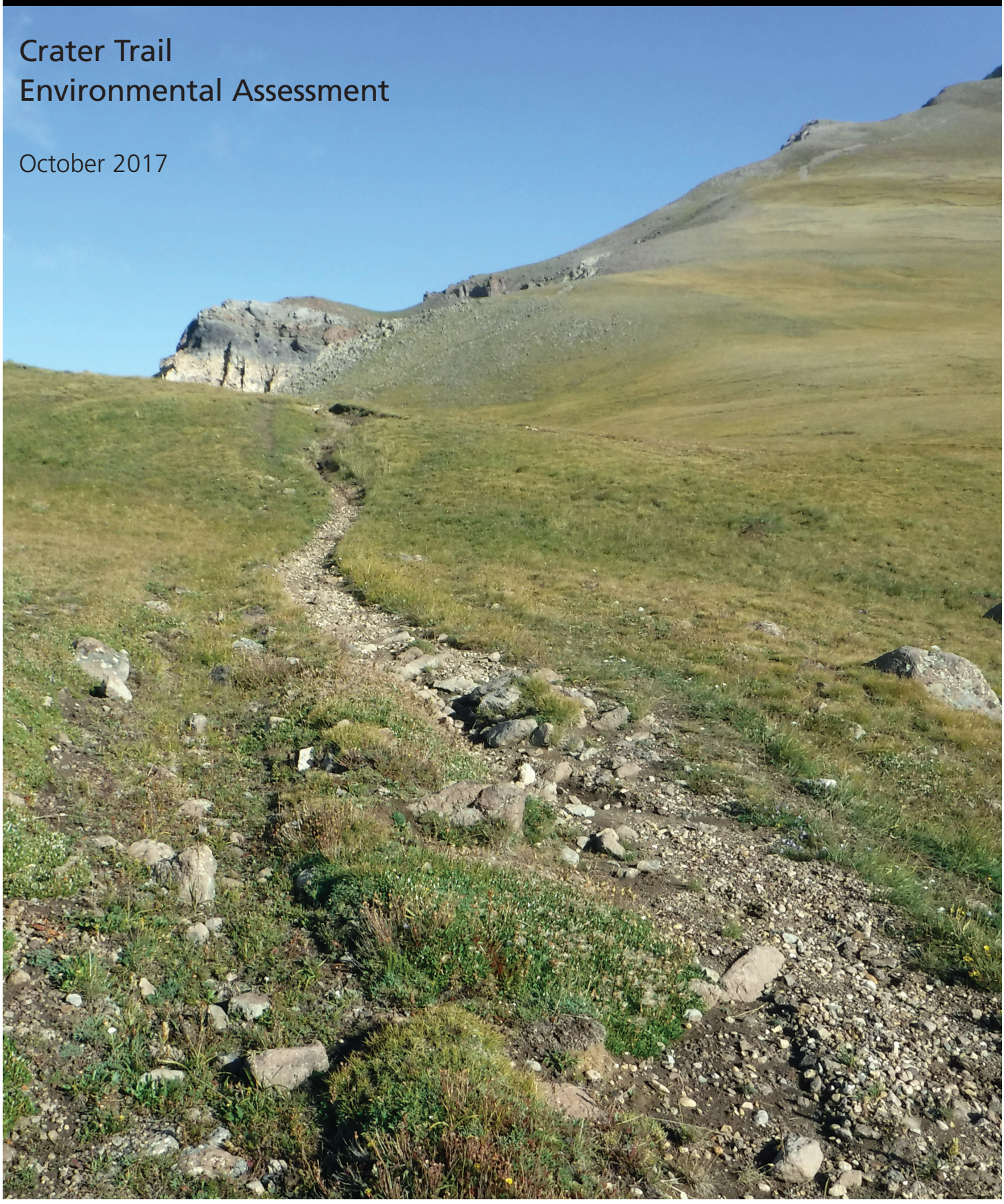
National Park Service
U.S. Department of the Interior

Rocky Mountain National Park
Colorado

# Crater Trail
# Environmental Assessment

October 2017



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# SUMMARY

Rocky Mountain National Park (RMNP or park) is evaluating the long-term management and use of the Crater Trail area. The 1-mile long trail is near the Continental Divide with a trailhead located on the northwest side of Trail Ridge Road near Milner Pass. The park is proposing to permanently close the Crater Trail to protect natural and cultural resources. The trail is mostly within designated wilderness and the Specimen Mountain Research Natural Area (RNA). It passes through a prehistoric archeological site above tree line, where substantial erosion is occurring, and lies within the Specimen Mountain Bighorn Sheep Protection Area. A decision is needed on the management and use of the trail that considers these sensitive resources and addresses the poor trail condition.

This Environmental Assessment (EA) evaluates four alternatives: a no-action alternative and three action alternatives. Under Alternative A, the no-action alternative, the trail would be open to visitor use with normal maintenance. Under Alternative B, the trail would be closed to visitor use, imported material would be used to restore the natural grade within the trail tread, and the trail would be stabilized and revegetated. Under Alternative C, the trail would be reconstructed within the existing alignment. Reconstructing the trail would include repairing eroded sections of the trail and constructing new rock-and-log erosion-control structures to stabilize the trail and prevent further erosion. Under Alternative D, the trail would be rerouted to a more sustainable alignment with moderate grades. With the proposed reroute, the Crater Trail would be about 1.5 miles long. Abandoned sections of the trail would be stabilized and revegetated to prevent erosion.

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 the objectives of the proposal, 2) evaluates potential issues and impacts on resources and values, and 3) identifies mitigation measures to lessen the degree or extent of these impacts.

Resource topics analyzed in detail include vegetation and soils; bighorn sheep; archeological resources; historic structures; ethnographic resources; Research Natural Areas; wilderness; and visitor use and experience. All other resource topics were dismissed because the proposed project would have little or no impact on those resources. Public scoping was conducted in accordance with NEPA.

The National Park Service (NPS) is also using this EA to coordinate public review of a draft memorandum of agreement (MOA) developed with the Colorado State Historic Preservation Officer (SHPO) and interested tribes in accordance with the implementing regulations for Section 106 of the National Historic Preservation Act. The draft MOA can be found in Appendix A. It outlines measures to minimize and mitigate adverse effects on historic properties. Comments regarding the MOA can be submitted along with comments on the EA.

## Public Comment

If you wish to comment on this EA, you may post comments online at http://parkplanning.nps.gov/romo or mail or hand deliver comments to Superintendent, Rocky Mountain National Park, Estes Park, Colorado 80517. This EA will be on public review for a minimum of 30 days.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. Although you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so. Comments will not be accepted by fax, by e-mail, or in any other way than those specified above. Bulk comments in any format (hard copy or electronic) submitted on behalf of others will not be accepted.

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# INTRODUCTION

The NPS is proposing to permanently close the Crater Trail to protect natural and cultural resources in Rocky Mountain National Park (RMNP or park). The abandoned trail would be closed to public access and revegetated. In addition, this environmental assessment (EA) evaluates three other alternatives: no action, reconstructing the trail within the existing alignment, and rerouting the trail to a more sustainable alignment.

The park was established in 1915. The purpose of the 265,795-acre park according to the Foundation Document for Rocky Mountain National Park (NPS 2013) "is to preserve the high-elevation ecosystems and wilderness character of the southern Rocky Mountains within its borders and to provide the freest recreational use of and access to the park's scenic beauties, wildlife, natural features and processes, and cultural objects." The NPS administers the historic, natural, and scenic values that contribute to the public's enjoyment of the park.

The Crater Trail is a 1-mile-long trail on the east side of Specimen Mountain near the Continental Divide (Figure 1). The Crater Trail starts near Milner Pass on Trail Ridge Road and extends above tree line to a geologic feature known as "the Crater." Euro American interest in the Specimen Mountain area began in the late 1800s, much earlier than the park's establishment as a National Park in 1915, due to a large population of bighorn sheep (bighorn) that inhabited the area. Specimen Mountain and the Crater continue to provide ideal habitat for bighorn, which congregate around the mountain and in the Crater. The Crater Trail was never fully formalized but rather formed during the early years of the park by visitors who established direct routes to the Crater. Like most trails in the park, the Crater Trail is an informal route that was not designed and constructed. The trail is typically closed annually from May 1 to August 15, to protect bighorn during the lambing season; however, the closure may last longer depending on the duration of the bighorn lambing season. The trail is in designated wilderness and is part of the Specimen Mountain Research Natural Area (RNA). For the past three years, the Crater Trail has been closed year-round due to severe trail erosion, pending the outcome of the EA process.

## Purpose and Need

The purpose of the proposed project is to protect bighorn sheep range, archeological resources, wilderness values, the Specimen Mountain RNA, and soil and vegetation resources currently being impacted by the Crater Trail.

The project is needed to address damage to natural and cultural resources resulting from use of the Crater Trail. The trail passes through a prehistoric archeological site above tree line, where substantial erosion is occurring, and lies within the Specimen Mountain Bighorn Sheep Protection Area. Sections of the trail are steep and highly eroded, resulting in poor hiking conditions and impacts on alpine tundra and cultural resources. A decision is needed on whether to close the trail, allow continued use of the existing trail, or implement trail improvements to protect sensitive resources.

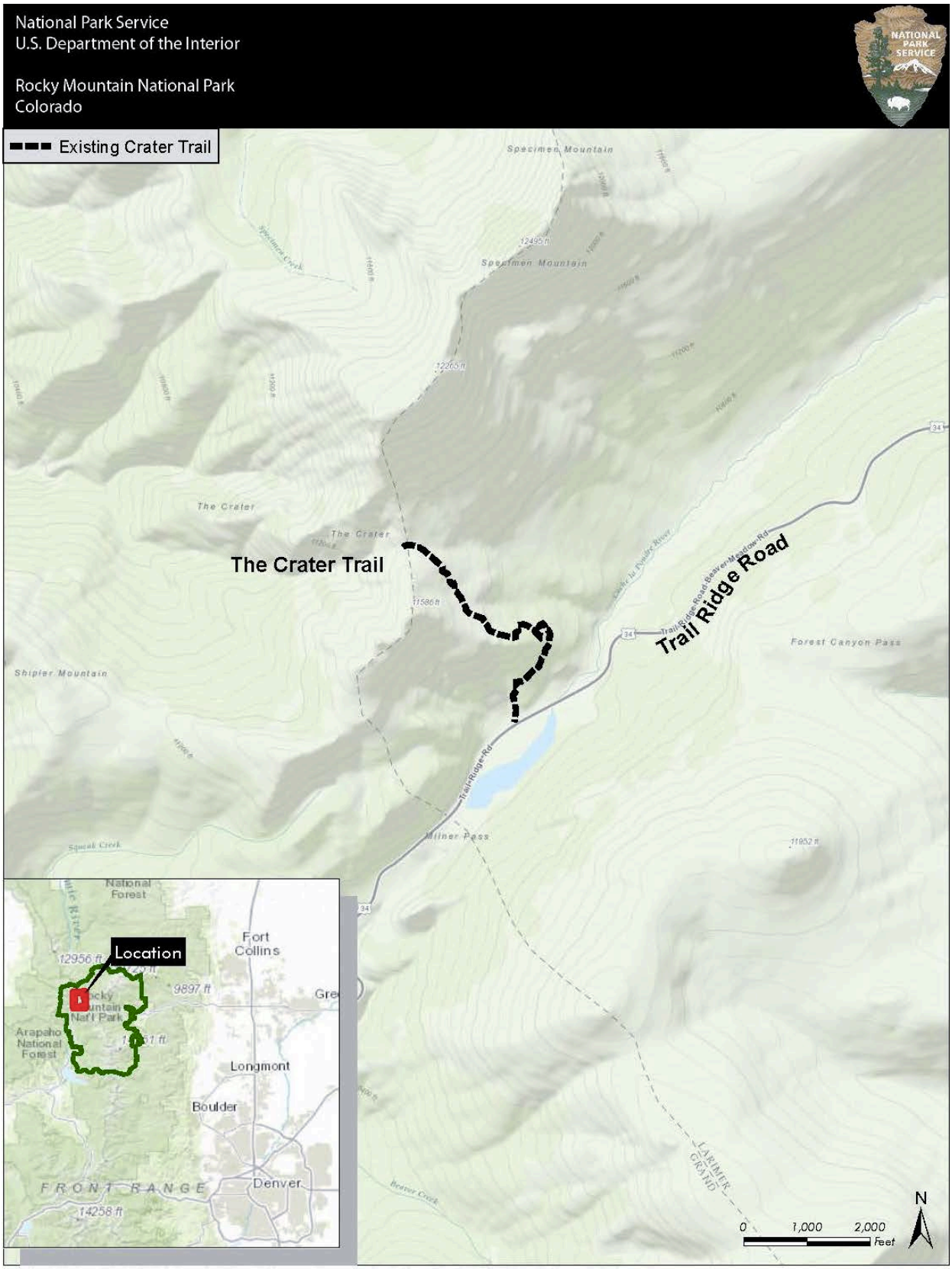


**Figure 1. Crater Trail project area.**

# Issues and Impact Topics Retained for Further Analysis

Environmental issues (issues) were identified during internal and external scoping. Issues are environmental problems, concerns, and opportunities regarding the proposal to close the Crater Trail, or with alternatives to the proposal. The issues describe the relationship between the actions in the proposal and alternatives and the specific resources that would be affected by those actions. The issues are organized by "impact topics," which are headings that represent the affected resources associated with the issues that are analyzed in detail. As a general rule, issues were retained for consideration and discussed in detail if:

- the environmental impacts associated with the issue are central to the proposal or of critical importance;
- a detailed analysis of environmental impacts related to the issue is necessary to make a reasoned choice between alternatives;
- the environmental impacts associated with the issue are a big point of contention among the public or other agencies; or
- there are potentially significant impacts on resources associated with the issue.

If none of the considerations above apply to an issue or impact topic, it was dismissed from detailed analysis. The issues and corresponding impact topics retained for analysis in this EA are presented in Table 1.

**Table 1. Issues and impact topics retained for further analysis.**

| Issues | Impact Topics Related to the Issues |
|---|---|
| The Crater Trail in its current alignment has several steep sections where extensive erosion is occurring. The Crater Trail also passes through subalpine forest and alpine tundra plant communities. Ongoing use, reconstruction, or rerouting the Crater Trail would involve ground disturbance and impacts on vegetation and soils. | Vegetation and Soils |
| The Crater and surrounding area are within a bighorn sheep lambing area. Bighorn sheep are sensitive to human disturbance, and ongoing use, reconstruction, or rerouting the Crater Trail could result in impacts on them. | Bighorn Sheep |
| The area surrounding the Crater Trail contains several prehistoric archeological sites. Ongoing erosion, reconstructing the trail, or rerouting the trail could result in impacts on these cultural resources. | Archeological Resources |
| The Crater Trail is eligible for listing on the National Register of Historic Places. Ongoing erosion, reconstructing the trail, rerouting the trail, or closing the trail could result in impacts on historic resources. | Historic Structures |
| The Crater Trail is within the Specimen Mountain Research Natural Area, one of three RNAs in the park. Activities in RNAs generally are restricted to nonmanipulative research, education, and other activities that will not detract from an area's research values. | Research Natural Areas |
| The Crater Trail is within designated wilderness. Ongoing erosion, reconstructing the trail, rerouting the trail, or closing the trail could result in impacts on wilderness character. | Wilderness |
| Although visitor use is low because of the short season, the Crater Trail provides visitors with access to alpine tundra and the Crater. Ongoing erosion, reconstructing the trail, rerouting the trail, or closing the trail could result in impacts on the visitor experience. | Visitor Use and Experience |

# Impact Topics Dismissed from Further Analysis

Several potential issues and impact topics were raised during internal and public scoping but were not retained for additional analysis. Using the same considerations noted previously, the interdisciplinary team analyzed these issues and determined they did not warrant more detailed discussion in this EA. Table 2 briefly discusses those impact topics with minor effects that were dismissed from further analysis along with a brief explanation of the reasons for dismissal.

**Table 2. Impact topics dismissed from further analysis.**

| Topic | Reason Dismissed |
|---|---|
| Climate Change | Potential sources of greenhouse gas emissions would include the use of a helicopter to transport materials during construction. The helicopter would be used an estimated 10 hours, burning about 450 gallons of fuel and producing about 9,000 pounds of the greenhouse gas $CO_2$ over a period of about 3 to 10 days. The increased greenhouse gas emissions from the action alternatives would cease when the helicopter is not in use and would not be discernable at a regional or local scale. For these reasons, climate change was dismissed from further analysis in the EA. |
| Special Status Plant Species | Special status plant species include federally-listed threatened, endangered, candidate, and proposed species; and species considered vulnerable or imperiled in Colorado by the Colorado Natural Heritage Program (CNHP).<br><br>Only three federally listed plant species have the potential to occur in Larimer County: Colorado butterfly plant (*Gaura neomexicana* spp. *coloradensis*), North Park phacelia (*Phacelia formosula*), and Ute ladies'-tresses orchid (*Spiranthes diluvialis*) (Appendix B). These three species occur only at elevations below 9,000 feet and are not found in subalpine or alpine habitat such as habitat in the Crater Trail project area.<br><br>Habitat for 24 plant species considered vulnerable or imperiled by the CNHP is present in areas potentially affected under the three action alternatives. These 24 species and their habitat are listed in Appendix B. No special status plant species were observed during rare plant surveys conducted in August 2016 (ERO 2016). No official survey protocols have been developed for these species, so the survey followed methods approved by park botany staff, as described in the survey report (ERO 2016). The area surveyed included 50 feet on either side of the existing trail and 50 feet around potential disturbed areas such as the rerouted trail alignment and potential borrow areas. Special status plant species were dismissed from further analysis in the EA because they are unlikely to be present and thus unlikely to be affected by any of the alternatives. |

| Topic | Reason Dismissed |
|---|---|
| Special Status Wildlife Species | Special status wildlife species include federally listed threatened, endangered, candidate, and proposed species; species listed as threatened or endangered by the Colorado Division of Parks and Wildlife (CPW); and species considered vulnerable or imperiled by the CNHP.<br><br>A total of 16 federally or state-listed wildlife species have the potential to occur in Larimer County. These species and their habitat are listed in Appendix B. Of these 16 wildlife species, only Canada lynx (*Lynx canadensis*), North American wolverine (*Gulo gulo luscus*), greenback cutthroat trout (*Oncorhynchus clarkii stomias*), and southern white-tailed ptarmigan (*Lagopus leucrus*) could potentially occur in the project area based on suitable habitat (Appendix B).<br><br>There are verified sightings of lynx and wolverine in the park in recent years, although none specifically from the project area. No breeding populations of either species are known to occur in the park. Although the project occurs in habitat for lynx and wolverine, these species are unlikely to be adversely affected because they are unlikely to be present in the park, only about 0.72 acre of habitat or less for these species would be lost under the action alternatives, and noise impacts and other disruptions would be temporary and only occur during a 3- to 4-month construction period. Use of mechanized equipment would be temporary and would not occur from early October to mid-August.<br><br>Greenback cutthroat trout and suitable habitat do exist downstream within the Cache la Poudre River and its tributaries. However, at its closest point, trail rehabilitation work would be 420 feet from Poudre Lake and the river. Trail rehabilitation would not alter river flows. With erosion controls in place, trail reconstruction or closure would not contribute sediment to the Cache la Poudre River and would not alter fish habitat.<br><br>The southern white-tailed ptarmigan (*Lagopus leucrus altipetens*) is the only bird species to live year-round on the alpine tundra in the park. This species is not currently listed as threatened or endangered, but is under review for federal listing as threatened or endangered. Another bird species listed as vulnerable or imperiled by the CNHP with the potential to occur in the project area is the brown-capped rosy-finch (*Leucosticte australis*). No surveys have been conducted in the project area for either of these species and no ptarmigans or brown-capped rosy-finches were observed during any site visits in 2016 by park staff or consultants. However, the upper elevations of the project area are within habitat for these two species and they could potentially be present in the project area. These species are likely to avoid the project area during work and may be temporarily displaced from foraging habitat near the project area. Impacts on ptarmigans and brown-capped rosy-finches are unlikely because abundant alpine tundra habitat is available nearby for displacement, 0.28 acre or less of alpine habitat for these species would be lost under any of the action alternatives, and noise impacts and other disruptions from use of mechanized equipment would be temporary and would not occur from May 1 to August 15, with limited exceptions as described under *Resource Protection Measures.* These timing restrictions would minimize disturbance during nesting and brooding, which occur during the summer months.<br>In a December 23, 2016 letter to the U.S. Fish and Wildlife Service (USFWS), the park determined that the preferred alternative may affect, but is not likely to adversely affect, Canada lynx, North American wolverine, and greenback cutthroat trout. The park also determined that the project would have no effect on any other federally listed threatened, endangered, or candidate species. The USFWS concurred with the park's findings on January 23, 2017 (USFWS 2017). |

| Topic | Reason Dismissed |
|---|---|
| Wildlife, other than Bighorn Sheep | Wildlife found in the park includes 52 mammal species, 276 bird species, 4 amphibian species, 2 reptile species, and 11 fish species. The distribution of wildlife species within the park varies by season, elevation, and types of habitats. The Crater Trail area includes subalpine and alpine habitats. Large mammals likely occurring in the project area include elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), bighorn sheep (*Ovis canadensis*), and moose (*Alces alces*).<br><br>The action alternatives could result in displacement of elk, migratory birds, small mammals, and other wildlife during the construction period lasting about 3 to 4 months until snowfall makes continued work impractical. Trail work and restoration would occur over 2 to 5 years depending on the alternative, and would involve the use of a helicopter to deliver fill soil as needed. Use of a helicopter would create additional noise that could displace wildlife over a period of a few days during the 6- to 8-week period from August 15 to October. Impacts on wildlife would be minimized because only hand tools would be used between May 1 and August 15, with exceptions to this limitation as described under *Resource Protection Measures*. Impacts on wildlife would be minimized because abundant habitat is available nearby for displacement, 0.72 acre of wildlife habitat of less would be lost under the action alternatives, noise impacts and other disruptions would be temporary and would end after construction is complete, and measures described under *Resource Protection Measures* would minimize disturbance from use of mechanized equipment. For these reasons, wildlife was dismissed from detailed analysis in this EA. |
| Wetlands | Numerous wetlands occur in the Crater Trail area. However, all of the alternatives would avoid impacts to wetlands with the exception of Alternative D, which would involve crossing a small palustrine emergent wetland with a turnpike constructed of wood with aggregate fill. Wetland surveys identified 0.24 acres of wetlands within 50 feet of the reroute alignment under Alternative D. About 60 square feet of wetlands would be permanently filled under this alternative, which is less than 0.7% of wetlands within 50 feet of the trail alignment. Because the proposed action would not affect wetlands and the other alternatives would result in minimal impacts or no impacts on wetlands, this topic was not carried forward for detailed analysis in the EA. |
| Ethnographic Resources and Sacred Sites | Based on consultation with Native American tribes traditionally associated with the park, no ethnographic resources or sacred sites have been identified in the project area. Scoping letters were sent on September 9, 2016, and the cultural resources survey report (ERO 2016) was sent to the tribes on December 5, 2016. Responses were received from the Comanche Nation and Cheyenne and Arapaho Tribes and indicated no concerns with the project. The park also followed up with phone calls to tribes that did not respond by mail, and no concerns with ethnographic resources or sacred sites were identified. Because no ethnographic resources or sacred sites have been identified in the project area through tribal consultation, these impact topics have been dismissed from detailed analysis in the EA. |
| Natural Soundscape | Use of a helicopter and potential use of chainsaws would generate unnatural sounds during construction. Helicopter use would occur for about 3 hours per day over period of about 3 to 10 days. Helicopter use would generate noise levels of about 97 decibels (dBA) at a distance of 100 feet, dissipating to about 62 dBA at 500 feet and 48.6 dBA at 5 miles. Chainsaws would not likely be used under the preferred alternative, but could be used under the other action alternatives. Chainsaw use would occur during a 6- to 8-week period during the first year of work and would generate estimated noise levels of 70 dBA at 100 feet, 56 dBA at 500 feet, and 35.5 dBA (comparable to background levels) at 1 mile. Although unnatural noise would be generated during trail restoration activities, helicopter noise would be short in duration, lasting only about 10 to 30 hours in total, and noise from chainsaws would dissipate to background levels within about 1 mile. For these reasons, natural soundscape was dismissed as an impact topic in the EA. |
| Indian Trust Resources | No Indian trust resources are in the park; therefore, Indian trust resources was dismissed as an impact topic in this EA. |
| Environmental Justice | Grand Lake, Estes Park, and other communities near the park contain both minority and low-income populations; however, environmental justice was dismissed as an impact topic because no actions in the alternatives would have disproportionately high health or environmental effects on these populations or communities. |

# ALTERNATIVES

Four alternatives, a no action alternative and three action alternatives, were carried forward for evaluation in the EA. A number of options for managing the Crater Trail area were considered and dismissed (see *Alternatives Considered and Dismissed*).

## Alternative A—No Action

The no action alternative describes the conditions that would continue to exist in the project area if no improvements, repairs, or changes in management were made (Figure 2). Under the no action alternative, the Crater Trail would be open to visitor use without rehabilitation or reconstruction. The closure to protect bighorn lambing areas from May 1 to August 15 would remain in effect. The park would continue to make periodic repairs to the trail as needed as part of normal maintenance, but erosion problems on steep slopes would remain.

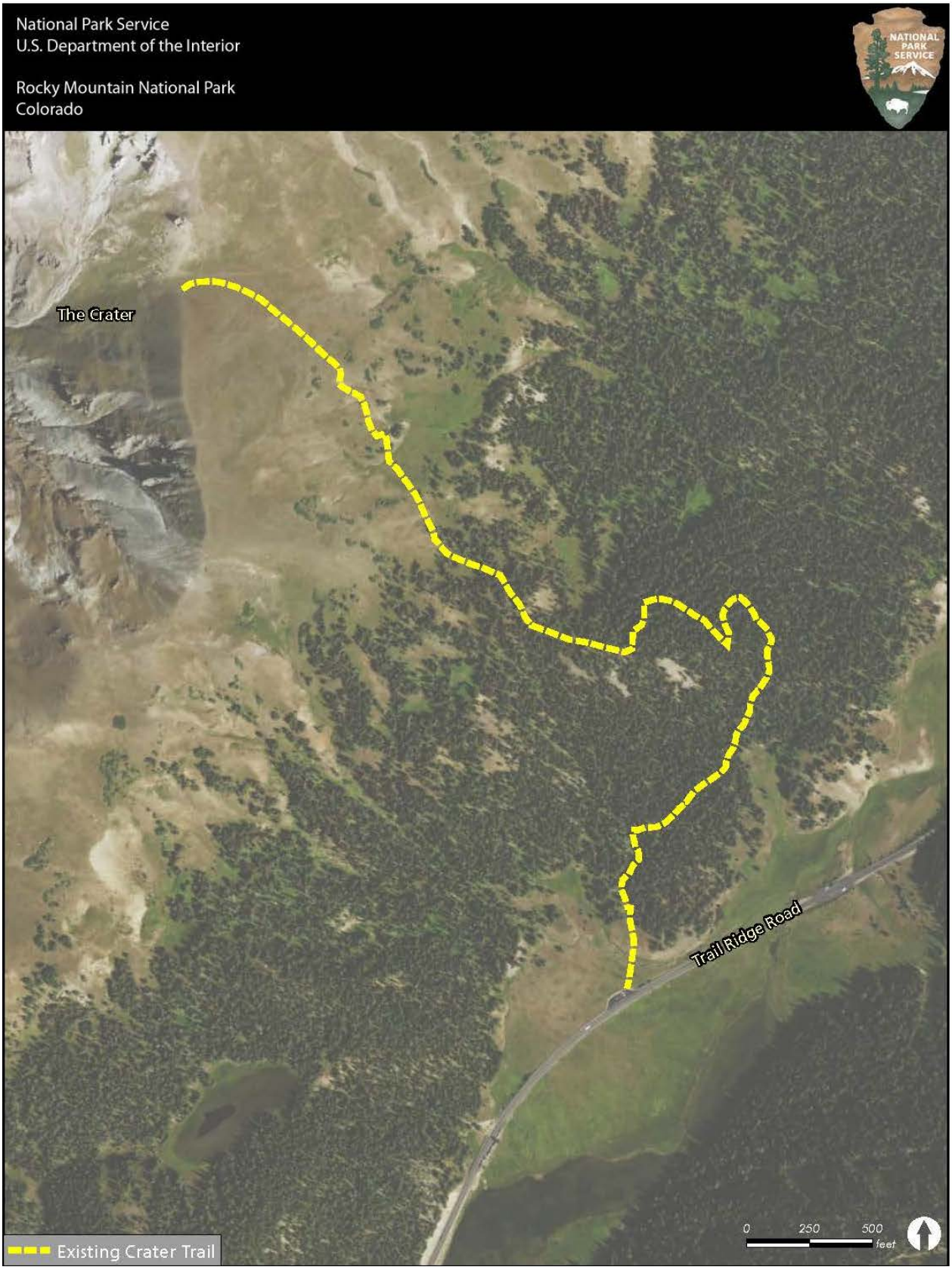


**Figure 2. No action alternative.**

## Alternative B—Close the Trail (Proposed Action and Preferred Alternative)

Alternative B would close the trail to visitor use (Figure 3). The trail would be abandoned and no longer maintained by the park. The existing footbridge near the trailhead would be removed, and temporary signs would be placed for up to two seasons informing visitors that the area is closed to the public and is being restored. A buck-and-rail fence would be installed at the trailhead to discourage public access. The parking area at the trailhead would be retained, because it provides parking for the Mount Ida Route and other trails in the area.

The total length of abandoned trail would be 1 mile. The abandoned trail surface would be stabilized and revegetated with native vegetation to restore natural conditions. Trail sections that are currently stable with minimal erosion and with no man-made drainage structures could be revegetated with limited seedbed preparation. Unstable eroding trail sections would require implementation of measures to improve drainage and reduce erosion. Erosion control could involve reestablishing the natural contours and drainage patterns by filling in the existing trail with imported fill material and installing erosion-control measures, such as small temporary check dams made of straw bales or temporary silt fences. A minimum of man-made structures that would biodegrade in time, such as small temporary check dams made of straw bales or temporary silt fences, would be left above tree line after restoration is complete; existing erosion-control structures below tree line could be left in as determined on a case-by-case basis.

Revegetation could be passive or active. Passive revegetation would allow natural regeneration to occur from surrounding vegetation, and would most likely be the preference for trail sections below tree line. Active revegetation would involve seeding or plantings of native vegetation in accordance with the park's Vegetation Restoration Management Plan (NPS 2006a). Active revegetation would likely be needed for severely eroded sections of the trail in the alpine tundra.

Work would be conducted by a crew of 6 to 8 workers traveling to the trailhead in pickup trucks and hiking to the work area daily. Materials would be transported to the trailhead by pickup trucks or possibly a small dump truck. Restoration work would primarily be conducted using hand tools with native material available on site. Imported fill dirt would be required to restore the grade in eroded trail sections in the alpine tundra and would be delivered to the project site using a helicopter. Helicopter operations would likely last for about 10 hours over a period of about 3 days This use has been evaluated through a Minimum Requirements Decision Guide (MRDG) process. Staging areas would be needed to temporarily store tools and would be within the existing tread.

Monitoring would be conducted to determine revegetation success and to determine the need for implementing weed-control measures per the park's Invasive Exotic Plant Management Plan (NPS 2003).

The construction season would occur over a 3- to 4-month period beginning after snowmelt and would continue until snowfall makes trail work impractical, likely in October. From May 1 to August 15, mechanized equipment would not be used; only hand tools would be used to minimize impacts on bighorn sheep lambing. After August 15, use of mechanized equipment would be allowed. Exceptions to the limitation on use of mechanized equipment could occur if monitoring indicated that bighorn sheep were not in the area, as described under *Resource*

*Protection Measures*. Trail work is anticipated to occur in daylight hours Monday through Friday, but weekend work could occur as needed. Work on the trail is expected to take two to three construction seasons.

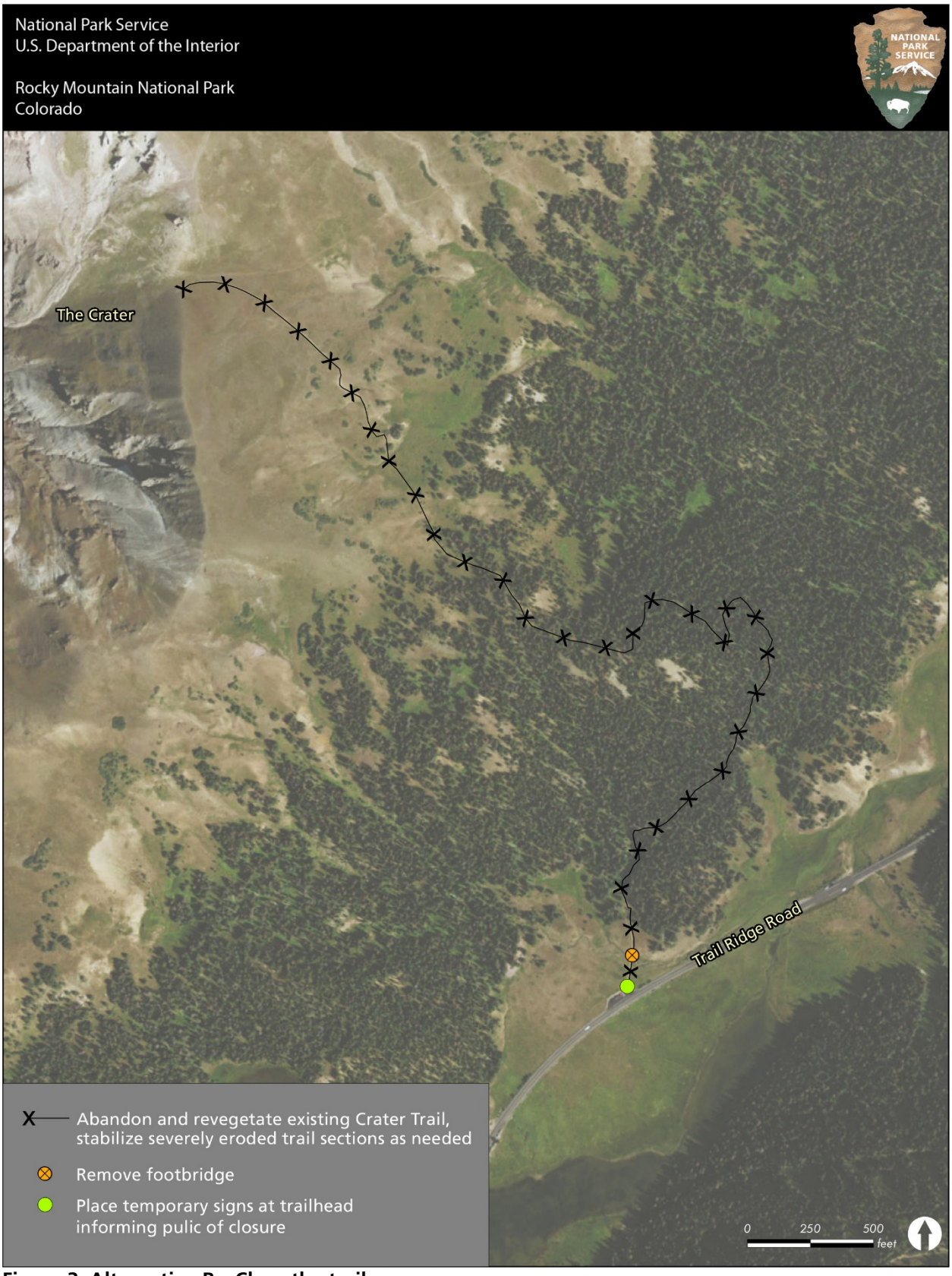


**Figure 3. Alternative B—Close the trail.**

## Alternative C—Reconstruct Trail within Existing Alignment

Under Alternative C, the Crater Trail would be reconstructed within the existing alignment with an emphasis on improved erosion control and creating sustainable trail tread surfaces (Figure 4). The width of the existing trail tread varies from 2 to 3 feet, with a grade that varies from about 5 to 30%. A construction zone about 3 to 5 feet wide would be needed to accommodate the tread and backslope. The width, alignment, and grade of the existing trail would not be changed. Existing erosion-control structures would be reconstructed, and additional erosion-control structures would be added as needed to stabilize the trail. This alternative could include digging drain dips or constructing log-and-rock water bars to shed water from the trail. Erosion-control structures would most likely be constructed from treated nonnative logs imported using a helicopter. Retaining bars could be installed along the trail to help retain tread material and prevent erosion. The number of additional erosion-control structures is unknown; however, disturbance associated with construction of new erosion-control structures would be limited to the existing trail corridor. Disturbance outside the trail corridor would be limited to gathering materials for trail construction. Any impacts resulting from gathering materials outside the trail corridor would be restored with native vegetation. An example of typical erosion-control structures that would be installed is shown in Figure 5.

Work would be conducted by a crew of 6 to 14 workers traveling to the trailhead in pickup trucks and hiking to the work area daily. Materials would be transported to the trailhead by pickup trucks or possibly a small dump truck. Trail reconstruction would be conducted primarily with hand tools and native material available on site. However, mechanized equipment (motorized and nonmotorized) may be needed to facilitate reconstruction of the trail and has been evaluated through an MRDG process. Mechanized equipment use could include chainsaws, grip-hoists, rock dollies, and battery-powered drills. Helicopters would be necessary to transport log check materials and tread materials to the site. If approved, helicopter use would likely occur for about 3 hours per day over a period of about 1 week.

Temporary staging and stockpiling areas would be needed for equipment and material storage during trail reconstruction. Staging and stockpiling areas would be located within existing disturbed areas at the trailhead parking area and at regular intervals along the trail. Staging areas along the trail would mostly be used to store tools, gathered rocks, or duff. About 20 to 25 staging areas would be needed and each would be about 10 feet by 20 feet in size. To minimize the amount of ground disturbance, staging and stockpiling areas would be placed on previously disturbed land where feasible or on areas devoid of vegetation. No excavation or ground disturbance would occur in staging areas other than temporarily placing tools and materials for later use.

Native timber, rock, and soil from on-site locations within areas surveyed for biological and cultural resources would be used to the extent possible to minimize the transport of material on the trail. Native soil would be gathered from areas inside the trail corridor, and no borrow pits would be established. Timber could be transported to the site by helicopter or harvested on site. If harvested on site, the preferred timber would be dead standing, out of sight from the trail, and without cavity nests. Rock would be gathered from nearby areas within 50 feet of the trail. A high line would be used to move rocks and material, to avoid rolling and dragging material through vegetated areas whenever possible.

Trail reconstruction would require closing the trail to visitors during construction. The park would advertise the trail closures in advance. The construction season would occur over a 3- to 4-month period during the summer, the same as for Alternative B. Work would begin after snowmelt and would continue until snowfall makes trail work impractical, likely in October. Limitations on use of mechanized equipment during the bighorn sheep lambing season from May 1 to August 15 would be imposed as described under *Resource Protection Measures*. Trail work is anticipated to occur in daylight hours Monday through Friday, but weekend work could occur as needed. Work on the trail is expected to take at least two construction seasons; thus, the existing trail closure would continue for 2 to 3 years.

Park staff would incorporate the trail into a regular maintenance schedule. Drainage or other structures would be constructed as needed to protect the trail and adjacent resources. This would require more maintenance than under the no action alternative due to the increase in erosion control structures.

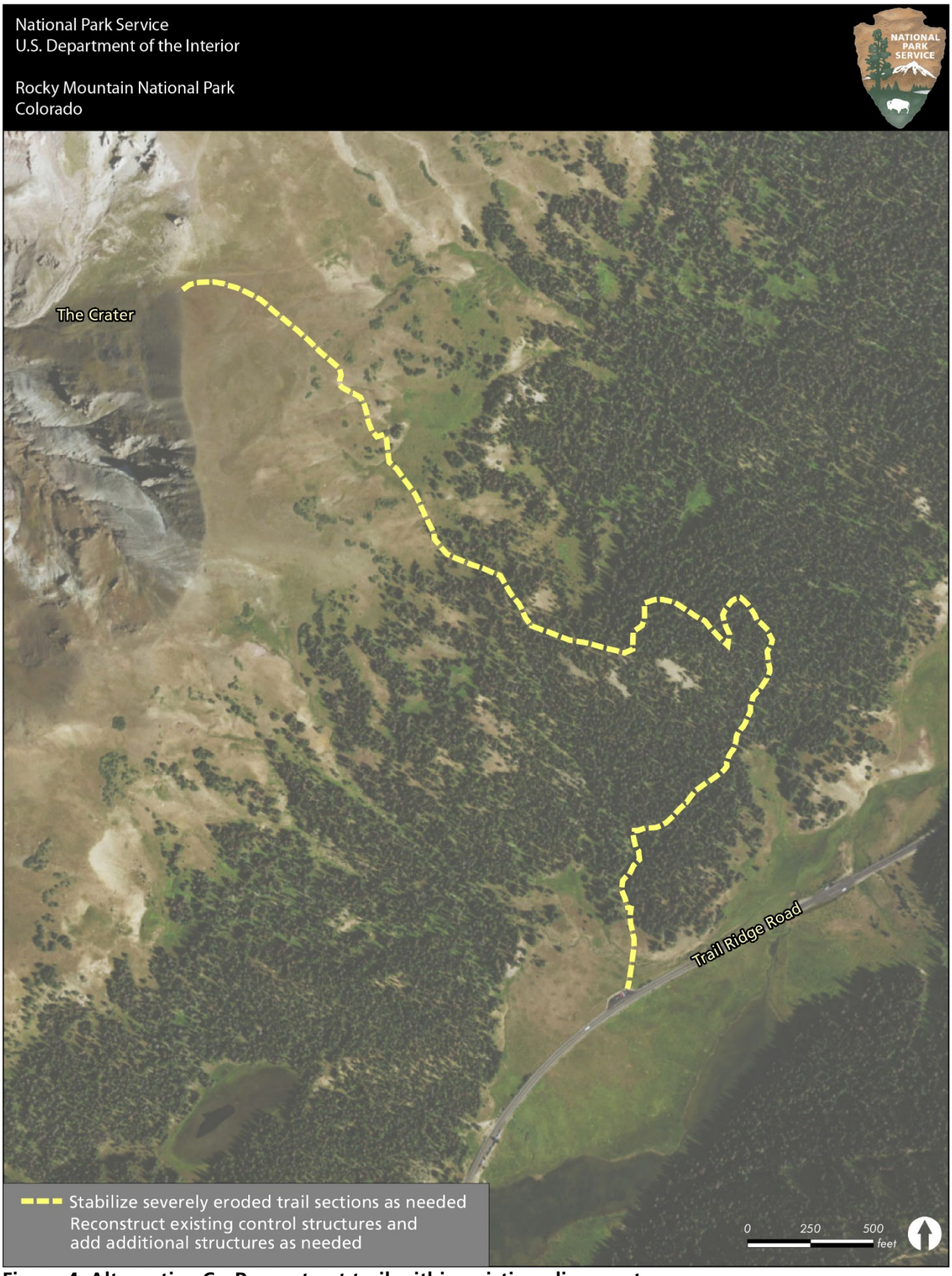


**Figure 4. Alternative C—Reconstruct trail within existing alignment.**

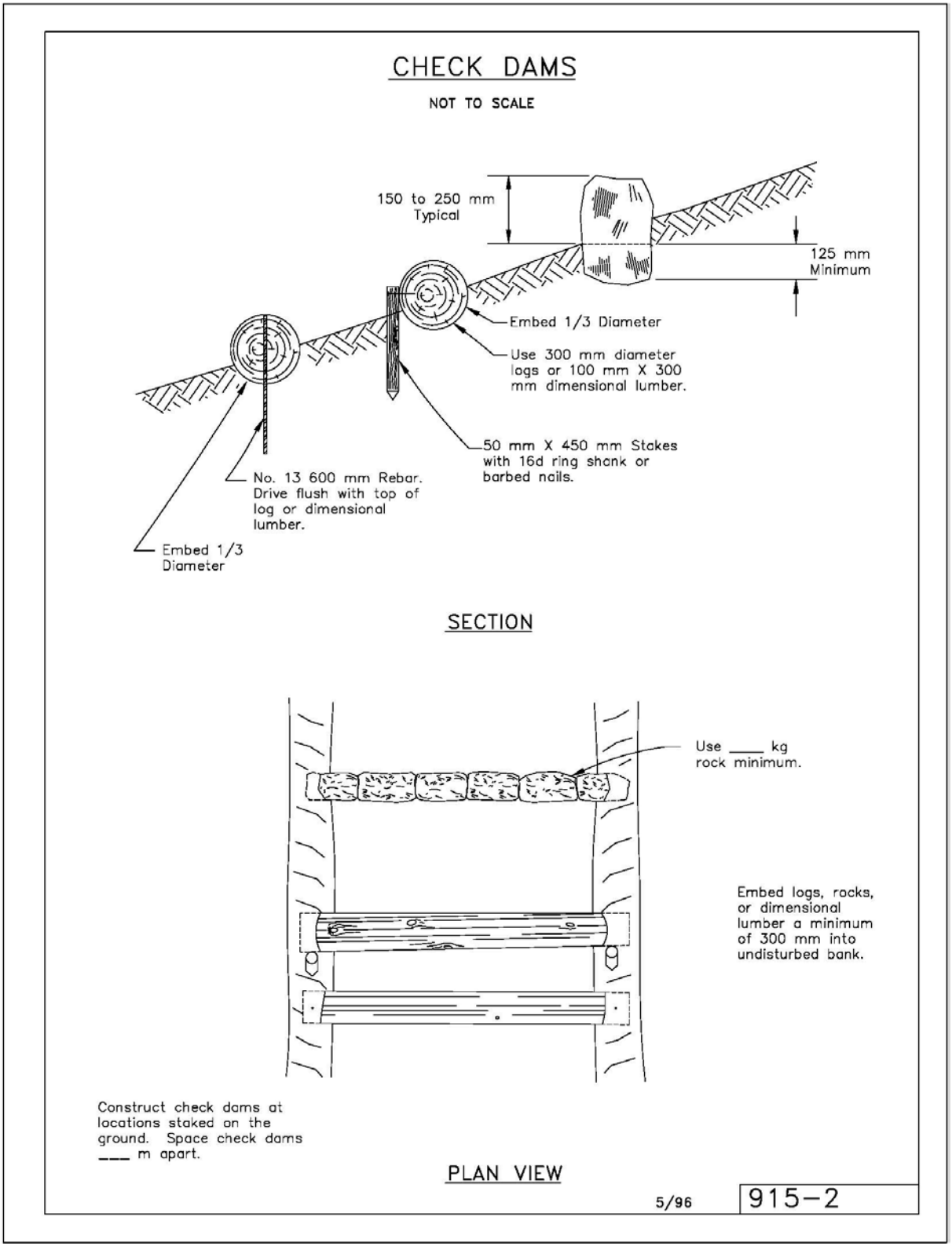


**Figure 5. Erosion control structures.**

## Alternative D—Reroute Trail on More Sustainable Alignment

Under Alternative D, the trail would be rerouted to a more sustainable alignment with a grade of 10% or less (Figure 6). With the reroute, the Crater Trail would be about 1.5 miles long, compared to the current trail's length of about 1 mile.

Construction of the rerouted trail would follow long-term sustainability design concepts. The NPS has adopted the concept of sustainable design as a guiding principle in the design of trails and other park infrastructure. As defined by the NPS Natural Resource Management Reference Manual #77:

> Sustainability of backcountry trail corridors is defined as the ability of the travel surface to support current and anticipated appropriate uses with minimal impact on the adjoining natural systems and cultural resources. Sustainable trails have negligible soil loss or movement and allow the naturally occurring plant systems to inhabit the area, while allowing for the occasional pruning and removal of plants necessary to build and maintain the trail. If well designed, built, and maintained, a sustainable trail minimizes braiding, seasonal muddiness and erosion. It should not normally affect natural fauna adversely nor require re-routing and major maintenance over long periods of time.

Sustainability in trail design considers whether the trail supports current and anticipated uses, the degree to which it protects natural systems, cultural resources, and the long-term maintenance requirements. The park uses a number of tools and guidance documents in the design, management, and maintenance of the trail system. Trail maintenance and reconstruction is currently managed under the 2000 Trail System Maintenance and Reconstruction Plan (NPS 2000). The park adopted Federal Trail Data Standards (Federal Geographic Data Committee 2011) for trail design and maintenance in 2012. Federal Trail Data Standards identify a common set of standardized trail classes ranging from minimally developed to fully developed. Each trail class has defined levels of tread and traffic flow, obstacles present, types of constructed features, and trail elements. Trail design standards consider a number of factors including key components about trail location, length, use, condition, and management.

The rerouted trail would have a tread about 24 inches wide, and the total width of disturbance to the ground surface would be about 3 to 5 feet, including the back slope, tread, and fill slope (or outside edge). The construction zone and clearing limits would be about 3 to 5 feet wide by 6 feet high. Overhanging tree branches and a few trees within the clearing limits would be removed in the first year of construction. The new trail alignment was designed to avoid trees and minimize tree removal to the greatest extent practicable. Several small patches of krummholz trees near the transition from subalpine forest to alpine tundra would need to be partially removed to accommodate the trail. An estimated 100 to 150 lodgepole pine (*Pinus contorta*), Engelmann spruce (*Picea engelmanii*), and subalpine fir (*Abies lasiocarpa*) would be removed along the length of the trail. Tree and branch removal would be the first phase of the project, followed by construction of the trail tread. Retention walls may be needed in a few areas with steep side slopes. Up to about 100 linear feet of retention walls may be needed, and in these areas, the construction zone would extend an additional 10 feet on the uphill side of the trail.

A footbridge would be constructed over a small stream crossed by the rerouted trail, and a rock causeway would be constructed through a wetland area. The bridge would have a span of about 25 to 30 feet, and would be a single or double stringer log footbridge, constructed of native timber and native log sills, with a native stone foundation. Limited work would be needed in the stream, temporarily disturbing a few square feet to set the foundation rocks to support the bridge sills. The footbridge would be constructed in accordance with the bridge and footlog standards in the park's Backcountry/Wilderness Management Plan (NPS 2001).

Three borrow sites have been identified along the proposed rerouted trail alignment (Figure 6). Each borrow area is about 250 square feet in area. Selected rocks would be removed from these areas as needed to construct the trail, and the borrow sites would be restored following construction.

Work would be conducted by a crew of 6 to 14 workers traveling to the trailhead in pickup trucks and hiking to the work area daily. Materials would be transported to the trailhead by pickup trucks or possibly a small dump truck. The trail would be constructed primarily using hand tools and native materials found on site. However, as with Alternative C, mechanized equipment would be needed to facilitate construction of the trail. Equipment used would be the same as under Alternative C and has been evaluated through an MDRG process. Helicopter use would be needed to transport materials such as logs and tread material to the work site. Helicopter use would likely occur over a period of about 3 hours per day for about 10 days. Construction of the reroute may require use of volunteers (up to an estimated 150 people) for short periods (one or more weekends). Volunteers would not camp near the Crater Trail, but would be transported to the trail daily in trucks, vans, or buses and would hike to the work area.

As described for Alternative C, temporary staging and stockpiling areas would be needed for equipment and material storage during trail reconstruction. Staging and stockpiling areas would be located within existing disturbed areas at the trailhead parking area, and at regular intervals along the trail. Staging areas along the trail would mostly be used to store tools, gathered rocks, or duff. About 20 to 25 staging areas would be needed and each would be about 10 feet by 20 feet in size. To minimize the amount of ground disturbance, staging and stockpiling areas would be placed on previously disturbed land where feasible or on areas devoid of vegetation. No excavation or ground disturbance would occur in staging areas other than temporarily placing tools and materials for later use.

Native timber, rock, and soil from on-site locations within areas surveyed for biological and cultural resources would be used to the extent possible to minimize the transport of material on the trail. Potential borrow sites have been identified for rock material needed to construct the rerouted trail (Figure 6). Native soil also would be gathered from areas inside the trail corridor. Timber could be transported to the site by helicopter or harvested on site. If harvested on site, the preferred timber would be dead standing, out of sight from the trail, and without cavity nests. A high line would be used to move rocks and material, to avoid rolling and dragging material through vegetated areas.

Construction of the reroute may require periodic or season-long closures of the existing Crater Trail for visitor and park staff safety. The park would advertise the trail closures in advance.

The construction season would be the same as for Alternatives B and C, beginning after snowmelt and continuing until snowfall makes trail work impractical, likely in October.

Limitations on use of mechanized equipment during the bighorn sheep lambing season from May 1 to August 15 would be imposed as described under *Resource Protection Measures*. Trail work is anticipated to occur in daylight hours Monday through Friday, but weekend work could occur as needed. Construction of the rerouted trail would likely take 3 to 5 years because of the short construction season and bighorn sheep closure. If chainsaws are not used, removing trees and overhanging branches would be accomplished using handsaws and other nonmechanized equipment, and may take an entire season. Construction would likely be phased so that work on the lower-elevation portions of the trail would occur earlier in the season, to reduce impacts on bighorn sheep, with work on higher-elevation portions of the trail above tree line occurring later in the season.

Following completion of the rerouted trail, abandoned sections of the existing trail would be stabilized to prevent erosion and revegetated with native plant species as described under Alternative B. About 1 mile of existing trail would be abandoned and revegetated.

Park staff would incorporate the rerouted trail into a regular maintenance schedule, as under Alternative C.

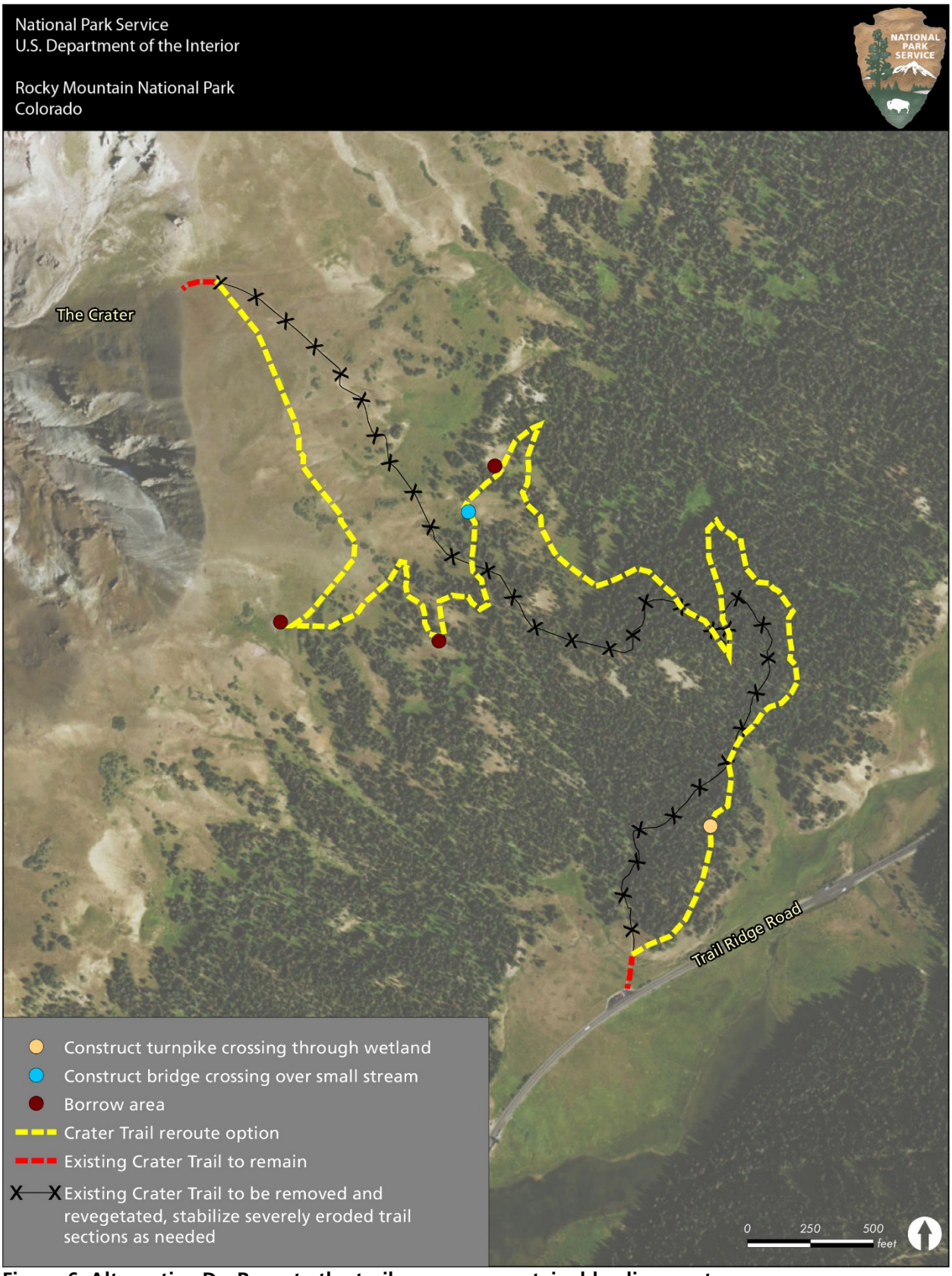


**Figure 6. Alternative D—Reroute the trail on a more sustainable alignment.**

# Resource Protection Measures

The following resource protection measures would be implemented to minimize the degree or severity of adverse effects.

### General Measures

- The construction area limits would be clearly defined, fenced, flagged, and delineated to keep ground disturbance to a minimum. No disturbance would occur beyond these limits other than protection measures for erosion/sediment control.
- All tools, equipment, barricades, signs, surplus materials, and rubbish would be removed from the project area upon project completion. Construction debris would be hauled from the park to an appropriate disposal location.
- The park has developed a comprehensive list titled "Construction Stipulations for Native Plant Conservation and Restoration" to help minimize impacts on natural resources (Appendix C). These measures cover all aspects of trail construction, including implementation, construction limits, equipment, clearing and grubbing, excavation, topsoil salvage, vegetation salvage, rough grading, finish grading, imported aggregate and soil, placement of topsoil, erosion control, seeding, and mulching and would be incorporated into contract documents. The park would also apply the 2006 Vegetation Restoration Management Plan (NPS 2006a) to guide revegetation activities.

### Water Resources

- Best Management Practices (BMPs) such as small temporary check dams made of straw bales or temporary silt fences would be used to minimize erosion and the introduction of sediments to aquatic habitat during and after construction.
- All vehicle and equipment fueling would occur more than 100 feet from any surface water in a location where a fuel spill would not be able to enter the water.
- A spill prevention and response plan that regulates the use of hazardous and toxic materials, such as fuels and lubricants for construction equipment, would be prepared.

### Wildlife and Species of Concern

- The park would ensure that personnel conducting trail restoration would be instructed on appropriate behavior in the presence of wildlife and on proper storage and handling of food, garbage, and other attractants.
- Potential impacts on species of concern, including boreal toads, would be avoided by conducting trail restoration work outside of the breeding season in wetlands. The restriction would start as soon as ice is melted off ponds/streams. If presence of amphibians is verified, the restriction would stay in place until metamorphosis, which can be as late as October. If amphibians are not present the work can move forward.
- From May 1 to August 15, mechanized equipment would not be used; only hand tools would be used to minimize impacts on bighorn sheep lambing. After August 15, use of mechanized equipment would be allowed. Exceptions to this limitation would be as follows: 1) if monitoring of bighorn sheep is conducted prior to work commencing and

no ewes or young lambs are identified in the area, use of mechanized equipment can commence; and 2) if monitoring of bighorn sheep is conducted prior to work and ewes or lambs are observed, use of mechanized equipment may commence in coordination with bighorn observations to assess disturbance; if no adverse impacts are observed, mechanized equipment use can continue independent of bighorn sheep monitoring.

- If bighorn sheep are observed, park staff would not approach and would wait for them to leave the area. If they change behavior (stop grazing, have one member constantly watch, stand up from a bedded position, etc.), park staff would retreat from the area until the sheep vacate the area and then continue work.

### Vegetation

- All equipment entering the park would be cleaned and pressure washed to remove foreign soil, vegetation, and other materials that may contain nonnative seeds or vegetation.
- Imported fill dirt would be from a weed-free source within the park to ensure that it is free of noxious weeds.
- All disturbed areas would be revegetated with native species. Revegetation plantings, if necessary, would use native species from genetic stocks originating in the park. Revegetation efforts would focus on recreating the natural spacing, abundance, and diversity of native plant species. All disturbed areas would be restored as nearly as possible to preconstruction conditions shortly after construction activities are completed.
- In an effort to avoid introduction of exotic plant species, no hay bales would be used. Hay often contains seed of undesirable or harmful invasive exotic plant species. Therefore, on a case-by-case basis, the following materials may be used for any erosion control that may be necessary: rice straw, straws determined by the NPS to be weed-free (e.g., Coors barley straw or Arizona winter wheat straw), cereal grain straw that has been fumigated to kill weed seed, and wood excelsior bales.
- Any nonnative invasive plant infestations discovered in the project area would be treated on a yearly basis for a minimum of three years following project completion. Nonnative invasive plant species would be managed in accordance with the park's Invasive Exotic Plant Management Plan (NPS 2003).

### Soils

- Erosion-control measures that provide for soil stability and prevent movement of soils into waterways would be implemented, such as silt fence structures made of burlap or biodegradable mesh.

### Cultural Resources

- Should previously undiscovered cultural resources be encountered, work would be stopped in the area of any discovery, and the NPS archeologist would consult with the Colorado State Historic Preservation Office and the Advisory Council on Historic Preservation, as necessary, according to 36 CFR 800.13, Post Review Discoveries. In the unlikely event that human remains are discovered during construction, provisions

outlined in the Native American Graves Protection and Repatriation Act (1990) would be followed.

- The park would ensure that all personnel who work on the trail are informed of the penalties for illegally collecting artifacts or intentionally damaging archeological sites or historic properties. Personnel would also be instructed on procedures to follow in case previously unknown archeological resources are uncovered during construction. Equipment traffic would be minimized in the area of the site. Equipment and materials staging areas would also avoid known archeological resources.
- Known historic and prehistoric sites and isolated occurrences would be flagged and avoided during rehabilitation/construction activities, and an archeologist meeting the Secretary of the Interior's Professional Qualification Standards would be on-site during ground-disturbing activities.
- A memorandum of agreement to resolve adverse effects on historic properties would be developed with the SHPO, American Indian tribes, and other consulting parties. All stipulations would be adhered to as part of this project.

### Visitor Use and Experience

- Signs, press releases, and other communication methods would be used to inform visitors about trail restoration and closures during construction.
- Barriers or signs would be used to deter visitor travel on the abandoned trail to allow restoration of these areas.

### Air Quality and Soundscapes

- All construction motor vehicles and equipment would have mufflers conforming to original manufacturer specifications that are in good working order to prevent excessive or unusual noise, fumes, or smoke.
- To reduce noise and emissions, construction equipment would not be permitted to idle for longer than two minutes when not in use.

### Public Health, Safety, and Park Operations

- Appropriate barriers and barricades would be used to clearly delineate work areas and prevent visitor travel near construction areas.
- Construction crews would wear appropriate attire such as hard hats, gloves, and goggles to protect themselves from natural hazards. Visitors would not be allowed into construction zones.
- Trucks hauling debris and other loose materials would be covered to maintain adequate freeboard to prevent spillage to paved surfaces.
- Emergency response protocols would be developed for implementation during construction. Construction activities would be conducted in accordance with established safety protocols.

- Employees and construction crews would be required to park their vehicles in designated locations.
- Construction workers and supervisors would be informed about the special sensitivity of park values, regulations, and appropriate housekeeping.

## Alternatives Considered and Dismissed

The following alternatives were considered for project implementation but were dismissed from further analysis, as described below.

### Alternative Reroute Alignments

The NPS considered several reroute alternatives that would have rerouted a portion of the trail while maintaining a portion of the existing trail. Alternatives considered included rerouting the section of the trail below tree line only, rerouting the section of trail in the alpine tundra only, or rerouting only a short section of trail in the tundra to avoid the steepest, most eroded section of trail. These alternatives were not selected because they would not meet trail sustainability requirements, would result in impacts on a known archeological site and, therefore, would not resolve the purpose and need for taking action.

### Close Trail and Allow Limited Access with Adaptive Management

The NPS considered closing the trail while continuing to allow limited, managed public access to the Crater area. This alternative would allow for limited day use through a permit system. Permittees would be given a map identifying a prescribed travel zone (south of the Crater), along with expectations and requirements for Leave No Trace travel. Monitoring and adaptive management would be implemented to adjust use of the area over time as necessary to minimize impacts on resources. This alternative would impose additional requirements on staff time and park resources to issue permits and monitor compliance. In addition, the alternative would not address all concerns related to natural and cultural resource damage and, therefore, would not resolve the purpose and need for taking action.

# AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes the affected environment (existing setting or baseline conditions) and analyzes the potential environmental consequences (impacts or effects) that would occur as a result of implementing the no action and action alternatives. Cumulative effects are analyzed for each resource topic carried forward.

## Cumulative Impact Scenario

The Council on Environmental Quality (CEQ) regulations that implement NEPA require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts 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 non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for the no action and action alternatives.

Cumulative impacts were determined by combining the impacts of the actions included in the alternatives with other past, present, and reasonably foreseeable future actions. Therefore, it is necessary to identify other past, present, or reasonably foreseeable future actions in the park that could result in cumulative impacts. Only one past, present, or reasonably foreseeable action was identified: monitoring of bighorn sheep has been ongoing in the Crater Trail area for many years and would continue under any of the alternatives.

## Vegetation and Soils

### Affected Environment

The analysis area for vegetation and soils includes the existing Crater Trail and reroute alignment, as well as a 50-foot buffer on either side. A biological resources survey was conducted in August 2016 to identify biological resources, including dominant plant species and soils, within the project area (ERO 2016). Vegetation and soils for the project area are described below.

#### *Vegetation*

The park lies within the Dry Domain, Temperate Steppe Division and Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow Province. This ecoregion is characterized by dramatic vertical zonation of vegetation, resulting from abrupt elevation gradients between flatlands and mountains. The park, with elevations from 7,860 feet to 14,259 feet, has three of the five life zones present: montane, subalpine, and alpine (NPS 2006a). Both the existing trail and proposed reroute alignment occur in the subalpine and alpine life zones, crossing subalpine mixed coniferous woodland and alpine tundra (Figure 7 and

Figure 8). About two-thirds of the length of the existing trail (0.66 mile) crosses subalpine habitat and one-third (0.33 mile) of the trail crosses alpine habitat.

Within the mixed coniferous forest in the analysis area, the dominant canopy species are lodgepole pine, subalpine fir, and Engelmann spruce. Common plant species in the subcanopy include woolly brome (*Bromus lanatipes*), tufted hairgrass (*Deschampsia cespitosa*), bluejoint (*Calamagrostis canadensis*), alpine timothy (*Phleum alpinum*), small flowered woodrush (*Luzula parviflora*), grouse whortleberry (*Vaccinium scoparium*), Jacob's ladder (*Polemonium pulcherrimum*), heartleaf arnica (*Arnica cordifolia*), American bistort (*Bistorta bistortoides*), ebony sedge (*Carex ebenea*), Rocky Mountain sedge (*Carex scopulorum*), common juniper (*Juniperis communis*), and yarrow (*Achillea millifolium*) (ERO 2016).

Alpine tundra species in the analysis area include alpine timothy, yarrow, buttercup (*Ranunculus eschscholtzii*), American bistort, alpine sunflower (*Rydbergia grandiflora*), alpine harebell (*Campanula rotundifolia),* death camus (*Anticlea elegans*), lousewort (*Pedicularis* sp.), alpine sagebrush (*Artemesia scopulorum*), western Indian paintbrush (*Castilleja occidentalis*), snow willow (*Salix reticulate*), Rocky Mountain sedge, and hayden sedge (*Carex haydeniana*) (ERO 2016).

No invasive plant species were observed in the analysis area during the biological resources survey in August 2016 (ERO 2016).

**Figure 7. Mixed coniferous forest along the existing Crater Trail.**

**Figure 8. Existing Crater Trail and alpine tundra.**

### *Soils*

The soils in the park developed as the result of weathering of the parent rock material. Park soils vary by the composition of parent rock and environmental conditions influenced by different vegetation types, climate, and elevation. The soils exhibit a wide range of characteristics in texture, depth, organic matter content, and physical and chemical properties (NPS 2016). Soils mapped within the analysis area by the Natural Resource Conservation Service (NRCS) include two dominant series: Fallriver gravelly sandy loam (10 to 45% slopes) and Trailridge-Mummy complex (20 to 60% slopes). Fallriver gravelly sandy loam was mapped within the subalpine woodland (9,000 to 11,800 feet elevation) and Trailridge-Mummy complex soils were mapped in the alpine tundra (10,4000 to 12,200 feet elevation) (USDA NRCS 2016). The soil profile grades from a very gravelly sandy loam near the surface to unweathered bedrock at depth.

The soils of the subalpine woodland have approximately 20 to 50 frost-free days and receive about 24 to 40 inches of precipitation annually. The soils of the alpine tundra have a very short frost-free period (10 to 30 days) and receive about 30 to 40 inches of precipitation annually (U.S. Department of Agriculture (USDA NRCS) 2016). In general, the soils in the subalpine life zone formed in gravelly slope alluvium, residuum, colluvium, or till derived from granite, gneiss, or schist. These soils range in depth from deep to shallow, depending on the depth to rock, and are somewhat excessively drained. The soils in the alpine life zone formed in gravelly slope alluvium, or residuum, colluvium, or till derived from granite, gneiss, or schist. These soils are shallow to very deep and are somewhat excessively drained (USDA NRCS 2016).

Based on field observations, the existing trail within the subalpine zone crosses soils consisting of fine to very fine silty sand with some gravels (Yeh and Associates 2016). The trail is eroded in areas due to the steep nature of the trail and fine-grained readily erodible soils. The existing trail above tree line is deeply incised in areas due to erosion of the volcanic fine-grained soils.

The reroute alignment crosses the slope above tree line at a flatter slope than the existing trail. A small rotational landslide has formed below the uppermost rock outcrop identified on the reroute alignment, above tree line. Many surficial features were observed including scarps, water pooling, and hummocks, indicating recent or ongoing movement (Yeh and Associates 2016).

## Environmental Consequences

### *Direct and Indirect Impacts*

#### Impacts of Alternative A—No Action

Currently, poor water drainage from the existing trail promotes soil transport, resulting in erosion of the trail tread and adjacent areas. Under the no action alternative, ground disturbance such as compaction and extensive erosion would continue along sections of the trail from continued foot traffic, particularly impacting alpine tundra plant communities. About 0.16 acre of trail surface in alpine habitat and 0.32 acre of trail surface in subalpine habitat would be affected by ongoing erosion, which would continue indefinitely. Because the trail is heavily eroded, visitors would likely hike around eroded areas in the alpine zone, trampling existing vegetation and creating new social trails, which would result in a loss of alpine vegetation. This alternative would have limited impacts on vegetation from trail maintenance, although continued erosion of the trail without major improvements could lead to a loss of vegetation. Creation of social trails would mostly be limited to alpine habitat and would affect less than 0.01 acre of vegetation and soils. This loss of vegetation would be permanent. Loss of vegetation along the edges of the trail would expose more soil to erosion, leading to additional soil loss. Vegetation and soil losses would mostly occur in the alpine tundra life zone. Although the losses of vegetation and soils would be small, any loss of alpine vegetation is important because alpine vegetation is more fragile and susceptible to erosion than the subalpine zone and other habitats in the park, may take decades to recover from disturbance, and is important to the purpose of the park. No mitigation measures would be implemented to reduce impacts of erosion under Alternative A. Overall, the no action alternative would result in detectable adverse impacts on vegetation and soils within the trail corridor.

#### Impacts of Alternative B—Close the Trail (Proposed Action and Preferred Alternative)

Under Alternative B, the trail would be closed and no longer maintained. Closing the trail would allow for revegetation of the trail and disturbed areas along the trail (approximately 0.48 acre of restored vegetation), which would benefit the subalpine forest and alpine tundra plant communities within the analysis area. About 0.16 acre of alpine habitat would be restored, and 0.32 acre of subalpine habitat would be restored. Restoration of alpine plant communities would likely take decades because of the short growing season and their fragile nature. The vegetation in the subalpine zone would likely recover within a few years, with understory plants filling in beneath the existing tree canopy. Reestablishing vegetation would benefit soils by protecting them from additional erosion. One of the purposes of the park is the preservation of high-

altitude ecosystems such as alpine tundra. Although the restored area of alpine tundra (0.16 acre) would be small, this benefit would be important because alpine tundra encompasses one-third of the park, one of the largest examples of alpine tundra ecosystems protected in the contiguous United States, and is important to the purpose of the park.

Some trampling of vegetation would likely occur during restoration and would be limited to within about 25 feet or less from the existing trail. Trampled vegetation would likely recover to preconstruction conditions within 1 to 2 years. Closing the trail would eliminate most human use of the Crater Trail area, resulting in benefits to vegetation and soils from reduced foot traffic. Overall, closing and revegetating the trail would be beneficial for vegetation and soils over the long term.

**Impacts of Alternative C—Reconstruct Trail within Existing Alignment**

Reconstruction of the trail would benefit vegetation and soils over the long term from improved erosion control and sustainable trail tread surfaces. Current foot traffic on the trail and creation of social trails are resulting in loss of soils and vegetation, as described in Alternative A. Though use of the trail by park visitors would continue and more maintenance would be required than under the no action alternative, new and improved erosion-control structures would better stabilize the trail and help mitigate the impacts of continued ground disturbance. The improved trail surface would reduce the number of visitors hiking off-trail and creating social trails across the tundra. By reducing erosion on about 0.16 acre of trail surface across the alpine tundra, Alternative C would reduce ongoing vegetation and soil loss.

Under this alternative, less than 200 square feet of alpine vegetation and soils and less than 200 square feet of subalpine vegetation and soils would be removed by construction of erosion-control structures such as water bars. The disturbance at each erosion-control structure would be small (limited to a few square feet). Use of staging areas to store tools and materials would result in trampling of vegetation, affecting about 0.04 acre of alpine habitat and 0.07 acre of subalpine habitat. To minimize the amount of ground disturbance, staging and stockpiling areas would be placed on previously disturbed land where feasible. The erosion-control structures would need to be replaced after about 10 to 20 years due to the harsh environmental conditions and visitor use, resulting in recurring disturbance to vegetation and soils. Impacts on vegetation and soils from replacing the structures would be similar to the initial disturbance when they are installed (a few square feet at each structure, totaling less than 400 square feet for the entire trail). Some temporary trampling of vegetation would likely occur during construction and replacement of the structures as workers install and transport materials, and would be limited to within about 25 feet or less from the existing trail. Removed vegetation would be restored and would recover within a few years in subalpine habitat; however, impacted vegetation in the alpine zone could take decades to fully recover due to the short growing season and fragile nature of alpine plant communities. Trampled vegetation from construction and staging would likely recover to preconstruction conditions within 1 to 2 years.

Construction activities could facilitate the establishment or spread of noxious weeds and nonnative vegetation because many of these species are able to outcompete native vegetation on disturbed sites. Measures such as cleaning equipment before entering the park and use of weed-free fill would be implemented to prevent the spread of exotic plant species as described in the *Resource Protection Measures* section.

Overall, Alternative C is expected to have a small adverse effect on vegetation and soils from construction activities and continued foot traffic. Over time, stabilizing the trail would benefit vegetation and soils by reducing erosion above tree line that threatens to damage alpine tundra plant communities near the trail. Although the benefits to vegetation and soils would be small, preservation of alpine vegetation and soils are important because alpine habitat is fragile and susceptible to erosion and may take decades to recover from disturbance.

**Impacts of Alternative D—Reroute Trail on More Sustainable Alignment**

Rerouting the trail to a more sustainable alignment would benefit vegetation and soils over the long term from improved erosion control and sustainable trail tread surfaces and would reduce creation of social trails and the resulting loss of soils and vegetation, as described in Alternative A. The rerouted and improved trail surface would reduce the number of visitors hiking off-trail and creating social trails across the tundra. Although the rerouted trail would reduce the creation of social trails, a net loss of alpine tundra and subalpine habitat would result, as described below.

Under this alternative, about 0.28 acre of alpine vegetation and 0.44 acre of subalpine vegetation would be permanently removed to construct 1.5 miles of trail tread for the rerouted trail and retention walls. Soils in the trail tread and backslope would be permanently impacted by compaction. The construction of the trail tread and backslope would result in the permanent loss of vegetation in a construction zone ranging from about 3 to 6 feet wide along the length of the rerouted trail, depending on the steepness of the side slope. In the alpine zone, this would result in permanent loss of previously undisturbed alpine tundra habitat. In the subalpine zone, vegetation clearing for the rerouted trail would require removal of low-density understory vegetation and about 100 to 150 lodgepole pine, Engelmann spruce, and subalpine fir trees. Some snags along the new trail alignment may need to be removed for safety reasons. Several small patches of krummholz trees near the transition from subalpine forest to alpine tundra would need to be partially removed to accommodate the trail. Use of staging areas to store tools and materials would result in trampling of vegetation, affecting about 0.04 acre of alpine habitat and 0.07 acre of subalpine habitat. As described under Alternative C, staging and stockpiling areas would be placed on previously disturbed land where feasible to minimize the amount of ground disturbance.

About 1 mile of abandoned trail would be stabilized and revegetated, resulting in the restoration of 0.16 acre of alpine habitat and 0.32 acre of subalpine habitat. Restoration of the alpine portion of the trail would likely take decades, as described under Alternative B. The net loss of alpine vegetation and soils from Alternative D would be about 0.12 acre and the net loss of subalpine vegetation and soils would be 0.12 acre after accounting for the abandonment and restoration of the existing trail. This loss would be permanent. Some trampling of vegetation would likely occur during restoration and would be limited to within a few feet from the existing trail. Trampled vegetation would likely recover to preconstruction conditions within 1 to 2 years.

As described under Alternative C, construction activities could facilitate the establishment or spread of noxious weeds and nonnative vegetation because many of these species are able to outcompete native vegetation on disturbed sites. However, resource protection measures (as described in the *Resource Protection Measures* section) would be implemented to prevent the spread of exotic plant species.

The permanent loss of 0.28 acre of alpine vegetation, permanent loss of 0.44 acre of subalpine vegetation, and compaction of soils within the trail construction zone would be partially offset by restoration of the existing trail; however, the restored existing trail would likely take decades to recover completely, especially in the alpine habitat. The loss of 0.44 acre of subalpine habitat would not likely be discernable at a parkwide scale because the subalpine habitat covers a large portion of the park and impacts would generally be limited to understory vegetation and common tree species. The net loss of alpine tundra habitat would be small (0.12 acre) but would be important because alpine tundra in the park is one of the largest examples of protected alpine tundra ecosystems in the contiguous United States, and is important to the purpose of the park. The park's foundation document lists alpine tundra as one of the park's most important resources (NPS 2013a). In addition, the park has identified alpine tundra as an important resource and has a "no net loss" goal for tundra preservation (NPS 2013b).

#### *Cumulative Impacts*

No past, present, and reasonably foreseeable future actions were identified that would result in measurable impacts on vegetation and soils. Bighorn sheep monitoring could result in minimal and localized vegetation trampling and ground disturbance in the area; however, these effects would not be measurable. Because there would be no impacts from past, present, and reasonably foreseeable future actions, there would be no cumulative effects under any of the alternatives.

## Bighorn Sheep

### Affected Environment

By the 1950s, pressures from hunting, disease, and habitat alteration had reduced bighorn sheep numbers in the park and surrounding areas to as few as 150 animals in remote areas in the park and surrounding mountains (NPS 2015). Bighorn populations have since increased. Wildlife managers reintroduced bighorn sheep to their historical range east of the park in 1978 and 1980 in an effort to increase population numbers. Past and ongoing threats to bighorn sheep in the park include loss of lower elevation habitat outside the park due to development, increased mortality from diseases carried by domestic sheep, and increased stress resulting from increased numbers of visitors to the park (McClintock and White 2006). Increased stress from interactions with visitors is of special concern at mineral licks that are easily accessible to visitors at Sheep Lakes (on the east side of the park) and the Crater.

Today, approximately 350 bighorn sheep live in the park and surrounding areas. The bighorn sheep population in the park includes the East-side herd and the West-side herd. The West-side herd contains the majority of sheep in the park and is further divided into two groups (the Continental Divide and Never Summer groups) that occupy separate but overlapping ranges west of and along the Continental Divide in the park (McClintock and White 2006). The ranges of these two groups overlap seasonally in the Specimen Mountain and Crater area. The Crater Trail area includes an important movement corridor for bighorn sheep. Bighorn sheep from the Continental Divide group must cross Trail Ridge Road near Milner Pass when traveling to and

from the Crater and Specimen Mountain. The Crater and adjacent areas are important lambing grounds for the West-side herd. Bighorn sheep are also attracted to the Crater by the presence of natural mineral licks (Stevens 1982). In recent years, up to 90 bighorn sheep have been observed at one time in the Crater area.

The lambing season in the Crater area typically extends from May 1 to about August 15 and the sheep are especially sensitive to human disturbance during this time. Research in Canyonlands National Park found that hikers often caused reactions in bighorn sheep, with the result that the bighorns fled in 61% of the encounters, typically fleeing about 300 feet before stopping (Papouchis et al. 2001). Bighorns responded more often to hikers than vehicles or mountain bikers, apparently because hikers were more likely to leave the trail and approach the sheep to observe or photograph them.

Over the years, the park has taken steps to limit public access due to concerns about impacts on bighorn. In 1971, the Specimen Mountain Trail was closed to public use from May 1 to July 1 (Stevens 1982). In 1978, the Specimen Mountain Trail above the Crater, and the Crater itself, were closed to public access for the summer (NPS 1978). In 1986, the park established a year-round closure of Specimen Mountain and Shipler Mountain above the Crater, and the Crater itself (NPS 1986). Also, beginning in 1986, the Crater Trail was closed annually from May 1 to about mid-July, depending on the duration of the bighorn sheep lambing season. In the 1990s, concern about increasing numbers of visitors at the Crater and associated impacts on bighorn sheep prompted the park to remove the trailhead sign for the Crater Trail and reduce references to Specimen Mountain and the Crater as areas to view bighorn sheep in park interpretive materials (NPS 1993). Currently, the Crater Trail and nearby areas, including Specimen and Shipler Mountains, are closed to public access during the lambing season.

## Environmental Consequences

### *Direct and Indirect Impacts*

#### Impacts of Alternative A—No Action

Under the no action alternative, there would be no new impacts on bighorn sheep. Use of the trail and off-trail travel by hikers would continue and would likely cause some displacement and increased stress in individual or small groups of bighorns. Potential effects on bighorn sheep from human presence, especially off-trail hikers, include increased physiological stress, changed behavior such as less time foraging and more time watching the surroundings, and changed movement patterns (displacement to nearby habitat). The closure from May 1 to August 15 to protect bighorn lambing areas would remain in effect. Some hikers would likely continue to disregard the closure and hike on the trail during the lambing season, resulting in some displacement and increased stress in bighorn sheep. If disturbance and displacement were to occur during the lambing season, the increased stress and reduced time foraging could lead to lower survival rates for lambs. With the closure from May 1 through August 15, impacts on bighorns would be primarily limited to the period from mid-August through October when lambing is not occurring, and would continue as long as the trail is open. Although impacts would be mostly avoided during the lambing period, the Crater and surrounding area are important year-round habitat for bighorn sheep, and interactions with visitors at the mineral lick at the Crater have been identified as a source of increased stress for bighorn sheep.

Alternative A would allow this ongoing disturbance of the sheep resulting from visitor use of the trail to continue indefinitely.

**Impacts of Alternative B—Close the Trail (Proposed Action and Preferred Alternative)**

Closing the trail could result in displacement and increased stress in bighorn sheep during the 3- to 4-month summer construction period, ending when snowfall makes continued work impractical. The rehabilitation process would occur over 2 to 3 years and would involve the use of a helicopter to deliver fill soil as needed. Use of a helicopter would create additional noise that could affect bighorn sheep over a period of about 3 hours per day for 3 days during the 6- to 8-week trail restoration period. Potential effects on bighorn sheep from increased human presence could include increased physiological stress, changed behavior such as less time foraging and more time watching the surroundings, and changed movement patterns (displacement to nearby habitat). Use of helicopters could disturb bighorns and reduce their foraging efficiency by causing the animals to expend more energy reacting to the helicopters while foraging. These effects would impact individuals or small groups of bighorn sheep, and would only occur during the 6- to 8-week construction season. Impacts on bighorn sheep would be minimized by implementing mitigation measures described above under *Resource Protection Measures*.

Restoration of the trail with native vegetation would reestablish bighorn sheep habitat within the trail tread, an area about 1 mile long and 3 to 4 feet wide. About 0.16 acre of alpine habitat would be restored and about 0.32 acre of subalpine habitat would be restored. Some trampling of vegetation providing habitat for bighorn sheep would likely occur during restoration and would be limited to within about 25 feet or less from the existing trail. Trampled vegetation would likely recover to preconstruction conditions within 1 to 2 years. Closing the trail would eliminate most human use of the Crater Trail area. Because bighorn sheep may respond to human disturbance and avoid areas with hikers, closing and revegetating the trail could lead to increased use of the area by bighorn sheep. This would be a permanent benefit to the entire bighorn sheep population in the Crater area. As previously described, the Crater and surrounding area are important year-round habitat for bighorn sheep and interactions with visitors at the mineral lick at the Crater have been identified as a source of increased stress for bighorn sheep. Overall, closing and revegetating the trail would be beneficial for bighorn sheep over the long term by eliminating an ongoing source of disturbance and stress for the sheep.

**Impacts of Alternative C—Reconstruct Trail within Existing Alignment**

Reconstruction of the trail would result in bighorn sheep displacement from increased human presence and noise during the 3- to 4-month construction period each year over 2 to 3 years. Although hand tools would be used wherever possible, chainsaws or other mechanized equipment may be needed for trail repair and reconstruction. Use of helicopters to import materials would create an additional source of noise and disturbance over a period of about 3 hours per day for about 7 days. As described under Alternative C, effects on bighorn sheep from increased human presence, use of helicopters, and increased noise from use of chainsaws could include increased physiological stress, such as less time foraging and changed movement patterns. These effects would impact individuals or small groups of bighorn sheep and would only occur during the construction season. Increased noise during construction could cause some individuals or small groups to leave the area for the duration of construction. After construction ends, displaced bighorn sheep would return to the area. Implementing mitigation measures to protect bighorn sheep, as described in the *Resource Protection Measures* section,

would reduce the potential for impacts on bighorn sheep from construction to the level where impacts on sheep during the lambing period are not expected. Impacts on bighorn sheep would be minimized because only hand tools would be used between May 1 and August 15, with exceptions to this limitation as described above for Alternative B.

Under this alternative, small amounts of bighorn sheep habitat would be temporarily affected during construction. Less than 400 square feet of bighorn sheep habitat would be removed by construction of erosion-control structures such as water bars. Temporary staging of tools would result in trampling of vegetation in a total area of about 0.04 acre in alpine habitat and 0.07 acre of subalpine habitat as described in the *Vegetation and Soils* section. Removed vegetation would recover within 1 to 2 years in the subalpine life zone, but may take decades to recover in the alpine tundra. Trampled vegetation would likely recover to preconstruction conditions within 1 to 2 years. Work crews would return every 10 to 20 years to replace the treated log erosion-control structures when they reach the end of their life cycle. Over time, stabilizing the trail would benefit bighorn sheep habitat by reducing erosion above tree line that threatens to damage alpine habitat near the trail.

Once reconstruction of the trail is complete, ongoing effects on bighorn sheep would be the same as impacts under the no action alternative. Use of the trail by hikers would continue and would likely cause some displacement and other adverse effects on bighorn sheep such as increased physiological stress, changed behavior, and changed movement patterns. The closure from May 1 to August 15 to protect bighorn lambing areas would remain in effect, which would reduce, but not eliminate, hikers using the trail during the lambing season. Improved trail conditions would not lead to greater use of the trail compared with the no action alternative because limited parking is available at the trailhead. As previously described, the interactions with visitors at the Crater have been identified as a source of increased stress for bighorn sheep. This source of stress would continue under Alternative C.

**Impacts of Alternative D—Reroute Trail on More Sustainable Alignment**

Rerouting the trail would result in bighorn sheep displacement from increased human presence and noise and other adverse effects on individuals or small groups of bighorn sheep such as increased physiological stress, changed behavior, and changed movement patterns as described under Alternatives B and C. Although hand tools would be used wherever possible, chainsaws or other mechanized equipment may be needed for trail construction. Use of helicopters to import materials would create an additional source of noise and disturbance over a period of about 3 hours per day for about 10 days. Increased noise during construction could cause some individuals or small groups to leave the area for the duration of construction. These effects would occur during the 3- to 4-month summer construction period each year over 3 to 5 years and would end after completion of construction. As with the other alternatives, implementing timing restrictions to protect bighorn sheep would reduce the potential for impacts on bighorn sheep from construction to the level where impacts on sheep during the lambing period are not expected. Impacts on bighorn sheep would be minimized because only hand tools would be used for trail work between May 1 and August 15, with exceptions to this limitation as described above for Alternative B.

Under this alternative, about 0.72 acre of vegetation providing bighorn sheep habitat (0.28 acre of alpine habitat and 0.44 acre of subalpine habitat) would be permanently removed along the 1.5 miles of new trail to construct the trail tread. The permanent impacts on vegetation would be about 2 to 6 feet wide along the length of the rerouted trail. In the alpine zone, this would result

in permanent loss of previously undisturbed alpine tundra habitat. In the subalpine zone, vegetation clearing for the rerouted trail would affect low-density understory vegetation and would include removal of 100 to 150 mature trees.

As described above under *Vegetation and Soils*, impacts on habitat also would result from construction of retention walls and use of staging areas to store tools and supplies during construction. About 0.02 acre of alpine habitat would be affected by trampling and destruction of vegetation from construction of the retention walls. Use of staging areas to store tools and materials would result in trampling of vegetation, affecting about 0.04 acre of alpine habitat and 0.07 acre of subalpine habitat. As described under Alternative C, staging and stockpiling areas would be placed on previously disturbed land where feasible to minimize the amount of ground disturbance. Trampled vegetation in staging areas would recover within 1 to 2 years.

About 1 mile of abandoned trail would be stabilized and revegetated, resulting in about 0.48 acre of alpine and subalpine bighorn sheep habitat restoration. The net loss of alpine habitat from Alternative D would be about 0.12 acre and the net loss of subalpine habitat would be 0.12 acre after taking into account 0.72 acre of permanent impacts from construction of the trail reroute and restoration of about 0.48 acre. Alpine tundra habitat would likely take many decades to reestablish in the trail tread, as described in the *Vegetation and Soils* section. The net loss of vegetation under this alternative (0.24 acre) would not have measurable effects on bighorn sheep given the large amount of habitat in the Crater area and the wide-ranging nature of this species.

Once the trail reroute is complete, ongoing effects on bighorn sheep would be the same as impacts under the no action alternative and Alternative C. Use of the trail by hikers would continue and would likely cause some displacement and other impacts on bighorn sheep as described under Alternatives A and C. The closure from May 1 to August 15 to protect bighorn lambing areas would remain in effect. Some hikers would likely continue to disregard the closure and hike on the trail during the lambing season, resulting in some displacement of bighorn sheep. Although Alternative D would create a new trail alignment, the rerouted trail would be in the same general area as the existing trail, with similar levels of human activity. Improved trail conditions would not lead to greater use of the trail because there is limited parking at the trailhead. The interactions between visitors and bighorn sheep at the Crater would continue under this alternative, as under the no action alternative, along with the resulting impacts on bighorn sheep.

### *Cumulative Impacts*

#### Alternative A – No Action

The impacts of past, present, and reasonably foreseeable future actions on bighorn sheep would result from bighorn sheep monitoring. Bighorn sheep monitoring has had, and would continue to have, effects on bighorns from human presence needed to conduct the monitoring. These effects could include displacement or increased stress as a reaction to the volunteer or volunteers collecting data. This impact would likely be negligible because the volunteers are experienced and trained in methods to avoid disturbing the sheep. Overall, bighorn sheep have likely benefitted, and would continue to benefit, from improved management made possible by collection of data on their numbers and movements. Overall, cumulative impacts from past,

present, and reasonably foreseeable future actions are beneficial. As previously described, the no action alternative would contribute adverse effects on bighorns from continued use of the trail. Thus, when the effects of the no action alternative are combined with the effects of other past, present, and reasonably foreseeable future actions, the total cumulative impacts on bighorns would be adverse, with an adverse incremental contribution from the no action alternative.

#### Alternative B—Close the Trail (Proposed Action and Preferred Alternative)

The impacts of past, present, and reasonably foreseeable future actions on bighorns would be small and adverse as described in Alternative A. As previously described, Alternative B also would contribute beneficial effects on bighorns. Thus, when the effects of Alternative B are combined with these other past, present, and reasonably foreseeable future actions, the total cumulative impacts on bighorns would continue to be beneficial. Alternative B would contribute a relatively large beneficial effect to the impacts that are already occurring.

#### Alternative C—Reconstruct Trail within Existing Alignment

The impacts of past, present, and reasonably foreseeable future actions on bighorns would be small and adverse. As previously described, Alternative C would contribute small adverse effects on bighorns from displacement during construction and loss of habitat. When the effects of Alternative C are combined with past, present, and reasonably foreseeable future actions, the total cumulative impacts on bighorns would be small and adverse, with an adverse incremental contribution from Alternative C.

#### Alternative D—Reroute Trail on More Sustainable Alignment

The impacts of past, present, and reasonably foreseeable future actions on bighorns would be beneficial, as described above for the no action alternative. As previously described, Alternative D would contribute small adverse effects on bighorns from displacement during construction and a net loss of 0.24 acre of bighorn habitat. When the effects of Alternative D are combined with past, present, and reasonably foreseeable future actions, the total cumulative impacts on bighorns would be small and adverse, with a relatively small adverse contribution from Alternative D.

## Historic Structures

### Affected Environment

Historic structures are part of the built environment and may include buildings, irrigation ditches, roads, transmission lines, and trails. The analysis area for historic structures is a 100-foot-wide corridor centered on Crater Trail and a proposed trail reroute alignment. The cultural resource survey conducted in August 2016 to identify potential historic properties (Briggs and Chance 2016) resulted in the documentation of Specimen Mountain Trail (also known as Crater Trail) (5LR14065.1).

Public interest in the Specimen Mountain area began in the late 1800s due to a large population of bighorn sheep that inhabited the area. Specimen Mountain and the Crater provide ideal habitat for bighorn, and bighorn still congregate around the mountain and in the Crater (McLaughlin and Watry, pers. comm. 2016). The trail was never formally designed by the park,

but rather was developed informally by visitors who found direct routes to the Crater (Ramaley 1970s). The area gained protection with the establishment of the park, but visitor interest in the area dramatically increased with the completion of Fall River Road in 1920 (Butler 2005). A more detailed history of trail development in the park is provided in the Class III Archeological Survey Report for the project (Briggs and Chance 2016).

The portion of the trail that intersects the analysis area is 5,145 feet long by 4 feet to 6 feet wide and follows the historical alignment of the trail, which is basically a path of least resistance that extends up the fall line of the slope in several areas. One rerecorded site (5GA4340/5LR14066) located along the trail near the Crater is a collapsed cairn that may be of historic origin (Briggs and Chance 2016); however, based on consultation with the SHPO, the site is considered eligible for listing on the NRHP until tribal consultation can occur (SHPO 2016). Specimen Mountain Trail is a historic property because it is an excellent example of early trail development within the park. The trail developed as a network of social trails, but the current alignment was established by the NPS in the 1930s to enhance recreation at the park by containing the trail to one alignment, closing social trails, and adding timber check dams and water bars. Erosion has adversely affected the trail, but has not significantly compromised the historic character of the trail because it retains physical integrity. The trail retains integrity of location, design, setting, materials, workmanship, and association. The historical design, materials, and workmanship of the trail and surrounding environment has not been altered and the trail is associated with early trail development and recreation at the park. The aspect of feeling is not present. A more detailed description of the trail's significance is provided in the Class III Archeological Survey Report for the project (Briggs and Chance 2016).

## Environmental Consequences

### *Direct and Indirect Impacts*

#### Impacts of Alternative A—No Action

Under the no action alternative, erosion from gullying and foot traffic would continue to occur along the trail (0.48 acre) resulting in an adverse effect. Incipient erosion would continue to compromise the physical integrity of the trail and would continue to diminish the trail's ability to convey historical significance. The no action alternative would lead to long-term adverse effects from accelerated erosion and may exclude the trail from NRHP eligibility. There would be no impacts on trail features that contribute to the structure's significance under the no action alternative.

#### Impacts of Alternative B—Close the Trail (Proposed Action and Preferred Alternative)

Under Alternative B, obliterating and revegetating the existing trail would result in a direct adverse effect from the irretrievable loss of the historic structure and would exclude the trail from NRHP eligibility. Alternative B would require mitigating the adverse effect by implementing a treatment plan in consultation between the NPS and SHPO. The likely treatment would be a Historic American Engineering Record. A draft MOA between the NPS and SHPO has been prepared, which includes measures to address and mitigate adverse effects (Appendix A).

#### Impacts of Alternative C—Reconstruct Trail within Existing Alignment

Reconstructing the trail within its historical alignment would have a beneficial effect on the trail by reducing erosion and contributing to the long-term preservation of the trail's historical integrity. Reconstructing the trail would mitigate ongoing adverse effects from erosion discussed under the no action alternative. Alternative C would preserve the historic character of the trail by maintaining the historical alignment and using compatible materials, workmanship, and design. Preservation of the trail would not affect its NRHP eligibility.

**Impacts of Alternative D—Reroute Trail on More Sustainable Alignment**

Under Alternative D, the effect of the trail reroute on the existing trail would be the same as under Alternative B. Obliterating and revegetating the existing trail would result in a permanent adverse effect on the existing historic structure. Obliterating the trail would irretrievably alter the historical integrity of the trail and would constitute a long-term adverse effect.

*Cumulative Impacts*

No past, present, or reasonably foreseeable future actions were identified that would result in measurable impacts on historic structures. Bighorn monitoring could result in minimal and localized ground disturbance and erosion; however, these effects would not be measurable. Updating the park's Backcountry/Wilderness Management Plan would not affect historic structures. Because there would be no impacts from past, present, and reasonably foreseeable future actions, there would be no cumulative effects under any of the alternatives.

# Archeological Resources

## Affected Environment

The analysis area for archeological resources includes a 100-foot-wide corridor surrounding Crater Trail and a proposed trail reroute alignment. A cultural resource survey was conducted of the area of potential effect (APE) in August 2016 to identify archeological resources (Briggs and Chance 2016). Archeological resources may consist of objects or sites and can include districts, cultural landscapes, and traditional cultural properties. The National Register of Historic Places (National Register) further defines an archeological site as "the place or places where the remnants of a past culture survive in a physical context that allows for the interpretation of these remains" (Little et al. 2000). The NPS has established an age criteria guideline of 50 years for a cultural resource to qualify for evaluation as a potential historic property. Historic properties are sites listed on, or eligible for listing on, the National Register.

The park straddles the Continental Divide and forms the headwaters of the Colorado River on the west, and major tributaries of the South Platte River (including the Big Thompson and Cache la Poudre Rivers) on the east. Despite its generally rugged appearance, the park provides some very accessible and direct travel routes over the mountains. Forest Canyon, Chapin, Sprague, Fall River, Mummy, and Boulder-Grand Passes, and the expanse of Bighorn Flats, provide access to the alpine environment and the resource-rich North and Middle Parks on the west side of the Continental Divide. As such, the park's culture-history is complex and requires an examination of archeological data from elsewhere along and on both sides of the Continental Divide.

The culture-history of both the South Platte and Northern Colorado River basins (Gilmore et al. 1999; Reed and Metcalf 1999) provide an archeological context for the park; however, the chronology of the South Platte River basin will be emphasized here because site types and prehistoric materials are more similar to the South Platte River basin culture-history. The chronology includes the Paleoindian Era (13400 to 7500 B.P.); the Archaic Era (ca. 8400 to 2000 B.P.); the Late Prehistoric Stage (1850 to 400 B.P., A.D. 150 to 1540); and the Protohistoric Stage (400 to 100 B.P., A.D. 1540 to 1860). A more detailed cultural-historical overview for the park is provided in the Class III Archeological Survey Report for the project (Briggs and Chance 2016).

Seven archeological resources were recorded or rerecorded during the survey. These resources include one open camp (5LR91); three open lithic scatters (5LR14058, 5LR14060, and 5LR14061); one open camp/open architectural site (5LR14059); and two isolated finds (5LR14062 and 5LR14063).

- Site 5LR91 is an open camp of unknown prehistoric affiliation that was recorded along the existing Specimen Mountain Trail (Crater Trail), which bisects the site. Although trail development and continued erosion of the trail have adversely affected the site, the remaining portion of the site is in good condition and may contain significant buried cultural deposits. The site is a historic property because it may provide information significant to interpreting the prehistoric occupation of the park.

- Site 5LR14058 is an open lithic scatter occupied during the Late Archaic Period (3000 to1800 B.P.) located along the trail reroute option corridor. The site is in good condition and may contain significant buried cultural deposits. The site is a historic property because it may provide information significant to interpreting the Late Archaic occupation of the park.

- Site 5LR14059 is an open camp/open archeological site occupied during the Middle Archaic Period (5000 to 3000 B.P.) located along the trail reroute corridor. The site is in good condition and may contain significant buried cultural deposits. The site is a historic property because it may provide information significant to interpreting the Middle Archaic occupation of the park.

- Sites 5LR14060 and 5LR14061 are open lithic scatters with unknown prehistoric cultural affiliation that are located along the trail reroute corridor. Besides minimal erosion, these sites are in good condition and may contain significant buried cultural deposits. The sites are historic properties because they may provide information significant to interpreting the prehistoric occupation of the park.

- Sites 5LR14062 and 5LR14063 are prehistoric isolated finds consisting of small lithic scatters; 5LR14062 was recorded along the reroute alignment and 5LR14063 was recorded within both the reroute and the Specimen Mountain Trail (Crater Trail) corridors. As isolated finds, these two archeological resources do not qualify as potential historic properties.

The significance of the five historic properties in the analysis area (5LR91, 5LR14058, 5LR14059, 5LR14060, and 5LR14061) is based on a high potential to contain important information in buried cultural deposits. This information may contribute to the understanding

of the prehistoric occupation of the park. At site 5LR91, buried cultural deposits have been impacted by the eroded existing trail, but the artifact assemblage combined with a substantial amount of accumulated windblown sediment suggest that other areas of the site have a high potential to contain significant buried cultural deposits. The remaining four historic properties (5LR14058, 5LR14059, 5LR14060, and 5LR14061) are in good condition, contain diverse artifact assemblages and abundant windblown sediments, and have a high potential for significant buried cultural deposits. A more detailed description of the significance of these five historic properties is provided in the Class III Archeological Survey Report for the project (Briggs and Chance 2016).

## Environmental Consequences

### *Direct and Indirect Effects*

#### Impacts of Alternative A—No Action

Under the no action alternative, erosion from gullying and continued foot traffic would continue to occur along the trail and through site 5LR91, resulting in an adverse effect on this historic property. Continuing erosion would impact 0.17 acre of the site along the trail, adversely affecting the integrity of buried cultural deposits. Overall, Alternative A would result in long-term adverse effects on site 5LR91, but would not significantly compromise the site's eligibility for listing on the NRHP because the area of the site affected by erosion would be small in relation to the total site area of 2.92 acres. There would be no effects from Alternative A on the remaining historic properties in the analysis area (5LR14058, 5LR14059, 5LR14060, and 5LR14061).

#### Impacts of Alternative B—Close the Trail (Proposed Action and Preferred Alternative)

Under Alternative B, ground disturbance from obliterating and revegetating the existing trail would result in an adverse effect on site 5LR91. Continuing trail erosion has exposed buried cultural deposits, and using hand tools and imported fill to obliterate the trail may further impact significant cultural deposits. However, trail obliteration and revegetation would not significantly compromise the site's eligibility for listing on the NRHP because the area of the site affected (0.17 acre) would be small in relation to the total site area (2.92 acres), about 6% of the total site area. Although the majority of the site would not be directly affected, Alternative B would result in permanent adverse effects on this historic property. Furthermore, trail obliteration and revegetation could introduce impacts such as trampling on site 5LR91outside of the existing trail. Placing a geotextile fabric within the existing trail tread and adjacent areas prior to the fill, as described under *Resource Protection Measures*, would help protect the current condition of the site and help mitigate adverse effects from erosion discussed under the no action alternative. A draft MOA has been developed between NPS and the SHPO to address and mitigate adverse impacts on cultural resources (Appendix A). There would be no effects from Alternative B on the remaining historic properties in the analysis area (5LR14058, 5LR14059, 5LR14060, and 5LR14061).

#### Impacts of Alternative C—Reconstruct Trail within Existing Alignment

Effects under Alternative C would be the same as Alternative B because ground disturbance from reconstructing the trail would result in an adverse effect on site 5LR91. The site would continue to be eligible for listing on the NRHP because the area of the site affected (0.17 acre)

would be small in relation to the total site area (2.92 acres), about 6% of the total site area. Mitigation measures to limit or reduce the adverse effect would be the same as Alternative B.

**Impacts of Alternative D—Reroute Trail on More Sustainable Alignment**

Rerouting the trail would involve ground-disturbing activities from the use of hand tools and possibly other mechanical equipment that would directly impact four historic properties (5LR14058, 5LR14059, 5LR14060, and 5LR14061). The ground disturbance required to construct the rerouted trail would directly affect buried archeological deposits, but the area of direct effect would be minimal compared with the overall site area. The area of direct effect is based on a 4- to 6-foot-wide corridor needed to reroute and construct the trail. Effects would include:

- About 0.006 acre of impacts at 5LR14058 (0.14 acre), resulting in 4% of the site being directly affected;
- About 0.045 acre of impacts at 5LR14059 (1.034 acres), resulting in 4% of the site being directly affected;
- About 0.003 acre of impacts at 5LR14060 (0.044 acre), resulting in 7% of the site being directly affected; and
- About 0.0005 acre of impacts at 5LR14061 (0.28 acre), resulting in 0.2% of the site being directly affected.

Under Alternative D, sites 5LR14058, 5LR14059, 5LR14060, and 5LR14061would continue to be eligible for listing on the NRHP because the area of direct effect would be minimal compared with the overall size of each site. In addition, use of the trail by visitors after trail completion may lead to illegal collection of cultural material at the four sites. Establishing a trail reroute also would require the obliteration and revegetation of the existing trail that bisects a historic property (5LR91) and would result in similar impacts as discussed under Alternatives B and C. Overall, constructing a trail reroute would either directly or indirectly compromise the physical integrity at all five historic properties in the analysis area, resulting in adverse effects on the five sites.

***Cumulative Impacts***

No past, present, or reasonably foreseeable future actions were identified that would result in measurable impacts on archeological resources. Bighorn monitoring could result in minimal and localized ground disturbance and erosion; however, these effects would not be measurable. Updating the park's Backcountry/Wilderness Management Plan would not affect archeological resources. Because there would be no impacts from past, present, and reasonably foreseeable future actions, there would be no cumulative effects under any of the alternatives.

# Research Natural Areas

## Affected Environment

RNAs contain prime examples of natural resources and processes and are part of a worldwide system of natural areas for scientific and educational purposes that has been established by the International Biological Program (NPS 2006b). The objectives for management in RNAs are: to

assist in the preservation of examples of natural ecosystems for comparison with those influenced by man; to provide educational and research areas for scientists to study the ecology, successional trends, and other aspects of the natural environment not disturbed by man; and to serve as a gene pool and preserve for native species of plants and animals and endangered or rare species. RNAs are managed to protect ecosystem integrity and are intended to be preserved as baselines, against which human-caused changes elsewhere can be measured. Activities in RNAs are restricted to nonmanipulative research, education, and other activities that will not detract from the area's research values. These specially designated areas are integral parts of the park's designation as an International Biosphere Reserve (NPS 2013a). Only foot traffic is allowed in the RNAs in the park. Stock use, aircraft use, and overnight camping are not allowed, except in an emergency or if specifically approved by the Superintendent (NPS 2001, 2010).

The analysis area for RNAs is the Specimen Mountain RNA, which includes Specimen and Shipler Mountains above 10,800 feet in elevation, and the Willow Creek drainage at the northwest boundary of the park at about 9,880 feet in elevation, an area of about 9,056 acres (NPS 1973; Figure 9). All but about the first 300 feet of Crater Trail from the parking area is within the RNA. The Specimen Mountain RNA is one of three RNAs designated in the park (in addition to the Paradise Park and West Creek RNAs) in 1976 with the completion of the park's Master Plan (NPS 1973, 1976). The Specimen Mountain RNA includes the Crater, an area of special geological interest due to relatively recent volcanic activity. The Specimen Mountain RNA is also important wildlife habitat, and visitor use in the RNA is prohibited at certain times of the year to reduce visitor disturbance to bighorns as described in the *Wildlife* section.

The park does not allow extensive research in the RNA unless it cannot be reasonably accomplished elsewhere, and park management reviews all research proposals. Ongoing research in the Specimen Mountain RNA consists mainly of bighorn monitoring in the Crater and Specimen Mountain areas conducted by a volunteer under the supervision of park staff. The Colorado Natural Areas Program sends a volunteer into the RNA once each year to document its condition. Other recent research includes archeological research, which was conducted in the RNA in 2014.

The presence of the Crater Trail in the RNA is contrary to two of the management objectives of the RNA: to preserve examples of natural ecosystems for comparison with those influenced by man; and to provide educational and research areas for scientists to study the ecology, successional trends, and other aspects of the natural environment not disturbed by man. The trail allows easy access to the Crater area, allowing human intrusion and resulting impacts on vegetation and wildlife, as described above under the *Vegetation and Soils* and *Bighorn Sheep* impact topics. Because a portion of the RNA is easily accessible to visitors via the Crater Trail, the value of the RNA to serve as an example of an undisturbed ecosystem and research area is diminished.

Although the trail is not compatible with the purposes of the RNA, the long history of visitor use of the Crater overlook resulted in the Crater Trail remaining open while the rest of the original Specimen Mountain Trail was closed to public access. In addition, the trail was used to provide access for bighorn sheep monitoring. Although trails are generally not allowed within RNAs, the park's Backcountry/Wilderness Management Plan makes a specific exception for the Crater Trail (NPS 2001).

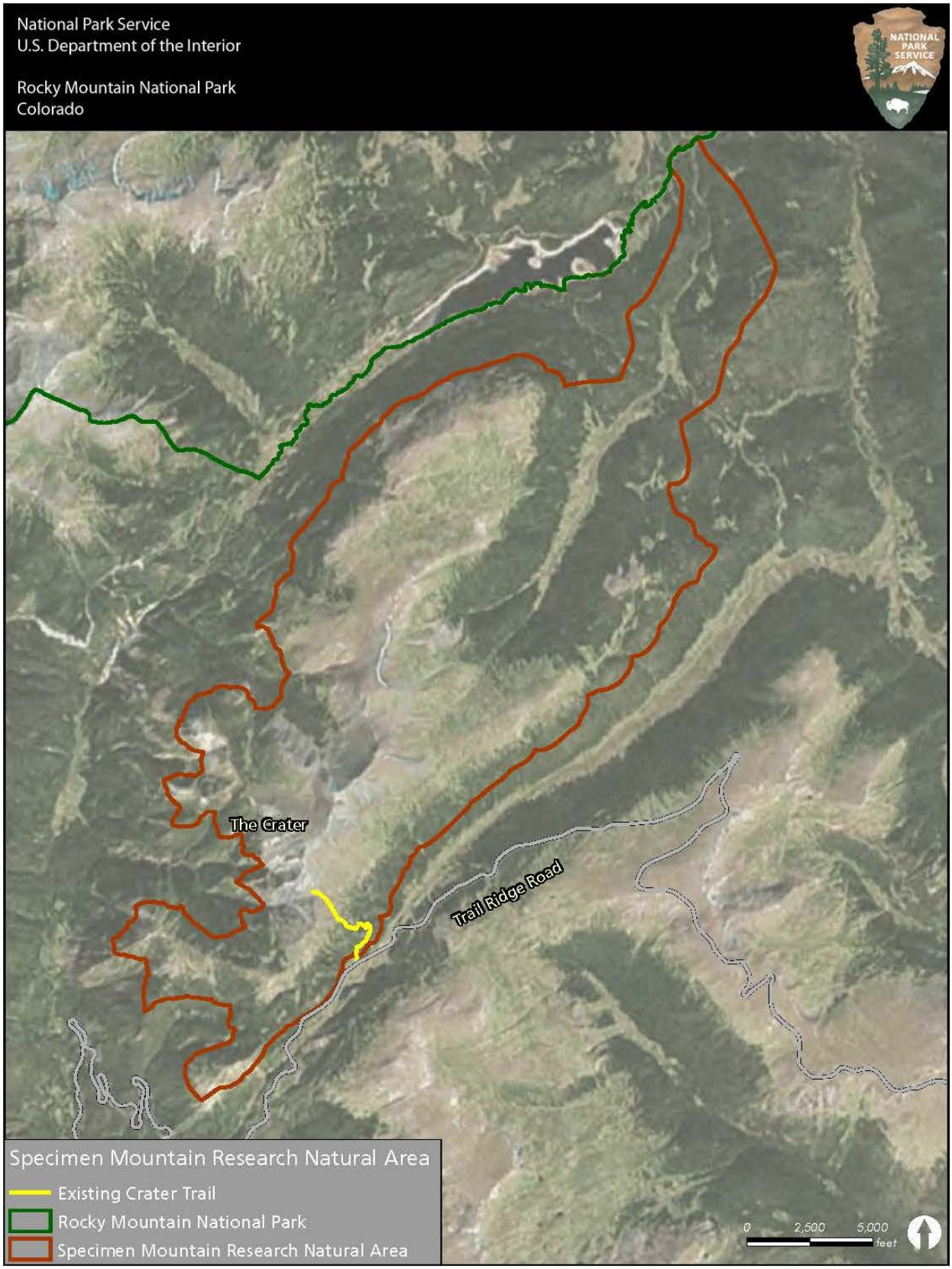


**Figure 9. Specimen Mountain Research Natural Area.**

## Environmental Consequences

### *Direct and Indirect Impacts*

#### Impacts of Alternative A—No Action

Under the no action alternative, the Crater Trail would continue to be used to access a portion of the Specimen Mountain RNA. Because a portion of the RNA would continue to be easily accessible to visitors via the Crater Trail, the value of the RNA as an example of an undisturbed ecosystem and research area would continue to be diminished. Ongoing effects on the resources protected by the RNA would continue, such as impacts on alpine tundra from erosion and creation of social trails and displacement and increased stress to bighorn sheep resulting from visitors hiking on the trail and off-trail. Impacts on vegetation and bighorn sheep under the no action alternative are described in detail in the *Vegetation and Soils* and *Bighorn Sheep* sections. These impacts would occur mostly during the period from August 15 through the fall, when the trail would be open to the public. The Crater Trail is the only trail open to the public within any of the three RNAs in the park. Allowing use of the trail to continue is incompatible with the purpose of a RNA and would result in an overall adverse effect on the RNA.

#### Impacts of Alternative B—Close the Trail (Proposed Action and Preferred Alternative)

Closing the trail would benefit resources protected by the RNA, including wildlife that are displaced by visitors using the trail. Because the Crater and nearby areas such as Shipler Mountain would no longer be easily accessible to visitors via the Crater Trail, the value of the RNA to serve as an example of an undisturbed ecosystem and research area would be enhanced. Ongoing effects on the resources protected by the RNA, such as impacts on alpine tundra from erosion and creation of social trails and displacement and increased stress to bighorn sheep resulting from visitors hiking on the trail and off-trail, would be reduced or eliminated. These benefits would extend year-round and would last indefinitely.

Abandoning and restoring the trail would reestablish 0.48 acre of vegetation and wildlife habitat, which would benefit the RNA by reducing the evidence of human influence and improving the value of the RNA to serve as an example of an undisturbed ecosystem and research area. The alpine tundra and subalpine forest would likely take decades to recover to a condition where no human disturbance is evident; therefore, the beneficial effects of restoring the trail would occur gradually over many years. The presence of trail crews and potential use of a helicopter to import materials would be an intrusion into the RNA, which is incompatible with the purpose of the RNA, but these disturbances would be temporary, lasting only 3 to 4 months per year for 2 or 3 years.

Once restoration work on the trail is complete, the objectives of the RNA to serve as a baseline or reference area with limited human impacts would be improved. The presence of the trail is inconsistent with the purposes of a RNA, and removing the trail would provide a substantial benefit to the RNA by permanently removing this inconsistency.

#### Impacts of Alternative C—Reconstruct Trail within Existing Alignment

Reconstructing the trail within the existing alignment would allow current impacts on the RNA from the trail to continue. A portion of the RNA would continue to be easily accessible to visitors via the Crater Trail, which would diminish the value of the RNA to serve as an example of an undisturbed ecosystem and research area, as described under the no action alternative.

Ongoing impacts on alpine tundra from erosion, creation of social trails, and displacement and increased stress to bighorn sheep resulting from visitors hiking on the trail and off-trail would continue as described in detail in the *Vegetation and Soils* and *Bighorn Sheep* sections. These impacts would occur mostly during the period from August 15 through the fall, when the trail would be open to the public.

Trail reconstruction would remove about 400 square feet of alpine and subalpine vegetation and result in some trampling of vegetation, as described in the *Vegetation and Soils* section. Vegetation would be expected to recover within 1 to 2 years. This disturbance would be repeated about every 10 to 20 years when the treated log erosion-control structures reach the end of their life cycle and require replacement. These impacts would not affect the management objective of the RNA. The presence of trail crews and use of a helicopter to import materials would be an intrusion into the RNA, which is incompatible with the purpose of the RNA. Disturbances resulting from the presence of trail crews would be temporary, lasting only 4 to 5 months per year for 2 or 3 years and would end once reconstruction of the trail is complete.

Impacts on the RNA under Alternative C once construction is complete would be small and adverse and would be the same as under the no action alternative. As previously described, the Crater Trail is the only trail open to the public within any of the three RNAs in the park. Allowing use of the trail to continue is incompatible with the purpose of a RNA, and would result in an overall adverse effect on the RNA.

**Impacts of Alternative D—Reroute Trail on More Sustainable Alignment**

Rerouting the trail would allow the current impacts on the RNA from trail use to continue because a portion of the RNA would continue to be easily accessible to visitors via the Crater Trail. Continued use of the trail would diminish the value of the RNA to serve as an example of an undisturbed ecosystem and research area, as described under the no action alternative. Ongoing impacts on alpine tundra from erosion, creation of social trails, and displacement and increased stress to bighorn sheep resulting from visitors hiking on the trail and off-trail would continue as described in the *Vegetation and Soils* and *Bighorn Sheep* sections. These impacts would occur mostly during the period from August 15 through the fall, when the trail would be open to the public.

Rerouting the trail would result in a net loss of 0.24 acre of vegetation and wildlife habitat. This would be an adverse effect on the RNA, which is intended to protect vegetation and wildlife in an undisturbed state. The presence of trail crews and use of a helicopter to import materials would be an intrusion into the RNA, which is incompatible with the purpose of the RNA. Disturbances resulting from presence of trail crews would be temporary, lasting only 4 to 5 months per year for 3 to 5 years and would end once reconstruction of the trail is complete.

As previously described for the no action alternative, impacts on the RNA under Alternative D once construction is complete would be small and adverse. Although the Backcountry/Wilderness Management Plan makes an exception for the Crater Trail, the presence of a trail is generally inconsistent with the purposes of a RNA. Allowing continued access to the trail and increasing its length by 0.5 mile would exacerbate this inconsistency by allowing continued use of the only trail open to the public within any of the three RNAs in the park and increasing the length of the trail.

### *Cumulative Impacts*

#### Alternative A—No Action

Past, present, and reasonably foreseeable future actions that have impacted, or would impact, the Specimen Mountain RNA would primarily result from bighorn monitoring. Bighorn monitoring would have both adverse and beneficial effects from human presence to collect bighorn data and from improved management of bighorn populations in the Crater area. These actions would continue to have beneficial effects on the RNA. As previously described in this EA, the no action alternative would result in adverse effects on the RNA from ongoing effects on resources such as vegetation and bighorn sheep and from continued visitor access, which is not compatible with the purposes of a RNA. When the effects of the no action alternative are combined with the effects of other past, present, and reasonably foreseeable future actions, the total cumulative impact on the RNA would continue to be small and adverse. The incremental impacts of the no action alternative would contribute small adverse effects, but would not substantially change the impacts that are already occurring.

#### Alternative B—Close the Trail (Proposed Action and Preferred Alternative)

As described above for the no action alternative, past, present, and reasonably foreseeable future actions have had, and would continue to have, beneficial effects on the RNA. As previously described in this EA, the beneficial effects of Alternative B on the RNA would result from restoring 0.48 acre of vegetation and reduced human presence after the trail is closed. When the effects of Alternative B are combined with the effects of other past, present, and reasonably foreseeable future actions, the total cumulative impact on RNAs would continue to be small and beneficial. The incremental impacts of Alternative B would contribute to, but would not substantially change, the impacts that are already occurring.

#### Alternative C—Reconstruct Trail within Existing Alignment

As described above for the no action alternative, past, present, and reasonably foreseeable future actions have had, and would continue to have, beneficial effects on the RNA. As previously described in this EA, Alternative C would result in adverse effects on the Specimen Mountain RNA from continuing impacts on vegetation and bighorn sheep and from continued visitor access, which is not compatible with the purposes of a RNA. When the effects of Alternative C are combined with the effects of other past, present, and reasonably foreseeable future actions, the total cumulative impact on the RNA would continue to be small and adverse, with a small adverse contribution from Alternative C.

#### Alternative D—Reroute Trail on More Sustainable Alignment

As described above for the no action alternative, past, present, and reasonably foreseeable future actions have had, and would continue to have, beneficial effects on the RNA. As previously described in this EA, Alternative D would result in adverse effects on the Specimen Mountain RNA from the net loss of 0.24 acre of vegetation and bighorn sheep habitat and from continued visitor access, which is not compatible with the purposes of a RNA, and continuing displacement of bighorn sheep by visitors using the trail. When the effects of Alternative D are combined with the effects of other past, present, and reasonably foreseeable future actions, the total cumulative impact on RNAs would continue to be small and adverse, with a small adverse contribution from Alternative D.

# Wilderness

## Affected Environment

In 2009, Congress designated the Rocky Mountain National Park Wilderness. The Wilderness Act (16 USC 1131-1136) directs the NPS to protect and manage wilderness so that it "generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable," and so that it "has outstanding opportunities for solitude, or a primitive and unconfined type of recreation." The Wilderness Act (16 USC 1133(b)) directs that "each agency administering any area designated as wilderness shall be responsible for preserving [its] wilderness character." The five qualities of wilderness character are (1) untrammeled, (2) undeveloped, (3) natural, (4) offers outstanding opportunities for solitude or primitive and unconfined recreation, and (5) other features of scientific, educational, scenic, or historical value.

The analysis area for wilderness is the portion of the trail and surrounding areas located within designated wilderness within 1 mile of the trail. The entire Crater Trail is within designated wilderness, with the exception of the first few hundred feet of the trail. The wilderness boundary is 200 feet from the centerline of Trail Ridge Road (Figure 10).

One of the stated purposes of Rocky Mountain National Park is to preserve the high-elevation ecosystems and wilderness character of the southern Rocky Mountains within its borders. Maintaining wilderness values is key to many visitors' experiences and to park management. In addition to the natural features of the wilderness, such as animals, plants, waters, and geologic features, the park contains intangible qualities of wilderness such as natural quiet, solitude, space, light, night sky, and scenery. Both tangible and intangible resources are equally important in wilderness management decisions affecting park resources. The wilderness areas are free of most man-made noises from machinery and motor vehicles and light pollution in the night sky. Activities causing excessive or unnecessary unnatural sounds in and adjacent to the park are monitored, and actions are taken to prevent or minimize unnatural sounds that adversely affect park resources or values or visitors' enjoyment of them (NPS 1994).

The Backcountry/Wilderness Management Plan for Rocky Mountain National Park (NPS 2001) defines wilderness management policies and actions at the park. The plan identifies the park's wilderness vision, long-range management goals, intermediate objectives, and actions and options to meet those objectives. The Backcountry/Wilderness Management Plan is also used as a working guide for staff who manage the wilderness resource. The Crater Trail is within Management Class 1 as designated by the Backcountry/Wilderness Management Plan. Characteristics and desired conditions of areas designated as Management Class 1 include: low use, day use only, no overnight camping, small group size, and no stock use. Access is generally moderate to difficult, and challenge and self-reliance are the goals of the visitor. Opportunities for solitude are outstanding and the chance of seeing other visitors or park staff is low. Areas within Management Class 1 are managed to have little evidence of recent impacts by humans, including management actions. Management Class 1 areas should have no designated or maintained trails, signs, or cairns, no discernable routes, and no facilities. Although the Backcountry/Wilderness Management Plan states that trails should not be present in Management Class 1, the plan contains a specific exception for the Crater Trail (NPS 2001).

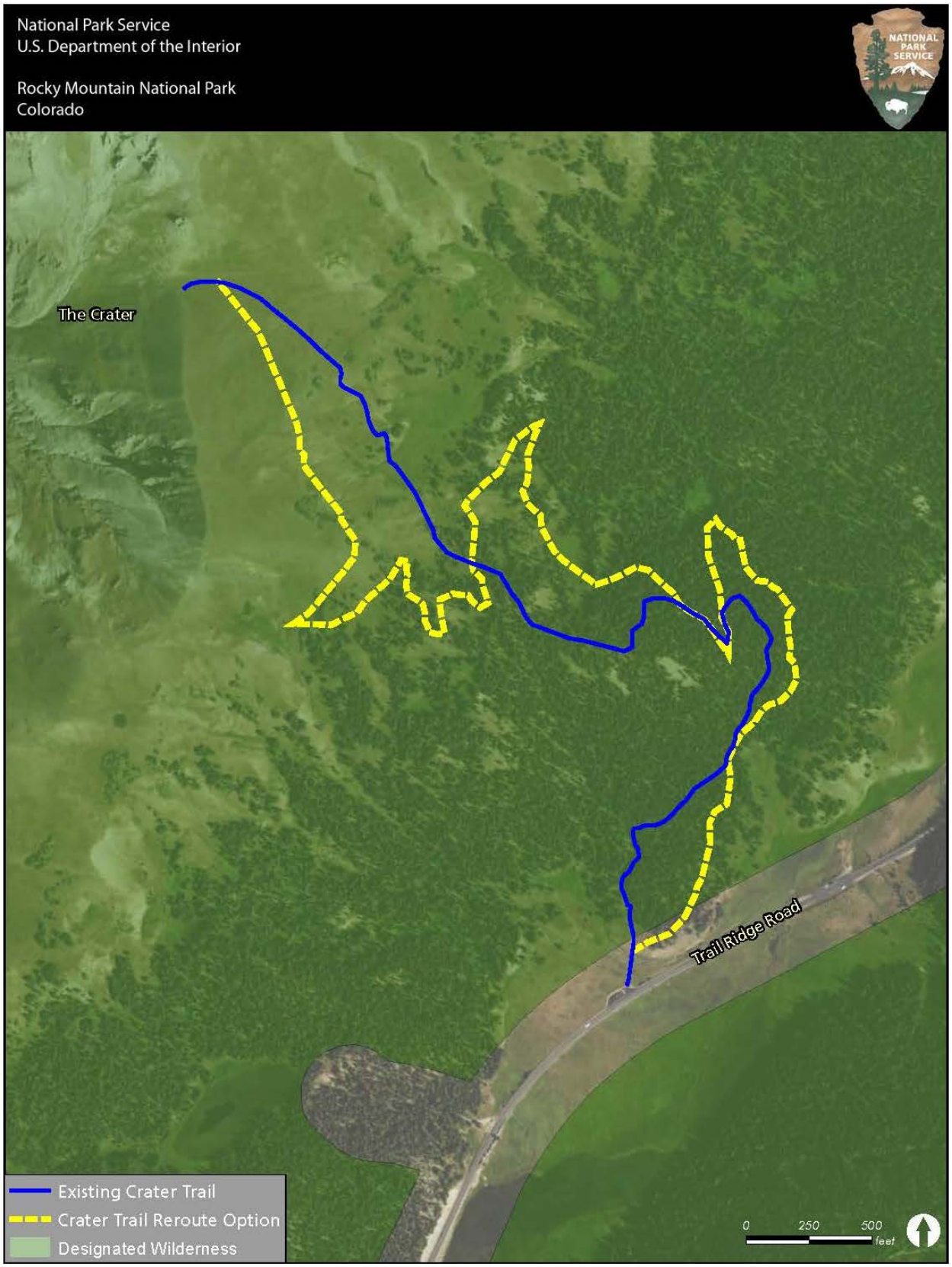


**Figure 10. Park wilderness boundary.**

## Environmental Consequences

### *Direct and Indirect Impacts*

#### Impacts of Alternative A—No Action

Under the no action alternative, continued use of the Crater Trail may result in additional damage, resulting in impacts on wilderness qualities, as described below.

The *untrammeled* and *undeveloped* qualities would be preserved with no change. No active management that would affect these qualities is proposed under this alternative. The area adjacent to the trail is undeveloped and would not change. The *natural* quality would be potentially adversely affected under this alternative. Poor water drainage from the current trail alignment would continue to result in accelerated erosion of the trail tread. In addition, visitors would likely continue to create social trails because of poor trail conditions, resulting in vegetation trampling, as described under *Vegetation and Soils*. These impacts would be mostly confined to a few steep eroded spots above tree line. The *opportunities for solitude and primitive and unconfined recreation* quality would be preserved unchanged under this alternative. The *other features of value* (cultural resources and research and education) could be adversely affected under the no action alternative. The existing trail passes through an archeological site, which could be adversely affected by continuing use of the trail, as described under *Archeological Resources*.

The no action alternative would cause the wilderness qualities of *natural* and *other features of value* to be permanently degraded. Erosion and resulting loss of soil, damage to vegetation, and ongoing impacts on cultural resources would affect these qualities of wilderness in perpetuity. Other aspects of wilderness quality would remain unchanged.

#### Impacts of Alternative B—Close the Trail (Proposed Action and Preferred Alternative)

Closing the trail would require work in wilderness that would be primarily conducted with hand tools. Potential effects on wilderness quality are described below.

The *untrammeled* quality would be temporarily degraded during construction of the trail. Unnatural sounds during trail closure and revegetation work would generally be low, and disturbance would be mostly contained to the narrow trail corridor. Exceptions include potential use of mechanized equipment, such as chainsaws, and use of a helicopter for material delivery. Use of a helicopter to import fill material would result in a temporary increase in noise that would affect the untrammeled quality of wilderness. Once construction is complete, the untrammeled quality of the wilderness would be preserved with no change following removal of the trail.

Removing the trail would benefit the *undeveloped* and *natural* qualities of wilderness. The human-made trail would be removed from the landscape and about 0.48 acre of vegetation would be restored by removing the existing trail tread and revegetating it with native vegetation. Areas that were previously damaged would be rehabilitated through erosion control, and erosion occurring in the trail tread would be reduced or eliminated. Removing public access would help protect alpine tundra from additional impacts from hikers creating social trails. As previously described, one of the purposes of the park is the preservation of high-altitude

ecosystems such as alpine tundra. Although the restored area of alpine tundra would be small, this benefit would be important because alpine tundra encompasses one-third of the park, one of the largest examples of alpine tundra ecosystems protected in the contiguous United States, and is important to the purpose of the park.

*Opportunities for solitude and primitive and unconfined recreation* would be permanently degraded under this alternative. The wilderness would continue to provide opportunities for primitive recreation, but permanently closing the trail would reduce opportunities for hiking in the wilderness. Although opportunities for hiking would be reduced, closing the trail is consistent with the intent of the park's Backcountry/Wilderness Management Plan (NPS 2001), which classifies the Crater Trail as within Management Class 1, which generally does not include trails, has little evidence of impacts by humans, and is generally moderate to difficult to access.

The *other features of value* (cultural resources and research and education) could be affected by closing and rehabilitating the trail. Archeological resources would be protected by reducing ongoing erosion, which is affecting an archeological site. Removing the trail would permanently degrade the wilderness quality of other *features of value* by obliterating the trail, as described under *Historic Structures*. Although removing the trail would be an adverse effect on cultural resources, the overall effect on this wilderness quality would be beneficial by protecting archeological resources from future degradation.

**Impacts of Alternative C—Reconstruct Trail within Existing Alignment**

Reconstructing the trail would require work in wilderness using primarily hand tools. Similar to Alternative B, increased unnatural sounds during trail reconstruction work would generally be low and disturbance would be mostly contained to the narrow trail corridor. Potential effects on wilderness quality are described below.

The *untrammeled* quality would be preserved with no change following completion of trail reconstruction. Unnatural sounds during trail reconstruction work would generally be low, and disturbance would be mostly contained to the narrow trail corridor with the exception of potential use of mechanized equipment, such as chainsaws, and use of a helicopter for material delivery. Elevated noise levels from the use of mechanized equipment would occur during construction over a 6- to 8-week period each year over 2 to 3 years. Use of a helicopter to import fill material would result in a temporary increase in noise that would affect the untrammeled quality of wilderness for about 3 hours per day over a period of about 7 days. This disturbance would be repeated about every 10 to 20 years when the treated log erosion-control structures reach the end of their life cycle and require replacement.

Reconstructing the trail would have negligible effects on the wilderness quality of *undeveloped* from the construction of erosion-control structures. This impact would last indefinitely.

Reconstructing the trail would improve the wilderness quality of *natural* by reducing the creation and use of social trails and consolidating use within the trail corridor. Reducing social trails would benefit the natural quality of wilderness by reducing vegetation trampling and soil erosion. This impact would likely last indefinitely, as long as the erosion-control structures are maintained and replaced by the park.

Opportunities for *solitude and primitive and unconfined recreation* are improved when trails are maintained to a level that ensures reasonable access. Alternative C would benefit opportunities for solitude and primitive and unconfined recreation by improving and restoring the trail, which provides access to wilderness. This impact would likely last indefinitely because the erosion-control structures would be replaced every 10 to 20 years. Providing access for hiking is consistent with the park's overall purpose to provide recreational access; however, the Crater Trail is within an area designated as Management Class 1 under the Backcountry/Wilderness Management Plan (NPS 2001), where trails are generally not present and access is generally moderate to difficult.

Reconstructing the trail could have negative effects on known and unknown archeological resources, as described in the *Archeological Resources* section, and thereby impact *other features of scientific, educational, scenic, or historical value*. Impacts on archeological resources would be permanent because these resources are not renewable.

**Impacts of Alternative D—Reroute Trail on More Sustainable Alignment**

As with Alternatives B and C, work within wilderness would be mostly accomplished using hand tools and would be limited to the existing trail corridor and the rerouted trail corridor. Impacts on wilderness qualities are described below.

The *untrammeled* quality would be unchanged following completion of trail reconstruction. Construction activities would introduce noise and additional human disturbance, which would adversely affect the untrammeled quality of the wilderness. Use of mechanized equipment, such as chainsaws, and use of a helicopter for material delivery would introduce unnatural sounds during trail reconstruction work. Impacts on the untrammeled quality would generally be low, and disturbance would be mostly contained to the narrow trail corridor. Elevated noise levels from the use of mechanized equipment would occur during construction over a 6- to 8-week period each year over 3 to 5 years. Use of a helicopter to import fill material would result in a temporary increase in noise that would affect the untrammeled quality of wilderness for about 3 hours per day over a period of about 10 days.

As described for Alternative C, rerouting the trail would have result in the following impacts to the undeveloped quality of wilderness through the construction of the following trail structures: approximately 100 linear feet of retention walls, one 25 to 30 - foot long, single or double stringer log footbridge, and a rock causeway through the wetlands. The construction of these features would also require the creation of a "borrow pit" area for the collection of stone related to these stone structures. Effects on the wilderness quality of undeveloped from the construction of erosion-control structures and possible construction of retention walls. This impact would last indefinitely.

Rerouting the trail to a more sustainable alignment would improve the wilderness quality of *natural* by reducing the creation and use of social trails and consolidating use within the trail corridor. Rerouting the trail to less steep grades and improving drainage would reduce the existing issues with erosion of the trail tread and adjacent areas. Native materials would be used to construct the trail reroute to protect the natural qualities of the wilderness character, wherever possible. Import of structural material may be needed at some locations. Rerouting the

trail would also result in adverse impacts on the wilderness quality of *natural* from permanent loss of undisturbed alpine tundra. Rerouting the trail would result in a permanent net loss of 0.12 acre of alpine vegetation and 0.12 acre of subalpine vegetation. Although the amount of alpine vegetation lost would be small, this would be an adverse effect on the wilderness quality of *natural* because of the park's purpose to protect alpine tundra.

Opportunities for solitude or primitive and unconfined recreation would be adversely affected during construction activities because the trail would be closed up to 3 to 4 months during construction each year over 3 to 5 years. As described previously, opportunities for *solitude and primitive and unconfined recreation* are improved when trails are maintained to a level that ensures reasonable access. After construction is complete, Alternative D would have beneficial effects on primitive recreation by improving the condition of the trail for hiking. As previously described under Alternative C, providing access for hiking is consistent with the park's overall purpose to provide recreational access, but is not consistent with Management Class 1 designation in the Backcountry/Wilderness Management Plan, where trails are generally not present and access is generally moderate to difficult (NPS 2001).

Rerouting the trail could have negative effects on known and unknown archeological resources, as described in the *Archeological Resources* section, and thereby impact *other features of scientific, educational, scenic, or historical value*. Impacts on archeological resources would result in permanent degradation of these resources because they are not renewable.

### *Cumulative Impacts*

#### Alternative A—No Action

Past, present, and reasonably foreseeable future actions that have impacted, or would impact, wilderness would mostly result from bighorn monitoring. As described previously, bighorn monitoring would have both adverse and beneficial effects from human presence to collect bighorn data and from improved management of bighorn populations in the Crater area. These actions would continue to have beneficial effects on wilderness. As previously described in this EA, the direct and indirect impacts of the no action alternative on wilderness would result from ongoing disturbance to the natural quality of the wilderness from erosion and trampling of vegetation and to other features of value from potential ongoing erosion damage to archeological resources. When the effects of the no action alternative are combined with the effects of other past, present, and reasonably foreseeable future actions, the total cumulative impact on wilderness would be small and adverse, with a small adverse contribution from the no action alternative.

#### Alternative B—Close the Trail (Proposed Action and Preferred Alternative)

As described under the no action alternative, past, present, and reasonably foreseeable future actions have had, and would continue to have, beneficial effects on wilderness. As previously described in this EA, the direct and indirect impacts of Alternative B on wilderness would include adverse effects on the untrammeled quality of the wilderness qualities during a 6- to 8-week period each year over 2 to 3 years. Closing the trail would result in beneficial effects on the wilderness qualities of undeveloped and natural, and adverse effects on opportunities for solitude and primitive and unconfined recreation after trail closure and revegetation is complete. Effects on other resources of value (cultural resources) would be both beneficial and

adverse. When the effects of Alternative B are combined with the effects of other past, present, and reasonably foreseeable future actions, the total cumulative impacts on wilderness would continue to be small and beneficial, with a beneficial contribution from Alternative B.

**Alternative C—Reconstruct Trail within Existing Alignment**

As described under the no action alternative, past, present, and reasonably foreseeable future actions have had, and would continue to have, beneficial effects on wilderness. As previously described in this EA, the direct and indirect impacts of Alternative C on wilderness would include adverse effects on wilderness qualities of untrammeled during a 6- to 8-week period over 2 to 3 years, beneficial effects on the wilderness qualities of natural and opportunities for solitude or primitive and unconfined recreation, and adverse effects on other features of scientific, educational, scenic, or historical value (cultural resources) after construction is complete. When the effects of Alternative C are combined with the effects of other past, present, and reasonably foreseeable future actions, the total cumulative impact on wilderness would continue to be small and adverse, with a relatively small adverse contribution from Alternative C.

**Alternative D—Reroute Trail on More Sustainable Alignment**

As described under the no action alternative, past, present, and reasonably foreseeable future actions have had, and would continue to have, beneficial effects on wilderness. As previously described in this EA, the direct and indirect impacts of Alternative D on wilderness would include adverse effects on wilderness qualities of untrammeled during a 6- to 8-week period each year over 3 to 5 years, adverse effects on the qualities of undeveloped and natural following construction from construction of erosion-control structures and removing 0.24 acre of vegetation to build the trail, and beneficial effects on opportunities for solitude or primitive and unconfined recreation after construction is complete. When the effects of Alternative D are combined with the effects of other past, present, and reasonably foreseeable future actions, the total cumulative impacts on wilderness would continue to be small and adverse, with a relatively small incremental contribution of both beneficial and adverse effects from Alternative D.

# Visitor Use and Experience

## Affected Environment

Although park visitation fluctuates from year to year, between 1994 and 2012, visitor numbers hovered around 3 million annually (NPS 2017). The park received more than 4,155,900 visitors in 2015, which was an attendance record and a 21% increase over 2014. The park set an attendance record again in 2016 with 4,526,335 visitors, an increase of more than 8% over 2015 (NPS 2017). Fall visitation, particularly on weekends, continues to increase at the park.

The analysis area for visitor use and experience is the Crater Trail area, including the trail, the parking area, the Crater, nearby portions of Specimen and Shipler Mountains, and nearby forested and alpine tundra areas potentially accessed from the trail. In 2016, more than 577,000 visitors entered through the Grand Lake entrance on the west side of the park, accounting for about 14% of park visitors.

The Crater Trail begins at a trailhead with a small parking area just east of Milner Pass and passes through subalpine forest, open meadows, and alpine tundra. The trail provides views of the Cache la Poudre River valley to the east, the Crater and the Never Summer Range to the west, and Specimen Mountain to the north. The trail also provides opportunities to view wildlife including deer, elk, moose, bighorn, and various species of birds and small mammals.

Bighorn are often visible at the Crater and in the surrounding area, and are one of the main draws for visitors hiking the trail. Visitors have been traveling to the Crater since before the park was established to view bighorn. As described in the *Bighorn Sheep* section, the park has taken steps over the years to limit public access due to concerns about impacts of visitors on bighorn sheep. In recent years, the Crater Trail and nearby areas, including Specimen and Shipler Mountains, have been closed to public access during the lambing season.

In 2012, an automated counter was set up at the Crater Trail trailhead and recorded an average of 30 visitors per day using the trail from the second half of August through September. This is substantially lower than the average number of visitors to the Crater per day from 1988 to 1998, which ranged from 60 to 130 (NPS 1998). Up to 3,000 visitors used the trail in 2012 (Pettebone 2016). Use of the trail is relatively low, compared with other trails in the park. For example, more than 64,000 visitors used the Wild Basin trailhead and more than 34,000 visitors used the Long's Peak trailhead in 2012, although use occurred over a longer period, from June through October (NPS 2012).

In recent years, the trail has been closed from May 1 to August 15 to protect bighorn during the lambing season; however, the closure has sometimes been extended longer depending on the duration of the bighorn lambing season. Because of its location at an elevation from 10,760 to 11,480 feet above sea level, the trail is often covered by snow from October to June or July. Because of snow conditions and the bighorn closure, most visitor use of the Crater Trail occurs from August 15 through October, with use falling off substantially as snow accumulation makes the trail more difficult to hike in the fall. For the past 3 years, the Crater Trail has been closed year-round due to severe trail erosion, pending the completion of the EA process.

## Environmental Consequences

### *Direct and Indirect Impacts*

#### Impacts of Alternative A—No Action

The no action alternative would allow continued visitor access to the trail with minimal improvements to the route. Existing hazards to visitors from severe erosion would continue. Additional erosion and trail degradation are likely if repairs are not made. Although the trail is in poor condition, foot traffic on the trail is likely to continue unchanged indefinitely at levels observed prior to the trail closure – about 3,000 visitors per year. Visitor use is unlikely to increase substantially in the future due to limited parking at the trailhead.

#### Impacts of Alternative B—Close the Trail (Proposed Action and Preferred Alternative)

The existing damaged trail would be restored, revegetated, and closed to visitor access. Opportunities to visit the Crater and view the bighorn herd and other wildlife in the area would be curtailed due to the trail closure. Alternative B also could have an adverse impact on visitor

use by creating higher use on other trails in the park. Visitor use would only be affected during a relatively brief portion of the hiking season in the park because most visitors hike the trail during the 6- to 8-week period from the end of the bighorn lambing season in mid-August until snowfall makes traveling the higher elevation areas of the trail impractical in October. Closing the trail would permanently eliminate public access to about 1 mile of trail of the 355 miles of trail that make up the park's trail system. Prior to the current 3-year closure, the Crater Trail was traveled by about 3,000 hikers per year, which is a relatively small number considering the much higher use of many other trails in the park. Visitors displaced from the Crater Trail would likely choose to hike on other trails in the park instead, resulting in increased use of about 3,000 visitors per year on other trails in the park.

Providing access to wild places is an important purpose of the park, and loss of access to the Crater and surrounding areas would permanently affect the visitor experience. However, the park's mission also includes preservation of high-elevation ecosystems and wilderness character, and these resources would benefit from closing the trail, as described in the *Vegetation and Soils* and *Wilderness* sections.

**Impacts of Alternative C—Reconstruct Trail within Existing Alignment**

Trail reconstruction would require full or partial trail closures during construction. Continuation of the existing trail closure during reconstruction would have adverse impacts on hikers by reducing access to the Crater area, and possibly increasing crowding on other trails, and would likely result in higher use on other trails in the park. Trail repairs and construction would require closure of trail sections for several weeks, particularly when the trail is being stabilized in place. Visitor use of the trail would be reduced for an additional to 2 to 3 years while repairs are implemented. Trail closures would occur during the 6- to 8-week time frame from the end of bighorn lambing in mid-August through October, which is also the time when most visitors hike the trail. The park would advertise any trail closures in advance. This disturbance would be repeated about every 10 to 20 years when the treated log erosion-control structures reach the end of their life cycle and require replacement.

After trail reconstruction is complete, the trail surface would be improved and stabilized, resulting in a safer and more enjoyable experience for visitors. Although the visitor experience would be improved, visitor use is unlikely to increase because of limited parking at the trailhead. Overall, trail reconstruction would have a beneficial effect over the life of the trail from trail improvements that restore the condition of the trail and increase visitor safety and enjoyment.

**Impacts of Alternative D—Reroute Trail on More Sustainable Alignment**

Rerouting the trail would require full closure during construction of the new trail alignment. As with Alternative C, trail closures would occur during the 6- to 8-week period from mid-August through October when most visitors hike the trail, adversely affecting visitor use of the trail for up to 3 to 5 years while repairs are implemented. Trail closures would be advertised in advance. Visitor use would be adversely affected during trail closures by limiting access to the Crater area and possibly increasing use on other nearby trails.

After the rerouted trail is complete, the visitor experience would be improved because the new trail alignment would be less steep, with grades of less than 10% below tree line and less than 12% above tree line, compared with the existing alignment, which has grades up to 30%. The less steep grade and more suitable hiking surface would result in a more enjoyable experience

for visitors hiking the trail. Rerouting the trail to remove the steep sections above tree line also would result in improved safety for visitors. The rerouted trail alignment was designed for long-term sustainability, but would also improve visitor experience with switchbacks that would provide improved views of the surrounding mountains and valleys compared with the existing trail. As previously described, visitor use of the trail is unlikely to increase compared with pre-project levels because of limited parking at the trailhead. Overall, rerouting the trail would have a beneficial effect over the life of the trail by increasing visitor safety and enjoyment.

### *Cumulative Impacts*

#### Alternative A—No Action

Past, present, and reasonably foreseeable future actions that have impacted, or may impact, visitor use and experience would mostly result from bighorn monitoring. Bighorn monitoring generally takes place when the trail is closed to visitors and, therefore, would not affect visitor use and experience. Collectively, these actions have had, and would continue to have, beneficial cumulative impacts on visitor use and experience. As previously described in this EA, the direct and indirect impacts of the no action alternative on visitor use and experience would be adverse from continued erosion of the trail. When the effects of the no action alternative are combined with the effects of other past, present, and reasonably foreseeable future actions, the total cumulative impact on visitor use and experience would continue to be beneficial. The incremental impacts of the no action alternative would not substantially change the impacts that are already occurring.

#### Alternative B—Close the Trail (Proposed Action and Preferred Alternative)

As described above for the no action alternative, past, present, and reasonably foreseeable future actions have had, and would continue to have, beneficial cumulative impacts on visitor use and experience. As previously described in this EA, the direct and indirect impacts of Alternative B on visitor use and experience would be adverse from closing the trail and reducing visitor access. When the effects of Alternative B are combined with the effects of other past, present, and reasonably foreseeable future actions, the total cumulative impact on visitor use and experience would be adverse, with a relatively large incremental contribution from Alternative B.

#### Alternative C—Reconstruct Trail within Existing Alignment

As described above for the no action alternative, past, present, and reasonably foreseeable future actions have had, and would continue to have, beneficial cumulative impacts on visitor use and experience. As previously described in this EA, the direct and indirect impacts of Alternative C on visitor use and experience would be beneficial over the life of the trail from trail improvements that restore the condition of the trail and increase visitor safety and enjoyment. When the effects of Alternative C are combined with the effects of other past, present, and reasonably foreseeable future actions, the total cumulative impact on visitor use and experience would be beneficial. The incremental impacts of Alternative C would contribute substantially to the beneficial impacts that are already occurring.

#### Alternative D—Reroute Trail on More Sustainable Alignment

As described above for the no action alternative, past, present, and reasonably foreseeable future actions have had, and would continue to have, beneficial cumulative impacts on visitor use and experience. As previously described in this EA, the direct and indirect impacts of Alternative D

on visitor use and experience would be beneficial over the life of the trail by increasing visitor safety and enjoyment. When the effects of Alternative D are combined with the effects of other past, present, and reasonably foreseeable future actions, the total cumulative impact on visitor use and experience would be beneficial. The incremental impacts of Alternative C would contribute substantially to the beneficial impacts that are already occurring.

# CONSULTATION AND COORDINATION

The following American Indian tribes, agencies, and organizations were contacted and were invited to participate in the planning process:

American Indian Consultation

- Arapaho Tribe of the Wind River Reservation, Wyoming
- Assiniboine and Sioux Tribes of the Fort Peck Indian Reservation, Montana
- Cheyenne and Arapaho Tribes, Oklahoma
- Comanche Nation, Oklahoma
- Hopi Tribe of Arizona
- Modoc Tribe, Oklahoma
- Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation, Montana
- Pueblo of Acoma, New Mexico
- Shoshone Tribe of the Wind River Reservation, Wyoming
- Southern Ute Indian Tribe of the Southern Ute Reservation, Colorado
- Ute Indian Tribe of the Uintah & Ouray Reservation, Utah
- Ute Mountain Tribe of the Ute Mountain Reservation, Colorado, New Mexico, and Utah
- White Mesa Ute, Utah

Bureau of Reclamation
Colorado Congressional Delegation (House and Senate)
Colorado Department of Public Health and Environment
Colorado Department of Natural Resources
Colorado Division of Parks and Wildlife
Colorado Fish and Wildlife Conservation
Colorado House members representing Larimer and Grand Counties
Colorado Natural Areas Program
Colorado Natural Heritage Program
Colorado Senate members representing Larimer and Grand Counties
Colorado State Historic Preservation Office
Estes Park Town Manager and Mayor
Federal Emergency Management Agency
Grand County Commissioners
Grand Lake Fire Protection District
Grand Lake Metropolitan Recreation District
Grand Lake Town Manager and Mayor
Larimer County Commissioners
U.S. Army Corps of Engineers, Regulatory Program
U.S. Department of Agriculture Natural Resource Conservation Service
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Geological Survey
U.S. Forest Service Sulphur Ranger District

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# APPENDICES

## Appendix A: Draft Memorandum of Agreement

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**MEMORANDUM OF**

**AGREEMENT BETWEEN**

**ROCKY MOUNTAIN NATIONAL PARK, NATIONAL PARK SERVICE AND**

**COLORADO STATE HISTORIC PRESERVATION OFFICER,**

**FOR CLOSURE OF THE CRATER TRAIL**

**WHEREAS,** the National Park Service manages and administers the Crater Trail (also known as the Specimen Mountain Trail) as part of Rocky Mountain National Park (Park) and proposes to close the trail with ensuing obliteration and revegetation; and

**WHEREAS,** a deeply incised segment of the Crater Trail bisects archeological site 5LR91; and

**WHEREAS,** the Park has determined that the Crater Trail (5LR14065.1) supports the overall eligibility of the Specimen Mountain Trail (5LR14065) and that both the trail and archeological site 5LR91 are eligible for listing in the National Register of Historic Places and the Colorado State Historic Preservation Officer (SHPO) concurred with this assessment on December 8, 2016 ; and

**WHEREAS,** the Park has determined that closure of the trail and the subsequent obliteration and revegetation will have an adverse effect on the Crater Trail and on archeological site 5LR91, and has consulted with the Colorado SHPO pursuant to 36 CFR Part 800, regulations implementing Section 106 of the National Historic Preservation Act (54 U.S.C. § 100101); and

**WHEREAS,** the Arapaho Tribe of the Wind River Reservation, Wyoming; Assiniboine and Sioux Tribes of the Fort Peck Indian Reservation, Montana; Cheyenne and Arapaho Tribes, Oklahoma; Comanche Nation, Oklahoma; Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation, Montana; Shoshone Tribe of the Wind River Reservation, Wyoming; Southern Ute Indian Tribe of the Southern Ute Reservation, Colorado; Ute Indian Tribe of the Uintah and Ouray Reservation, Utah; and Ute Mountain Tribe of the Ute Mountain Reservation, Colorado, New Mexico, and Utah participated in the consultation and have been invited to concur in this Memorandum of Agreement; and

**WHEREAS,** the Park has provided the Advisory Council on Historic Preservation the opportunity to comment on this project and the Advisory Council has declined to participate in the process; and

**NOW, THEREFORE**, the NPS and Colorado SHPO agree that the project shall be implemented in accordance with the following stipulations:

## I. STIPULATIONS

### A. Professional Qualifications

NPS shall ensure that archeological work conducted pursuant to this agreement is carried out by, or under the direct supervision of, a person or persons meeting the minimum appropriate qualifications set forth in the Department of the Interior's "Professional Qualifications" (49 FR 44738-46739).

### B. Minimization of Adverse Effects

1. NPS will ensure subsurface cultural deposits are protected in-situ to the maximum extent possible.
2. NPS will conduct cultural resource awareness training for staff involved in trail obliteration and revegetation activities.
3. An archeological monitor will be onsite to monitor ground disturbing activities.

### C. Mitigation of Adverse Effects

1. The NPS will complete a plan that will inform the public about why the Crater Trail was closed and rehabilitated. This could include a display at the visitor center and/or other media communication methods.
2. The plan will be archived at the park and a copy will be sent to the Colorado SHPO.
3. The NPS will conduct limited data recovery according to NPS standards, as outlined in Director's Order 28, NPS Cultural Resources Management Guideline, Revision 5 (DO–28; NPS 1997) and in the Secretary of the Interior's Standards and Guidelines for Archeological and Historic Preservation (U.S. DOI 1983). The primary objective of data recovery is to prevent the loss of site specific archeological information. The park will develop the data recovery plan in coordination with the Colorado SHPO.
4. After limited data recovery, the NPS will obliterate, stabilize and revegetate the trail through 5LR91 following the Rocky Mountain National Park Vegetation Restoration Management Plan (2006) and additional guidelines listed below.
    a. Minimally to moderately eroded trails shall be scarified. Topsoil shall be spread loose to a minimum depth of 4 inches over all disturbed areas. The area will be seeded with native alpine species.
    b. Moderately to severely eroded trails shall be scarified. Biodegradable soil erosion devices shall be applied to the disturbed area. Sterile fill may be used to stabilize the area. Topsoil shall be spread loose to a minimum depth of 8 inches over all disturbed areas. The area will be replanted and seeded with native alpine species.

    Conserved topsoil shall be spread a minimum of 2 inches loose depth over all disturbed areas. Imported topsoil shall be fertile, friable, free draining, sandy loam free of subsoil, refuse, stumps, roots, brush, weeds, rocks larger than one inch and shall be sterilized.

**D. Monitoring and Reporting**

Following the conclusion of the undertaking described in the MOA, the NPS shall provide all parties to this MOA a draft report detailing work undertaken pursuant to its terms within 120 days. The report will present the results of the data recovery, including all analyses. The report shall include any scheduling changes proposed, any problems encountered, and any disputes and objections received in the NPS's efforts to carry out the terms of this MOA.

All samples will be permanently stored at the Rocky Mountain National Park curation facility until funding is available to perform additional, as needed, analyses. All field and lab analysis forms, field notes, photographs, maps, and the final report will be curated in the Rocky Mountain National Park collections.

**E. Inadvertent Resource Discoveries**

If previously unknown archeological resources are discovered during obliteration or revegetation activities, all work in the immediate vicinity of the discovery will be halted and the procedures of 36 CFR Part 800.13[c] will be followed. In the unlikely event that Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony are discovered, all work in the immediate vicinity of the discovery will be halted and the procedures of 43 CFR § 10.3 will be carried out including taking immediate steps to protect the discoveries in situ, notification of the eleven aforementioned tribes, tribal consultation, and the development and execution of a Plan of Action.

**II. DISPUTE RESOLUTION**

Disputes regarding the completion of the terms of this Agreement shall be resolved by the signatories. If the signatories cannot agree regarding a dispute, the NPS or Colorado SHPO may request the participation of the Advisory Council to assist in resolving the dispute. Any recommendation or comment provided by the Advisory Council will be understood to pertain only to the subject of the dispute. The NPS's responsibility to carry out all actions under this Agreement that are not the subjects of dispute will remain unchanged.

At any time during implementation of the measures stipulated in this Agreement, should a member of the public raise an objection to any such measure, the NPS shall take the objection into account and consult as needed with the Colorado SHPO.

**III. AMENDMENT OF AGREEMENT**

The Agreement may be modified by amendment at any time by mutual concurrence of all parties. Amendment of the Agreement, as necessary, shall be accomplished in the same manner as the original agreement. Amendments will be in writing and approved by the original signatories or their designated official.

## IV. TERMINATION OF AGREEMENT

Either party to this Agreement may terminate it by providing thirty (30) calendar days notice to the other party, provided that the parties will consult during the period prior to termination to seek agreements on amendments or other actions that would avoid termination. In the event of termination by the SHPO, the NPS will request the comments of the ACHP, in accordance with 36 CFR Part 800.7[a].

## V. ANTI-DEFICIENCY ACT

All actions taken by the park in accordance with this MOA are subject to the availability of funds, and nothing in this MOA shall be interpreted as constituting a violation of the Anti-Deficiency Act.

## VI. TERM OF AGREEMENT

This Agreement shall become effective after the date of the last signatory. The Agreement shall be null and void if its terms are not carried out within five (5) years from the date of its approval by the Park and SHPO, unless the signatories agree in writing to an extension for carrying out its terms. Otherwise, this Agreement shall become null and void when the project is complete, and all of the above stipulations are fulfilled. The Agreement and any amendments shall be binding upon the parties, their successors, and assigns.

Execution of this Agreement by the NPS and the Colorado SHPO, its subsequent acceptance by the Council, and implementation of its terms, evidences that the NPS afforded the Council an opportunity to comment on the project and its effects on historic properties, that the NPS has taken into the account the effects of the undertaking on historic properties, and that the NPS has satisfied its Section 106 responsibilities for the project referenced in this Agreement.

**MEMORANDUM OF AGREEMENT**
**CLOSURE OF THE CRATER TRAIL**
**Signatories**

**National Park Service**

By: _____ Date: _____
Darla Sidles
Superintendent, Rocky Mountain National Park

**Colorado State Historic Preservation Office**

By: _____ Date: _____
Steve Turner
State Historic Preservation Officer

**Advisory Council on Historic Preservation**

By: _____ Date: _____
John Fowler
Executive Director, Advisory Council on Historic Preservation

# Appendix B: Special Status Species Lists

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# Appendix B
# Special Status Species

**Table 1. Federally-Listed Threatened and Endangered Species in Larimer County, Colorado.**

| Common Name | *Species* | Status | Species Excluded | Habitat Requirements | Rationale for Exclusion |
|---|---|---|---|---|---|
| **AMPHIBIANS** | | | | | |
| Boreal toad | *Anaxyrus boreas boreas* | Under review | Yes | Spruce-fir and alpine meadows between 7,500 and 11,500 feet including lakes, marshes, wetlands or bogs. | Lack of breeding habitat in project areas. Trail closure and rehabilitation will result in no measurable impact to wetlands. |
| **BIRDS** | | | | | |
| ** Least tern | *Sterna antillarum* | Endangered | Yes | Riparian habitat on the Platte River in Nebraska | The project will not alter flows in the Cache la Poudre River, which is a tributary of the South Platte River. |
| Mexican spotted owl | *Strix occidentalis lucida* | Threatened | Yes | Heavily vegetated canyons or forested areas | This species and suitable habitat do not occur in the project area. |
| Southern white-tailed ptarmigan | *Lagopus Leucura altipetens* | Under review | NO | Alpine tundra | The project occurs in white-tailed ptarmigan habitat. |
| ** Piping plover | *Charadrius melodus* | Threatened | Yes | Broad, sandy beaches, usually on islands | The project will not alter flows in the Cache la Poudre River, which is a tributary of the South Platte River. |
| ** Whooping crane | *Grus Americana* | Endangered | Yes | Riparian habitat on the Platte River in Nebraska | The project will not alter flows in the Cache la Poudre River, which is a tributary of the South Platte River. |
| **FISH** | | | | | |
| Greenback cutthroat trout | *Oncorhynchus clarki stomias* | Threatened | NO | Isolated headwaters of mountain streams | The project occurs near areas of suitable habitat for greenback cutthroat trout. |

# Appendix B
# Special Status Species

| Common Name | *Species* | Status | Species Excluded | Habitat Requirements | Rationale for Exclusion |
|---|---|---|---|---|---|
| ** Pallid sturgeon | *Scaphirhunchus albus* | Threatened | Yes | Riparian habitat on the Platte River in Nebraska | The project will not alter flows in the Cache la Poudre River, which is a tributary of the South Platte River. |
| **MAMMALS** | | | | | |
| Canada lynx | *Lynx canadensis* | Threatened | NO | Subalpine and upper montane forests between 8,000 and 12,000 feet | The project occurs in lynx habitat. |
| Preble's meadow jumping mouse | *Zapus hudsonius preblei* | Threatened | Yes | Stream and riparian habitats along the Colorado Front Range and southeastern Wyoming | Project occurs above 7,800 feet elevation, outside of range. |
| North American wolverine | *Gulo Gulo luscus* | Proposed Threatened | NO | Large roadless or isolated areas at higher elevations | The project occurs in wolverine habitat. |
| **PLANTS** | | | | | |
| Colorado butterfly plant | *Gaura neomexicana spp. Coloradensis* | Threatened | Yes | Moist areas of flood plains in Laramie and Platte counties in Wyoming, and Larimer, Jefferson, and Weld counties in Colorado | Does not occur in the project area. |
| North Park Phacelia | *Phacelia formosula* | Endangered | Yes | Between 8,000 and 8,300 feet in Jackson County, Colorado | Does not occur in the project area. |
| Utes ladies' - tresses | *Spiranthes diluvialis* | Threatened | Yes | Below 6,500 feet in moist to wet alluvial meadows, flood plains of perennial streams | Does not occur in project area. Project occurs above 7,800 elevation, outside of range |
| **Western prairie fringed orchid | *Platanthera praeclara* | Threatened | Yes | Riparian habitat on the Platte River in Nebraska | The project will not alter flows in the Cache la Poudre River, which is a tributary of the South Platte River. |

# Appendix B
# Special Status Species

| Common Name | *Species* | Status | Species Excluded | Habitat Requirements | Rationale for Exclusion |
|---|---|---|---|---|---|
| **INSECTS** | | | | | |
| Arapahoe snowfly | *Capnia Arapahoe* | Candidate | Yes | Known only from two populations in tributaries to the Cache la Poudre River below 6,000 feet in elevation | This species is not known to occur in the project area and the project is above the known elevation range of this species. |

** Water depletions in the South Platte River basin may affect these downstream species

**Table 2. Colorado Natural Heritage Program vulnerable or imperiled species potentially occurring in the Crater Trail project area (list updated May 5, 2017).**

| Scientific Name | Common Name | CHNP Status* | Habitat |
|---|---|---|---|
| **BIRDS** | | | |
| *Leucosticte australis* | Brown-capped rosy-finch | S3S4 | Alpine tundra and rock crevices above tree line, primarily in Colorado |
| **PLANTS** | | | |
| *Aquilegia saximontana* | Dwarf blue columbine | S3 | Cliffs, rocky slopes in alpine and subalpine communities |
| *Artemisia pattersonii* | Patterson's wormwood | S3 | Open rocky tundra |
| *Asplenium septentrionale* | Grass-fern | S3S4 | Crevices of rocks, around boulders and on cliffs |
| *Botrychium lanceolatum* | Lanceleaf moonwort | S3 | subalpine woodland, open fields |
| *Botrychium manganese* | Mingan moonwort | S1 | Subalpine woodland, dense forest to open meadow and from summer-dry meadows to permanently saturated fens and seeps |
| *Carex oreocharis* | Grassyslope sedge | S1 | Dry slopes in granite soils |
| *Castilleja puberula* | Shortflower paintbrush | S2S3 | Rocky tundra and high peaks of the Continental Divide |
| *Chionophila jamesii* | Snowlover | S3S4 | Moist grassy slopes or flats in rocky or gravelly soil |
| *Cypripedium fasciculatum* | Clustered lady's slipper | S3 | Subalpine woodland, open to densely shaded lodgepole or sometimes spruce-fir forests |
| *Cystopteris montana* | Mountain bladderfern | S1 | Subalpine woodland, moist soil in spruce-fir forests |
| *Draba crassa* | Thickleaf draba | S3 | Alpine scree slopes, high mountain cliffs |

# Appendix B
# Special Status Species

| Scientific Name | Common Name | CHNP Status* | Habitat |
|---|---|---|---|
| *Draba fladnizensis* | Austrian draba | S2S3 | Alpine, scree slopes |
| *Draba grayana* | Gray's draba | S2 | Alpine, scree slopes |
| *Draba porsildii* | Porsild's draba | S1 | Alpine, scree slopes |
| *Draba streptobrachia* | Alpine tundra draba | S3 | Tundra meadows, scree slopes |
| *Dryopteris expansa* | Spreading woodfern | S1 | Subalpine woodland, moist, dense spruce-fir forests and cliff bases |
| *Equisetum variegatum* | Variegated rush | S1 | Subalpine woodland, tundra meadows, scree slopes |
| *Eriophorum gracile* | Slender cotton-grass | S1 | Subalpine woodland, fens, wet meadows and pond edges |
| *Lewisia triphylla* | Threeleaf lewisia | S2 | Subalpine woodland, moist meadows |
| *Listera borealis* | Northern twayblade | S2 | Subalpine woodland, moist spruce-fir forests, mossy seeps |
| *Luzula subcapitata* | Colorado woodfern | S3 | Subalpine woodland, subalpine and alpine willow carrs |
| *Mimulus gemmiparus* | Yellow monkeyflower | S1 | Subalpine woodland, granite seeps, slopes and alluvium in open sites within spruce-fir and aspen forests |
| *Pentsemon harbourii* | Harbour's beardtongue | S3S4 | Rocky substrate, loose scree slopes |
| *Telesonix jamesii* | James' telesonix | S2 | Subalpine woodland, boulder fields, cliff faces, rocky outcrops in tundra and mixed conifer forests |

*S1 species are critically imperiled in Colorado (5 or fewer known occurrences in the state); S2 species are imperiled (6 to 20 known occurrences in the state); S3 species are vulnerable (21 to 100 known occurrences in the state); and S4 species are apparently secure in the state (usually more than 100 occurrences and more than 10,000 individuals).

## Appendix C: Construction Stipulations for Native Plant Conservation and Restoration

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# Appendix C
# Construction Stipulations for Native Plant Conservation and Restoration
## ROCKY MOUNTAIN NATIONAL PARK, COLORADO
(Revised March 2011)

**Purpose**
The enabling legislation for Rocky Mountain National Park (RMNP) and National Park Service (NPS) Management Policies require park managers to preserve natural conditions within the park. These construction stipulations have three purposes:

- to protect the natural environment and preserve natural conditions
- to reduce the cost of seed collection, plant propagation, outplanting, topsoil restoration, and exotic plant treatments required for native plant restoration once a project is completed
- to reduce the cost of invasive exotic plant control

These stipulations should be used as a guideline for minimizing impacts caused by ground-disturbing projects. Each project should be reviewed on an individual basis and stricter stipulations may be necessary in sensitive locations. Ground disturbing projects may require a vegetation restoration plan that identifies the type of restoration that will be done once construction is complete. The Division of Resources Stewardship in cooperation with other divisions usually writes the restoration plan in accordance to the RMNP Vegetation Restoration Management Plan Version 2 July 2006.

## Checklist

**Check all items that apply to this project**

**Implementation**

- ☐ The Contractor/NPS personnel shall take every precaution and make every effort to protect the delicate environment of Rocky Mountain National Park.
- ☐ Construction stipulations will be incorporated in the contract documents and all NPS construction projects.
- ☐ A performance bond will be required to cover all portions of the contract.
- ☐ A one-year warranty will be required for all seeding or planting of vegetation completed by contractors.
- ☐ The project budget includes sufficient funds to cover the cost of all restoration work.
- ☐ To the degree possible, the project will be planned to maximize the survivability of salvaged trees and shrubs. Plant salvage will occur in early spring or late fall/early winter during dormancy.
- ☐ Sufficient lead time (as much as one year or more) will be provided for seed collection and propagation of plants for vegetation restoration.
- ☐ Reseeding will be scheduled in the fall or spring when soil temperature reaches 50 degrees.

**Construction Limits**

- ☐ The construction area limits will be clearly defined, fenced, flagged or somehow delineated to keep ground disturbance to a minimum. Any deviation from the approved area of disturbance must be approved by the signatories to this document.

- ☐ Construction equipment will be kept within the construction limits to protect adjacent undisturbed vegetation. Under no circumstance will any vehicle be allowed outside the construction limits. Whenever possible keep equipment on hardened surfaces.

- ☐ Turning areas for hauling vehicles shall be approved by the CO and/or Project Manager.

- ☐ Areas to be used for parking and stockpiling material are strictly controlled and will require approval of the CO and/or Project Manager prior to their use by the Contractor.

**Equipment**

- ☐ Rubber-tired or tracked vehicles will be used unless specific approval for tracked vehicles has been granted by the Project Manager. This will reduce soil compaction and erosion.

- ☐ Equipment will be refueled on an existing road or parking lot. Any spills will be cleaned up immediately. All equipment must have a spill kit on hand at all times.

- ☐ Construction equipment not being used shall be parked out of the traveled way of roads and trails and within the construction limits or on approved paved surfaces.

- ☐ All earth-moving equipment (excluding hauling vehicles) shall be cleaned of mud, plant materials and weed seed prior to entering the National Park and when moving between project sites inside the park as per the RMNP Aquatic Disinfection Guidelines and Technical Memorandum No. 86-68220-07-05. Hauling vehicles shall meet the same requirement before their initial entrance into the park; subsequent entries will not require cleaning unless ordered by the Project Manager.

- ☐ Solvents used to clean pavers, tools, etc., shall be carefully used, completely contained at the work site, and satisfactorily cleaned up as may be required.

**Clearing and Grubbing**

- ☐ Selected snags with 4 to 12 inches diameter at breast height (dbh) shall be salvaged and stockpiled in designated storage areas for subsequent placement on the completed slopes. The trees and snags shall be cut into random lengths from 8 to 30 feet and shall be limbed on one side. Sound snags and dead trees are preferred over live trees.

- ☐ Surface boulders that will remain on the site following construction shall be carefully stockpiled with natural face up to protect natural lichen growth. Boulders will be replaced in their natural position partially buried at ½ to 2/3 of the total boulder height with lichen facing up.

- ☐ Trees larger than 12 inches dbh and trees from 4 to 12 inches dbh not designated for salvaging and stockpiling shall become the property of the contractor and shall be removed from the park. Trees less than 4 inches dbh and over 3 feet in height shall be disposed of outside the park.

- ☐ Grubbing of stumps shall be accomplished in such a manner as to conserve topsoil material. Non-conventional methods will be required to remove stumps in order to conserve topsoil without contaminating the material with underlying inorganic soils. Pushing trees over with

heavy equipment or performing grubbing operations shall not be permitted until topsoil is conserved.

- ☐ If stumps are to be left in place, trees should be flush cut to ground level. Designated trees and snags once cut shall be removed in such a manner as to minimize damage to adjacent trees and vegetation.

- ☐ Furrows created by dragging larger timber away for disposal shall be hand raked to blend with finished grade.

- ☐ Burning of debris within the park will not be permitted. All debris and left over construction materials shall be removed from the park and disposed of in accordance with applicable local, State, and Federal regulations.

**Excavation**

- ☐ If excavation and/or grading is required for ditches, foundations, road construction, etc., the topsoil shall be salvaged and stored in a separate location (refer to next section). Topsoil refers to the uppermost soil horizon, and natural humus bearing soils, duff, and vegetable matter. The depth of topsoil in the park varies and must be evaluated for each project to determine how much of the topsoil should be saved. As a rule, the depth of topsoil in the park is about the first six inches of soil. The NPS will designate topsoil salvage depths by location.

- ☐ Trees and shrubs are to be avoided if possible during trenching or excavation.

- ☐ Any excavated boulders, subsoil or topsoil that will not be needed for the project are to be removed as soon as possible to minimize damage to underlying vegetation.

**Topsoil Salvage**

- ☐ Salvaged topsoil will be separated from the sub-soil and stored in windrows no higher than three feet and three feet wide. If possible, the soil will be stockpiled in a disturbed area to minimize the impact to adjacent vegetation.

- ☐ If the topsoil is to be stockpiled for several months or longer, it should be planted in a cover crop as specified by the Biologist or Natural Resource Specialist.

- ☐ A minimum of 2 inches of material shall be conserved in all cases, and a depth of 12+ inches of material is possible in some locations. Live vegetation less than 3 feet in height and limbs less than 1 inch in diameter may be incorporated as topsoil in the stockpiles. Conserved topsoil shall consist of natural humus bearing soils, duff, and vegetable mater obtained from the overlying portions of the project excavation and embankment areas.

- ☐ Due to the limited amount of material available for topsoil and the need to establish the best growing medium possible for revegetation, non-conventional methods will be required to excavate, stockpile, and place the conserved material. Equipment capable of excavating small, isolated pockets of soil; removing stumps as required; and placing material on slopes and in pockets on rock ledges will be required to perform the work.

**Vegetation Salvage**

- ☐ A representative from the Division of Resources Stewardship shall clearly identify all plant materials (trees, shrubs, grasses and forbs) to be salvaged prior to the start of construction. Do not disturb these areas until the materials have been harvested or cleared by a Resource Stewardship representative.

- ☐ A representative from the Division of Resources Stewardship shall clearly identify all plant materials to be transplanted outside the zone of disturbance.

- ☐ RMNP contains many plant species of special concern. If a species of special concern is present at the project site, the goal of plant salvage and revegetation is no net loss of this plant. The representative from the Division of Resource Stewardship will identify any species of special concern.

- ☐ When salvaging trees and shrubs, as much soil as possible shall be preserved around the roots. Root balls from salvaged trees and shrubs will either be boxed, placed in containers or wrapped in burlap. The plants must be watered to keep the soil moist until they are replanted. Stockpile salvaged trees in a safe area where they can be watered.

- ☐ Trees, shrubs and other containerized plants will be watered during the first growing season.

- ☐ If sod will be salvaged at the project site, the sod can be stripped with a backhoe, sod cutter or spade. Ground disturbing projects in the alpine tundra should salvage all sod.

    - ☐ If sod is to be replaced within five (5) days it can placed on canvas burlap and stored at the construction site. The sod should be watered and covered to prevent the vegetation from drying out. During hot, dry weather, the salvaged sod must be watered every day.

    - ☐ Sod that cannot be replanted within five days must be placed into wooden flats lined with three inches of vermiculite and peat and watered daily. These flats would have to be watered daily.

**Rough Grading**

- ☐ A balance is to be achieved between these competing and equal considerations: (a) the creation of steep cuts and fills to minimize the amount of disturbance, and (b) the creation of flatter cuts and fills to minimize erosion and promote the reestablishment of vegetative cover. This will help to create micro-habitats and terraces that provide for erosion control and ease in native plant establishment.

**Finish Grading**

- ☐ Once construction is complete, the natural contour of the land is to be restored to the degree possible. Slopes shall simulate the irregularity of the existing terrain.

- ☐ Abrupt angles are to be avoided at the top, toe and ends of newly formed slopes. The top, toe and ends of the slope are to blend in with natural contours. NPS Landscape Architect will provide direction as needed.

- ☐ All earth and rock slopes shall be left with a roughened surface as they are being constructed.

    Cut Slopes

    - ☐ Boulders firmly in place and protruding from cut slopes shall be left undisturbed.

    - ☐ All cut slopes shall be sculpted to irregular surfaces preserving segments of large rock outcrops leaving staggered, irregular ledges, shelves, and outcrops with jagged edge appearance and planting pockets suitable for placement of topsoil and plants. NPS Landscape Architect will provide direction as needed.

Fill Slopes

☐ Fill slopes shall be graded to provide an irregular surface with staggered ridges steeper than the nominal slope ratio, staggered ledges, planting pockets, and large boulders exposed above the nominal fill slope.

☐ Where shown on the plans or directed by CO and/or Project Manager, additional material shall be incorporated into the fill slopes to obtain additional blending into the natural terrain and to develop areas for planting.

☐ Any soil that has been over-compacted by traffic or equipment, especially when wet, will be tilled to a minimum depth of 4 inches, and up to 24 inches, to break up rooting restrictive layers, and then harrowed to prepare the required seedbed.

**Imported aggregate and soil**

☐ All imported topsoil must be approved by a representative from the Division of Resource Stewardship prior to delivery and placement.

☐ All material sources used in the production of aggregates require archaeological clearance by a state or federal agency. The Contractor shall furnish written proof of archaeological clearance before transporting any aggregate into the park.

☐ All material sources require clearance for exotic plants. The Contractor/NPS personnel shall notify the CO and/or Project Manager of the sources(s) proposed for use at least 1 month before beginning operations. The source(s) will be investigated for exotic plants during the period. If exotics are present, the investigator will determine if the upper portion of the source is to be stripped or the exotics sprayed with an herbicide. When an herbicide is required, a licensed applicator shall apply the spray. An agronomist's certification that the source(s) is free from exotic plants may be substituted for the above requirements.

**Placement of Topsoil**

☐ Prior to placement of topsoil, prepare the areas as follows.

(a) Slope ratios of 3:1 or less should be scarified to a nominal depth of 4 inches, but up to 24 inches is possible. Disking or scarification shall be done in a direction perpendicular to the natural flow of water.

(b) Slopes steeper than 3:1 shall be prepared as directed by the CO and/or Project Manager.

☐ Conserved topsoil shall be spread a minimum of 2 inches in depth, loose measurement, over all disturbed soil areas. Topsoil is to be replaced without compacting the soil. If topsoil is compacted, it must be scarified to a minimum depth of 4 inches and possibly up to 24 inches as determined by Resource Stewardship staff.

☐ Imported topsoil, when being used, shall be spread a minimum of 4 inches in depth, loose measurement, over all disturbed soil areas. Imported topsoil is to be placed without compacting the soil and must be incorporated (mixed) into native subsoil to a depth of 12 inches. If topsoil is compacted, it must be scarified to a minimum depth of 4 inches and possibly up to 24 inches as determined by Resource Stewardship staff.

☐ After spreading has been completed, large clods, loose stones larger than 12 inches, stumps, and large roots shall be removed and disposed of outside the park in accordance with local, county, State, and Federal regulations. Stones smaller than 12 inches which are firmly embedded in the topsoil may be left on the finished slopes

**Erosion Control**

☐ Temporary erosion control devices or methods shall be used to protect sensitive areas. Sensitive areas include but are not limited to lakes, stream corridors, drainages, riparian areas, wetlands, and aspen groves.

☐ In areas where slopes are greater than 2:1, soil erosion devices (including but not limited to weed-seed free straw bales, wattles and blankets) will be applied to the disturbed area. Certified weed seed free hay is not acceptable for use in RMNP. For larger disturbed areas, erosion control fencing must be installed. Areas requiring erosion control will be delineated and inspected by the park Biologist.

☐ Logs shall be placed on all erodible slopes. Logs shall be staggered and placed in a random fashion to prevent the appearance of a pattern. Logs will be measured by the linear foot, in place, completed and accepted.

☐ Logs should be staked to the slope by at least 1 inch by 2 inch by 2-1/2 foot hardwood stakes. Reinforcing steel (no. 5), 2-1/2 feet in length may be used in hard material where wood stakes cannot be driven. A minimum of three stakes shall be required to anchor logs up to 8 feet in length. Additional stakes shall be required for each 2 feet of additional length over the 8 feet. A minimum of five stakes shall be used to anchor logs over 8 inches in diameter. Stakes shall be driven perpendicular to the ground line to a minimum depth of 18 inches. The top of the stake shall not extend above the log nor shall it protrude from the ground less than one-half the diameter of the log. Remove branches on one side of logs to allow maximum contact with the ground. Place logs such that log maximizes contact with the ground.

☐ Trees and snags shall be placed on slopes following the placement of topsoil.

**Seeding**

☐ Planted seed shall be covered with no more than 1/4 to 3/4 inch of soil.

**Mulching**

☐ Division of Resources Stewardship personnel will determine if a project requires the use of mulch. Wood products such as chips should be made about one year before use to allow time for the chips to cure, otherwise they may inhibit vegetation restoration. Mulch spread over a seeded area will cover approximately 75% of the area up to a ½ inch depth.

**Special Considerations**

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## GENETIC GUIDELINES FOR RESTORATION PROJECTS

Rocky Mountain National Park has been actively involved in restoring human caused disturbances since the 1960's and has been an UNESCO International Biosphere Preserve since 1976. In the late 1980's preserving genetic integrity in vegetation restoration projects became a priority issue. Following are guidelines adopted by the park:

1. Evaluate which restoration class (I, II, III) project is located in. Each class has specific guidance from the RMNP Restoration Management Plan to what restoration techniques and plant materials can be used.
2. Salvage as much plant material (e.g. whole plants, sometimes sod) and topsoil prior to the disturbance as possible.
3. Evaluate sites to determine if salvageable material and/or natural regeneration will provide sufficient plant cover to compete with weeds, retard erosion, and meet other management goals. (If natural regeneration is selected, it may be enhanced by activities such as raking, watering and weeding).
4. When collection of additional plant material is necessary, whenever possible, plant material will be collected from either directly on or adjacent to the site to be revegetated. If parts of plants are collected for propagation, a minimum of fifty plants should be sampled to protect local genotypes
5. A plants material program is an appropriate technique when local plant material is needed for large-scale projects via a seed increase program. The nearest plants material center is in Meeker Colorado and the park has been involved in a seed increase program with Meeker for years. If seed is collected from shrubs, a minimum of fifty shrubs should be sampled from any one area to protect local genotypes and no more than 10% of the seed from any one shrub should be collected to leave an adequate amount of seed behind for natural plant germination and also as a food source for wildlife. If blue grama (*Bouteloua gracilis*) is to be used, the appropriate plant material center would be in Los Alamos, New Mexico.
6. If collection of plant material directly on site is not possible, material may be moved within the major drainages of the park. When possible match habitat type, aspect and elevation.
7. In special circumstances, material may be moved between the major drainages in the park, to be approved on a case by case basis.
8. To protect genetic integrity, no plant material will be moved across the Continental Divide.
9. No plant material will be planted higher or lower than 1,500 feet in elevation from their point of origin.
10. Nursery material grown from seed or propagules not collected in Rocky Mountain National Park or in immediately adjacent drainages will not be planted in the park unless approved on a case by case basis.
11. Transplanting plants from adjacent undisturbed sites may be suitable in some areas on a limited basis, particularly in the backcountry. However, transplanting is very expensive, frequently fails, and should be done very cautiously so as not to impact the undisturbed site.
12. Plant cultivars or other non-local native species in class III areas only when absolutely necessary for competition with exotics or to retard erosion. This would only be allowed in developed areas of the park such as park housing, National Historic Register sites as mandated by the National Historic Preservation Act after a case by case review by the park's natural resource specialist, park archeologist, landscape architect, and/or designated historian or on severe sites where succession will go from grass/forb to dense forest. In an area that would eventually become dense forest, the cultivars will eventually be shaded out. For example steep ski slopes being restored at Hidden Valley. All other revegetation alternatives including sterile cover crops, heavy mulch, and delaying planting until local material is available will be considered before cultivars are used. Only cultivars of species growing in Rocky Mountain National Park will be used and varieties will be chosen that originated as close to the park as possible.
13. Non-invasive exotic ornamentals may be planted in National Historic Register sites as mandated by the National Historic Preservation Act after a case by case review by the park's natural resources specialist, park archeologist, landscape architect and/or designated historian. The

park's natural resources specialist will ensure the exotic species are not on the state of Colorado's noxious weed list or show aggressive tendencies that could allow the plant to escape into natural areas of the park.

14. Exotic grasses may be planted to meet historical management goals in developed areas only, but only in association with National Historic Register Sites or in some limited cases around park employee houses. However, Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*) timothy (*Phleum commutatum*) and red top (*Agrotis gigantea*), which are commonly used in seed mixes are aggressive invaders into natural areas of the park and other native grasses should be seriously considered before these species are used. Seed mixes should also avoid using clovers such as White sweetclover (*Melilotus alba*) and yellow sweetclover (*Melilotus officinalis*) due to their aggressive tendencies.

**Rocky Mountain National Park**
1000 US Hwy 36
Estes Park, CO 80517