KEYSTONE
COLORADO

DERCUM MOUNTAIN IMPROVEMENTS PROJECT ENVIRONMENTAL ASSESSMENT

FEBRUARY 2014

USDA Forest Service
White River National Forest
Dillon Ranger District

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LIST OF ACRONYMS

AF	Acre Feet
AMSL	Above Mean Sea Level
APE	Area of Potential Affects
BA	Biological Assessment
BE	Biological Evaluation
BEIG	Built Environment Image Guide
BI	Beneficial Impact
BMP	Best Management Practice
CCC	Comfortable Carrying Capacity
CDA	Connected Disturbed Area
CDOW	Colorado Division of Wildlife
CDPHE	Colorado Department of Public Health and Environment
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CM	Centimeter
CPW	Colorado Parks and Wildlife
CRCT	Colorado River Cutthroat Trout
CWA	Clean Water Act
DAU	Data Analysis Unit
DDT	Dichloro-Diphenyl-Trichloroethane
DMP	Drainage Management Plan
DN	Decision Notice
DSH	Diurnal Security Habitat
DRD	Dillon Ranger District
EA	Environmental Assessment
EIS	Environmental Impact Statement
FT	Feet
FTE	Full Time Equivalent
ID Team	Interdisciplinary Team
K_w	K-factor
LAA	May Affect, Likely to Adversely Affect
LAU	Lynx Analysis Unit
MAII	May Adversely Impact Individuals
MDP	Master Development Plan
MIS	Management Indicator Species
MM	Management Measure
MOU	Memorandum of Understanding
MPB	Mountain Pine Beetle
NDIS	Natural Diversity Information Source

NE	No Effect
NEPA	National Environmental Policy Act
NFS	National Forest System
NHPA	National Historic Preservation Act
NI	No Impact
NLAA	May Affect, No Likely to Adversely Affect
NLJ	Not Likely to Jeopardize
NOPA	Notice of Proposed Action
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
OAHP	Office of Archaeology and Historic Preservation
PDC	Project Design Criteria
PDF	Project Design Feature
PUD	Planned Unit Development
R2	Forest Service Region Two
ROD	Record of Decision
SHPO	State Historic Preservation Officer
SIO	Scenic Integrity Objective
SIVC	Species with an Identified Viability Concern
SMS	Scenery Management System
SOLC	Species of Local Concern
SRLMD	Southern Rockies Lynx Management Direction
SUP	Special Use Permit
TEP	Threatened, Endangered, and Proposed species
TES	Threatened, Endangered, and Sensitive species
USACE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WCPH	Watershed Conservation Practices Handbook
WIZ	Water Influence Zone
WRENSS	Water Resources Evaluation of Non-point Silvicultural Sources
WRNF	White River National Forest

Chapter 1
Purpose and Need

1. PURPOSE AND NEED

A. DOCUMENT STRUCTURE

The U.S. Department of Agriculture Forest Service (Forest Service) has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This EA discloses the direct, indirect, and cumulative environmental impacts that would potentially result from implementation of the Proposed Action or the No Action Alternative. The document is organized into seven chapters, plus two appendices:

Chapter 1 – Purpose and Need: includes information on the history of the project proposal, the purpose of and need for the project, and a summary of the Forest Service's proposal for achieving that purpose and need. This chapter also details how the Forest Service informed the public of the proposal and how the public responded.

Chapter 2 – Description of Alternatives: provides a detailed description of the Forest Service's Proposed Action for achieving the stated purpose and need, as well as the No Action Alternative. This discussion also includes project design criteria, mitigation, and monitoring measures. Finally, this chapter provides a summary table of the environmental consequences associated with each alternative.

Chapter 3 – Affected Environment and Environmental Consequences: describes the physical, biological and human environment, and the potential effects of implementing the Proposed Action and the No Action Alternative. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation, and finally, a description of the effects of the Proposed Action.

Chapter 4 – Finding of No Significant Impact: prepared according to 40 CFR 1508.27(b)

Chapter 5 – Consultation and Coordination: provides a list of preparers and agencies/organizations consulted during the development of the EA.

Chapter 6 – References: provides a scientific bibliography of studies that support the environmental analysis.

Chapter 7 – Figures: includes the figures that are referred to throughout the analysis.

Appendices: Appendix A – Cumulative Effects Projects: includes a table of cumulative effects projects and project descriptions. **Appendix B – Response to Comments Received on the Keystone Resort Dercum Mountain Improvements Projects NOPA:** responds to individual comments included in the four letters submitted in response to the Notice of Proposed Action, as well copies of the individual letter.

B. INTRODUCTION

Keystone Ski Resort (Keystone) opened to the public in 1970. Keystone operates under a Forest Service-issued special use permit (SUP) authorizing the use of National Forest System (NFS) lands for the purposes of constructing, operating, and maintaining a winter sports resort, including food services, rentals, retail sales, and other ancillary facilities. The SUP covers 8,536 acres on the Dillon Ranger District of the White River National Forest (WRNF) approximately 6 miles south on Highway 6 from the Silverthorne/Dillon exit off Interstate 70. With the exception of private lands at the River Run and Mountain House base areas, the entirety of Keystone's existing lift, trail and infrastructural network is operated on public lands.

Guest expectations continue to evolve in today's competitive skier/rider market and resorts must constantly focus on raising service standards and improving the overall recreational experience. Keystone has not made many substantive infrastructural or qualitative improvements over the past two decades (since the Outpost Gondola was installed in 1991). The most notable improvements since that time include: the replacement of the Ruby chairlift with a detachable six-pack in 2000; snowcat skiing in Little Bowl/Erickson Bowl in 2003; the addition of the A-51 Terrain Park in 2004; snowcat skiing on Independence Mountain in 2006; and replacement of the River Run Gondola in 2009.

In accordance with the terms of the SUP, Keystone completed a Master Development Plan (MDP) in 2009 to outline its plans for future development and improvement on NFS lands within its SUP area. Proposed projects are identified in, and consistent with, Keystone's 2009 MDP, which has been reviewed and accepted by the WRNF. However, acceptance does not constitute an approval, and implementation of individual projects identified in the MDP is contingent upon site-specific analysis/approval in accordance with the NEPA process.

The Dercum Mountain Improvements project is designed to improve the overall recreational experience at Keystone by accommodating existing and future guest expectations. Proposed projects specifically address: the resort's family atmosphere; on-mountain guest services; teaching opportunities; the mountain bike trail network; and resort maintenance/operations.

With one exception (a snowcat access route), all proposed projects are within Keystone's Forest Service-administered SUP boundary, which encompasses 8,536 acres of NFS lands. All but two proposed projects are limited to the front side of the resort on Dercum Mountain.

This EA discloses site-specific review of the following project components, which are described in more detail in Chapter 2:

- Removal and replacement of the Summit House Restaurant with a larger and more efficient facility
- New water and wastewater infrastructure to support the new Summit House facility

- Upgrades to existing snowmaking infrastructure in order to continue to provide coverage on *Bachelor*, *Cross Cut*, *Wild Irishman*, *Whipsaw*, and *Jack Straw* trails
- Enlargement of the existing snowtubing area at Adventure Point
- Removal and replacement of the existing yurts at Adventure Point with a permanent facility
- Development of new teaching terrain and installation of an additional surface conveyor lift at the summit of Dercum Mountain
- Installation of a new surface conveyor lift at the mid-terminal station of the River Run Gondola
- Installation of a new surface conveyor to accommodate a teaching terrain park above the A-51 terrain park
- Conversion of four tree islands on the western side of Dercum Mountain into a dedicated "Family Adventure Zone"
- Construction of a groomable egress trail out of Bergman Bowl (reroute of *Jane's Journey*)
- Construction of a dedicated snowcat access route between the Mountain House maintenance facility and Keystone Gulch Road
- Construction of new mountain bike trails

The "Alternatives Considered in Detail" section in Chapter 2 provides a full description of these proposals under the "Alternative 2" heading.

C. THE NEPA/EA PROCESS

The proposed improvements constitute a federal action, which has the potential to affect the quality of the human environment on public lands administered by the Forest Service. Therefore, the proposal must be analyzed pursuant to the National Environmental Policy Act (NEPA). Under NEPA, federal agencies must carefully consider environmental concerns in their decision making process and provide relevant information to the public for review and comment.

This EA has been prepared to analyze the potential site-specific direct, indirect, and cumulative effects which are anticipated to result from implementation of the Proposed Action. Additionally, it is intended to ensure that planning reflects the opportunities and constraints posed by the immediate and surrounding area and that it minimizes potential resource conflicts.

D. PURPOSE AND NEED FOR ACTION

The Purpose and Need for Action is focused on improving the quality of the recreational experience at Keystone.

All guests—regardless of their ability level—access and depart Keystone's lift and trail network via Dercum Mountain. Select trails on the front side of Dercum Mountain also have lights for night skiing, so this portion of the SUP area is heavily used throughout the day and evening. With primarily beginner and intermediate terrain, Dercum Mountain is very popular with Keystone's core market sector (intermediate skiers) and is heavily used for teaching terrain. In addition, the A-51 Terrain Park is located on the west side of Dercum Mountain.

The summit of Dercum Mountain provides two key facilities: the Summit House and Adventure Point. The Summit House provides rental lockers, limited retail, a bar/lounge and restaurant, restrooms, ski school, and a ski patrol area. This facility is heavily used throughout the day and during the evening for night skiing. Adventure Point offers snowtubing throughout the day and evening.

Due to the importance of Dercum Mountain for defining the recreational experience at Keystone, strategic improvements are necessary to maintain and enhance Keystone's reputation as a family-oriented resort in today's recreation and action sports market. Keystone has identified upgrades to the front side of Dercum Mountain as the highest priority projects from the 2009 MDP. Specific projects that have been designed in response to each need are identified and discussed in detail in Chapter 2.

Need #1

Improve On-Mountain Guest Services

The existing Summit House was built in 1970 and has been expanded and retrofitted several times over the years. The result is a series of disconnected and inefficient spaces and outdated architecture that neither meets guests' needs/expectations nor fits with the character of the resort. The 2009 MDP identifies a 13,000-square foot deficiency at the Summit House in the following areas: bar and lounge space, ski school, restaurant seating, food preparation, restrooms and ski patrol.

In addition, the existing on-site wastewater treatment system for the Summit House is antiquated and requires the maintenance of a septic system, leach fields, and a sewage lagoon on public lands (located south of Adventure Point).

To respond to this need the following projects are proposed:

- Removal and replacement of the Summit House Restaurant with a larger and more efficient facility
- New water and wastewater infrastructure to support this facility

Need #2

Enhance Keystone's Ability to Provide Early Season Terrain

Keystone depends on its snowmaking system to ensure a consistent and quality snow surface throughout the season. Numerous components of the snowmaking system on Dercum Mountain are inefficient in terms of the water, electricity, and time required to maintain and operate them.

On Dercum Mountain, existing snowmaking infrastructure that has historically been used to provide coverage on *Whipsaw*, *Crosscut*, *Bachelor*, *Wild Irishman* and *Jack Straw* trails, as well as trail connectors, is antiquated and inefficient. Furthermore, while snowmaking coverage has historically been provided on *Wild Irishman* and *Jack Straw*, these trails do not have dedicated infrastructure. Instead, hoses are dragged over-the-snow from adjacent trails that have permanent snowmaking infrastructure or snow is pushed with snowcats to cover critical areas.

To respond to this need the following projects are proposed:

- Strategic snowmaking infrastructure upgrades and installations in order to continue to provide coverage on *Bachelor*, *Cross Cut*, *Wild Irishman*, *Whipsaw*, and *Jack Straw* (Note: no new snowmaking coverage is proposed)

Need #3

Improve and Enhance Adventure Point

Adventure Point, at the top of the River Run Gondola, is popular with all ages, including both skiing and non-skiing guests. However, recreational activity at Adventure Point is limited by the confined area in which the facility exists. Furthermore, the guest services at Adventure Point are currently provided in two yurts that are undersized and do not provide restrooms.

To respond to this need the following projects are proposed:

- Enlargement of the existing tubing area at Adventure Point
- Removal and replacement of the existing yurts with a larger, permanent facility with restrooms

Need #4

Improve Teaching/Learning Areas at Keystone's Ski and Ride School

Keystone's teaching/learning areas are located at three sites across Dercum Mountain: at the Mountain House base area; at the River Run Gondola mid-station; and at the summit. Generally, the children's ski school participants stay in the base area and then move onto the Kokomo carpet lift and the Ranger chairlift at the summit of Dercum Mountain; the adult ski school participants start at the summit.

The majority of beginner skiers use the teaching terrain at the summit; therefore, these two lifts and the associated terrain are in high demand. Because surface lifts are ideal for beginner skiers who often times find loading and unloading chairlifts difficult, there is a need for an additional carpet lift at the top of

Dercum Mountain in this popular teaching terrain. Given the heavy use of beginner lifts at the summit, Keystone has identified the need for additional beginner terrain and associated surface lifts elsewhere on Dercum Mountain.

To respond to this need the following projects are proposed:

- Develop new teaching terrain and install an additional surface conveyor lift at the summit of Dercum Mountain
- Install a new surface conveyor lift at the mid-terminal station of the River Run Gondola
- Install a new surface conveyor to accommodate a teaching terrain park above the A-51 terrain park.

Need #5

Improve Upon Keystone's Family Atmosphere

Keystone's reputation as a family-friendly resort is a result of the many children's events offered, Adventure Point, and the innovative teaching terrain (kid-friendly runs and adventure zones). Keystone currently offers adventure zones within tree islands throughout the front side of Dercum Mountain. These adventure zones include obstacles and features that help children learn skiing and riding techniques in engaging ways. The adventure zones are short, isolated courses including *Klondike's Adventure*, *Lost Mine*, *Ripperroo's Forest* and *Ripperoo's Alley*. Often, beginners ride traditional chairlifts to reach adventure zones dispersed throughout the front side of Dercum Mountain, which can be difficult to navigate for families and small children.

Keystone would like to expand on this theme by creating a state-of-the art, dedicated adventure zone with more diverse terrain and features. Central to this theme is a fun and innovative way to teach skills and build confidence while encouraging families to make a stronger connection to the forest and outdoor recreation. Additionally, enhancing the adventure zones with forest interpretive features would broaden the resort's family-friendly reputation, provide an educational aspect for kids and adults, and also provide the opportunity for Keystone to promote its relationship with the Forest Service.

To respond to this need the following project is proposed:

- Conversion of four tree islands on the western side of Dercum Mountain into a dedicated "Family Adventure Zone"

Need #6

Improve Skier Egress from Bergman Bowl

Bergman Bowl is located east of the Outpost on North Peak. The upper bowl has gentle slopes suitable for low intermediates, while the lower slopes are somewhat steeper and suitable for intermediate/advanced intermediate skiers. Keystone Adventure Tours primarily uses the upper half of

Bergman Bowl to begin snowcat tours for guests prior to engaging them in more difficult terrain in Erickson and Independence bowls. To ski out of the bowl, guests must navigate a narrow, treed trail (referred to as *Jane's Journey*), requiring more advanced skills. *Jane's Journey* is not adequate to facilitate Ski Patrol responsibilities in Bergman Bowl.

To respond to this need the following project is proposed:

- Improve Jane's Journey by constructing a groomable egress trail out of Bergman Bowl

Need #7

Separate Resort Snowcats and Guests

Currently, Keystone snowcats navigate between the maintenance facility (at the Mountain House base area), North Peak and the Outback throughout the day and evening. During operational hours, snowcats that drive up and down the front side of Dercum Mountain encounter skiers and riders coming down the mountain. While this is not uncommon in the ski industry, it is every resort's goal to minimize encounters between snowcats/snowmobiles and guests for obvious reasons. Additionally, snowcats that travel up and down the steep terrain between Dercum Mountain and the Outback consume more fuel than traveling a flatter route.

To respond to this need the following project is proposed:

- Construction of a dedicated snowcat access route between the Mountain House maintenance facility and Keystone Gulch Road

Need #8

Improve Lift-Served Mountain Biking at Keystone

Keystone has earned a reputation for its advanced lift-served mountain bike trails and features; however, there is a need to provide more beginner and intermediate bike trails for its guests. The resort has identified opportunities across Dercum Mountain for expanding its beginner and intermediate mountain bike terrain.

Currently lift-served mountain bike trails at Keystone allow riders to choose between easier and more difficult trails several times along each route. Although this can be beneficial for more skilled riders who want to bypass certain trail segments, it can be challenging for lower ability level riders to share trail segments with more seasoned riders. Keystone has identified opportunities across Dercum Mountain for maintaining existing trail connectivity while providing other trail segments that are entirely beginner or intermediate. Additional trail segments could also be designed to offer bikers options to avoid using mountain access roads.

To respond to this need the following project is proposed:

- Construct new beginner, intermediate and advanced mountain bike trails

E. SCOPE OF ANALYSIS

This EA is not a decision document, rather it documents the site-specific environmental analysis for the proposed action alternative, as well as the No Action Alternative. A *draft* Decision Notice (DN) has been prepared to accompany this EA and documents the responsible official's likely decision.

Scope consists of the range of actions, alternatives, and impacts to be considered within this environmental analysis. It includes the geographical, spatial, and temporal boundaries associated with the actions, alternatives, and impacts. Individual project elements are discussed in detail in Chapter 2 and illustrated in Figures 1 and 2. A detailed scope of this environmental analysis is presented at the beginning of each resource section in Chapter 3.

This EA has been prepared in accordance with Council on Environmental Quality (CEQ) regulations for implementing NEPA.[1]

F. IDENTIFICATION OF ISSUES

In accordance with regulatory direction, and in furtherance of cooperative management among federal agencies charged with oversight of environmental and natural resources; federal, state, local, and tribal entities with a likely interest and/or jurisdiction in the Proposed Action were sent scoping notices and/or consulted prior to and throughout the NEPA process.

In February 2012, a notice of proposed action (NOPA) was mailed to community residents, interested individuals, public agencies, and other organizations. The NOPA indicated that the Forest Service made the decision to combine the scoping process with the legal notice and opportunity to comment, as described in 36 CFR 215.3. It was specifically stated that the 30-day NOPA comment period was the only opportunity to submit formal written comments on this project. The public was asked to submit comments by March 9, 2012.

A press release and legal notice were distributed to key local and regional media. In response to the Forest Service's solicitations for public comment, four letters were received. Three of the comment submittals were generally supportive, while one comment submittal was generally opposed to the project. Most substantive comments were related to recreation (four comments) and socioeconomics (two comments), although one comment was provided on water, wildlife, scenery and traffic parking and access. A Response to Comments is included in Appendix B of this EA.

Issues are unresolved conflicts that arise as a result of the Proposed Action. The issues are addressed in Chapter 3 – Affected Environment and Environmental Consequences. Some issues have been addressed through modification of the Proposed Action and/or site-specific Management Requirements (refer to Table 2-3). Resource issues and indicators include:

[1] 40 CFR 1508.25

HUMAN ENVIRONMENT

Recreation

Issue: By design, proposed projects would alter the recreational experience at Keystone, particularly for beginners and families. This extends to winter and summer activities, and includes alternative forms of recreation.

Analytical Indicators:

- Discussion of Keystone's ability to accommodate public skiing of all ability levels, particularly beginners and families.
- Discussion of the recreational opportunities provided at Keystone in all seasons under each alternative.
- Quantitative and qualitative analysis of existing and proposed guest service facilities and infrastructure.

Scenery

Issue: Proposed projects within Keystone's developed lift and trail network (primarily at the summit of Dercum Mountain and the Family Adventure Zone) would have incremental impacts to scenic resources, particularly as viewed from within the ski area.

Analytical Indicators:

- Discussion of the Scenic Integrity Objectives (SIO) for the Project Area, as defined by the 2002 WRNF Land and Resource Management Plan.
- Documentation of the incremental effects to the scenic environment resulting from implementation of the proposed projects compared to historic landscape alterations within the SUP area.
- Discussion of the Forest Service's Built Environment Image Guide (BEIG) as applicable to existing and proposed guest service facilities.
- Perspective rendering of the Summit House facility as compared to the existing condition.

Cultural

Issue: Proposed projects and associated ground disturbing activities may affect known or unidentified cultural resources.

Analytical Indicators:

- Discussion of cultural surveys completed to date in the vicinity of the Project Area.

Social and Economic Resources

Issue: Keystone is an important contributor to the economy of Summit County. In both the short- and long-term, proposed projects could affect employment, personal income (i.e., wages) and workforce housing

Analytical Indicators:

- Potential effects to socioeconomic indicators in Summit County, including: population, employment, housing, and public services (to be modeled in IMPLAN3 software).

PHYSICAL AND BIOLOGICAL ENVIRONMENT

Wildlife and Aquatic Species

Issue: Implementation of proposed projects (including construction and use) could affect Threatened, Endangered and Sensitive (TES) and Management Indicator (MIS) wildlife and aquatic species.

Analytical Indicators:

- Acreage of impacts to Region 2 Sensitive, Management Indicator, and Threatened/Endangered/Candidate species' habitat.
- Identification and analysis of impacts on threatened and endangered aquatic species and habitat present in the Project Area.
- Analysis of physical stream health in the Project Area and the effects on aquatic life.
- Assessment of trout and macroinvertebrate populations in Project Area on streams and at reference sites as based on field surveys.
- Documentation of presence/absence of sensitive amphibians and their habitat within the Project Area.
- Identification of Lynx Analysis Unit (LAU) boundaries, lynx habitat loss and lynx habitat connectivity in relation to the Project Area.

Vegetation

Issue: Plant communities (including Threatened, Endangered, and Sensitive [TES] species, WRNF Species with an Identified Viability Concern [SIVC] and invasive plant species) may be impacted as a result of proposed projects.

Analytical Indicators:

- Identification of TES plant species and habitat present in the Project Area.
- Identification of WRNF species with an identified viability concern and habitat present in the Project Area.
- Quantification (acreage) of proposed ground disturbance and overstory vegetation removal.

Soil Resources

Issue: Proposed ground disturbance may increase erosion and reduce soil organic matter.

Analytical Indicators:

- Discussion of site-specific soil conditions and baseline inventory of soil organic matter.
- Area (acres) of temporary and permanent disturbance according to high/moderate/low erodibility soils classes.
- Analysis of increased erosion hazard due to ground disturbance.

Watershed and Wetlands

Issue: Proposed ground disturbance (e.g., clearing and grading) may contribute sediment and reduce stream bank stability in Camp Creek, Redemption Creek and Jones Gulch and affect riparian habitat, wetlands and fisheries.

Issue: Project activities may cause changes in surface and groundwater hydrology that support streams and wetlands.

Issue: The proposed activities have the potential to add to the effects of past vegetation management and snowmaking that have increased surface runoff and groundwater recharge rates and accelerated erosion processes in places where drainage structures are not adequate to route water effectively off the mountain.

Issue: Proposed ground disturbance (e.g., clearing and grading) may affect the quantity and quality of wetlands within the Study Area.

Analytical Indicators & Requirements:

- Identification/quantification of waters of the U.S., including wetlands in the vicinity of the Project Area.
- Identification of any Clean Water Act (CWA) impaired or threatened waterbody segments in the Project Area.
- Quantification of changes in water yield or discharge to receiving streams from proposed clearing and grading.
- Quantification of connected disturbed areas (CDA) in the vicinity of the Project Area.
- Identification of clearing and grading in the Water Influence Zone (WIZ).
- Narrative description of effects to wetland functions and values.

- Quantification of existing stream health in Camp Creek and narrative description of how the project is expected to affect stream health.
- Narrative discussion of how the project is expected to affect the presence of rill and gully erosion.

Geotechnical Stability

Issue: Proposed ground disturbance and vegetation removal could affect slope stability on Dercum Mountain.

Analytical Indicators:

- Analysis of slope stability and geological constraints associated with project components.

G. CONSISTENCY WITH THE WRNF'S 2002 LRMP

Keystone operations carried out on NFS lands within the SUP area must comply with the management direction as provided in the 2002 Revised White River National Forest Land and Resource Management Plan (2002 Forest Plan). The 2002 Forest Plan includes 33 separate Management Areas for different portions of the forest based on ecological conditions, historic development, and anticipated future conditions. The Keystone SUP area falls within the 8.25 Management Area (Ski Areas–Existing and Potential), which directs:

> *"Facilities may be intensively used throughout the year to satisfy a variety of seasonal recreational demands. Base areas that serve as entrance portals are designed as gateways to public lands. Forested areas are managed as sustainable cover with a variety of species and age classes in patterns typical of the natural landscape character of the area. Protection of scenic values is emphasized through application of basic landscape aesthetics and design principles, integrated with forest management and development objectives."*[2]

As part of this analysis, the Proposed Action and Purpose and Need were reviewed to determine consistency with the 2002 Forest-wide Goals and Objectives as well as the specific Standards and Guidelines for Management Area 8.25, which provide direction for ski areas—existing and potential. The 2008 Southern Rockies Lynx Management Direction (SRLMD) amended the 2002 Forest Plan with respect to Forest-wide and Management Area 8.25 Canada lynx standards and guidelines. The Proposed Action and Purpose and Need were also compared with this amendment to determine consistency. No inconsistencies between the proposal and pertinent standards and guidelines were identified.

[2] USDA Forest Service, 2002

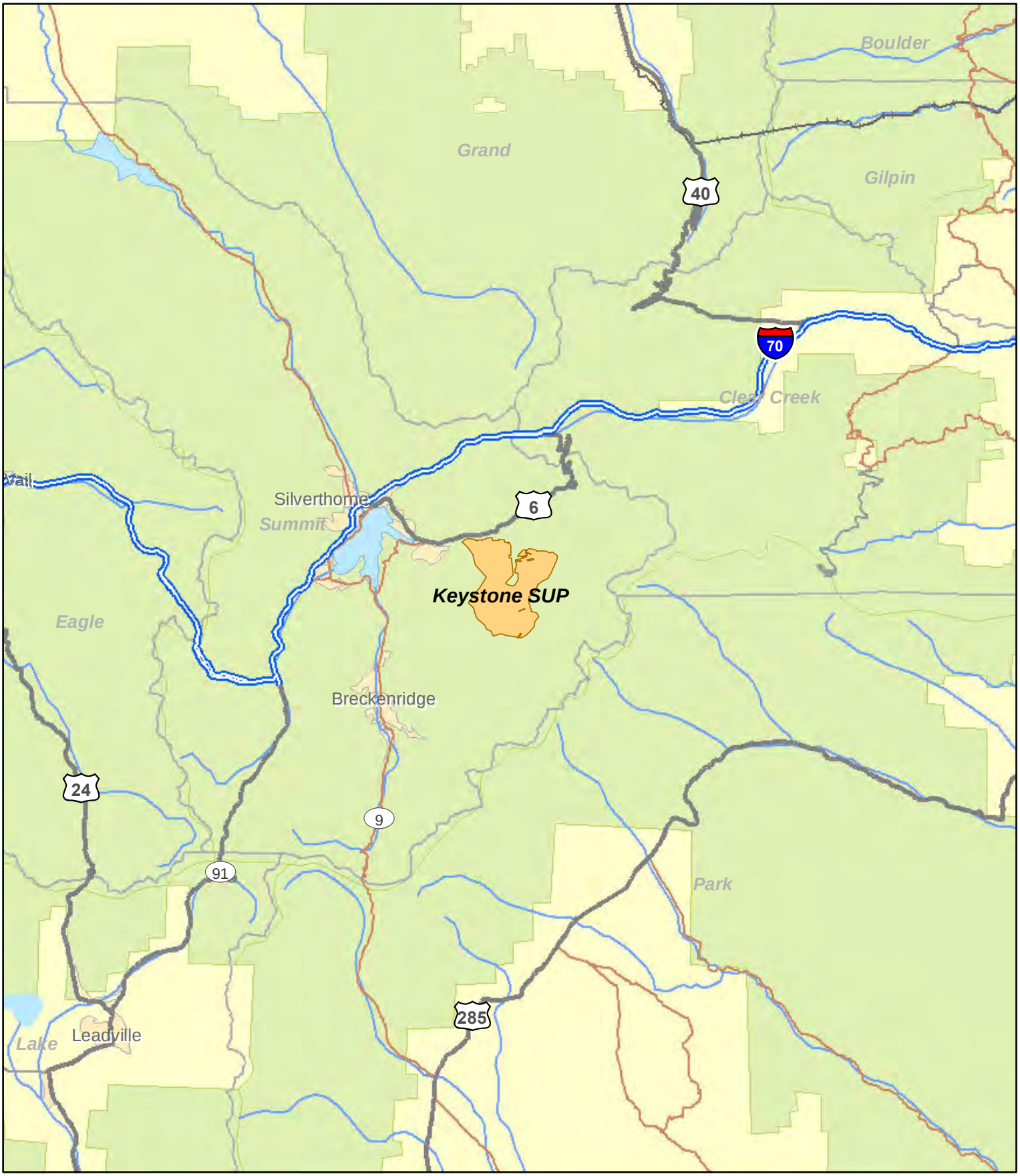
H. OTHER NECESSARY PERMITS, LICENSES, ENTITLEMENTS AND/OR CONSULTATION[3]

This EA is designed to serve as an analysis document for parallel processes at several levels of government. The Forest Service decision would apply only to NFS lands analyzed within this EA. However, potential effects resulting from implementation of an action alternative on lands and activities administered by other federal, state, and local jurisdictions are also disclosed within this EA. The U.S. Army Corps of Engineers (USACE) has developed protocols for the delineation of wetlands. These procedures were followed for the delineation of wetlands within or adjacent to project element areas.

Decisions by jurisdictions to issue or not issue approvals related to this proposal may be aided by the analyses presented in this EA. While the Forest Service assumes no responsibility for enforcing laws, regulations, or ordinances under the jurisdiction of other governmental agencies, Forest Service regulations require permittees to abide by applicable laws and conditions imposed by other jurisdictions. In addition to requisite Forest Service approvals, the following permits or approvals may be required to implement an action alternative:

- State of Colorado, Stormwater Management Plan
- US Fish and Wildlife Service, ESA Section 7 Consultation
- Summit County Building Construction Permit
- Summit County grading permit for construction of portions of the Keystone Gulch Snowcat Access Route on private lands

[3] Per 40 CFR 1502.25(b)



Keystone Dercum Mountain Improvements Project EA
Vicinity Map

Prepared By: SE GROUP

0 2 4 8 Miles

Chapter 2
Description of Alternatives

2. DESCRIPTION OF ALTERNATIVES

A. INTRODUCTION

This chapter includes a discussion of how alternatives were developed, an overview of Management Requirements, a description of each alternative considered in detail, and a comparison of these alternatives.

B. ALTERNATIVES CONSIDERED IN DETAIL[4]

The range of alternatives the Forest Service Interdisciplinary Team (ID Team) considered for this analysis was bound by the Purpose and Need for Action, as well as by the issues which arose from internal and external scoping (detailed in Chapter 1). NEPA requires that an environmental analysis examine a range of alternatives, which are "reasonably related to the purpose of the project."[5] Furthermore, Forest Service Handbook 1909.15 directs the ID Team to "consider a full range of reasonable alternatives to the Proposed Action that address the significant issues and meet the Purpose and Need for the Proposed Action."[6]

Due to the scope and scale of the Proposed Action, two alternatives are analyzed in detail in this EA. Alternatives 1 and 2 are defined here, and depicted on Figures 1 and 2, respectively.

ALTERNATIVE 1 – NO ACTION

The No Action Alternative essentially reflects a continuation of existing recreational and operational activities within Keystone's SUP area without changes, additions, or upgrades. No new recreational opportunities, facilities, snowmaking infrastructure or trail improvements are included in this alternative.

The following discussion is focused on existing facilities, operations and opportunities relative to the Proposed Action. For a map of the existing facilities and operations, refer to Figure 1.

Summit House

Under the No Action Alternative, no changes to the current configuration of the 13,000-square foot Summit House facility would occur. Although it falls short of meeting Keystone's needs, nor guest expectations, the following services would continue to be offered at the Summit House: bar and lounge space, ski school space, restaurant seating, food preparation, restrooms and ski patrol.

[4] Refer to Tables 2-1 and 2-2 for a summary of the differences between the alternatives.
[5] 40 CFR 1502.14(a)
[6] USDA Forest Service, 2008

The Summit House would continue to rely on the on-site wastewater treatment system south of Adventure Point (composed of a septic system, leach fields, and a sewage lagoon). However, the wastewater treatment system would be expected to require additional maintenance in the future.

Adventure Point

Under the No Action Alternative, no changes to the Adventure Point area would occur. Guest services (with the exception of restrooms) would continue to be provided at two yurts.

Teaching Areas

Under the No Action Alternative, no changes to the existing teaching areas at Keystone would occur. Keystone would continue to provide learning/teaching areas located at three sites across Dercum Mountain: at the Mountain House base area; at the River Run Gondola mid-station; and at the summit.

Adventure Zones

Under the No Action Alternative, Keystone would continue to offer adventure zones within tree islands throughout the front side of Dercum Mountain. Existing adventure zones would remain short, isolated courses including *Klondike's Adventure*, *Lost Mine*, *Ripperoo's Forest* and *Ripperoo's Alley*. Beginners would continue to access these adventure zones dispersed throughout the front side of Dercum Mountain by riding chairlifts, which can be difficult for families and small children.

Jane's Journey Snowcat Skiing Egress

Under the No Action Alternative, *Jane's Journey* would continue to provide skier egress from Bergman Bowl. In its current form, *Jane's Journey* is narrow and does not facilitate proper guest and patrol use.

Keystone Gulch Snowcat Access Route

Snowcats would continue to navigate between the maintenance facility (at the Mountain House base area), North Peak and the Outback by travelling on trails across Dercum Mountain.

Mountain Bike Trails

Lift-served mountain bike trails at Keystone would continue to total approximately 55 miles within the SUP area.

Snowmaking Infrastructure

Under the No Action Alternative, no changes to snowmaking infrastructure at Keystone would occur. Keystone's existing snowmaking system is capable of providing coverage across approximately 655 acres of terrain.

ALTERNATIVE 2 – THE PROPOSED ACTION

Components of the Proposed Action focus on addressing the Purpose and Need for Action identified in Chapter 1. If approved, construction of the proposed improvements would occur primarily in the summer months and, given the short construction season at Keystone's higher elevations, are expected to be completed over multiple construction seasons. In conjunction with any approved ground disturbing activities, Management Requirements identified in Table 2-3 would be implemented to avoid or minimize resource impacts (e.g., soil and water). All disturbed areas would be revegetated and stabilized promptly. For a map of the proposed facilities and operations, refer to Figure 2.

Summit House

The Summit House is proposed to be replaced with a larger, multi-story facility (approximately 20,000 square feet) with capacity for roughly 700 indoor guests and 200 outdoor guests. The new Summit House would accommodate daytime and evening use, food service, ski patrol, restrooms, and ski school. The facility could also accommodate special events throughout the year (e.g., weddings).

The new Summit House facility would be constructed consistent with the provisions of the Forest Service's Built Environment Image Guide (BEIG) and would incorporate energy efficient building systems. The new design would better fit with the existing buildings at Keystone and would incorporate ranching, mining and/or rustic influences as prescribed by the BEIG for the Rocky Mountain Province. Under BEIG standards, the building form would be relatively simple and compact with pitched roofs and modest overhangs. Natural building materials, such as stone, wood, and heavy timber would be used when available and practical. Color schemes would be inspired by the natural surroundings.

While the exact location of the new Summit House facility has not been determined, given the previously-disturbed nature of the summit of Dercum Mountain, this analysis includes a large potential disturbance area to allow Keystone and the Forest Service to identify the most suitable location. This would allow flexibility for the final site location, ensuring that the final location has been fully analyzed for all resource impacts (e.g., soils and botany).

Adventure Point

To better accommodate existing use at Adventure Point, the existing tubing area is proposed to be expanded to accommodate current and future use (refer to Figure 2). **Note**: no additional snowmaking is proposed at Adventure Point.

The existing yurts at Adventure Point are proposed to be removed and replaced with a new 2,500-square foot permanent facility. The proposed Adventure Point facility would better accommodate operations and guest needs, and would include a small food and beverage service outlet, observation platform, restrooms, ticketing and storage. Keystone's long-term goal for this proposed facility is for it to become a year-

round, interactive outdoor adventure complex that integrates the tubing operations with the summer mountain biking program.

The proposed Adventure Point facility would be located uphill (west) of the existing yurts and is designed to minimize conflicts with existing skier circulation and infrastructure. As with the proposed Summit House facility, it would be constructed consistent with the provisions of the BEIG. Utility lines for this proposed facility would tie into the Summit House infrastructure. The location of the existing yurts would be revegetated.

Infrastructure

New water and wastewater systems would be required to support both the proposed Summit House and the adjacent Adventure Point tubing facility. Water and wastewater lines are proposed from the summit, down the south side of Dercum Mountain on *Diamond Back*, tying into existing sewer and well water services located on the Keystone Gulch Road. These new sewer lines would eliminate the need for the septic system, leach fields, and a sewage lagoon on NFS lands south of Adventure Point.

Teaching Area and New Carpet Lifts

The existing learning area on the southwest summit of Dercum Mountain is proposed to be supplemented. West of the Summit House—between the Ranger and Kokomo lifts—a new 4-acre teaching terrain is proposed to be serviced by a conveyor lift.

Two other areas are proposed for new teaching (carpet) lifts: 1) the lower end of *Schoolmarm* uphill of the Peru Express top terminal; and 2) near the mid-station of the River Run Gondola. The proposed teaching lift at the mid-station of the Gondola would supplement an existing carpet lift already in that location. This area is especially busy on days with inclement weather. The proposed carpet lift uphill of the Peru Express would service a terrain park teaching area near the more advanced A-51 Terrain Park.

Family Adventure Zone

Four tree islands on the western side of Dercum Mountain are proposed to be developed into a "Family Adventure Zone." The Family Adventure Zone is intended to be a unique amenity that would further Keystone's ability to meet the needs of families. The intent of this project is to provide the opportunity to promote the partnership between the Forest Service and Keystone in helping families make a stronger connection to the forest and outdoor recreation.

Construction of the Family Adventure Zone would involve grading, tree clearing, infrastructure (i.e., electrical lines) and construction of numerous interactive features within and around the tree islands on *Schoolmarm*, *Schoolmaster* and *Hoodoo* to create a unique family-oriented experience. The project entails developing trail sections into interactive, educational, skiing/riding features for children of all ages and ability levels and their families. It is important to note that it is not intended to be a "park" (such as a

terrain park), but is proposed to help children learn the basics of skiing and riding through an educational and interpretative process.

Permanent and seasonal components of the Family Adventure Zone would include hands-on and interactive features such as wooden bridges, a tunnel, snow forts/igloos, tree houses, a mock fire lookout tower, and ecological and educational attractions (refer to Photo 2-1, below). Refer to Figure 2 for the location of the Family Adventure Zone.

Photo 2-1:
Example a Family Adventure Zone Constructed Feature

Jane's Journey Snowcat Skiing Egress

In order to improve egress for guests and ski patrol in Bergman Bowl, the existing *Jane's Journey* egress trail is proposed to be realigned to create a groomable trail. The proposed trail would be approximately 30 feet wide and 3,500 feet long, requiring minimal tree removal and spot grading along its extent.

Keystone Gulch Snowcat Access Route

A snowcat access route is proposed to connect the maintenance shop near the Mountain House base area west to Keystone Gulch Road. This dedicated snowcat access route is designed to eliminate snowcat/skier conflicts as well as reduce fuel consumption between the Outback and Mountain House. The approximately 35-foot wide route would extend for approximately 5,150 feet and would generally follow

Granny's mountain bike trail alignment, requiring tree removal and grading along its extent. The area would be revegetated upon completion of construction.

Mountain Bike Trails

Seven new mountain bike trails (totaling approximately 9 miles) are proposed on Dercum Mountain. The intent of new mountain bike trails is threefold: 1) divide trails into distinct ability level zones—beginner, intermediate and advanced; 2) develop more beginner and intermediate trails; and 3) minimize vehicle/bike conflicts. Proposed mountain bike trails would be constructed using a combination of hand tools and machinery, and would require grading and tree removal for the length of each trail. The following proposed trails are identified, by number, on Figure 2.

- MTB #1: a 3.5-mile beginner trail starting at the summit of Dercum Mountain and terminating at the base of the resort.
- MTB #2: a 1-mile intermediate route off the summit of Dercum Mountain.
- MTB #3: a 0.5-mile intermediate extension of an existing advanced trail.
- MTB #5: a 2.5-mile intermediate trail.
- MTB #6: a 0.25-mile intermediate trail providing access to *Helter*, an existing 3-mile intermediate trail.
- MTB #7: a 1-mile intermediate trail designed to improve circulation and improve trail safety by reducing usage of an existing intermediate trail in the same area.
- Girl Scout Trail extension: As the existing Girl Scout Trail is intersected by advanced trails, the design intent is to separate different ability levels and create a more appropriate trail for intermediate riders.

The single proposed beginner trail (MTB #1) would be approximately 8 feet wide, while the intermediate trails would be approximately 3 to 6 feet wide. Wetlands within the vicinity of the trails would be avoided or bridged.

Snowmaking Infrastructure

Existing snowmaking infrastructure that has historically accommodated coverage on *Bachelor, Cross Cut, Wild Irishman, Whipsaw, and Jack Straw* is proposed to be replaced and/or expanded. Replaced and expanded snowmaking infrastructure on these heavily used trails would expedite snowmaking operations and improve snow consistency. *Note that the amount of water currently used to provide coverage on these trails would not increase as a result of proposed upgrades*. All disturbed areas would be revegetated and returned to their pre-construction condition.

MODIFICATIONS MADE TO THE PROPOSED ACTION

The original Proposed Action (as described in the February 2012 NOPA) included new snowmaking infrastructure and coverage on Dercum Mountain. New snowmaking project included: *School Master*, *Hoodoo* (related to the proposed Family Adventure Zone), around the expanded Adventure Point snowtubing area, around the proposed surface conveyor near the mid-station of the River Run Gondola, and on the proposed beginner area between the Ranger and Kokomo lifts.

Between February 2012, when the NOPA was released, and summer 2013 the Proposed Action was modified based on input from Forest Service resource specialists concerning the potential impacts to stream health in sub-watersheds on Dercum Mountain, as well as geotechnical impacts, of adding more water to Dercum Mountain in the form of snowmaking. As a result, all **new** snowmaking coverage (and related infrastructure) was removed from the Proposed Action. The only snowmaking projects that remain in the Proposed Action are upgrades related to making the existing system more efficient and reliable (refer to description of the Proposed Action, above).

C. COMPARISON OF ALTERNATIVES

Table 2-1 is provided to aid the reader in comparing and contrasting each of the alternatives by project element.

Table 2-1:
Alternative Comparison Matrix

	Alternative 1 No Action	Alternative 2 The Proposed Action
SUP BOUNDARY	8,536 acres	8,536 acres
SKI AREA CAPACITY (CCC)	12,110	12,110
SKIABLE TERRAIN		
Beginner	3.7 acres	8.7 acres
Novice	124.9 acres	124.9 acres
Low Intermediate	79.5 acres	69.5 acres
Intermediate	455.2 acres	455.2 acres
Advanced Intermediate	216.2 acres	216.2 acres
Expert	12.3 acres	12.3 acres
Total	*891.1 acres*	*886.8 acres*
LIFT NETWORK		
Aerial Chairlifts	13	13
Surface Lifts	7	10
Total	*20*	*23*
SNOWMAKING COVERAGE	655 acres	655 acres

Table 2-1:
Alternative Comparison Matrix

	Alternative 1 No Action	Alternative 2 The Proposed Action
GUEST SERVICES AT THE SUMMIT OF DERCUM MOUNTAIN		
Summit House	16,770 sq. ft.	~20,000 sq. ft.
Adventure Point	~1,400 sq. ft.	~2,500 sq. ft.
MOUNTAIN BIKE TRAILS	~55 miles	~64 miles

For the purpose of comparison, the environmental consequences associated with implementation of the previously described alternatives are summarized in Table 2-2. This represents a summary of the detailed analyses and disclosures found on a resource-by-resource basis throughout Chapter 3. For detailed discussions of potential effects resulting from implementation of either of the alternatives, including cumulative effects, refer to Chapter 3.

Table 2-2:
Summary Comparison of Environmental Consequences by Alternative

Issue/Indicator	Alternative 1 No Action	Alternative 2 The Proposed Action
RECREATION ***By design, proposed projects would alter the recreational experience at Keystone, particularly for beginners and families. This extends to winter and summer activities, and includes alternative forms of recreation.***		
Accommodation of public skiing of all ability levels, particularly beginners and families	No change.	The recreational experience/family-friendly atmosphere at Keystone would improve with the additional teaching terrain, the Family Adventure zone, improvement to Adventure Point, and snowmaking improvements.
Recreational opportunities provided at Keystone in all seasons	No change.	Keystone would maintain, and improve, its reputation for advanced lift-served mountain bike trails and features, while adding opportunities for lower ability level riders.
Guest service facilities and infrastructure	No change.	More functional, efficient and aesthetically pleasing on-mountain guest service facilities at the summit of Dercum Mountain (at the Summit House and Adventure Point) would improve guest services.
SCENERY ***The incremental effects of proposed projects within Keystone's developed lift and trail network (primarily at the summit of Dercum Mountain and the Family Adventure Zone) would have incremental impacts to scenic resources, particularly as viewed from within the ski area.***		
Scenic Integrity Objectives (SIO) for the Project Area, as defined by the 2002 WRNF Land and Resource Management Plan	Meets the *Very Low* SIO.	Implementation of the Proposed Action would not affect Keystone's compliance with the *Very Low* SIO.

Table 2-2:
Summary Comparison of Environmental Consequences by Alternative

Issue/Indicator	Alternative 1 No Action	Alternative 2 The Proposed Action
Incremental effects to the scenic environment resulting from implementation of the proposed projects compared to historic landscape alterations within the SUP area	No change.	Due to the existing developed visual character of the Project Area, implementation of Alternative 2 would represent an incremental and inconsequential change to the appearance of the Keystone SUP.
Discussion of the Forest Service's BEIG as applicable to existing and proposed guest service facilities	N/A	Proposed facilities at the summit of Dercum Mountain (Summit House and Adventure Point) would better fit with the other existing buildings at Keystone and would conform to the architectural character prescribed in the BEIG.
Perspective rendering of proposed landscape alterations surrounding the Summit House facility as compared to the existing condition.	Refer to Figure 3.	Refer to Figure 3.
CULTURAL ***Proposed projects and associated ground disturbing activities may affect known or unidentified cultural resources.***		
Cultural surveys completed to date in the vicinity of the Project Area	The majority of Keystone's SUP area was inventoried for cultural resources in 1982 and 1983. Relative to the Proposed Action, areas that were not included in the 1982 and 1983 inventories were inspected in July 2012 and August 2013	
Inventory of the Project Area for cultural resources and historic properties	There is no potential to affect the historic sites within the APE.	Implementation of Alternative 2 would have "no effect" on any known NRHP-listed or eligible historic properties within the APE.
SOCIAL & ECONOMIC RESOURCES ***Keystone is an important contributor to the economy of Summit County. In both the short- and long-term, proposed projects could affect employment, personal income (i.e., wages) and workforce housing***		
Potential effects to socioeconomic indicators in Summit County, including: population, employment, housing, and public services (to be modeled in IMPLAN3 software).	No direct or indirect impacts.	On-going operation of the Proposed Action would directly create 12 seasonal positions (6 FTEs) at Keystone. Current vacancies in Keystone employee housing could accommodate the 12 additional (primarily seasonal) employment positions at Keystone resulting from the Proposed Action.
WILDLIFE & AQUATICS ***Implementation of proposed projects (including construction and use) could affect Threatened, Endangered, or Proposed Species, Sensitive Species, and Management Indicator (MIS) wildlife and aquatic species.***		
Impacts to Threatened, Endangered or Proposed Species.	*No Effect* to any TEP species.	*No Effect* to any TEP species, with two exceptions: • Canada lynx: NLAA • N. American Wolverine: NLJ

Table 2-2:
Summary Comparison of Environmental Consequences by Alternative

Issue/Indicator	Alternative 1 No Action	Alternative 2 The Proposed Action
Impacts to MIS Species or habitat.	No direct or indirect impacts.	Management Requirements (Table 2-3) are designed to avoid, minimize, and mitigate the potential for soil and slope destabilization, erosion, and sedimentation from disturbance areas that could alter aquatic communities. The Proposed Action would not measurably contribute to any negative trend in the Forest-wide population or habitat trend of elk, aquatic macroinvertebrates, or All Trout that would affect achieving Forest Plan MIS objectives.
Impacts to R2 Sensitive Species.	No direct or indirect impacts.	"*May impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing*" for all R2 sensitive species analyzed.
VEGETATION ***Plant communities (including Threatened, Endangered, and Sensitive [TES] species) may be impacted as a result of proposed projects.***		
TES plant species and habitat present in the Project Area	No direct or indirect impacts.	The Proposed Action would have no effects on any TEP species. For the five R2 sensitive species with potentially suitable habitat in the Project Area: • Triangleglobe moonwort: MAII • Slender moonwort: MAII • Peculiar moonwort:MAII • Yellow lady's slipper: No Impact • Dwarf raspberry: No Impact
SOILS ***Proposed ground disturbance may increase erosion and reduce soil organic matter.***		
Area (acres) of soil disturbance, by type	No direct or indirect impacts.	Alternative 2 would result in approximately 1 acre of grading, 20 acres of tree removal and grading, 2 acres of tree removal, and 24 acres of regrading within previously graded areas. No areas of "Severe" or "High" risk within the areas of proposed soil disturbance were identified. Implementation of soil management requirements would minimize erosion and impacts to soil organic material in the Project Area.

Table 2-2:
Summary Comparison of Environmental Consequences by Alternative

Issue/Indicator	Alternative 1 No Action	Alternative 2 The Proposed Action
GEOTECHNICAL STABILITY ***Proposed ground disturbance and vegetation removal could affect slope stability on Dercum Mountain.***		
Analysis of slope stability and geological constraints associated with project components.	No direct or indirect impacts.	For the most part, projects contained in the Proposed Action are not predicted to have any negative effects on geology, geologic hazards, or geotechnical slope stability. Recommended PDF and mitigation measures have been identified to further reduce any potential impacts.
WATERSHED AND WETLANDS ***Proposed ground disturbance (e.g., clearing and grading) may contribute sediment and reduce stream bank stability in Camp Creek, Redemption Creek and Jones Gulch and affect riparian habitat, wetlands and fisheries.*** ***Project activities may cause changes in surface and groundwater hydrology that support streams and wetlands.*** ***The proposed activities have the potential to add to the effects of past vegetation management and snowmaking that have increased surface runoff and groundwater recharge rates and accelerated erosion processes in places where drainage structures are not adequate to route water effectively off the mountain.*** ***Proposed ground disturbance (e.g., clearing and grading) may affect the quantity and quality of wetlands within the Analysis Area.***		
Identification/quantification of waters of the U.S., including wetlands in the vicinity of the Project Area.	Approximately 158 acres of wetlands were identified within the Analysis Area (refer to Table 3H-1).	
Identification of any Clean Water Act (CWA) impaired or threatened waterbody segments in the Project Area.	None of the stream segments within the Analysis Area are listed on the Colorado State 303(d) list as impaired streams under the Clean Water Act.	
Quantification of changes in water yield or discharge to receiving streams from proposed clearing and grading.	No direct or indirect impacts.	Calculated water yield increase: 14.4 total AF.
Quantification of connected disturbed areas (CDA) in the vicinity of the Project Area.	A field investigation completed during the fall of 2011 and summer of 2012 as part of Keystone's Drainage Management Plan provides important information regarding existing conditions related to stream health. Data collected during the field investigation, such as location and characteristics of roads, road-side ditches, culverts, etc., was incorporated into a Geographic Information System (GIS) database in order to estimate the spatial extent of CDAs. Results from this investigation that are relevant to the CDAs analysis are displayed in Table 3J-8.	

Table 2-2:
Summary Comparison of Environmental Consequences by Alternative

Issue/Indicator	Alternative 1 No Action	Alternative 2 The Proposed Action
Identification of clearing and grading in the Water Influence Zone (WIZ).	No direct or indirect impacts.	Approximately 1.0 acre of Camp Creek's WIZ and 0.7 acre of Mozart Creek's WIZ would be impacted by tree removal and grading associated with the proposed FAZ and Jane's Journey trails, respectively.
Narrative description of effects to wetland functions and values.	No direct or indirect impacts.	To avoid impacts to wetlands, proposed mountain bike trails would rerouted or wetlands would be bridged. Rather than grading the entire extent of *Jane's Journey*, portions of the trail that lie within wetland boundaries would be cleared of vegetation, approximately 0.68 acre, over the snow to avoid any ground disturbance. Impacts to wetlands on the *Whipsaw* and *Wild Irishman*, where snowmaking pipelines are proposed, would be avoided by installing pipelines above ground wherever wetlands crossings are required. With these design features, the Proposed Action would avoid and minimize wetland impacts and therefore comply with all management direction concerning wetlands.
Quantification of existing stream health in Camp Creek and narrative description of how the project is expected to affect stream health.	The WRNF completed a Stream Channel Condition Survey for stream reaches located in the Camp Creek and Jones Gulch watersheds. The results of the Channel Survey are summarized in Table 3J-7.	Field observations indicate that impacts resulting from the Proposed Action, including water yield increases, in the Camp Creek, Redemption Creek, WS #3, WS #5, and WS #18 must be mitigated in order to comply with the WCPH. These are watersheds that have experienced slope stability problems due to a combination of geologic characteristics and increased water yields. PDF have been designed to protect stream health and maintain consistency with the WCPH. With adherence of identified PDF, the Proposed Action would be consistent with the WCPH and would not adversely impact the health of Analysis Area watersheds.
Narrative discussion of how the project is expected to affect the presence of rill and gully erosion.	N/A	PDF have been incorporated into the Proposed Action to minimize or avoid rill and gully erosion.

D. MANAGEMENT REQUIREMENTS DESIGNED TO MINIMIZE/AVOID ENVIRONMENTAL EFFECTS

In order to minimize potential resource impacts from construction and implementation of the proposed projects, Management Requirements (including Project Design Features [PDF] and Best Management Practices [BMPs]) detailed in Table 2-3 have been incorporated into the Proposed Action.

The bulk of the Management Requirements provided in Table 2-3 are considered common practices that ski areas have historically used in alpine and sub-alpine environments to prevent or decrease potential resource impacts. However, some Management Requirements were designed specifically around the proposed projects.

PDFs and BMPs were designed by the Forest Service, Keystone, and specialists involved in this analysis. The potential effects of implementing the Proposed Action (disclosed in Chapter 3) assume these Management Requirements are applied.

In addition to the Management Requirements prescribed below for each resource area, Keystone would be required to prepare and submit the following documents for Forest Service approval:

- Project construction and grading plans.
- Pre-construction erosion control/drainage management plans.
- Pre- and post-construction noxious weed control plans.
- Post-construction erosion control plans.
- Post-construction revegetation plans.

Keystone's Drainage Management Plan (DMP) has been accepted and approved by the WRNF and while some of the DMP projects are currently underway, others would be applied as PDFs for projects contained in the Proposed Action. These DMP projects are also listed in Table 2-3, below.

Table 2-3:
Management Requirements

CULTURAL AND HERITAGE RESOURCES
Although site-specific surveys have been conducted, if undocumented historic and/or prehistoric properties are located during ground disturbing activities or planning activities associated with approved construction activities, they will be treated as specified in 36 CFR 800.11 concerning Properties Discovered During Implementation of an Undertaking.
SCENIC RESOURCES
Individual components of the Family Adventure Zone will be designed in coordination with the Forest Service Landscape Architect to ensure they are consistent with Forest Service policy for the built environment.
Facility and structure design, scale, color of materials, location, and orientation will be incorporated into proposed buildings to meet the scenic integrity objective for this Project Area and the Built Environment Image Guide guidelines.
FSM guidelines (Section 2380) and Built Environment Image Guide (BEIG) guidelines will be followed: • The scenic character will be protected through appropriate siting of buildings and the use of low-impact materials and colors (e.g., indigenous construction materials, such as stone and wood, as well as low-reflective glass and roofing materials). • Remain in context with the landscape (i.e., influenced by rustic, ranching, mining and railroad styles). • Architecture, materials, and colors should follow the Forest Service's Built Environment Image Guide (BEIG).
Facilities or structures including buildings, lift terminals and chairs need to meet reflectivity guidelines. This includes any reflective surfaces (metal, glass, plastics, or other materials with smooth surfaces), that do not blend with the natural environment. They should be covered, painted, stained, chemically treated, etched, sandblasted, corrugated, or otherwise treated to meet the solar reflectivity standards. The specific requirements for reflectivity are as follows: Facilities and structures with exteriors consisting of galvanized metal or other reflective surfaces will be treated or painted dark non-reflective colors that blend with the forest background to meet an average neutral value of 4.5 or less as measured on the Munsell neutral scale.
Facilities or structures need to meet color guidelines. Bright colors are inappropriate for the forest setting. The colors should be muted, subdued colors because they blend well with the natural color scheme. The Forest Service Handbook No. 617, "National Forest Landscape Management for Ski Areas, Volume 2, Chapter 7," refers recommended colors for ski areas on page 37 of that handbook. The colors are darker colors; greens, browns, navy blue, grays and black.
VEGETATION
Where Sensitive plant species and plant species of Local Concern (SOLC) are found in the Project Area the following design criterion applies. The WRNF zone botanist will recommend to the line officer where site specific protection measures are needed, including activity restrictions (area, timing, retaining felled trees on-site to provide connectivity/linkage of habitats, etc.), such that implementation will not result in a trend toward Federal listing or loss of population viability. (Forest Plan PETS Standard #3; Forest Plan Plant Species of Viability Concern Standard #1; DR 9500-4)
Through project design, *Botrychium* populations will be identified on the ground and buffered from management actions that would directly or indirectly negatively impact population viability. While avoidance is preferred, over-snow logging may be allowed within occupied habitat. Negative impacts to *Botrychium* populations will be avoided or minimized when populations are dormant under frozen soil. Do not designate landings, burn piles and other concentrated disturbances in habitat occupied by *Botrychium* species. (Forest Plan Plant Species of Viability Concern Standard #1; PETS Standard #3; IDT; DR 9500-4)
Re-vegetation should be completed using native species where feasible, preferably collected from local genetic stock or seed available from local Forests' Native Plant Materials programs. (Forest Plan Biodiversity Standard #1; Forest Plan Biodiversity Guideline #1; FSM 2070)

Table 2-3:
Management Requirements

All mulch, hay and straw used shall be certified weed-free. Seed testing for noxious weed seed should be done as feasible, depending on the size of the Project Area, timing and other considerations. (Forest Plan Weeds Standard #3)
Sites with low erosion potential, suitable native seed sources nearby, and low risk of colonization by noxious weeds or other harmful invasive plant species, may be allowed to re-vegetate naturally. If these conditions do not apply or if there is a need to accelerate the natural re-vegetation process, apply erosion control measures and/or seed or plant the site according to the approved seed mix from the ski area's operating plan.
Tree clearing limits will be adequately marked to minimize mistakes in clearing limits during construction.
Any Engelmann spruce that is felled must be either removed from the area or treated within one year after felling to prevent the buildup of spruce bark beetle. Treatments can include burning, burying or peeling the bark off felled Engelmann spruce.
Any loss of riparian vegetation caused by construction activities should be re-vegetated immediately after construction with native vegetation, willow cuttings, and/or native, certified, weed free seed.
Vegetative buffers will be maintained adjacent to intermittent or perennial drainages and wetlands, to the extent possible. Where avoidance is not possible, impacts will be minimized in sensitive areas. Hand-felling should occur where necessary and feasible.
In all areas where grading or soil disturbance will occur, topsoil or other organic amendment will be stockpiled and re-spread following slope grading and prior to re-seeding where possible/practical.
Soil-disturbing activities will be avoided during periods of heavy rain, runoff, or wet soils.
Areas determined to have been compacted by construction activities may require mechanical subsoiling or scarification to the compacted depth to reduce bulk density and restore porosity.
NOXIOUS WEEDS
To minimize the spread of noxious weeds during construction, the following measures will apply: a. All construction equipment will be cleaned prior to entry onto NFS land. b. Equipment may require Forest Service inspection prior to moving it from areas infested with invasive species of concern to areas free of such invasive species. Reasonable measures will be taken to make sure equipment is free of soil, seeds, vegetative matter, or other debris that could contain noxious weed seeds before moving into the Project Area. c. All equipment surfaces should be cleaned, especially drive systems, tracks and "pinch points" to ensure removal of potentially invasive debris. Reasonable measures include pressure-washing or steam cleaning in an offsite location so oil, grease, soil and plant debris can be contained and provide optimal protection of Project Areas. d. A Forest Service Representative shall be notified at least 24 hours in advance of off-road equipment arriving on the Forest, to provide the option of inspecting the equipment to ensure it has been cleaned as required. e. Equipment may also require inspection prior to moving it from areas infested with invasive species of concern to areas free of such invasive species. Those areas can be identified prior to project implementation with the Forest Service Weed Program Manager. f. Reasonable measures include pressure-washing or steam cleaning in an offsite location so oil, grease, soil and plant debris can be contained and provide optimal protection of Project Areas. (Noxious Weed Standards #1 and 4 [p. 2-30])

Table 2-3:
Management Requirements

Existing infestations will be treated within and adjacent to travel routes prior to implementing the project to help eradicate/control existing weeds and/or suppress seed production. Method of treatment needs to be approved by the Forest Service Weed Program Manager. Travel routes include ski area access roads. (Forest Plan Noxious Weed Standards #1 and #4 [p. 2-30])
Work closely with the Forest Service to treat and monitor noxious weed infestations at Project Area construction sites for a minimum of four years after project completion. Method of treatment needs to be approved by the Forest Service Weed Program Manager. (Forest Plan Disturbance Process Standards #1-4)
WATERSHED & SOILS
Although the impacts of grading the entire extent of the Keystone Gulch snowcat access route have been analyzed and disclosed in this analysis, construction of the route will be conducted with the absolute minimal amount of grading necessary, and in coordination with Forest Service representatives.
All new/replaced snowmaking lines that cross wetlands must remain above-ground in order to avoid wetland impacts.
The new sewer line down *Diamond Back* will eliminate the need for the septic system, leach fields, and a sewage lagoon on NFS lands south of Adventure Point. Once the new sewer line is brought on-line in association with the new Summit House, the septic system, leach fields, and a sewage lagoon will be decommissioned and the area restored.
Soil surveys have been completed within the disturbance areas to ensure no net loss of soil organic matter. Keystone will work with the Forest Service Soil Scientist to re-establish depths similar to preconstruction depths of organic matter.
Prior to construction, a detailed site erosion control plan will be prepared. This plan shall include the following components: • Silt fences, straw bales, straw wattles, and other standard erosion control BMPs shall be employed to contain sediment onsite. • Jute-netting or appropriate erosion-control matting on steep fill slopes (i.e., land with a slope angle of 35 percent or greater) will be utilized to protect soils and enhance conditions for vegetation re-establishment. • Promptly revegetate disturbed areas. Seed mixtures and mulches will be free of noxious weeds. To prevent soil erosion, non-persistent, non-native perennials or sterile perennials may be used while native perennials become established. The Forest Service must approve the seed mixtures prior to implementation, unless previously approved seed mixes are employed.
Existing roads will be used for construction and routine maintenance of the proposed project components where possible.
Vegetative buffers will be maintained adjacent to intermittent or perennial drainages and wetlands, to the extent possible. Where avoidance of the vegetative buffer is not possible, disturbance will be minimized.
In all areas where grading or soil disturbance will occur, a reassessment of the quantity (depths) of soil A and/or organic ground cover would be made to ensure no net loss of this material. Re-spreading of stockpiled topsoil/A horizon material and/or the duff layer (O horizon) or where necessary applying an organic amendment would promote the successful rehabilitation of these areas in addition to promoting compliance with USFS policy direction towards soil productivity.
Ground cover, as a combination of revegetation, organic amendments and mulch applications, should restore depths of soil *A* and/or organic ground cover.
Keystone will work with the Forest Service soil scientist on final construction plans to ensure proper design features are incorporated.
Proposed PDF Related to Mountain Bike Trail Construction
Wherever possible, approved mountain bike trails will be aligned using natural topography to create grade reversals or rolling dips to facilitate maintenance-free drainage. Waterbars, ditches and cross drains will be used only when grade reversals and rolling dips are not practical.

Table 2-3:
Management Requirements

Routing trails directly down the fall line will be avoided. Drainage structures will be placed above steep stretches of trail to minimize the amount of water that gets routed onto steeps. In steep areas, the frequency of drainage features will be increased.
The routing of trails down the bottom of ephemeral draws or other low spots will be avoided so that water has somewhere to drain besides down the trail tread.
The number of times trails cross streams will be minimized. Where stream crossings are required, rolling dips or grade reversals will be used where trails approach streams to drain trail runoff into undisturbed soils rather than directly into streams.
Bike trails will be managed with seasonal closures, as needed, to avoid the development of ruts when soils are saturated.
When rehabilitating abandoned trails, ensure an adequate number of drainage features are installed to eliminate ongoing erosion problems. Check dams, waterbars and sediment traps will be used to keep water and sediment from running down entrenched trails.
Proposed Mitigation Measures and PDF Common to all Study Watersheds
Prior to construction, boundaries for tree removal, terrain grading; and wetlands and WIZs near construction sites will be clearly flagged.
Soil-disturbing actions will be avoided during periods of heavy rain or excessively wet soils (MM-9).
Cuts, fills, and road/trail surfaces will be constructed to be strongly resistant to erosion (MM-9)
Roads and other disturbed sites will be maintained and stabilized during and after construction to control erosion (MM-11)
Suitable locations for drainage features will be selected within and near graded areas and contour graded areas to disperse runoff onto ground that is stable and well vegetated.
Before grading, topsoil will be removed and properly stockpiled so it can be utilized during restoration of graded area.
Graded areas near perennial or intermittent streams, such as the Midway Teaching Carpet and FAZ trails, will be designed to minimize surface erosion and to drain runoff through adequate BMPs for sediment control (e.g., fiber logs and/or sediment traps).
Ski trail construction will be accomplished by flush-cutting trees to minimize ground disturbance.
Water bars and associated BMPs must be implemented immediately after construction of proposed graded ski trails; inspect water bars during the first snowmelt period following construction.
The downstream end of water bars will include BMPs that encourage sediment separation and dispersion of flow, such as fiber logs.
Where appropriate, disturbed areas will be re-vegetated, including new ski trails, with WRNF-approved seed mixtures.
Proposed Mitigation Measures and PDF to protect the integrity of the WIZ
Construction equipment will be kept out of streams, except if specifically authorized by the WRNF (MM-3).
Effects to soils will be minimized by limiting the width of skid trails to 12 feet and spacing between trails to no closer than 120 feet on average. Low p.s.i. (less than 7 p.s.i.) tracked equipment will be utilized when available (Forest Plan Soils Guidelines #4).
In order to address stream health concerns related to low wood frequency, trees will be felled into the inter-trail islands within the WIZ to improve LWD density; however, trees will be felled in a way that protects vegetation in the WIZ from damage.
Excavation, or storage of earthen material, will not occur in the WIZ.
Native vegetation will be used for streambank stabilization to the maximum extent practicable (MM-3).

Table 2-3:
Management Requirements

To the maximum extent possible, guests will be discouraged from skiing the interior of inter-trail islands within the WIZ to maximize vegetative growth in the riparian areas.
Water bars must be designed and constructed to discharge surface runoff originating within the proposed graded ski trails away from the WIZ and into well vegetated areas, effectively disconnecting disturbed areas from the stream network.
Proposed Mitigation Measures to Offset Impacts of Water Yield Increases
a. Successful revegetation projects will offset increases in watershed yield per the following average ratios: b. Forest revegetation (conifer trees), such as the FAZ revegetation project: once mature, conifer trees may consume approximately 1.2 to 1.4 AF/acre. This evapotranspiration ratio was modeled using WRENSS. c. Topsoil improvement and revegetation of ski trails using a WRNF-approved seed mix of native mountain grasses: approximately 1.5 AF per revegetated acre. d. Planting willows in riparian areas or where adequate shallow groundwater conditions exist: approximately 3.0 AF per acre.
In order to protect long-term stream health from damage by increased runoff, implement revegetation programs on currently disturbed areas to offset water yield increases. At a minimum, the following water yield increases must be mitigated: a. Camp Creek: 3.1 AF b. Redemption Creek: 0.4 AF c. WS #3: 0.9 AF d. WS #5: 0.2 AF e. WS #18: 1.5 AF Revegetation programs must be successfully implemented in the above-mentioned watersheds in order to offset the impacts of water yield resulting from the Proposed Action.
Topsoil improvement and revegetation of ski trails using a WRNF-approved mix of mountain grasses is required to be implemented on approximately 2.1 acres within the Camp Creek Watershed to offset the 3.1 AF of increased water yield. Keystone will work with the WRNF to determine the location and extent of additional revegetation projects needed to mitigate the impacts of the proposed improvements on watershed runoff. Such revegetation projects will be included in the corresponding Summer Construction Plan for review and approval by the WRNF as a condition of approval for the construction of project improvements.
GEOTECHNICAL STABILITY
Family Adventure Zone: The concern with locally increasing moisture (and thereby triggering a local slide reactivation) can be mitigated in two ways: (1) the sinuous trail should be reconfigured so that it does not cross into the Qlsy polygon, and/or (2) if the trail stays in its present configuration, waterbars should be created along it that prevent runoff from Qlsi going onto Qlsy.
Adventure Point: runoff should be prevented from the new snowtubing lanes/former tree island from draining southward. The new snowtubing lanes should be sloped gently to the north (as are the present tubing lanes), so that runoff will flow away from the graben.
Surface lift west of the Gondola mid-station: grading should be configured to divert water away from the infiltration area, and into an incised drainage or pipeline. In this case, the grading could actually have a positive effect on mountain-wide slope stability.

Table 2-3:
Management Requirements

Improved *Jane's Journey* trail: an inslope ditch should be created that will collect runoff and direct it west along the route, until it can be released at, or west of, the western margin of the slide area. By redirecting water off of the lower part of the slide, the egress route will increase slope stability.
MTB 1: the trail drainage at the 180-degree switchback on the moraine crest should be diverted to flow into Camp Creek, rather than being allowed to flow north onto the landslide deposit.
AIR QUALITY
To the extent feasible, site improvements should be installed promptly in order to reduce the potential for dust emissions. The area disturbed by clearing, earth moving, or excavation activities will be kept to a minimum at all times, allowing improvements to be implemented in sections.
Grading areas, including lift terminal areas, will be watered as necessary and practical to prevent excessive amounts of dust. In the absence of natural precipitation, watering of these areas will occur as practical.
WILDLIFE
During construction, contractors should provide an on-site bear proof container for all edible and food related trash in order to minimize conflicts with black bears. No food products or food containers should be thrown in the larger roll-off type dumpsters.
Raptors will be surveyed prior to implementation each year. Protect active and inactive raptor nest areas. A no-disturbance buffer around active nest sites will be required from nest-site selection to fledging (March through July).
If boreal owl nests are detected within impact areas, direct mortality of eggs and/or nestlings could be avoided by conducting tree removal in potential nesting habitat outside of the May 21 to July 15 nesting (with eggs/young) period.
If olive-sided flycatcher nests are detected within impact areas, direct mortality of eggs and/or nestlings could be avoided by conducting tree removal in potential nesting habitat outside of the June 1 and July 15 nesting period.
If American marten dens are detected within impact areas, direct mortality of current year recruitment could be avoided by conducting tree removal in potential denning habitat outside of the March 1 to June 15 period.
The 3,500-foot long, rerouted *Jane's Journey* egress trail will be no more than 30 feet wide.
During construction of the rerouted *Jane's Journey* trail: • To the extent possible, when configuring the trail's alignment without compromising the functional character of the trail, existing meadows, forest gaps, and openings between trees will be exploited to minimize tree removal and maintain canopy closure above the trail. • The removal of sapling and pole stage spruce and fir that have live branches within 6 feet of the ground and will be minimized, and areas where the understory has greater than 35% horizontal cover will be avoided. This represents snowshoe hare foraging habitat. • Dense patches of snowshoe hare foraging habitat will be avoided. • Once the skier's right and left sides of the trail are flagged, site survey will be conducted with Keystone personnel and a Forest Service wildlife biologist to confirm optimal trail alignment.
All construction activities should be confined to daylight hours, excluding emergencies.
Construction workers are prohibited from bringing dogs to the construction site.
All vehicle windows should be kept closed and doors locked on all vehicles to prevent bear entry.

Table 2-3:
Management Requirements

The Keystone Gulch Road closure will continue to be implemented, where, starting at the proximal end of the road, the road is closed with a locked gate and closed to all activity from May 15 to June 15 (for elk calving) except for required spring runoff and erosion control work.
Under Alternative 2, 19.3 acres of lynx habitat would be affected on NFS lands. All or a portion of this habitat loss should be offset by enhancing lynx and snowshoe hare habitat within the Snake River LAU or within contiguous LAUs by planting trees, decommissioning roads, and other beneficial silvicultural practices. A Forest Service wildlife biologist will outline practices for implementation. *This conservation measure is not needed for consistency with SRLMD.*

Chapter 3
Affected Environment and Environmental Consequences

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

CEQ regulations direct agencies to succinctly describe the environment that may be affected by the alternatives under consideration. As such, Chapter 3 describes the existing environment for resources across the human, physical and biological environments that have the potential to be affected by implementing either of the alternatives. Each Affected Environment description is followed by an Environmental Consequences discussion that provides an analysis of the potential effects of implementation of the alternatives.

A. ORGANIZATION OF CHAPTER 3

Chapter 3 is organized by resource area in the following order:

SCOPE OF THE ANALYSIS

The Scope of the Analysis briefly describes the geographic and/or regulatory as well as temporal bounds of analysis for each resource. The Scope of the Analysis varies according to resource area and may be different for direct, indirect and cumulative effects.

AFFECTED ENVIRONMENT

The Affected Environment section provides a description of the existing condition of the environment potentially affected.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

This section provides an analysis of direct and indirect environmental effects of implementing each of the alternatives, according to the issues and indicators identified in Chapter 1.

- Direct effects are caused by the action and occur at the same time and place.
- Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (i.e., likely to occur within the duration of the project).

CUMULATIVE EFFECTS

Cumulative effects are the result of the incremental direct and indirect effects of any action when added to other past, present, and reasonably foreseeable future actions, and can result from individually minor but collectively significant actions taking place over a period of time.

A. RECREATION

SCOPE OF ANALYSIS

The Project Area for recreation is specific to areas within Keystone's SUP boundary that have potential to be affected by proposed projects, primarily the front side of Dercum Mountain (North Peak and The Outback are not discussed in detail). On-mountain guest services, as they relate to proposed projects, are also discussed.

AFFECTED ENVIRONMENT

Keystone is surrounded by numerous ski resorts in Summit and Eagle counties, each offering a wide variety of terrain and facilities. This abundance and diversity has created a highly competitive market, in which Keystone has operated since 1970. First owned by Keystone International, Inc., the resort was acquired by Ralston Purina in 1974. Since 1997 it has been under the ownership of Vail Resorts, Inc.

Developed skiing at Keystone occurs on three mountains—Dercum Mountain, North Peak, and the Outback. Keystone has a base elevation of 9,280 feet with a summit elevation on Bear Mountain of 12,610 feet. The existing lift-served vertical drop is approximately 2,663 feet (from the top of Outback to Mountain House). Most of the skiing and riding is located on the north and west facing slopes with connecting routes on some south, southeast and southwest faces.

A variety of winter recreation activities are available at Keystone, including alpine skiing, snowboarding, telemark skiing, adaptive skiing, ski-biking, snowcat skiing, backcountry access, sleigh rides, and snowtubing. Summer recreation activities at the ski resort are also quite varied and include sightseeing, hiking, mountain biking, horseback riding, and scenic chairlift rides. Access to NFS lands outside of the ski area's operational boundary is available through a backcountry access point located on Independence Mountain. Signage at the access point informs skiers exiting the ski area of the risks and responsibilities associated with entering out-of-bounds terrain.

Keystone offers night skiing and riding several days a week throughout the winter. Several lifts and most of the trails on the front-side of Dercum Mountain operate until 8:30 p.m., including the River Run Gondola, A-51, Kokomo conveyor lift and sometimes the Summit Express. Approximately 284 acres of terrain are illuminated. During the evening hours, a portion of the Summit House is made available to night skiers and riders, as well as snowtubing guests.

Over the past 11 years, for which data is available, Keystone averaged roughly 1.1 million visitors, during which time Keystone experienced moderately fluctuating skier visitation. Skier visits ranged from as high as 1,230,100 visits in the 2000/01 season to as low as 944,433 visits in the 2003/04 season.

Lift Network

Keystone operates 20 lifts, including 13 chairlifts (one eight-passenger gondola, one six-passenger gondola, one high-speed detachable "six-pack" chairlift; five high-speed detachable quad chairlifts; one fixed-grip quad chairlift, one fixed-grip triple chairlift, and three fixed-grip double chairlifts) and six conveyor (carpet) lifts for beginners, plus one conveyor lift for tubing guests. Conveyor lifts are ideal for beginner skiers who often times find loading and unloading chairlifts difficult and are currently heavily used at Keystone, particularly those at the summit of Dercum Mountain.

Dercum Mountain is the hub of Keystone's skiing and riding with the convergence of five high capacity lifts (River Run Gondola, Summit Express, Montezuma Express, Ruby Express, and Outpost Gondola), two beginner lifts (Kokomo and Ranger) and the Summit House restaurant.

Terrain Network

Keystone offers approximately 3,000 acres of skiing/riding terrain across three mountains and five bowls, making it the largest resort in Summit County.[7] In addition to the 891 acres in the developed terrain network, Keystone offers gladed skiing and in-bounds, hike-to terrain. Boundary management is designed to reduce the instances of skiers and riders leaving the ski area boundary from undesignated locations and into sensitive or closed areas.

Keystone's core market is made up of intermediate skiers and riders, comprising 35 percent of the resort's market and 48 percent of developed terrain. However, Keystone currently operates with a deficiency of beginner, low-intermediate and expert terrain compared to their target skier/rider market.[8] Beginner and low-intermediate terrain is critical for providing teaching/learning areas at the resort.

Dercum Mountain

The summit of Dercum Mountain is at 11,640 feet and offers a variety of trails with long groomers, the A-51 Terrain Park, night skiing/riding terrain, and tubing at Adventure Point. All guests moving to and from North Peak and the Outback must transition through this area. A limited amount of space at the summit of Dercum Mountain, coupled with six lift terminals, the Summit House facility and Adventure Point create congestion issues. People moving from River Run to North Peak and the Outback must pass through the summit of Dercum Mountain after riding the River Run gondola or the Summit Express. Guests coming from the Mountain House base area take either the Peru Express or Argentine Lift, and then ride Montezuma, before they can go over the summit of Dercum Mountain.

The front side (north face) of Dercum Mountain generally has gentle slopes on the upper three quarters and steeper slopes on the bottom quarter. Most of the skiers/riders in the low intermediate skill class (a

[7] This terrain total includes the managed ski area boundary, including areas accessed via snowcat and hiking.
[8] Keystone Resort, 2009

large part of Keystone's clientele) choose to use the central trails (i.e., *Paymaster* to *Schoolmarm*) but must negotiate more difficult parts of the mountain to ski these trails. When riding the Montezuma Express, guests can avoid the lower steep pitch but must use *Upper Schoolmarm* to access the top of these trails. If they use the Peru Express, they must take the *Lower Schoolmarm* or *Dercum's Dash* skiways to access the bottom of the mountain. Most guests choose to use the Montezuma Express (Keystone's second most popular lift).

Teaching Terrain

Beginner areas are a vital component of a ski area in attracting new participants to the sport. All of Keystone's beginner areas are located on Dercum Mountain. However, as discussed previously, Keystone currently operates with a deficiency of beginner/teaching terrain.

Beginner skiers and riders coming through the River Run base use the teaching conveyor beside the gondola mid-station or ride the gondola to the mountain top to access the Kokomo conveyor or Ranger chairlift. Generally, the children's ski school participants stay in the Mountain House base area and then progress onto the Kokomo and the Ranger lifts at the summit of Dercum Mountain, whereas the adult ski school participants start at the summit.

Although there are two beginner lifts at the top of Dercum Mountain, there are no specific beginners/children's facilities in the Summit House and the lifts and trails are subject to wind. Both beginner lifts are located in and amongst the other ski trails, and although the *Kokomo* trail is roped off to provide segregation from the higher skilled skiers on *Schoolmarm* and *Endeavor*, both trails underneath the Ranger chairlift are frequented by skiers/riders in much higher skill classes (in route to *Diamond Back* or *Mine Shaft*). The majority of beginner skiers use this teaching terrain at the summit of Dercum Mountain; therefore the Ranger and Kokomo lifts and the associated terrain are in high demand.

As a result of the heavy use of the beginner area at the summit, additional beginner terrain on Dercum Mountain is currently provided near the mid-station of the River Run Gondola. This area is especially busy on days with inclement weather because it is less exposed to wind and other elements than the summit teaching area.

Finally, a roughly 3.5-acre beginner area is located at the Mountain House base. The Discovery double chairlift and four teaching conveyors service this teaching terrain. This area is heavily used by kids ski school.

Adventure Zones

Keystone currently offers "adventure zones" within tree islands throughout the front side of Dercum Mountain. These are short, isolated courses that include obstacles and features such as bridges, bumps and tunnels, which help children learn skiing and riding techniques in engaging ways. Adventure zones

include *Klondike's Adventure*, *Lost Mine*, *Ripperroo's Forest* and *Ripperoo's Alley*. Often, beginners ride traditional chairlifts to reach adventure zones dispersed throughout the front side of Dercum Mountain, which can be difficult to navigate for families and small children.

Bergman Bowl Skier Egress

Bergman Bowl is located east of the Outpost on North Peak. The upper bowl has gentle slopes suitable for low intermediates, while the lower slopes are somewhat steeper and suitable for intermediate/advanced intermediate skiers. The lower half of the bowl is tree covered and only a small portion of it is skied. There is no lift service to this portion of the SUP area. Keystone Adventure Tours primarily uses the upper half of Bergman Bowl to begin snowcat tours for guests prior to engaging them in more difficult terrain in Erickson and Independence bowls.

All skiers who access Bergman Bowl by snowcat or hiking egress through a narrow trail referred to as *Jane's Journey*, which intersects with *Prospector*. From there they descend *Mozart* to either the Ruby Express or Santiago Express. Although Keystone has attempted to improve the situation on *Jane's Journey* by removing deadfall along the route, guests must navigate a narrow, often icy, treed trail marked by yellow bands on trees to ski out of the bowl. The existing egress route is difficult to navigate for ski patrollers towing toboggans and requires more advanced skills of the guests than the terrain it serves, effectively increasing the required ability level to ski Bergman Bowl.

Adventure Point

Keystone offers snowtubing on top of Dercum Mountain at Adventure Point, immediately east of the Summit House. For the 2007/08 season, new tubing lanes and a state-of-the-art tubing specific conveyor lift were added. On the snowtubing hill, guests can choose from multiple lanes, each offering different speeds and experiences. This area is popular with all ages, including both skiing and non-skiing guests. However, due to the limited area in which this facility exists the number of snowtubers is limited during each one-hour session. During busy times such as holidays and spring break, as well as the popular evening hours, guests routinely wait in long lines between tubing runs (limiting the number of runs they can make in a one-hour session), or wait for later sessions that can accommodate their group.

Two small yurts are immediately adjacent to the snowtubing lanes and serve as a warming hut for tubing guests. The yurts provide limited drinks and snacks for guests at Adventure Point, but do not provide restrooms. Ticket sales and locker space for the adjacent Adventure Point tubing operation are currently provided in the yurts, but the facility is undersized to provide the requisite guest services. Restrooms (located at the Summit House facility) are located approximately 200 feet from the existing yurts.

On-Mountain Guest Services

In addition to the skier service space provided in the two base areas, there are a number of skier service buildings located around the Keystone Ski Area. Currently, there are over 37,000 square feet of skier

service space provided in three different on-mountain buildings: the Summit House, La Bonte's Cabin (at the bottom terminals of the Ruby Express and Santiago Express, between Dercum Mountain and North Peak) and the Outpost Lodge at the summit of North Peak. The on-mountain buildings offer food service facilities, restrooms, accessory retail, ski patrol and space dedicated to mountain operations.

Summit House

The Summit House, located at the top of Dercum Mountain, was one of Keystone's original buildings. It was there when Keystone opened on November 21, 1970, and was originally known as "Key Top." The Summit House is located adjacent to the top terminals of the Montezuma Express, River Run Gondola and Summit Express front side lifts, as well as the backside Outpost Gondola, Ruby Express and Ranger lifts. It provides food service including bar/lounge, retail and restrooms, as well as ski patrol facilities.

Due to the ease of lift access, the general location of the Summit House could accommodate a substantial amount of the resort's mid-day capacity. However, current limitations in seating capacity and inefficient use of space prevent the Summit House from maximizing the service opportunities presented by its central location. In over 40 years of operation, the Summit House has been expanded and retrofitted several times. The result is a series of disconnected and inefficient spaces and outdated architecture that neither meets guest needs/expectations nor fits with the character of the resort.

In addition to its inefficiencies in space, the Summit House is situated in an illogical location. It obstructs the logical entrance to *Frenchman,* one of the most popular trails on the upper mountain, and makes it more difficult to see other entrances to trails under the Montezuma Express. Its presence also diverts more people onto *Schoolmarm*, which is one of the busiest trails on the mountain.

Per the 2009 Keystone MDP, there is a large deficit of space at the Summit House in the following areas: bar and lounge, ski school, restaurant seating, food preparation, restrooms and ski patrol.[9] As noted in the 2009 MDP, the Summit House currently provides 529 indoor restaurant seats and 162 outdoor restaurant seats. With the biggest deficit being in restaurant seating, guests can become frustrated with long wait times for available seating and be forced to descend to the base area facilities for lunch.

Infrastructure

Although sewer and water systems are currently installed along Keystone Gulch Road, the Summit House and Adventure Point Yurts do not currently tie into these systems. Rather, an on-site wastewater treatment system (located south of Adventure Point) is utilized, which requires the maintenance of a septic system, leach fields, and a sewage lagoon on public lands.

[9] Keystone Resort, 2009

Snowcat Access

Currently, snowcats operate between the maintenance facility (at the Mountain House base area), North Peak and the Outback. During operational hours, snowcats that drive up and down the front side encounter skiers and riders coming down the mountain. Although this is an inherent issue that all ski areas contend with, minimizing encounters between ski area equipment and guests is of obvious importance. Additionally, traveling up and down the steep terrain between Dercum Mountain and the Outback requires large quantities of fuel.

Snowmaking

Keystone depends on its snowmaking system to ensure a consistent and quality snow surface throughout the season, particularly in the early season. The resort's existing snowmaking system is capable of providing coverage across approximately 654 acres of terrain. However, numerous components of the snowmaking system on Dercum Mountain have been identified that represent inefficiencies in terms of water, electricity, and time.

On Dercum Mountain, existing snowmaking infrastructure that has historically been used to provide coverage on *Whipsaw*, *Crosscut*, *Bachelor* and *Jack Straw*, as well as trail connectors, is antiquated and inefficient. For example, *Jack Straw* (below *Zuma Highway*) has no permanent snowmaking infrastructure (pipes or hydrants). The location of the nearest air/water hydrant makes for a long push for snowcats. Furthermore, while snowmaking coverage has historically been provided on *Wild Irishman*, this trail does not have dedicated infrastructure. Instead, hoses are dragged over-the-snow from the adjacent trail—*Wild Irishman*—to accommodate snowmaking coverage there.

Mountain Biking

Keystone operates one of the most progressive and extensive systems of cross country and downhill bike trails at any ski area in North America, rivaled only by Whistler/Blackcomb in British Columbia, Canada and Northstar in California. Keystone's trails can be loosely divided into four categories: 1) traditional cross country, 2) lift-served downhill, 3) lift served cross country and 4) free-ride parks and features. The Keystone Bike Park encompasses approximately 55 miles of trails and, combined with the trails branching from the nearby Colorado Trail on the WRNF, this system provides numerous downhill and cross country riding opportunities. On the adjacent WRNF, riders can venture onto the *Keystone Ranch Loop*, *West Ridge Loop* and the *Aquaduct Trail*.

The Keystone Bike Park consists of downhill trails with progressive terrain for riders of all abilities, but the resort is best known for its advanced and expert terrain. Riders can take the Summit Express to the top of Dercum Mountain and gain access to Colorado's most extensive array of lift-served terrain—from green trails, with wider tracks and gentler grades (approximately 6 percent), to double black trails, which can include skinny bridges, step-ups, drops, and large jump features. Currently, lift-served mountain bike

trails at Keystone allow riders to choose between easier and more difficult trails several times along each route. Although this can be beneficial for more skilled riders who want to bypass certain trail segments, it can be challenging for lower ability level riders to share trail segments with more seasoned riders.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – The No Action Alternative

Selection of the No Action Alternative would not result in any operational or infrastructural changes/additions within Keystone's SUP area. No alteration to the recreational experience would occur, and generally speaking, the quality of winter and summer recreation opportunities would resemble those currently existing (as described in the Affected Environment section). As such, no direct or indirect impacts to recreational resources would be expected under Alternative 1.

Alternative 2 – The Proposed Action

Visitation

None of the proposed projects are expected to drive appreciable increases in daily or annual visitation at Keystone. As such, the historic visitation trend, moderately fluctuating and averaging roughly 1.1 million skier visits annually, would be expected to continue under Alternative 2.

Lift Network

Under the Proposed Action three surface conveyor lifts (carpet lifts) would be added to Keystone's existing lift network. This would bring Keystone's lift network to 13 chairlifts and 9 conveyor lifts. Given the heavy use of surface conveyor lifts at Keystone, and because surface lifts are ideal for beginner skiers who often find loading and unloading chairlifts difficult, these additional beginner/teaching lifts would allow Keystone to better accommodate public skiing, particularly for beginners and families.

Terrain Network

Under Alternative 2, all additions/modifications to the terrain network would occur within Keystone's existing SUP boundary and, with the exception of *Jane's Journey*, on the front side of Dercum Mountain. The developed terrain network would decrease slightly—from 891 acres to 887 acres—as discussed below. Although approximately 5 acres of new teaching terrain (developed) would be created under the Proposed Action, the overall decrease in developed terrain is attributable to the conversion of *Hoodoo* and *Schoolmaster* (both low intermediate trails) from traditional trails to the Family Adventure Zone (discussed below). The deficiency in beginner terrain would be addressed by more than doubling the acreage currently available—from just under 4 acres to just under 9 acres.

Under Alternative 2, the existing deficiency in low intermediate terrain, discussed above under "Terrain Network," would be slightly exacerbated by the conversion of *Hoodoo* and *Schoolmaster* to alternative

terrain for the Family Adventure Zone. Although the 2009 MDP contains projects that would address this deficiency, the current proposal does not address this condition.

Neither Hoodoo nor Schoolmaster is considered a popular trail because Schoolmarm is much more obvious to Keystone's guests. However, the conversion of these two trails to alternative terrain for the Family Adventure Zone could be considered a loss to locals who enjoy these trails.

Teaching Terrain

Under the Proposed Action, two areas on Dercum Mountain would be supplemented with additional teaching terrain: 1) at the summit, west of the Summit House between the Ranger and Kokomo lifts; and 2) near the mid-terminal station of the River Run Gondola. The surface conveyor proposed at the top of the Peru Express would serve an existing beginner terrain park area and that terrain would not be altered.

Under Alternative 2, the existing learning area at the summit of Dercum Mountain (which is in high demand) would be supplemented with approximately 4 acres of new teaching terrain and an additional surface conveyor lift. The new terrain would address existing demand for teaching terrain and, by adding the terrain and lift, the area would be better defined as a teaching pod and would encourage a separation of ability levels in that area.

Supplementing the existing terrain near the mid-terminal station of the River Run Gondola with an additional acre of teaching terrain would address the existing deficiency of beginner terrain at Keystone.

Both of these additions to Keystone's teaching terrain address the deficiency of beginner terrain at the resort, discussed previously under "Terrain Network." As such, these additions would improve the recreational experience at Keystone and further improve the family-friendly atmosphere at Keystone.

Adventure Zones

The proposed Family Adventure Zone would provide a recreational and learning experience that is unique in the ski industry. Enhancing the adventure zones with forest interpretive features would broaden the ski area's appeal, provide an educational aspect for kids and adults, and also provide the opportunity for Keystone to promote its relationship with the Forest Service. These zones are designed to encourage families to make a stronger connection to the forest and outdoor recreation. Additionally, the dedicated Family Adventure Zone would eliminate the need for beginners to ride multiple traditional chairlifts to use adventure zones dispersed throughout the front side of Dercum Mountain, which can be a challenge for families and small children to reach. For all of the above reasons, the Family Adventure Zone would improve the recreational experience at Keystone, particularly for beginners and families.

Although the proposed Family Adventure Zone involves the conversion of *Hoodoo* and *Schoolmaster* from traditional trails to the Family Adventure Zone, this is not expected to noticeably impact skiers/riders on developed terrain across Dercum Mountain. Similar terrain opportunities are provided on

the adjacent *Silver Spoon* and *Last Chance* trails and travel routes between *Schoolmarm* and either *Haywood* or *Dercurm's Dash* would be maintained for those who prefer to ski/ride on traditional trails rather than through an adventure zone.

Bergman Bowl Egress

As proposed, this wider, groomable trail would allow the resort to better accommodate intermediate and above skill levels. This project would also accommodate ski patrol operations in Bergman Bowl by providing expedited egress.

Adventure Point

Proposed improvements at Adventure Point would benefit operations and the guest experience. Enlargement/improvement of the tubing area would give Keystone greater flexibility in creating and maintaining snowtubing lanes throughout the year. The proposed Adventure Point support facility would better accommodate operations and guest needs, and would include a small food and beverage service outlet, observation platform, restrooms, ticketing and storage in a nicer, permanent facility. This would improve the alternative winter recreational experience at Keystone and also help reduce the demand for services at the nearby Summit House.

Summit House

Implementation of the Proposed Action would enhance the recreational experience for all of Keystone's guests by providing more efficient on-mountain guest services at the locations in which they are needed.

Under the Proposed Action, the Summit House would be replaced with a larger, multi-story facility. Depending on the precise location of the proposed facility at the summit of Dercum Mountain (i.e., in its current location or slightly south), the new location could make *Frenchman* and other trails under the Montezuma Express more accessible, relieving traffic from *Schoolmarm*, which is one of the busiest trails on the mountain.

The Proposed Action would reduce the deficit of restaurant seating space at the Summit House, increasing the number of seats by approximately 30 percent.

Implementation of the Proposed Action would improve the recreational experience for Keystone's guests by providing a more efficient and aesthetically pleasing on-mountain guest service facility at the summit of Dercum Mountain. Additionally, by redesigning/relocating the facility, circulation at the summit and utilization of the trails under the Montezuma Express could be improved. Finally, under the Proposed Action guest service space would be brought more in line with optimal conditions with the addition of approximately 210 restaurant seats.

Infrastructure

Under the Proposed Action, water and wastewater lines would be installed from the summit of Dercum Mountain down *Diamond Back*, tying into existing sewer and well water services located on the Keystone Gulch Road. These lines would cross the existing Jackstraw Road and Girl Scout mountain bike trails. As such, the trails may be temporarily rerouted or closed for a short period during construction. While this may temporarily displace users of these trails, the duration of closure is expected to be minimal and the impact to recreational users of these trails would be negligible.

Keystone Gulch Snowcat Access Route

Under Alternative 2, the dedicated snowcat access route to connect the maintenance shop near the Mountain House base area west to Keystone Gulch Road would eliminate snowcat/skier conflicts as well as reduce fuel consumption between the Outback and Mountain House. This would improve both the guest experience and operations at Keystone.

Snowmaking

Under the Proposed Action, Keystone's existing 654-acre snowmaking system would be improved with upgraded/expanded infrastructure. While no additional water is proposed to be used in the snowmaking system, inefficiencies in the system in terms of water, electricity, and time would be rectified and Keystone's ability to provide a consistent and quality snow surface would be improved, particularly in the early season.

Mountain Biking

Under the Proposed Action, seven new mountain bike trails would increase the total miles of lift-served mountain biking by 16 percent (9 miles)—to approximately 64 miles. The proposed trails would maintain existing trail connectivity while providing other trail segments that are entirely beginner or intermediate. This would also minimize vehicle/bike conflict areas by offering bikers options to avoid using mountain access roads. As a result of implementing Alternative 2, the summer recreational experience at Keystone would be expected to improve for all mountain bike ability levels, but particularly for beginner and intermediate riders. Keystone would maintain, and improve, its reputation for advanced lift-served mountain bike trails and features, while adding opportunities for lower ability level riders.

CUMULATIVE EFFECTS

For a detailed description of past, present, and reasonably foreseeable future projects that have affected, and have potential to change, the recreational setting and opportunities within the Keystone SUP area, the reader is referred to Appendix A in this document.

B. SCENERY RESOURCES

SCOPE OF ANALYSIS

The Analysis Area for scenery resources is primarily focused on the front (north) side of Dercum Mountain. However, two proposed projects are located on the southern aspect of Dercum Mountain—proposed water/wastewater lines and improvements to *Jane's Journey*.

The aesthetic impacts of the proposed changes within the Analysis Area were considered in relation to the overall existing development/recreational theme of the resort. Analysis of the aesthetic environment requires an evaluation of the Project Area and its ability to absorb the effects of both historic and ongoing human modification. Slope, natural vegetation types and patterns, topography, and viewing distance are important factors in this analysis. The development of skier facilities, infrastructure, and developed trails on NFS and private lands within the ski area has occurred over the past four decades over which time the area has been managed as a winter recreation site. Thus, Keystone has developed into a concentrated four-season resort, and due to its nature as a developed ski area, it is reasonable to assume that the majority of guests expect it to appear as such.

MANAGEMENT OF THE SCENIC ENVRIONMENT ON NATIONAL FOREST SYSTEM LANDS

The Scenery Management System (SMS) was adopted in 1995 as the primary scenery management direction by the Forest Service. In brief, the SMS is a systematic approach for assessing scenic resources in a Project Area to help make management decisions on the project.

Scenic Integrity Objectives and Landscape Character

An action can cause changes to scenic resources that can be objectively measured. By assessing the existing scenic character of an area in terms of pattern elements (form, line, color and texture) and pattern character (dominance, scale diversity and continuity), it is possible to identify the extent to which the scenic character would exhibit scenic contrast with the landscape, or its converse—scenic compatibility.

The 2002 Forest Plan establishes limits of acceptable change for Scenic Resources.[10] The limits of acceptable change of a particular area (e.g., Management Area, as defined in the 2002 Forest Plan) are the documented Scenic Integrity Objectives (SIO), which serve as management goals for scenic resources. SIOs provide a measure of visible disruption of landscape character, ranging from "*Very High"* to "*Unacceptably Low*." In order of least-to-most altered, SIOs are:

- **Very High** (unaltered)
- **High** (appears unaltered)

[10] USDA Forest Service, 2002

- **Moderate** (slightly altered)
- **Low** (moderately altered)
- **Very Low** (heavily altered)
- **Unacceptably Low** (extremely altered)

For reference, *Very High* SIOs are typically found in designated wilderness areas and special interest areas. While there is no standard for SIOs in relation to ski area SUP areas on NFS lands, in most cases, they fall somewhere between *Very Low* and *Moderate*. This is in recognition of the developed nature of ski areas, which tend to operate in highly scenic environments (i.e., assigning an artificially high SIO at a developed ski area would be unachievable, just as assigning an artificially low SIO would not incentivize the ski area to strive to minimize visual impacts).

As indicated in the 2002 Forest Plan, the Analysis Area within Keystone's SUP area is designated as *Very Low*.[11]

The *Very Low* SIO is defined as:[12]

> *Deviations may strongly dominate the valued landscape character. They may borrow from valued attributes such as size, shape, edge effect and pattern of natural openings, changes in vegetation types, or architectural styles outside the landscape being viewed. However, deviations must be shaped by and blend with the natural terrain so that elements such as unnatural edges, roads, landings and structures do not dominate the composition.*

The 2002 Forest Plan states that all NFS lands shall be managed to attain the highest possible scenic quality commensurate with other appropriate public uses, costs, and benefits.[13]

Scenery Management System Distance Zones

Viewing distance is important in determining how change is perceived across a landscape. Distance zones are divisions of a particular landscape being viewed, and are used to describe the part of a characteristic landscape that is being inventoried or evaluated.

- Immediate Foreground: This zone begins at the viewer and extends to about 300 feet. Individual leaves, flowers, twigs, bark texture, and other details dominate this view.
- Foreground: This zone is usually limited to areas within 300 feet to 0.5 mile (not to exceed 0.5 mile) of the observer, but it must be determined on a case-by-case basis, as should any

[11] Ibid.
[12] USDA Forest Service, 1995
[13] USDA Forest Service, 2002

distance zoning. Generally, detail of landforms is more pronounced when viewed from within the foreground zone.

- Middleground: Alterations in the middleground (0.5 to 4 miles from the observer) are less distinctive. Texture is normally characterized by the masses of trees in stands or uniform tree cover.
- Background: This zone extends from middleground (minimum of 4 miles between the observer and the area being viewed) to infinity. Shape may remain evident beyond 10 miles, especially if it is inconsistent with other landscape forms. Beyond 10 miles, alteration in landscape character becomes obscure.

The Built Environment Image Guide

The Built Environment Image Guide (BEIG) was prepared by the Forest Service for the "thoughtful design and management" of the built environment contained within the National Forests.[14] The Forest Service defines the built environment as "the administrative and recreation buildings, landscape structures, site furnishings, structures on roads and trails, and signs installed or operated by the Forest Service, its cooperators, and permitees."[15] The BEIG divides the United States into eight provinces which combine common elements from the ecological and cultural contexts over large geographical areas; the Keystone SUP area and adjacent NFS lands are within the Rocky Mountain Province. Site development, sustainability, and architectural character should conform to BEIG guidelines described for this Province.

AFFECTED ENVIRONMENT

Keystone's existing lift and trail network, all related infrastructure, maintenance and guest service buildings are currently consistent with the 2002 Forest Plan SIO designation of *Very Low* for the SUP area, as well as Forest-wide guidelines for scenery management. Keystone's traditional, below tree-line trails are the major contributing factor to the *Very Low* SIO ("appears heavily altered") classification for the developed portions of the SUP area.

Scenic Characteristics of Keystone's SUP Boundary and the Project Area

Developed winter recreation dominates the sense of place at Keystone. The aesthetic landscape across private and NFS lands in the vicinity of Keystone has been defined by recreation since the resort opened to the public in 1970, with the development of trails, lifts, infrastructure, and skier facilities on NFS lands evolving since that time. Roughly 890 acres of skiable terrain have been developed on NFS and private lands, with an additional 2,110 acres of glades, bowls and other undeveloped terrain.[16]

[14] USDA Forest Service, 2001
[15] Ibid.
[16] This terrain total includes the managed ski area boundary, including areas accessed via snowcat and hiking.

Vegetation cover throughout the SUP area varies due to the broad range in elevation, slope aspect, and gradient. Plants that occur within the alpine zones (11,000 to 11,500 feet) and subalpine zones (9,000 to 11,500 feet) of Colorado characterize the SUP area. Dominant species include subalpine fir and Engelmann spruce, lodgepole pine, whortleberries, and elk sedge to treeline. Above treeline, vegetation types include herbaceous dominated meadows, with turflands and snowfields. The distinctive vegetation patterns typical of cut ski slopes contribute to the scenic character of Keystone's current operational boundary area. Lodgepole pine within and around the SUP area, primarily below 9,800 feet, continue to succumb to mountain pine beetle outbreak. This mortality is expected to continue to affect the scenic quality of Keystone and surrounding NFS and private lands in the near future.

Keystone's 891 acres of developed lift-served terrain are located on, or accessible from, three mountains: Dercum Mountain, North Peak and the Outback. The summit of Dercum Mountain is at 11,640 feet and offers a variety of trails with long groomers, the A-51 Terrain Park, night skiing/riding terrain, and snowtubing at Adventure Point. The front side of Dercum Mountain generally has gentle slopes on the upper three quarters and steeper slopes on the bottom quarter. Again, the scenic character of the front side of Dercum Mountain, including the Analysis Area for proposed projects, is largely defined by the distinctive vegetation patterns typical of cut ski slopes and developed winter recreation sites.

Aside from within the ski area, the Keystone SUP area is visible from the US Highway 6 corridor in the vicinity of Dillon and the River Run Village. High elevation portions of the SUP area are also visible throughout Summit County in Silverthorne, Dillon, Frisco, and along Swan Mountain Road which connects Keystone to Breckenridge. The Tenmile Range, which extends north-south between Frisco and Breckenridge and includes the Peaks Trail, the Siberia Loop and Breckenridge Ski Resort, also provides views of the back side of Keystone; although the resort is not visible from most locations in the Town of Breckenridge and some other vantage points within the valleys of the Tenmile Range.

The elevation of US Highway 6 and the River Run Base Area at Keystone is approximately 9,340 feet. The summit elevation of Dercum Mountain (near the existing Summit House facility) is 11,640 feet. The aerial lifts and trails on the front side of Dercum Mountain are on northerly aspects and are visible in the middleground/background distance zones from the River Run Village and other points along US Highway 6. Views of Keystone from the Tenmile Range, including Breckenridge Ski Resort and the Peaks Trail, are of the Outback and North Peak areas and occur in the background distance zone.

Approximately 284 acres of terrain on the front side of Dercum Mountain are illuminated. During the evening hours, a portion of the Summit House is made available to night skiers and riders, as well as tubing guests. The lighting network at Keystone is illuminated on most nights at Keystone, regardless of whether the resort is open for night skiing, to allow for snowmaking and grooming operations. While trail lighting is limited to the northerly aspects of Dercum Mountain (the front side), diffuse light can be seen over the ridgeline from southern vantage points, such as the Tenmile Range and Swan Mountain Road.

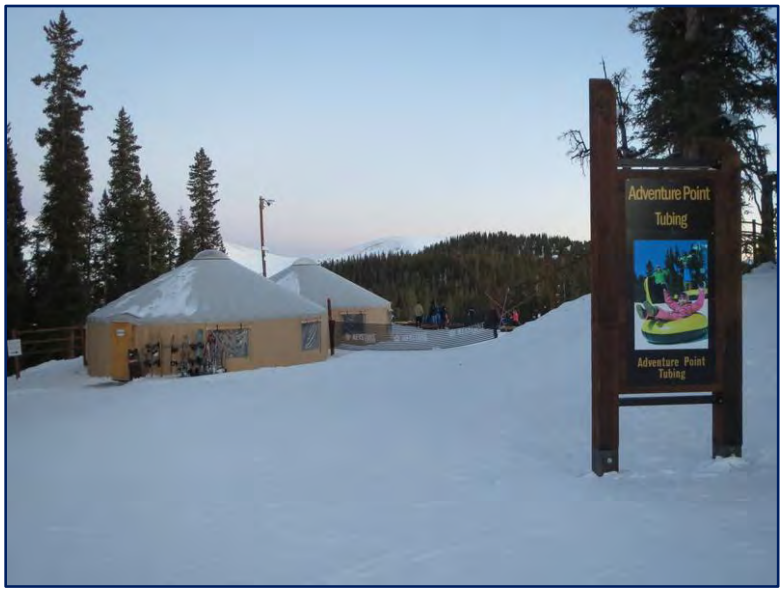
The summit of Dercum Mountain is intensely developed and includes the existing Summit House and Adventure Point facilities, an existing teaching area and entry points to front side and back side terrain. The top terminals of the Montezuma Express, River Run Gondola and Summit Express lifts are also located at the summit of Dercum Mountain, as well as the top terminals of the Outpost Gondola, Ruby Express and Ranger lifts. Photo 3B-1 depicts the existing view of the summit of Dercum Mountain, looking northwest.

Photo 3B-1:
Dercum Mountain Summit

The Summit House (located to the left in Photo 3B-1) has been expanded and retrofitted several times. The resulting architecture is somewhat incongruous, in that additions were designed and constructed at different times producing parts of the facility with markedly diverse architectural details (e.g., the main food service/lounge area is one story with a flatter roof while the restroom and ski patrol area is three stories with steeper pitched roofs and multiple story decks/balconies). The Summit House was constructed prior to the implementation of the BEIG, and as such the facility was not subject to the BEIG requirements for the Rocky Mountain Province.

The existing Adventure Point facility is housed within two semi-permanent yurt structures (refer to Photo 3B-2). The design of the existing yurts does not fit with the existing buildings at Keystone, particularly the nearby Summit House facility and gondola top terminals. The area surrounding the Adventure Point facility is primarily forested, except the lighted snowtubing lanes and *Spring Dipper* trail.

Photo 3B-2:
Adventure Point Yurts



Bergman Bowl is accessed through snowcat (Keystone Adventure Tours) operations at Keystone or by hiking from the top of the Outpost Gondola on the North Peak. The area is primarily comprised of an un-modified, natural bowl. The existing Jane's Journey egress trail is a narrow primitive route marked by yellow bands on trees to lead skiers out of the area. This area, and specifically Jane's Journey egress, is only visible from limited vantage points within the ski area. The existing egress route is only discernible in the foreground view (i.e., skiing on the egress trail).

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

Under the No Action Alternative, no changes or modifications would be approved that would affect the scenic quality of the SUP area. As discussed under Existing Conditions, Keystone's traditional, below tree-line trails are the major contributing factor to the *Very Low* SIO ("appears heavily altered") classification for the developed portions of the SUP area.

The existing condition of the Summit House, as viewed from the top of Dercum Mountain within the ski area, would remain unchanged under the No Action Alternative.

Alternative 2 – Proposed Action

All proposed terrain, facility and infrastructural projects are within the existing lift and trail networks of Keystone's SUP (with the exception of a small portion of the proposed Keystone Gulch Snowcat access route). Due to the existing developed visual character of the Project Area, implementation of Alternative 2 would represent an incremental and inconsequential change to the appearance of the Keystone SUP.

Aside from travelers on US Highway 6 and visitors and residents in River Run Village, the only other viewpoints with a line of sight to project components are within the ski area itself. Implementation of the project elements contained in the Proposed Action would not affect Keystone's compliance with the SIO of *Very Low*.

To the casual observer in River Run Village or those traveling on US Highway 6 or Swan Mountain Road (middleground/background viewpoints), the proposed projects would be indistinguishable from the existing trails. It is reasonable to assume that anyone viewing the Project Area from the foreground view (i.e., within the ski area) would expect to see lifts, trails and infrastructure. Even then, it would be difficult to distinguish most elements of the Proposed Action from existing features. No project elements would be visible from the Tenmile Range, including Breckenridge Ski Resort, and no additional lighting is proposed, so no changes to the scenic character of Keystone from these southern vantage points is expected.

The replacement of the Summit House facility would represent the most recognizable change from existing conditions, as viewed from the top of Dercum Mountain within the ski area. For this reason, a perspective rendering of the proposed Summit House facility is provided to demonstrate the change from existing conditions.[17] The reader is referred to Figure 3. Replacement of the Summit House and Adventure Point facilities with improved structures that meet BEIG Rocky Mountain Province requirements is expected to produce a net benefit to the overall scenic compatibility of structures on NFS lands within Keystone's SUP. These new facilities would better fit with the other existing buildings at Keystone and would conform to the architectural character prescribed in the BEIG.

Constructed elements of the Family Adventure Zone would not be visible from outside of the ski area, however, these elements would alter the view of guests in his portion of the SUP area. Rather than traditional trails and tree islands around *Schoolmaster* and *Hoodoo*, guests would encounter constructed features such as wooden bridges, snow forts/, tree houses, a mock fire lookout tower, and educational/interpretive elements. These elements would be designed in coordination with the Forest Service Landscape Architect to ensure they are consistent with Forest Service policy for the built environment. It is reasonable to assume that anyone viewing the Family Adventure Zone from the foreground view (i.e., within the ski area) would expect to see such infrastructure.

With respect to project components not located on the front side of Dercum Mountain, changes to scenic resources as result of the *Jane's Journey* trail would only be perceived from within the ski area and even then, it would be difficult to distinguish the proposed trail from the existing one. Similarly, the area

[17] It is important to note this perspective rendering is based on conceptual plans and the final construction design may deviate from the image in the perspective.

containing the proposed water and wastewater lines is only visible from within the ski area, and once installation and revegetation is complete the area would be indistinguishable from current conditions.

Construction of new terrain, new facilities and the installation of new snowmaking and infrastructure would result in temporary ground disturbance, which would be promptly revegetated. During construction and revegetation periods these activities would be evident in the Immediate Foreground and Foreground distance zones. However, only skiers see the Project Area in the foreground view. As revegetation efforts mature over time (two-to-five years), these disturbances would ultimately return to a condition similar to the present.

Best management practices and project design features (identified in Table 2-3) would be applied, where appropriate, to minimize or avoid impacts to visual resources.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

Incremental past, present, and reasonably foreseeable actions that have cumulatively affected, or could affect, scenery resources at Keystone are primarily related to overstory vegetation removal and the creation developed skiable terrain. The development of trails, lifts, infrastructure, and skier facilities on NFS lands in the SUP area has occurred over five decades. Development of the resort has occurred through numerous phases and projects. Cumulatively, these projects have transformed the Keystone SUP into a place visually dominated by recreation (winter and summer). The proposed projects continue this trend, although they add incremental visual alterations to current conditions.

Reasonably foreseeable future actions within the Keystone SUP area include projects identified in Keystone's 2009 Master Development Plan (MDP) that are not analyzed in the current proposal. These projects include:

- A variety of new/upgraded lifts, trails, snowmaking and guest service facilities on the North Peak and Outback
- Lift access to North and South Bowls
- Lift access to the Windows, Bergman Bowl and Independence Bowl

In summary, Keystone is, has been, and is likely to be in the future a place of intensely developed winter recreation. Keystone has developed into a concentrated four-season resort, and due to its nature as a developed ski area, it is reasonable to assume that the majority of viewers expect it to appear as such, and will continue this expectation into the future.

C. CULTURAL RESOURCES

SCOPE OF ANALYSIS

This cultural resource assessment is mandated by the National Historic Preservation Act of 1966 (NHPA). Section 106 of the NHPA requires that federal agencies take into account the effects of a federal undertaking on any cultural resource that is included in or eligible for inclusion in the National Register of Historic Places (NRHP). Cultural resources may refer to sites, areas, buildings, structures, districts, and objects which possess scientific, historic, and/or social values of a cultural group or groups as specified by 36 CFR 296.3.

NRHP eligibility is evaluated in terms of the integrity of the resource; its association with significant persons, events, or patterns in history or prehistory; its engineering, artistic, or architectural values; or its information potentially relative to important research questions in history or prehistory.[18] The significance of NRHP eligibility of cultural resources is determined by the Forest Archaeologist in consultation with the State Historic Preservation Officer (SHPO).

The Area of Potential Affects (APE) is Keystone's SUP boundary, specifically where proposed ground disturbing activities could impact cultural resources. The majority of Keystone's SUP area was previously inventoried for cultural resources in 1982 and 1983. These inventories documented eight archaeological sites and one isolated find located near the Project Area. All sites were recommended as "not NRHP eligible" or "needs data." Relative to the Proposed Action, areas that were not included in the 1982 and 1983 inventories were inspected in July 2012 and August 2013; these inventories are identified in the technical report contained in the project file.[19]

AFFECTED ENVIRONMENT

Prior to conducting the 2012 and 2013 inventories, a files search through Colorado's Office of Archaeology and Historic Preservation (OAHP) Compass on-line database was performed to confirm that no new cultural resources had been documented in the Project Area. According to this files search, there are no archaeological sites within any of the proposed developments in the Keystone SUP area. The 2012 and 2013 surveys investigated areas outside of the current ski trail network for two specific projects—proposed Mountain Bike Trail "MTB 1" and a portion of an improved egress trail from Bergman Bowl. Neither of the surveys identified any new cultural resources.

[18] 36 CFR Section 60.4
[19] Metcalf Archaeological Consultants, Inc., 2013

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

Because no ground disturbance is proposed under the No Action Alternative, there is no potential to affect the historic sites within the APE as a result of the No Action Alternative.

Alternative 2 – The Proposed Action

All reports were submitted to the SHPO in completion of the NHPA Section 106 process. The 2012 and 2013 inventories led to recommendations of "no historic properties affected." Implementation of Alternative 2 was determined to have "no effect" on any known NRHP listed or eligible historic properties within the APE.

As stated in the Project Design Features (Table 2-3), if previously-unknown Native American cultural resources, artifacts, or human remains are discovered during implementation of any approved projects, all ground disturbing activities will cease, and the Forest Service will be notified immediately.

CUMULATIVE EFFECTS

Because not direct or indirect environmental consequences have been identified, no cumulative effects have been identified.

D. ECONOMIC ANALYSIS

SCOPE OF ANALYSIS

A correlation exists between public use of National Forest System (NFS) lands and the economies of adjacent communities. This correlation encompasses seasonal tourism, population, housing, employment and income levels. The strength of this correlation is assessed in the following analysis. The area of economic effect, or Analysis Area, for the proposed project is defined as Summit County, Colorado.

Economic Impact Theory – By drawing non-local visitation to an area, ski facilities can generate economic activity in the form of employment and dollar flows. Further, these benefits accrue to both the ski area and to local businesses that benefit from spending by visitors. Perhaps just as importantly, the *direct* dollars spent at ski areas and local businesses have a secondary (multiplier) impact, creating additional dollar flows/jobs within the local and regional economy.

Economic Impacts – Employment and dollar flows are typically defined at three levels:

- Direct – Employment and dollar flows created as a direct impact of a business. On and off-site construction jobs, resort-based jobs and non-resort jobs generated by visitor expenditures are included in this category. The majority of these jobs/dollar flows will be created within a small geographic area—typically in the immediate area of the resort.
- Indirect – Employment and dollar flows created by industry-to-industry spending. For instance, increased food and beverage spending at Keystone results in the purchase of more supplies from food vendors. This revenue allows the food vendors to create more employment. These are indirect jobs. These jobs/dollar flows would be created both locally and throughout the geographic area in which the resort regularly conducts business.
- Induced – Employment and dollar flows created by increased household spending. The additional jobs and income created by direct spending allow consumers to increase their spending on goods and services. This spending allows a number of businesses to create more jobs. These are induced jobs. Induced jobs/dollar flows are generated over a relatively broad geographic area.

The *direct* and secondary (*indirect* and *induced*) impacts of Alternatives 1 and 2 were projected using a computer-based model—IMPLAN3.[20] IMPLAN3 is a broadly accepted model used for making projections regarding employment and economic impacts and is often used by the Forest Service in the preparation of environmental analyses.

[20] IMPLAN3 software guides users though the task of creating an impact study that tracks the effects of a modeled event (such as each Alternative) against 440 unique sectors in the United States. The result is a detailed summary of economic impacts including: changes in jobs, household incomes, tax impacts, and gross regional product.

In this analysis, existing and prospective new jobs are defined in terms of "Full-Time-Equivalents" (FTEs)—one FTE provides sufficient work to keep one person employed full-time for one year. In seasonal industries—such as ski areas—one FTE may represent several employment positions.

AFFECTED ENVIRONMENT

Population

From 1970 to 2006, Summit County was one of the fastest growing counties in Colorado (from 2001 to 2002 growth was 10 percent), likely due to changes in traditional employment opportunities (e.g., tele-commuting) and an increase in the popularity of healthy/recreation lifestyles.[21] However, according to population projections, these historic growth rates are not expected to continue over the next two decades. Summit County's population growth from 2000 to 2010 was 25.8 percent, or an average of 2.6 percent per year. Therefore, population projections anticipate growth in Summit County to average 2.14 percent per year. This growth represents an 86.6 percent increase, or an additional 20,395 residents over the 25 year period.[22]

Population projections are approximations that are affected by factors such as changes in assumptions (numbers of persons per household), transient residents, the number of second homes, and second home owners converting into permanent residents. Table 3D-1 displays population projections and percent change for 2015, 2020, and 2025 for Summit County.

Table 3D-1:
Summit County Projected Permanent Population Projections (2000–2025)

Time Frame/Years	Percent Change	New Residents Added	Projected Ending Population
2000–2010	25.8	6,078	29,626
2010–2015	12.5	3,755	33,706
2015–2020	15.1	5,082	38,788
2020–2025	13.3	5,155	43,943

Source: U.S. Census Bureau and State Demographer

Housing

There were approximately 27,938 housing units in Summit County as of July 1, 2008, including both the unincorporated areas of the County and incorporated towns.[23] More than half of the County's housing stock (53 percent) is located in unincorporated areas, such as Wildernest or the Snake River Basin. Keystone is also located in an unincorporated area of Summit County. Of the 14,800 housing units in

[21] Summit County, 2010
[22] Ibid.
[23] Summit County, 2009b

unincorporated areas of the County, 61 percent—or 8,973 units—are multi-family housing types (i.e., condominiums and townhomes). The remaining 5,827 units (39 percent) are single-family residences.[24]

As of 2008, there were almost as many dwelling units in Summit County (27,938) as there were permanent residents (28,611).[25] These figures seem to suggest a large housing surplus; however, many of these housing units are not available to the permanent population. Due to the tourism-based nature of the County, many of these housing units are used as second homes and short-term rentals. It is estimated that about 64 percent of the housing units in the County are owned by second homeowners.[26] While some of these second home units are rented, they are almost all available as short-term rentals for visitors only. As a result, almost two thirds of the County's housing stock is not accessible to permanent residents. The recent decline in the real estate market (primarily occurring after 2008) has released some second homes onto the available housing market for permanent residents, but the percentage of housing units accessible to them remains low.

Table 3D-2:
Summit County Housing Stock and Occupancy Status (As of July 1, 2008)

Area	Number of Total Housing Units	Occupied Housing Units	Percent Occupied Year-Round	Housing Units Vacant/Not Permanently Occupied	Percent Not Permanently Occupied
Town of Breckenridge	6,394	1,639	25.63%	4,755	74.37%
Town of Blue River	660	320	48.47%	340	51.53%
Town of Dillon	1,244	354	28.42%	890	71.58%
Town of Frisco	2,982	1,062	35.61%	1,920	64.39%
Town of Montezuma	45	24	52.38%	21	47.62%
Town of Silverthorne	1,813	1,216	67.08%	597	32.92%
Unincorporated Areas (including Keystone)	14,800	5,318	35.93%	9,482	64.07%
Total Summit County	**27,938**	**10,013**	**35.84%**	**17,925**	**64.16%**

Economy

In 2010, Summit County's economy had a Gross Regional Product of approximately $1.7 billion, providing 25,363 jobs that produce approximately $1.2 billion total personal income.[27]

[24] Summit County, 2009b
[25] Ibid.
[26] Ibid.
[27] IMPLAN, 2013

Economic Sectors and Major Employers

At least 65 percent of all employment in Summit County is related to travel and tourism operations.[28] In this context, travel and tourism consists of sectors that provide goods and services to visitors to the local economy, as well as to the local population.[29] For the purposes of this analysis these sectors include: retail trade; passenger transportation; arts, entertainment and recreation; and accommodation and food services. Nationally, travel and tourism only accounts for about 15 percent of total employment. When compared with 65 percent in Summit County, the extent of the local county economy which relies on tourism becomes evident. It should also be noted that the percentage of employment related to travel and tourism in Summit County is likely higher than presented, as second home construction and some other tourism related activities are not included in this calculation.

Keystone is one of the largest employers in Summit County in general, and specifically in travel and tourism. Other large employers in the County include other ski resorts (e.g., Arapahoe Basin Ski Area, Beaver Run Resort, Breckenridge Ski Resort, Copper Mountain Resort), local municipalities (e.g., Breckenridge Resort Chamber, Summit County Government, Summit School District, Summit County Restaurant Association, Town of Breckenridge, Town of Frisco, Town of Dillon, Town of Silverthorne), and retail stores (e.g., City Market, Safeway, Silverthorne Outlets, Target, Wal-Mart). The specific economic contribution of Keystone in terms of employment and labor income is discussed below under the Keystone Ski Resort heading.

Employment Status

Employment status is a measure of the number of people who are jobless or employed in the local labor force. The most common metric of employment status is the unemployment rate, calculated as the number of people who are jobless, looking for jobs, and available for work divided by the labor force. In 2010, Summit County had a lower annual unemployment rate (7.8 percent) than the State of Colorado (8.9 percent) and the United States as a whole (9.6 percent).[30]

Keystone Ski Resort

Visitation

Keystone is a major generator of visitor activity in Summit County, attracting local, regional, national and international visitors. Keystone visitors tend to fall into one of two broad categories:

[28] Headwaters Economics, 2011
[29] It is not known, without additional research such as surveys, what exact proportion of the jobs in these sectors is attributable to expenditures by visitors, including business and pleasure travelers, versus by local residents. Some researchers refer to these sectors as "tourism-sensitive." They could also be called "travel and tourism-potential sectors" because they have the potential of being influenced by expenditures by non-locals. In this report, they are referred to as "travel and tourism."
[30] Headwaters Economics, 2011

- Day Visitors – Visitors who travel to and from Keystone for a day of activity. No overnight lodging is involved.
- Destination Visitors – Visitors whose trip to Keystone includes one or more nights spent away from their place of residence.

Over the past 11 years, for which data is available, Keystone averaged about 1.1 million visitors—approximately 60 percent of which were destination (overnight) visitors.[31] This is a critical distinction, as destination visitors' per diem expenditures are higher than day visitors' per diem expenditures. Destination skiers incur costs for lodging, food, travel, etc., resulting in significantly higher expenditures than day visitors.

Long-term trends in annual visitation at any ski area are defined by the overall value that guests perceive and the quality of the experience in general. The total guest experience at any ski area comprises many factors, including, but not limited to, terrain variety, the lift network, dining and guest services, and snow quality.

Based on projections from the IMPLAN3 Model, Keystone's 1.1 million annual visitors currently spend approximately $68,798,000 within the resort and approximately $142,877,000 outside of the resort. This *direct* spending generates a total annual dollar flow of approximately $232,676,000 into the economy, which includes *direct*, *indirect* and *induced* impacts.[32]

Employment

As is true for most mountain resorts, Keystone employs more workers in winter than in the summer. In January 2012, Keystone employed a total of 2,280 workers. As some of these workers are part time and/or seasonal employees, this translates to 1,309 Full Time Equivalents (FTEs; discussed previously). In June 2012, Keystone employed a total of 1,103 workers. This translates to 794 FTEs.[33] Over the course of the year, Keystone employed a total of 2,776 workers (**note:** year-round workers are calculated in both the winter and summer figures provided above). As some of these workers are part time and/or seasonal employees, this translates to approximately 1,524 FTEs. The breakdown of full-time, part-time, year-round and seasonal employment in the summer and winter at Keystone is provided in Table 3D-3.

[31] The complete breakdown of skiers is as follows: Local – 8.9%, in state day – 31.2%, in state overnight – 15.5%, out of state overnight – 41.8%, international – 2.6%
[32] IMPLAN, 2013
[33] Keystone Ski Resort, 2012

Table 3D-3:
Employment at Keystone Resort, Winter and Summer 2011/12

Employment Type	Full-time	Part-time	Total
WINTER SEASONAL			
Year-round	551	56	607
Winter Seasonal	1,245	428	1,673
Total Winter Employment	1,796	484	2,280
Full Time Equivalents	--	--	1,309
SUMMER SEASONAL			
Year-round	551	56	607
Summer Seasonal	365	131	496
Total Summer Employment	916	187	1,103
Full Time Equivalents	--	--	794
TOTAL EMPLOYMENT POSITIONS (WINTER AND SUMMER COMBINED)			
Total Employment Positions	2,161	615	2,776
Full Time Equivalents	--	--	1,524

Source: Keystone Ski Resort, 2012

Labor Income

The Congressional Labor Office defines labor income as income that is derived from employment. This includes all compensation that is a return from work effort, and typically includes labor earnings (wages and salaries), employer provided benefits (health insurance, life insurance, etc.), and taxes paid to the government on behalf of the employees. Employment at Keystone currently generates approximately $48,696,000 in *direct* labor income, approximately $8,982,000 in *indirect* labor income and approximately $9,029,000 in *induced* labor income. In total, employment at Keystone generates approximately $66,707,000 in labor income.[34]

Employee Housing

As per Keystone's PUD (Planned Unit Development), Keystone has a total of 1,173 employee housing credits (EHCs). Employee housing is provided across multiple locations, including: Sunrise I and II (located north of Highway 6/West Keystone Road intersection); Sagebrush (located in the Mountain House Base Area); Tenderfoot (located north of Highway 6, adjacent to the Keystone Conference Center); and Hidden River Lodge (located on Highway 6). Keystone does not have any off-site employee housing.

[34] IMPLAN, 2013

Public Services

In Summit County public services are provided by the County, individual municipalities, special districts and non-profit organizations. In general, the provision of public facilities, schools, and recreational resources currently meets local demand.[35] Since the 1990s Summit County has opened a new Community and Senior Center, the North Branch Library in the Town of Silverthorne, the South Branch Library in the Town of Breckenridge, a new County Commons facility in Frisco (housing the Main County Library and a number of social service programs), and two new recreation centers: the Breckenridge Recreation Center and the Silverthorne Recreation Center. Additionally, individual towns within the County are providing similar and other community and public facilities (e.g., parks, theaters, and pavilions). Current School District expansion plans take into consideration projected budgets, enrollment, and demographic trends.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

As required by NEPA, a No Action Alternative has been included in this analysis for review alongside the Proposed Action.[36] By definition, the No Action Alternative represents a continuation of existing management practices without changes, additions, or upgrades to existing conditions. No new recreational opportunities, facilities or trail improvements would be implemented if this alternative is selected. Therefore, there would be no impacts to economic characteristics or trends in Summit County.

Alternative 2 – Proposed Action

Population

Although Alternative 2 would result in the creation of new employment positions, a percentage of which would be expected to relocate into Summit Country (primarily seasonally) specifically for the job, Summit County's overall population growth rate would remain the same as is projected for the No Action Alternative at 2.14 percent per year through 2025.

Housing

During the three summer construction seasons associated with implementation of the Proposed Action, construction workers who do not have local housing would have access to Keystone employee housing, which is generally reduced in occupancy to approximately 50 percent during the summer season.

[35] Summit County, 2009a
[36] 40 CFR 1502.14

No new employee housing is proposed (or required) to be supplied as a result of the Proposed Action. Current vacancies in Keystone employee housing could accommodate the 12 additional (primarily seasonal) employment positions at Keystone resulting from the Proposed Action.

Economy

Economic Sectors and Major Employers

As discussed under the No Action Alternative, Summit County's economy has historically been largely based on travel and tourism. However, because of the small number of additional jobs associated with the Proposed Action, Alternative 2 is not anticipated to measurably affect this overall economic condition.

Employment Status

Construction and ongoing operation of the Proposed Action would result in the generation of employment, on a *direct* and *indirect/induced* basis. The Proposed Action would *directly* create 12 on-going seasonal positions (6 FTEs) at Keystone. During the three-year construction period, construction of the project components (discussed below under the Keystone Ski Resort heading) is expected to create approximately 288 additional *direct, indirect* and *induced* jobs in the local economy (FTEs; outside of Keystone *direct* employment). These construction jobs would not be on-going; construction related employment would cease following the completion of the project components.

Keystone Ski Resort

Visitation

Keystone's projections do not anticipate major increases in visitation as a result of the Proposed Action. While Keystone may experience gradual increases in visitation related to regional growth over the long-term, for the purposes of this analysis Keystone is assumed to continue to experience moderately fluctuating skier visitation, hovering around 1.1 million visits.

Employment

Under the Proposed Action, construction of the project components is expected to occur over a period of three years. For the purposes of this analysis construction was assumed to take place between 2014 and 2016. Construction at Keystone is typically carried out in the summer season, between April and November. Over the three-year period, construction of the project components would generate approximately 288 total FTEs (annual average of 96 FTEs per year), and approximately $20,526,281 in dollar flows to the economy. This includes approximately 240 *direct* FTEs, approximately 24 *indirect* FTEs and approximately 24 *induced* FTEs and approximately $14,923,253 in *direct* dollar flows, approximately $2,752,934 in *indirect* dollar flows and approximately $2,850,094 in *induced* dollar flows.

On-going operation of the Proposed Action would *directly* create 12 seasonal positions (6 FTEs) at Keystone. This employment would create an additional 2 FTEs (one *indirect* and one *induced*) as well as

contribute approximately $788,836 in total dollar flows (*direct, indirect* and *induced)* into the local economy.

Labor Income

The total labor income (*direct*, *indirect* and *induced*) generated by the construction and operation of the Proposed Action is expected to be approximately $6,849,432. This labor income would be distributed throughout the employment positions created by the Proposed Action (including *direct, indirect* and *induced* positions) and is not expected to substantially impact individual prosperity measures for Summit County.

Public Services

As discussed under the No Action Alternative, public service provision is related to population growth, government revenue sources, economic activity and property values. Under the Proposed Action, economic development and growth (in terms of both economic activity and taxable property) can be expected to increase commensurate with the projected population increase. Therefore, public services would not be directly or indirectly affected by Alternative 2.

CUMULATIVE EFFECTS

For a detailed description of past, present, and reasonably foreseeable future projects within the cumulative effects Analysis Area, the reader is referred to Appendix A in this document.

Forest Service decisions within Keystone's SUP area, as well as the approval of private land development by Summit County, have contributed to growth trends and the social and economic environment within the County. Keystone, along with the three other ski areas within Summit County, have driven both employment and dollar flows that accrue to both the ski areas and other area businesses.

In November 1970, the Keystone ski area opened with four lifts. Since that time, Keystone has continued to be developed as a destination ski resort, including development on public and private lands. The most recent improvements at Keystone include the addition of approximately 311 acres of snowcat skiing/riding terrain in Bergman, Erickson and Independence bowls (an additional 266 acres of undeveloped forested areas below the alpine bowls became accessible), improvements to the terrain park, and replacement of the River Run Gondola. Keystone now includes three villages with a wide variety of shops, restaurants/bars and accommodations which support skiing, snowboarding, golf, mountain biking, horseback riding and many other activities on a year-round basis.

As noted above, the estimation of social and economic impacts is related to visitation—as expenditures by visitors generate dollar flows and support new jobs. Keystone's projections do not anticipate major increases in visitation as a result of Alternative 1 or Alternative 2. Rather, Keystone expects gradual increases in visitation related to regional growth over time.

No other current or reasonably foreseeable future projects with potential to impact social and economic resources have been identified.

With the projected growth, the remaining housing capacity in Summit County would continue to be built as necessary. Under either of the Alternatives, Keystone would continue to provide the full amount of workforce housing that they are responsible for, based on the number of employees and Keystone operations. Private developers and employers would also be required to contribute toward housing credits. Together, employers and the County would continue to work towards supplying a sufficient amount of housing available to the permanent population.

Summit County projects 13,955 more dwelling units could be built in the next ten years, a portion of which is anticipated to be affordable housing, likely relieving some of the limited housing availability.[37]

[37] Summit County, 2009b

E. WILDLIFE AND AQUATIC SPECIES

SCOPE OF ANALYSIS

The Analysis Area encompasses approximately 3,000 acres of NFS lands within Keystone's SUP area, but extends beyond the SUP area, on a species-by-species basis. The Analysis Area is defined for each species throughout this section.

This wildlife analysis is tiered to the 2002 WRNF Forest Plan, and incorporates by reference the 2002 Forest Plan, as amended, as well as the 2008 Southern Rockies Lynx Amendment.[38] Species analyzed include those identified as listed proposed, threatened, endangered (TEP), Forest Service Region 2 (R2) sensitive and management indicator species (MIS). Biological Assessment (BA), Biological Evaluation (BE) and MIS reports were prepared for this project. The BA analyzes the potential effects on federally listed TEP species. The BE provides a similar analysis regarding the potential effects of the Proposed Action on Forest Service R2 Sensitive Species in the area. The MIS report addresses species that the Forest Service uses as a means to monitor selected issues on the Forest as required by regulation.[39] In addition, migratory birds were addressed per the 2008 Forest Service Memorandum of Understanding with the United States Fish and Wildlife Service (USFWS) to promote the conservation of migratory birds.

The following analysis is a summary of the BA, BE and MIS reports that are contained in the project file.[40] Additional information can be obtained by reviewing the larger documentation there. All references are contained therein.

AFFECTED ENVIRONMENT

Analysis-specific field surveys supplemented the extensive habitat and animal database that is available for Keystone as a result of other project-related field surveys conducted virtually every year dating back to 1990. Field surveys were conducted through all project component areas in each of the years between including 2008 and 2011, focusing on TEP, R2 sensitive species, MIS, and migratory birds that may occur in the vicinity of project component areas or that may be affected otherwise by the implementation of the Proposed Action. Collectively, the animal database used for the present analysis represents the best scientific information currently available.

Threatened, Endangered and Proposed Species

Federally listed and proposed animal species that are considered include those identified by the USFWS (current as of Mar. 13, 2013) as potentially present on the WRNF, potentially present on the Dillon

[38] USDA Forest Service, 2002; USDA Forest Service, 2008
[39] 36 CFR 219.19
[40] Thompson, 2013a,b

Ranger District (DRD), and/or potentially affected by management decisions associated with Alternatives 1 and 2. Uncompahgre fritillary butterfly (*Boloria acrocnema*), humpback chub (*G. cypha*), bonytail (*Gila elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), greenback cutthroat trout (*Oncorhynchus clarkii stomias*), North American wolverine (*Gulo gulo luscus*), and Canada lynx (*Lynx canadensis*) were identified (the reader is referred to Table 3E-1). Of the species listed, only the four big river fish and lynx are addressed in detail. Other listed and proposed species known to occur elsewhere on the WRNF and/or in Colorado were considered, but dropped from detailed consideration in this analysis. The rationale for dropping these species includes: they were not identified by the USFWS or Forest Service as potentially present in the Analysis Area; their habitats do not occur in or near the Analysis Area; they have no affinities to Analysis Area habitats; the Analysis Area is outside of the species' range; and/or the management decisions associated with Alternative 2 would have "no effect" on the species, on their habitats, or on designated critical habitat.[41]

Table 3E-1:
TEP Animal Species that May be Affected by
Keystone's Dercum Mountain Improvements Analysis

Common and Scientific Name	Status	Rationale for Occurrence (Habitat)
Uncompahgre fritillary butterfly, *Boloria acrocnema*	E	No suitable habitat (alpine snow willow stands >12,000' on peaks ≥ 12,600'). Analysis far outside species' distribution.
Humpback chub, *Gila cypha*	E	Potentially affected by Colorado River water depletions (far downstream in Colorado River)
Bonytail chub, *G. elegans*	E	Potentially affected by Colorado River water depletions (far downstream in Colorado River)
Colorado pikeminnow, *Ptychocheilus lucius*	E	Potentially affected by Colorado River water depletions (far downstream in Colorado River)
Razorback sucker, *Xyrauchen texanus*	E	Potentially affected by Colorado River water depletions (far downstream in Colorado River)
Greenback cutthroat trout, *Oncorhynchus clarkii stomias*	T	Not part of historic range; no occupied or potential habitat present (isolated mountain stream headwaters)
North American wolverine, *Gulo gulo luscus*	P	Historic range (remote mountains and alpine areas). One known individual uses portions of the Project Area.
Canada lynx, *Lynx canadensis*	T	Present; potential forage/travel habitat (montane and subalpine forests)

Federal status, listed after species, is as follows: E = Endangered, T = Threatened, P = Proposed. Potential pre-field survey occurrence on the Analysis Area and habitat affinity is summarized for each species. Candidate species are addressed in the Biological Evaluation (Thompson, 2012).

Big River Fish

None of the four listed, endangered fish occur any closer to the Project Area than the main stem of the Colorado River near Rifle. The Colorado pikeminnow has been collected on the main stem of the

[41] Thompson, 2013a

Colorado River as high as just above Palisade and adults occur in the Gunnison River. The razorback sucker is present in the Colorado River well above DeBeque. Critical habitat for the bonytail and humpback chub occurs further down the Colorado River. Bonytail and humpback chubs have not been recorded on the main stem of the Colorado River or any of its tributaries higher than the Black Rocks area below Grand Junction.

These four big river fish are addressed together because they all occur far downstream from the Analysis Area in the upper Colorado River basin and because water depletions, water quality degradation, and the effects of impoundments have been the major factors adversely affecting these species. The Forest Service has determined that activities resulting in water depletion in the Upper Colorado River Basin may jeopardize the continued existence of the four endangered fish. Section 7 of the Endangered Species Act mandates that actions authorized, funded, or implemented by a federal agency will not likely jeopardize the continued existence of a listed endangered or threatened species or result in the destruction or adverse modification of critical habitat. Federal actions that would result in new depletions of water or degradation of water quality to tributaries of the Colorado River require consultation with the Service.

Keystone is authorized to divert 1,485.2 acre feet of water and use 343.8 acre feet of water through prior Section 7 Consultations. No other facilities improvements or upgrade projects have been authorized at Keystone that have altered water use authorized through the above Section 7 Consultations. Environmental baseline water use at Keystone remains below levels authorized through Section 7 Consultation. Maximum recent diversions total 700.46 acre feet (693.06 acre feet for snowmaking and 7.4 acre feet for domestic uses), well below the 1,485.2 acre feet authorized through prior Section 7 Consultations. Maximum recent depletions total 139.09 acre feet (138.6 acre feet for snowmaking and 0.49 acre feet for domestic uses), well below the 343.8 acre feet authorized through prior Section 7 Consultations.

Canada Lynx

Canada lynx in the contiguous United States was listed as threatened effective April 24, 2000. The Canada lynx has been classified by the State of Colorado as a State endangered species since 1976. On September 17, 2010, the Colorado Division of Wildlife (CDOW) announced that the lynx reintroduction project had successfully accomplished its goal of establishing a breeding population in the Southern Rockies.

The Southern Rockies Ecosystem represents the extreme southern edge of the range of lynx in North America. The majority of historic lynx occurrence records in the Southern Rockies are associated with the "Rocky Mountain Conifer Forest" type. Canada lynx occur primarily in spruce-fir and lodgepole pine forests, at elevations between 8,000 and 12,000 feet (2,450 to over 3,650 meters).

Because of the patchy, discontinuous distribution of lynx habitat in Colorado, maintaining landscape-level habitat connectivity may be paramount to maintaining a viable population. Colorado lynx habitats are not only constrained by broad alpine zones and non-forested valleys, but also by towns, reservoirs, highways, and other human developments that fragment and isolate montane and subalpine lynx habitats. Any continuously forested corridor between mountain ranges supporting lynx habitat that is relatively free of human development has the potential to be an important landscape linkage.

Lynx are present in Summit County and individuals have passed through Keystone Ski Area beginning shortly after lynx were reintroduced to Colorado in 1999. In addition to lynx moving through southern Summit County during exploratory movements, several lynx have taken up residency recently (for at least part of the year) south of Breckenridge. The large habitat blocks south of Breckenridge in the Swan River Lynx Analysis Unit (LAU) may not be large enough by themselves to support a year-round home range, but they are connected via continuous forest cover to similar, large, higher quality habitat blocks in the Snake River LAU that surround developed Keystone ski terrain.

Southern Summit County, which includes the Keystone Project Area, is relatively well connected with forested habitats in adjacent mountain ranges to the south and west. This landscape linkage through the southeastern corner of Summit County is the most eastern of a limited number of such movement linkages available on the West Slope. This landscape linkage may also be the most valuable linkage for conducting lynx movements to northern Colorado (i.e., north of I-70) when continuous habitat connectivity and large blocks of lynx habitat to the north are considered.

Potentially impaired lynx movements across Keystone are largely an issue during the ski season when some level of human activity may be present 24 hours a day. It is not so much the habitat fragmentation of developed ski terrain that may impair lynx movements as the human activity associated with skiing. Lynx activity varies by sex, season, and reproductive status such that lynx may be active at any time of day. Habitat connectivity along this linkage segment is completely unrestricted by ski area activities seven months of the year (on average) and largely unimpaired 17.5 hours/day during the ski season, including the nocturnal and both crepuscular periods when lynx are more likely to be active.

A mountain pine beetle (MPB) epidemic (now ebbing) recently advanced through southern Summit County and is thought to have appreciably impaired lynx foraging values in lodgepole pine forests within and beyond the Snake River LAU. Within forests dominated by lodgepole pine, MPB-induced lodgepole pine mortality has and will alter lynx prey species abundance and lynx habitat use. Reduced foraging habitat in the lodgepole zone could further impair the ability of lynx to maintain a home range within the LAU and connected LAUs over the moderate term (approximately 25 to 40 years) until adequate forest cover redevelops. MPB effects in mixed conifer (spruce-fir dominated with a subdominant lodgepole pine component) stands could cause minor to moderate long-term increases in the primary lynx prey base, while year-round habitat connectivity through affected areas would not be meaningfully affected.

Approximately 40 percent of the Analysis Area supports lodgepole pine forests that have been, or will be, affected by MPB to some extent.

Snake River LAU

The Project Area is located within the Snake River LAU (LAU 26). The Snake River LAU contains 75,747 total acres, including 64,484 acres (85.1 percent) in federal ownership and 11,263 acres (14.9 percent) in non-federal ownership. The Snake River LAU encompasses the entire Snake River Watershed, bounded on the east and north by the Continental Divide, by I-70 on the north and west, and by the Snake River-Swan River hydrologic divide on the south.

Environmental baseline statistics of lynx habitat in the Snake River LAU, reflecting the habitat-impairing effects of the MPB epidemic, are summarized in Table 3E-2. Lynx habitats on private lands on the WRNF are not mapped and classified. The habitat effectiveness of LAU 26 is considered to be impaired in its ability to support lynx. LAU 26 contains segments of the Loveland Pass Lynx Linkage, designated and managed as a Forested Landscape Linkage (Management Area 5.5).

Table 3E-2:
Current Environmental Baseline Status of Lynx Habitat in the Snake River LAU

Habitat Description	Acres of Habitat in LAU (acres)	Percent of all Lynx habitat in LAU (%)
Winter Foraging	8,240.7	20.47
Denning	5,806.7	14.42
Other	5,200.0	12.92
Currently Unsuitable	21,015.5	52.2
Total Lynx Habitat a	40,262.9	100.0
Non-habitat	24,221.6	-
USFS Acres in LAU	64,484.4	85.1
Private Acres in LAU	11,262.9	14.9
Total Acres in LAU	**75,747.3**	**100.0**

The Swan River Lynx Analysis Unit, LAU 27, encompassing approximately 79,008 acres, is contiguous to the west of the Snake River LAU. The Swan River LAU is noted in this analysis because it is functionally connected to habitats in the Snake River LAU. The lynx corridor through southern Summit County extends through both LAUs, and the two LAUs are part of the lynx Analysis Area. Swan River LAU boundaries extend from the crest of the Tenmile Range on the west, the Continental Divide on the south and east, the Blue River drainage to the Gold Hill and Ophir Mountain area on the north, and to the Swan River/Snake River hydrologic divide north.

Region 2 Sensitive Species

R2 sensitive species represent those that are declining in number or occurrence or whose habitat is declining, either of which could lead to federal listing if action is not taken to reverse the trend, and species whose habitat or population is stable but limited. From the updated R2 sensitive species list, a subset of species, including one amphibian, six birds, and four mammals (Table 3E-3), was determined to be present or potentially present on the WRNF.[42] Only those species that are present or potentially present are considered in this analysis.

Table 3E-3:
Region 2 Sensitive Animal Species That Occur on the WRNF and their Potential Occurrence in the Analysis Area

Common name, *Scientific name*	Rationale for Potential Analysis Effects (Habitat Affinity)
INSECTS	
Great Basin silverspot, *Speyeria nokomis nokomis*	No habitat (Wetlands supporting violet populations)
FISH	
Roundtail chub, *Gila robusta robusta*	No suitable habitat (CO River up through Glenwood Canyon)
Mountain sucker, *Catostomus platyrhynchus*	No suitable habitat (small to medium streams below 7000'; 4 populations documented on the Rifle and Blanco Districts)
Bluehead sucker, *Catostomus discobolus*	No suitable habitat (CO River up to Alkali Creek) Canyon)
Flannelmouth sucker, *Catostomus latipinnis*	No suitable habitat (CO River & larger tribs.)
Colorado River cutthroat trout, *Oncorhynchus clarkii pleuriticus*	No suitable habitat (Isolated, headwater streams and lakes)
AMPHIBIANS	
Boreal western toad, *Anaxyrus boreas boreas*	Potential breeding habitat (Subalpine marshes and wet meadows; ponds, margins of streams; 8,500–11,000')
Northern leopard frog, *Lithobates pipiens*	No habitat (Permanent wetlands)
BIRDS	
Northern goshawk, *Accipiter gentilis*	Pot. habitat (Closed montane forests > 7,500')
Northern harrier, *Circus cyaneus*	Pot. habitat (Grasslands, agricultural lands, marshes, & alpine)
Ferruginous hawk, *Buteo regalis*	No habitat (Plains, grasslands)
American peregrine falcon, *Falco peregrinus anatum*	Pot. habitat (Cliffs, habitats concentrating/exposing vulnerable prey)
Bald eagle, *Haliaeetos leucocephalus*	No habitat (Open water bodies, big game winter range)
White-tailed ptarmigan, *Lagopus leucurus*	No habitat (Alpine habitat and upper elevation willow stands)
Greater sage grouse, *Centrocercus urophasianus*	No habitat (Sagebrush)
Columbian sharp-tailed grouse, *Tympanuchus phasianellus columbianus*	No habitat (Sagebrush and mountain shrub)
Flammulated owl, *Otus flammeolus*	No habitat (Old-growth ponderosa pine and aspen)
Boreal owl, Aegolius funereus	Pot. habitat (Mature spruce-fir & mixed conifer)

[42] USDA Forest Service, 2011

Table 3E-3:
Region 2 Sensitive Animal Species That Occur on the WRNF and their Potential Occurrence in the Analysis Area

Common name, *Scientific name*	**Rationale for Potential Analysis Effects (Habitat Affinity)**
Black swift, *Cypseloides niger*	No local nesting habitat (Waterfalls, cliffs)
Lewis' woodpecker, *Melanerpes lewis*	No habitat (Ponderosa pine and cottonwoods)
Olive-sided flycatcher, *Contopus cooperi*	Present (Open, upper elev. conifer forests)
Loggerhead shrike, *Lanius ludovicianus*	No habitat (Plains, low valleys, shrublands)
Purple martin, *Progne subis*	No habitat (Old-growth aspen)
Brewer's sparrow, *Spizella breweri*	No habitat (Sagebrush and other structurally similar shrublands)
Sage sparrow, *Amphispiza belli*	No habitat (Low elevation big sagebrush and sage/greasewood)
MAMMALS	
Pygmy shrew, *Microsorex hoyi montanus*	Pot. habitat (Variety of subalpine habitats)
Fringed myotis, *Myotis thysanodes*	No habitat (Forests/woodlands to 7,500'; unknown on WRNF
Hoary bat, *Lasiurus cinereus*	Pot. habitat (Including mixed conifer and lodgepole pine forest)
Spotted bat, *Euderma maculatum*	No habitat (Cliffs, arid terrain)
Townsend's big-eared bat, *Corynorhinus townsendii townsendii*	No habitat (Structures, tree cavities <9,500')
American marten, *Martes americana*	Present (Conifer forests)
North American wolverine, *Gulo gulo luscus*	Pot. travel habitat (Mountains)
River otter, *Lontra canadensis*	No habitat (Year-round open water and streamflows of ≥ 10 cfs
Rocky Mountain bighorn sheep, *Ovis canadensis canadensis*	No habitat (High visibility habitat near escape terrain)

Note: Other R2 species are not listed because they have not been found on the WRNF, they have no affinities to Analysis Area habitats, the Analysis Area is outside of the species' range or elevational distribution. Potential pre-field survey occurrence on the Analysis Area, potential for project effects, and habitat affinity is summarized for each species. Species in bold are potentially present and/or are discussed in the text.

Boreal Western Toad

The boreal western toad inhabits marshes, wet meadows, and the margins of streams, beaver ponds, lakes, and glacial kettle ponds between 7,000 and 11,860 feet in Colorado. They may be active both day and night, hiding beneath rocks, logs, or in rodent burrows when inactive. These toads emerge from winter chambers during May and begin moving back to the hibernaculum in late August and early September. By October, most toads have entered hibernation. Breeding begins in late spring as the winter snow pack recedes.

Although this toad was once widespread in Colorado's mountains, and while suitable habitat is still widespread, this species has declined in recent years, with chytrid fungus (*Batrachochytrium dendrobatidis)* thought to be the primary agent.

Boreal toad surveys covered all water bodies potentially suitable as breeding habitat within and beyond project component areas. Surveys consisted of assessing boreal toad habitat life stage components and

systematically walking through wetlands, searching pond margins, creeks, side channels, and other suitable breeding/rearing habitats for egg masses, tadpoles, subadults, and adult toads. Potential breeding habitats within the Keystone SUP area were also opportunistically surveyed during both summers as they were encountered during other fieldwork.

For impact analyses, a 1.5-mile radius is the general distance within which project effects are considered on the WRNF.[43] There are eight known, extant boreal toad breeding sites in the Analysis Area. All but one (in the North Fork of the Snake River) are beyond the 1.5-mile radius dispersal distances considered for Analysis Areas on the WRNF.

Northern Goshawk

Goshawks (*Accipiter gentilis*) are a forest-interior species generally associated with mature aspen and conifer forests between 7,500 and 11,300 feet on the WRNF. Goshawks nest in mature to old-growth aspen and mixed aspen and coniferous forests with a depauperate understory on gently sloping north or east aspects near the bottom of stream courses.

The Forest Service monitors known goshawk nest sites on the DRD. Natural Diversity Information Source (NDIS) data indicate that goshawks are uncommon in Summit County and that one to two individuals can be observed daily in appropriate seasons and habitats. The goshawk Analysis Area for this project is the upper Snake River basin above Dillon Reservoir, which would include the furthest extent of any nest territories that might overlap proposed Alternative 2 disturbance areas.

No evidence of goshawks was detected within the Analysis Area during calling surveys, during other wildlife-oriented fieldwork, or during any other wildlife surveys conducted at Keystone almost annually since 1990. Goshawks may not nest within the Analysis Area because of fragmented character within the interior of the ski area, the high elevation forest stand characteristics of the Bergman forest block containing the *Jane's Journey* egress trail, and superior nesting and foraging habitat at lower elevations in the surrounding area. Although there are unconfirmed reports from Keystone patrollers of a raptor meeting the general description of a goshawk in the North Peak area, the Forest Service has not recently conducted surveys on Keystone Ski Area and they are unaware of any local territories that might overlap the Keystone Area. The upper one-half of the Analysis Area is composed of spruce-fir forest and it is uncommon for goshawks to nest in that habitat in Colorado. However, while goshawks may not nest within developed ski terrain, they could hunt the ski area as part of large hunting territory. Goshawks have been detected hunting developed portions of Breckenridge, Vail, Ski Cooper, and Powderhorn ski areas. Therefore, it is possible that goshawks could utilize portions of the Dercum Mountain Analysis Area as part of a local pair's large range. Primary prey species abundance within the Dercum Mountain Analysis Area and the larger surrounding landscape is relatively moderate (re: small and medium-sized

[43] Grove, 2011

birds and red squirrels) to low (re: snowshoe hares and blue grouse) compared to other Colorado ski areas where goshawks have been detected hunting. Nevertheless, habitats within the Dercum Mountain Analysis Area represent potential foraging habitat.

Northern Harrier

In Colorado, northern harriers (*Circus cyaneus*) are considered residents, most numerous in migration and least numerous in summer. They are relatively rare breeders that nest in a variety of habitats, including native and non-native grasslands, agricultural lands, emergent wetlands, and tall desert shrublands, with the only requirement being abundant cover, such as that provided by tall reeds, cattails, and grasses. They have not been documented in Summit County and their primary breeding areas in Colorado include extensive wetlands on the eastern plains and the San Luis Valley. In the vicinity of the Analysis Area (and higher mountains), harriers are considered rare to locally uncommon. During late summer and fall migration, harriers may wander or range (i.e., considered accidental and rare—one record in the state) above treeline. Their numbers declined in the 1970s due to DDT, but they continue to decline due to habitat loss.[44] In Colorado, the loss of extensive wetland habitat probably poses the greatest threat to the species.

The northern harrier Analysis Area for this project is southern Summit County, which would include the local transitory range of any migrants that might move through the Analysis Area. Although the Analysis Area and surrounding area are unsuitable as breeding habitat, this species has never been detected in the Keystone SUP area during nearly annual wildlife surveys dating back to 1990. It is possible, though extremely unlikely, that during late summer and fall migration, harriers could wander through the Dercum Mountain Analysis Area and opportunistically hunt non-forested habitats, including ski trails.

American Peregrine Falcon

Peregrine falcons (*Falco peregrinus anatum*) generally occur on the Forest as rare breeders and, as uncommon, non-nesting migrants. The number of peregrines nesting in Colorado and summering on the Forest has been increasing. Based on recent bird atlas work, it is estimated that the number of peregrines in Colorado at 236 breeding pairs.

Viable peregrine nesting sites possess two components: (1) adequate nesting habitat, and (2) extensive hunting habitat with an adequate prey base to support the adults and their offspring. Nesting sites are located on precipitous cliffs ranging in height from 40 to 2,100 feet, averaging 200 to 400 feet tall. All habitats within the 10-mile radius need not be considered essential habitat, since only those areas that attract or support peregrine prey need be protected or enhanced. Any habitat that supports or concentrates birds should be considered essential to locally nesting peregrines.

[44] Ehrlich et al., 1992

The peregrine falcon Analysis Area for this project extends approximately 30 miles from Dillon Dam, the maximum hunting distance away from the nest site that would also overlap the Dercum Mountain Analysis Area. An active peregrine falcon eyrie is present in the Tenmile Range such that the Dercum Mountain Analysis Area could be considered to be within a hunting territory. Birds from this eyrie are thought to prey on pigeons and other birds around Dillon Reservoir. The Dercum Mountain Analysis Area is located within 10 miles, but beyond 1 mile of the active peregrine eyrie. There are no habitats within the Dercum Mountain Analysis Area that concentrate prey or that expose the moderate prey base to peregrine attack any more so than other habitats common in the surrounding area.

Boreal Owl

Boreal owls (*Aegolius funereus*) are rare to locally uncommon residents of Colorado's mountains, mainly above 9,000 feet. They inhabit mature and late-successional spruce-fir and spruce-fir/lodgepole pine forests interspersed with small meadows, streams, and wetlands. They prefer stands with a relatively high density of mature trees (≥ 12 in. dbh) with an open understory and multilayered canopy. Recent surveys in Colorado have shown that the species is widely distributed in suitable habitats, with records from most of the higher mountain ranges in the state.

Boreal owls are tolerant of human and machine noise. In Colorado, these owls have nested within 30 meters of a major highway. There is no evidence that human disturbance is an important factor in boreal owl nest loss or movements.

The boreal owl Analysis Area for this project extends outward from the Keystone SUP area to the furthest extent of any boreal owl home range that could overlap the Dercum Mountain project component areas. Because boreal owl home ranges can be in the range of 3,447 to 3,894 acres (e.g., for two males), the boreal owl Analysis Area could extend 3 to 4 miles beyond the proposed disturbance areas on Dercum Mountain.

While evidence of nesting boreal owls was not detected in or near Dercum Mountain project component areas, most of the mature, closed canopy, spruce-fir and mixed conifer stands on Dercum Mountain outside of developed ski terrain are structurally suitable as boreal owl nesting habitat. This is also true for some larger intertrail islands on the north side of Dercum Mountain, although there are habitat fragmentation issues that may impair or preclude home range viability within the developed ski area. Most other spruce-fir and mixed conifer habitat that would be removed by implementation of Alternative 2 could also provide foraging values for one or more pairs of owls.

Olive-sided Flycatcher

Olive-sided flycatchers (*Contopus cooperi*) are uncommon summer residents of higher Colorado mountains and migrants through lower elevations. In Colorado, they breed from 7,000 to 11,000 feet,

primarily in dense, mature spruce-fir and Douglas-fir forests, especially on steep slopes or near cliffs, and less often in other coniferous forests, montane and foothill riparian forests, and aspen forests.

The olive-sided flycatcher Analysis Area for this project extends outward to the furthest extent of any home range that could overlap the proposed Dercum Mountain project component areas. Field surveys conducted between 2008 and 2011 did not detect any olive-sided flycatchers in or around project component areas. While olive-sided flycatchers are present in some portions of the Keystone SUP area, most Dercum Mountain project component areas (i.e., all but Adventure Point and Jane's Journey egress trail) represent unsuitable or poor quality habitat for this species. Heavily fragmented forest, the interior of large intertrail islands and closed forest blocks, and islands without prominent snags do not appear to be occupied.

Pygmy Shrew

Pygmy shrews (*Microsorex hoyi montanus*) are a species associated with the northern boreal forests of Canada and the northern United States. Until 1961 this shrew was unknown from the Rocky Mountains south of Montana. In Colorado, the three locations where this shrew has been captured represent a variety of habitats including spruce-fir and lodgepole pine forests, clearcuts and selectively logged forests, forest-meadow edges, boggy meadows, willow thickets, aspen-fir forests, and subalpine parkland. However, they are thought to occur primarily in spruce-fir and lodgepole pine forests, where they are most abundant in mature and old-growth structural stages. This species is considered to only occur in the central mountains of Colorado in discontinuous, relic populations. However, more recently, 12 representative habitats were sampled above 9,000 feet across the WRNF for the presence of pygmy shrews and captured nine individuals (in 7,203 trapnights) in a variety of habitat types at five different locations at elevations ranging from 9,600 to 11,180 feet.

The pygmy shrew Analysis Area for this project extends outward to the furthest extent of any home range that could overlap the proposed Alternative 2 disturbance areas. No suitable trapping surveys have been conducted within the Project Area to detect this rare species. This species remains rare on the landscape, although trapability is likely a contributing factor. Based on the species' broad habitat affinities, forested and mesic habitats associated with Alternative 2 disturbance areas fall within the broad habitat continuum known to be occupied by this species.

Hoary Bat

The hoary bat (*Lasiurus cinereus*) is a solitary species, roosting primarily among foliage in deciduous and coniferous trees, often along the edges of clearings. They have been observed in a number of forested cover types, including mixed conifer, lodgepole pine, ponderosa pine, pinyon-juniper, and riparian areas with cottonwood and willow. Hoary bats forage on a wide variety of insects, especially moths.

Because of this species' dependence on trees with foliage for summer roosts, insect, disease and large-scale disturbances, such as the current MPB epidemic, pose a substantial, imminent threat to hoary bat populations. The only known roost locations of hoary bats in R2 were in live lodgepole pine trees, and the individuals located in that study preferred trees that were larger and had greater canopy cover than random. The MPB epidemic in Region 2 has killed more than 3 million acres of pine forests, decreasing the quality and quantity of this vital roosting habitat. Forest lands in Region 2 are often surrounded by unsuitable roosting habitat, so forests likely provide important roosting opportunities across the Region.

The species has been documented on the WRNF (Snider 2011) and is considered in detail because of insufficient information on their distribution on the Forest. Based on nightly foraging ranges of other similar bats, the hoary bat Analysis Area could extend several miles beyond the proposed Alternative 2 disturbance area. The hoary bat Analysis Area for this project extends outward from the Dercum Mountain Analysis Area to the furthest extent of any nocturnal foraging range that bats roosting in the Analysis Area might use.

American Marten

Martens (*Martes americana*) are boreal weasels closely associated with dense, late-successional, spruce-fir forests in Colorado, although their seasonal distribution also extends upward into the alpine and down into lodgepole pine forests and coniferous riparian corridors. Martens generally avoid habitats lacking overhead cover, including large clearcuts, burns, and meadows. Forest stands with more than 30 percent canopy cover of coniferous trees are thought to be necessary for suitable marten habitat, and 40 to 60 percent cover is considered optimal. They appear to tolerate some forest thinning, the effects on population varying with the size and the intensity of the activity.

Martens are well distributed across the WRNF in suitable habitats in mid- to upper elevation zones. Although they are most commonly observed in spruce-fir forests, they are occasionally seen in lower-elevation, mixed-conifer forests. Martens are present in Dercum Mountain Analysis Area, most common in spruce-fir and upper elevation mixed conifer stands, but also occasionally extending into the lodgepole pine zone.

The American marten Analysis Area for this project extends outward from the Dercum Mountain Analysis Area to the furthest extent of any marten home range that could overlap the Proposed Action disturbance areas. Therefore, the marten Analysis Area could extend approximately 1 mile beyond the proposed Alternative 2 disturbance areas.

Management Indicator Species

The Forest Service has identified 16 MIS to provide a means to monitor selected issues on the Forest as required by regulation.[45] MIS are those whose response to management activities can be used to predict the likely response of a larger group of species with similar habitat requirements. In addition, selected MIS should be those whose change in population would be directly attributable to the management action. MIS are meant to be a Forest-wide issue and MIS trends are to be evaluated at the Forest-wide scale. Analysis-level activities are evaluated in relation to how they affect Forest-wide population and habitat trends.

As indicated in Table 3E-4, three MIS are considered in detail in this analysis.

Table 3E-4:
WRNF MIS and Their Potential to Occur in Habitats Affected by the Proposed Action

MIS Species	Habitat Occupied by Species? Are species and habitat present in the Analysis Area?	Will Proposed Action affect (direct, indirect, or cumulative) the species or its habitat?
Elk *(Cervus elephus)*	Wide range of forest and non-forest habitats Species Presence: Yes Habitat Presence: Yes	Species - Alt. 1: No; Alt. 2: Yes Habitat - Alt. 1: No; Alt. 2: Yes
Cave Bats	Caves, abandoned mines, and cliffs for roosting; foraging habitat along forest edges Species Presence: No Habitat Presence: No	Species - No Habitat - No Project will not affect any cave resources or this species group.
American Pipit *(Anthus rubescens)*	Alpine Grassland Species Presence: No Habitat Presence: No	Species - Alts. 1&2: No Habitat - Alts. 1&2: No Project would not affect alpine grassland or this species.
Brewer's Sparrow *(Spizella breweri)*	Sagebrush and shrub steppe habitats Species Presence: No Habitat Presence: No	Species: Alts. 1&2: No Habitat: Alts. 1&2: No Project would not affect sagebrush habitats or this species.
Virginia's Warbler *(Vermivora virginiae)*	Dry dense mountain shrub habitats and pinyon-juniper adjacent to coniferous forests Species Presence: No Habitat Presence: No	Species: Alts. 1&2: No Habitat: Alts. 1&2: No Project would not affect shrub habitat types or this species.

[45] 36 CFR 219.19, 1982

Table 3E-4:
WRNF MIS and Their Potential to Occur in Habitats Affected by the Proposed Action

MIS Species	Habitat Occupied by Species? Are species and habitat present in the Analysis Area?	Will Proposed Action affect (direct, indirect, or cumulative) the species or its habitat?
Aquatic Macroinvertebrates	Perennial streams, intermittent streams, lakes and reservoirs Species Presence: Yes Habitat Presence: Yes	Species - Alt. 1: No; Alt. 2: Yes Habitat - Alt. 1: No; Alt. 2: Yes
All Trout (brook, brown, rainbow, CR cutthroat)	Perennial streams and lakes Species Presence: Yes Habitat Presence: Yes	Species - Alt. 1: No; Alt. 2: Yes Habitat - Alt. 1: No; Alt. 2: Yes

Species in **bold** are project MIS.

American Elk

Rocky Mountain elk inhabit the central and northern Rocky Mountains, including western Canada, south through eastern Oregon and Washington, Idaho, western Montana, Wyoming, Colorado, Utah, Nevada, New Mexico and Arizona. Colorado supports the largest elk population of any state or province where they range over much of the western two-thirds of the state. Elk range over most of the WRNF and use essentially all habitats.

Elk were selected as a MIS to answer the question "Does Forest motorized and non-motorized travel and recreation management result in effective use of habitat by ungulates?" Forest-wide, the elk population is increasing, but the population is decreasing in some areas as a result of intentional management. The main MIS concern for elk is habitat effectiveness and their ability to disperse across the Forest. Elk were selected as a project-level MIS for the Dercum Mountain project because they are seasonally present.

Tracking surveys have been conducted along the west boundary of Keystone, twice each year (i.e., May-June and November) since 1984. This standardized, approximately 12-mile transect extends from the mouth of Keystone Gulch, along the bottom of the gulch to the top of The Outback, then south across South Bowl and along Keystone Ridge (aka West Ridge) to near the mouth of Keystone Gulch. The purpose of the surveys was to monitor the compatibility of the ski season with big game use of the ski area. Beginning in 1999, similar semiannual surveys were initiated in Jones Gulch to address similar issues. Additional year-round surveys (1997–2002) were conducted in part to evaluate elk presence and use as part of former, discontinued development proposals.

Survey results indicated that little conflict is occurring between Keystone's operations and spring big game migration. Spring skiing and elk migration at Keystone are mutually exclusive temporal events. Ski seasons normally end approximately one month before the first elk begin entering Keystone Gulch from the west. The limited amount of maintenance activities occurring during the migration period, which

focuses on minimizing erosion associated with runoff, probably has little effect on migrants because maintenance is diurnal, most migration is nocturnal and crepuscular, and there are large adjacent areas devoid of human presence that displaced animals can move to.

Aquatic Macroinvertebrates

Aquatic macroinvertebrates were selected to address trends and conditions of flowing waters only. Therefore, macroinvertebrates in still water habitats will not be discussed further in this document.

The aquatic macroinvertebrate Analysis Areas for this project include those streams (including Camp Creek, Keystone Gulch, and the Snake River above Dillon Reservoir) draining the Analysis Area that could be affected by sediments and increased flows from proposed Alternative 2 disturbance areas.

Because of their wide distribution and their sensitivity to disturbance and pollutants, aquatic macroinvertebrates are widely used to monitor the health of streams and rivers. This group was not chosen as a MIS because of any viability concerns, and there is not a viability concern for this species on the WRNF.

All Trout (Brook, Brown, Rainbow, & Colorado River Cutthroat)

Fish communities are used to describe the existing condition of the Analysis Area and potential effects of various project components. Total trout (including brook [*Salvelinus fontinalis*], brown [*Salmo trutta*], rainbow [*Oncorhynchus mykiss*], Colorado River cutthroat trout [*O. clarkii pleuriticus*], and their hybrids, hereinafter MIS trout, or trout) density, or the number of all trout individuals per 100 meters of stream, is an MIS, and a useful measure of habitat quality.

The all trout Analysis Area for this project includes those streams (including Camp Creek, Keystone Gulch, and the Snake River above Dillon Reservoir) draining the Analysis Area that could be affected by sediments and increased flows from proposed Alternative 2 disturbance areas.

Decreased habitat quality can result from changes in channel morphology and increased sedimentation. Fall spawning fish (brook and brown trout) could potentially be affected by water depletions when eggs are in the gravels. Egg mortality can result from flow reductions dewatering egg deposition areas and increasing anchor ice occurrence. This group was not chosen as a MIS because of any viability concerns, and there is not a viability concern for this MIS group on the WRNF.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

The effects of Alternatives 1 and 2 on TEP, R2 Sensitive and MIS are summarized in Tables 3E-5 and 3E-6. These tables are referred to throughout the effects determinations for Alternatives 1 and 2.

Table 3E-5:
Determination Summary of Effects on TEP Animal Species

Common and Scientific Name	Determination by Alternative[a]	
	1	2
Uncompahgre fritillary butterfly, *Boloria acrocnema*	NE	NE
Humpback chub, *Gila cypha*	NE	NE
Bonytail chub, *G. elegans*	NE	NE
Colorado pikeminnow, *Ptychocheilus lucius*	NE	NE
Razorback sucker, *Xyrauchen texanus*	NE	NE
Greenback cutthroat trout, *Oncorhynchus clarkii stomias*	NE	NE
North American wolverine, *Gulo gulo luscus*	NLJ	NLJ
Canada lynx, *Lynx canadensis*	NE	NLAA

[a] Determinations are NE = "No effect," NLAA = "May affect, not likely to adversely affect," NLJ = "Not likely to jeopardize," and LAA = "May affect, likely to adversely affect."

Table 3E-6:
Determination Summary of Effects on R2 Sensitive Animal Species

Common name, *Scientific name*	Determination	
	Alternative 1	Alternative 2
INSECTS		
Great Basin silverspot, *Speyeria nokomis nokomis*	NI	NI
FISH		
Roundtail chub, *Gila robusta*	NI	NI
Mountain sucker, *Catostomus platyrhynchus*	NI	NI
Bluehead sucker, *Catostomus discobolus*	NI	NI
Flannelmouth sucker, *Catostomus latipinnis*	NI	NI
Colorado River cutthroat trout, *Oncorhynchus clarkii pleuriticus*	NI	NI
AMPHIBIANS		
Boreal western toad, *Bufo boreas boreas*	NI	MAII
Northern leopard frog, *Rana pipiens*	NI	NI
BIRDS		
Northern goshawk, *Accipiter gentilis*	NI	MAII
Northern harrier, *Circus cyaneus*	NI	MAII
Ferruginous hawk, *Buteo regalis*	NI	NI
American peregrine falcon, *Falco peregrinus anatum*	NI	MAII
Bald eagle, Haliaeetos leucocephalus	NI	NI
White-tailed ptarmigan, *Lagopus leucurus*	NI	NI
Greater sage grouse, *Centrocercus urophasianus*	NI	NI
Columbian sharp-tailed grouse, *Tympanuchus phasianellus columbianus*	NI	NI
Flammulated owl, *Otus flammeolus*	NI	NI
Boreal owl, *Aegolius funereus*	NI	MAII

Table 3E-6:
Determination Summary of Effects on R2 Sensitive Animal Species

Common name, *Scientific name*	Determination	
	Alternative 1	Alternative 2
Black swift, *Cypseloides niger*	NI	NI
Lewis' woodpecker, *Melanerpes lewis*	NI	NI
Olive-sided flycatcher, *Contopus cooperi*	NI	MAII
Loggerhead shrike, *Lanius ludovicianus*	NI	NI
Purple martin, *Progne subis*	NI	NI
Brewer's sparrow, *Spizella breweri*	NI	NI
Sage sparrow, *Amphispiza belli*	NI	NI
MAMMALS		
Pygmy shrew, *Microsorex hoyi montanus*	NI	MAII
Fringed myotis, *Myotis thysanodes*	NI	NI
Hoary bat, Lasiurus cinereus	NI	MAII
Spotted bat, *Euderma maculatum*	NI	NI
Townsend's big-eared bat, *Corynorhinus townsendii townsendii*	NI	NI
American marten, *Martes americana*	NI	MAII
North American wolverine, *Gulo gulo luscus*	NI	MAII
River otter, *Lontra canadensi*s	NI	NI
Rocky Mountain bighorn sheep, *Ovis canadensis canadensis*	NI	NI

NI = No impact; BI = Beneficial impact; MAII = may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.

Alternative 1 – No Action

The No Action Alternative reflects a continuation of existing operations and management practices without changes, additions, or upgrades of the existing conditions on NFS land (other than those previously approved). No new facilities or recreational opportunities would be approved under the No Action Alternative.

As indicated in Table 3E-5 and 3E-6, there would be no impacts to TEP or R2 Sensitive species under Alternative 1. Likewise, there would be no effects to MIS as a result of selection of Alternative 1. Additional information on the effects determinations for species under Alternative 1 can be found in the BA and BE, contained in the project file.

Alternative 2 – Proposed Action

Threatened and Endangered Species

Big River Fish

Under Alternative 2, there would be no additional water diversions, depletions, or water use associated with the Proposed Action. As a result, there would be no effect to Big River Fish.

Canada Lynx

Alternative 2 would be consistent with historic ski area operations, but would result in an extension of the current development area boundary within the existing SUP area. Alternative 2 would impact 49.1 acres of lynx habitat types and 19.3 acres of lynx habitat, including 7.9 acres of winter foraging habitat on NFS and private lands. Impacts to lynx habitat represent <0.1 percent of the 40,243.6 acres of lynx habitat in LAU 26.

Direct impacts to lynx habitat would almost entirely result from the development of conventional compacted ski terrain and facilities resulting in the permanent conversion of lynx habitat into "non-habitat." Alternative 2 would result in the additive loss of 7.9 acres of snowshoe hare habitat in 16 polygons, equivalent to about 40 percent of the size of an average hare home range. Alternative 2 would have collectively insignificant and discountable effects on lynx diurnal security habitat effectiveness and home range efficacy. The proposed *Jane's Journey* egress trail would remove a linear corridor of forest cover extending from treeline to the existing *Prospector* trail on North Peak representing the initial, non-natural fragmentation of this large forest block that is part of the centerline of the relatively narrow, most functional, continuously forested, lynx movement corridor that extends through southern Summit County. Although lynx could cross this trail, such an opening in otherwise continuous forest cover could impair local and landscape level habitat connectivity, particularly when skiers are present.

Proposed projects included in Alternative 2 (including the new Summit House, the Family Adventure Zone, expanded Adventure Point, additional teaching terrain, snowmaking improvements, new mountain bike trails and infrastructure improvements) are not, individually or collectively, expected to measurably increase annual visitation at Keystone. Alternative 2 is not expected to result in any increased skier use of undeveloped habitat blocks outside of the dissected portion of the ski area that could have further negative effects on the lynx prey base, lynx Diurnal Security Habitat (DSH), habitat connectivity, or lynx home range efficacy. Alternative 2 is expected to make only insignificant and discountable incremental contributions to traffic volumes along regional highways serving Keystone Resort as a result of the 10 to 12, new, full time, seasonal employees. Alternative 2 is not expected to generate any secondary development from additional residents or employees.

The direct and indirect effects of Alternative 2 would be consistent with all applicable 2009 Southern Rockies Lynx Management Direction. Conservation measures are included in the Proposed Action to further avoid, minimize, or mitigate project effects, specifically those that would offset project-related habitat losses and ameliorate habitat connectivity. The reader is referred to Table 2-3 for more information on conservation measures.

Even considering the collective habitat losses, land use, and human activity within the Snake River LAU, including considerable recent losses associated with the MPB epidemic, the additive loss of lynx habitat associated with Alternative 2 is not considered to be adverse. Alternative 2's collective effects on lynx

foraging, sheltering, and breeding would not exceed the definitions of insignificant and discountable. Therefore, Alternative 2 warrants a "**may affect, not likely to adversely affect**" determination for Canada lynx.

On November 7, 2013, the Forest Service requested that, pursuant to Section 7(c) of the Endangered Species Act (50 CFR 402.14), informal consultation be initiated with the United States Fish and Wildlife Service (FWS) for impacts to Canada lynx. The transmittal to FWS indicated that:

> *"even considering the collective habitat loss, land use, and human activity within the Snake River LAU, including recent losses associated with the MBP epidemic, the additive losses of lynx habitat associated with Alternative 2 are not considered to be adverse. Alternative 2's collective effects on lynx foraging, sheltering and breeding would not exceed the definitions of insignificant and discountable. Therefore, Alternative 2 warrants a "may affect, not likely to adversely affect determination for Canada lynx."*

On December 4, 2013 the USFWS issued a letter of concurrence on the Forest Service's "may affect, not likely to adversely affect" determination.

Region 2 Sensitive Species

Determination of potential effects to sensitive animals (including insects, fish, amphibians, reptiles, birds, and mammals) considers the area, configuration, and function of suitable and occupied habitat affected, home range size and number of individuals affected, size, density, and location of the population, and consequence of negative effects on the species as a whole within the WRNF and within its range.

Boreal Western Toad

With the implementation of BMPs (refer to Table 2-3), Alternative 2 would be consistent with all standards and guidelines, and Forest direction applicable to boreal toads and leopard frogs.

Boreal toad surveys conducted within and around the Keystone SUP area for former projects (e.g., the Jones Gulch and Ski Tip proposals, residential development at the mouth of Jones Gulch, etc.) did not locate any evidence of breeding toads. In recent years, the Forest Service has also conducted their own surveys in Keystone Gulch, along the Snake River, and at the base of Dercum Mountain. No additional toad populations were located.

Regarding boreal toads, Alternative 2 "**may impact individuals, but are not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**."

Northern Goshawk

Alternative 2 would affect goshawks by removing or thinning forest cover on NFS lands within the Dercum Mountain Analysis Area that supports potential prey species (e.g., snowshoe hare and/or red

squirrel). Based on goshawk habitat associations, Alternative 2 would affect 21.4 acres of potential goshawk foraging habitat. With the exception of the relatively large, intact block of high quality foraging habitat associated with the Bergman forest block containing the proposed rerouted *Jane's Journey* egress trail, all of the other Dercum Mountain project component areas are already fragmented and associated with developed ski terrain that likely support a lower prey density. No goshawk nests or nesting habitat associated with a known nesting block would be affected. Indirect effects associated with this project would have no impacts on goshawks.

For Northern Goshawk Alternative 2 "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**."

Northern Harrier

Alternative 2 could affect the availability and effectiveness of potential foraging habitat via a net gain of non-forested habitats (via forest clearing for ski trails). By itself, this effect would result in a "beneficial impact" determination. However, because some currently effective, potential foraging habitat would be temporarily disturbed on existing ski trails by snowmaking infrastructure installation and permanently lost to facilities installation, the insignificant and discountable direct effects would not be entirely beneficial. Therefore, the effects of Alternative 2, including the implementation of project design criteria (PDC), "**may adversely impact individual harriers, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**."

American Peregrine Falcon

Ski trail development below treeline under Alternative 2 may slightly benefit peregrines by increasing the quality of potential foraging habitat by creating additional openings that prey species would have to fly across (thereby increasing the vulnerability of forest and "edge" birds to peregrine predation). In addition, potential prey recovery habitat would be improved for birds knocked down by peregrines above the former canopy. However, because some currently effective, potential foraging habitat would be temporarily disturbed on existing ski trails by snowmaking infrastructure installation and because small areas of currently effective, potential foraging habitat would also be lost to facilities development, overall potential effects would not be entirely beneficial. Peregrines are not particularly bothered by humans per se, so the temporary construction activity and increased summer recreational activities should have little negative effect on the availability of the local prey base. Overall, Alternative 2 should slightly improve the availability of the local peregrine prey base.

The Proposed Action "**may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**."

Boreal Owl

Alternative 2 would affect boreal owls by removing or thinning linear forest strips, representing potential year-round foraging habitat and, to a lesser extent, potential, but presently unoccupied, nesting habitat, scattered throughout one or more owl home ranges. Potential boreal owl foraging habitat affected would total 19.2 acres. Loss of forest-interior prey may be partially offset during the snow free season by substantial increases in deer mice on newly created ski trails. Potential nesting habitat affected, largely associated with mature, closed canopy spruce-fir stands, would total 10.16 acres. If nest trees associated with active territories occur within impact areas during the construction season, direct mortality of eggs and/or nestlings would be avoided by conducting tree removal outside the May 21 to July 15 nesting period when eggs/young could be present. Indirect effects associated with this project and limited to increases in dispersed recreation (i.e., other than that associated with Alternative 2) extending into boreal owl habitat would have no impact on this species.

Regarding boreal owls, Alternative 2 "**may impact individuals, but are not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing**."

Olive-sided Flycatcher

Past and present actions, largely associated with historic mining and logging and more recent ski area development in the Dercum Mountain Analysis Area, have negatively affected suitable olive-sided flycatcher foraging and nesting habitat through habitat conversion, fragmentation, and loss. However, olive-sided flycatchers persist within the Keystone SUP area, including in some developed ski terrain.

Alternative 2 would affect olive-sided flycatchers by removing linear forest strips, portions of which represent potential, but apparently unoccupied, summer nesting and foraging habitat, scattered throughout the home ranges of at least several pairs of birds. Forest cover that would be affected, representing potential olive-sided flycatcher foraging and nesting habitat, would total up to 19.15 acres. If nest trees associated with active territories occur within impact areas during the construction season, direct mortality of current year recruitment could be avoided by conducting tree removal outside the June 1 and July 15 nesting period when eggs/young are present. While Alternative 2 would reduce the amount of foraging and nesting habitat within the existing SUP area, the ski area would continue to support these flycatchers (as influenced by the MPB epidemic, see above). Habitat effectiveness may decline in an area larger than the area of tree removal as a result of forest fragmentation effects, snag removal, and subsequent ski trail forage effectiveness.

For olive-sided flycatchers, Alternative 2 "**may impact individuals, but are not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**."

Pygmy Shrew

Alternative 2 could impact individual pygmy shrews through direct, construction-related mortality and/or loss of potential habitat. Loss of forest-interior prey may be partially offset during the snow free season by substantial increases in deer mice (potential prey) on newly created ski trails. The Alternative 2 impact areas represent an insignificant proportion of the total potential range and habitat available to this species on the Forest. The probability that this species would be present in those potentially suitable habitats proposed for Dercum Mountain upgrading when it is so rare on the WRNF is unlikely.

Because potential habitat would be removed and altered, Alternative 2 "**may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**."

Hoary Bat

Alternative 2 could impact individual hoary bats through the loss of potential roosting/foraging habitat associated with mixed conifer stands and any remaining mature lodgepoles that survive the MPB epidemic. The Alternative 2 impact areas represent an insignificant proportion of the total potential range and habitat available to this species on the Forest. The probability that this species would be present in those potentially suitable habitats proposed for Dercum Mountain upgrading when it is so rare on the WRNF is unlikely.

As a result of the potential habitat that would be removed and altered, Alternative 2 "**may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**."

American Marten

Alternative 2 would affect martens by removing linear forest strips, which represent foraging habitat and possible denning habitat, likely extending into portions of several individuals' home ranges. Affected forest cover, representing at least potential marten habitat, would total up to 19.15 acres under Alternative 2. Most of this forest cover loss would be associated with medium to small intertrail islands within currently developed ski terrain that support lower prey densities and that are less used by marten. The proposed *Jane's Journey* and tubing hill Analysis Areas represent occupied, primary marten habitat. No known marten dens are present within disturbance areas; however marten dens are virtually impossible to locate without the use of radio-collared animals. Young-of-the year would be vulnerable to den tree removal that occurred between approximately March 1 and June 15. Because denning selection, if not denning per se, generally begins before the ski season has ended, marten may not select den sites within areas currently used for tree skiing, although such diurnal skiing when martens are asleep in arboreal and subnivian dens probably has little influence.

Marten habitat effectiveness may decline in an area larger than the area of tree removal as a result of fragmentation effects and tree skiing. All of the Dercum Mountain project components areas currently receive skiing and other human activities at least during the ski season. The effects of tree skiing intertrail islands on the local forest prey base are unclear, but are unlikely to be beneficial. Loss of forest-interior prey would be partially offset during the snowfree season by substantial increases in deer mice on newly created ski trails. Within the existing SUP area, marten habitat would be further fragmented by additional ski trails, restricting (but not blocking) marten movements, and habitat effectiveness similar to that now experienced by martens on the existing ski area.

Regarding American marten, Alternative 2 "**may impact individuals, but are not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing**."

Management Indicator Species

American Elk

Habitat conversion to ski trails would affect mostly fragmented habitat within the developed ski area that receives diurnal human disturbances associated with summer maintenance and recreational activities during spring through fall when elk are present, using the area as transitional range, elk calving (during years with early snowmelt), calf-rearing, and summer range. As a result, these currently impaired habitats would have their effectiveness further reduced by habitat fragmentation and slightly increased levels of human activities throughout the Analysis Area. Construction activity displacement effects would persist for years and while full recovery cannot be assumed in more isolated project component areas receiving little or no human activity (e.g., *Jane's Journey*), it is possible that elk use could largely return to former levels after about seven years, as long as human use remains near current environmental baseline levels. Elk may benefit from increased forage availability on new conventional ski trails, as long as they are not displaced by human activity, although summer forage availability is not a limiting factor. Assuming full habitat occupancy at present, temporarily or permanently displaced elk would compete with their cohorts in the Data Analysis Unit (DAU) for the reduced effectiveness of spring through summer habitats. Alternative 2 development and facilities would not affect elk winter range availability and use.

Alternative 2 would not measurably contribute to any negative trend in the DAU or Forest-wide population or habitat trend of this MIS that would affect achieving Forest Plan MIS objectives.

Aquatic Macroinvertebrates

Alternative 2 would require no additional water use by Keystone. The Resort would continue pumping water out of the Snake River unaffected by the Proposed Action. Alternative 2 includes a number of site-specific, watershed and aquatic resources management measures (in addition to other related PDFs associated with soils, vegetation, wetland, and aquatic resources) that would be implemented to avoid, minimize, and mitigate negative effects to aquatic habitat within and below the Analysis Area.

Management Requirements (Table 2-3) are designed to avoid, minimize, and mitigate the potential for soil and slope destabilization, erosion, and sedimentation from disturbance areas, increased runoff from soil disturbance areas and areas cleared of forest into streams, increases in stream volumes and water velocities, destabilized channels, and degraded water quality that could alter aquatic faunal communities. There should be no moderate- to long-term negative hydrologic effects to aquatic communities, although there could be minor, short-term, incremental hydrologic effects to aquatic MIS until the PDFs achieve compensatory effectiveness.

Nevertheless, conditions resulting from Alternative 2 would continue to provide aquatic macroinvertebrate habitat in the Dercum Mountain Analysis Area and would not measurably contribute to any negative trend in the Forest-wide population or habitat trend of aquatic macroinvertebrates that would affect achieving Forest Plan MIS objectives.

All Trout (Brook, Brown, Rainbow, & Colorado River Cutthroat)

Management Requirements (Table 2-3) are designed to avoid and minimize potential erosion and sedimentation. Increased runoff from areas cleared of forest has the potential to further increase stream volumes and water velocities, channel destabilization, water quality degradation, and the alteration of aquatic Camp Creek habitat at the project level, beyond what has already occurred in and below developed ski terrain. The implementation of Management Requirements would reduce these potential effects over time. No additional snowmaking or water use is proposed. Physical habitat quality would likely be maintained in its current condition under Alternative 2. Potential effects to fisheries in Camp Creek would be unlikely because the creek does not support overwintering habitat and only the very lowest, lower gradient reach of the creek potentially supports fish in summer. It is unlikely that with the implementation of Management Requirements (Table 2-3) and changes to stream flows or water quality would reach the Snake River, below which the river supports brook and rainbow trout. There would be no flow reductions in Camp Creek, Keystone Gulch, or the reach of the Snake River below its confluence with Camp Creek that would affect fall spawning fish.

Alternative 2 would continue to provide physical habitat quality for salmonids in those occupied reaches of Keystone Gulch and the Snake River, including fall spawning areas, and would not measurably contribute to any negative trend in the Forest-wide population or habitat trend of this MIS that would affect achieving Forest Plan MIS objectives.

CUMULATIVE EFFECTS

For a detailed description of past, present, and reasonably foreseeable future projects within the cumulative effects Analysis Area, the reader is referred to Appendix A in this document. Most of these projects have been approved and are part of the environmental baseline considered and described above under individual species accounts. Approved, but unimplemented components of those projects are

considered to have been implemented and part of the environmental baseline that may be further affected by Alternatives 1 and 2

Threatened and Endangered Species

As of 2009, towns and unincorporated areas in southern Summit County were approximately 78 percent built-out. Summit County planners anticipate up to approximately 13,955 more units could be built in these areas, without considering the implementation of strategies that would reduce the development potential. The majority of this additional development would occur over many years, virtually all well beyond full build-out of the Proposed Action (Year 2019). All of this development would occur on private lands, so LAU statistics would be unaffected. Most of this development would be in-fill projects, where additional residences are built on vacant lots within existing subdivisions. With respect to lynx, most of these subdivisions are not in primary lynx habitat and most are within existing development areas outside of lynx habitat. However, some of this future development, particularly those in unincorporated areas, has the potential to affect the margins of lynx habitat. Potential additive effects include habitat conversion and fragmentation and reduced habitat effectiveness and habitat connectivity. Some of these effects and additional risk factors will extend onto adjacent NFS lands, further impairing habitat effectiveness and habitat connectivity and the ability of the Swan and Snake River LAUs to support a lynx home range.

With respect to reasonably foreseeable projects considered, additional components of the 2009 Keystone MDP would reduce spruce-fir forest cover, impair habitat connectivity in other portions of the southern Summit County lynx corridor extending through the Keystone SUP area, and further expand the current development area boundary beyond current limits within the existing SUP area. Proposed components of the 2013 Arapahoe Basin MDP (within the ski area's SUP area) would reduce spruce-fir forest cover, impair habitat connectivity in a portion of the southern Summit County lynx corridor northeast of Keystone that extends over Loveland Pass, and expand the current development area boundary beyond current limits within the existing SUP area. The proposed Weber Gulch Hut (on NFS lands on the northern flank of Bald Mountain, in Breckenridge) would increase dispersed winter recreational activity in a forested bottleneck of the of the southern Summit County lynx corridor west of Keystone. The Tenderfoot Mountain proposal would increase summer-through-fall motorcycle-related activity and disturbances in a large area extending from the town of Keystone to I-70 that slightly overlaps the 5.5 Management Area containing the southern Summit County lynx corridor northwest of Keystone.

The collective effects of these future federal actions could further impair lynx habitat connectivity through southern Summit County and central Colorado, along the easternmost, and possibly the most important, of four continuously forested lynx corridors on the West Slope.

Region 2 Sensitive Species

Boreal Western Toad

Reasonably foreseeable actions considered herein that could affect boreal toads that could also be affected by Alternative 2 would include the implementation of future components of the Keystone MDP and continued build out of residential developments in the vicinity of Keystone. Those actions would affect possibly historic, but currently unoccupied and unsuitable boreal toad habitat within the Analysis Area.

Northern Goshawk

Impact zones associated with reasonably foreseeable projects considered in this analysis would contribute additional effects to foraging and potential nesting habitat associated with any pair of goshawks whose territory may overlap the Analysis Area. However, goshawks would persist in this Analysis Area. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to this species because impact zones associated with those other projects would not extend to potential habitat for this species that could be directly and indirectly affected by Alternative 2 on NFS land.

Northern Harrier

Reasonably foreseeable actions that could affect harriers that could also be affected by Alternative 2 would include the implementation of future components of the 2009 Keystone MDP and Arapahoe Basin's MDP. These actions could also provide potentially beneficial, but in all likelihood unrealized, increases in potential foraging habitat.

American Peregrine Falcon

Past and present actions (largely associated with more recent ski area developments within the Keystone SUP area) that created grasslands out of closed canopy forest, have potentially benefitted peregrines by creating additional openings that prey species would have to fly across (thereby increasing the vulnerability of forest and "edge" birds to peregrine predation) and increasing the quality of potential foraging habitat (by improving potential prey recovery habitat, for birds knocked down by peregrines above the former canopy). Similar increases in potential foraging habitat from the reasonably foreseeable the implementation of future components of the 2009 Keystone MDP and A Basin's MDP could also provide potentially beneficial, but in all likelihood unrealized increases in potential foraging habitat.

The ongoing MPB epidemic may reduce short- and moderate-term foraging opportunities along mid- and lower-elevation lodgepole pine and mixed conifer habitats in the upper Blue River Valley, including the Dercum Mountain Project Area and other portions of the SUP area.

Boreal Owl

Past and present actions, largely associated with historic mining and logging and more recent ski area and secondary residential development in the Dercum Mountain boreal owl Project Area, have negatively affected suitable foraging and nesting habitat through habitat conversion, fragmentation, loss, and incomplete successional recovery. However, boreal owls probably persist in the upper Snake River drainage and may occur in the Keystone SUP area.

Impact zones associated with reasonably foreseeable projects (probably limited to future components of the 2009 Keystone MDP) considered in this analysis would contribute additional effects primarily to potential boreal owl foraging and nesting habitat within the Keystone SUP area. However, sufficient, potential boreal owl foraging and nesting habitat would persist in the Analysis Area to allow a portion of one or more boreal owl territories to overlap the Keystone SUP area. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to this species because impact zones associated with those other projects would not extend to potential habitat for this species that could be directly and indirectly affected by Alternative 2 on NFS land.

Olive-sided Flycatcher

Past and present actions largely associated with historic mining and logging and more recent ski area development in the Dercum Mountain Project Area, have negatively affected suitable olive-sided flycatcher foraging and nesting habitat through habitat conversion, fragmentation, and loss. However, olive-sided flycatchers persist within the SUP area, including in some developed ski terrain.

Impact zones associated with reasonably foreseeable projects considered in this analysis (limited to future components of the 2009 Keystone MDP) would contribute additional effects to olive-sided flycatcher foraging and nesting habitat in the Snake River basin. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to this species because impact zones associated with those other projects would not extend to potential habitat for this species that could be directly and indirectly affected by Alternative 2 on NFS land.

Pygmy Shrew

Past and present actions that resulted in habitat conversion, fragmentation, loss, and incomplete successional recovery that were largely associated with historic mining and logging and more recent ski area development in the SUP area, may have negatively affected potential habitat of this species. Large areas of potential pygmy shrew habitat persist in the Snake River basin, including developed and undeveloped ski terrain within the SUP area.

Impact zones associated with reasonably foreseeable projects considered in this analysis (limited to future components of the Keystone MDP) would contribute additional effects to potential pygmy shrew habitat in the Snake River basin. However, a substantial acreage of potential habitat for this species would persist

in this Analysis Area. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to this species because impact zones associated with those other projects would not extend to potential habitat for this species that could be directly and indirectly affected by Alternative 2 on NFS land.

Hoary Bat

Past and present actions that resulted in habitat conversion, fragmentation, loss, and incomplete successional recovery that were largely associated with historic mining and logging and more recent ski area development in the Dercum Mountain Project Area, may have negatively affected potential habitat of this species, both positively and negatively. Large areas of potential hoary bat habitat persist in the Snake River basin, including developed and undeveloped ski terrain within the SUP area.

Impact zones associated with reasonably foreseeable projects considered in this analysis (probably limited to future components of the Keystone MDP) would contribute additional effects to potential hoary bat habitat in the Snake River basin. However, a substantial acreage of potential habitat for this species would persist in this Analysis Area. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to this species because impact zones associated with those other projects would not extend to potential habitat for this species that could be directly and indirectly affected by Alternative 2 on NFS land.

American Marten

Forest fragmentation associated with ski area development in late-successional forests is thought to negatively affect local marten use of the landscape via a reduced prey base (at least on ski runs in winter), reduced cover (potentially for resting, denning, traveling, predator evasion, and thermal refugia), and reduced effectiveness of remaining forest habitat (from disturbances associated with recreation and management activities). Past and present actions, largely associated with historic mining, logging, and trapping, and more recent ski area and secondary residential development in the Analysis Area, have negatively affected marten habitat through habitat conversion, fragmentation, loss, and incomplete successional recovery. However, marten continue to use developed ski terrain where suitable habitat is present in intertrail islands at Keystone.

Impact zones associated with reasonably foreseeable projects considered in this analysis, limited to future components of the 2009 Keystone MDP and continued residential build-out in the Keystone base area, would contribute additional negative effects to marten habitat and mortality in the marten Analysis Area. Future MDP components would have the same qualitative effects as the Dercum Mountain project and stray pets associated with future residential development might present an increased mortality risk, or food source, to martens. However, marten would persist in this Analysis Area. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to this

species because impact zones associated with those other projects would not extend to potential habitat for this species that could be directly and indirectly affected by Alternative 2 on NFS land.

Management Indicator Species

American Elk

Past actions, largely associated with historic mining, logging, and reservoir developments and more recent ski resort and supporting infrastructure developments (in particular secondary residential and commercial developments and traffic increases), have affected seasonal elk habitats in the upper Blue River Valley. Actions earlier than the 1950s, when elk first began recolonizing the valley, affected unoccupied habitat, but the resulting habitat losses, modifications, and distributions of human developments and activities in the Valley established a baseline for how elk utilize the landscape today in response to present actions.

Reasonably foreseeable projects considered in this analysis would have additional, incremental effects to seasonal and year-round elk habitat use, habitat connectivity, and highway mortality. Those projects would contribute minor, local negative effects on elk habitat effectiveness, but no discernible effect on elk habitat effectiveness within the DAU or on the WRNF.

Aquatic Macroinvertebrates

Past and present actions that have affected aquatic macroinvertebrates and their habitat in the vicinity of the Analysis Area include historic mining, historic and contemporary logging, other habitat modifications (including Alpine and Nordic ski area development), secondary resort development, and the effects of recreational activities. These actions have modified stream channels to some extent and resulted in short-term to long-term perturbations to water quality and aquatic faunal communities compared with control streams.

Reasonably foreseeable actions considered herein that could affect aquatic macroinvertebrates that could also be affected by Alternative 2 would include be implementation of future components of the 2009 Keystone MDP, implementation of the 2013 Arapahoe Basin MDP, implementation of the Tenderfoot Mountain trails project, and continued southern Summit County residential build-out. Effects to aquatic macroinvertebrates could result from habitat conversion, ground disturbance, erosion, sedimentation, increased runoff (short- to long-term), increases and decreases of woody debris in streams, and other negative water quality impacts. The impact zones of other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to Analysis Area streams because impact zones associated with those projects would not extend to the flowing waters that could be directly and indirectly affected by Alternatives 1 and 2 on NFS land. Stream conditions on the WRNF as a whole are generally in good (i.e., somewhat near reference) condition and Forest-wide aquatic macroinvertebrates are expected to move toward reference (i.e., better) conditions as more conservative habitat protection measures are implemented and as habitat improves.

All Trout (Brook, Brown, Rainbow, & Colorado River Cutthroat)

In and around the Analysis Area, past actions have had mostly negative effects to native trout and their habitat and beneficial and negative effects to the non-native trout considered in this MIS group. Past and present actions that have affected trout and their habitat in the vicinity of the Analysis Area include historic mining, historic and contemporary logging, other habitat modifications (including Alpine and Nordic ski area development), secondary resort development, water diversions and impoundments, road building, the effects of recreational activities, and CPW management (i.e., restocking). These actions have eliminated and degraded existing habitat (e.g., Peru Creek and upper reaches of the Snake River below the Peru Creek confluence), presumably also affecting fall spawning, and introduced non-native trout to streams presumably occupied by Colorado River Cutthroat (CRCT). Introductions of non-native brook, brown, and rainbow trout into Colorado in the late 1800s clearly benefitted these species, while these same introductions and other factors negatively affected CRCT.

Reasonably foreseeable actions considered herein that could affect trout that could also be affected by Alternative 2 would include be implementation of future components of the 2009 Keystone MDP, implementation of the 2013 A Basin MDP, implementation of the Tenderfoot Mountain trails project, and continued southern Summit County residential build-out. Effects to trout could result from habitat conversion, ground disturbance, erosion, sedimentation, increased runoff (short- to long-term) and altered stream hydrology, increases and decreases of woody debris in streams, and other mostly negative water quality impacts. These future actions would all include management requirements that would avoid and minimize negative effects to water quality that would likely minimize additional impacts to aquatic macroinvertebrate communities. The impact zones of other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to Analysis Area streams because impact zones associated with those projects would not extend to the flowing waters that could be directly and indirectly affected by Alternatives 1 and 2 on NFS land.

F. VEGETATION

SCOPE OF ANALYSIS

This section provides a general discussion of common plant species known to occur on NFS lands in the Analysis Area, which encompasses the approximately 3,000 acres of NFS lands within the Keystone SUP area. Elevations range from 9,280 feet at the base of the mountain to 12,610 feet at the summit of Bear Mountain.

The project file includes the 2013 Biological Assessment (BA) and 2013 Biological Evaluation (BE) that were prepared specifically to analyze potential effects of the Proposed Action. Together, the BA and BE analyze listed proposed, threatened, endangered, and Forest Service Region 2 (R2) sensitive species.[46] This analysis of botanical resources summarizes the BA and BE. It incorporates by reference the 2002 Forest Plan, as amended.[47]

AFFECTED ENVIRONMENT

Field surveys for plants were conducted through all project component areas between 2010 and 2011. Focused survey methods were followed, with systematic surveys conducted in good quality potential habitat for all federally-listed, Forest Service R2 sensitive species, and WRNF plant Species of Local Concern (SOLC). Consideration was also given to the Project Area's location in the landscape for broader habitat connectivity considerations. Project-specific field surveys supplemented the extensive plant, habitat, and animal database that is available for Keystone Resort as a result of other project-related field surveys conducted virtually every year dating back to 1990. Collectively, the plant and animal database used for this analysis represents the best scientific information currently available.

Threatened, Endangered and Proposed Species

Federally listed and proposed plant species that were initially considered in the BA included those identified by the Forest Service as potentially present on the WRNF, potentially present on the DRD, and/or potentially affected by management decisions associated with Alternatives 1 and 2. Penland alpine fen mustard (*Eutrema penlandii*)—listed as threatened—was the only threatened, endangered or proposed (TEP) species identified.

Other TEP species known to occur elsewhere on the WRNF and/or in Colorado were considered, but dropped from detailed analysis. This can be attributed to a number of factors, including: they were not identified by the USFWS or Forest Service as potentially present on the DRD; their habitats do not occur on the DRD or in the Project Area; they have no affinities to Project Area habitats, the Project Area is outside of the species' range; and/or the management decisions associated with Alternative 2 would have

[46] Thompson, 2013a,b
[47] USDA Forest Service, 2002

"no effect" on the species, on their habitats, or on designated critical habitat. Candidate species are addressed in the BE.[48]

Penland Alpine Fen Mustard

Only one of the thirteen threatened and endangered plants federally listed for Colorado has been documented in the vicinity of the Dercum Mountain Project Area. The threatened plant, Penland alpine fen mustard (*Eutrema penlandii*), has been found in Summit County on Hoosier Ridge, approximately 15 miles southwest of the Project Area. There are no records of this plant outside the Hoosier Ridge area that extends south to Mount Sherman in the Mosquito Range. This mustard is found above 11,800 feet in rocky crevices where there is moisture during the growing season (primarily from snowmelt), and rooted in mosses on stream banks, in hummock areas, or other sub-irrigated mossy areas. *Eutrema* flowers from mid-July through mid-August, and is in fruit after this time period.

During plant surveys conducted within the Project Area, neither *Eutrema penlandii* nor suitable habitat for it was detected.

Region 2 Sensitive Species

Thirty three species of sensitive plants are known or expected to occur on the WRNF; of these, potential habitat exists within the Project Area for seven species. Required habitats for these species are summarized in Table 3F-1. Species in bold are potentially present in the Project Area.

Table 3F-1:
Region 2 Sensitive Plant Species that occur, or that may occur, on the WRNF and their Potential Occurrence in the Project Area

Common name, *Scientific name*	Pre-field Potential Occurrence (Habitat Description)
Sea pink, *Armeria maritima* ssp. *sibirica*	No habitat (Wet sandy alpine slopes 11,900–13,000')
Park milkvetch, *Astragalus leptaleus*	No habitat (Wet meadows/aspen; Gun. Basin, Middle Park)
Trianglelobe moonwort, *Botrychium ascendens*	Pot. habitat (Montane willow wetlands and ruderal habitats)
Slender moonwort, *Botrychium lineare*	Pot. habitat (Montane through subalpine ruderal habitats)
Peculiar moonwort, *Botrychium paradoxum*	Pot. habitat (Montane through subalpine ruderal habitats)
Smooth rockcress, *Braya glabella*	No habitat (Sparse. calcareous alpine gravels >12,000')
Lesser panicled sedge, *Carex diandra*	No habitat (Subalpine wetlands, wet meadows, w. carrs)
Livid sedge, *Carex livida*	No habitat (Fens)
Yellow lady's slipper, *Cypripedium parviflorum*	Pot. habitat (Variety of forests, incl. S-F & LP, 5,700–12,400')
Clawless draba, *Draba exunguiculata*	No habitat (Granitic alpine fellfields 12,000–14,000')
Gray's Peak whitlow-grass, *Draba grayana*	No habitat (Gravelly alpine slopes 11,500–14,000')
Weber's draba, *Draba weberii*	No habitat (Single location in Summit County, 11,500–11,600')
Roundleaf sundew, *Drosera rotundifolia*	No habitat (Continuously moist or saturated fens)

[48] Thompson, 2013b

Table 3F-1:
Region 2 Sensitive Plant Species that occur, or that may occur, on the WRNF and their Potential Occurrence in the Project Area

Common name, *Scientific name*	Pre-field Potential Occurrence (Habitat Description)
Giant helleborine, *Epipactis gigantea*	No habitat (Sandstone seeps, springs, hot springs 4,800–8,000')
Dropleaf buckwheat, *Eriogonum exilifolium*	No habitat (Sparsely vegetated, rolling, sedimentary hills <8,500')
Altai cotton-grass, *Eriophorum altaicum* var. *neogaeum*	No habitat (Peat wetlands 9,500–14,000')
Chamisso's cotton-grass, *Eriophorum chamissonis*	No habitat (High elevation peaty wetlands)
Slender cotton-grass, *Eriophorum gracile*	No habitat (Peaty wetlands & saturated soils, 6,900–8,000')
Hall fescue, *Festuca hallii*	No habitat (Alpine tundra and subalpine grasslands, 11,000–12,000')
Simple bog sedge, *Kobresia simpliciuscula*	No habitat (mesic to wet tundra and fens, 8,970–12,800')
Colorado tansy-aster, *Machaeranthera coloradoensis*	No habitat (Sparsely vegetated sandy soils 8,500–12,500')
Kotzebue's grass-of-Parnassus, *Parnassia kotzebuei*	No habitat (Edges of standing water bodies 10,000–12,400')
Harrington penstemon, *Penstemon harringtonii*	No habitat (Open sagebrush, pinyon-juniper habitats)
Porter feathergrass, *Ptilagrostis porteri*	No habitat (Peaty soils in willow-tuft. hairgrass >10,000')
Ice cold buttercup, *Ranunculus karelinii*	No habitat (Ridge/Mtn. top rock, scree, 12,000–14,100')
Dwarf raspberry, *Rubus arcticus* ssp. *acaulis*	Pot. habitat (Moist montane and sub-alpine habitats, 7,000–9,720')
Sageleaf willow, *Salix candida*	No habitat (Nutrient-rich fens and thickets, 8,800–10,600')
Autumn willow, *Salix serissima*	No habitat (Calcareous fens, 7,800–9,300')
Narrowleaf peatmoss, *Sphagnum angustifolium*	No habitat (Fens)
Baltic sphagnum**,** *Sphagnum balticum*	No habitat (Fens)
Sun-loving meadowrue, *Thalictrum heliophilum*	No habitat (Steep oil shale slopes 6,300–8,800')
Lesser bladderwort, *Utricularia minor*	No habitat (Fens and other calm, shallow, aquatic habitats)
American cranberrybush, *Viburnum opulus* var. *americanum*	Not present (facultative wetland plant not documented in CO)

The remaining R2 plant species do not occur in the habitats present in the Project Area, do not have elevation and/or distributional ranges that overlap the Project Area, have not been documented in the general geographic area of the Project Area, would not be affected by the Proposed Action, and do not warrant detailed consideration with respect to the Proposed Action.

Slender Moonwort

Moonworts are small, inconspicuous, and often ephemeral species, which may not appear above the ground every year. *Botrychium* populations are often found in disturbed areas such as landings, skid trails, and along roadsides. Due to the small size of slender moonwort and its scattered habitat availability, this species may be more abundant than is presently known. Because *Botrychium* aggregations are often found in genus groups, aggregations of relatively common moonworts represent potential habitat for this and

other rare moonworts. Slender moonwort produces spores from July to August and is most visible during the months of July and August. Threats to moonworts include surface disturbing activities that may physically change soils or moisture. Ski trail development through closed-canopy forests in Colorado has benefited moonworts by creating potential habitat out of previously unsuitable habitat, as ski runs are known to provide habitat for moonwort species. Moonworts appear to be tolerant of snow compaction.

Slender moonwort (*Botrychium lineare*), a federal candidate species whose listing as threatened is "warranted, but precluded," occurs in extremely small, localized, and disjunct populations in the United States and Canada. Despite known populations in Colorado, Montana, Idaho, Washington, Oregon, California, New Brunswick, and Quebec, there are less than 200 individual plants known in the world. About one-quarter of this total (53 plants) occurs on Pikes Peak (9,000 feet). Another population (2 plants) occurs in El Paso County at 8,700 feet. The fourth Colorado population in Lake County near Leadville is based on previously misidentified specimens at the University of Colorado herbarium.

Until recently (ca. 2005), the USFWS limited area of *B. lineare* consideration in Colorado to the east slope of the Front Range. However, Warren Hauk (Denison Univ.), who found the upper *B. lineare* population on Pikes Peak, indicated that in 2000 he found a moonwort population at approximately 9,900 feet near the base of Copper Mountain Ski Area in Summit County that contained *B. lineare*. Investigation of this site did not detect *B. lineare*, though it is possible that it might occur in Summit County, given its inconspicuous appearance and reproductive mechanism (wind dispersed spores).

Field surveys of the Project Area were optimally timed (phenologically) to detect TES plants, and SOLC known to occur and potentially present on the WRNF. No *B. lineare* or any other R2 sensitive moonworts were detected, however, western moonwort (*B. hesperium*), Mingan moonwort (*B. minganense*), pale moonwort (*B. pallidum* or *"redbank"*), reflected moonwort (*B. echo*), and common moonwort (*B. lunaria*) were detected growing on open ski slopes, along access roads, and beneath ski lifts. Because moonworts frequently exist in genus communities that may support unexpressed plants for years before plants emerge above ground, it is possible, though extremely unlikely, that slender moonwort spores are present, but that the plants have not emerged.

Trianglelobe Moonwort

The distribution of trianglelobe moonwort (*Botrychium ascendens)* ranges from southeastern Alaska to California, Nevada, Utah, Colorado, and Wyoming. Trianglelobe moonwort habitat includes wetlands, wetland edges, montane willow communities with high moss, gravel and cobble ground cover. The preferred substrate for the plant is calcareous, volcanic, or granitic alluvium. Trianglelobe moonwort shares other life history characteristics with slender moonwort, described above. Trianglelobe moonwort was not detected during plant surveys of the Project Area; however, portions of the Project Area support some of the ruderal habitats that this species is generally associated with.

Paradox Moonwort

Paradox moonwort (*Botrychium paradoxum*), first described in 1981, has been found in only a few, widely scattered sites in the western United States and southwestern Canada. In the United States, it has been documented in Idaho, Montana, Oregon, Utah, Washington, Wyoming, and Colorado. Elevation range of the plant is approximately 9,000 to 12,500 feet. Paradox moonworts are found in montane to subalpine grassy meadows and open areas. Potential habitat for the paradox moonwort includes ski trails, old landings, skid trails, roadsides, under conifer saplings, meadows, and other clearings, ruderal habitats similar to other moonworts. Paradox moonwort is most visible during the months of July and August. Paradox moonwort was not detected during plant surveys of the Project Area; however, portions of the Project Area support some of the ruderal habitats in which this species is generally associated.

Yellow Lady's Slipper

Yellow lady's slipper (*Cypripedium parviflorum*) is an orchid known from all Canadian provinces and most states, except Nevada, Texas, Louisiana, and Florida. Although widespread, it is uncommon in most of its range. In Colorado, it grows in aspen groves and ponderosa pine/Douglas-fir forests, riparian and riparian transition, cottonwood, lodgepole pine, and spruce-fir forests up to the alpine zone, with an approximate upper elevation limit of 12,500 feet. Sizeable populations occur on the east slope of the Front Range, but elsewhere in Colorado, they are limited to plants in a few scattered patches. This species has not been documented in Summit County. The closest known population to the Project Area is in the vicinity of Carbondale. Yellow lady's slipper flowering may range over a ten-week period from May through August, depending on local environmental conditions, and flowers may remain open for up to three weeks. Habitat falling within the general continuum of this species is present within the Project Area, but the species was not located and is considered to be absent in the Project Area.

Dwarf Raspberry

Dwarf raspberry (*Rubus arcticus* ssp. *acaulis*) is a small herbaceous wetland plant that is restricted to North America and possibly Siberia. Although it is a relatively widespread species, occurrences of dwarf raspberry are few and tend to be widely separated within the continental United States. In Region 2, this species is known from mountainous areas in Colorado and Wyoming. Eight of the ten documented occurrences in Colorado and Wyoming are on NFS lands. In Colorado, two occurrences are on the Pike National Forest and three are on the Arapaho National Forest. The Colorado Natural Heritage Program designates it critically imperiled (S1) in Colorado. In Colorado and Wyoming, dwarf raspberry grows in the montane and subalpine, at elevations between approximately 7,000 and 9,720 feet. This species can grow in forested wetlands, willow carrs, mossy stream-sides, mountain meadows, and alpine tundra. Although clearly found in tundra in the northern parts of its range, there do not appear to be documented occurrences above treeline in Region 2. This species could be affected by skier- and snowcat-compacted terrain. While portions of the Project Area occur in the life zone and at elevations inhabited by this

species, this species, and indicator species for it were not located during plant surveys and it is considered to be absent in the Project Area.

PLANT SPECIES OF LOCAL CONCERN

The WRNF Forest Plan does not include direction (standards or guidelines) for the management of plant SOLC. However, direction for the management of these species is provided in Forest Service Manual (FSM) 2670.22, number 2, which states to "Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands." There are 113 WRNF SOLC that may occur in the Dercum Mountain Project Area. Thirteen of those have habitat present within the Project Area, and eight of those were detected on, and adjacent to, project component areas during systematic surveys conducted in 2010 and 2011. The SOLC were generally found in wetlands or on existing ski runs, with the plant populations being located at sites scattered throughout the Project Area. *Listera borealis* and *Sphagnum platyphyllum* plant populations were found growing in forested wetlands. *Botrychium* (moonwort) species were growing on open ski slopes, along access roads and beneath ski lifts, as moonworts frequently colonize disturbed areas such as ski runs and roadsides. GPS site location data were recorded for all SOLC identified during the botanical survey at Keystone. Completed WRNF Rare Plant Species Field Survey Forms along with .klm files showing survey routes and plant locations are contained in the project file at the Dillon Ranger District.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

The No Action Alternative reflects a continuation of existing operations and management practices without changes, additions, or upgrades of the existing conditions on NFS land (other than those previously approved). Therefore there would be no effects to any TEP, R2 Sensitive, or SOLC plants as a result of selection of Alternative 1.

Alternative 2 – Proposed Action

Threatened and Endangered Species

Penland Alpine Fen Mustard

During plant surveys, *Eutrema penlandii* and suitable habitat for it was not detected. With the exception of the upper end of *Jane's Journey*, no proposed projects would extend into the alpine where potential *Eutrema* habitat could occur. The 0.4-acre area of *Jane's Journey* at approximately 11,700 feet, would affect a sparse Krummholz/willow/forb community that is not located below a persistent snowfield and does not support a down-slope wetlands that could represent potential habitat for this species. Proposed Dercum Mountain improvements would not increase skier use of alpine terrain or alter snowcat use

patterns or avalanche control where incrementally increased snow compaction could adversely affect potential *Eutrema* habitat.

Alternative 2 would have no effect on this species.

Region 2 Sensitive Species

Determination of potential project effects to sensitive plants considers the habitat requirements, number of individuals/populations affected, size, density, vigor, and location of the affected population(s), total number of individuals and populations, and consequence of negative effects on the species as a whole within the WRNF and within its range. Impacts to unoccupied habitats would have "no impact" on R2 sensitive plants.

Based on plant surveys of the Project Area, surveys of proposed disturbance areas, surveys of adjacent areas where prior and current R2 plants were previously located, habitats that would be affected in the Project Area, and species' habitat affinities, five R2 sensitive plant species, trianglelobe moonwort (*Botrychium ascendens), s*lender moonwort (*B. lineare*), peculiar moonwort (*B. paradoxum*), yellow lady's slipper (*Cypripedium parviflorum*), and dwarf raspberry (*Rubus arcticus* ssp. *acaulis*) had potentially suitable habitat in the Project Area.

As identified in Table 3F-2, the Proposed Action would have no impact on the remaining 28 sensitive plant species.

Table 3F-2:
Determination Summary of Effects on R2 Sensitive Plant Species resulting from the Dercum Mountain Improvements Project

Common name, Scientific name	Determination	
	Alternative 1	Alternative 2
Sea pink, *Armeria maritima* ssp. *Sibirica*	NI	NI
Park milkvetch, *Astragalus leptaleus*	NI	NI
Trianglelobe moonwort, *Botrychium ascendens*	NI	MAII
Slender moonwort, *Botrychium lineare*	NI	MAII
Peculiar moonwort, *Botrychium paradoxum*	NI	MAII
Smooth rockcress, *Braya glabella*	NI	NI
Lesser panicled sedge, *Carex diandra*	NI	NI
Livid sedge, *Carex livida*	NI	NI
Yellow lady's slipper, *Cypripedium parviflorum*	NI	NI
Clawless draba, *Draba exunguiculata*	NI	NI
Gray's Peak whitlow-grass, *Draba grayana*	NI	NI
Weber's draba, *Draba weberii*	NI	NI
Roundleaf sundew, *Drosera rotundifolia*	NI	NI
Giant helleborine, *Epipactis gigantea*	NI	NI
Dropleaf buckwheat, *Eriogonum exilifolium*	NI	NI

Table 3F-2:
Determination Summary of Effects on R2 Sensitive Plant Species resulting from the Dercum Mountain Improvements Project

Common name, Scientific name	Determination	
	Alternative 1	Alternative 2
Altai cotton-grass, *Eriophorum altaicum var. neogaeum*	NI	NI
Chamisso's cotton-grass, *Eriophorum chamissonis*	NI	NI
Slender cotton-grass, *Eriophorum gracile*	NI	NI
Hall fescue, *Festuca hallii*	NI	NI
Simple bog sedge, *Kobresia simpliciuscula*	NI	NI
Colorado tansy-aster, *Machaeranthera coloradoensis*	NI	NI
Kotzebue's grass-of-Parnassus, *Parnassia kotzebuei*	NI	NI
Harrington penstemon, *Penstemon harringtonii*	NI	NI
Porter feathergrass, *Ptilagrostis porteri*	NI	NI
Ice cold buttercup, *Ranunculus karelinii*	NI	NI
Dwarf raspberry, *Rubus arcticus ssp. acaulis*	NI	NI
Sageleaf willow, *Salix candida*	NI	NI
Autumn willow, *Salix serissima*	NI	NI
Narrowleaf peatmoss, *Sphagnum angustifolium*	NI	NI
Baltic sphagnum, *Sphagnum balticum*	NI	NI
Sun-loving meadowrue, *Thalictrum heliophilum*	NI	NI
Lesser bladderwort, *Utricularia minor*	NI	NI
American cranberrybush, *Viburnum opulus* var. *americanum*	NI	NI

NI = No impact.
MAII = may impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing.

Slender Moonwort

With respect to slender moonwort, the Proposed Action "**may impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing**."

Trianglelobe Moonwort

With respect to trianglelobe moonwort, the Proposed Action "**may impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing**."

Paradox Moonwort

With respect to paradox moonwort, the Proposed Action "**may impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing**."

Yellow Lady's Slipper

With the implementation of PDF, the Proposed Action would have **no direct or indirect impact** on yellow lady's slipper.

Dwarf Raspberry

With the implementation of PDF, the Proposed Action would have **no direct or indirect impact** on dwarf raspberry.

Species of Local Concern

Alternative 2 would have direct and indirect effects on eight SOLC. Some of the moonworts are the most common moonwort species on the WRNF. Others (i.e., *Botrychium pallidum* or "redbank" and *B. echo*) were former R2 species considered on the WRNF before they were delisted after being found to be far more common than previously thought as a result of specific moonwort surveys. *Botrychium minganense* is not quite as common, but it is widespread in Summit and Eagle Counties (e.g., at Keystone, Breckenridge, Copper Mountain, Beaver Creek, and Vail Ski Areas and at Vail/Shrine Pass). While the Forest Service only has records of 19 individuals on the WRNF, in 2003 1,590 individuals of *B. minganense* in 77 aggregations were located along 24.7 miles (141.47 acres) of proposed snowmaking pipeline corridors on existing ski trails at Copper Mountain Ski Area, alone. Therefore, in the event that some or all of the moonwort populations in proposed disturbance areas at Keystone Resort would not be avoided, the loss of these individuals and populations would not present a viability concern Forest-wide or range-wide.

CUMULATIVE EFFECTS

Appendix A includes a table of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

The Proposed Action may lead to cumulative effects to three species of moonwort, all three of which are R2 Sensitive Species. These are the trianglelobe moonwort, the slender moonwort, and the paradox moonwort. Identical to the direct and indirect impacts, the Proposed Action may impact individuals, but are not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing.

Similarly, the Proposed Action may lead to cumulative effects on eight of the SOLC, identical to those mentioned under direct and indirect effects. The Proposed Action may impact individuals, but are not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing.

G. SOIL RESOURCES

SCOPE OF ANALYSIS

The scope of the soils resource analysis includes areas proposed for direct disturbance on the front side of Dercum Mountain, the *Diamond Back* trail, and a drainage in Bergman Bowl. This analysis is based on review of the Holy Cross Area Soil Survey, field surveys completed September 5th and 6th, 2012, and post field work characterization of soil properties completed during the fall of 2012. Sample sites were selected to conduct a baseline survey of soil organic matter (organic *O* and mineral *A* horizons, commonly referred to as "duff" and "topsoil" layers, respectively) within proposed disturbance areas to ensure activities such as grading and clearing do not result in a net loss of soil organic matter or increased landscape instability.

FOREST PLAN DIRECTION

Both the 2002 Forest Plan and the Watershed Conservation Practices Handbook (WCPH) provide soil management measures to guide land treatments within the WRNF. In addition, policy more specifically related to Water, Wetlands and Geotechnical resources have been incorporated into those sections of the DEIS. The following direction contains measures that are most applicable to the soils resource as it is related to the proposed Keystone projects.

WRNF 2002 Forest Plan

8.25 Ski Areas – Existing and Potential

Soils Standard 1. Effective ground cover (mulch) upon completion of ground disturbing activities will meet minimum levels of pre-treatment habitat type (Aspen 95 percent, Lodgepole Pine 90 percent, Spruce-Fir 95 percent).

Soils Guideline 1. Ground cover as a combination of revegetation and mulch applications, should meet the requirements in the table below, one and two years following completion of ground disturbing activities.

Table 3G-1:
Soil Guideline 1 – Ground Cover Requirements

Erosion Hazard Class	Year 1 Minimum Effective Ground Cover (%)	Year 2 Minimum Effective Ground Cover (%)
Low	20–30	30–40
Moderate	30–45	40–60
High	45–60	60–75
Very High/Severe	60–90	75–90

Soils

Guideline 1. Conduct an onsite slope stability exam in areas identified as potentially unstable. Potentially unstable land is described as having a "high" or "very high" instability ranking. Limit intensive ground-disturbing activities on unstable slopes identified during examinations.

Guideline 3. When logging over the snow, conditions should allow for 1 foot of packed snow to be continuous (i.e., not patchy) and competent enough so that wheeled or tracked vehicles do not break through. When logging over frozen ground, a minimum of 3 inches of continuous frozen ground should be present.

USFS Watershed Conservation Practices Handbook (WCPH)

Hydrologic Function

- MM-2. Manage land treatments to maintain enough organic ground cover in each activity area to prevent harmful increased runoff.

Sediment Control

- MM-11. Stabilize and maintain roads and other disturbed sites during and after construction to control erosion.
- MM-12. Reclaim roads and other disturbed sites when use ends, as needed, to prevent resource damage.

Soil Quality

- MM-14. Maintain or improve long-term levels of organic matter and nutrients on all lands.

These are a summary of the most pertinent management measures in the Forest Plan and WCPH. More specific definitions and design criteria can be found in those documents which are contained in the project file.

EXISTING CONDITIONS

The Project Area is located within the Keystone SUP and on adjacent NFS and private lands, primarily on the front side of Dercum Mountain between the elevations of 9,300 feet and 11,640 feet amsl. In this location, and at this elevation, it receives much of its precipitation in the form of snow. The climate and elevation of the Project Area limit the rate of soil formation. Refer to Chapter 3 Section I – Geotechnical for a discussion of geology and geotechnical issues in the Project Area.

A total of 17 soil map units were mapped within the SUP boundary (refer to Table 3H-1). These soils can be broadly grouped into ten taxonomic units: Cryaquolls-Borohemists, Cryoborolls-Cryaquolls, Leighcan,

Tolby, Legualt, Hechtman, Tolby, Hiwan, Teewinot, and Moran.[49] Mapped miscellaneous land types include cirque lands, rock outcrops, and standing water.

Table 3G-2:
Soil Management Units Identified within the SUP Boundary

Soil Management Unit	Area (acres)	Drainage Class	Available Water Capacity	Runoff	Effective Rooting Depth
100A - Cryaquolls-Borohemists association, 0 to 15% slopes	30.97				
Cryaquolls		Variable	Variable	Variable	>40”
Borohemists		Very Poorly	Low	Slow	>40”
104A - Cryoborolls-Cryaquolls association, 0 to 15% slopes	90.18				
Cryoborolls		Well	Moderate	Moderate	> 60”
Cryaquolls		Very poorly	Moderate	Moderate	> 60”
204D - Leighcan family, till substratum-Rock outcrop complex, 40 to 150% slopes	310.92				
Leighcan		Somewhat excessively	Low	Moderate	> 20–40”
Rock Outcrop		N/A	N/A	N/A	N/A
225B - Leighcan family-Cryaquolls complex, 0 to 25% slopes	554.64				
Leighcan		Somewhat excessively	Slow	Slow	> 60”
Cryaquolls		Very poorly	Moderate	Moderate	> 60”
254D Rock outcrop-Leighcan-Hechtman families complex, 40 to 150% slopes	107.94				
Rock Outcrop		N/A	N/A	N/A	N/A
Leighcan		Somewhat excessively	Low	Moderate	20–40”
Hechtman		Somewhat excessively	Low	Rapid	< 20”
290B Leighcan family, 5 to 40% slopes	826.02				
Leighcan		Somewhat excessively	Low	Slow	> 60”
290C Leighcan family, till substratum, 40 to 60% slopes	481.29				
Leighcan		Somewhat excessively	Low	Slow	> 60”
293A Tolby family, 0 to 15% slopes	120.06				
Tolby		Excessively	Very low	Moderate	> 60”

[49] Cryoborolls-Cryaquolls components are classified as the “Great Group” rather than the “Family” level that many of the named soil components are for the Project Area.

Table 3G-2:
Soil Management Units Identified within the SUP Boundary

Soil Management Unit	Area (acres)	Drainage Class	Available Water Capacity	Runoff	Effective Rooting Depth
293B Tolby family, 15–25% slopes	12.39				
Tolby		Excessively	Very low	Moderate	> 60”
604C Leighcan family, 40–60% slopes	1558.45				
Leighcan		Somewhat excessively	Low	Moderate	> 20”
650B Leighcan-Leighcan families, moderately deep complex, 5–40% slopes	417.29				
Leighcan		Somewhat excessively	Low	Moderate	> 40”
Leighcan		Somewhat excessively	Low	Moderate	20–40”
654D - Tolby family-Rock outcrop-Hiwan family complex, 40–150% slopes	307.05				
Tolby		Excessively	Very low	Moderate	> 20”
Rock Outcrop		N/A	N/A	N/A	N/A
Hiwan		Excessively	Very low	Rapid	> 20”
670C Legualt-Tolby families complex, 40–65% slopes	1762.96				
Leighcan		Somewhat excessively	Low	Moderate	> 20”
Tolby		Excessively	Very low	Moderate	> 20”
901B Moran family-Rubble land complex, 5–40% slopes	382.75				
Moran		Somewhat excessively	Low	Moderate	> 20”
Ruble Land		N/A	N/A	Slow	N/A
Rock Outcrop		N/A	N/A	N/A	N/A
Teewinot		Well	Moderate	Rapid	> 20”
901D Moran family-Rock outcrop-Teewinot family complex, 40–150% slopes	838.68				
Moran		Somewhat excessively	Low	Moderate	> 20”
Ruble Land		N/A	N/A	Slow	N/A
Rock Outcrop		N/A	N/A	N/A	N/A
Teewinot		well	Moderate	Rapid	> 20”
908A Moran family-Cryaquolls-Borohemists complex, 0–25% slopes	53.28				
Moran		Somewhat excessively	Low	Moderate	> 60”
Cryaquolls		Well	Moderate	Moderate	> 60”
Borohemists		Excessively	Low	Slow	> 40”
Rock Outcrop		N/A	N/A	N/A	N/A

Table 3G-2:
Soil Management Units Identified within the SUP Boundary

Soil Management Unit	Area (acres)	Drainage Class	Available Water Capacity	Runoff	Effective Rooting Depth
CQ Cirque land, 40–150% slopes	51.76	N/A	N/A	N/A	N/A
UNCL	23.29	N/A	N/A	N/A	N/A
W	4.65	N/A	N/A	N/A	N/A

Notes:
Available Water Capacity refers to the volume of water that should be available to plants if the soil, inclusive of rock fragments, were at field capacity.
Runoff refers to the degree to/rate at which precipitation, once interfaced with the soil, flows as a result of gravitational forces. Greater rates of Runoff are generally consistent with greater erosion risk.
N/A = not applicable
Source: USDA Forest Service, 1998

Drainage class ratings for these soils range from very poorly to excessively drained, and have variable runoff potential (slow to rapid). Revegetation limits are generally moderate to severe due to soils with high water tables, shallow organic materials, low available water capacity and variable textures. Cut/fill slope stability potential varies widely from slight to severe due to high water table, low load bearing strength, organic material, variable textures and slopes.

Surface and subsurface soil erodibility is generally low within the identified Project Area, with K-factor (K_w) values of surface soil horizons ranging from 0.10 to 0.15.[50] Using the whole soil (*w* subscript) K-factor values best reflect natural soil conditions in the field as rock fragment serve to "armor" soil and make them less erodible overall.[51] Soil organic matter can also be related to soil erodibility as organic horizons allow infiltration and provide productive soils for stabilizing vegetation.[52] Maintenance of soil organic matter and surface *O* and *A* horizon integrity minimizes erosion, compaction, and drainage management issues within the ski area.

Field surveys conducted September 5th and 6th, 2012 generally revealed shallow depth of soil organic matter within the Project Areas, with depths varying from 0 cm in most areas up to 9 cm within the *O* horizon, and 0 to 30 cm within the *A* horizon. A mean thickness was calculated for these materials of 3 and 6.6 cm, respectively. Generally, where previous grading has occurred in soils across the front side of Dercum Mountain, suveys revealed gravelly soils with sparse vegetation. These coarse textures allow high infiltration rates and increased rates of runoff; field surveys noted evidence of tension cracks and

[50] The factor K represents the soil's susceptibility to erosion in their plot condition based on soil texture. Soils that are resistant to erosion have low K values (0.02 to 0.15); soils that display moderate erosion potential are in the middle of the range (0.16 to 0.27); and highly erodible soils tend to have values greater than 0.28.
National Resource Conservation Service, 2008
[51] McCormick et al., 1982
[52] Franzluebbers, 2002; McMullen, 2011

gullying. Specifically, soil samples taken in the area of *Schoolmarm* trail and near the Family Adventure Zone are young soils that could benefit from the application of an organic matter amendment to increase the depth of soil organic matter. Samples near the middle of *Schoolmarm*, near *Ballhooter* trail, soils were very gravelly and had evidence of a young slide. Soils sampled in areas that have not been previously disturbed revealed generally healthy forests with good understory vegetation and functioning *O* horizon. For additional soil characteristics, refer to soils data contained in the project file.

Currently, Keystone has developed a Drainage Management Plan (DMP) for Dercum Mountain, to identify areas where current drainage conditions could be improved to minimize surface erosion and slope stability problems (refer to Chapter 3 Section I – Geotechnical) and to provide a set of tools to mitigate problems and maintain existing drainage infrastructure. The inventory completed for the DMP revealed that the drainage network was generally in good condition, the roads and associated drainage systems were well maintained, and ski trails were in good condition with the exception of *A-51* trails. However, the inventory identified the need for repairs and improvements to waterbars throughout Dercum Mountain. In addition, surface runoff originating in the upper elevations of Dercum Mountain is infiltrating into the ground and contributing to slope instability in the lower elevations of Dercum Mountain. The DMP identifies recommendations to reduce ground water pressure and soil saturation and redirect runoff away from unstable slopes. For detailed information on the existing conditions of drainage management on Dercum Mountain, refer to the Drainage Management Plan in the project file. For information regarding slope stability, refer to Chapter 3 Section I – Geotechnical.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

No new development projects would occur as a result of implementation of the No Action Alternative. The resort would continue to operate under its current configuration and capacity. Because no ground disturbance is proposed under the No Action Alternative, there is no potential to affect soil resources within the area of potential effect as a result of the No Action Alternative.

Alternative 2 – Proposed Action

Implementation of the Proposed Action would result in approximately 1 acre of grading, 20 acres of tree removal and grading, 2 acres of tree removal, and 24 acres of regrading within previously graded areas. New grading and tree removal would be required for the tubing area, mountain bike trails, new trails in the Family Adventure Zone, *Jane's Journey* egress trail, the snowcat access trail, the summit house and summit teaching area and the midway teaching carpet. Regrading would occur primarily within existing ski trails where upgraded snowmaking infrastructure and sewer lines would be installed, as well as at the summit house/teaching area and in areas of the Family Adventure Zone that overlap the existing *Hoodoo* and *School Master* trails. Soils within these areas have low surface and subsurface soil erodibility potential ($K_w \leq 0.15$), and with implementation of appropriate features for drainage management

(including those identified in the existing DMP as well as those identified here), erosion within the Project Area could be minimized (refer to Table 3G-3). For all of the proposed projects under Alternative 2, implementation of the following soil management requirements and Project Design Features (PDF) would minimize erosion and impacts to soil organic material in the Project Area:

1. Soil surveys have been completed within the disturbance areas to ensure no net loss of soil organic matter. Keystone will work with the Forest Service Soil Scientist to re-establish depths similar to preconstruction depths of organic matter. Soil amendments to maintain or improve levels of soil organic matter could include, but are not limited to, compost, compost/biochar mixtures, topsoil importation, and Class A biosolids.
2. Prior to construction, a detailed site erosion control plan will be prepared. This plan shall include the following components:
    - Silt fences, straw bales, straw wattles, and other standard erosion control BMPs shall be employed to contain sediment onsite.
    - Jute-netting or appropriate erosion-control matting on steep fill slopes (i.e., land with a slope angle of 35 percent or greater) will be utilized to protect soils and enhance conditions for vegetation re-establishment.
    - Promptly revegetate disturbed areas. Seed mixtures and mulches will be free of noxious weeds. To prevent soil erosion, non-persistent, non-native perennials or sterile perennials may be used while native perennials become established. The Forest Service must approve the seed mixtures prior to implementation, unless previously approved seed mixes are employed.
3. Existing roads will be used for construction and routine maintenance of the proposed project components where possible.
4. Vegetative buffers will be maintained adjacent to intermittent or perennial drainages and wetlands, to the extent possible. Where avoidance of the vegetative buffer is not possible, disturbance will be minimized.
5. In all areas where grading or soil disturbance will occur, a reassessment of the quantity (depths) of soil *A* and/or organic ground cover would be made to ensure no net loss of this material. Re-spreading of stockpiled topsoil/*A* horizon material and/or the duff layer (*O* horizon) or where necessary applying an organic amendment would promote the successful rehabilitation of these areas in addition to promoting compliance with USFS policy direction towards soil productivity.
6. Soil-disturbing activities will be avoided during periods of heavy rain or excessively wet soils.
7. Areas determined to have been compacted by construction activities may require mechanical subsoiling or scarification to the compacted depth to reduce bulk density and restore porosity.

8. Ground cover, as a combination of revegetation, organic amendments and mulch applications, should restore depths of soil *A* and/or organic ground cover.

Table 3G-3:
Ground Disturbance by Soil Map Unit

Soil Map Unit Disturbance Type/Project	K_w	Acres
225B	0.15	2.54
Regrading		1.09
Sewer		1.09
Tree Removal		1.45
New Trail		1.45
290B	0.15	17.48
Grading		0.42
New Tubing Area		0.42
Grading/Tree Removal		7.34
New Trail		5.17
New Tubing Area		2.17
Regrading		9.72
New Trail		0.41
SM Infrastructure Improvement		9.31
290C	0.15	2.17
Grading/Tree Removal		0.74
New Trail		0.74
Regrading		1.43
SM Infrastructure Improvement		1.43
293A	0.15	2.96
Grading/Tree Removal		2.96
New Trail		2.96
604C	0.10	1.46
Grading/Tree Removal		0.26
New Trail		0.26
Regrading		0.42
SM Infrastructure Improvement		0.42
Tree Removal		0.78
New Trail		0.78
650B	0.15	14.83
Grading		0.03
New Tubing Area		0.03
Grading/Tree Removal		5.47
New Restaurant Location		0.72

Table 3G-3:
Ground Disturbance by Soil Map Unit

Soil Map Unit / Disturbance Type/Project	K_w	Acres
New Trail		4.23
New Tubing Area		0.52
Regrading		9.33
New Facility Location		3.14
New Restaurant Location		0.64
New Trail		1.44
Sewer		2.80
SM Infrastructure Improvement		1.31
670C	0.10	3.36
Grading/Tree Removal		1.31
New Trail		1.31
Regrading		2.05
Sewer		2.05
901D	0.10	0.04
Tree Removal		0.04
New Trail		0.04
UNCL	N/A	1.80
Grading/Tree Removal		1.80
New Trail		1.80
W	N/A	0.32
Grading		0.32
New Tubing Area		0.32
Grand Total		**46.96**

Note: K_w – Surface and subsurface susceptibility of erosion for the whole soil.

All of the proposed projects occur within soils with low landslide potential (refer to Chapter 3 Section I – Geotechnical for more details). Use of the WRNF Landscape Stability Model predicted no areas of "Severe" or "High" risk within the areas of proposed soil disturbance; details of the modeled results are contained in the project file.

There would be a permanent loss of approximately 0.5 acre of soil resources where the new restaurant and yurts are installed. The location of the new restaurant has previously been graded, thus, soil compaction, reduction in organic matter and reduced vegetative cover has already occurred in this area. However, the location of the yurt (approximately 2,500 square feet) would result in new tree removal and grading. The 0.5-acre footprint for the restaurant and yurt would increase the impermeable acreage at the summit of

Dercum Mountain; however, with removal of the existing Summit House the increase in impermeability would be minimized.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

Incremental past, present, and reasonably foreseeable actions have cumulatively affected, or could affect soils resources, particularly the depth of organic-rich soil horizons across the SUP area. As discussed in the Existing Condition section, the drainage inventory completed for Dercum Mountain show generally good drainage conditions, although maintenance and improvements to drainage management is necessary to continue to minimize erosion. Areas subjected to ski area management, including tree removal, grading and snowmaking exhibit shallower depths of organic matter and greater signs of erosion when compared to natural conditions. Cumulatively, if the disturbance required by the Proposed Action is carefully managed with effective erosion control, the low to moderate movement potential of the soil management units coupled with relatively deep organic matter and well-drained mineral subsoils would serve to prevent further impacts to the soils resource within the SUP. The above stated PDFs would be required to minimize any impacts.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Approximately 0.5 acre of soil resources would be replaced with a permanent structure under Alternatives 2. Soil is a very slowly renewable resource, as estimates for rates of soil formation range from 0.0056 cm to 0.00078 cm/year.[53] Globally, rates of soil formation are not keeping pace with erosion, leading to widespread soil loss that in part owes to grading activities such as those associated with ski area development.[54] In this sense, soil loss from development at the summit of Dercum Mountain is an irreversible and irretrievable commitment of resources.

[53] Alexander, 2006
[54] Wakatsuki and Rasyidin, 1992

H. WETLANDS

SCOPE OF ANALYSIS

The Analysis Area for wetlands is limited to specific areas within Keystone's SUP area, including Jones Gulch, Redemption Creek, Camp Creek and Watersheds #1, #3, #5, #8 and #9 on the front and back sides of Dercum Mountain, and the main drainage in Bergman Bowl.

U.S. ARMY CORPS OF ENGINEERS DIRECTION

The *U.S. Army Corps of Engineers Wetlands Delineation Manual*, hereinafter referred to as 1987 Manual, and the Interim Regional Supplement, defines wetlands as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."[55] Wetlands generally include swamps, marshes, bogs, and similar areas. Activities within and near these areas, including tree removal, culvert installation, grading, and changes in runoff regimes may affect the ecological functions of wetland resources. Impacts to wetlands are regulated by Section 404 of the Clean Water Act (CWA), and such activities would require issuance of a permit from the U.S. Army Corps of Engineers (USACE).

According to the 1987 Manual, wetlands that have been disturbed through natural and/or anthropogenic alteration of hydrology, soils, and/or vegetation do not necessarily exist under "normal circumstances."[56] "Normal circumstances" has been further defined as "the soil and hydrologic conditions that are normally present, without regard to whether the vegetation has been removed."[57] Examples of alteration may include: removal of vegetation, removal of soil, placement of fill, channelization, drainage, fires, beaver dams, etc. Areas that do not exist under "normal circumstances" require modified wetland delineation techniques identified as the "Atypical Method for Delineation" in the 1987 Manual. Due to grading and vegetation removal for ski trail development, portions of the Analysis Area were determined to exist under "atypical circumstances." Therefore wetlands within the Analysis Area were delineated using one of the appropriate protocols for either the "routine approach" or the "atypical method."

FOREST PLAN DIRECTION

The 2002 Forest Plan includes one pertinent guideline outlining management direction for riparian areas and wetland resources on NFS lands (specified below). Pursuant to the Forest Plan, as amended, stream health management measures and design criteria are provided in the Region 2 Watershed Conservation Practices Handbook (WCPH) to ensure applicable Federal and State laws are met on NFS lands in

[55] Environmental Laboratory, 1987, supplemented 2010; Cowardin et al., 1979
[56] Ibid.
[57] USACE, 1990

Region 2.[58] The WCPH contains several Management Measures of relevance regarding the protection of riparian areas and wetlands.

Forest-wide: Water and Riparian Resources

Guideline 2. Keep vehicles and equipment out of streams, lakes, and wetlands except to cross at designated points, build crossings, do restoration work, or where protected by 1 foot of snowpack or frozen soil.

Applicable WCPH Management Measures (MM)

- MM-1. Manage land treatments to conserve site moisture and to protect long-term stream health from damage by increased runoff.
- MM-2. Manage land treatments to maintain enough organic ground cover in each activity area to prevent harmful increased runoff.
- MM-3. In the water influence zone (WIZ) next to perennial and intermittent streams, lakes, and wetlands, allow only those actions that maintain or improve long-term stream health and riparian ecosystem condition.
- MM-6. Maintain long-term ground cover, soil structure, water budgets, and flow patterns of wetlands to sustain their ecological function.
- MM-7. Manage stream flows under appropriate authorities to minimize damage to scenic and aesthetic values, fish and wildlife habitat, and to otherwise protect the environment.
- MM-10. Construct roads and other disturbed sites to minimize sediment discharge into streams, lakes, and wetlands.
- MM-11. Stabilize and maintain roads and other disturbed sites during and after construction to control erosion.

EXECUTIVE ORDER 11990

Additional direction regarding wetlands management for the USACE and Forest Service is provided by Executive Order (EO) 11990 – Protection of Wetlands. Presidential EO 11990 requires federal agencies to avoid, to the extent practicable, long- and short-term adverse impacts associated with the destruction or modification of wetlands. More specifically, EO 11990 directs federal agencies to avoid new construction in wetlands unless there is no reasonable alternative. The Order states further that where wetlands cannot be avoided, the proposed action must include all practicable measures to minimize harm to wetlands. As required by EO 11990 and the CWA, avoidance and minimization measures must be considered through

[58] USDA Forest Service, 2002; USDA Forest Service, 2006

the planning process. Therefore, this section also identifies planning constraints with regard to terrain development.

EXISTING CONDITIONS

Wetlands

Approximately 158 acres of wetlands were identified within the Analysis Area (refer to Table 3H-1). Wetlands within the Analysis Area consist of groundwater seeps and riparian wetland systems fed by Camp Creek, Jones Gulch and Keystone Gulch and their unnamed tributaries. Jurisdictional and proposed non-jurisdictional (isolated) wetlands (according to the USACE) with potential to be affected by the Proposed Action were identified. Some of the wetlands delineated were disturbed during previous resort development by grading, rerouting water and/or vegetation removal. Many of these disturbances were authorized and/or occurred prior to the CWA and/or were authorized by a 404 Permit. Wetlands that have been previously disturbed are in various stages of regeneration and continue to exhibit the necessary characteristics of a wetland under "atypical situations," though hydric soil, vegetation or hydrology indicators may have been lacking at the time of the delineation. These wetlands that have been previously disturbed are generally reduced in value for wildlife due to impacts that have reduced vegetative cover and or changed characteristics of the hydrology.

Wetlands within the Analysis Area offer varying degrees of value as wildlife and plant habitat, water storage locations and water filtration qualities. Wetlands within previously disturbed ski trails generally lack deep organic soils and well established vegetation. In addition, historic grading in these wetlands has modified some hydrologic flow. Wetlands within tree islands or ungraded trails often show signs of good water retention and filtration capabilities and plant and wildlife habitat. Fens, ground water fed, peat forming wetlands, in particular have very good water holding capacity and purification values, but they also have high nutrient levels and plant diversity, and can provide environmental characteristics (soils, moisture, temperature and light) for quality habitat.[59]

Wetland classification is based on the Cowardin classification system.[60] The Cowardin system classifies wetlands primarily by dominant plant community. Three types of wetlands were identified within the Analysis Area consisting of palustrine emergent, palustrine scrub/shrub and palustrine forested. Dominant riparian and wetland vegetation at Keystone includes *Equisetum arvense, Vaccinium myrtillus, Senecio triangularis*, *Pedicularis groenlandica, Mertensia ciliata*, *Saxifraga arguta*, *Cardamine cordifolia*, *Salix planifolia*, *Carex aquatilis*, *Veratrum viride*, *Abies lasiocarpa*, *Pinus contorta*, and *Picea engelmannii*.

[59] U.S. EPA, 2012
[60] Cowardin et al., 1979

Palustrine Emergent Wetlands

Palustrine emergent wetlands (PEM) were identified across approximately 14.4 acres within the Analysis Area. This wetland class is characterized by the presence of erect, rooted, usually perennial, herbaceous hydrophytic plants.[61] *Carex* sp., *Equisetum arvense*, *Senecio triangularis*, *Pedicularis groenlandica, cardamine cordifolia* and *mertensia ciliata* were the dominant plants. Low chroma soil matrices and a thick organic layer, 8 inches or greater, were characteristic of these hydric soils. PEM wetlands were generally saturated to the surface, located within riparian zones of perennial drainages, on natural benches and in concavities throughout the Analysis Area.

Palustrine Shrub/Scrub Wetlands

Palustrine shrub/scrub (PSS) wetlands were the most common type of wetland within the Analysis Area, totaling approximately 24.4 acres. Cowardin et al. has defined this type of wetland as being dominated by a woody vegetation community composed of shrubs and young trees less than 6 feet tall.[62] The dominant species present within these wetlands includes *Salix planifolia and Carex sp*. The majority of the PSS wetlands found within the Analysis Area were found within riparian zones of perennial drainages in the area, were saturated within the top 4 inches, and had approximately 10 inches of low chroma hydric soils.

PSS/PEM Wetlands

PSS/PEM wetlands were also common within the Analysis Area with approximately 23.6 acres of PEM/PSS mosaic wetlands delineated. These wetlands were dominated by a mix of PEM/PSS dominant species including *Salix planifolia*, *Senecio triangularis and Carex sp*. These wetlands were saturated to the surface and had approximately 10 inches of low chroma hydric soils.

Forested Wetlands (Palustrine Forested)

Forested wetlands occupy approximately 16.6 acres of the Analysis Area and are typically dominated by a spruce/fir forest (*Picea engelmannii* and *Abies lasiocarpa*), quaking aspen (*Populus tremuloides*), or a successional stage combining the conifer species with the aspens. The understory consists of species typical of palustrine emergent wetlands including monkshood, bitter cress (*Cardamine cordifolia*), marsh marigold, globe flower, and blue bells.

FEN Wetlands

Groundwater-fed, peat-forming wetlands were identified within the Analysis Area. There are approximately 3.9 acres of fen wetlands within the Analysis Area; none are affected by any of the projects. Dominant vegetation in these wetlands varied from variety of *Carex* sp., such as *Carex aquatilis*, and *Juncus* sp. and *Salix planifolia.* Generally, the soil organic horizon was greater than 18 inches.

[61] These species are known to occur in wetlands at Keystone, but are not necessarily indicative of wetlands.
[62] These species are known to occur in wetlands at Keystone, but are not necessarily indicative of wetlands.

In addition to the wetland types identified above, approximately 75 acres of wetlands, primarily in the watersheds #5 and #6, were delineated through aerial imagery and remain unclassified. None of these wetlands have potential to be affected by any of the proposed projects.

Identified wetland type and acreage are presented Table 3H-1.

Table 3H-1:
Wetlands Identified within the Analysis Area

Name	Area (acres)
Watershed #3	1.97
Watershed #5	9.95
Watershed #8	0.83
Watershed #9	28.59
Camp Creek Watershed	30.71
Jones Gulch	84.71
Redemption	0.96
Total	**157.73**

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

No new development projects would occur as a result of implementation of the No Action Alternative. The resort would continue to operate under its current configuration and capacity. Because no ground disturbance is included under the No Action Alternative, no wetland resources would be affected as a result of the No Action Alternative.

Alternative 2 – Proposed Action

Proposed projects with the potential to affect wetlands include mountain bike trails, *Jane's Journey*, and improved snowmaking infrastructure on *Whipsaw* and *Wild Irishman*. To avoid impacts to wetlands, Keystone would reroute or bridge wetlands when they are encountered by mountain bike trails within the area of effects. In addition, rather than grading the entire extent of *Jane's Journey*, portions of the trail that lie within wetland boundaries would be cleared of vegetation, approximately 0.68 acre, over the snow to avoid any ground disturbance. This would result in a type conversion of wetlands from PSS and PFO to PSS, changing the habitat function of wetlands within this area. This change would not require a permit from the USACE. Impacts to wetlands on the Whipsaw and Wild Irishman ski trails, where snowmaking pipelines are proposed, would be avoided by installing pipelines above ground wherever wetlands crossings are required. With these design features, the Proposed Action would avoid and minimize wetland impacts and therefore comply with all management direction concerning wetlands.

CUMULATIVE EFFECTS

No long-term direct or indirect effects to the wetlands resource have been identified as related to the Proposed Action. Although past ski area activities have affected the function and values of wetlands within the Analysis Area, the proposed projects would not cause additional wetlands impacts.

I. GEOTECHNICAL

SCOPE OF ANALYSIS

This geotechnical analysis (i.e., the Analysis Area) is specific to areas within Keystone's SUP boundary that have potential to be affected by proposed projects, primarily the front side of Dercum Mountain (North Peak and The Outback are not discussed in detail). On-mountain guest services, as they relate to proposed projects, are also discussed.

The following summary of geotechnical issues in the Analysis Area is based on literature review, aerial photography interpretation, and field observations made by J.P. McCalpin since 1998. Please refer to the full report in the project file for details about research methods, tables, figures, and sources.

AFFECTED ENVIRONMENT

Six of the eight components of the Proposed Action are on the northern part of the ski area, which descends about 2,300 feet from the northernmost sub-summit of Dercum Mountain (elevation 11,641 feet above mean sea level) to the floodplain of the Snake River (elevation 9,300 feet amsl). The "front side" of Dercum Mountain is a north-facing slope generally triangular in shape. The slope descending from the summit of Dercum at 11,641 feet amsl to 10,000 feet amsl is approximately 23 percent (13 degrees). From 10,000 feet amsl to the base at 9,300 feet amsl the terrain is much steeper, approximately 43 to 50 percent (23 to 27 degrees). This part of the slope was eroded, smoothed, and steepened by the late Pleistocene glacier in the Snake River Valley, which terminated about 3 miles downvalley from the resort base area. Keystone has experienced multiple "mudslides" on this lower portion of the resort. The steep slope combined with a surface of loose glacial till makes this area particularly susceptible to geotechnical instability.

Two of the proposed project components are not located on Dercum Mountain: one is located in Bergman Bowl, the other in the valley at the base of Dercum Mountain. Bergman Bowl, located to the southeast of the summit of Dercum Mountain, contains a large young landslide. This landslide area contains several scarps (steep slope or cliff resulting from erosion or faulting) and landslide deposits. The youngest and steepest landslides lie north of the Bergman Bowl drainage and are marked by steep headscarps in bedrock and benched landslide topography.

The area between the Mountain House and Keystone Gulch along the base of Dercum Mountain is characterized by alluvial fan deposits, landslide deposits, moraine deposits, and inactive talus deposits (accumulation of broken rock fragments).

In order to fully understand geotechnical and slope stability risks that are inherent to Dercum Mountain, it is necessary to inventory the geology of the area. The geology of Dercum Mountain can be examined in two categories: bedrock geology and surficial geology. In terms of understanding geotechnical risks at Keystone, surficial geology is substantially more important.

Bedrock Geology

Dercum Mountain lies on the western margin of the Colorado Front Range, a Precambrian basement-cored uplift of Laramide age (late Cretaceous, ca. 50 to 65 million years old). Dercum Mountain is composed of three Precambrian rock formations, from oldest to youngest, the Idaho Springs Formation, the Swandyke hornblende gneiss, and the Silver Plume granite.

Bedrock outcrops are relatively rare on the northern flank of Dercum Mountain above approximately 10,000 feet amsl (the glacial trimline, marking the uppermost extent of the most recent glacier), and tend to occur only at the summit, in the headscarps of major landslides, and in short ridge segments that trend downslope and are flanked by landslide deposits. Elsewhere, roadcuts and pipeline trenches show the surface to be underlain by either landslide debris, or by deeply weathered bedrock.

Surficial Geology

Surficial geology refers to the geology of unconsolidated surface deposits less than about 1.5 million years old, or Quaternary deposits. Surficial deposits on Dercum Mountain include glacial deposits, alluvial deposits (deposits resulting from water movement), colluvial deposits (deposits found at the bottom of a slope, resulting from gravity-induced movement), and landslide deposits. In the valley bottom of the Snake River, all Quaternary deposits are river alluvium.

Landslide deposits cover the greatest area surface area at Keystone, and have been mapped as covering roughly between 75 to 95 percent of the northern slope. Landslide deposits are generally unconsolidated masses of boulders, gravel, sand, silt, and clay. Within the deposit angular blocks of bedrock and rounded boulders from glacial till are separated by a matrix of finer-grain gravel through clay. Landslide deposits are the most likely materials on the mountain to suffer renewed slope instability, for reasons described below.

Glacial till is the next most abundant deposit at Keystone, covering much of the lower slopes of the mountain below about 10,000 feet amsl.

Geologic Hazards

Geologic hazards are normal geologic surface or subsurface processes that may pose a threat to infrastructure elements or human life. The Analysis Area for the Proposed Action contains three types of potential geologic hazards: landslides, debris flows, and seismic activity. These processes are part of the affected environment (i.e., baseline conditions), and may be both affected by, and can affect, the Proposed Action.

Landslides

Previous geologic reports have described the northern slope of Dercum Mountain as one extensive landslide complex. Despite this consensus among the mappers, there have been no large-scale landslide

movements on this slope since ski operations began. Based on theory and observations from many parts of the world, landslide deposits are the most likely materials on the mountain to suffer renewed slope instability. This higher susceptibility arises because past landslides created a downslope-tilted, basal plane at the landslide bottom of sheared and pulverized clayey material, and this material has the lowest strength of any material on Dercum Mountain (that is, the weakest link in the chain).

Debris Flows

Debris flows (locally referred to as "mud slides") result from the movement of unconsolidated deposits with high water content. The deposit liquefies after moving some threshold distance. Much of the lower part of Dercum Mountain (below about 9,700 feet amsl) is composed of debris flow deposits derived from farther upslope. These debris flows do not have large volumes, but do have enough scouring capacity to erode channels up to 10 feet deep in their upper parts. However, once the flow reaches a flat area with a slope angle below a threshold value, the flow will spread out and deposit debris thinly over a large area. An example of such an event is the June 2011 debris slide-debris flow event that buried the main mountain access road east of Mountain House. Field observations suggest many small debris flows only travel as far as the next landslide-formed bench before stopping and depositing their load, whereas larger, more infrequent debris flows may travel all the way to the base of Dercum Mountain. The largest flows may reach the Snake River, such as the longest of the 1988 "mudslide."

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

The eight components of the Proposed Action have the potential to produce several impacts on geology and geologic hazards in the Analysis Area. There is the potential for several geologic effects, including: 1) decrease in slope stability due to removal of tree root strength in areas that are proposed for clearing; 2) decrease in slope stability due to higher groundwater levels following proposed trail clearing; and 3) disturbance of surface soils during the construction of proposed facilities improvements. The effects of these actions potentially involve changes in runoff; surface erosion (including the delivery of sediment to channels); sediment transport offsite; and effects on slope stability.

Alternative 1 – No Action

No new development projects would occur as a result of selection of the No Action Alternative. The resort would continue to operate under its current configuration and capacity. Because no additional ground or vegetation disturbance is proposed under the No Action Alternative, there is no potential to further affect slope stability and geotechnical hazard risk in the Analysis Area.

Alternative 2 – Proposed Action

For the purpose of this geotechnical analysis, the direct and indirect environmental consequences of the Proposed Action are analyzed on a project-by-project basis.

Summit House

The proposed Summit House Restaurant is at the summit of Dercum Mountain, which is a flat area underlain by stable bedrock (Precambrian biotite gneiss), above the head of any mapped landslides. Based on this rock type (weathered gneiss), the flat topography, and the lack of evidence for past landsliding, it is not anticipated that proposed site grading would have any consequential geologic effects.

The proposed sewer line would descend the back (south) side of Dercum Mountain to the floor of Keystone Gulch. Widmann et al. (2002) did not map any landslides along the sewer line route, and bedrock geology suggests that there has been no substantial slope instability here. At the bottom of the sewer line it would pass into a younger, more loosely structured deposit. Given the character of the deposits near the bottom of the proposed sewer line, there is a small but finite possibility that the lowest 600 feet of the sewer line might be subjected to future scour of on unknown depth.

Family Adventure Zone

In the proposed Family Adventure Zone (which would utilize *Hoodoo* and *Schoolmaster*), cutting new trails in tree islands would slightly increase soil moisture and infiltration to shallow groundwater, and to thus slightly decrease slope stability. In order to assess the ultimate impact, whether or not the area of slight moisture increase shows signs of recent slope instability must be considered.

The western sinuous trail is planned through a tree island that lies on a questionable old landslide deposit, on the flank of a ridge underlain by bedrock. Due to the old age of this deposit it has been densified and thinned by erosion, and thus not very susceptible to reactivation.

The eastern sinuous trail is planned through *Hoodoo* and through parts of the tree islands to the east and west of it. Most of the sinuous trail lies on intermediate-age landslide deposits and included areas of shallow bedrock, so is unlikely to be affected by the Proposed Action. However, the two easternmost trail loops cross over into a young landslide that is much more prone to reactivation. That landslide has an area of 50 acres, compared to 1.2 acres for the total disturbance area associated with the sinuous trail. The affected area is sufficiently small in relation to the size of the landslide that the direct impacts of tree clearing would likely be insufficient to trigger massive reactivation.

Of more concern, however, is the impact of inadvertently routing runoff water from the sinuous trail onto the young landslide. Such a local increase in moisture could trigger a local slide reactivation. That possibility could be mitigated in several ways: (1) reconfigure the sinuous trail so that it does not cross into the Qlsy polygon, and/or (2) if the trail stays in its present configuration, create waterbars along it that prevent runoff from Qlsi going onto Qlsy. Additional management requirements are identified in the Soils and Water Resources section of the EA (and reiterated in Table 2-3), as well as the Keystone Mountain Drainage Management Plan (DMP). The common theme of these management requirements is

to develop and implement solutions for surface and subsurface water in that does not exacerbate existing erosion, mass movement, or stream health issues.

Improved Snowmaking Infrastructure

The Proposed Action includes improvements to the snowmaking system on the following trails: *Bachelor*, *Cross Cut*, *Jack Straw*, *Whipsaw*, *Wild Irishman*. The area of coverage on these trails would not increase as a result of proposed upgrades. For the purposes of slope stability, the area of snowmaking is not as important as the total amount of water added to the trails. If the amount of water annually added as artificial snow does not increase on the above five trails, then there will be no permanent geologic impact.

Adventure Point

Proposed tree clearing in the tree island between the present snowtubing area and the sewage ponds would have a slight negative impact on slope stability. It is difficult to predict the impact of grading and tree-clearing on a deep-seated sackung (a post-glacial feature resembling a tectonic rift) trough in bedrock, or the impact of the sackung on snowtubing operations.

Due to the above uncertainty, a design feature has been incorporated into the Proposed Action that will prevent runoff from the new snowtubing lanes/former tree island from draining southward. The new snowtubing lanes would be sloped gently to the north (as are the present tubing lanes), so that runoff would flow away from the graben.

New Carpet Lifts

The proposed surface lift near the top of the Peru Express lies on stable bedrock beyond the limits of any mapped landslide, and involves no new disturbance (tree clearing or grading), so should have no impact on slope stability. Some tree clearing and grading is proposed in conjunction with construction of this terrain. Evidence of only shallow bedrock of Idaho Springs Formation was found throughout this area. There was no evidence of past slope instability or gully erosion here. Accordingly, installation of this lift should have negligible geologic impact.

The proposed surface lift west of the Gondola mid-station is located within a previously-mapped large landslide polygon. According to the landslide mapping done for this study, the surface lift would be located in an intermediate-age slide lobe. However, this part of the Qlsi slide is quite flat and comprises the southwest margin of an infiltration area. Therefore, this short surface lift is not predicted to have any impact on slope stability. If the grading could be configured to divert water away from the infiltration area and into an incised drainage or pipeline, the grading could actually have a positive effect on localized slope stability.

Jane's Journey Egress Trail

A large, young landslide was mapped in Bergman Bowl which straddles most of the length of the proposed improved egress route, approximately 2,812 feet of its total length of 3,500 feet. While the proposed egress route would cross this young landslide, it would cross at a location that is relatively flat and construction of the trail would require limited grading. This amount of grading is not anticipated to have a consequential effect on the stability of the slide mass because: (1) it is a small, local mass redistribution near the bench-toe boundary, so would not destabilize the slide as much as an unbalanced mass removal farther downslope near the toe; and (2) the volume of the local mass redistribution is small compared to the inferred volume of the slide deposit.

A more important factor for slope stability is where the surface runoff would go following construction of this egress route. At present the natural runoff on the bench continues downslope onto the toe of the slide. Infiltration of the runoff into the toe can keep groundwater levels high in the toe, which decreases slope stability. Diverting some or all of the runoff into an inslope ditch would increase slope stability; alternatively, site specific adoption of other management requirements identified in the Water and Soils resources section of the EA and/or the DMP could be explored at the time of project implementation.

Keystone Gulch Snowcat Access Route

The majority of the alignment of the proposed snowcat access route is on alluvial deposits that do not exhibit any evidence of slope instability, and can withstand small cuts and fills if necessary to form the road grade. There are no foreseeable geotechnical impacts from the construction of the snowcat access road, as long as it is built on its proposed low-elevation alignment at the toe of the slope.

Mountain Bike Trails

The 3 miles of proposed intermediate bike trails involve minimal reshaping of the ground surface and would not be designed to capture or divert surface runoff, but would permit runoff to cross them following the natural downslope direction. Therefore, it is not anticipated that these intermediate trails would have any geotechnical impacts.

As proposed, the beginner trail would be built to a higher standard and would have a cut-and-fill cross section where it traverses sideslopes, which is much of its length. The highest 2.5 miles of this trail from Summit House to approximately the Family Adventure Zone are within stable bedrock outside of the mapped limits of any landslides. In that section, neither the ground disturbance, nor the possible rerouting of surface runoff, is anticipated to cause slope stability problems. For the next 0.9 mile, Trail 1 is either on stable bedrock or on old landslide deposits that would be difficult to reactivate, so no adverse effects on stability are anticipated. The lowest 0.9 mile of Trail 1 descends eastward along the lateral moraine limit, remaining on that moraine for about half of its length. Then the trail switchbacks 180 degrees as it crosses the moraine crest and then begins to zig-zag down onto a mapped landslide lobe. The only

potential geotechnical impact of Trail 1 would be diverting more runoff and thus infiltration onto the lowest 0.45 mile of the trail on the landslide. To prevent this possibility, the trail drainage at the 180-degree switchback on the moraine crest should be diverted to flow into Camp Creek, rather than being allowed to flow north onto the landslide deposit.

CUMULATIVE EFFECTS

There exist incremental past, present, and reasonably foreseeable actions that have cumulatively affected, or could affect, slope stability in the Keystone SUP.

As previously noted, nearly the entire north face of Dercum Mountain has been mapped as a large landslide. Detailed landslide mapping in the Jones Gulch and Ski Tip areas shows that landslides and debris flows have occurred in this area since the end of the latest major glaciation, roughly. 15,000 years ago. Since the early 1970s there have been several landslides on Keystone, mostly concentrated in the lower third of Dercum Mountain. These events indicate that parts of the mountain have reached the threshold for slope instability.

Development of Keystone Ski Area began in 1968 and the ski area opened in November 1970. Artificial snowmaking began in 1972. While the cumulative effects of all previous trail clearing and snowmaking actions on slope instability have never been quantitatively assessed, it is widely known that cutting trails (removing trees) and adding artificial snow leads to local increases in soil moisture and groundwater levels, which in turn decrease slope stability.

Some slight stability-negative effects from proposed trail clearing and runoff diversions can be expected in relation to the Proposed Action. Where the slight impacts of trail clearing and runoff diversions would occur on young mapped landslides or intermediate-age landslides, which are more prone to reactivation, recommendations have been made for mitigating the negative impacts via runoff routing. Many of the proposed projects are not predicted to have any negative effects on geology, geologic hazards, or geotechnical slope stability. Management requirements (discussed previously and identified in Table 2-3) are suggested to reduce potential risks. Chapter 3 Section J – Watershed of this EA also elaborates on proposed management requirements. Therefore, on a mountain-wide basis, the cumulative impacts of the Proposed Action on slope stability are not anticipated to be significant.

J. WATERSHED

SCOPE OF ANALYSIS

The Analysis Area for watershed and wetlands focuses on riparian and wetland resources contained by the drainage areas (the Study Watersheds) located on Dercum Mountain. The Study Watersheds, which are tributary to the Snake River, comprise a total of 5,230 acres. The Study Watersheds are described in more detail in the Affected Environment, below.

FOREST PLAN DIRECTION

Pursuant to the 2002 Forest Plan, as amended, stream health management measures and design criteria are provided in the Region 2 Watershed Conservation Practices Handbook (WCPH) to ensure applicable Federal and State laws are met on NFS lands in Region 2.[63] The Forest Plan and the WCPH direct how snowmaking and land treatments are managed on the White River National Forest. Forest Plan Standards for ski areas specifically state:

> *2. Snowmaking and other water depletions will be conducted in a manner that conserves stream pattern, geometry, substrate composition, and aquatic habitat in affected perennial streams.*
>
> *3. Snow management, including snowmaking and snow-farming, will be conducted in a manner that prevents slope failures and gully erosion, as well as bank erosion and sediment damage in receiving channels.*

The WCPH contains several Management Measures of relevance regarding stream health and water resources effects:

Applicable WCPH Management Measures

The WCPH includes Management Measures (MM) that are environmental goals to protect soil, aquatic and riparian systems:

- MM-1. Manage land treatments to conserve site moisture and to protect long-term stream health from damage by increased runoff.
- MM-3. In the water influence zone (WIZ) next to perennial and intermittent streams, lakes, and wetlands, allow only those actions that maintain or improve long-term stream health and riparian ecosystem condition.
- MM-5. Conduct actions so that stream pattern, geometry, and habitats maintain or improve long-term stream health.

[63] USDA Forest Service, 2002; USDA Forest Service, 2006

- MM-6. Maintain long-term ground cover, soil structure, water budgets, and flow patterns of wetlands to sustain their ecological function.
- MM-9. Limit roads and other disturbed sites to the minimum feasible number, width, and total length consistent with the purpose of specific operations, local topography, and climate.
- MM-10. Construct roads and other disturbed sites to minimize sediment discharge into streams, lakes, and wetlands.
- MM-11. Stabilize and maintain roads and other disturbed sites during and after construction to control erosion.
- MM-16. Apply runoff controls to disconnect new pollutant sources from surface and groundwater.

Relevant WCPH Definitions

The WCPH provides definitions for some terms that are important to conveying information in this report:

Concentrated-Use Site: Areas designed and managed for high density of people or livestock, such as developed recreation sites and livestock watering areas.

Connected Disturbed Areas: (CDAs) High runoff areas like roads and other disturbed sites that have a continuous surface flow path into a stream or lake.[64] Hydrologic connection exists where overland flow, sediment or pollutants have a direct route to the channel network. CDAs include roads, ditches, compacted soils, bare soils, and areas of high burn severity that are directly connected to the channel system. Ground disturbing activities located within the water influence zone should be considered connected unless site-specific actions are taken to disconnect them from streams.[65]

Ephemeral Stream: A stream that flows only in direct response to precipitation in the immediate locality (watershed or catchment basin), and whose channel is at all times above the zone of saturation.

Hydrologic Function: The ability of a watershed to infiltrate precipitation and naturally regulate runoff so streams are in dynamic equilibrium with their channels and floodplains.

Intermittent Stream: A stream or reach of stream channel that flows, in its natural conditions, only during certain times of the year or in several years. It is characterized by interspersed, permanent surface water areas containing aquatic flora and fauna adapted to the relatively harsh environmental conditions found in these types of environments.

Gully: An erosion channel greater than 1 foot deep.

[64] USDA Forest Service, 1999
[65] USDA Forest Service, 1999; Furniss et al., 2000

Permanent Stream: A stream or reach of a channel that flows continuously or nearly so throughout the year and whose upper surface is generally lower than the top of the zone of saturation in the areas adjacent to the stream.

Rill: An erosion channel less than 1 foot deep.

Stream Health: The condition of a stream versus reference conditions for the stream type and geology, using metrics such as channel geometry, large woody debris, substrate, bank stability, flow regime, water chemistry, and aquatic biota.

Stream Health Class: A category of stream health. Three classes are recognized in the Rocky Mountain Region: robust, at-risk and diminished. These classes are recommended to be used for assessing long-term stream health and impacts from management activities.

Swale: A landform feature lower in elevation than adjacent hillslopes, usually present in headwater areas of limited areal extent, generally without display of a defined watercourse or channel that may or may not flow water in response to snowmelt or rainfall. Swales exhibit little evidence of surface runoff and may be underlain by porous soils and bedrock that readily accepts infiltrating water.

Water Influence Zone: The land next to water bodies where vegetation plays a major role in sustaining long-term integrity of aquatic systems. It includes the geomorphic floodplain (valley bottom), riparian ecosystem, and inner gorge. Its minimum horizontal width (from top of each bank) is 100 feet or the mean height of mature dominant late-seral vegetation, whichever is most.

AFFECTED ENVIRONMENT

Project Area Description

Keystone is situated at elevations ranging from 9,250 to 11,640 feet, receiving a significant portion of its annual precipitation as snow during the winter months. Annual precipitation at Keystone averages 26 inches, with approximately 14 inches occurring between November and April.[66] Monthly mean temperatures range between 17 and 26 degrees Fahrenheit for the low temperatures and between 46 and 54 degrees Fahrenheit for the high temperatures.

As stated above, the Study Watersheds are tributary to the Snake River. A brief description of the Study Watersheds follows:

- **Jones Gulch**, a third-order watershed, is the easternmost of the Study Watersheds. Direct tributary to the Snake River, it contains 1,750 acres.
- **Camp Creek**, also a third-order watershed and direct tributary to the Snake River. It is heavily developed and portions of its stream channels have been piped. Its surface area amounts to 770 acres.

[66] This is moisture, not snow depth.

- **Redemption Creek**, is a second-order watershed tributary to the Snake River and contains 210 acres. Sections of the Redemption Creek channel have also been piped as a result of ski area development.
- **Watersheds Numbers (WS #) 1, 3, 5, and 18**, are hill-slope watersheds which drain directly into the Snake River. Their combined surface area totals 695 acres.
- **WS #7, 8, and 17**, are hill-slope watersheds tributary to Keystone Gulch, tributary to the Snake River. They encompass a total of 895 acres.
- **Mozart Creek (WS #9)**, occupies 910 acres and is drained by a third-order stream tributary to Keystone Gulch. A 2,200-foot section of Mozart Creek was piped during the early development of the ski area.

None of the stream segments within the Analysis Area are listed on the Colorado State 303(d) list as impaired streams under the Clean Water Act.[67]

Water Yield

Runoff hydrographs for the Study Watersheds were developed following the methodologies presented in the Water Resource Evaluation of Nonpoint Silvicultural Sources (WRENSS) Procedural Handbook, as updated by Troendle, Nankervis, and Porth, 2003, and supplemented by the CSCUSA Handbook.[68] In summary, the WRENSS Model generates a water balance using seasonal precipitation and vegetation type and density (distributed by watershed aspect). The Model then computes the amount of water potentially available for runoff. The water balance of the WRENSS Model is coupled with a snowmaking hydrology computation process developed through the CSCUSA study. Together, these calculations produce estimates of water yield typical of subalpine mountain watersheds. For each study watershed, the WRENSS Model distributes the calculated annual yield using simulated hydrographs based on hundreds of years of data recorded at several different gauging stations. The simulated hydrographs represent the normalized distributions of the annual yield in six-day intervals throughout the year. It is important to note that the computations do not include routing of runoff water through the watershed to the stream system. Thus, the water yield hydrographs do not represent streamflow per se, but rather basin-wide water yield to the receiving waters. In other words, the WRENSS hydrologic model was developed to simulate expected changes in streamflow as the result of silvicultural activities, not streamflow itself.

Water yields and distribution hydrographs were modeled for Alternatives 1 and 2 and for baseline conditions using monthly average precipitation and temperature data for each watershed. The purpose of this modeling effort is to estimate the effects of existing and proposed ski area development and activities on the watersheds' yield and peak flow. The baseline hydrographs modeled conditions prior to any human

[67] Colorado Department of Public Health and Environment, 2012
[68] Troendle et al., 1980, as updated 2003

impacts, such as logging or ski trail development, taking place in these watersheds. For baseline conditions, it was conservatively assumed that all terrain below the tree line was forested.

Under current conditions, the Study Watersheds' yields are affected by tree removal associated with ski area development (see Table 3J-1) and by the input of additional water in the form of snowmaking. Currently, Keystone utilizes, on average, 571.3 acre feet of water per season for its snowmaking operations. This average is based upon data available for the last seven ski seasons and reflects the volume of water pumped through the snowmaking guns. A portion of the volume of water pumped through the snowmaking guns is subject to losses due to evaporation, sublimation, and evapotranspiration.[69] These losses depend upon air temperatures during the snowmaking process, the volume of water pumped, and the type of year (dry, average, or wet). Snowmaking water losses during average year conditions total approximately 20 percent. As shown in Table 3J-2, the amount of water used by Keystone for snowmaking during the last seven seasons ranges from 462 acre feet to 693 acre feet. Man-made snow is currently applied on approximately 655 acres of ski trails. The average ratio of water usage to acreage of trails with snowmaking corresponding to current conditions is 0.87 acre feet/acre, including snowmaking on terrain parks.

Table 3J-1:
Study Watersheds – Existing Conditions

Watershed	Surface Area (acres)			
	Total	Above Treeline	Forested	Clear-Cut
Camp Creek	770.4	0.0	436.4	334.0
Jones Gulch	1,746.9	658.2	1053.9	34.7
Redemption Creek	212.5	0.0	121.2	91.3
WS #1	107.1	0.0	90.2	16.9
WS #17	138.1	0.0	110.9	27.2
WS #18	146.8	0.0	71.6	75.2
WS #3	174.7	0.0	100.8	73.9
WS #5	265.7	0.0	225.0	40.7
WS #7	182.7	0.0	176.4	6.2
WS #8	575.4	2.6	556.5	16.3
Mozart Creek	910.3	144.1	597.9	168.2

[69] Ibid.

Table 3J-2:
Summary of Snowmaking Water Use for the Period 2005–2012 – Existing Conditions

Ski Season	Snowmaking Water (acre feet)
2005/06	539.5
2006/07	462.1
2007/08	464.9
2008/09	631.9
2009/10	621.5
2010/11	586.0
2011/12	693.1
Average	**571.3**
Minimum	**462.1**
Maximum	**693.1**

Water yields and peak flows calculated using the WRENSS Model for each study watershed are summarized in Table 3J-3, for both baseline and current conditions assuming average precipitation and temperatures. Hydrograph plots that depict the character of these water yields in time were also developed using the WRENSS Model. These modeled hydrographs reveal flow characteristics reflective of the current ski trail system and snowmaking applications. In general, snowmelt hydrographs influenced by vegetative clearing and snowmaking have higher intensity peak flows which occur earlier in the runoff season as compared to pre-development conditions. This is a result of the higher volume and rate of snowmelt due to decreased canopy interception and evapotranspiration, and increased solar radiation in cleared areas, and also due to the snowmaking water input (additional to natural precipitation) to the affected watersheds.

Table 3J-3:
WRENSS Model Output for Baseline and Existing Conditions – Average Year

Watershed	Baseline Conditions		Existing Conditions	
	Water Yield (acre feet)	Peak Flow (cfs)	Water Yield (acre feet)	Peak Flow (cfs)
Camp Creek	384.4	2.43	791.5	8.30
Jones Gulch	1,121.4	9.40	1,221.7	10.77
Redemption Creek	71.9	0.33	241.4	2.44
WS #1	29.2	0.16	44.9	0.40
WS #17	31.6	0.20	40.9	0.34
WS #18	30.8	0.18	99.1	1.11
WS #3	65.8	0.51	168.7	1.87
WS #5	89.9	0.75	121.4	1.12
WS #7	33.6	0.22	38.1	0.25
WS #8	89.5	0.68	110.7	0.82
Mozart Creek	395.6	3.88	562.7	6.25

Table 3J-3 depicts the modeled yield and peak flow values corresponding to average precipitation and temperature for the Study Watersheds. However, watershed yield and peak flow can differ substantially from year-to-year due to natural variability of precipitation patterns. For example, a typical wet year with annual precipitation 20 percent higher than the average year produced an estimated yield between 28 percent and 128 percent higher than those corresponding to the average precipitation year. Similarly, a typical dry year with annual precipitation equal to 80 percent of the average generated a watershed yield approximately 25 to 90 percent lower than the average year amounts. The modeled results for the typical dry, average, and wet years are shown in Table 3J-4.

Table 3J-4:
WRENSS Model Output for Existing Conditions – Dry, Average, and Wet Years

Watershed	Dry Year		Average Year	Wet Year	
	Yield (acre feet)	Percent of Average	Yield (acre feet)	Yield (acre feet)	Percent of Average
Camp Creek	550.6	70%	791.5	1,061.1	134%
Jones Gulch	676.7	55%	1,221.7	1,837.4	150%
Redemption Creek	180.1	75%	241.4	308.7	128%
WS #1	22.1	49%	44.9	71.4	159%
WS #17	13.9	34%	40.9	74.1	181%
WS #18	60.8	61%	99.1	142.4	144%
WS #3	111.4	66%	168.7	232.4	138%
WS #5	53.6	44%	121.4	200.3	165%
WS #7	3.7	10%	38.1	80.7	212%
WS #8	23.4	21%	110.7	252.0	228%
Mozart Creek	298.2	53%	562.7	869.2	154%

Stream Health

Stream Health Definitions

As described above, the Forest Plan adopted the WCPH for direction on projects that affect water resources. The WCPH mandates several Management Measures of relevance regarding stream health and water resources effects. To facilitate the evaluation of stream health compliance in the context of the WCPH Management Measures, the WCPH outlines several key definitions relevant to the quantification of stream health. The definitions of Stream Health and Stream Health Class are provided in the Forest Plan Direction section above.

In order to characterize the existing status of stream health, the WRNF conducted intensive field stream surveys utilizing the Forest Service Region 1/Region 4 survey methodology for measuring and quantifying specific stream health metrics. Surveyed stream health metrics included: percent surface fines, LWD, residual pool depth, and unstable banks (these metrics are described in detail in the paragraphs below). The WRNF has surveyed streams in different ski areas throughout the Forest,

including both reference and study reaches. Reference stream reaches are located in basins with little to no development. Reference streams represent natural conditions that are the most attainable for a given channel type, climate, geology, aspect and slope. Reference stream reaches were surveyed to provide an analytical control against which to compare the conditions found in study reaches. Concurrently, study stream reaches were surveyed in areas that were judged to reflect the effects caused by management and project activities. Within the Study Watersheds, stream health data is available for Camp Creek, Jones Gulch, and Mozart Creek (the only third-order watersheds within the Analysis Area).

Table 3J-5:
Stream Health Classes for Attainment of Forest Plan Standards (WCPH)

Stream Health Class	% of Reference	Habitat Condition
Robust	> 74 or < 126[a]	Stream exhibits high geomorphic, hydrologic and/or biotic integrity relative to its natural potentials condition. Physical, chemical and/or biologic conditions suggests that State assigned water quality (beneficial, designated or classified) uses are supported.
At-Risk	59 to 73 or 127 to 141[a]	Stream exhibits moderate geomorphic, hydrologic and/or biotic integrity relative to its natural potential condition (as represented by a suitable reference condition). Physical, chemical and/or biologic conditions suggest that State assigned water quality (beneficial, designated or classified) uses are at risk and may be threatened.
Diminished	< 58 or > 141[a]	Stream exhibits low geomorphic, hydrologic and/or biotic integrity relative to its natural potential conditions (as represented by a suitable reference condition). Physical, chemical and/or biologic conditions suggest that State assigned water quality (beneficial, designated or classified) uses may not be supported.

[a] For metrics that increase with decreasing stream health, such as fine sediment and unstable stream banks.

Potential Management Effects to Stream Health

Metric:

Unstable Banks: A streambank showing evidence of the following: breakdown (clumps of bank are broken away and banks are exposed); slumping (banks have slipped down); tension cracking or fracture (a crack visible on the bank); or vertical and eroding (bank is mostly uncovered, less than 50 percent covered by perennial vegetation, roots, rocks of cobble size or larger, logs of 0.1 meter in diameter or larger, and the bank angle is steeper than 80 degrees from the horizontal). Undercut banks are considered stable unless tension fractures show on the ground surface at the back of the undercut.[70]

[70] USDA Forest Service, 2006

Causal Mechanism(s):

Increased Runoff: The WCPH lists increased runoff as one of the major sources of stream impacts. Several investigators have demonstrated that increases in peak discharge and annual volume of runoff can negatively impact the stability of streambanks.[71]

Impacts to Riparian Vegetation: Many land use activities can lead to accelerated bank erosion. Riparian vegetation provides internal bank strength. Removal of native riparian vegetation may lead to weakened internal bank strength and subsequent decrease in bank stability.[72]

Channel Network Extension: Roadside drainages frequently connect directly to the stream channel and result in a net increase in the length of the existing channel network within the watershed. This increases the efficiency of flow routing within the watershed, increasing peak flows and subsequent erosion and sediment transport. The WCPH outlines the following Design Criterion under MM-1: "In each 3rd order and larger watershed, limit connected disturbed areas so that the total stream network is not expanded by more than 10 percent. Progress toward zero connected disturbed area as much as feasible." Roads are usually a primary source of channelized connection between disturbed soils and the stream channel. Because roadside drainage ditches provide an efficient mechanism for capturing runoff and frequently drain to a stream system, a direct link between the road-generated sediment source and the stream system is easily created. A second potential source of connected disturbance could be sparsely vegetated ski trails with drainage water bars that connect directly to the stream system.

Connected Graded Terrain: In terms of the effect of proposed management activities upon bank stability conditions in affected stream reaches, ultimately the area of disturbance and/or snowmaking that is directly connected to the stream system is the variable of management concern. The WCPH clearly documents the relationship between CDAs and effects to peak flows in the associated stream system. Likewise, the effect of channel network extension and the increased efficiency of hydraulic routing have been well documented by several investigations, including references in the Zero Code of the WCPH.[73]

Metric:

Percent Surface Fines: The effect of land disturbances such as roads, roadside ditches, ski trails, and utility corridors within forested watersheds tend to cause an increase in exposed and compacted surface soils and therefore increase erosion and sediment transport. An increase of sediment load input to the stream network of a watershed is often indicated by higher percentages of fine-grained particles on the channel bed. Fine sediment deposition can diminish habitat by aggradation, or filling in, of pool systems. Pools are important components of habitat for many fish species and other aquatic organisms. Filling by

[71] David, 2009
[72] Rosgen, 2006
[73] Burroughs and King, 1989; Troendle and Olsen, 1994

fines affects pool habitat by reducing volume, particularly during low flow conditions, and obliterating substrate cover.

Causal Mechanism(s):

Connected Disturbed Area (CDAs): High-runoff areas, like roads and other disturbed sites, having a continuous surface flow path into a stream or lake. Hydrologic connection exists where overland flow, sediment, or pollutants have a direct route to the channel network. CDAs include roads, ditches, compacted soils, bare soils, and areas of high burn severity that are connected to the channel system. Ground disturbing activities located within the WIZ should be considered connected unless site-specific actions are taken to disconnect them from the streams. CDAs provide a measure of the extent to which a stream reach is influenced by direct, channelized connections between disturbed soils and the stream network itself.

Metric:

Wood Frequency: Sustainable woody debris recruitment is recognized as an important riparian function in mountain channels. Standing dead trees provide habitat for nesting species in the riparian zone and contribute detritus and insects to streams. Once in streams, coarse woody debris helps maintain channel structure by storing sediment and encouraging pool scour. LWD reduces stream energy by interrupting the continuous slope of channel beds and creating turbulence. In streams supporting fisheries, LWD also helps provide stable fish habitat by retaining spawning gravel and by serving as rearing cover.

Causal Mechanism(s):

Vegetation Removal in WIZ: Recruitment of LWD is dependent upon maintenance of riparian vegetation structure and function. Removal of vegetation within the WIZ has been demonstrated to have a negative impact upon maintenance of adequate wood frequency.

Existing Stream Health

The WRNF has completed a Stream Channel Condition Survey (Channel Survey) for stream reaches located in the Camp Creek and Jones Gulch watersheds. Information collected during the Channel Survey includes different metrics such as bank stability, residual pool depth, LWD, and percentage of fine sediment found within the streambed. Comparison of these metrics against those found at reference channels allowed the WRNF to classify surveyed stream reaches into one of three health classes: robust, at-risk, and diminished (refer to Table 3J-5). Stream health classes are used for assessing long-term stream health and impacts from management activities. In addition, Management Measure MM-3 included in the WCPH states that "only those actions that maintain or improve long-term stream health and riparian ecosystem condition" shall be allowed.

As mentioned in the Potential Management Effects to Stream Health section, disturbance of the WIZ has a direct effect on stream health metrics, such as LWD, and fine sediments. The WCPH states the

importance of the WIZ in the protection of interacting aquatic, riparian, and upland functions. Furthermore, Management Measure MM-3 includes design criteria requiring that new concentrated-use sites be located outside the WIZ if practicable. Table 3J-6 compares the extent of the WIZ estimated for pre-development, or baseline, against existing conditions. Relative to baseline conditions, most of the tree removal within the WIZ has occurred in the Camp Creek, Redemption Creek, and Mozart Creek watersheds.

Table 3J-6:
Impacts to the WIZ within Keystone's Watersheds – Existing Conditions

Watershed	Baseline (acres)	Existing (acres)	Existing (% of Baseline)
Camp Creek	100.8	64.1	64%
Jones Gulch	135.0	131.9	98%
Redemption Creek	32.6	19.9	61%
WS #1	8.3	6.5	78%
WS #17	10.0	9.2	92%
WS #18[a]	0.0	0.0	N/A
WS #3[a]	0.0	0.0	N/A
WS #5[a]	0.0	0.0	N/A
WS #7	21.4	20.0	94%
WS #8	52.4	51.8	99%
Mozart Creek	68.5	38.0	55%

[a] No perennial/intermittent stream channels identified in these watersheds.

The results of the Channel Survey are summarized in Table 3J-7. As stated before, stream health data is available for Camp Creek, Mozart Creek, and Jones Gulch. Jones Gulch and Mozart Creek were found to have a *Robust* classification for all four metrics; Camp Creek on the other hand, was found to have a *Degraded* health. Camp Creek was surveyed twice: in 2003 and again in 2011. Residual pool depth and percent of fine sediment on the streambed were classified as *Robust* by both surveys, while bank stability and LWD were found to be less than *Robust*. LWD was classified as *At-Risk* in 2003; however, the 2011 survey found that LWD had degraded to *Dimished*. Bank stability was classified as *Diminished* both in the 2003 and 2011 surveys. As seen in Table 3J-6, 36 percent of Camp Creek's WIZ has been impacted by tree removal, thus reducing the density of logs and large tree limbs within the stream channel and decreasing the LWD metric. In addition, culverts located along the stream channels often present an obstacle to LWD transport within the stream system. Because these culverts must be periodically cleared of obstructions caused by woody debris, the culverts constitute sites of net woody debris loss from the stream system. As stated above, bank instability can be related to increases in water yield and peak streamflows associated with tree removal, roads, and CDAs within the watershed. More detail regarding existing CDAs is presented in the paragraphs below.

Table 3J-7:
Keystone's Stream Health Data

Stream	Metric	Stream Health Class
Camp Creek 2003	Unstable Banks	Diminished
	Residual Pool Depth	Robust
	Large Woody Debris	At-Risk
	Fine Sediments	Robust
Camp Creek 2011	Unstable Banks	Diminished
	Residual Pool Depth	Robust
	Large Woody Debris	Diminished
	Fine Sediments	Robust
Mozart Creek	Unstable Banks	Robust
	Residual Pool Depth	Robust
	Large Woody Debris	Robust
	Fine Sediments	Robust
Jones Gulch	Unstable Banks	Robust
	Residual Pool Depth	Robust
	Large Woody Debris	Robust
	Fine Sediments	Robust

Existing Connected Disturbed Area

A field investigation completed during the fall of 2011 and summer of 2012 as part of Keystone's Drainage Management Plan provides important information regarding existing conditions related to stream health.[74] Data collected during the field investigation, such as location and characteristics of roads, road-side ditches, culverts, etc., was incorporated into a Geographic Information System (GIS) database in order to estimate the spatial extent of CDAs. In particular, Keystone's Drainage Management Plan provides insight as to the extent to which the disturbed areas route flows directly to the stream system (i.e., are connected to the stream) within each watershed. For example, ski trails and roads where clear evidence of direct hydrologic connection to the stream system was observed were classified as CDAs. Results from this investigation that are relevant to the CDAs analysis are displayed in Table 3J-8.

[74] Resource Engineering, Inc., 2012

Table 3J-8:
Connected Roads within the Study Watersheds – Existing Conditions

Watershed	Natural Stream Channel Length[a] (ft)	Road Drainage Connected Length (ft)	Percent Increase of Channel Length (%)
Camp Creek	22,242	3,922	18%
Jones Gulch	36,921	748	2%
Redemption Creek	7,238	2,111	29%
WS #1[b]	1,771	368	21%
WS #17[b,c]	5,952	291	5%
WS #18[b,d]	0	0	N/A
WS #3[d]	0	1,078	N/A
WS #5[d]	0	562	N/A
WS #7[b,c]	6,067	472	8%
WS #8[b,c]	16,422	4,791	29%
Mozart Creek[c]	17,444	3,573	20%

[a] Derived from GIS and field data analysis.
[b] Most of the impacts within watersheds WS #1, WS #7, WS #8, WS #17, and WS #18 are associated with non-ski area activities, such as housing developments, Keystone Road, and Keystone Gulch Road.
[c] Includes the portion of Keystone Gulch to which the watershed is a tributary.
[d] No perennial/intermittent stream channels identified in these watersheds.

Table 3J-9:
Connected Disturbed Areas within the Study Watersheds – Existing Conditions

Watershed	Existing Disturbed Areas[a] (acres)	Connected Disturbed Areas (acres)	Percent Disturbed Areas that are Connected
Camp Creek	334.0	15.0	4%
Jones Gulch	34.7	0.6	2%
Redemption Creek	91.3	14.4	16%
WS #1[b]	16.9	2.1	12%
WS #17[b]	27.2	1.6	6%
WS #18[b]	75.2	0.0	0%
WS #3	73.9	5.0	7%
WS #5	40.7	0.9	2%
WS #7[b]	6.2	0.3	5%
WS #8[b]	16.3	5.3	33%
Mozart Creek	168.2	18.1	11%

a Examples of disturbed areas include ski trails, roads, and parking lots.
b Most of the impacts within watersheds WS #1, WS #7, WS #8, WS #17, and WS #18 are associated with non-ski area activities, such as housing developments, Keystone Road, and Keystone Gulch Road.

The WCPH provides management measures and design criteria to protect the hydrologic function of watersheds. Design Criteria for MM-1 states that "In each watershed containing a 3rd-order and larger stream, limit connected disturbed areas so the total stream network is not expanded by more than 10 percent." Direct connection of disturbances to the stream channel, such as roads via roadside ditches, results in a net increase in the length of the existing channel network within the watershed. Although some of the Study Watersheds are of first and second orders, the concept of minimizing the length of connected roads still applies. Connected disturbed areas capture surface runoff and concentrate flows within the watershed, increasing both volume and peak streamflows. This, in turn, creates a direct link between the sediment generated in disturbed areas and the stream system. As discussed before, CDAs have a direct, negative impact in stream health metrics such as unstable banks and channel sedimentation.

As shown in Table 3J-8, Camp Creek, Redemption Creek, WS #1, WS #8, and Mozart Creek exhibit an existing level of channel network extension that exceeds the 10 percent threshold identified the Design Criteria included in MM-1. The most impacted watersheds, in terms of increased length of channel network, are Redemption Creek and WS #8, with 29 percent increase in channel network length each. WS #1, Mozart Creek, and Camp Creek also show a substantial increase in channel length, with 21, 20, and 18 percent, respectively. Table 3J-9 shows that WS #8 and Redemption Creek are also the most impacted in regards to CDAs, with 33 and 16 percent of disturbed areas that are connected. Most of the impacts within watersheds WS #1, WS #7, WS #8, WS #17, and WS #18 are associated with non-ski area activities, such as housing developments, Keystone Road, and Keystone Gulch Road.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

Under the No Action Alternative, Keystone would continue current summer and winter seasonal operations. Creation of additional skiing terrain would not occur with selection of this alternative. This alternative would have no direct or indirect effects on the watershed and aquatic resources. Existing concerns regarding the stream health of Camp Creek, as defined earlier, would be expected to continue.

Alternative 2 – Proposed Action

The Proposed Action involves clearing a total of 15.5 acres of existing forested areas within the Study Watersheds. The improvement projects also propose to re-vegetate 1.7 acres in the Camp Creek Watershed; therefore, the proposed net loss of forested areas would total 13.8 acres. As shown in Table 3J-10, all of the Study Watershed would experience some degree of grading and/or tree removal. Table 3J-11 provides a summary comparison between pre-development, existing, and proposed forest acreage.

Table 3J-10:
Dercum Mountain Watersheds

Watershed	Proposed Projects Summary	Proposed Disturbance (acres)	
		Grading/ Regrading	Tree Removal
Camp Creek	Grading/regrading and tree removal. Family Adventure Zone; mtn. bike trails; Install 2 new surface lifts; improvements to existing snowmaking infrastructure; revegetation.	19.6	3.2
Jones Gulch	Grading/regrading and tree removal. Adventure Point; mtn. bike trails; Improvements to Summit House.	4.6	2.3
Redemption Creek	Grading and tree removal. Mtn. bike trails.	0.5	0.5
WS #1	Grading and tree removal. Snowcat access route.	1.5	0.2
WS #17	Grading and tree removal. Snowcat access route.	0.3	0.0
WS #18	Grading and tree removal. Snowcat access route.	3.0	1.4
WS #3	Grading and tree removal. Mtn. bike trails.	0.8	0.7
WS #5	Grading/regrading and tree removal. Mtn. bike trails; improvements to existing snowmaking infrastructure	0.8	0.2
WS #7	Grading/Tree Removal – Mtn. bike trails.	< 0.1 acre	< 0.1 acre
WS #8	Grading/regrading and tree removal. Dercum Summit Teaching Area; mtn. bike trails.	3.2	2.3
Mozart Creek	Grading/regrading and tree removal. Adventure Point; Dercum Summit Teaching Area; mtn. bike trails; Jane's Journey egress; new sewer line.	14.8	3.0
Total		**49.1**	**13.8**

Table 3J-11:
Comparison of Existing and Proposed Impacts to Forests

Watershed	Baseline Forested Areas (acres)	Existing Clear-Cut		Alternative 2 Clear-Cut (Cumulative)	
		Surface Area (acres)	Percent of Baseline Forest	Surface Area (acres)	Percent of Baseline Forest
Camp Creek	770.4	334.0	43.4%	337.2	43.8%
Jones Gulch	1,088.7	34.7	3.2%	37.1	3.4%
Redemption Creek	212.5	91.3	43.0%	91.8	43.2%
WS #1	107.1	16.9	15.8%	17.1	16.0%
WS #17	138.1	27.2	19.7%	27.2	19.7%
WS #18	146.8	75.2	51.2%	76.5	52.1%
WS #3	174.7	73.9	42.3%	74.6	42.7%
WS #5	265.7	40.7	15.3%	40.8	15.4%
WS #7	182.7	6.2	3.4%	6.3	3.5%
WS #8	572.8	16.3	2.8%	18.6	3.3%
Mozart Creek	766.1	168.2	22.0%	171.2	22.3%

Water Yield

Hydrologic computations performed using the WRENSS hydrologic model show that, absent the implementation of mitigation measures, water yields originating from the Study Watersheds would increase up to 2 percent relative to existing condition. These potential changes in water yields are a consequence of the proposed tree removal. Within each watershed, tree removal reduces the amount of water intercepted, stored, and transpired by the watershed's vegetation; therefore an increase in water yield can be expected as a result of tree removal. However, implementation of mitigation measures (identified later in this section and in Table 2-3), such as revegetation programs, would offset or minimize the potential increases in water yield. For example, the Family Adventure Zone (FAZ) revegetation project (1.7 acres) would consume approximately 1.9 acre feet of water per year once the trees mature (assuming average conditions for temperature and precipitation). Table 3J-12 summarizes the increases in annual water yield modeled for the Proposed Action under average climatic conditions.

Table 3J-12:
Estimated Changes to Annual Yield – Alternative 2

Watershed	Water Yield (acre feet)			Change Relative to Existing Yield (%)	Cumulative Change Relative to Baseline Yield (%)
	Baseline	Existing	Proposed		
Camp Creek	384.4	791.5	794.6	0.4%	107%
Jones Gulch	1,121.4	1,221.7	1,224.0	0.2%	9%
Redemption Creek	71.9	241.4	241.8	0.2%	236%
WS #1	29.2	44.9	45.2	0.6%	55%
WS #17	31.6	40.9	40.9	0.0%	30%
WS #18	30.8	99.1	100.7	1.5%	227%
WS #3	65.8	168.7	169.6	0.5%	158%
WS #5	89.9	121.4	121.6	0.2%	35%
WS #7	33.6	38.1	38.2	0.2%	14%
WS #8	89.5	110.7	113.3	2.3%	27%
Mozart Creek	395.6	562.7	565.7	0.5%	43%

Stream Health

The Proposed Action would involve tree removal and terrain grading within different areas of the Study Watersheds, including the WIZ. MM-3 included in the WCPH states that only those projects that maintain or improve long-term stream health should be allowed in the WIZ next to perennial and intermittent streams. As discussed before, tree removal within the WIZ can negatively affect the LWD stream health metric while terrain grading may generate CDAs and impact stream health in metrics such as unstable banks and channel sedimentation. In order to evaluate the potential impacts to stream health resulting from the Proposed Action, the proposed vegetation clearing and grading were mapped along with the existing WIZ (see Table 3J-13). The WCPH considers ground disturbing activities within the WIZ as connected to the stream, unless site-specific actions are implemented to disconnect these areas from the

stream. The analysis shows that tree removal and grading is proposed within the WIZ corresponding to the Camp Creek and Mozart Creek watersheds.

Approximately 1.0 acre of Camp Creek's WIZ and 0.7 acre of Mozart Creek's WIZ would be impacted by tree removal and grading associated with the proposed FAZ and *Jane's Journey* trails, respectively. The 1.0 acre of tree removal and terrain grading would occur within 100 feet of an intermittent stream tributary to Camp Creek. The proposed *Jane's Journey* egress trail would require 0.7 acre of tree removal and spot grading in the WIZ near the headwaters of Mozart Creek. In addition to impacts to the WIZ, increases in water yield may also negatively affect stream health, especially in watersheds with an already degraded condition, such as Camp Creek. Therefore, in order to maintain the long-term stream health of the watersheds, project design features were developed to offset impacts to the WIZ and mitigate the effects of water yield increases. The design features are presented after this discussion of Stream Health (and reiterated in Table 2-3). With full implementation of project design features, stream health would be maintained in all Project Area watersheds.

Jones Gulch was classified as having *Robust* stream health in all four metrics. Furthermore, the *Robust* classification is well beyond the threshold for the *At-Risk* category. For example, existing unstable banks on Jones Gulch were surveyed at 5 feet per 100 feet of stream bank, which corresponds to 36 percent of the reference; fine sediments on the streambed were measured at 17 percent, or 80 percent of the reference value. The *Robust/At-Risk* threshold for these two metrics is 126 percent (refer to Table 3J-5). The Proposed Action involves 2.3 acres of tree removal in the Jones Gulch Watershed, all outside of the WIZ. This represents less than 1 percent of the approximate 693 acres of existing forested areas in the Jones Gulch Watershed, and 3 percent relative to baseline conditions. The calculated water yield increase associated with the Proposed Action in Jones Gulch is 2.3 acre feet, an increase of 0.2 percent relative to existing conditions. Stream health in Jones Gulch would be maintained.

Although stream health data is only available for Camp Creek, Mozart Creek, and Jones Gulch, field observations indicate that impacts resulting from the Proposed Action, including water yield increases, in the Camp Creek, Redemption Creek, WS #3, WS #5, and WS #18 must be mitigated in order to comply with the WCPH. These are watersheds that have experienced slope stability problems due to a combination of geologic characteristics and increased water yields.[75] Table 3J-14 shows, for each Study Watershed, the proposed tree removal and associated water yield increase calculated by the WRENSS hydrologic model. Subsequent paragraphs outline mitigation measures and project design features (PDF) designed to protect stream health and maintain consistency with the WCPH.

[75] GEO-HAZ Consulting, Inc., 2012

Table 3J-13:
Proposed Tree Clearing within the WIZ of Study Watersheds

Watershed	Baseline Vegetated WIZ (acres)	Existing Vegetated WIZ		Proposed Vegetated WIZ	
		(acres)	Percent of Baseline	(acres)	Percent of Baseline
Camp Creek	100.8	64.1	64%	63.0	63%
Jones Gulch	135.0	131.9	98%	131.9	98%
Redemption Creek	32.6	19.9	61%	19.9	61%
WS #1	8.3	6.5	78%	6.5	78%
WS #17	10.0	9.2	92%	9.2	92%
WS #18[a]	0.0	0.0	N/A	0.0	N/A
WS #3[a]	0.0	0.0	N/A	0.0	N/A
WS #5[a]	0.0	0.0	N/A	0.0	N/A
WS #7	21.4	20.0	94%	20.0	94%
WS #8	52.4	51.8	99%	51.8	99%
Mozart Creek	68.5	38.0	55%	37.3	54%

a No perennial/intermittent stream channels identified in these watersheds.

Table 3J-14:
Tree Removal and Water Yield Increase – Proposed Conditions

Watershed	Proposed Clear-Cut (acres)	Calculated Water Yield Increase	
		(acre feet)	(% of Existing)
Camp Creek	3.3	3.1	0.4%
Jones Gulch	2.3	2.3	0.2%
Redemption Creek	0.5	0.4	0.2%
WS #1	0.2	0.3	0.6%
WS #17	0.0	0.0	0.0%
WS #18[a]	1.4	1.5	1.5%
WS #3[a]	0.7	0.9	0.5%
WS #5[a]	0.2	0.2	0.2%
WS #7	0.1	0.1	0.2%
WS #8	2.3	2.6	2.3%
Mozart Creek	3.0	3.0	0.5%

Proposed Mitigation Measures and PDF Common to all Study Watersheds

- Prior to construction, clearly flag boundaries for:
  - Tree removal;
  - Terrain grading; and
  - Wetlands and WIZ near construction sites.

- Avoid soil-disturbing actions during periods of heavy rain or wet soils (MM-9).
- Make cuts, fills, and road/trail surfaces strongly resistant to erosion (MM-9).
- Stabilize and maintain roads and other disturbed sites during and after construction to control erosion (MM-11).
- Select suitable locations for drainage features within and near graded areas and contour graded areas to disperse runoff onto ground that is stable and well vegetated.
- Before grading, remove and properly stockpile topsoil so it can be utilized during restoration of graded area.
- Design graded areas near perennial or intermittent streams, such as the Midway Teaching Carpet and FAZ trails, to minimize surface erosion and to drain runoff through adequate BMPs for sediment control (e.g., fiber logs and/or sediment traps).
- Ski trail construction will be accomplished by flush-cutting trees, to minimize ground disturbance.
- Water bars and associated BMPs must be implemented immediately after construction of proposed graded ski trails; inspect water bars during the first snowmelt period following construction.
- The downstream end of water bars will include BMPs that encourage sediment separation and dispersion of flow, such as fiber logs.
- Where appropriate, re-vegetate disturbed areas, including new ski trails, with WRNF-approved seed mixtures.

Proposed Mitigation Measures and PDF to protect the integrity of the WIZ

- Keep construction equipment out of streams, except if specifically authorized by the WRNF (MM-3 Design Criteria).
- Minimize effects to soil by limiting the width of skid trails to 12 feet and spacing between trails to no closer than 120 feet on average. Utilize low p.s.i. (less than 7 p.s.i.) tracked equipment when available (Forest Plan Soils Guidelines #4).
- In order to address stream health concerns related to low wood frequency, fell trees into the inter-trail islands within the WIZ to improve LWD density; however, fell trees in a way that protects vegetation in the WIZ from damage.
- Do not excavate earth material or store excavated material in the WIZ (MM-3 Design Criteria).
- Use native vegetation for streambank stabilization to the maximum extent practicable (MM-3 Design Criteria).

- To the extent practicable, discourage guests from skiing the interior of inter-trail islands within the WIZ to maximize vegetative growth in the riparian areas.
- Water bars must be designed and constructed to discharge surface runoff originating within the proposed graded ski trails away from the WIZ and into well vegetated areas, effectively disconnecting disturbed areas from the stream network.

Proposed Mitigation Measures to Offset Impacts of Water Yield Increases

As discussed before, revegetation programs can reduce water yields by increasing the watershed's water consumptive use rate. Successful revegetation projects would offset increases in watershed yield per the following average ratios:

- Forest revegetation (conifer trees), such as the FAZ revegetation project: once mature, conifer trees may consume approximately 1.2 to 1.4 acre feet/acre. This evapotranspiration ratio was modeled using WRENSS.[76]
- Topsoil improvement and revegetation of ski trails using a WRNF-approved seed mix of native mountain grasses: approximately 1.5 acre feet per revegetated acre.[77]
- Planting willows in riparian areas or where adequate shallow groundwater conditions exist: approximately 3.0 acre feet per acre.[78]

  Notes:

  - The water consumptive use ratios for mountain grasses and willows presented above are estimates calculated based upon data currently available and the referenced studies. Actual ratios will be a function of several factors, such as site location (e.g., elevation, aspect), climate, vegetation density, and groundwater levels.
  - In addition to the FAZ revegetation program, Keystone has implemented a 1-acre soil treatment and revegetation study site on the *Santa Fe* trail. The study involves topsoil improvement, seed and fertilizer application, and adequate irrigation. Irrigation water will be supplied by snowmelt runoff water collected and conveyed to the site by road-side ditches. The 1-acre study plot was improved and seeded in the summer of 2013. Specifications for this type of soil treatment and revegetation would be developed in subsequent years based upon practical field experience drawn from the study site.
  - Keystone planted willows on the *Haywood* trail, in the lower section of the 2011 mudslide where shallow groundwater is present. Field observations collected in August of 2013 indicated the revegetation effort was being successful.

[76] Ibid.
[77] USDA Soil Conservation Service, 1970; Smith, 2008
[78] Nagler et al., 2003, 2005; Cleverly et al., 2006

In order to protect long-term stream health from damage by increased runoff, implement revegetation programs on currently disturbed areas to offset water yield increases. At a minimum, the following water yield increases must be mitigated:

- Camp Creek: 3.1 acre feet
    - The Camp Creek water yield increase was modeled taking into account the FAZ revegetation project. In other words, additional revegetation projects must be implemented to offset the impacts of 3.1 acre feet of increased water yield.
- Redemption Creek: 0.4 acre feet
- WS #3: 0.9 acre feet
- WS #5: 0.2 acre feet
- WS #18: 1.5 acre feet

Revegetation programs must be successfully implemented in the above-mentioned watersheds in order to offset the impacts of water yield resulting from the Proposed Action. For example, topsoil improvement and revegetation of ski trails using a WRNF-approved mix of mountain grasses, as described above, will be required to be implemented on approximately 2.1 acres within the Camp Creek Watershed to offset the 3.1 acre feet of increased water yield. Keystone will work with the WRNF to determine the location and extent of additional revegetation projects needed to mitigate the impacts of the proposed improvements on watershed runoff. Such revegetation projects will be included in the corresponding Summer Construction Plan for review and approval by the WRNF as a condition of approval for the construction of project improvements.

Construction and implementation of the Proposed Action, following the mitigation measures and PDF outlined above will be consistent with the WCPH and will not adversely impact the health of Study Watersheds.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context. In addition, the following activities have affected watershed resources in the Analysis Area:

- Historic mining and logging activities
- Implementation of various drainage improvements per Keystone's 2012 Drainage Management Plan (DMP)[79]

[79] Resource Engineering,Inc., 2012

- Roads, including Forest, State, County, and private (e.g., State Hwy 6, Keystone Gulch Road, and others);
- Residential/urban development, including septic systems, impervious areas, and water use;

The stream health effects of increased watershed yield are most evident in the directly affected on-mountain streams. As discussed in the Affected Environment Section, the Camp Creek, Jones Gulch, Redemption Creek, WS #1, WS #3, WS #5, and WS #18 watersheds are directly tributary to the Snake River; they comprise 3,424 acres. WS #7, WS #8, Mozart Creek, and WS #17, which are tributary to Keystone Gulch and the Snake River, total 1,806 acres in surface area. The Snake River basin, from its headwaters to the inlet of Dillon Reservoir, totals 49,773 acres. In other words, the Study Watersheds are relatively small in surface area as compared to the much larger Snake River basin. In addition, Dillon Reservoir and Denver Water's trans-basin diversion system have a major impact on the basins' hydrology. Thus, the Snake River from its headwaters to the inlet of Dillon Reservoir defines the downstream spatial boundaries for the Watershed Resources Cumulative Effects analysis. Three basins are included in this spatial extent: 1- Peru Creek-Snake River (HUC 140100020202); 2- North Fork Snake River (HUC 140100020201); and 3- Keystone Gulch-Snake River (HUC 140100020203).

The WRNF has completed an assessment of its watersheds per the USFS Watershed Condition Framework Implementation Guide.[80] The assessment rated the Peru Creek-Snake River and the Keystone Gulch-Snake River basins as "Functioning at Risk," while the North Fork Snake River basin was rated as "Functioning Properly." Twelve indicators of watershed condition were rated by the WRNF for the assessment. Table 3J-15 summarizes the ratings corresponding to the different indicators for each basin.

[80] USDA Forest Service, 2010

Table 3J-15:
Watershed Condition Indicators

Indicator	Watershed		
	Peru Creek-Snake River Functioning at Risk	North Fork-Snake River Functioning Properly	Keystone Gulch-Snake River Functioning at Risk
Aquatic Biota	Poor	Poor	Poor
Riparian/Wetland Vegetation	Good	Good	Fair
Water Quality	Poor	Good	Fair
Water Quantity	Good	Good	Poor
Aquatic Habitat	Fair	Good	Fair
Roads and Trails	Poor	Fair	Poor
Soils	Fair	Good	Fair
Fire Regime or Wildfire	Good	Good	Good
Forest Cover	Good	Good	Good
Forest Health	Good	Good	Fair
Terrestrial Invasive Species	Good	Good	Fair
Rangeland Vegetation	Fair	Good	Poor

Watersheds subjected to activities associated with ski area management, including trail construction and snowmaking, tend to exhibit cumulative changes to channel conditions as compared to watersheds in undeveloped conditions. These changes are caused by increases in watershed yield and peak runoff magnitude and duration due to the effects of tree removal, terrain grading, and snowmaking. Affected channel reaches typically exhibit long-term, continuing adjustments to their dynamic equilibria due to changes in magnitude, timing, and duration of their corresponding hydrographs. Table 3J-12 in the Direct and Indirect Environmental Consequences section of this report, compares the water yield calculated for baseline, existing, and proposed conditions.

In addition to impacts to stream channel condition, the cumulative effects of the development of Keystone are reflected in the slope stability issues within the ski area operational boundary (a direct result of increased water yield). The resort has consulted with different slope stability specialists and has developed a Drainage Management Plan (DMP) in order to address the existing effects of water yield increase realized as erosion and slope stability problems. The existing impacts to stream health and watershed condition would continue to be reduced through implementation of recommendations issued by the slope stability specialists and continued implementation of mitigation projects included in the 2012 DMP. For example, waterbars are to be repaired and improved in the *Frenchman*, *Go Devil*, *Schoolmaster*, *Whipsaw*, *River Run*, *Santa Fe*, and *Last Hoot* ski trails. Additional DMP projects to be implemented include:

- Reconstruction and improvement of waterbars and drainage ditches in the A-51 Terrain Park;
- Improvement and enlargement of sediment detention ponds;

The main goals of the drainage improvement projects are to disconnect disturbed areas for the stream network and prevent erosion damage. These projects have been funded and scheduled to be implemented between 2013 and 2015. Additional detail will be included in the appropriate Summer Construction Plan for review and approval by the WRNF.

Remaining lift, trail and infrastructure projects from Keystone's 2009 MDP (not currently proposed) are considered reasonably foreseeable future actions. However, such projects would require site specific NEPA analysis/approval prior to implementation and it is anticipated that said projects would include PDF and mitigation measures to offset potential impacts to watershed health.

As discussed earlier in this report, connected roads increase the intensity of surface runoff and constitute a source of sediment input into the stream system. The total length of existing roads within the spatial extent of the cumulative effects analysis is approximately 129 miles, with a corresponding road density of 1.66 mile per square mile. Although a study of road connectedness at the spatial extent of the cumulative effects analysis was not completed, the Proposed Actions includes PDF and mitigation measures in order to maintain the extent of connected roads within the Resort. Thus, the Proposed Action would not have an adverse, cumulative effect on road connectedness.

Residential and urban development may occur within the spatial extent of the cumulative effects analysis. Residential and urban development and the associated land use changes would have a cumulative effect on the stream health and water quality Snake River Basin. However, it is anticipated that such development would be subject to local, State, and Federal regulations requiring water quality protection measures.

When considered with the effects of past development and future potential development, Alternative 1 would not cumulatively affect watershed resources. Considering the project effects in addition to past, present, and reasonably foreseeable future actions, implementation of the Proposed Action would maintain stream health through successful implementation of mitigation measures and PDF described previously. By maintaining the health of the streams, the Proposed Action would not exhibit any negative influence upon watershed conditions in a cumulative context.

Chapter 4
Finding of No Significant Impact

4. FINDING OF NO SIGNIFICANT IMPACT

After reviewing the EA, I have determined that the Proposed Action will not, individually or cumulatively, significantly affect the quality of the human, biological or physical environment. The provisions of 40 CFR 1508.27(b) indicate that project significance must be judged in terms of both *context* and *intensity*. Based on a review of these provisions, I have determined that an environmental impact statement is not required. I base my findings on the following definitions of *context* and *intensity*:

A. CONTEXT

The significance of an action must be analyzed in several contexts and varies with the setting. In the case of site-specific actions, significance depends more on the effects in the locale rather than the world as a whole. Both short- and long-term effects are relevant.

The direct and indirect analysis contained in the EA focuses on Keystone SUP area (8,536 acres), and extends further for cumulative effects analysis, depending on the resource. For example, the cumulative effects Analysis Area for Canada lynx is the Snake River Lynx Analysis Unit, which is 75,747 acres of NFS lands, and for the economic analysis the cumulative effects Analysis Area is Summit County. An initial screen was conducted to ensure that the Proposed Action is consistent with the 2002 Forest Plan. The EA does not indicate that anything in the Proposed Action would lead to a precedent at the local, regional or national level.

B. INTENSITY

Intensity is a measure of the severity, extent, or quantity of effects, and is based on information from the effects analysis of this EA and the references in the Project Record. I have determined that the interdisciplinary team considered the effects of this project appropriately and thoroughly with an analysis that is responsive to concerns and issues raised by the public. They took a hard look at the environmental effects using relevant scientific information and their knowledge of site-specific conditions gained from field visits. My finding of no significant impact is based on the intensity of effects using the ten factors identified in 40 CFR 1508.27(b).

1. *Impacts that may be both beneficial and adverse. A significant effect may exist even if the federal agency believes that on balance the effect will be beneficial.*

I have considered both the beneficial and adverse impacts associated with the Proposed Action as presented in the EA. The Proposed Action provides recreational benefits to many users of NFS lands within Keystones SUP area, and is consistent with the terms and conditions of the SUP, as well as the 8.25 Management Area from the 2002 Forest Plan. Potential adverse impacts to the human, biological and physical environment are thoroughly documented in Chapter 3 and, where necessary, Management Requirements (composed of Project Design Features and Best Management Practices) have been designed

to minimize or avoid impacts to specific resources. Management Requirements are identified in Table 2-3 of the EA.

2. *The degree to which the proposed action affects public health or safety.*

The projects have been designed to provide guests with an improved recreational experience within the Keystone SUP area. The Proposed Action does not significantly affect public health or safety.

3. *Unique characteristics of the geographic area such as the proximity to historical or cultural resources, parklands, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas.*

The area that would be affected by any approved project elements does not represent a unique geographic area, contain historic features, park lands, prime farmlands, wilderness, of wild and Scenic Rivers. No wetlands would be impacted as a result of the requirement (Table 2-3 of the EA) that all new/replaced snowmaking lines that cross wetlands must remain above-ground. Alternative 2 would impact 19.3 acres of lynx habitat, representing <0.1 percent of the 40,243 acres of lynx habitat in the Snake River LAU.

4. *The degree to which the effects on the quality of the human environment are likely to be highly controversial.*

The term "controversial" in this context refers to cases where substantial scientific dispute exits as to the size, nature, or effects of a major federal action on some human environmental factor rather than to public opposition of a proposed action or alternative.

No scientific dispute exists regarding the Proposed Action or the analysis contained in the EA. Initial concerns related to contributing to additional runoff on Dercum Mountain (potentially exacerbating stream health/geotechnical concerns) were addressed through project redesign and the inclusion of Management Requirements.

Based on the fact that the Forest Service has analyzed and approved numerous projects of this type, I do not consider the effects of this project to be controversial, nor is there scientific dispute about these effects.

5. *The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.*

Proposed projects within the Keystone SUP area are common at ski areas that operate on NFS lands. The analysis shows the effects are not uncertain, and do not involve unique or unknown risks. Throughout the EA analysis, the Proposed Action was modified to address potential impacts to watershed resources and geotechnical stability. Furthermore, Table 2-3 identifies Management Requirements (composed of Project Design Features and Best Management Practices) that are designed to minimize or avoid potential

impacts to the human, biological and physical environment. Combined with the Forest Service's experience with implementing these types of activities at ski areas, I have determined that there will not be significant effects on the human environment.

6. *The degree to which the action may establish precedent for future actions with significant effects or represents a decision in principle about a future consideration.*

I have determined that this decision does not establish precedence for future actions with significant risks to the environment. The Proposed Action is consistent with Forest-wide and Management Area 8.25 direction, as well as Keystone's SUP. Furthermore, the proposed projects are typical of those that exist at developed four-season resorts operating under permit from the Forest Service. Prior to accepting Keystone's proposal for the Dercum Mountain improvements to initiate the requisite NEPA review, the Forest Service completed our due diligence process to ensure these projects represent an appropriate use of NFS lands.

7. *Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.*

The Cumulative Effects analyses presented for each resource throughout Chapter 3 in the EA discloses past, present, and reasonably foreseeable future actions with potential to lead to effects which are cumulative in nature. Due to modifications made to the Proposed Action throughout the NEPA process, in addition to Management Requirements outlined in Table 2-3, this analysis does not identify any cumulatively significant impacts that are anticipated to result from implementation of the Proposed Action.

8. *The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.*

As indicated on page 3-20 of the EA, there are no archaeological sites within any of the proposed developments in the Keystone SUP area. All reports were submitted to the SHPO in completion of the NHPA Section 106 process. Inventories in 2012 and 2013 led to recommendations of "no historic properties affected." Implementation of the Proposed Action was determined to have "no effect" on any known NRHP listed or eligible historic properties within the APE.

9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

There would be no effect to any threatened, endangered or proposed species, with two exceptions. For Canada lynx, the determination is "may affect, not likely to adversely affect," and for Northern American wolverine, the determination is "not likely to jeopardize."

As discussed in Chapter 3E of the EA, on November 7, 2013, the Forest Service requested that, pursuant to Section 7(c) of the Endangered Species Act (50 CFR 402.14), informal consultation be initiated with the United States Fish and Wildlife Service for impacts to Canada lynx. On December 4, 2013 the USFWS issued a letter of concurrence on the Forest Service's "may affect, not likely to adversely affect" determination.

The Proposed Action is consistent with all applicable lynx-related provisions of the Southern Rockies Lynx Management Direction and the associated FEIS/ROD, as well as with Section 7(d) of the Endangered Species Act.

10. Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment.

I have reviewed in the EA, Biological Assessment/Biological Evaluation/Management Indicator Species report, and the project file and have determined that no federal, state, or local laws, regulations, or requirements for protection of the environment will be violated with implementation of the Proposed Action.

Chapter 5
Consultation and Coordination

5. CONSULTATION AND COORDINATION

A. LIST OF PREPARERS

FOREST SERVICE TEAM

The following people participated in the initial scoping, were members of the Interdisciplinary Team, and/or provided direction and assistance during the preparation of this EA.

Forest Service ID Team

Scott Fitzwilliams	White River National Forest Supervisor, Responsible Official
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Cynthia Keller	Environmental Coordinator, Dillon Ranger District
Shelly Grail Braudis	Snow Ranger, Dillon Ranger District
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Brian McMullen	Soil Scientist, Supervisor's Office
Corey Lewellen	Fisheries Biologist, Dillon Ranger District
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This EA was prepared by:

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B. AGENCIES, ORGANIZATIONS, TRIBAL GOVERNMENTS AND PERSONS CONTACTED

FEDERAL GOVERNMENT

U.S. Fish & Wildlife	Kurt Broderdorp
U.S. Environmental Protection Agency	Larry Svoboda, Region 8

TRIBAL GOVERNMENT

Ute Mountain Ute Indian Tribe	Chairman Gary Hayes
Ute Mountain Ute Indian Tribe	Terry Knight
Ute Indian Tribe	Chairperson Richard Jenks, Jr.
Ute Indian Tribe	Betsy Chapoose
Southern Ute Indian Tribe	Chairperson Pearl Casias
Southern Ute Indian Tribe	Neil B. Cloud

STATE GOVERNMENT

Colorado Parks and Wildlife	Shannon Schwab, District Wildlife Manager, Area 9

LOCAL GOVERNMENT

Breckenridge Town Council
Summit County Commissioners
Town of Breckenridge
Upper Blue Planning Commission

LOCAL MEDIA

Summit County Citizens Voice
Glenwood Post Independent

OTHER ENTITIES AND ORGANIZATIONS

Keystone Neighbourhood Company	Mark Mathews, Executive Director
Keystone Citizens League	Matt Walsh, President

OTHER INTERESTED INDIVIDUALS

Daryl H. Oshiro

Chapter 6
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Chapter 7
Figures

7. FIGURES

Figure 1: Alternative 1 – Existing Conditions

LEGEND

SUP Boundary

Existing Lifts

Prepared By: SE GROUP

0 250 500 1,000 Feet

Outpost Gondola
Ruby Express
Kokomo
MTB 2
MTB 3
Girl Scout MTB
MTB 1
Summit Express
Montezuma Express
MTB 7
A-51 Lift
MTB 5
River Run Gondola
Peru Express
MTB 6
Lower MTB 1
Argentine
Discovery

Figure 2: Proposed Keystone Mountain Improvements

Prepared By: SE GROUP

0 250 500 1,000 Feet

LEGEND

- SUP Boundary
- Existing Lifts
- Proposed Sewer Line
- Existing Mountain Bike Trails
- Proposed Mountain Bike Trails-Beginner
- Proposed Mountain Bike Trails-Intermed.
- Proposed Composting Toilet
- Proposed Facilities
- Proposed Family Adventure Zone Features
- Proposed Carpet Lifts
- Proposed Jane's Journey Realignment
- Proposed Snowcat Access to Gulch Rd.
- Proposed Revegetation
- Proposed Grading/Tree Removal
- Proposed Improved Snowmaking Infrastructure

Summit House Existing Conditions

Summit House Visual Simulation

Figure 3: Visual Simulation of Summit House at Keystone Resort

Appendices

Appendix A: Cumulative Effects Projects

Appendix B: Response to Comments received on the Keystone Resort Dercum Mountain Improvements Project Environmental Assessment

APPENDIX A: CUMULATIVE EFFECTS PROJECTS

Notable developments and activities that have occurred over five decades within Keystone's SUP area include (but are not limited to):

1970s

- Opening of Keystone with four lifts (1970)
- Installation of first snowmaking system (completed 1972)
- Development of Keystone Lodge, tennis center and condominiums (1974)

1980s

- Construction of the Keystone Ranch Golf Course (1980)
- Development of the Keystone Conference Center(1989)

1990s

- Outpost and North Peak Expansion (1991)

2000s

- Construction of the Keystone Nordic Center and the Keystone River Golf Course (2000)
- Replacement of the Ruby chairlift with a detachable six-pack (2000)
- Addition of the A-51 Terrain Park (2004)
- Replacement of the River Run Gondola (2009)
- Acceptance of Keystone's Ski Area Master Development Plan (2009)
- Implementation of various drainage improvements per Keystone's 2012 Drainage Management Plan (DMP)
- Various planned lift and trail projects from Keystone's 2009 Master Development Plan (not currently proposed)
- Various planned facilities from Keystone's 2009 MDP (not currently proposed);
- Improvements to on-mountain drainage network per Keystone's 2012 DMP (not currently proposed);
- Vegetation management, including the Keystone Ski Area Forest Health Project;
- Residential/urban development, including septic systems, impervious areas, and water use;

The following past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant for analysis in Alternatives 1 and 2 from a cumulative effects context. Basic information provided here for each project is complimented in corresponding analyses in Chapter 3. Not all resources would be affected by all of these projects. Cumulative effects analyses presented in Chapter 3 resource sections are based on these descriptions and the best available information for each project. Projects are located on NFS lands, unless otherwise noted.

Project (Project Status)	Project Location (Straight Line Distance to Keystone SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Resources Potentially Affected
2009 Keystone Master Development Plan	Keystone's SUP boundary	Includes new/upgraded lifts, trails, snowmaking and guest service facilities throughout Dercum Mountain, North Peak, the Outback, and on Independence Mountain.	Accepted 2009	8,536 acres	Recreation Scenery Socioeconomics Soils Vegetation Watershed Wildlife
Keystone Little Bowl/Erickson Bowl Snowcat Skiing EA	Little Bowl and Erickson Bowl portions of Keystone's SUP boundary	Guided snowcat skiing on 580 acres of terrain that had previously been accessible only by hiking.	Approved December 2003, implemented 2004	580 acres	Recreation Wildlife
Keystone Upper Independence Bowl Snowcat Skiing EA	Independence Bowl portion of Keystone's SUP area	Guided snowcat skiing on 280 acres of Independence Bowl that had previously been accessible only by hiking.	Approved/implemented 2006	280 acres	Wildlife Recreation
2012 Arapahoe Basin MDP	~5 miles	Master Plan update to include "the Beavers area" for lift-served skiing. This entails tree removal to support the construction of traditional trails as well as gladed terrain.	Acceptance October 2012	1,872 acres	Recreation Scenery Socioeconomics Soils Vegetation Watershed Wildlife

Project (Project Status)	Project Location (Straight Line Distance to Keystone SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Resources Potentially Affected
Dillon Reservoir Forest Health and Fuels EA	~2 miles	Developed to manage forest vegetation affected by the mountain pine beetle epidemic and reduce the threat of catastrophic wildfire to community infrastructure. Approximately 3,300 acres of NFS lands will be treated, including: 2,537 acres of forest health treatments; 290 acres of wildland urban interface defensible space fuel treatments; 304 acres of aspen enhancement treatments; and approximately 169 acres of hazard tree removal and scenery improvement along roads. Associated activities include reforestation, hazardous fuel reduction treatments, road maintenance, road reconstruction, road decommissioning.	Approved March 2007. Project activities were initiated in 2007 with expected completion by 2018.	3,300 acres	Recreation Scenery Vegetation Watershed Wildlife
2011 Keystone Ski Area Forest Health Project	Within SUP area	Implement a variety of vegetation treatments on NFS lands within the Keystone SUP area. These treatments are designed to minimize risk for users and infrastructure and to expedite forest regeneration following the ongoing mountain pine beetle epidemic. Entails removing dead and dying trees, regenerating lodgepole pine where they occur, and perpetuating mixed conifer and aspen stands throughout Keystone's SUP area.	Decision Notice Signed May 2011	~1,647 acres	Recreation Scenery Soils Vegetation Watershed Wildlife

Project (Project Status)	Project Location (Straight Line Distance to Keystone SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Resources Potentially Affected
Tenderfoot Mountain Motorcycle Trail System Environmental Assessment	~2 miles	The proposal is to create an approximately 30-mile single-track trail system in the Tenderfoot/Frey Gulch area (north of Hwy 6 between Dillon and Keystone. This includes approximately 15 miles of new trail construction and approximately 15 miles of reconstruction of existing trails in the area.	Analysis being completed	30 miles	Recreation Soils Vegetation Watershed Wildlife
Forest-wide Hazardous Tree Removal and Fuels Reduction Project EA	0–100 miles	Remove hazard trees within 150' of roads and trails and 200' of recreation sites on the White River National Forest over the next ten years. Lodgepole pine affected by the mountain pine beetle will be targeted for removal.	Approved: 2009	Forest-wide	Forest Health Recreation

Project (Project Status)	Project Location (Straight Line Distance to Keystone SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Resources Potentially Affected
WRNF Travel Management Implementation Action Plan	0.1 – 100 miles	The Forest Service approved a comprehensive travel management plan (TMP) for the WRNF. The TMP identifies ways to accommodate and balance the transportation needs of the public and provide adequate access for forest and resource management, while still allowing for protection of natural resources. The Implementation Plan outlines steps to begin implementation actions in accordance with the WRNF TMP FEIS and ROD. Full travel management implementation is expected to take several years to complete. The TMP categorizes travel designations under two seasons: summer and winter. Summer is defined as May 21 through November 22. Winter is November 23 through May 20.	Final EIS and ROD March 2011, Implementation 2011 - 2015	Project area includes 2,482,000 acres within the WRNF	Recreation Scenery Soils Vegetation Watershed Wildlife

Project (Project Status)	Project Location (Straight Line Distance to Keystone SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Resources Potentially Affected
White River National Forest Land and Resource Management Plan – 2002 Revision	All NFS lands within, and adjacent to, Keystone's SUP area	The decision approved Alternative K in the Final EIS as the 2002 Revised Land and Resource Management Plan. Alternative K sustains the capabilities of forest ecosystems while addressing social values and expectations, as well as managing for multiple resource outputs. Ecosystem components are actively managed to improve wildlife habitat, water quality and soil productivity. Management activities maintain or restore ecosystem structure, function and composition. Emphasis is placed on quality recreation experiences in a predominately natural setting. Recreation growth becomes more managed, while still allowing modest increases in use.	April 2, 2002, as amended	2,270,000 acres	Wildlife Watershed Wetlands Scenery Socio-econ Recreation

APPENDIX B: RESPONSE TO COMMENTS RECEIVED ON THE KEYSTONE RESORT DERCUM MOUNTAIN IMPROVEMENTS PROJECTS NOPA

The four letters received in response to the February 2012 Notice of Proposed Action (NOPA) are attached here. Individual comments raised in each letter are addressed here, organized by resource topic.

RECREATION COMMENTS

Dan Gibbs Summit County Board of County Commissioners

1) The NOPA document states that Granny's Trail will be reestablished after the snowcat access road is built. The County would recommend that the location of the trail be on the south side of the new access road, as opposed to being wedged in between the access road and Soda Ridge Road.

Response

The final layout of Granny's Trail will be based on site-specific considerations that lead to the best overall alignment of the trail. This will be identified through field investigations including representatives from Summit County Government, Keystone Ski resort and the USFS.

2) The BOCC is very supportive of the proposed improvements outlined in the NOPA document. We strongly support and appreciate Vail Resorts willingness to undertake capital improvement projects at Keystone and feel that the proposed improvements are necessary and will improve the overall recreational experience.

Response

No response necessary.

Matt Walsh Keystone Citizens League

3) As a Keystone homeowner and the president of the Keystone Citizens League, representing several hundred Keystone homeowners, we are continually evaluating ways to improve both guest and resident experiences that include improving our property values during these continued challenging economic times. Vail Resorts has been a tremendous partner in these efforts and thus why I want to express our organizations support for projects such as the new Summit House restaurant, and more family-friendly trails and activities.

Response

No response necessary.

4) I have every confidence that the Mountain Improvement Projects will be constructed in the most environmentally-sensitive of ways and will help improve circulation, planning and the quality of experiences.

Response

No response necessary.

5) I appreciate your role of oversight of our public lands, and encourage you to move forward with your review and approval of these projects.

Response

No response necessary.

Mark Mathews Keystone Neighbourhood Company

6) I wanted to express our support for the Keystone Mountain Improvements Projects.

Response

No response necessary.

7) The Keystone Neighbourhood Company is continually evaluating ways to improve our owners and guest experiences especially as they positively improve property values during this time. Vail Resorts has been a tremendous partner in these efforts and this is why I want to express our support for projects such as the new Summit House restaurant, and more family-friendly trails and activities.

Response

No response necessary.

8) We believe the Mountain Improvements Projects will be constructed in an environmentally-sensitive of manner and will help improve the quality of homeowner and guest experiences.

Response

No response necessary.

9) We appreciate being able to give our input into the process and look forward to your approval of the Projects.

Response

No response necessary.

WATER COMMENTS

Daryl Oshiro

10) The impacts of human endeavors are self-evident! Siltation has almost choked the river to the extinction of insect, plant and fish life. The following are serious pressures to the eco-system and issues that need to be addressed by Keystone Resorts and our community:

- **Water pollution caused by upstream mine tailings, run- off from parking lots and hard surfaces.**
- **Siltation caused by run- off parking lots, construction, non-vegetated surfaces, tree cutting.**
- **Severe loss of aquatic life caused by siltation, low avg. water flows, poor water quality, loss of habitat.**

Response

The Proposed Action was modified to eliminate additional snowmaking coverage, which addresses stream health issues. Also, site-specific Management Requirements have been developed to minimize or avoid impacts to soils and watershed resources.

WILDLIFE COMMENTS

Daryl Oshiro

11) The impacts of human endeavors are self-evident! Siltation has almost choked the river to the extinction of insect, plant and fish life. The following are serious pressures to the eco-system and issues that need to be addressed by Keystone Resorts and our community: loss of wildlife corridors due to expansion of roads, trails, markers, kiosks, construction.

Response

Potential impacts to wildlife have been thoroughly documented in the EA. The project file contains a Biological Assessment, Biological Evaluation and Management Indicator Species Report, and the EA provides a summary of this documentation.

SCENERY COMMENTS

Dan Gibbs Summit County Board of County Commissioners

12) It appeared that the proposed snowcat access route between the Mountain House Maintenance Facility and Keystone Gulch Road was going to be an over the snow route that would only require the removal of trees. However, additional information gathered at the above mentioned site visit revealed that the project proponents would like to construct an approximately 25' to 30' wide road in order to allow for winter and summer vehicle use. It would appear that extensive grading work would be associated with the construction of this road. The proposed road is intended to accommodate approximately 5-15 snowcat trips per day (grooming and delivery of food and beverage supplies to mountain restaurants) as well as snowmobile use. This use could have potential negative impacts on surrounding property owners.

Response

Keystone will coordinate with residents in the vicinity of Keystone Gulch to establish an appropriate schedule for use of the snowcat route access route to minimize any inconveniences to adjacent homeowners.

SOCIOECONOMIC COMMENTS

Dan Gibbs Summit County Board of County Commissioners

13) As documented in the County's August 26th comment letter to the USFS on the Breckenridge Ski Resort Peak 6 DEIS, the BOCC has previously requested that all future NEPA review processes include analysis and mitigation of the social and socioeconomic impacts that would be created by the proposed action. Accordingly, the BOCC requests that the potential social and socioeconomic impacts of the proposed Keystone Ski Resort projects be addressed as part of the Environmental Assessment (EA) process.

Response

The EA includes an analysis of potential economic impacts associated with the Proposed Action. This analysis acknowledges that a correlation exists between public use of NFS lands and the economies of adjacent communities, encompassing seasonal tourism, population, housing, employment and income levels. The impacts of Alternatives 1 and 2 were projected using a computer-based model—IMPLAN3 – which is a broadly accepted model used for making projections regarding employment and economic impacts and is often used by the Forest Service in the preparation of environmental analyses.

14) The County's Master Plans have identified certain National Forest System lands as desirable sites to accommodate affordable workforce housing, due to their close proximity to employment centers and their accessibility to public transit service and other necessary community infrastructure and utilities. One of the properties the County is actively pursuing is the "Keystone Gulch" property located directly south of the Keystone Gulch condominiums. It appears that the proposed alignment of the Snowcat access road would bisect the Keystone Gulch parcel, which would severely limit our design options for the property. During the March 6 site visit, Jim Curnutte indicated that the County would be willing to work with Keystone to determine if a mutually agreeable alignment for the road can be found so that both party's goals can be achieved. One option discussed with Jeff Zimmerman included the possibility of working together with Vail Resorts to coordinate access to both the Keystone Gulch parcel and the adjacent 1.6-acre employee housing site, which is owned by the resort.

Response

Although this comment is beyond the scope of this analysis, the proposed snowcat access route was modified as a result of discussions with Summit County. The final proposed alignment avoids the parcel in question.

TRAFFIC PARKING AND ACCESS COMMENTS

Dan Gibbs Summit County Board of County Commissioners

15) The proposed snowcat access road crosses an approximately 6.79 acre parcel land owned by Vail Summit Resorts. This property is zoned Natural Resources 2 (NR-2). The NR-2 zone district allows for the continuation of those uses that existed, or were otherwise approved, at the time the land was transferred from State or Federal ownership to private ownership. Since the proposed road has not been previously approved, it may not be constructed until such time as the zoning for the property has been changed to a zone district that would allow for its construction.

Response

Snowcats currently traverse the private parcel in question, so re-zoning is not considered a necessity for a dedicated snowcat access route. However, Chapter 1 of the EA indicates that a County grading permit may be necessary for construction of the route.