on the historic district from the introduction of nonconforming design changes and nonconforming structural elements such as asphalt curbing and steel guardwalls. Since Watchman Overlook, North Junction, and Cleetwood Cove are noncontributing to the Rim Drive Historic District, past and future rehabilitation would not affect the historic district. Past maintenance activities have removed some of the historic stone masonry structures that lacked structural integrity, that could not be incorporated into the required road design, or that were repaired or rebuilt with materials or workmanship not compatible with their historic design (NPS 2008, 2009). Planned future rehabilitation work on Rim Drive would be conducted in accordance with a PA, the treatment plan outlined in the Rim Drive Cultural Landscape Report (NPS 2009), and the *Secretary of the Interior's Standards for Rehabilitation*.

The impact of past actions has resulted in local long-term negligible to minor adverse effects on historic structures. The overall cumulative effects on historic structures from Alternative 2 in combination with past and reasonably foreseeable future actions would be local, long-term, negligible to minor, and adverse with a long-term negligible contribution from Alternative 2 with implementation of the provisions of the PA.

Conclusions. Road rehabilitation work would address deteriorating road conditions and would maintain and protect the historic features that contribute to the Rim Drive Historic District. Effects on historic structures are anticipated to be local, long-term, and negligible to minor with implementation of the provisions of the PA. Rock scaling would have no direct effect on historic structures. This work would reduce potential effects from unanticipated rockfall on downslope historic structures. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification and assessment of effect for historic properties and any needed mitigation through the development of a treatment plan. Cumulative effects would be would be local, long-term, and negligible to minor.

Alternative 3 – Rehabilitation of Rim Drive with Selective Rockfall Mitigations

Direct and Indirect Effects. The planned rehabilitation of Rim Drive and manual and technical rock scaling would introduce the same effects as described under Alternatives 1.

The additional treatment of rockfall slopes using rock bolting, colored and sculpted shotcrete, buttressing, and anchored wire mesh at Dutton Cliff and Anderson Point would add new elements to the slopes above Rim Drive but would not introduce effects on historic structures. Rockfall treatments would reduce the potential for effects on historic masonry guardwalls and other historic features from rockfall.

Cumulative Effects. The impact of past actions has resulted in local, long-term negligible to minor effects on historic structures. The overall cumulative effects on historic structures from Alternative 3 in combination with past and reasonably foreseeable future actions would be local, long-term, and negligible to minor with a long-term negligible contribution from Alternative 3 with implementation of the provisions of the PA. The additional rockfall mitigation measures associated with Alternative 3 would further reduce the potential for adverse effects on downslope historic structures.

Conclusions. Road rehabilitation work would address deteriorating road conditions and would maintain and protect the historic features that contribute to the Rim Drive Historic District. Effects on historic structures are anticipated to be local, long-term, and negligible to minor with implementation of the provisions of the PA. Rock scaling and additional technical treatment of rockfall areas at Anderson Point and Dutton Cliff would have no direct effect on historic structures and treatments would not introduce elements incompatible with the Rim Drive Historic District. This work would reduce potential effects from unanticipated rockfall on downslope historic structures. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification and assessment of effect for historic properties and any needed mitigation through the development of a treatment plan. Cumulative effects would be would be local, long-term, and negligible to minor.

Alternative 4 – Rehabilitation of Rim Drive with Extensive Rockfall Mitigation

Direct and Indirect Effects. The planned rehabilitation of Rim Drive would have the same effect on historic structures as Alternatives 2. The effects of both manual and technical rock scaling would be similar to Alternative 3 but would further reduce the potential for damage to historic structures with application of rockfall mitigation treatment at 21 locations, including Anderson Point and Dutton Cliff. Protective measures such as rock bolting, buttressing, anchoring wire mesh, and adding shotcrete would not introduce effects on historic structures.

Cumulative Effects. The impact of past actions has resulted in local, long-term negligible to minor effects on historic structures. The overall cumulative effects on historic structures from Alternative 4 in combination with past and reasonably foreseeable future actions would be local, long-term, and negligible to minor with a long-term negligible contribution from Alternative 4 with implementation of the provisions of the PA. The additional extensive rockfall mitigation measures associated with Alternative 4 would further reduce the potential for effects on downslope historic structures. Cumulative effects on historic structures would be local, long-term, and negligible to minor.

Conclusions. Road rehabilitation work would address deteriorating road conditions and maintaining and protecting the historic features that contribute to the Rim Drive Historic

District. Effects on historic structures are anticipated to be local, long-term, and negligible to minor with implementation of the provisions of the PA. Rock scaling and technical treatment of rockfall areas at 21 locations would have no direct effect on historic structures. This work would reduce potential effects from unanticipated rockfall on downslope historic structures. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification and assessment of effect for historic properties and any needed mitigation through the development of a treatment plan. Cumulative effects would be would be local, long-term, and negligible to minor.

CULTURAL LANDSCAPES

Affected Environment

Cultural landscapes are the result of the interaction between people and their geographic surroundings and the influence of the individuals' beliefs and actions exhibited on their landscapes. The land may be shaped or modified because of land use, politics, laws, technology, or economics. Cultural landscapes provide a living dynamic record of an area's past, a chronicle of its history. Because it is a living record, the long-range preservation can be a challenge to land managers.

According to DO–28: *Cultural Resource Management Guideline* (page 87), a cultural landscape is:

> ...a reflection of human adaptation and use of natural resources and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. The character of a cultural landscape is defined both by physical materials, such as roads, buildings, walls, and vegetation, and by use reflecting cultural values and traditions.

Rim Drive and associated historic structures comprise a historic designed landscape (NPS 2009). Rim Drive's cultural landscape is significant under tourism, conservation, transportation, engineering, and landscape architecture themes. As a cultural landscape, the design relationship between the road and the landscape is its defining feature. The period of significance is 1926 to 1941, which includes the road's construction and the period from 1931 to 1941 when the PWA, a national public works program, added rustic elements to the basic road under NPS design guidance. Rim Drive's circuitous route was completed in sections and beginning in 1931, PWA work crews constructed features such as stone retaining walls, stone guardwalls, shoulders, turnouts, stone-lined drainage ditches, culvert headwalls, and cut stone curbs. NPS' design resulted in the rustic natural character of the road, lessening its impact on the landscape.

Impact Intensity Threshold

For purposes of analyzing potential effects on cultural landscapes, the thresholds of change for the intensity of an impact are defined in Table 11.

TABLE 11. CULTURAL LANDSCAPES IMPACT AND INTENSITY THRESHOLDS

Impact Intensity	Intensity Description
Negligible	The impact is at the lowest levels of detection with neither adverse nor beneficial consequences. The determination of effect for section 106 would be no adverse effect.
Minor	The alteration of a pattern(s) or feature(s) of the landscape would not diminish the overall integrity of the landscape. The determination of effect for section 106 would be no adverse effect.
Moderate	The alteration of a pattern(s) or feature(s) of the landscape would diminish the overall integrity of the landscape. The determination of effect for section 106 would be adverse effect. A PA is executed among the NPS and applicable state or tribal historic preservation officers and, if necessary, the advisory council in accordance with 36 CFR 800.6(b). Measures identified in the PA to minimize or mitigate adverse effects reduce the intensity of impacts under NEPA from major to moderate.
Major	The alteration of a pattern(s) or feature(s) of the landscape would diminish the overall integrity of the landscape. The determination of effect for section 106 would be adverse effect. Measures to minimize or mitigate adverse effects cannot be agreed upon and the NPS and applicable state or tribal historic preservation officers and/or advisory council are unable to negotiate and execute a PA in accordance with 36 CFR 800.6(b).

Short-term impact—occurs only during the construction period.
Long-term impact—occurs during and continues after the construction period.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects. Under the no action alternative, continued routine maintenance of the road and associated features would occur, but rehabilitation of the road would not take place, and limited manual rock scaling would be undertaken by park personnel. Maintenance activities would temporarily introduce visual, audio, and atmospheric elements into the landscape setting of Rim Drive; however, these intrusions would be short-term, lasting only as long as construction and repairs.

Routine road maintenance and repair would continue, but important landscape contributing features would not be stabilized or rehabilitated. Continued deterioration of the road and associated historic stone masonry structures from structural deficiencies could lead to adverse effects on the road and associated features such as stone retaining walls, stone guardwalls, stone-lined drainage ditches, culvert headwalls, and cut stone curbs. Damage to contributing elements of the road is difficult to predict, but could range from minor to moderate depending on the scale of the structural failure. Structural failures that lead to temporary road closure and associated repairs would affect the land use, topography, vegetation, audio and visual effects, and circulation patterns of the cultural landscape. Effects on the cultural landscape are anticipated to be local, long-term, negligible to minor based on the current level of maintenance; however, should there be a failure to a structural feature, effects on the cultural landscape would be local, long-term, and minor to moderate depending on the severity of the failure. For purposes of Section 106, the determination of effect for routine maintenance would be no adverse effect and the effect from structural failure would be adverse effect.

Rock scaling conducted by the NPS would reduce the potential for effects on historic structures that contribute to the cultural landscape from unanticipated rockfall against

downslope historic stone masonry structures such as headwalls, guardwalls, stone curbing, and the road itself. Protective measures would be implemented during manual rock scaling to prevent unanticipated effects on downslope historic features from rock scaling activities.

Cumulative Effects. Past actions such as road maintenance and reconstruction have affected historic features that contribute to the cultural landscape along Rim Drive. Previous actions that have added new structural features or changes to the road also have contributed to the current condition of the cultural landscape. Previous reconstruction work at the Watchman Overlook, North Junction, and Cleetwood Cove parking areas has affected the historic integrity of these areas such that they are no longer contributing elements to the historic designed landscape. Other nonconforming work has included construction of stone guardwalls and other structural elements that did not conform to NPS rustic design standards. Planned future road maintenance would be compatible with the cultural landscape according to the treatment plan outlined in the Rim Drive Cultural Landscape Report (NPS 2009).

The overall cumulative effect on the cultural landscape from the no action alternative in combination with past and reasonably foreseeable future actions would be local, long-term, and negligible to minor. The no action alternative would contribute negligible to minor effects on contributing historic structures from continued deterioration of the road and associated structures and ongoing maintenance activities, and a minor to moderate adverse impact if road failure occurs. For purposes of Section 106, the determination of effect for routine maintenance would be no adverse effect and the effect from structural failure would be adverse effect.

Conclusions. Effects on the cultural landscape are anticipated to be local, long-term, and negligible to minor from deterioration of the road, typical maintenance work, and manual rock scaling. However, should there be a failure to the road or related structural features, effects on the cultural landscape would be local, long-term, minor to moderate, and adverse under Section 106. Manual rock scaling would have no effect on historic structures and would protect downslope features from rockfall. Cumulative effects would be local, long-term, and negligible to minor.

Alternative 2 – Rehabilitation of Rim Drive with Rock Scaling

Direct and Indirect Effects. Proposed rehabilitation work under Alternative 2 would be conducted to preserve the integrity, design characteristics, and craftsmanship of structural features and enhance the overall historic designed landscape. Rehabilitation would be conducted in accordance with a PA the NPS and Oregon SHPO would prepare that stipulates for the continued identification, evaluation, and assessment of effect for known and unknown historic properties and provides for the development of a treatment plan for historic properties that may be adversely affected by project implementation. Work would also be conducted in accordance with the treatment plan contained in the Rim Drive Cultural Landscape Report (NPS 2009) and would meet the *Secretary of the Interior's Standards for Rehabilitation* (1992). This includes reuse of original material, repair and replacement of features in-kind, and use of compatible PWA and NPS rustic designs when adding new features. Stabilization and paving would maintain the structural integrity of the road. Construction activities such as stabilizing slopes, road widening and repaving, adding

guardrails and guardwalls, repairing stone masonry walls, and improving parking lot drainage would add new elements to the landscape or reinforce existing structural features adjacent to the road. Construction and repair of walls would be compatible with NPS rustic design standards and the treatment plan detailed in the Rim Drive Cultural Landscape Report (NPS 2009). Miscellaneous culvert repairs, replacement, and drainage improvements would reflect NPS rustic design of structural elements by using original design, similar materials, and similar craftsmanship whenever possible.

There would be local long-term negligible to minor effects on contributing historic structures from the proposed road rehabilitation and stabilization work. Mechanical rock scaling would reduce the potential for rockfall damage on downslope historic features such as stone masonry headwalls, guardwalls, and curbing. Rock scaling would introduce temporary audio and visual effects on the cultural landscape during work. These effects would be short-term and negligible. Overall, rehabilitation work would have a local long-term negligible to minor effect on the cultural landscape by addressing deteriorating road conditions and maintaining and protecting the historic features that contribute to the historic designed landscape. For purposes of Section 106, the determination of effect would be no adverse effect.

Cumulative Effects. Past actions such as road maintenance and parking lot reconstruction have affected the historic integrity of contributing elements to the historic designed landscape along Rim Drive. Previous actions that have added new structural features such as nonconforming guardwalls or road widening have contributed to the current condition of the cultural landscape. Previous rehabilitation of other sections of Rim Drive such as the Watchman Overlook, North Junction, and Cleetwood Cove parking areas have resulted in unintended effects on the historic designed landscape from the introduction of nonconforming design changes and nonconforming structural elements such as asphalt curbing and steel guardwalls. Past work to Watchman Overlook, North Junction, and Cleetwood Cove have resulted in a determination of noncontributing to the Rim Drive Historic District. Past maintenance activities have removed some of the historic stone masonry structures that lacked structural integrity, that could not be incorporated into the required road design, or that were repaired or rebuilt with materials or workmanship not compatible with their historic design (NPS 2008, 2009). Planned future rehabilitation work on Rim Drive would be conducted in accordance with a PA, the treatment plan outlined in the Rim Drive Cultural Landscape Report (NPS 2009), and the *Secretary of the Interior's Standards for Rehabilitation (1992)*.

The impact of past actions has resulted in local long-term negligible to minor effects on the cultural landscape. The overall cumulative effects on the cultural landscape from Alternative 2 in combination with past and reasonably foreseeable future actions would be local, long-term, and negligible to minor with a long-term negligible contribution from Alternative 2 with implementation of the provisions of the PA.

Conclusions. Effects on the cultural landscape are anticipated to be local, long-term, and negligible to minor for stabilization and rehabilitation work, while mechanical rock scaling would reduce the potential for rockfall damage to historic structures that contribute to the cultural landscape. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification and

assessment of effect for historic properties and any needed mitigation through the development of a treatment plan. Cumulative effects would be local, long-term, and negligible to minor.

Alternative 3 – Rehabilitation of Rim Drive with Selective Rockfall Mitigations

Direct and Indirect Effects. The planned rehabilitation of Rim Drive and manual and mechanical rock scaling would introduce the same effects as detailed under Alternatives 2. The additional rock bolting, colored and sculpted shotcrete, buttressing, and anchored wire mesh at Dutton Cliff and Anderson Point would introduce temporary audio and long-term visual adverse effects on the historic designed landscape, but would also reduce the potential for rockfall that could affect historic structural elements of the landscape. The introduction of nonconforming elements to the historic landscape, such as rock bolting, shotcrete, buttressing, and anchored wire mesh would be designed and incorporated to blend with the natural landscape, as feasible. These elements would also be placed sufficiently upslope so that they would not be visible to visitors operating a vehicle and would not impair the visible portion of the historic circulation pattern.

Cumulative Effects. Cumulative effects on the historic designed landscape from rock scaling and road rehabilitation would be similar to Alternative 2, but would further reduce the potential for damage to the cultural landscape with the additional rockfall mitigation. The overall cumulative effects on the cultural landscape from Alternative 3 in combination with past and reasonably foreseeable future actions would be local, long-term, and negligible to minor. Alternative 3 would have a local and negligible contribution to cumulative cultural landscape effects with short- and long-term effects.

Conclusions. The effects on the cultural landscape would be local, long-term, and negligible to minor for rehabilitation work on Rim Drive. Rockfall mitigation treatments would reduce the potential for damage to historic elements of the landscape, but would introduce short- to long-term audio and visual effects on the cultural landscape from the introduction of permanent rockfall mitigation elements such as rock bolting, buttressing, and anchored wire mesh. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification and assessment of effect for historic properties and any needed mitigation through the development of a treatment plan. Cumulative effects would be local, long-term, and negligible to minor.

Alternative 4 – Rehabilitation of Rim Drive with Extensive Rockfall Mitigation

Direct and Indirect Effects. The planned rehabilitation of Rim Drive and extensive manual and mechanical rock scaling would introduce the same effects as detailed under Alternative 3. Rockfall treatment measures at all medium to high hazard slopes would introduce short-term audio and visual effects on the historic designed landscape during treatment and long-term visual effects from the introduction of permanent rockfall mitigation elements, but would also reduce the potential for unanticipated effects from rockfall damage to downslope contributing historic structures such as retaining walls, guardwalls, and stone curbing. Permanent rockfall mitigation elements such as rock bolting,

buttressing, and anchored wire mesh would be designed to be compatible with the natural landscape and would be placed sufficiently upslope to reduce visual effects on the designed circulation pattern in order to maintain the historic designed landscape.

Cumulative Effects. Cumulative effects on the historic designed landscape from rock scaling and road rehabilitation would be similar to Alternative 2. Extensive rockfall treatments at 21 locations along Rim Drive would further reduce the potential for unanticipated effects from rockfall on downslope contributing historic structures. The overall cumulative effects on the cultural landscape from Alternative 4 in combination with past and reasonably foreseeable future actions would be local, long-term, and negligible to minor. Alternative 4 would have a local and negligible to minor contribution to cumulative cultural landscape effects over the short and long term.

Conclusions. Effects on the cultural landscape are anticipated to be local, long-term, and negligible to minor for rehabilitation work on Rim Drive. Rockfall mitigation would reduce the potential for rockfall damage to historic structural elements of the cultural landscape, but would introduce short- to long-term audio and visual effects on the cultural landscape from the introduction of permanent rockfall mitigation elements such as rock bolting, buttressing, and anchored wire mesh. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification and assessment of effect for historic properties and any needed mitigation through the development of a treatment plan. Cumulative effects would be local, long-term, and negligible to minor.

VISITOR USE AND EXPERIENCE

Affected Environment

Although Crater Lake National Park is fairly isolated and located several hours by car from a metropolitan area, the park receives about 500,000 visitors each year but can fluctuate as much as 25% from year to year (NPS 2012b). Less than 100,000 of these visits occur during the winter months. The park's southern entrance station is 76 miles from Medford and 56 miles from Klamath Falls, and the northern entrance is approximately 80 miles from Bend. The weather plays a large role in determining the park's visitation each year. Park visitation is typically highest on weekends in June, July, and August with the majority of visitors staying an average of five hours in the middle of the day (10:00 a.m. to 3:00 p.m.) (NPS 1999). A visitor use survey conducted in 2001 found that the park is used primarily for day-use (81%) and many visitors stop at Crater Lake as part of a north-south auto trip.

Rim Drive is one of the primary destinations at Crater Lake as many visitors enjoy the scenery while driving along the road and often stop at pullouts to take photographs and view the lake. West Rim Drive often serves as a throughway for visitors coming from the north or south, and receives higher traffic volumes than East Rim Drive. In the summer of 2001, average daily traffic was 2,000 vehicles on West Rim Drive and 600 on East Rim Drive (Robert Peccia & Associates 2003). In addition to West Rim Drive, the most visited places in the park are Rim Village and the Rim Village Visitor Center. Rim Drive is typically closed from early October through early July.

The Crater Lake Lodge is in the Rim Village and has 71 guest rooms and a 78-seat restaurant and bar (NPS 2005). The lodge is open mid-May through mid-October. Mazama Cabins has 40 units and is in the Mazama Village complex. It is open late May through mid-September.

While the most common visitor use activity is scenic driving (94%), several recreational activities exist at the park and are enjoyed by park visitors. Summer recreation includes bicycling, photography, swimming, hiking, picnicking, backpacking, interpretive activities, taking the boat tour at Cleetwood Cove, and riding the guided shuttle tour around Rim Drive (NPS 2012b). Winter activities include cross-country skiing, snowshoeing, and snowmobiling. Snowmobile use is allowed in a limited portion of the park, from the north entrance station to North Junction and only when the park determines that snow depth is adequate. In addition, there are approximately 960 snowmobile trails within the adjoining Umpqua, Rogue River, and Winema national forests (NPS 1994). Backcountry camping is also available in the winter with a permit.

Rim Drive is a popular route for bicyclists, primarily from July through September. Most cyclists start from the park headquarters area and ride around the lake clockwise, which puts one of the steepest and longest grades at the beginning of the trip.

The park has more than 50 miles of maintained hiking trails, with access from Rim Drive in various locations. The Plaikni Falls Trail, which is accessed from Pinnacles Road off Rim Drive, was completed in 2010 and is one of the most popular trails in the park, although information is not available on the number of visitors to this trail per year. The popularity of the trail is due to the falls, which are a short hike in from the trailhead. No campgrounds are in the project area; however, the road provides access to the Mazama campground, which has 200 sites and is open July through mid-September, and the Lost Creek campground, which has 16 tent sites and is open from mid-July to early October (NPS 2012a).

Several annual visitor events also take place at the park. The Rim Run takes place in August, is in its 36th year, and includes a 10k, half marathon, and full marathon. The event is open to 500 participants. The Century Ride also occurs in August and includes 100-mile and 62-mile bike routes. The rides are limited to 275 and 25 riders, respectively. Cycle Oregon is a bicycle ride in its 24th year that provides a new route through various parts of Oregon each summer. The park has been a part of the route for some of those years and the ride is scheduled to travel around Crater Lake in 2012. Founders Day (August 25) is also celebrated annually in the park by providing free admission to all visitors. The Crater Lake National Park Trust group also holds visitor events throughout the season, including Family Fun Day each September.

Impact Intensity Threshold

NPS *Management Policies 2006* state that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks, and that the NPS is committed to providing appropriate high-quality opportunities for visitors to enjoy the park. Part of the purpose of the park is to offer opportunities to present and future generations to experience and understand park resources and values. Crater Lake National

Park's enabling legislation stipulates that the park will be dedicated and set apart forever as a public (park) or pleasure ground for the benefit of the people of the United States. The thresholds of change for the intensity of an impact on visitor use and experience are described in Table 12.

TABLE 12. VISITOR USE AND EXPERIENCE IMPACT AND INTENSITY THRESHOLDS

Impact Intensity	Intensity Description
Negligible	Changes in visitor use and experience would be imperceptible. The visitor would not likely be aware of the effects associated with the change.
Minor	Changes in visitor use and experience 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 use and experience 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 use and experience 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.

Short-term impact—effects occur only during project implementation activities.
Long-term impact—effects extend beyond the project implementation activities.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects. There would be no change in the fundamental nature and quality of the visitor experience or recreational opportunities along Rim Drive under the no action alternative. There would be no temporary disruption of traffic due to construction activities, as would be experienced in the build alternatives. However there would be unplanned disruptions as the Park repairs the road and removes rockfall. Road conditions would continue to deteriorate to the point that the quality of the visitor experience is diminished from a visibly damaged road, structural deficiencies in road subgrade, further bench erosion, damage from rockfall, and deterioration of other structural features, such as the historic rock walls. The quality of recreational experiences along Rim Drive such as bicycling and sightseeing would decline due to the poor condition of the road. The potential for road failure and road closure for repairs would increase, and the intensity of the adverse impacts is anticipated to increasingly worsen with each passing year. The effects on visitor use and experience under the no action alternative would be local, long-term, moderate to major, and adverse.

Cumulative Effects. Other past, present, and future projects that effect visitor use and experience include forest thinning, visitor center stabilization, and future road maintenance and repairs on Rim Drive. These actions result in temporary disruption in visitor access or traffic delays, but would improve the quality and safety of the visitor experience. Past, present, and reasonably foreseeable future projects would have mostly parkwide short-term minor adverse effects on visitor use and experience but would have beneficial effects over the long term. The overall cumulative effects on visitor use and experience from the no action alternative in combination with past, present, and reasonably foreseeable future actions would be parkwide, short-term, minor, and adverse with a long-term minor to moderate adverse contribution from the no action alternative.

Conclusion. The no action alternative would have local long-term moderate to major adverse effects on visitor use and experience from ongoing deterioration of the road and structural features that contribute to the quality of the visitor experience, and that provide access to recreation resources. Although the road would remain open to visitor access, as road conditions deteriorate, periodic maintenance projects or road failure would require traffic delays or road closure at random times and locations, which would inconvenience visitors. Cumulative effects would be parkwide, both short- and long-term, minor, and adverse.

Alternative 2 – Rehabilitation of Rim Drive with Rock Scaling

Direct and Indirect Effects. The quality of the visitor experience and access to recreation resources would be temporarily impacted by construction activities required to rehabilitate Rim Drive and conduct rock scaling. Traffic delays, short-term closures, and closed parking areas and pullouts would inconvenience visitors traveling along the road. The visitor experience would be temporarily affected by a change in scenic quality from the presence of construction equipment and construction-related disturbance and noise (for more detail on visual quality, see "Visual Resources" on page 99). Road improvements would have a beneficial effect on the visitor experience from a safer, more consistent road width and shoulder, and better opportunities to view park attractions. Expansion of the Cleetwood Cove parking area would improve the quality of the visitor experience and the ability to access the trail and boat tours safely. Improvements to the Rim Village parking area, pullouts, and other infrastructure also would improve the quality of the visitor experience.

The timing of construction work is dependent on the snowpack and weather conditions. Once the snow is cleared from Rim Drive in the spring and conditions allow, roadwork would begin. This would most likely be in late June or early July. Construction would continue until weather conditions preclude further construction; most likely late September or early October. The majority of the roadwork would allow for one lane to remain open at all times. Traffic delays would be no more than 30 minutes on each of East and West Rim drives. Traffic control measures such as flaggers or signal lights would be used to lessen impacts on traffic flow. Night work may occur in areas of the park where overnight guests at Crater Lake Lodge or the Lost Creek campground would not be affected by construction impacts such as lighting and equipment noise.

As described in Table 3, rock scaling activities would result in temporary traffic delays as scaling crews and equipment may require temporary single-lane and/or full road closures. Construction work would occur from Monday through Friday. Site specific road closures for scaling operations would be limited to Monday to Thursday to reduce visitor impacts. Rock scaling work is expected to occur over multiple years. For maximum effectiveness, the FHWA recommends that each slope would be scaled on a six-year cycle. Rock scaling activities would also have a short-term minor adverse effect on the quality of the visitor experience at a local level. Some of the rock scaling work may be conducted in the spring prior to opening the road to the public. Rock scaling activities are unlikely to affect the number of visitors to the park as temporary delays from previous manual rock scaling activities conducted by park staff have not deterred visitors. Over the long term, reductions

in rockfall along Rim Drive would reduce travel delays caused by rockfall clearing activities within the road.

As described in Table 3, the park would implement a number of measures to reduce visitor impacts, and maintain the quality of the visitor experience and access to recreation resources during construction. The park would provide clear and concise information on the status of rehabilitation work, traffic delays, and parking lot closures. To facilitate visitor planning, the status of roadwork and traffic delays would be advertised two weeks in advance and would be updated daily. The status of road construction and travel restrictions would be communicated via a number of outlets—the park website, newspapers, radio, entrance stations, visitor centers, news releases, media outlets, postings in local businesses, and other locations.

A short-term minor to moderate adverse effect on the quality of the visitor experience would occur at the local and parkwide level during periods of construction. Construction-related noise would diminish the experience for some visitors as they explore areas along Rim Drive. While construction activities and traffic delays would temporarily inconvenience visitors, substantial changes in the number of visitors to the park are not expected. Annual events like the Rim Run and Century Ride may be subject to minor inconveniences traveling through construction zones. Over the long term, the proposed improvements to the condition of Rim Drive, parking areas, pullouts, and associated features would provide a beneficial effect on the quality of the visitor experience, as well as provide more consistent and better-defined road shoulder and foreslope. The improvements would ensure protection of the road's structural features for visitor enjoyment and safe travel for many years.

Cumulative Effects. Effects from past, present, and reasonably foreseeable future projects would be similar to those described under Alternative 1. The overall cumulative effects on visitor use and experience from Alternative 2 in combination with past, present, and reasonably foreseeable future actions would be parkwide, short- to long-term, minor, and adverse. Alternative 2 would contribute short-term minor adverse effects on the quality of the visitor experience during construction but would have a beneficial contribution to cumulative effects over the long term.

Conclusion. Rehabilitation of damaged and deteriorating sections of the road would have a long-term beneficial effect on visitors traveling on Rim Drive. A short-term minor to moderate adverse effect on the quality of the visitor experience would occur at the local and parkwide level during periods of construction. Rock scaling would result in local short-term minor to moderate adverse effects on the visitor experience. Cumulative effects would be parkwide, short- to long-term, minor, and adverse, with a long-term beneficial contribution from Alternative 2.

Alternative 3 – Rehabilitation of Rim Drive with Selective Rockfall Mitigations

Direct and Indirect Impacts. Impacts resulting from rehabilitation of Rim Drive and rock scaling would be the same as those described under Alternative 2.

Selective rockfall treatments occurring at Dutton Cliff and Anderson Point would require temporary road closures in these locations because the use of cranes and other equipment

would occupy both travel lanes. Road closures would be limited to Monday through Thursday and would be announced well in advance to reduce visitor impacts. Closures may last up to two to three weeks in some locations. Night work would not occur near Lost Creek campground to avoid noise impacts to overnight guests. Impacts from selective rockfall treatments would be local, short-term, moderate, and adverse.

Cumulative Effects. Effects from past, present, and reasonably foreseeable future projects would be similar to those described under Alternative 1. The overall cumulative effects on visitor use and experience from Alternative 3 in combination with past, present, and reasonably foreseeable future actions would be parkwide, short-term, minor to moderate, and adverse. Alternative 3 would contribute short-term minor adverse effects on the quality of the visitor experience during construction but would have a beneficial contribution to cumulative effects over the long term.

Conclusion. Rehabilitation of damaged and deteriorating sections of the road would have a long-term beneficial effect on visitors traveling Rim Drive. Selective rockfall treatments at Anderson Point and Dutton Cliff, in addition to manual and technical rock scaling, would result in local short-term minor to moderate adverse effects on the visitor use and experience. Cumulative effects would be parkwide, short- to long-term, minor to moderate, and adverse, with a long-term beneficial contribution from Alternative 3.

Alternative 4 – Rehabilitation of Rim Drive with Extensive Rockfall Mitigation

Direct and Indirect Effects. Impacts resulting from Rim Drive rehabilitation and rock scaling activities under Alternative 4 would be the same as those described under Alternative 2.

Extensive rockfall mitigation would result in traffic delays over several peak visitor seasons due to phased rockfall work at 21 locations. Although each slope would have specific mitigation techniques implemented depending on the conditions at that location, Monday to Thursday road closures may occur for several weeks at some locations. The effects on visitor use and experience along Rim Drive would be local, short-term, moderate, and adverse.

Cumulative Effects. Effects from past, present, and reasonably foreseeable future projects would be similar to those described under Alternative 1. The overall cumulative effects on visitor use and experience from Alternative 4 in combination with past, present, and reasonably foreseeable future actions would be parkwide, short-term, moderate, and adverse with a long-term beneficial contribution from Alternative 4.

Conclusion. Rehabilitation of damaged and deteriorating sections of the road would have a local short-term minor to moderate adverse effect on visitors traveling on Rim Drive and a long-term beneficial effect due to a smoother, safer road. Extensive rockfall mitigation at 21 locations, in addition to manual and technical rock scaling, would result in parkwide short-term moderate adverse effects on the visitor use and experience. Cumulative effects would be parkwide, short- to long-term, moderate, and adverse.

VISUAL RESOURCES

Affected Environment

Rim Drive circles the caldera, offering views of the lake for much of the route. Two picturesque islands, Wizard Island and Phantom Ship, are on the west and south ends of the lake, respectively, and may be viewed from several locations around the lake. A number of pullout areas border the lake, giving visitors the opportunity to get out of their cars and fully enjoy the views. Rock formations along Rim Drive also provide visual interest to travelers. Rim Drive is linked to other Cascade Mountain volcanic areas by its 1997 designation by the Oregon Department of Transportation as part of the Volcanic Legacy Scenic Byway (VLSB) that links with the Shasta Volcanic Scenic and Lassen Volcanic National Park. In 1998, the FHWA named Rim Drive an All American Road.

According to the 2001 visitor survey (NPS 2001), the predominant visitor activity at Crater Lake National Park is lake viewing. Ninety-four percent of respondents reported sightseeing and scenic driving as very important activities during their visit. In addition, 63% of visitors indicated that sightseeing and scenic driving would be important parts of any future visits to the park.

The historic nature of the road is emphasized by stone masonry guardwalls and retaining walls built from native and historic materials. According to the Corridor Management Plan for the VLSB, these features add to the visual quality of driving Rim Drive and give the features found throughout the park a cohesive and connected appearance (Gyorgyfalvy 2001).

Impact Intensity Threshold

Visual resources are the features that define the visual character of an area. Features that define the visual character of an area could include natural features, vistas, viewsheds, and architecture. The thresholds of change for the intensity of impacts on visual resources are described in Table 13.

TABLE 13. VISUAL RESOURCES IMPACT AND INTENSITY THRESHOLDS

Impact Intensity	Intensity Description
Negligible	The action would result in barely perceptible changes to existing views.
Minor	The action would result in slightly detectable changes to views in a small area, or would introduce a compatible human-made feature to an existing developed area.
Moderate	The action would be readily apparent and would change the character of visual resources in the area. The visitor would be aware of the effects associated with the alternative and would likely express a neutral to negative opinion about the changes.
Major	The action would be highly noticeable and visible from a considerable distance or over a large area. The character of visual resources would change substantially. The visitor would be aware of the effects associated with the alternative and would likely express a strong negative opinion about the changes.

Short-term impact—following project completion, recovery would take less than three years.
Long-term impact—following project completion, recovery would take more than three years.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects. Under the no action alternative, there would be no immediate change in the visual character of Rim Drive. However, not addressing the deteriorating condition of the road and adjacent drainage, embankment, and infrastructure problems would lead to further deterioration. Bench erosion, damaged pavement and historic guardwalls from rockfall events, and the general deterioration in the condition of the pavement surface would detract from the scenic quality of the road corridor. The no action alternative would have a local long-term minor to moderate adverse impact on the visual character of the road if structural deficiencies and other proposed rehabilitation work are not implemented.

Cumulative Effects. Past and ongoing road maintenance and other improvement projects to Rim Drive have resulted in periodic disturbances and changes to the visual quality. The forest thinning and fuel reduction projects affect visual quality through the removal of timber encroaching on OR 62 and in other locations to reduce the danger of wildfire. Multiple small disturbed sites resulting from previous construction activities within the park have created visual impacts that have not been rehabilitated. These past, present, and reasonably foreseeable future projects would have parkwide long-term minor adverse effects on visual quality. The overall cumulative effects on visual quality from past, present, and reasonably foreseeable future actions would be parkwide, long-term, minor, and adverse, with the no action alternative contributing long-term minor to moderate adverse impacts.

Conclusion. The no action alternative would have a local long-term minor to moderate adverse effect on the visual character of the road corridor if deteriorating road infrastructure is not rehabilitated. Cumulative effects would be parkwide, long-term, minor, and adverse.

Alternative 2 – Rehabilitation of Rim Drive with Rock Scaling

Direct and Indirect Effects. Visual impacts would occur during road construction from construction equipment, materials, and ground disturbance. Construction activities and construction-related disturbances such as road excavation and clearing, repair and construction of stone masonry walls, MSE walls, and adding new pavement and striping would provide a short-term visual contrast from current conditions. Any disturbances to existing structural features or new structural features such as culverts, guardwalls, and retaining walls would be constructed with original materials, if possible, or materials that match the color, texture, and historic character of existing facilities (see “Historic Structures” section). Rehabilitation of damaged and deteriorating sections of the road and structures would have a long-term beneficial effect on the visual quality of the road by protecting the scenic views of the lake for which the park is renowned. Improvements to the Cleetwood Cove parking lot would change the visual character with tree removal and additional asphalt parking and would have a local long-term moderate adverse impact on visual quality. Additional parking at Cleetwood Cove would improve visual quality by eliminating overflow parking along the shoulder of Rim Drive, which distracts from the views of the landscape. Rock scaling would have local short-term minor adverse effects on visual resources from

equipment and debris during scaling activities. Once completed, the results of rock scaling operations are unlikely to be noticeable to most visitors.

Cumulative Effects. Visual resource effects from past, present, and reasonably foreseeable future projects would be similar to those described under Alternative 1. The overall cumulative effects on visual resources from Alternative 2 in combination with past, present, and reasonably foreseeable future actions would be parkwide, long-term, minor, and adverse. Alternative 2 would contribute short-term minor adverse effects on the quality of visual resources during construction but would have a beneficial contribution to cumulative effects over the long term.

Conclusion. Rehabilitation of damaged and deteriorating sections of the road would have a short-term minor adverse effect and a long-term beneficial effect on the visual quality of the road. Expansion of the Cleetwood Cove parking area would have a local long-term moderate adverse impact from tree removal and additional asphalt parking. Rock scaling would result in local short-term minor adverse effects on visual resources. Cumulative effects would be parkwide, long-term, minor, and adverse.

Alternative 3 – Rehabilitation of Rim Drive with Selective Rockfall Mitigations

Direct and Indirect Effects. Road rehabilitation and rock scaling would have the same effect on the visual character along Rim Drive as Alternative 2. Rockfall mitigation techniques at Dutton Cliff and Anderson Point would result in short-term visual impacts from the presence of equipment and machinery along the road during mitigation work. Rockfall treatment techniques such as rock bolting, buttressing, and shotcrete would be implemented in a manner to blend with the existing rock face to the extent possible to minimize visual impairment. Anchored wire mesh would be placed high on the slope at Anderson Point so that it would not be readily apparent to most travelers on the road. Effects on visual resources during rockfall mitigation would be local, short-term, minor, and adverse during construction and negligible to minor and adverse over the long term.

Cumulative Effects. Visual resource effects from past, present, and reasonably foreseeable future projects would be similar to those described under Alternative 1. The overall cumulative effects on visual resources from Alternative 3 in combination with past, present, and reasonably foreseeable future actions would be parkwide, long-term, minor, and adverse, with a short-term minor adverse contribution from Alternative 3 during construction. Although rockfall mitigation techniques under this alternative would blend with the existing rock face to the extent possible, some long-term visual effects may occur.

Conclusion. Rehabilitation of damaged and deteriorating sections of the road would have local short-term minor adverse effects on the visual quality of Rim Drive during construction, with a long-term beneficial effect by protecting and preserving the scenic and visual character of the road. Additional rockfall mitigation applied at Anderson Point and Dutton Cliff would have a local short-term minor adverse effect on visual quality during construction and negligible to minor adverse effect over the long term because most treatment measures would blend with the existing environment. Cumulative effects on visual resources would be parkwide, long-term, minor, and adverse.

Alternative 4 – Rehabilitation of Rim Drive with Extensive Rockfall Mitigation

Direct and Indirect Effects. Road rehabilitation and rock scaling would have the same effect on the visual character along Rim Drive as Alternative 2. Rockfall mitigation techniques implemented at 21 rockfall sites along Rim Drive would result in short-term visual impacts from the presence of equipment and machinery along the road during mitigation work. The majority of the specialized rockfall treatment would involve the use of rock bolts to secure larger rocks on the slope. Rockfall treatment techniques such as rock bolting, buttressing, and shotcrete would be implemented in a manner to blend with the existing rock face to the extent possible to minimize visual impairment. Effects on visual resources during rockfall mitigation would be local, short-term, minor, and adverse during construction and negligible to minor and adverse over the long term.

Cumulative Effects. Visual resource effects from past, present, and reasonably foreseeable future projects would be similar to those described under Alternative 1. The overall cumulative effects on visual resources from Alternative 4 in combination with past, present, and reasonably foreseeable future actions would be parkwide, long-term, minor, and adverse. Alternative 4 would contribute short-term minor adverse effects on the quality of visual resources during construction. Although rockfall mitigation techniques under this alternative would blend with the existing rock face to the extent possible, some long-term visual effects may occur.

Conclusion. Rehabilitation of damaged and deteriorating sections of the road would have local short-term minor adverse effects on the visual quality of Rim Drive during construction with a long-term beneficial effect by protecting and preserving the scenic and visual character of the road. Additional rockfall mitigation applied at 21 sites around Rim Drive would have a local short-term minor adverse effect on visual resources during construction and negligible to minor adverse effects over the long term because most treatment measures would blend with the existing environment. Cumulative effects would be parkwide, long-term, minor, and adverse.

SOUNDSCAPES

Affected Environment

According to the Crater Lake National Park GMP (NPS 2005), "the serenity and beauty of Crater Lake National Park offers its visitors a wide range of recreational activities and opportunities to experience natural beauty, quiet, solitude, reflection, and inspiration." Natural sounds are considered an important part of park ecology and visitor experience. In addition, more than 90% of the park is managed as wilderness or backcountry where visitor expectations for natural quiet and solitude are high.

In the past, a natural soundscape devoid of human-induced noise was important to the visitor experience in a backcountry or wilderness setting. More recent research has indicated that natural soundscapes in parks are important not only in backcountry or wilderness settings, but in frontcountry settings as well. Impacts on the natural soundscape occur to visitors within the park, and also affect biological resources within and around the park.

The soundscape along Rim Drive is influenced primarily by vehicle traffic. About 41,000 vehicles traveled the road in 2010. Park operations, maintenance, and administration activities also contribute to the traffic and noise generated along the road. According to the 2001 visitor survey, respondents rated the importance of 10 selected park attributes. Attributes that received a high importance rating include natural quiet/sounds of nature and solitude. Eighty-nine percent of respondents to the 2001 visitor survey indicated natural quiet and sounds of nature were either very or extremely important park attributes that should be considered in preservation planning for Crater Lake National Park. Because of the importance of lake viewing to visitor use (see "Visual Resources"), and views of the lake are primarily accessed through Rim Drive, the sights and sounds of motor vehicle traffic are frequently present. Other noise sources along Rim Drive include snowmobiles during winter months and tour boats in the summer. Snowmobiles are allowed along 10 miles of Rim Drive, which is seasonally closed to automobiles during the winter. Boating on the lake consists of nine daily commercial boat tours throughout the summer and boats used for research and monitoring by park staff.

One of the largest threats to the natural quiet of national parks is the presence of commercial, air tour, and military overflights (McCain 1997). A large number of aircraft use air space over Crater Lake National Park on a daily basis, including commercial, military training, and private aircraft. There is also sporadic use of park emergency (search and rescue, emergency medical, and fire) and other administrative flights (research and logistical support of backcountry operations). Flight altitudes vary from thousands of feet above the terrain to ground-hugging, treetop level.

A two-year acoustic monitoring project began in June 2010 to capture baseline ambient sound levels within the park (NPS n.d.)[1]. The project was initiated as a result of a petition by a helicopter tour company to provide commercial sightseeing flights over the park (see "Cumulative Effects"). Of particular interest for the study are effects of anthropogenic noise, including aircraft, on the northern spotted owls and pacific tree frogs within the park. At this time, monitoring has been completed at 14 locations throughout the park. Preliminary sound data from a remote backcountry location near Grayback Road found that anthropogenic noise is present 12.7% of the time or a little more than three hours of every day. It is likely that anthropogenic noise is more prevalent in less isolated locations.

Existing ambient noise data in frontcountry areas near Rim Drive are currently not available. As noted previously, daytime motor vehicle traffic is the primary source of noise along Rim Drive and aircraft overflights is the most noticeable night time noise. Noise monitoring at Zion National Park in Utah found average ambient noise within frontcountry locations to be approximately 48 dBA (NPS 2010b). Average ambient noise levels near Rim Drive are likely to be similar to Zion, but short-term higher noise levels near the road from cars, trucks, buses, and motorcycles may range from 50 to 90 dBA.

[1] The study was conducted as a research project and was not derived from NPS standards for acoustic data analysis. Results are considered preliminary and for informational purposes only.

Impact Intensity Threshold

The methodology used to assess noise impacts is consistent with NPS *Management Policies 2006* and DO–47: *Soundscape Preservation and Noise Management*. The thresholds of change for the intensity of an impact on the soundscape are described in Table 14.

TABLE 14. SOUNDSCAPE IMPACT AND INTENSITY THRESHOLDS

Impact Intensity	Intensity Description
Negligible	The natural sound environment would not be affected, or the effects would be at or below the level of detection and the changes would be so slight that they would not be of any measurable or perceptible consequence to the visitor experience.
Minor	The effects on the natural sound environment would be detectable, although the effects would be localized, small, and of little consequence to the visitor experience. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate	The effects on the natural sound environment would be readily detectable with consequences at the local level. Mitigation measures would be minimal, but would not eliminate adverse effects.
Major	The effects on the natural sound environment would be obvious and would 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 their success could not be guaranteed.

Short-term impact—effects lasting for the duration of the construction period.
Long-term impact—effects lasting longer than the duration of the construction period.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects. The soundscape along Rim Drive would continue to be affected by park visitor traffic and through traffic and trucks; park operations, maintenance, and administration activities; boat tours; snowmobiles; and overflights. Periodic road maintenance and rock cleanup and scaling would continue to be conducted when necessary, and the noise associated with these operations would likely involve trucks, graders, backhoes, and other equipment. Snowmobile use in the park from the north entrance station to the rim would continue to affect the natural soundscape during the winter. Under the no action alternative, there would be a local long-term minor adverse impact on the natural soundscape from traffic along Rim Drive.

Cumulative Effects. Past actions along the road, including periodic maintenance, repairs, and overlays, have introduced temporary elevated noise levels during construction activities. Forest thinning and fuel reduction projects have resulted in temporary elevated noise levels from chainsaws, truck traffic, and other equipment. Overall past, current, or reasonably foreseeable future actions would result in parkwide long-term minor adverse cumulative effects on the natural soundscape. The overall cumulative effects on the natural soundscape from the no action alternative in combination with past, current, or reasonably foreseeable future actions would be parkwide, short-term, minor, and adverse, with a negligible adverse contribution from the no action alternative.

Conclusions. The no action alternative would have a local long-term minor adverse impact on the natural soundscape along Rim Drive from traffic and routine road

maintenance, including rock scaling by park staff. Cumulative effects would be parkwide short-term, minor, and adverse.

Alternative 2 – Rehabilitation of Rim Drive with Rock Scaling

Direct and Indirect Effects. Road rehabilitation activities would result in temporarily elevated noise levels at construction zones along the road about 40 to 50 dBA above existing ambient conditions. Equipment that would generate noise includes graders, trucks, backhoes, cranes, and other equipment. Table 15 shows noise emission levels for various types of construction equipment that would likely be used for this project (FHWA 2008).

TABLE 15. CONSTRUCTION EQUIPMENT NOISE EMISSION LEVELS

Equipment	Typical Noise Level (dBA) (50 feet)
Backhoe	80
Concrete Mixer	85
Crane, Mobile	83
Excavator	85
Grader	85
Jackhammer	88
Loader	85
Paver	89
Rock Drill	98
Truck	88

Source: FHWA 2008.
Note: This list is not all-inclusive but includes a representative sample of construction equipment.

While most of the noise would occur within the road corridor, truck traffic delivering supplies, asphalt, and removing excavated material would increase traffic-related noise along local routes leading to the construction area. In addition, haul trucks would periodically travel to the various staging areas shown in Figure 3. Construction traffic would occur primarily during daylight hours; however, limited night construction would occur at some locations to facilitate completion of construction and to avoid daytime visitor impacts. Night work would not occur in proximity to Lost Creek campground and Crater Lake Lodge to avoid noise impacts on overnight guests. New smoother pavement would result in a slight reduction in traffic noise levels.

Manual, and particularly mechanical, rock scaling operations would result in elevated sound levels at discrete locations. Noise from cranes and heavy equipment, as well as loaders and haul trucks, would increase noise levels above ambient conditions. Construction and rock scaling operations would have a local short-term moderate adverse effect on the natural soundscape. There would be no long-term adverse effects on the soundscape following construction activities because none of the road improvements are anticipated to increase traffic capacity.

Cumulative Effects. Effects from past, present, and reasonably foreseeable future projects would be similar to those described under Alternative 1. The overall cumulative effects on natural soundscapes from Alternative 2 in combination with past, present, and reasonably foreseeable future actions would be parkwide, short-term, minor, and adverse, with a short-term minor adverse contribution from Alternative 2 during construction and rock scaling.

Conclusion. Rehabilitation of Rim Drive and mechanical rock scaling operations would have a local short-term moderate adverse effect on the natural soundscape from equipment

and vehicle operations. Cumulative effects would be parkwide, short-term, minor, and adverse.

Alternative 3 – Rehabilitation of Rim Drive with Selective Rockfall Mitigations

Direct and Indirect Effects. Effects from road rehabilitation on the soundscape along Rim Drive would be the same as Alternative 2. Rockfall mitigation at Dutton Cliff and Anderson Point would result in noise impacts from rock scaling equipment and other techniques such as the short-term use of a rock drill for installation of anchored mesh and rock bolts (Table 15). The effects on the soundscape during rockfall mitigation would be local, short-term, moderate, and adverse.

Cumulative Effects. Effects from past, present, and reasonably foreseeable future projects would be similar to those described under Alternative 1. The overall cumulative effects on the natural soundscape from Alternative 3 in combination with past, present, and reasonably foreseeable future actions would be parkwide, short-term, minor, and adverse. Alternative 3 would contribute short-term moderate adverse effects on the natural soundscape during construction.

Conclusion. Road rehabilitation would have a local short-term moderate adverse effect on the natural soundscape along Rim Drive. Rock scaling and selective rockfall mitigation at Anderson Point and Dutton Cliff also would result in local short-term moderate adverse effects on the natural soundscapes at two locations. Cumulative effects on the natural soundscape would be parkwide, short-term, minor, and adverse.

Alternative 4 – Rehabilitation of Rim Drive with Extensive Rockfall Mitigation

Direct and Indirect Effects. Effects from road rehabilitation on the natural soundscape along Rim Drive would be the same as Alternative 2. Rockfall treatment at 21 rockfall locations along Rim Drive would result in noise impacts from rock scaling equipment, loaders, rock drilling, haul trucks, and other equipment needed for the installation of anchored mesh, rock bolts, and shotcrete. The effects on the natural soundscape during extensive rockfall mitigation would be local, short-term, moderate, and adverse.

Cumulative Impacts. Effects from past, present, and reasonably foreseeable future projects would be similar to those described under Alternative 1. The overall cumulative effects on the natural soundscape from Alternative 4 in combination with past, present, and reasonably foreseeable future actions would be parkwide, short-term, minor, and adverse. Alternative 4 would contribute local short-term moderate adverse effects on the natural soundscape during construction.

Conclusions. Road rehabilitation would have a local short-term moderate adverse effect on the natural soundscape along Rim Drive. Rock scaling and extensive rockfall mitigation at 21 locations along Rim Drive also would result in local short-term moderate adverse effects on the natural soundscape. Cumulative effects on the natural soundscape would be parkwide, short-term, minor, and adverse.

PUBLIC HEALTH AND SAFETY

Affected Environment

According to NPS DO–87, park roads are "intended to enhance visitor experience while providing safe and efficient accommodation of park visitors" (NPS 1984). When Rim Drive was completed in 1941, traffic was less frequent and vehicles were smaller than today. Over time, increased traffic, inconsistent lane widths, bench erosion, rockfall hazards, increasing popularity of bicycling and insufficient parking areas create hazards for drivers, especially for large vehicles such as buses and recreational vehicles. At some sharp corners, large vehicles often need to use part of the oncoming traffic lane to negotiate a turn or wheels leave the pavement, which is a safety concern. Bench erosion and eroded road shoulders with steep dropoffs create hazardous conditions and conflicts for vehicles, bicycles, and pedestrians (Figure 15). In some locations PWA-era stone guardwalls are damaged and require repair.

Accident data for the park is available for 1998, 1999, and 2000 from the Vehicle and Visitor Use Study (Robert Peccia & Associates 2003), which indicates annual vehicle accidents of 44, 28, and 21, respectively. Motor vehicle accident data from the park indicates the following number of accidents from 2002 through 2008:

- 2002 – 29
- 2003 – 33
- 2004 – 26
- 2005 – 35
- 2006 – 13
- 2007 – 15
- 2008 – 14

FIGURE 15. BENCH EROSION AND UNRAVELING PAVEMENT EDGE

According to park staff, only one vehicle accident may have been caused by rockfall in 70 years. Driver error is typically the cause of many of the motor vehicle accidents in national parks, although deteriorating road conditions can increase the potential for accidents. To address rockfall damage to the road and other potential hazards, park personnel have undertaken an ongoing effort of manual rock scaling at various locations throughout the park and road maintenance.

The Cleetwood Cove parking area was created to provide parking for visitors hiking the Cleetwood Trail, which provides the only access to the lake and the boat launch. Currently, parking accommodations are insufficient for the amount of visitors to that area of the park during peak season. Visitors frequently park their vehicles along Rim Drive on the east and west sides of the trailhead, creating a hazard for other traffic, pedestrians, and bicyclists.

Impact Intensity Threshold

Public health and safety refers to the ability of the NPS to provide a healthy and safe environment for visitors and park staff, to protect human life, and to provide for injury-free visits and appropriate responses when accidents and injuries occur. The thresholds of change for the intensity of an impact on public health and safety are described in Table 16.

TABLE 16. PUBLIC HEALTH AND SAFETY IMPACT AND INTENSITY THRESHOLDS

Impact Intensity	Intensity Description
Negligible	The effects would be at low levels of detection and would not have appreciable effects on public health and safety.
Minor	The effects would be detectable and would be of a magnitude that would not have appreciable effects on public health and safety.
Moderate	The effects would be readily apparent and would result in a change in public health and safety that would be noticeable to park staff and the public.
Major	The effects would be readily apparent, would result in a substantial change in public health and safety in a manner noticeable to park staff and the public, and would be markedly different from existing operations.

Short-term impact—effects occur only during project implementation activities.
Long-term impact—effects extend beyond the project implementation activities.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects. The park would continue with ongoing road maintenance and rockfall scaling and cleanup under the no action alternative. Public safety concerns on Rim Drive associated with deteriorating road pavement, narrow traffic lanes, bench erosion, and rockfall would not be addressed. The potential for traffic accidents would be similar to existing conditions and may increase as the road continues to deteriorate. Failure of any portion of the road would create an increased safety risk. The safety of park personnel performing rock scaling operations would remain a concern; however, a Job Hazard Analysis (JHA) has been developed by the park for rock scaling operations to identify potential hazards and actions to minimize hazards and protect workers. The no action alternative would result in local long-term minor to moderate adverse effects on public health and safety if road rehabilitation is not implemented. Rock scaling operations by park staff would have a beneficial effect by partially reducing the potential for rockfall and work would continue to be conducted according to recognized safety practices.

Cumulative Effects. Past actions along the road, including periodic maintenance, repairs, and overlays, have provided a benefit to public health and safety by addressing the minimum repairs needed. Forest thinning and fuel reduction projects reduce the risk of forest fires and associated public safety risks along Rim Drive. Emergency stabilization of the visitor center would benefit the safety of visitors through an improved facility. The past, current, and reasonably foreseeable future actions would result in parkwide long-term beneficial impacts on public health and safety. The overall cumulative impacts on public health and safety from the no action alternative in combination with past, current, or reasonably foreseeable future actions would be parkwide, long-term, negligible to minor, and adverse, with a local minor to moderate adverse contribution from the no action alternative.

Conclusion. The no action alternative would result in local long-term minor to moderate adverse effects on public health and safety by not addressing safety issues and needed road rehabilitation and repairs. The potential for accidents would be similar to existing conditions and may increase as the road and guardwalls continue to deteriorate, and the need for maintenance and potential for road failure increases. Rock scaling operations by park staff would continue to have a beneficial effect by partially reducing the potential for rockfall, while using methods to protect worker safety. Cumulative effects would be parkwide, long-term, negligible to minor, and adverse.

Alternative 2 – Rehabilitation of Rim Drive with Rock Scaling

Direct and Indirect Effects. Road rehabilitation would result in safety concerns for crews performing the work. Tasks such as using heavy equipment, working with hot asphalt and other materials, working in high altitudes, exposure to potentially adverse weather conditions, and other job hazards pose a risk to worker health and safety. Rock scaling activities would create risks for crews using rock scaling equipment, for personnel using ropes to perform scaling activities in areas higher on the rock face, and for rock and debris falling near personnel on the ground. Construction contractors would be required to develop a health and safety plan to address potential job hazards and ensure personnel are working in compliance with the plan. Maintaining a safe environment for park staff, contractors, and visitors during and after construction would be a primary objective. A variety of BMPs would also be used during construction to inform and direct visitors through construction zones, and to protect contractors and park staff (Table 3). There would be a local short-term minor adverse effect on public health and safety during construction.

Proposed road rehabilitation and improvements would address safety and road maintenance concerns associated with deterioration of Rim Drive. Improvements to road pavement, minor road realignments, curve widening, reestablishment of shoulder width, and guardwall/retaining wall repair would improve safety and driving conditions and reduce the potential for accidents. Manual and technical rock scaling would reduce the risk of rockfall on Rim Drive. Additional parking at Cleetwood Cove would alleviate vehicles parking on the shoulder of Rim Drive and the risk of accidents. Upon completion of construction work, local long-term beneficial effects on public health and safety are expected from road improvements.

Cumulative Effects. Effects from past, present, and reasonably foreseeable future projects would be similar to those described under Alternative 1. Past, present, and reasonably foreseeable future projects would have parkwide long-term beneficial effects on public health and safety. The overall cumulative impacts on public health and safety from Alternative 2 in combination with past, current, and reasonably foreseeable future actions would be parkwide, long-term, and beneficial with a local short-term minor adverse effect during construction and a parkwide long-term beneficial contribution from Alternative 2.

Conclusion. There would be local short-term minor adverse effects on public health and safety due to risks from construction work and rock scaling activities. Proposed road rehabilitation, Cleetwood Cove parking lot improvements, and rock scaling would address public health and safety concerns associated with Rim Drive and associated facilities. Improvements to road pavement, minor road realignments, curve widening,

guardwall/retaining wall repair, and drainage work would improve safety and driving conditions. Alternative 2 would result in local short-term minor adverse effects on public health and safety during construction and local long-term beneficial effects from improvements to the structural features of the road and safety measures, such as rock scaling, that reduce the potential for rockfall. Cumulative effects would be parkwide, long-term, and beneficial.

Alternative 3 – Rehabilitation of Rim Drive with Selective Rockfall Mitigations

Direct and Indirect Effects. Effects from road rehabilitation on public health and safety would be the same as Alternative 2. Potential safety hazards from rock scaling activities to park personnel would be minimized through safety measures prescribed in the JHA, developed by park staff, and health and safety plans prepared by road construction and rockfall contractors. In addition to rock scaling, selective rockfall treatments at Dutton Cliff and Anderson Point would further reduce the risk of rockfall in these areas, creating a safer route for travelers. Alternative 3 would have a local short-term minor adverse effect on public health and safety due to risks from construction work and selective rockfall mitigation activities and a long-term benefit from a reduction in potential rockfall.

Cumulative Effects. Effects from past, present, and reasonably foreseeable future projects would be similar to those described under Alternative 1. The overall cumulative impacts on public health and safety from Alternative 3 in combination with past, current, and reasonably foreseeable future actions would be parkwide, long-term, and beneficial with a local long-term beneficial effect from Alternative 3 from rockfall mitigation work at Anderson Point and Dutton Cliff that reduces the risk of rockfall.

Conclusion. There would be local short-term minor adverse effects on public health and safety due to risks from construction work and rock mitigation work. Proposed road rehabilitation, Cleetwood Cove parking lot improvements, and rock scaling would address public health and safety concerns associated with Rim Drive and associated facilities. Improvements to road pavement, minor road realignments, curve widening, guardwall/retaining wall repair, and drainage work would improve safety and driving conditions. Alternative 3 would result in local short-term minor adverse effects on public health and safety during construction and local long-term beneficial effects from improvements to the structural features of the road and selective rockfall treatments at Anderson Point and Dutton Cliff that reduce the potential for rockfall. Cumulative effects would be parkwide, long-term, and beneficial.

Alternative 4 – Rehabilitation of Rim Drive with Extensive Rockfall Mitigation

Direct and Indirect Effects. The effects from road rehabilitation on public health and safety would be the same as Alternative 2. Worker safety during extensive rockfall treatments at 21 rockfall sites along Rim Drive would be a concern, minimized through safety measures prescribed in the JHA and contractor health and safety plans. Ultimately, this work would further reduce the risk in these areas, creating a safer route for travelers. Alternative 4 would have a local short-term minor adverse effect on public health and safety due to risks from

construction work and rock scaling activities and a long-term benefit by reducing potential rockfall.

Cumulative Effects. Effects from past, present, and reasonably foreseeable future projects would be similar to those described under Alternative 1. The overall cumulative impacts on public health and safety from Alternative 4 in combination with past, current, and reasonably foreseeable future actions would be parkwide, long-term, and beneficial with a local long-term beneficial effect from Alternative 4 from rockfall mitigation work at 21 rockfall locations along Rim Drive that reduces the risk of rockfall.

Conclusion. There would be local short-term minor adverse effects on public health and safety due to risks from construction work and rockfall mitigation work. Proposed road rehabilitation, Cleetwood Cove parking lot improvements, and rock scaling would address public health and safety concerns associated with Rim Drive and associated facilities. Improvements to road pavement, minor road realignments, curve widening, guardwall/retaining wall repair, and drainage work would improve safety and driving conditions. Alternative 4 would result in local short-term minor adverse effects on public health and safety during construction and local long-term beneficial effects from improvements to the structural features of the road and selective rockfall treatments at 21 locations on Rim Drive that reduce potential rockfall. Cumulative effects would be parkwide, long-term, and beneficial.

PARK OPERATIONS

Affected Environment

Park staff is responsible for the day-to-day maintenance of Rim Drive and other roads and park facilities in the project area to provide a safe environment for park visitors. Roadwork and maintenance along the road includes patching, striping, and shoulder work; parking lot and pullout maintenance; culvert and ditch maintenance; rockfall cleanup and repair of rockfall damage to roads; and snow removal. Rim Drive is vital to park operations as park staff use the road to access portions of the park for visitor services, maintenance, law enforcement, search and rescue, resource management, and emergency vehicle access. Due to the high levels of snowfall in the park, Rim Drive is plowed only in the spring and early summer, as conditions permit. Snow levels on the road typically reach anywhere from 10 to 15 feet in the spring with snowdrifts reaching up to 60 feet high. Snowplowing operations can take several weeks to complete in preparation for park visitors. Park staff work seven days a week, 10 hours a day during snowplowing operations.

The deterioration of Rim Drive has resulted from a combination of factors. Since its construction in 1934, the road has never been fully rehabilitated or reconstructed. Increased traffic volume and heavier vehicles over the years have led to wear on the road and associated structures. Heavy snowpack during the winter and resulting rockfall onto the road have contributed to deterioration of the road. Several areas along the road suffer from bench erosion, resulting in steep dropoffs and posing potential hazards for traffic, bicyclists, and pedestrians. In addition, guardwalls and retaining walls have been undermined by erosion, and drainage structures are in need of repair in several locations. While park staff is

responsible for the continued maintenance of the road and associated structures, needed repairs are beyond what can be accomplished with park maintenance staff and resources.

Park staff is currently engaged in periodic manual rock scaling operations along Rim Drive during the summer months when the road is open. Scaling operations are limited to loose rocks on lower slopes bordering the road that are easily and safely reached from lifts.

The lack of adequate parking at Cleetwood Cove requires additional park staff involvement in traffic control and patrol to maintain visitor safety and protect park resources. This diverts park resources from other required activities elsewhere in the park.

Impact Intensity Threshold

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 park operations to protect and preserve vital resources and provide for a high-quality visitor experience. The thresholds of change for the intensity of an impact on park operations are described in Table 17.

TABLE 17. PARK OPERATIONS IMPACT AND INTENSITY THRESHOLDS

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 would 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.

Short-term impact—effects last for the duration of the treatment action.
Long-term impact—effects continue after the treatment action.

Environmental Consequences

Alternative 1 – No Action

The park would continue ongoing road and parking area maintenance, snow removal, manual rock scaling operations, and administrative operations under the no action alternative. Road maintenance and repair work would increase as the condition of the road deteriorates. Underlying structural problems that result in increased maintenance would not be addressed. Road failure leading to closure of a portion of Rim Drive or emergency repairs is a possibility if structural issues are not addressed. The cost for maintaining the road and addressing periodic structural failures would increase. With deteriorating road conditions over time, the no action alternative would result in local long-term moderate or greater adverse effects on park operations.

Cumulative Effects. Past actions along the road, including periodic maintenance, repairs, and overlays, have had a minor adverse effect on park operations. As the condition of the road worsens, additional time is spent by park personnel on road maintenance that contributes to the site restoration backlog for natural resource crews. Emergency stabilization of the visitor center would benefit park operations as maintenance needs for the building would decrease and time may be spent on other maintenance needs. Previously disturbed sites from previous construction projects at the park contribute to outstanding items for park maintenance crews. The past, current, or reasonably foreseeable future actions would result in parkwide long-term minor adverse impacts on park operations. The overall cumulative impacts on park operations from the no action alternative in combination with past, current, and reasonably foreseeable future actions would be parkwide, long-term, minor to moderate, and adverse. The contribution of the no action alternative to cumulative effects on park operations would be local, minor to moderate, and adverse.

Conclusion. The no action alternative would result in local long-term moderate or greater adverse effects on park operations by creating greater maintenance needs for the road and associated structures. Inadequate parking at Cleetwood Cove would not be addressed, requiring additional park staff presence during peak visitation. Maintenance requirements and costs would increase over time as the road and associated infrastructure continues to deteriorate. Cumulative effects would be parkwide, long-term, minor to moderate, and adverse.

Alternative 2 – Rehabilitation of Rim Drive with Rock Scaling

Direct and Indirect Effects. Proposed roadwork and mechanical rock scaling would reduce maintenance requirements and costs. Minor road realignments, wider shoulders, structural repairs, new pavement, bank stabilization, drainage work, and other repairs would improve driving conditions and would reduce the risk of future road failure. Park maintenance operations would be substantially improved by implementing road repairs that reduce the need for continual repairs to deteriorating infrastructure. The service life of the roads, parking areas, pullouts, guardwalls, culverts, and other structural features would be extended by several decades. Technical rock scaling proposed under this alternative, in addition to scaling performed by park staff, would further reduce rockfall cleanup activities in the spring and damage to the road, as well as rockfall events during the peak season, providing a beneficial effect on park operations. Rock scaling needs by park staff may also be reduced with additional technical rock scaling.

Additional demands would be placed on park staff during construction to coordinate construction activities and visitor use such as public notification of delays. Construction work and traffic delays would cause a disruption in normal traffic patterns, park operations, parking, and visitor activities in the park. Alternative 2 would have local and parkwide short-term minor to moderate adverse impacts on park operations during construction. Traffic-control measures would be implemented to facilitate travel and protect visitors and park staff. Upon completion of construction work, parkwide long-term beneficial effects on park operations are expected from road improvements.

Cumulative Effects. Effects from past, present, and reasonably foreseeable actions under Alternative 2 would be similar to those described for Alternative 1. The past, current, and

reasonably foreseeable future actions would result in parkwide long-term minor adverse impacts on park operations. The overall cumulative impacts on park operations from Alternative 2 in combination with past, current, and reasonably foreseeable future actions would be parkwide and beneficial over the long term, with a minor adverse effect in the short term and a long-term beneficial effect from Alternative 2.

Conclusion. The proposed road rehabilitation and improvements would address road maintenance concerns along Rim Drive. Minor road realignments, wider shoulders, structural repairs, new pavement, parking area improvements, bench stabilization, drainage work, and other repairs would improve driving conditions and would reduce the risk of future road failure. Additional mechanical rock scaling would likely reduce the need for park scaling operations. Construction work and associated traffic delays would cause a disruption in normal traffic patterns, parking, and visitor activities in the park; and would place a greater demand on park staff. Alternative 2 would result in local and parkwide short-term minor to moderate adverse impacts during construction and parkwide long-term beneficial effects on park operations by improving the road surface and decreasing maintenance requirements. Cumulative effects on park operations would be parkwide and beneficial over the long term.

Alternative 3 – Rehabilitation of Rim Drive with Selective Rockfall Mitigations

Direct and Indirect Effects. Improvements to Rim Drive and associated structures and parking areas would have the same effects described under Alternative 2. Selective rockfall treatments at Anderson Point and Dutton Cliff would create an additional burden on park staff due to periodic road closures, preventing regular access to these areas by park staff for other maintenance needs and in managing visitor traffic and inquiries. Rockfall mitigation in these areas would provide a long-term benefit to park operations by reducing rockfall maintenance needs at sites that have experienced rockfall in the past. Manual scaling and ditch cleanup may still be necessary, but is anticipated to be on a less frequent basis. Thus, Alternative 3 would result in local short-term minor adverse effects on park operations during rockfall mitigation, with long-term beneficial effects.

Cumulative Effects. Effects from past, present, and reasonably foreseeable actions under Alternative 3 would be similar to those described under Alternative 1. The past, current, and reasonably foreseeable future actions would result in parkwide long-term minor adverse impacts on park operations. The overall cumulative impacts on park operations from Alternative 3 in combination with past, current, and reasonably foreseeable future actions would be parkwide and beneficial over the long term, with a local short-term minor adverse contribution from Alternative 3 and a beneficial effect over the long term.

Conclusion. Alternative 3 would result in local and parkwide short-term minor to moderate adverse effects on park operations from road rehabilitation activities and minor adverse effects during selective rockfall treatments at Anderson Point and Dutton Cliff, but would have beneficial effects over the long term. Cumulative effects would be parkwide and beneficial over the long term and local, minor, and adverse in the short term.

Alternative 4 – Rehabilitation of Rim Drive with Extensive Rockfall Mitigation

Direct and Indirect Effects. Effects from road rehabilitation on park operations along Rim Drive would be the same as Alternative 2. Rockfall mitigation at the 21 specified locations would result in additional similar impacts on park operations as described under Alternative 3 for implementation at more treatment sites. Additional traffic delays or road closures would occur over several visitor seasons, placing a greater demand on park staff and daily operations. The effects on park operations during rockfall mitigation would be parkwide, short-term, moderate, and adverse. Following construction, the effects on park operations would be parkwide, long-term, and beneficial with reduced need for park staff to address rockfall.

Cumulative Impacts. Effects from past, present, and reasonably foreseeable future actions would be similar to those described under Alternative 1. The past, current, and reasonably foreseeable future actions would result in parkwide long-term minor adverse impacts on park operations. The overall cumulative effects on park operations from Alternative 4 in combination with past, present, and reasonably foreseeable future actions would be parkwide and beneficial with a short-term moderate adverse effect from Alternative 4 during rockfall treatment operations and long-term beneficial effects.

Conclusion. Alternative 4 would result in local and parkwide short-term minor to moderate adverse effects on park operations from road rehabilitation activities and moderate adverse effects from extensive rockfall mitigation, but would have parkwide and beneficial effects over the long term. Cumulative effects would be parkwide and beneficial over the long term.

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CONSULTATION AND COORDINATION

INTERNAL SCOPING

Internal scoping was conducted by an interdisciplinary team of professionals from Crater Lake National Park, Denver Service Center staff, FHWA, and consultants. Team members met multiple times from 2010 through 2012 to discuss the purpose and need for the project, various treatment options for road rehabilitation and rockfall mitigation, potential environmental impacts, reasonably foreseeable actions that may have cumulative effects, and resource protection and BMPs.

EXTERNAL SCOPING

External scoping began with a public scoping notice released on September 19, 2011 describing the proposed project and soliciting comments or concerns with the proposal to rehabilitate 29.4 miles of Rim Drive and rockfall mitigation work (Appendix A). The park sent letters describing the proposed project and asking for comments to more than 700 interested individuals; organizations; state, county, and local governments; federal agencies; local businesses; and media outlets describing the preferred alternative and asking for comments. The results of scoping are discussed in the "Scoping" section in the "Purpose and Need" chapter on page 8.

AGENCY CONSULTATION

Compliance with section 106 of the NHPA is not being subsumed under NEPA, but is being conducted separately through ongoing consultation with the Oregon SHPO, who was notified of the proposed project by letter on September 19, 2011. The SHPO responded in a letter dated October 7, 2011 that they look forward to being a part of the process for the continued protection of the historic resources at Crater Lake. The Advisory Council on Historic Preservation (ACHP) also responded to the scoping letter in a letter dated November 9, 2011 that they would need several additional pieces of information to determine if their participation is warranted in the section 106 process (Appendix B). NPS will provide the additional information requested by the ACHP following further consultation with the SHPO on the PA. NPS will also invite the ACHP to participate in the PA as a signatory.

On April 22, 2011, the Cultural Resources Survey of the Proposed West and East Rim Drive Rehabilitation and Rockfall Mitigation Projects was sent to the SHPO requesting concurrence with the findings and recommendations made in the report. A final project determination of effect will be provided once the NPS has determined the final area of potential effect. The SHPO has determined that a PA is appropriate because the project would be phased and effects on historic properties are long-term and unknown. Implementation of the PA would provide for continued Section 106 consultation between the NPS and SHPO and stipulate the continued identification, assessment of effect, and

development of a treatment plan for unavoidable historic properties throughout the phased undertaking. A signed PA executed pursuant to § 800.14(b) between the NPS and the Signatories must be completed prior to issuance of a Finding of No Significant Impact (FONSI). The PA shall take effect when executed by the Signatories. The signed PA will be included as an appendix to the FONSI.

In accordance with the Endangered Species Act, the NPS contacted the USFWS by letter on September 19, 2011 to solicit input on threatened, endangered, and species of concern for the proposed project. No response was received. Since the park has determined there would be no effect on federally listed species, no additional consultation with the USFWS is required. The USFWS will be sent a copy of this EA for their review and a letter requesting concurrence with the park's determination that the project would not affect federally listed species.

AMERICAN INDIAN CONSULTATION

The park initiated consultation with American Indian tribes and organizations, including the Cow Creek Tribe and Klamath Tribe, on September 19, 2011 informing them of the proposed project and soliciting comments. Information from the tribes also was requested to determine if any ethnographic resources are in the project area and if the tribes wanted to be involved in the environmental compliance process. The park has not received any written comments as of the date of this EA. American Indian tribes traditionally associated with the lands of the park will have an opportunity to review and comment on this EA. The park will provide the tribes with the PA for review and comment and invite their participation as concurring parties. The NPS will continue to consult with the tribes throughout the implementation of this project.

ENVIRONMENTAL ASSESSMENT REVIEW AND LIST OF RECIPIENTS

The EA will be released for a 30-day public comment period. To inform the public of the availability of the EA, the NPS will publish and distribute a letter to the park's general mailing list; area tribes; and federal, state, and local agencies. The park will provide a press release to the area media. In addition, the park will provide hard copies of the EA to area libraries. Interested individuals may obtain a copy of the EA upon request. The EA will also be available for review at the park's visitor center and on the Internet at http://parkplanning.nps.gov/crla. Comments can be submitted through this website or provided in writing to: Superintendent, Attn: Rim Drive Rehabilitation and Rockfall Mitigation Project, P.O. Box 7, Crater Lake, OR 97604.

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COMPLIANCE WITH FEDERAL AND STATE REGULATIONS

The NPS and FHWA would comply with all applicable federal and state regulations when implementing the preferred alternative (Alternative 3) to rehabilitate Rim Drive and implement rockfall treatment measures. Permitting and regulatory requirements for the preferred alternative are listed in Table 18. Permitting and regulatory requirements for Alternatives 2 and 4 would be similar to Alternative 3.

TABLE 18. ENVIRONMENTAL COMPLIANCE REQUIREMENTS

Agency	Statute, Regulation, or Order	Purpose	Project Application
Federal			
National Park Service	National Environmental Policy Act	Applies to federal actions that may significantly affect the quality of the environment.	Environmental review of the preferred alternative and decision to prepare a FONSI or EIS.
	National Historic Preservation Act, section 106	Protection of historic and cultural resources.	The park will complete consultation with the Oregon SHPO to address anticipated effects and mitigation for cultural resources and preparation of a PA.
	EO 11990, "Protection of Wetlands"	Requires avoidance of adverse wetland impacts where practicable and mitigation, if necessary.	Wetland disturbance is possible from construction activities.
	EO 11988, "Floodplain Management"	Requires avoidance of adverse floodplain impacts where practicable and mitigation, if necessary.	No floodplains would be affected by the preferred alternative.
	DO–77-2: *Floodplain Management*	Protection of natural resources and floodplains.	No floodplains would be affected by the preferred alternative.
U.S. Army Corps of Engineers	Clean Water Act – section 404 Permit to discharge dredge and fill material	Authorizes placement of fill or dredge material in waters of the U.S. including wetlands.	Incidental wetland disturbance is possible during construction. The FHWA would seek a Nationwide 404 Permit for work that would impact wetlands or waters of the U.S.
U.S. Fish and Wildlife Service	Endangered Species Act	Protection of federally listed threatened or endangered species.	The park has consulted with the USFWS as part of the NEPA process. The park has determined there would be no effect on listed species upon receipt and concurrence from the USFWS.
State of Oregon			
Oregon Department of Environmental Quality	NPDES General Permit and Stormwater Erosion and Sediment Control Plan	Erosion control and protection of water quality from construction activities.	An erosion and sediment control plan would be developed prior to earthwork and surface disturbances.

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APPENDIXES

Appendix A — Public Scoping Notice
Appendix B — Agency Scoping Comments

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APPENDIX A
PUBLIC SCOPING NOTICE

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United States Department of the Interior
NATIONAL PARK SERVICE
Crater Lake National Park
P.O. Box 7
Crater Lake, OR 97604

IN REPLY REFER TO:
L7617

September 19, 2011

Subject: Scoping Notice — Preparation of an Environmental Assessment for Rehabilitation of East and West Rim Drives and Rockfall Mitigation at Crater Lake National Park

Dear Friends and Neighbors,

The National Park Service (NPS) is beginning an environmental assessment to evaluate the potential impacts from the proposed rehabilitation of 29.4 miles of East and West Rim drives and rockfall mitigation work at Crater Lake National Park (park). Road rehabilitation is being considered for the entire length of West Rim Drive (5.9 miles) beginning at Munson Valley Road to North Junction Road, and the entire length of East Rim Drive (approximately 23.5 miles) which completes the loop around Crater Lake from North Junction Road to Munson Valley Road, as well as adjacent spur roads and parking areas (see attached map). The existing pavement on both sections of road is old with rutted, lateral cracking and severe raveling of the road pavement edge. Erosion of the road shoulder and road slumping are also occurring at several locations. Rockfall from the steep slopes bordering East and West Rim drives has the potential to damage the road and endanger travel. The proposed project is being considered to address the degraded condition of the road and rockfall hazard. The proposed rehabilitation work would improve travel safety for the public and reduce road maintenance requirements.

Potential solutions being considered to repair and rehabilitate the road involve constructing new retaining walls, reinforcing fill slopes, making subsurface repairs, and resurfacing paved areas with new asphalt. Rockfall mitigation would include reducing the hazards of frequent or high-risk rockfall events using rock scaling, rock bolts, rockfall fences and attenuation barriers, and other slope stabilization techniques. The sites proposed for rockfall mitigation are on East and West Rim drives, Munson Valley Road, Cloudcap Drive, and Pinnacles Road.

An environmental assessment will be prepared in compliance with the National Environmental Policy Act (NEPA) to provide the decision-making framework that 1) analyzes a reasonable range of alternatives to meet project objectives, 2) evaluates issues and impacts to park resources and values, and 3) identifies mitigation measures to lessen the degree or extent of these impacts.

The park encourages public participation throughout th e planning process. There will be two opportunities to comment formally on the project—once during initial project scoping and again following release of the environmental assessment. The park is currently in the scoping phase of the proposed project and i nvites the public to submit written suggestions, comments, and concerns regarding the project online at the NPS Planning, Environment, and Public Comment (PEPC) website at: http://parkplanning.nps.gov/crla. Comments also may be sent to the address below no later than October 19, 2011.

Superintendent at Crater Lake National Park
P.O. Box 7
Crater Lake, OR 97604

Commenters should be aware that their entire comment – including personal identifying information – may be made publicly available at any time. While commenters can ask that their personal identifying information be withheld from public review, the NPS cannot guarantee that this will be possible.

If you have questions or need additional information, ple ase contact Matt Shaefer via email at Matt_Shaefer@nps.gov.

Sincerely,

Craig Ackerman
Superintendent

Enclosure:
Map illustrating the project area

APPENDIX B
AGENCY SCOPING COMMENTS

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Preserving America's Heritage

November 9, 2011

Mr. Craig W. Ackerman
Superintendent
Crater Lake National Park
National Park Service
P.O. Box 7
Crater Lake, OR 97604

REF: Proposed Rehabilitation of East and West Rim Drive and Rockfall Mitigation Crater Lake National Park, Oregon

Dear Mr. Ackerman:

On October 7, 2011, the Advisory Council on Historic Preservation (ACHP) received your notification for the referenced project which was submitted in accordance with Section 800.6(a)(1) of our regulations, "Protection of Historic Properties" (36 CFR Part 800). Unfortunately, the background documentation included with your submission does not meet the specifications listed in Section 800.11(e). We, therefore, are unable to determine whether Appendix A of the regulations, *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, applies to this undertaking. Accordingly, we request that you submit the following information so that we can determine whether our participation is warranted.

- A description of the undertaking, including photographs and maps, as necessary ;
- A description of the steps to identify historic properties;
- A description of the affected historic properties, including information on the characteristics that qualify them for the National Register;
- A description of the undertaking's effects on historic properties,
- An explanation of why the criteria of adverse effect were found applicable or inapplicable; a nd
- Copies or summaries of any views provided by consulting parties and the public, including comments from the Tribal Historic Preservation Officers, Indian tribes, and the Oregon State Historic Preservation Officer (SHPO).

Upon receipt of the additional information, we will notify you within 15 days of our decision. If you have any questions, please contact Katry Harris at 202-606-8520, or via email at kharris@achp.gov.

Sincerely,

Raymond V. Wallace

Raymond V. Wallace
Historic Preservation Technician
Office of Federal Agency Programs

Oregon
John A. Kitzhaber, MD, Governor

Parks and Recreation Department
State Historic Preservation Office
725 Summer St NE, Ste C
Salem, OR 97301-1266
(503) 986-0671
Fax (503) 986-0793
www.oregonheritage.org

June 20, 2011

Mr. Craig Ackerman
NPS Crater Lake NP
PO Box 7
Crater Lake, OR 97604

RE: SHPO Case No. 11-0773
Crater Lake West & East Rim Drive Rehab & Rockfall Mitigation Projs

Dear Mr. Ackerman:

Thank you for submitting documentation on the project referenced above. The cultural resources survey report completed by your agency makes a compelling case that the National Register-listed Rim Drive Historic District is need of restoration and rehabilitation. However, the description of work is not complete enough for our office to provide an opinion on the potential effect of the undertaking. More detailed descriptions, drawings, and illustrations for each work item associated with the project will be needed before we can complete our review.

If providing the requested information will be too burdensome or if this project will take place over a number of years, consider if a Programmatic Agreement would be appropriate. The document could exempt ordinary maintenance and classes of activities, which would allow both agencies to focus on projects with the potential to adversely affect the district.

We look forward to continuing to work with the National Park Service to protect the Rim Drive Historic District. Please be sure to reference the SHPO case number shown above to allow us to accurately track your project. A separate response concerning archaeological resources is forthcoming. Feel free to contact me if you have any questions or concerns regarding the additional information requested.

Sincerely,

Ian P. Johnson
Historian
(503) 986-0678
ian.johnson@state.or.us

As the nation's principal conservation agency, the Department of the Interior has the responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS CRLA 106/113970/November 2012 / Printed on recycled paper

National Park Service
U.S. Department of the Interior

Crater Lake National Park
Oregon

Crater Lake National Park
P.O. Box 7
Crater Lake, Oregon 97604