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Otak

North Slope Recreation Area (NSRA)

WATERSHED ACCESS AND RECREATION PLAN

FINAL: April 2026

2026

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ACKNOWLEDGEMENTS

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ACRONYM LIST

BMP/BMPs	Best Management Practices
COTREX	Colorado Trails Explorer
CPW	Colorado Parks and Wildlife
NEPA	National Environmental Policy Act
NSRA	North Slope Recreation Area
OPPI	Outdoor Pikes Peak Initiative
PPAM	Pikes Peak America's Mountain
RPI	Regional Partnerships Initiative
RRC	RRC Associates
USFS	United States Forest Service (Department of Agriculture)

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EXECUTIVE SUMMARY

Overview and Purpose of this Project

Colorado Springs Utilities provides safe, clean, and reliable water service to numerous communities. It takes long-term planning, careful monitoring, and a commitment to conservation efforts to ensure access to this resource lasts for future generations. Colorado Springs Utilities (Springs Utilities) operates the water collection, treatment, and distribution system serving more than 530,000 customers, including City residents and customers living in the Ute Pass communities west of the City, military bases, and other suburban areas outside the City Limits. The North Slope Recreation Area (NSRA), the focus of this planning effort, encompasses a portion of the Pikes Peak watershed and includes three reservoirs – North Catamount, South Catamount, and Crystal Creek Reservoirs.

Springs Utilities is a four-service municipally owned agency with a mission to provide safe, reliable, competitively priced utilities to its customers.

The NSRA is located in the Colorado counties of El Paso and Teller and is controlled, operated, and maintained by Springs Utilities as part of the municipal water supply system.

Springs Utilities manages its watershed lands, including the NSRA, for the protection of water supply, system infrastructure, forestry, wildlife, and cultural resources located on the watershed lands. Other land managers in the areas immediately adjacent to the Springs Utilities-managed NSRA include El Paso County, Teller County, the Catamount Institute, the Town of Green Mountain Falls, Colorado Parks and Wildlife (CPW), and the United States Forest Service (USFS), with portions of Bureau of Land Management land also managed by the USFS.

Located on the north side of Pikes Peak, the NSRA is a popular outdoor destination along the Pikes Peak Highway and is managed in partnership with Pikes Peak America's Mountain (PPAM), with whom Springs Utilities has an agreement for management of the recreational uses in the area. Visitors can explore miles of hiking and biking trails, and fishing at North Catamount, South Catamount, and Crystal Creek Reservoirs. Non-motorized water recreation, including paddleboarding and kayaking, is also permitted at all three reservoirs. In addition to protecting Springs Utilities infrastructure, natural and cultural resources, and addressing public safety and security needs, this project is evaluating existing and potential public recreation trails and connections within the NSRA in collaboration with local land management partners to create a long-term plan for managing the area's access and recreation, providing a more comprehensive recreation experience.

Springs Utilities retained Otak to support development of the North Slope Recreation Area Watershed Access and Recreation Plan (Plan). As a subconsultant to Otak, RRC Associates prepared a comprehensive visitor survey and also conducted data mobility analysis to understand visitation patterns in the North Slope Recreation Area and surrounding context. The project is analyzing existing public access and recreation on the NSRA and will provide recommended concepts for improved public access and trails for sustainable recreational use of the NSRA that will protect infrastructure, natural and cultural resources, and address security and public safety needs.

The project team coordinated with a technical team consisting of Springs Utilities operations, planning, security, and environmental divisions, PPAM, City of Colorado Springs Parks, Recreation, and Cultural Services (City Parks), USFS, CPW, and other agencies to guide the planning process. The public and those with diverse interests were engaged through a public process to collect input to be considered in the development and finalization of suitable planning concepts and proposed improvements for the NSRA. The Plan includes recommendations for implementation and policy recommendations that, when presented to Springs Utilities Board of Directors and the Colorado Springs City Council, may be considered for approval.

Planning Background and Current Focus

In previous planning processes to develop watershed access and recreation policies, Springs Utilities engaged the public and various interests, partner agencies, (USFS, CPW, El Paso and Teller Counties), and others (local recreation interest groups, Springs Utilities customers, neighboring communities, etc.) to provide input regarding different management alternatives. Past engagement included evaluation of the potential for commercial guided activities. The data collected from those previous planning processes is being referenced as part of this planning process and final plan recommendations. These collaborations also helped to lay the foundation for the goals established for this plan.

This planning effort is focused on analyzing existing and potential public access and recreation activities on the NSRA and making recommendations regarding the current recreation access and trails with specific focus on infrastructure protection and security, public safety, and sustainability. This effort is also developing concepts for improved public access and recreational use of the NSRA while minimizing any adverse effect on existing operations, infrastructure, drinking water sources, natural resources, or public recreational experiences.

Two technical memorandums were submitted to Springs Utilities for review and have been consolidated into this Plan. This document focuses on the entirety of the background, existing conditions, conceptual analysis, and recommendations process.

Goals and Evaluation Criteria

Goals

Consistent with applicable provisions of City Charter and City Code, any recommendations or proposed improvements for the NSRA must be consistent with the following goals based on collaboration and feedback from internal stakeholders and partner agencies:

- Enhance security measures and strengthen infrastructure protection to safeguard critical assets.
- Develop and enforce clear rules, regulations, and procedures to ensure the safety of the public, staff, and infrastructure.
- Support public recreational access options that align with Springs Utilities core operations and are financially and environmentally sustainable.
- Ensure adequate resource allocation for the sustainable management of the NSRA, now and into the future.

Draft Evaluation Criteria

In addition to the goals stated above, draft evaluation criteria were developed as a part of this project to further assess recommended improvements and modifications to recreational access at the NSRA. These criteria help evaluate if proposed actions advance Springs Utilities needs and start to form a framework for prioritization or phasing of improvements based on which actions advance multiple goals at once, represent an efficient path to implementation, or require additional coordination with partner agencies. Criteria developed for this plan include:

- Potential for relocation of trails off service roads for improved public safety and reduced conflict with Springs Utilities operations.
- Potential to move trails away from Springs Utilities infrastructure to improve infrastructure security and public safety.
- Potential to improve or avoid areas with existing conflicts.
- Considerations of necessary adjacent land manager coordination and permitting.
- Opportunity for improved or additional trail/recreational access.
- Opportunity for improved trail sustainability and maintenance.
- Estimated costs.

In *Figure 1: Draft Evaluation Criteria Chart Featuring Initial Discussed Areas of Study* on the next page, these criteria are listed along with the various proposed connection improvements (further details found in 04 CONCEPTS & PROPOSED IMPROVEMENTS), and the ratings that were assigned to each by the project team.

These ratings are based on currently available data and subject to change as further information is gathered, conditions evolve, and/or design and engineering takes place on each of these connections.

Figure 1: Draft Evaluation Criteria Chart Featuring Initial Discussed Areas of Study

Initial Areas of Study	Relocate Trails Off Service Road	Move Trails Away From Utility Infrastructure	Areas with Existing Conflicts	Partner Coordination and Permitting Considerations	Improved Recreation Access or Opportunity	Improve Sustainability and Maintenance	Potential Cost	Priority Level
1 - Crystal Dam & Trails: Evaluate trail sustainability, identify risks to infrastructure and determine if sustainable alternatives are feasible in current alignment, re-routing or closure.	◒	●	●	◒	○	●	$$$	2
2 - Mount Esther to Crystal Creek Reservoir Connection: Study a direct connection from Mount Esther to Crystal Creek Reservoir and on to the North and South Catamount Reservoirs.	◒	●	●	○	●	◒	$$	2
3 - Catamount Shortcut Road: Remove trail on service road and explore new trail routes providing the same connection to North and South Catamount off of the road thereby reducing user conflicts between trail users and vehicles. Routes to be explored could include areas both north and south of the existing road and would require coordination with local and federal agencies.	●	○	●	●	◒	○	$$$	3
4 - Catamount Loop Road: Relocate trail off of Catamount Loop Road.	●	○	◒	○	◒	○	$$	1
5 - Catamount Trail Section 1: Remove Catamount Trail from service roads. Utilities existing Mackinaw Trail to provide connectivity between existing trailheads and access to the water.	●	◒	●	○	◒	◒	$	1
6 - Ridge Trail: Relocate Ridge Trail on service road.	●	○	◒	○	◒	○	$	3
7 - Blue River & Mule Deer Trails: Relocate Blue River and Mule Deer Trail from service roads. Maintain access to North Catamount trailhead by existing Mackinaw Trail.	●	◒	◒	○	○	○	$	1
8 - Mackinaw to Limber Pine Trail Connection: Consider additional connection in this area between the existing Mackinaw Trail and Limber Pine Trail.	◒	○	◒	○	●	○	$$	1
9 - Improving or Closing Trails not on Utilities' Managed Lands: Improving/removing trails on BLM/USFS while maintaining connection to Teller County Open Space trailhead.	●	○	◒	●	◒	○	$$	3
10 - Catamount Trail Section 2: Remove existing trail from service road in section between trailhead and Vayhinger Trail connection point and re-route connection adjacent to road to consider alternative Ring the Peak trail route.	●	◒	◒	○	◒	◒	$$	3

○ No/Not Applicable ◒ Some ● Yes $ Low $$ Medium $$$ High

02

BACKGROUND & EXISTING CONDITIONS ANALYSIS

The North Slope Recreation Area (NSRA) contains a combination of historic water supply infrastructure, high elevation forest and riparian ecosystems, scenic reservoir landscapes, and active utility operations that collectively shape existing public access and recreation conditions. While the area offers notable recreational features, wildlife habitat, and scenic viewpoints, public use occurs within a highly managed watershed containing critical infrastructure, operational staging areas, emergency evacuation routes, and service roads. Existing access is limited seasonally and primarily concentrated at designated managed trailheads and parking areas. However, there are also numerous US Forest Service (USFS) system trails and unauthorized social trails that provide access to the NSRA. As much of this access overlaps with utility facilities and service routes, it creates ongoing safety, operational, and resource management challenges that showcase the need for improved access control, trail management, and visitor guidance.

Existing Public Areas of Interest

Historic features within the NSRA primarily relate to early water supply infrastructure and land management activities. Crystal Creek, South Catamount, and North Catamount Reservoirs retain numerous original components, and work is ongoing to improve and modernize various features of the water system infrastructure. Springs Utilities has additionally identified several historic items within the NSRA which relate back to original land management activities.

The area is defined by high-elevation forests that include a diverse mix of coniferous and deciduous species, along with localized riparian ecosystems within the watershed. Vegetation is dominated by mixed conifers—primarily spruce, fir, and pine—while Gambel oak, aspen groves, and scattered meadows are interwoven throughout the property. The three primary watersheds—along with their associated wetlands and perennial streams—create habitat that supports fish, waterfowl, and larger wildlife species such as deer, elk, and moose. Additional details on wildlife and habitat conditions are provided in the *Areas of Environmental Interest* section of this report and illustrated in *Figure 12*.

Scenic viewpoints within the NSRA are generally located along trail corridors, shoreline access points, and open meadow areas. Visitors can view the Pikes Peak summit from multiple locations, including areas adjacent to the Catamount Reservoirs. Photographs of key areas throughout the NSRA can be found in the following sections, with their locations indicated by letters on the “Areas of Interest and Field Observations” diagrams, *Figures 14-18*.

Existing Springs Utilities Facilities

The NSRA is accessible directly from the Pikes Peak Highway, which runs across Crystal Creek Reservoir dam to the Catamount reservoirs just prior to Mile 7 Parking Area. Several trail connections

lead to the NSRA property from adjacent communities or as unauthorized or non-designated trails originating from USFS lands, however many of these connections have been identified as unauthorized social trails that need designation, improvement, or closure to meet Springs Utilities recreation management goals. Public access to the NSRA is limited and typically runs from early May through mid-October, weather permitting. However, areas around Crystal Creek Reservoir are publicly accessible year-round from the Pikes Peak Highway and the Crystal Reservoir Visitor Center parking lot, with unauthorized access to the Catamount reservoirs from connecting trails regularly occurring during the closure period. Electric and pedal assist bikes (e-bikes) have not been approved for use on trails on the NSRA and references to biking on trails are for non-electric assisted biking.

Trail access is primarily through eight trailheads identified by Springs Utilities at various points within the NSRA property:

- Crystal Reservoir Visitor Center
- North Catamount Dam (South) intersection of Ridge and South Catamount Creek Trails
- North Catamount Dam (North) intersection of Mackinaw and Catamount Trails
- Intersection of Ridge and South Catamount Creek Trails
- Intersection of Mackinaw, Mule Deer, and Blue River Trails
- Intersection of Catamount and Limber Pine Trails (South)
- Intersection of Catamount and Limber Pine Trails (North)

An additional trailhead is located adjacent to the western boundary of the NSRA along the Elder-Fehn Trail on Teller County Open Space land.

Four parking lots are located on the NSRA property with one sited just beyond the southern terminus of Crystal Dam (20 parking spaces), one at the Crystal Reservoir Visitor Center (103 parking spaces), one lot at the southern terminus of the North Catamount Dam (60 parking spaces), and the fourth parking lot located near the northern terminus of South Catamount Dam (60 parking spaces). Additional roadside parking is dispersed throughout the Catamounts reservoir area. The Crystal Reservoir Visitor Center, operated by Pikes Peak America's Mountain (PPAM), is located adjacent to the Pikes Peak Highway and provides visitors with an opportunity to purchase merchandise, snacks, maps, and other souvenirs while on Pikes Peak. Additional amenities include vault toilets and a food truck in the parking lot, with paved paths leading to the reservoir's shore. The shop is open year-round and features seasonal gem and rock prospecting activities for families.

An emergency helipad is located across the Pikes Peak Highway from the Crystal Reservoir Visitor Center parking lot. This helipad can support two aircraft within the designated landing area. An additional emergency helipad is available between North and South Catamount Reservoirs near the accessible parking spaces at North Catamount Dam along Ridge Road. These helipads are in place to serve as potential landing spots for life-flight helicopters in the event of a serious injury or emergency in the NRSA or along the Pikes Peak Highway. No trails or designated pedestrian access lead to or through the helipad area.

To operate the water system, Springs Utilities requires access to all dams, valve houses, pipelines, tunnels, electric lines, electrical systems, water measuring points, water quality monitoring locations and other operational infrastructure. PPAM operates their primary vehicle and maintenance staging area for their operations and the Pikes Peak Highway near Crystal Dam. Many of these areas are not open to the public as they are active Springs Utilities and PPAM working areas. To decrease conflicts between operations in these areas and members of the public, Springs Utilities personnel and PPAM North Slope

Rangers redirect members of the public that enter these areas, which is a frequent occurrence.

In conjunction with the maintenance staging area, Springs Utilities and PPAM utilize space alongside Catamount Shortcut Road as a materials storage and handling area. This represents an additional operational conflict with current recreational use, as members of the public currently utilize the service road to access the Catamount Reservoirs by foot from Crystal Creek Reservoir. Numerous unauthorized social trails have been identified leading into active staging or work areas for Springs Utilities and PPAM, representing operational conflict points with recreational users.

Figure 2: Example Construction Materials Storage Area Along Catamount Shortcut Road

Figure 3: Construction Staging Area Along Catamount Shortcut Road

Existing high-pressure water pipelines, electrical transmission lines, caretaker facilities, associated dam infrastructure, and other operational areas located in the NSRA are depicted in *Figure 5 North Slope Recreation Area Infrastructure* on the following page. These represent current or potential operational conflict areas, as visitors have been observed using flumes and transmission maintenance corridors to access locations that are not accessible via existing trails. It is crucial that visitors are prevented from entering these areas to ensure public safety, support efficient operations and maintenance, and protect the integrity of critical infrastructure.

All authorized trails have accompanying signage with an example shown in *Figure 4 Existing Signage on Catamount Trail*. Additionally where appropriate, Springs Utilities has signage indicating closed or otherwise unauthorized trails.

Figure 4: Existing Signage on Catamount Trail

Figure 5: North Slope Recreation Area Infrastructure

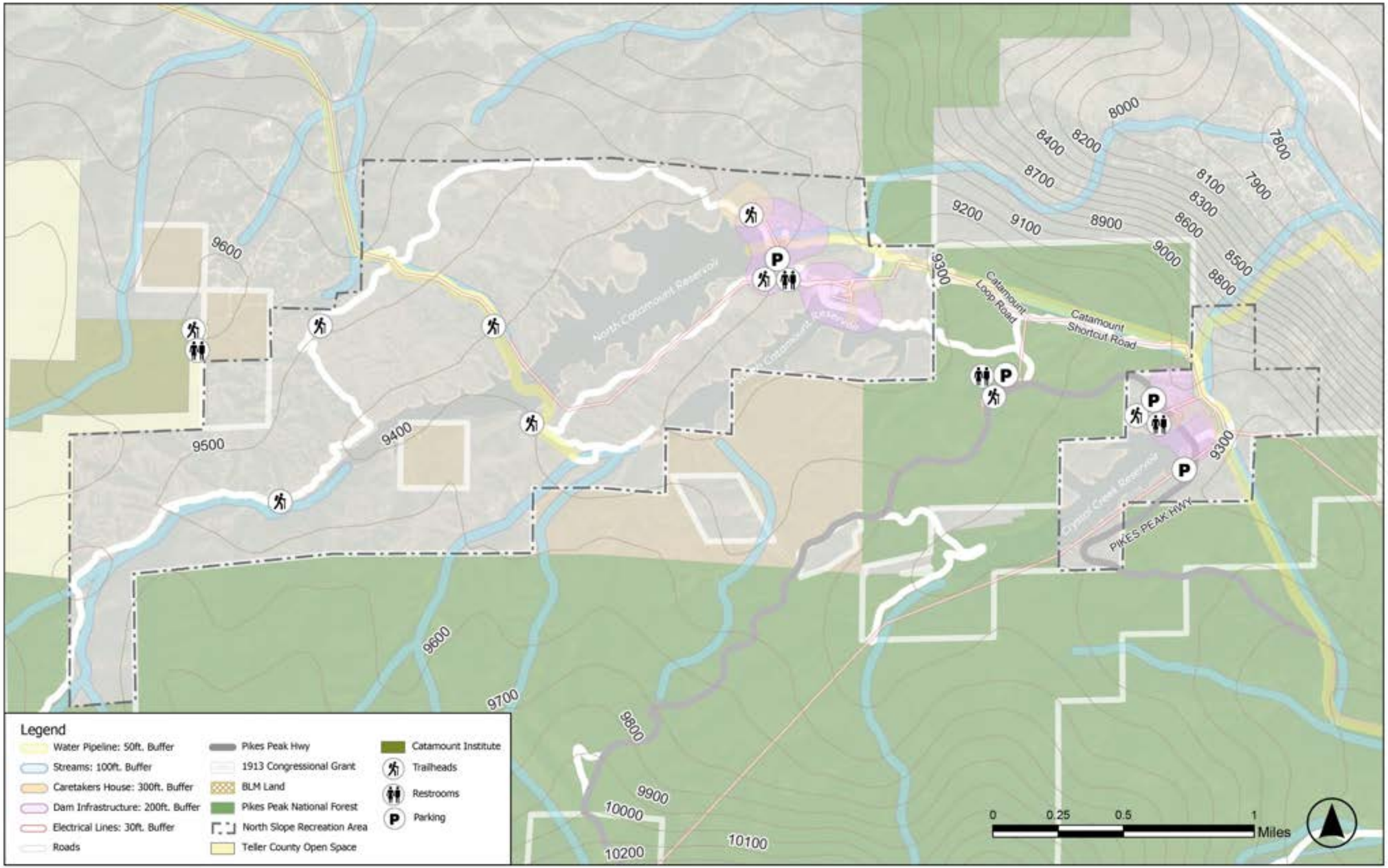
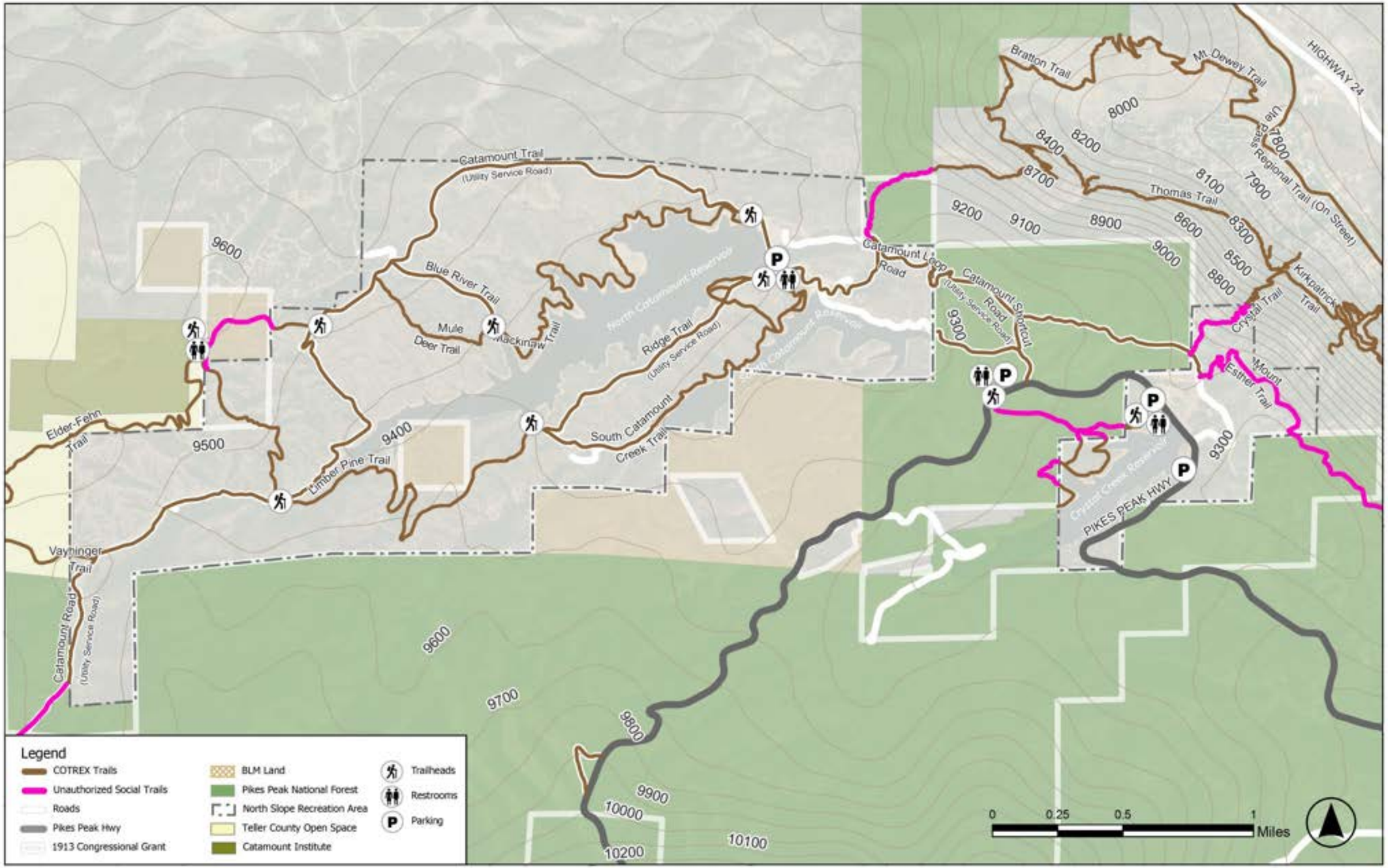


Figure 6: Existing Trails Network



Existing Trails Network

The following section details the existing trail network within the NSRA. A brief description of each designated trail has been provided in accompaniment to *Figure 6: Existing Trails Network,* which details current trail alignments. Where possible, photos have been provided to further illustrate existing trail conditions, and allowed uses for each trail have been identified. Any uses that are not expressly noted below are considered prohibited.

Crystal Trail

The Crystal Trail is an out-and-back trail originating at the Crystal Reservoir Visitor Center which provides users with fishing access to Crystal Creek Reservoir's northern shoreline. Per Colorado Trails Explorer (COTREX), the trail runs for nearly three miles, with approximately one-half mile of this trail on the NSRA property leading towards Green Mountain Falls and a further one and a third miles of trail along the northern shoreline of Crystal Creek Reservoir. Hiking, leashed dogs, and non-motorized biking are allowed uses. Portions of the Crystal Trail as shown on COTREX's web maps are unauthorized social trails on lands managed by Springs Utilities. More information regarding unauthorized social trails can be found later in this section.

Figure 7: Crystal Creek Reservoir Shoreline

Catamount Shortcut Road

The Catamount Shortcut Road currently provides public access between Crystal Creek Reservoir and the trailheads at the southern terminus of North Catamount Dam along unpaved Springs Utilities service roads. This is located on USFS lands and Springs Utilities has a special use permit for infrastructure along this road. Hiking, leashed dogs, and non-electric assisted biking are allowed uses. A snapshot of this road can be seen below in *Figure 8: Colorado Springs Utilities Service Road.*

Figure 8: Colorado Springs Utilities Service Road

South Catamount Creek Trail

South Catamount Creek Trail connects users from the trailhead at the southern terminus of North Catamount Dam and the intersection of the Ridge and Limber Pine Trails. Hiking, leashed dogs, and non-electric assisted biking are permitted. Due to the trail's proximity to the northern shoreline of South Catamount Reservoir, it serves as a convenient fishing access route for the public. Portions of the western terminus of the trail lead onto an unpaved Springs Utilities service road.

Figure 9: Access to South Catamount Creek Trail on Service Road from Limber Pine Trail. [Looking southwest. Access to South Catamount Creek is to the left]

Ridge Trail

The Ridge Trail provides connectivity between the trailhead located at the southern terminus of North Catamount Dam and the intersection of the South Catamount Creek and Limber Pine Trails along an unpaved Springs Utilities service road. Hiking, leashed dogs, and non-electric assisted biking are permitted. While not immediately adjacent to the southern shoreline of North Catamount Reservoir, users can access the water for fishing at designated points along the trail.

Catamount Trail

The Catamount Trail provides access from the trailheads at the southern terminus of North Catamount Dam to various trails including the Mackinaw, Mule Deer, Blue River, Limber Pine, and Teller County Open Space Vayhinger trails along an unpaved Springs Utilities service road. Hiking, leashed dogs, and non-electric assisted biking are allowed uses.

Figure 10: Catamount Trail on Service Road [Located just off frame of Figure 16, Map 3 to the west]

Mackinaw Trail

The Mackinaw Trail leads from the northern terminus of North Catamount Dam to the intersection of the Blue River and Mule Deer Trails, spanning a total of two and a half miles. Leashed dogs are allowed on the trail, while non-electric assisted biking is not an approved use. While Mackinaw Trail does not directly provide water access to North Catamount Reservoir, the trails proximity to the shore allows for fishing access.

Blue River Trail

The Blue River Trail provides access between the Catamount Trail and the intersection between the Mule Deer and Mackinaw Trails along an unpaved Springs Utilities service road. Hiking, leashed dogs, and non-electric assisted biking are allowed uses.

Mule Deer Trail

The Mule Deer Trail provides access between the Catamount Trail and the intersection between the Blue River and Mackinaw Trails. Hiking, leashed dogs, and non-electric assisted biking are allowed uses.

Figure 11: Mule Deer Trail Leading to North Catamount Reservoir from Service Road

Limber Pine Trail

The Limber Pine Trail provides access between the intersection of the Ridge and South Catamount

Creek Trails and the Catamount Trail to the north. This trail is split into two sections, bisected by the Catamount Trail. Hiking, leashed dogs, and non-electric assisted biking are permitted.

Vayhinger Trail

The Vayhinger Trail and Elder-Fehn Trail are a part of the Teller County Catamount Open Space. The Vayhinger Trail provides access from the Catamount Trail to the Elder-Fehn Trail. Hiking, leashed dogs, and non-electric assisted biking are allowed uses.

Unauthorized Trails

Unauthorized trails are trails that have not been approved by Springs Utilities and formally included in the NSRA trails system. Springs Utilities has identified the following trails as providing unauthorized access to the North Slope Recreation Area:

- Crystal Creek Trail on Springs Utilities managed property below Crystal Creek Dam
- Catamount Trail through USFS managed land
- Mount Esther Trail through USFS managed land
- Crystal Trail from Pikes Peak Highway near the Mile Seven Parking Area to the north shore of Crystal Creek Reservoir through USFS managed land
- Limber Pine Trail on Bureau of Land Management (BLM) land

These unauthorized social trails have been created over the years by members of the public as a means of informally connecting the NSRA to other trails or destinations within the local area. Many of these trails in their current state are in poor condition and are generally unsustainable for long-term use due to instability, width, steepness, or a combination of factors. Springs Utilities has not recognized these social trails as a part of the existing recreational opportunities available within the NSRA. All existing trails and unauthorized social trails are identified in *Figure 6*.

Areas of Environmental Interest

Areas of Environmental Interest within the NSRA are primarily identified through existing resource data available from Colorado Parks and Wildlife (CPW). These areas generally include riparian corridors, reservoir shorelines, mature forested areas, and seasonal wildlife concentration zones. Sensitivity is based on species use, habitat function, and known places where wildlife and humans intersect. See *Figure 12* for wildlife habitats/natural resource areas in the NSRA

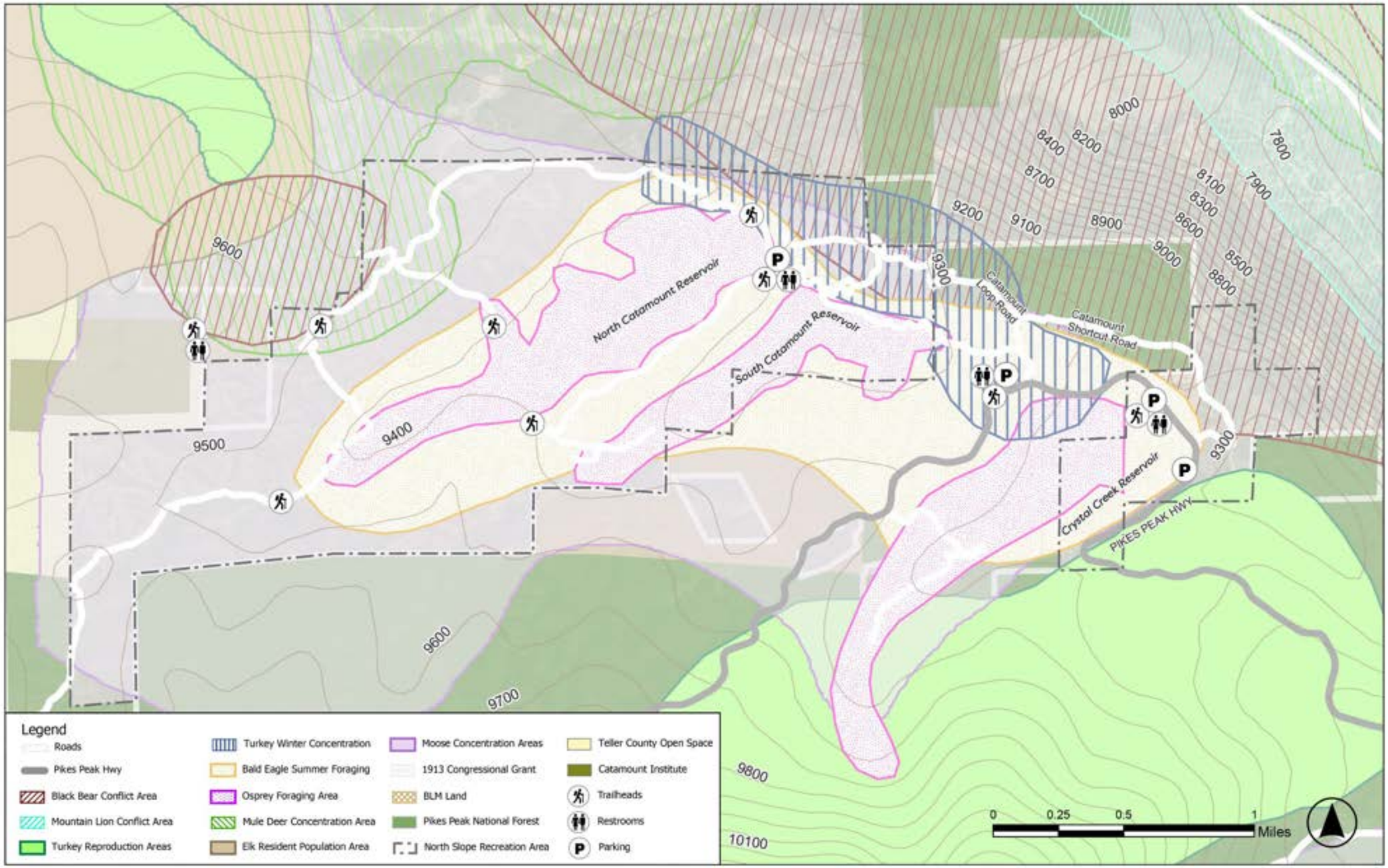
Elk, moose, and mule deer habitat areas in the NSRA have been mapped based on data provided by CPW. Mountain lion habitat encompasses the entire NSRA and extends eastward to the foothills around Colorado Springs. Black bear habitat areas are more seasonally defined with fall concentrations documented near Crystal Creek Reservoir and east of the Catamount Reservoirs. However, summer distribution expands to cover all reservoir areas.

Bald eagles use shoreline and open-water areas around the reservoirs for summer foraging, with highest activity typically occurring near the larger water bodies. Osprey also forage at all reservoirs, relying on open-water conditions and available perches for hunting. Wild turkey activity includes reproductive use south of Crystal Creek Reservoir and wintering habitat located in the forested areas between the three reservoirs.

The Colorado Fishing Atlas, compiled by CPW, identifies the fish species that are stocked into each of the three reservoirs in the NSRA and provides the methods, bait, and bag limits. Crystal Creek Reservoir is stocked with Brook, Brown, Cutbow, Colorado River Cutthroat, Lake, Rainbow, and Snake River Cutthroat Trout. South Catamount Reservoir is stocked with Brook, Cutbow, Lake, Rainbow, and Snake River Cutthroat Trout. North Catamount Reservoir is stocked with Cutbow,

Cutthroat, Lake, Rainbow, and Snake River Cutthroat Trout.

Figure 12: Wildlife Habitat/Natural Resource Areas Map



Potential Improvement Opportunities

Numerous potential opportunities exist to improve trail connectivity and amenities within the NSRA. The Crystal Reservoir Visitor Center represents a desirable destination for recreation users due to the presence of parking, food, and restrooms, among other amenities. Individuals have been accessing this area through informal and unauthorized social trails, which present an opportunity to designate certain corridors for improvement and adoption. The Mount Esther Trail currently has been identified as one such unauthorized social trail where individuals enter the NSRA property that could be improved or realigned to provide better access while limiting operational conflicts with Springs Utilities infrastructure. Furthermore, several trailheads and access points located beyond the NSRA boundaries represent challenges related to user conflicts, visitor flow, and information consistency. Improving conditions with adjacent land managers, particularly regarding signage, permitted uses, and access expectations would reduce the likelihood of visitors unintentionally entering restricted areas.

Additional parking facilities at key recreation points could also benefit from targeted improvements to circulation, delineation, or surface condition and can help facilitate control capacity.

Figure 13: Pikes Peak View from Crystal Creek Reservoir Nearby Meadow

PPAM, as manager of the Pikes Peak Highway and recreation on the NSRA, has expressed several potential improvement opportunities that fit within the long-range plans of both Springs Utilities and PPAM and would consider the creation of more formalized outdoor recreation activities and events to financially support the long-term sustainability of the NSRA, allow for disbursement of recreation activities/use, and proactively plan for the population growth of Colorado Springs and the surrounding region. These improvements may include additional benches, the installation of shade structures or covered picnic areas, and similar low-impact amenities. Due to the open nature of the area, these additional facilities would need to have lightning safety protection added for the safety of users. Pilot installations would allow Springs Utilities and PPAM to evaluate visitor demand, maintenance requirements, and suitability for broader implementation across the NSRA. *Figures 14 -18* highlight locations of some such improvement opportunities, and document existing conditions observed on site. These observations will help further guide future recommendations to enhance recreational access and management for both visitors and staff at the NSRA. Letters called out on the upcoming figures indicate the locations of images previously shown, such as *Figure 13* (left) corresponding to letter H on *Figure 14*.

Figure 14: Areas of Interest and Field Observations, Map 1

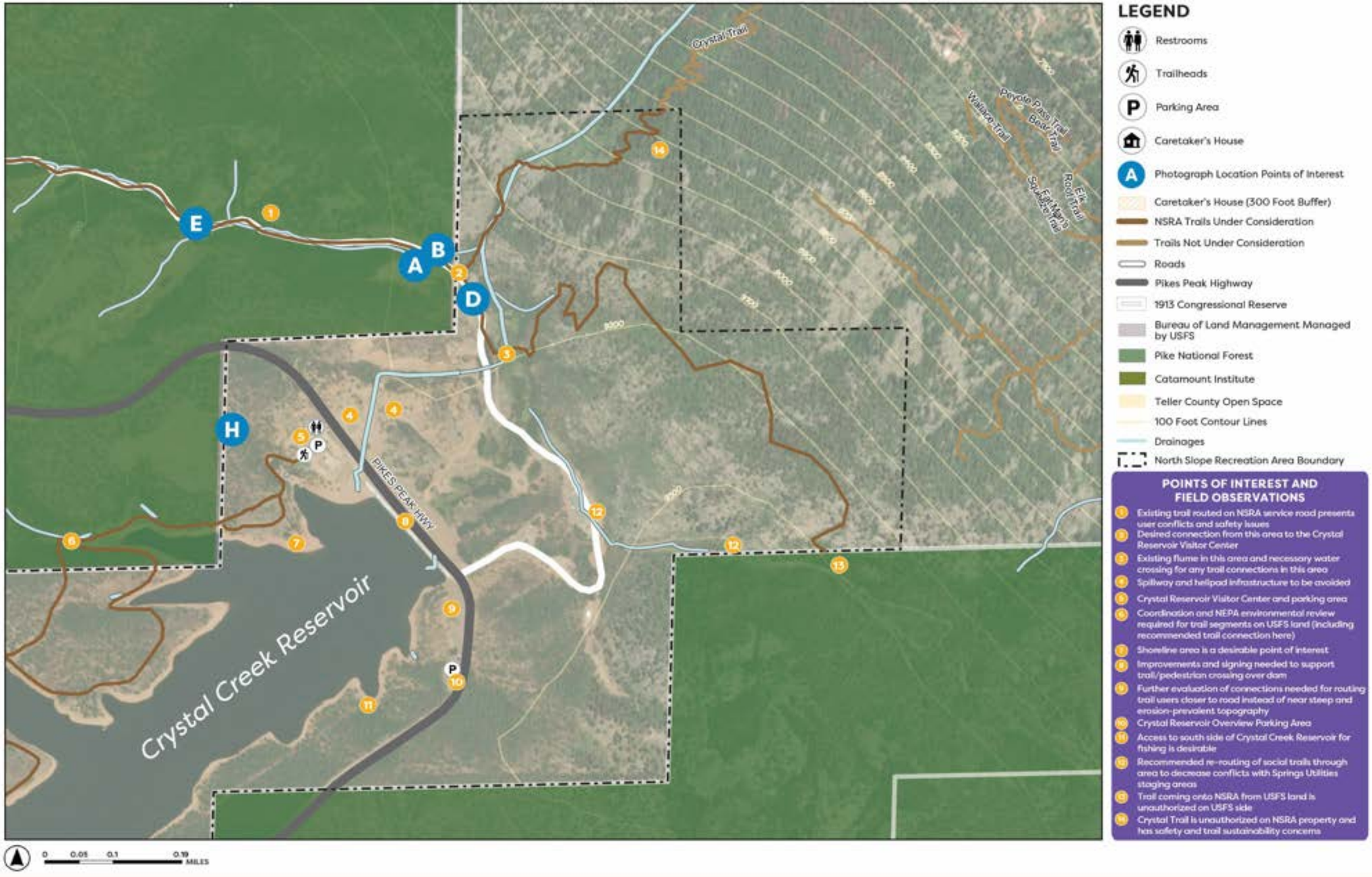


Figure 15: Areas of Interest and Field Observations, Map 2

Figure 16: Areas of Interest and Field Observations, Map 3

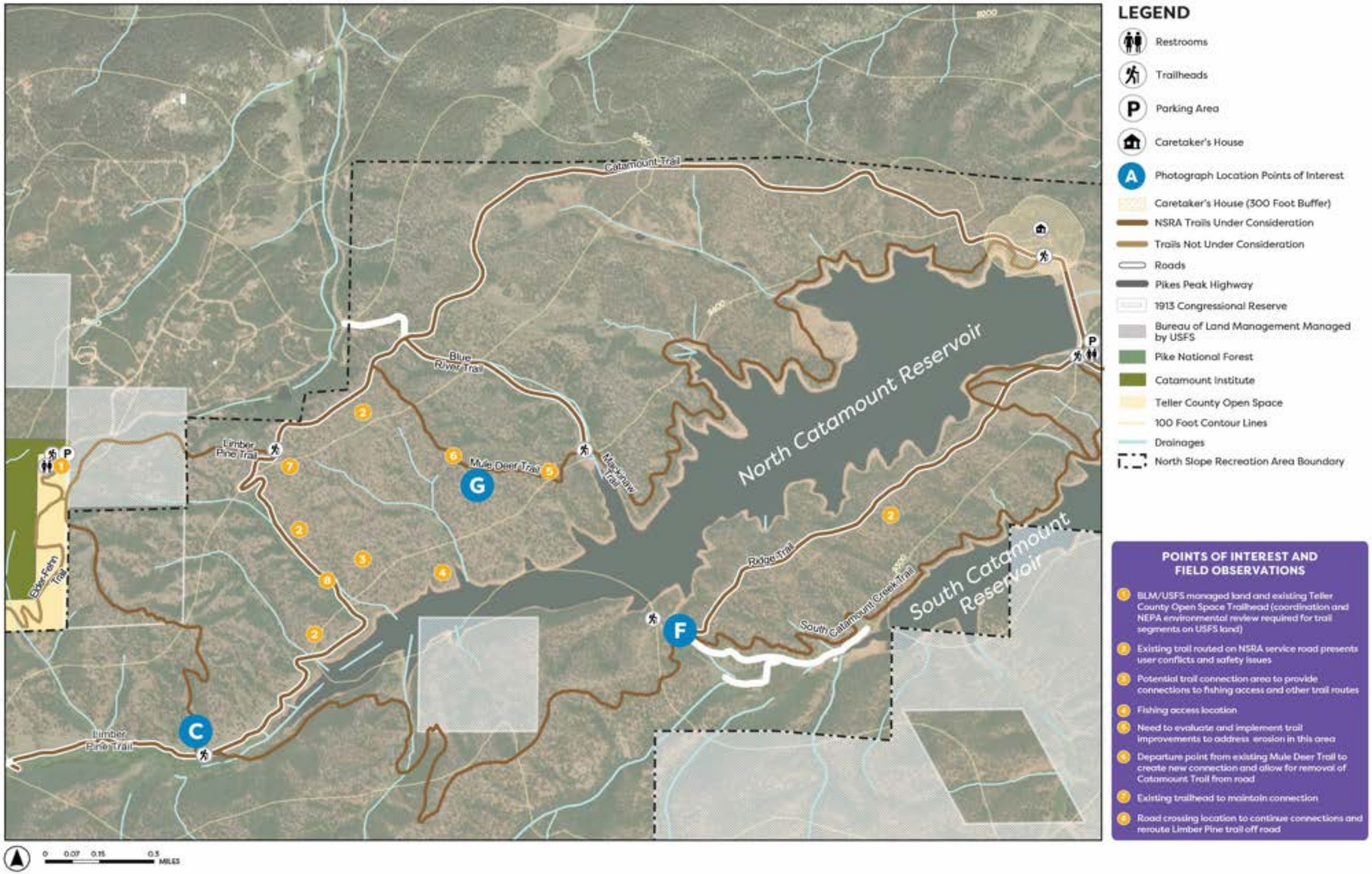
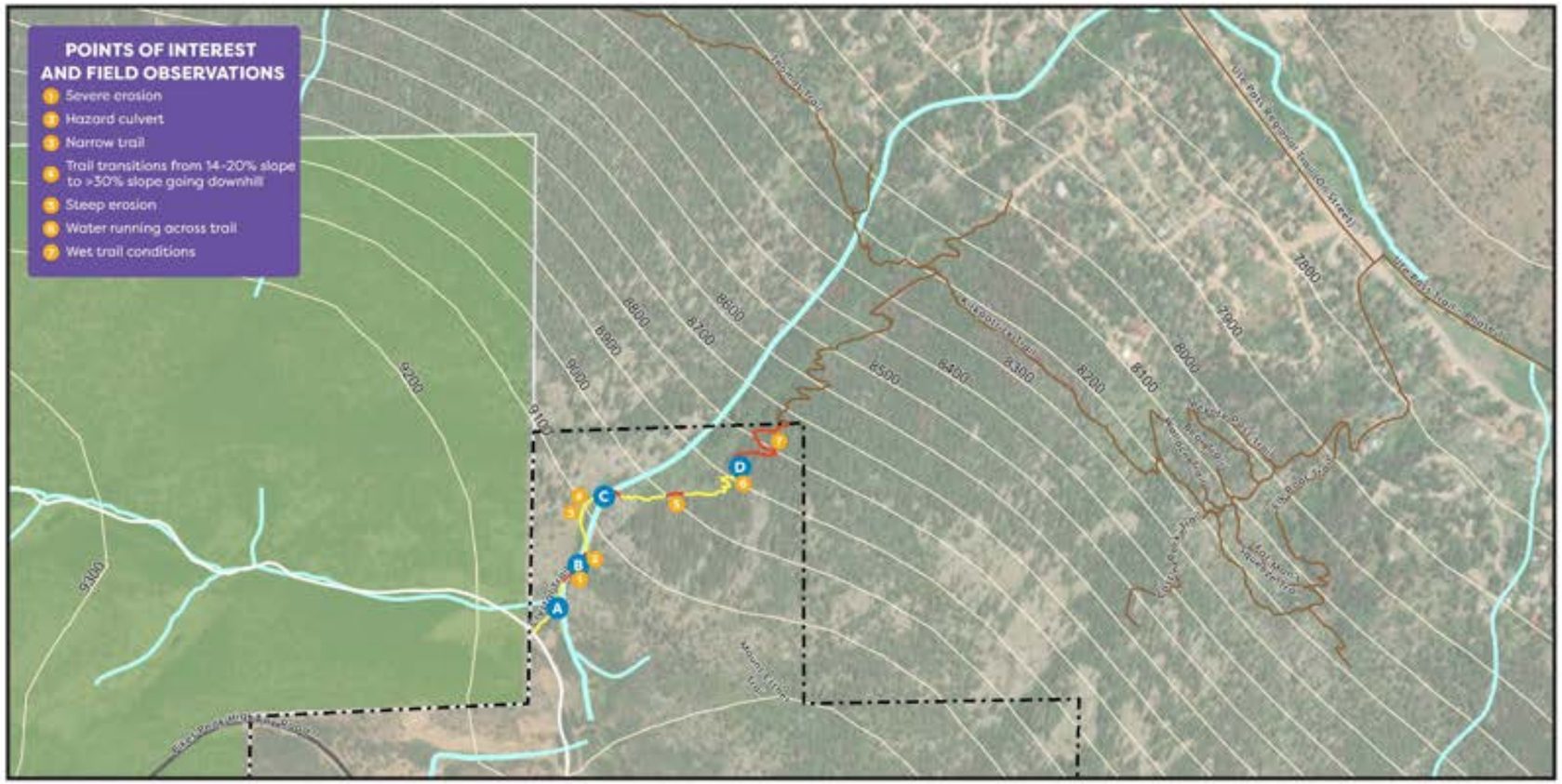


Figure 17: Areas of Interest and Field Observations, Map 4

Figure 18: Crystal Creek Drainage Assessment



Mobility Data Analysis

Springs Utilities and Otak have partnered with RRC Associates (RRC) to provide mobility data, demographics, uses, and other metrics specific to the NSRA. The data contains several options for filtering data down for more specific results; however, these were not utilized.

Mobile location data was collected across a broader geographic area encompassing and extending beyond the NSRA. This expanded extent was necessary to calculate metrics such as dwell time, which rely on device observations occurring both before entry into and after departure from the NSRA, as well as to better understand potential activity and impacts in adjacent areas. The entire NSRA property, Crystal Creek, North Catamount, and South Catamount Reservoirs were specifically mapped and analyzed; however, these reservoir sites accounted for a relatively small proportion of overall observed use compared to other recreation areas within the study boundary. While not representing a data problem, it should be noted that the data does capture the joint Springs Utilities and PPAM staging and service yard near Crystal Creek Dam, as well as construction site and staging areas near and around North and South Catamount Dams.

Data was collected for two study periods: December 2022 through September 2023, and December 2024 through September 2025. The final dataset contained a total of 44,196 unique devices which represented a total of 103,481 visitor days. Results indicate that Colorado residents accounted for 56 percent of visitor days, with additional visitation originating primarily from Texas (11 percent), Missouri (4 percent), and Kansas (3 percent). El Paso County (where Colorado Springs is located) accounted for 36 percent of all visitor days, whereas Teller County only accounted for 4 percent. Within the NSRA, 24 percent of visitor activity occurred on trails and 16 percent on roads (excluding the Pikes Peak Highway), with the Crystal Trailhead area exhibiting the highest use density outside the Pikes Peak Highway corridor. Visitation was highest on weekends, peaked around midday (11 a.m. to 12 p.m.), and reached its annual maximum in July, which accounted for 17 percent of total visitor days.

An executive summary has been provided by RRC which has been attached as Appendix A. Furthermore, the Mobility Data Dashboard has also been included in this report under Appendix B.

Public Survey

RRC collaborated with Springs Utilities and Otak to create a public survey that outlines visitor perceptions of outdoor recreation options and opportunities across the region. The survey covered the following major topics:

- Types of activities participated in at NSRA
- Desired amenities for outdoor recreation
- Preferences for prioritization at NSRA
- Opinions on managing costs from outdoor recreation
- Personal values placed on goals for NSRA
- Recreation characteristics and demographics

The survey was distributed to respondents via a postcard which was handed to visitors as they entered the NSRA. This postcard included a website link and QR code for individuals to take the survey after their visit. Additionally, an online link was distributed to NSRA users by posting to Springs Utilities and City of Colorado Springs websites and distribution to recreation user non-profits.

A total of 937 respondents participated to some extent in the survey between May 21st and September 17th, 2025. Most respondents utilized the online link (88 percent) due to its broader reach and availability. The remaining 12 percent of respondents participated via the postcard with most using the QR code.

Results of the survey were split between three total categories; Colorado Springs residents (defined as any respondent with a ZIP code in the Colorado Springs area), out-of-region (including non-local visitors from Colorado and other out-of-state visitors), and unspecified (respondents who did not provide a ZIP code). A category tabulating all responses was included for all metrics.

A brief summary of metrics has been included here with a full summary report of the Public Survey and associated data available in the attached Appendix C.

Survey responses indicate that basic visitor services are the most valued amenities, with restrooms and trash cans receiving the highest enhancement ratings, as over 60 percent of respondents reported these features would either greatly or moderately improve their experience. Additional wayfinding at trailheads, along with dog waste stations and rest areas or shelters were also identified by a substantial portion of respondents as providing at least some enhancement to their visit. In contrast, amenities such as public transit connections, guided tours, bike or gear repair stations, gear cleaning facilities, and reservable parking areas were largely viewed as having little to no effect on the overall visitor experience.

Approximately three-quarters of respondents endorsed activities such as hiking, fishing, wildlife viewing, walking, picnicking, and kayaking or canoeing. Support for boating and organized events was comparatively lower with all other activities receiving some form of support from more than half of respondents. Preferences were largely consistent across residency groups.

When asked to rate the importance of various objectives for the NSRA and surrounding lands, respondents consistently identified a core set of priorities as extremely important. The highest-rated objectives indicate a strong desire to balance ecological protection and water system needs with continued public access to high-quality recreational experiences. Outdoor education, interpretation, and volunteer opportunities were comparatively less supported by respondents.

Customer Survey

Springs Utilities developed an online customer survey in collaboration with Otak and RRC to gain insights from customers on recreation at the NSRA. The survey covered the following major topics:

- Recreational activities
- Watersheds
- Spring Utilities management of reservoirs
- Concerns and benefits of adding commercial recreation guided tours

The survey was distributed online to a panel of Springs Utilities customers demographically representative of the overall Springs Utilities customer base. A total of 402 customers participated in the survey between July 14, 2025, and August 9, 2025, and resulted in a ±4.88% confidence interval. Survey results were used quantitatively in conjunction with qualitative information from the public survey and other public engagement.

Figure 19: Customer Survey Key Findings

Survey respondents were mostly homeowners, with 30 percent of respondents renting their home. The majority of respondents, 50 percent, have been Springs Utilities customers for 15 years or longer. The respondents included customers from equal generations: 35 percent were Generation X (born 1966 to 1981), 33 percent were Generation Y (born 1982 to 1996), 26 percent were from the Boomer Generation (born 1947 to 1965), and just 3 percent were Generation Z (born 1997 and later). The survey found the following key findings:

- Customers favor revenue generation strategies and increased fees over limitations on recreation.
- Impacts to forests, watersheds, wildlife, water supply, and water quality were seen as the greatest concerns to adding commercial guided recreation tours.
- Providing an opportunity for visitors to learn how to recreate responsibly and bring tourism revenue to the community were chosen as top benefits of adding commercial guided recreation tours.

Engagement Summary

As part of this planning process, two rounds of public meetings were conducted, each consisting of an in-person and an online meeting opportunity, in June 2025 and October 2025, for a total of four public meetings.

June 2025

Two public meetings, one in-person on June 10th and one online on June 12th, were held to introduce the public to the NSRA Access and Recreation Plan project. The in-person meeting consisted of a presentation during which attendees were encouraged to ask questions, as well as Mentimeter polling questions to be answered live by participants. Mentimeter is an interactive presentation tool that allows presenters to collect real-time audience input—such as polls, quizzes, and word clouds—using participants' own devices. Attendees then had the opportunity to disperse to the various boards around the room for specific questions/discussions with project representatives. The online meeting was a Town Hall format on Microsoft Teams which included a presentation with opportunities to submit questions to the team throughout the meeting.

Objectives:

- Introduce the NSRA recreation impact study process at a high level
- Provide background on the NSRA and existing infrastructure and trails
- Establish scope and process of the study
- Obtain general feedback via Mentimeter polling tool
- Address customer questions
- Outline the project timeline and future engagement opportunities

Both meetings, especially the meeting held online, had lower attendance than expected based on previous knowledge about interest in the topic but both resulted in good questions and input from those in attendance. The public also had the opportunity to continue to engage with the project after the meetings via a community survey, watching the virtual meeting recording, and providing feedback directly to Springs Utilities via email. Attendees were also informed there would be another round of public meetings in October. An after-action report has been included for these meetings in Appendix D.

October 2025

Two public meetings were held in October 2025 to update the public on the progress of the North Slope Recreation Area Watershed Access and Recreation Plan, an in-person meeting on October 14th, and an online meeting on October 23rd. The in-person meeting featured a presentation and a Q&A session. Attendees had the opportunity to ask general questions and after the presentation provided feedback on concept maps presented. The online meeting used a Town Hall format on Microsoft Teams and included a presentation with opportunities to ask questions throughout the meeting.

Objectives:

- Review Springs Utilities history and significant events
- Review Springs Utilities current policies
- Review of the NSRA recreation impact study
- Review the input collected through surveys, community events, and stakeholder meetings
- Introduce the proposed concept maps and collect feedback
- Address customer questions
- Outline the project timeline and future engagement opportunities

The in-person meeting was well attended and contributed to stronger engagement among those affected by the study, offering a meaningful forum for input that helped inform the direction of the plan. While the online meeting had much lower attendance, it provided a clear recording and explanation of the concept maps for community members to revisit if they were not able to attend either meeting. An after-action report has been included for these meetings in Appendix E.

Comments & Questions Received

Throughout the project process, members of the public had various opportunities to comment on project materials, ask questions, or provide additional input on desired aspects of the plan. Feedback was primarily received through the public meeting registration forms and direct emails to engage@CSU.org. Approximately 74 questions/ comments were received and covered the following range of topics.

Topics in **Bold*** indicate the top five which received the most comments:

- **Access***
- Amenities
- **Commercial Use***
- Communication
- Cost Management
- Education
- Environmental
- **Management***
- Project Process
- **Ring the Peak***
- **Trails***
- Springs Utilities Operations
- Water Recreation
- Wildfire Risk

Access

Questions and comments focused on access to the North Slope Recreation Area, including:

- Seasonal closures and re-opening schedules
- Access for different user groups
- Water access rules and regulations

Commercial Use

Questions and comments focused on commercial guided recreation use and permitting, including:

- Opportunities for guides, outfitters, and excursions on reservoirs and trails
- Cost structure for commercial guided recreation activities
- Anticipated use authorization for watercraft, angling restrictions, and parking access

Management

This category included a larger variety of questions including:

- Enforcement of boundaries and seasonal closures
- Leave No Trace and public use rules enforcement
- Staffing needs, such as additional rangers or partnership opportunities
- Adaptive management plans and annual reporting
- Infrastructure improvements (e.g., road paving)
- Recreation limitations and watercraft rental policies
- Intended use of the plan and anticipated policy changes
- Proposed amenities for the area

Ring the Peak

Interest in this topic was primarily focused on the proposed route for a Ring the Peak trail through the North Slope Recreation Area, with additional questions concerning:

- The role of the Colorado Parks & Wildlife in the Ring the Peak project
- Signage plans for the trail

Trails

This topic focused on proposed trail modifications within the North Slope Recreation Area, including:

- Trail closures or relocations
- Hiking limitations
- Changes to seasonal access

- Scheduled trail re-openings after construction
- Additional or improved trails
- Accessibility upgrades (ramps, parking, etc.)
- New trailheads and parking areas
- Plans for Crystal Trail

The full matrix of public comments has been included in Appendix F.

03

POLICY RECOMMENDATIONS

During the development of the Plan, recommendations to change policies were identified to address operational infrastructure and water-supply protection needs while still supporting recreational access. These policy recommendations around new activities on the NSRA, specifically commercial guided recreation activities, would be presented in the Plan pending final approval from Springs Utilities Board and City Council.

Implementation of the Existing Recreational Policy

Under the direction of its Chief Executive Officer (CEO), Springs Utilities is authorized to enforce existing recreational policies as outlined in the Excellence in Governance Policy Manual – Utilities Board Instruction to the Chief Executive Office I-7 Water Supply Management' 2025, City Code Provisions 12.4.801-806 and the 2010 Plan for Recreational Uses on Municipal Watershed Lands.

The Plan offers a comprehensive review of opportunities and best practices for enhancing existing recreational activities and would be formally adopted by the Utilities CEO.

Within this planning document are the givens established by Springs Utilities for the protection of the water supply and watershed lands, including the following:

- Strengthen security and infrastructure protection. Establish rules, regulations, and methods to ensure the safety of the public, staff, and infrastructure.
- Accommodate public access and recreational uses that are financially and environmentally compatible. Ensure compatibility with Springs Utilities core business operations.
- Ensure that personnel and financial resources are sufficient to support safe recreational activities, and that resources are sufficient to protect the North Slope Recreation Area and Springs Utilities operations.

With regard to management of NSRA, it is recommended to address and implement the following:

1. Provide for public access on designated and authorized trails and areas

Springs Utilities may close or reroute previously authorized public areas and trails to protect public safety, natural resources, and critical infrastructure, and minimize risk to system infrastructure and operational conflict. This will include, but is not limited to, closing trails that are unsafe or unsustainable, moving trails off service roads, or closing areas to dispersed use or access and would allow the enforcement of trespass, including ticketing or removal from the property. This may include the authorization by the CEO for trails that would have a regional use, such as Ring the Peak.

2. Off-season public access

Springs Utilities may authorize limited off-season public non-motorized access to watershed lands, but only where there is appropriate management and

oversight established and when managing recreation partners have received approval from Springs Utilities. This may include considering limited winter public recreational access/uses at Crystal Creek Reservoir, such as snow shoeing, as the primary management focus is to maintain safety and to keep the public away from and off system infrastructure and reservoir ice.

3. Operating plans covering NSRA

Springs Utilities shall ensure that operating plans covering watershed lands are consistent with its objectives, as proposed by managing partners (e.g., PPAM/Parks within the NSRA) and reviewed and approved by Springs Utilities. Executive Agreements will be updated as appropriate.

4. Authorizing recreation managing partner rental program(s)

Springs Utilities may allow the establishment and management of rental equipment on NSRA by its managing partner, so long as it is consistent with Springs Utilities objectives and formally authorized uses (e.g., non-motorized watercraft, fishing gear, etc.) at Crystal Creek Reservoir. It is the responsibility of the managing partner to ensure that the establishment of such programs and related fees are legally allowable.

5. Formally closing the Crystal Trail on Utilities managed property

As a part of the Plan recommendations, Springs Utilities may close or decommission the social trail below Crystal Creek Reservoir and within the drainage of Crystal Creek on Springs Utilities managed property until a safe, sustainable alternative reroute is developed and approved by Springs Utilities. Springs Utilities may coordinate with the NSRA managing partner and the community of Green Mountain Falls to implement and maintain the closure. Springs Utilities may inform on alternative trail routing (such as possible improvement and formalization of the Catamount Trail) or alternative trail design and construction within the Crystal Creek drainage consistent with Springs Utilities recreational policy and protection of Springs Utilities infrastructure.

6. New activities or trails within municipal water supply reserve lands on Pikes Peak

Springs Utilities, in the interest of protecting the water supply of the City of Colorado Springs, reserves the right to engage with the U.S. Forest Service, regarding any proposals for new activities or developments with the areas of the Pike National Forest reserved for this purpose. This would include the proposed development of new trails (and the potential designation of the Ring the Peak trail or corridor). Such proposals that could affect the protection of the municipal water supplies within these reserved areas appropriately require such consideration consistent with the 1913 Congressional Reservation, the 1914 Cooperative Agreement and 1923 and 1924 Cooperative Agreements that address these reserve lands.

7. Springs Utilities recommendation for approving commercial guided recreation with adoption of BMPs

Springs Utilities, under the direction of the CEO, may implement policy with City Council approval of a resolution authorizing the conditional use of commercial guided recreation within the NSRA. Implementation would rely on identified best management practices and an adaptive management framework to monitor and address potential impacts. When the BMPs outlined in this Plan are applied, the activity becomes legally permissible and consistent with the health, safety, fire protection, and conservations standards required by City Code.

New Recreational Policy for Commercial Guided Recreation

In 2023, Springs Utilities initiated a study of existing unauthorized commercial guided fishing and boating tours at the NSRA. The study investigated the effects of those private commercial activities on watershed conditions, water system operations, and public recreation. Springs Utilities, along with the NSRA recreation managing partner PPAM, paused commercial recreation activities until the effects of

commercial guided tours were documented, other example programs were reviewed, and commercial recreation could be formally considered for approval. Outcomes from the study identified alternatives including the development and use of best management practices that provide effective and adaptive management to protect operations of the water system, watershed conditions (including water quality and other environmental values), and public recreational experience. The study concluded that implementation of best management practices could maintain proper health, safety, fire protection, and conservation standards per city code.

Alternatives and Criteria Considered

Three alternative management scenarios were considered:

- Maintain the status quo of relatively unmanaged oversight of commercial guided recreation tours;
- Formally prohibit commercial guided recreation activities; and
- Authorize commercial guided recreation subject to appropriate management practices.

Public and Stakeholder Input on Commercial Guided Recreation

Springs Utilities conducted surveys in 2023 and 2025 of public visitors at the NSRA and Springs Utilities residential customers to determine level of support and related community values related to commercial guided activities on the NSRA. The results of these surveys garnered mixed responses of public support for commercial guided recreation and largely deferred to the management discretion of Springs Utilities and PPAM.

Respondents who were indifferent to or supportive of commercial guided recreation activities on the NSRA believed they should have appropriate management and oversite, not damage the natural resources, should be administered in a clear, open, and transparent manner, and should provide additional benefits to the community.

Use of Best Management Practices including Adaptive Management

Identified BMPs address important elements of a sustainable commercial guided recreation permit program. Key elements to the program shall include at a minimum: Commercial Permit Administration (e.g., how permits are issued); standard requirements of Commercial Outfitter Permits (e.g., compliance with watershed rules and regulations, reporting, etc.); Outfitter Management (e.g., monitoring and enforcement); and Adaptive Management (adjusting management practices based on the effectiveness of existing BMPs). These BMPs are listed in Section 04, *Tables 3 – 8*.

Adaptive management provides Springs Utilities and a managing partner the ability to adjust to changing circumstances over time, creates formal monitoring networks and processes, and maximizes opportunities to modify from gained experience. Agreements with PPAM as a managing partner would include a management cycle to accomplish the following:

- Develop and implement an initial management plan
- Monitor and review effectiveness of the management plan and effected conditions
- Actively address any unforeseen conditions
- Modify or adapt the management plan based on the monitoring to improve overall management

It is recommended that if approved, PPAM manage and operate the commercial recreation program, utilizing the best management practices to protect resources and provide day to day oversight. PPAM would collect fees and revenue from commercial permits, and any excess revenue could be deposited in the reserve account to support PPAM's management and maintenance of NSRA to cover future CIP projects, renovations/ replacements, and equipment needs.

04

CONCEPTS & PROPOSED IMPROVEMENTS

The following concepts and proposed improvements focus on improving watershed access and trail connectivity within the North Slope Recreation Area (NSRA) while prioritizing public safety, resource protection, and operational compatibility. Proposed trail realignments emphasize removing recreation users from active service roads, improving east–west and reservoir-to-reservoir connections, and enhancing overall user experience through sustainable trail design. Recommendations also address longstanding safety, erosion, and management challenges by decommissioning unsafe or unsustainable routes, coordinating with adjacent land managers (El Paso and Teller Counties, Green Mountain Falls, and the US Forest Service (USFS), and applying established Colorado Springs Utilities (Springs Utilities) best management practices to guide future planning, design, and implementation.

Concepts for Watershed Access & Trail Alignments

Mount Esther

The Mount Esther area serves as a primary entry point to the NSRA for visitors arriving on the Pikes Peak Highway. This portion of the property also sits between two USFS parcels, allowing additional access from USFS land as well as from nearby communities on Highway 24 (see the Crystal Trail section below for more detail). Since visitors can access both the Crystal Reservoir Visitor Center and Crystal Creek Reservoir, this area experiences a high concentration of activity. However, guiding visitors to designated recreation areas is challenging because of nearby Springs Utilities and Pikes Peak Highway operational facilities, such as the adjacent maintenance area.

Proposed improvements in this area include:

- Enhancing access to the south side of Crystal Creek Reservoir;
- Formalize adoption of Mt Esther trail on Springs Utilities property
- Improving connections and pedestrian routes between parking areas and the Crystal Reservoir Visitor Center;
- Strengthening the connection between the Visitor Center and the North and South Catamount Reservoirs;
- Improving connectivity between existing trails; and
- Enhancing user experience and reducing potential conflict by relocating trail users off utility service roads and onto dedicated, designated trails.

Given that some of these existing and proposed connections involve USFS land, coordination and National Environmental Policy Act (NEPA) environmental review will be required for these segments. For further information, see *Figure 20 Proposed Connections, Map 1*.

Shortcut Road

This area lies entirely on USFS land and includes the Catamount Shortcut Road, which links the two separate parcels that make up the NSRA. For visitors traveling between the Crystal Creek Reservoir area to the east and the North and South Catamount

Reservoirs to the west, the existing route follows a service road, creating potential conflict between pedestrians and vehicles, as well as between visitors and Springs Utilities operations, diminishing the overall user experience.

Recommended improvements in this area include creating an enhanced connection to the North Catamount area, either by routing a trail off the existing service road or by developing a parallel side path if a separate route is not feasible. Additional connections to the South Catamount Reservoir and associated facilities may also be considered. Since all proposed concepts in this area are on USFS land, coordination and NEPA environmental review will be required. For further information, see *Figure 23 Proposed Connections, Map 4*.

Catamounts

The largest concern within the Catamounts region is recreational use, like trail routes, on active service roads. This creates safety concerns and conflicts between visitors and Springs Utilities operations and maintenance personnel. Multiple existing trails currently overlap with service roads including the Catamount and Ridge Trails. An additional goal for this area includes improving connectivity between the reservoirs and existing trail systems.

To address the noted concerns and issues, the Ridge Trail is recommended to be decommissioned and replaced with an alternative route between the road and South Catamount Reservoir, across the contour to the south and parallel to the existing service road. The Catamount Trail also is recommended to be decommissioned from the existing trailhead on the northern terminus of North Catamount Dam to the existing intersection of the current Catamount and Limber Pine Trails. Connectivity between these areas is recommended to be served by an extension of the Mackinaw Trail, which is discussed in more detail in following sections. The Blue River Trail is recommended to be closed to recreation users but will still provide service or emergency vehicular access to the trailhead intersection with the existing Mackinaw and Mule Deer Trails. For further information, see *Figure 21 Proposed Connections, Map 2*.

North Catamount Dam

Pedestrian connectivity is recommended to be improved across North Catamount Dam. It is recommended to establish a new connection across contour between the trailheads, parking, restrooms, and the accessible fishing dock at the southern terminus of North Catamount Dam and the "hairpin turn" on Catamount Loop Road. This new connection can serve to remove recreation users from hiking on the service and access roads and provide a more enjoyable recreation experience. Lastly, a short section of trail is recommended to be developed off the service road between the existing eastern terminus of the Mackinaw Trail and the northern terminus of North Catamount Dam. For further information, see *Figure 21 Proposed Connections, Map 2*.

Mackinaw Trail

The Mackinaw Trail currently provides users with a waterfront hiking only trail which serves as informal fishing access along the northern shoreline of North Catamount Reservoir. It is recommended to designate hiking and non-electric assisted biking uses on this trail and to improve it as an east-to-west connection along the north side of North Catamount Reservoir as a reroute of the Catamount, Blue River, and northern half of the Mule Deer Trails. Erosion concerns on the existing Mule Deer Trail also warrant further evaluation and potential improvements.

Extending the Mackinaw Trail westward would provide a more direct connection between North Catamount Reservoir parking area and the intersection of the Limber Pine Trail, two desirous areas for recreation users. This potential extension of the Mackinaw Trail would then become the primary hiking and non-electric assisted biking connection between North Catamount Dam and the Limber Pine

Trail. Additionally, several promising fishing locations have been identified but are not currently well connected, presenting opportunities for targeted trail spurs or access points. This approach would avoid continuous shoreline routing. Connections between the Limber Pine Trail and Teller County Open Space Trailheads would be formally provided as part of this process. For further information, see *Figure 22 Proposed Connections, Map 3*.

Crystal Trail

Several area-specific issues have been identified along the Crystal Trail on Springs Utilities managed property, largely related to highly erosive soils and poor trail conditions that present safety concerns and risk to Springs Utilities' water infrastructure in the Crystal Creek drainage. Nearly the entire trail as it currently exists on NSRA property would require significant and costly upgrades due to several locations exhibiting severe erosion and hazardous conditions. Additionally, the trail outputs users near the active Springs Utilities and PPAM staging and service area which exacerbates ongoing operational conflicts between recreation users, Springs Utilities' operations, and land managers. When taken together, these factors demonstrate that Crystal Trail within the NSRA is less than ideal and unsustainable to manage in its current configuration.

It is recommended that the Crystal Trail be closed and decommissioned on Spring Utilities property until a suitable alternative route is established due to the significant safety hazard it poses to recreation users and risk to Springs Utilities' infrastructure. Alternative trail connectivity from Green Mountain Falls into the NSRA could be considered including possible improvement and formalization of the Catamount Trail, which would require authorization from the USFS. Successful efforts in this goal will require coordination with the Town of Green Mountain Falls as the Crystal Trail is recognized, signed, and utilized by local residents on the Green Mountain Falls side of the NSRA property boundary.

Figure 20: Proposed Connections, Map 1

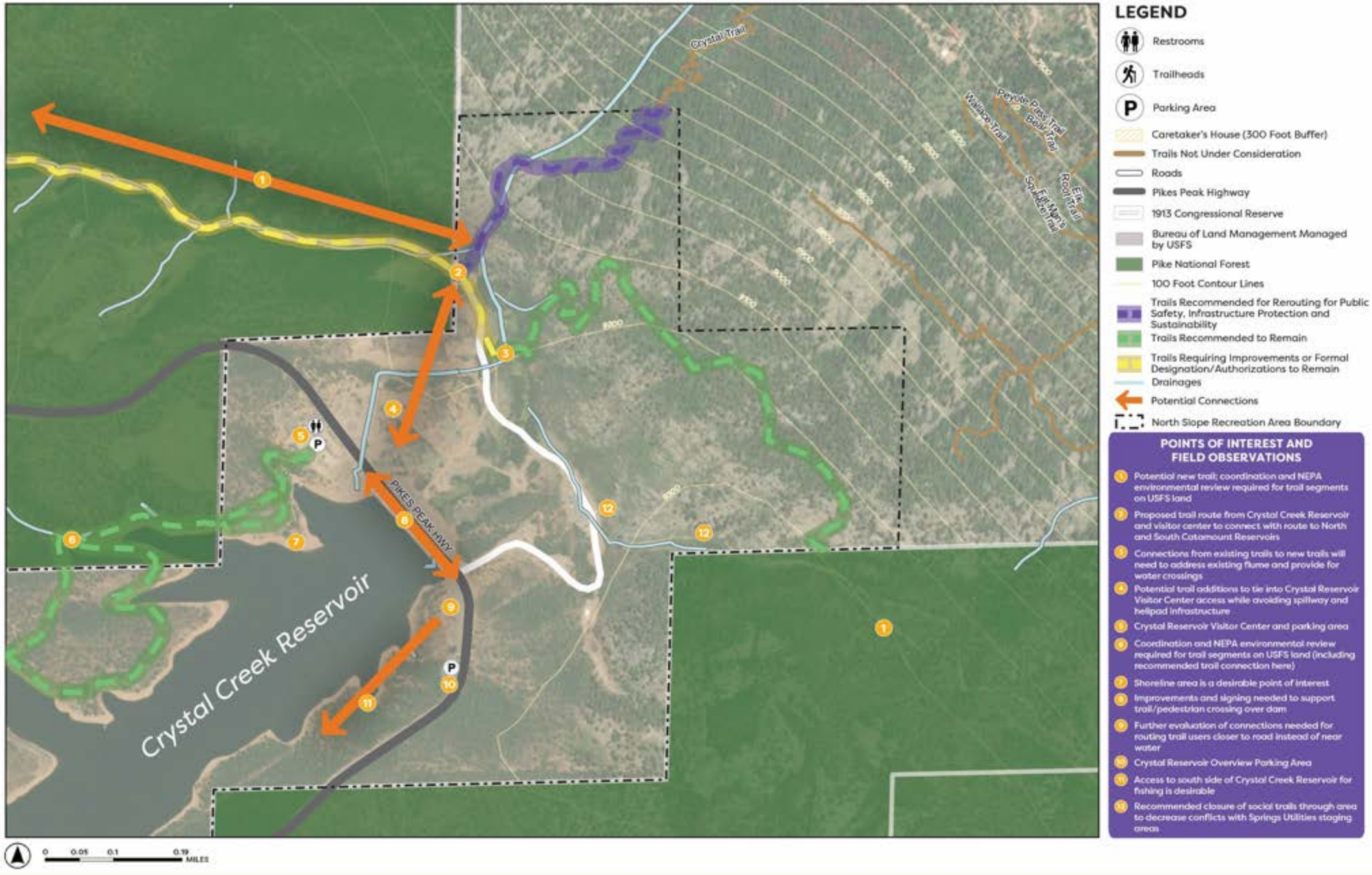


Figure 21: Proposed Connections, Map 2

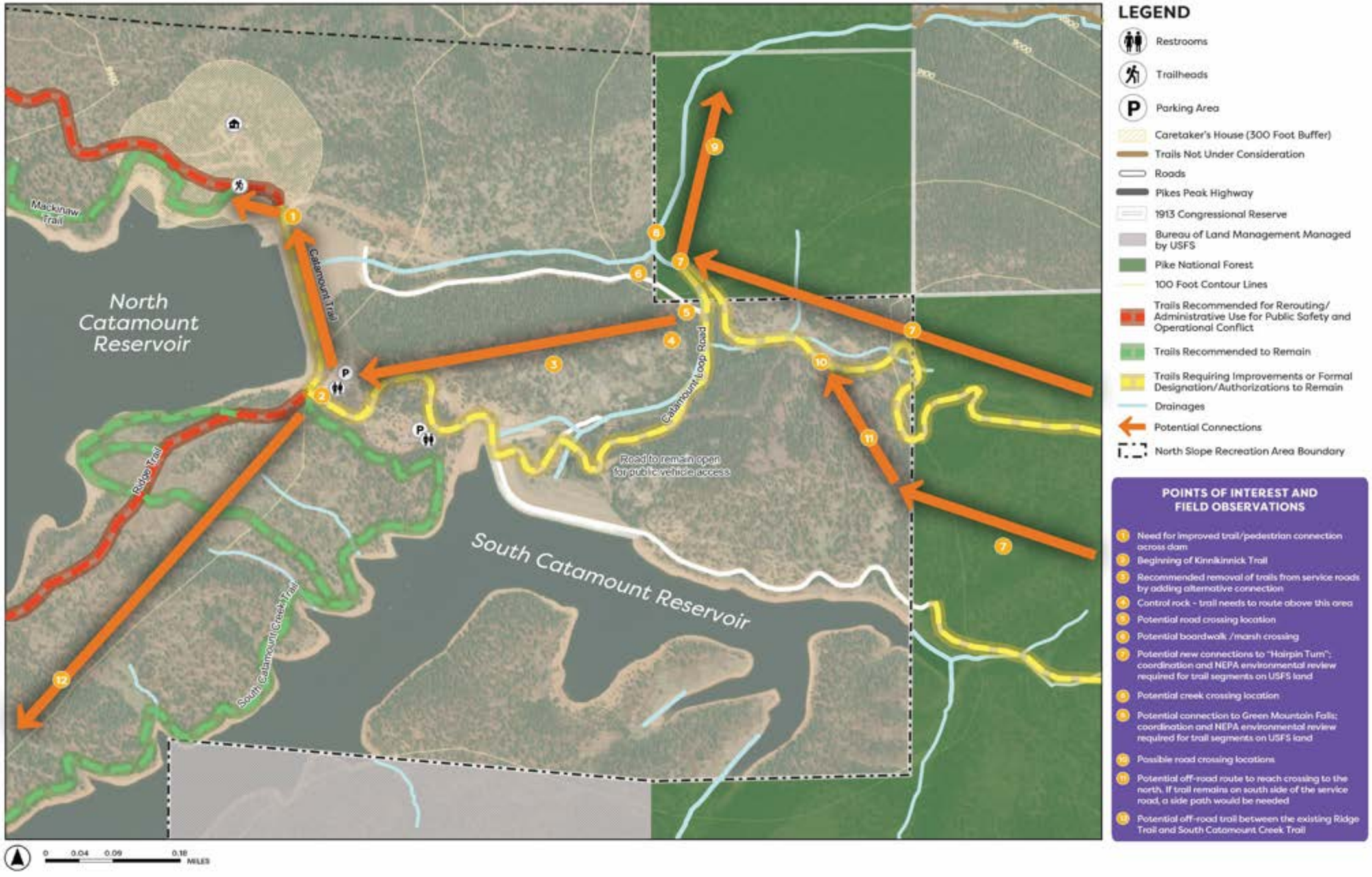


Figure 22: Proposed Connections, Map 3

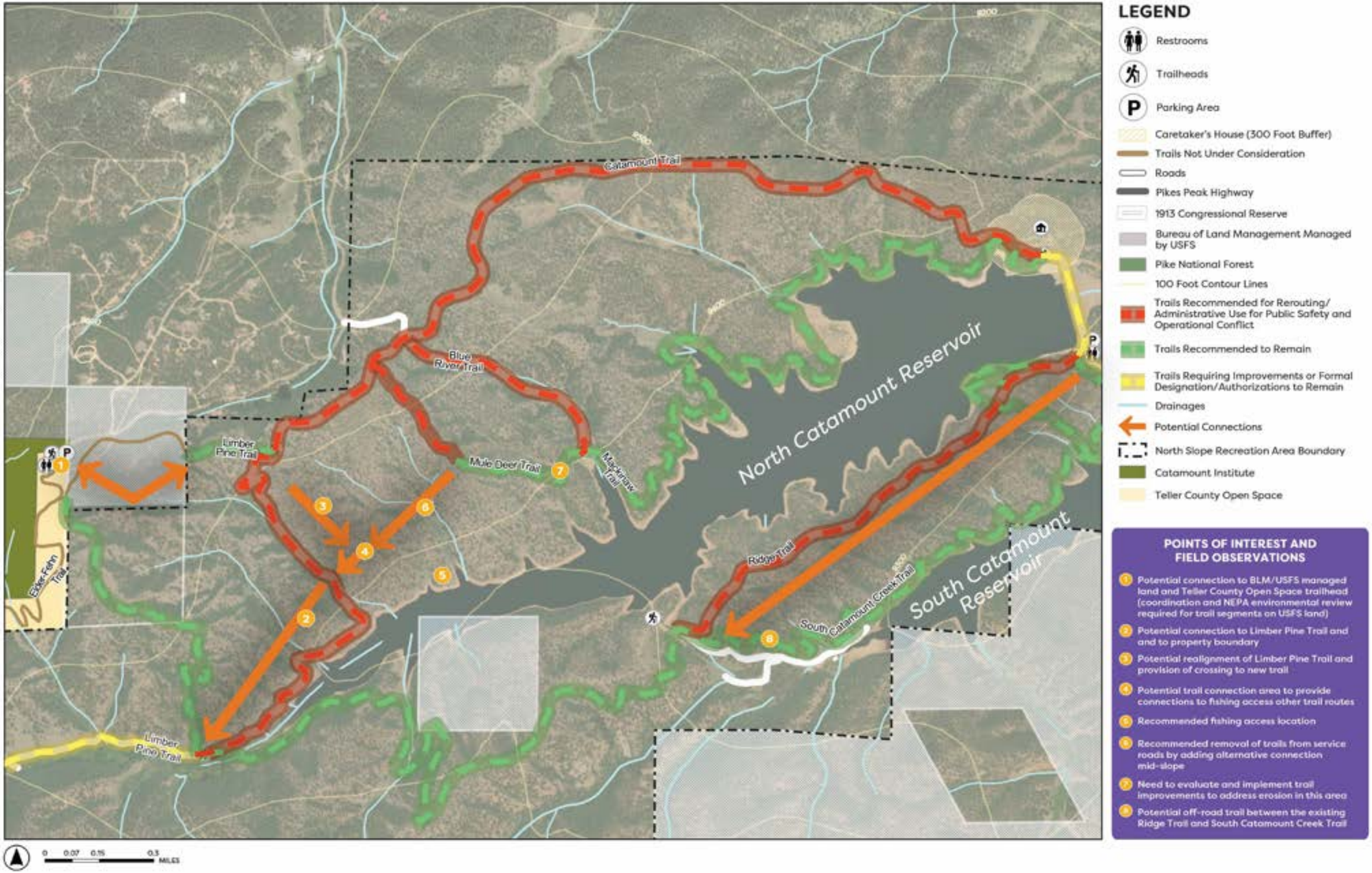
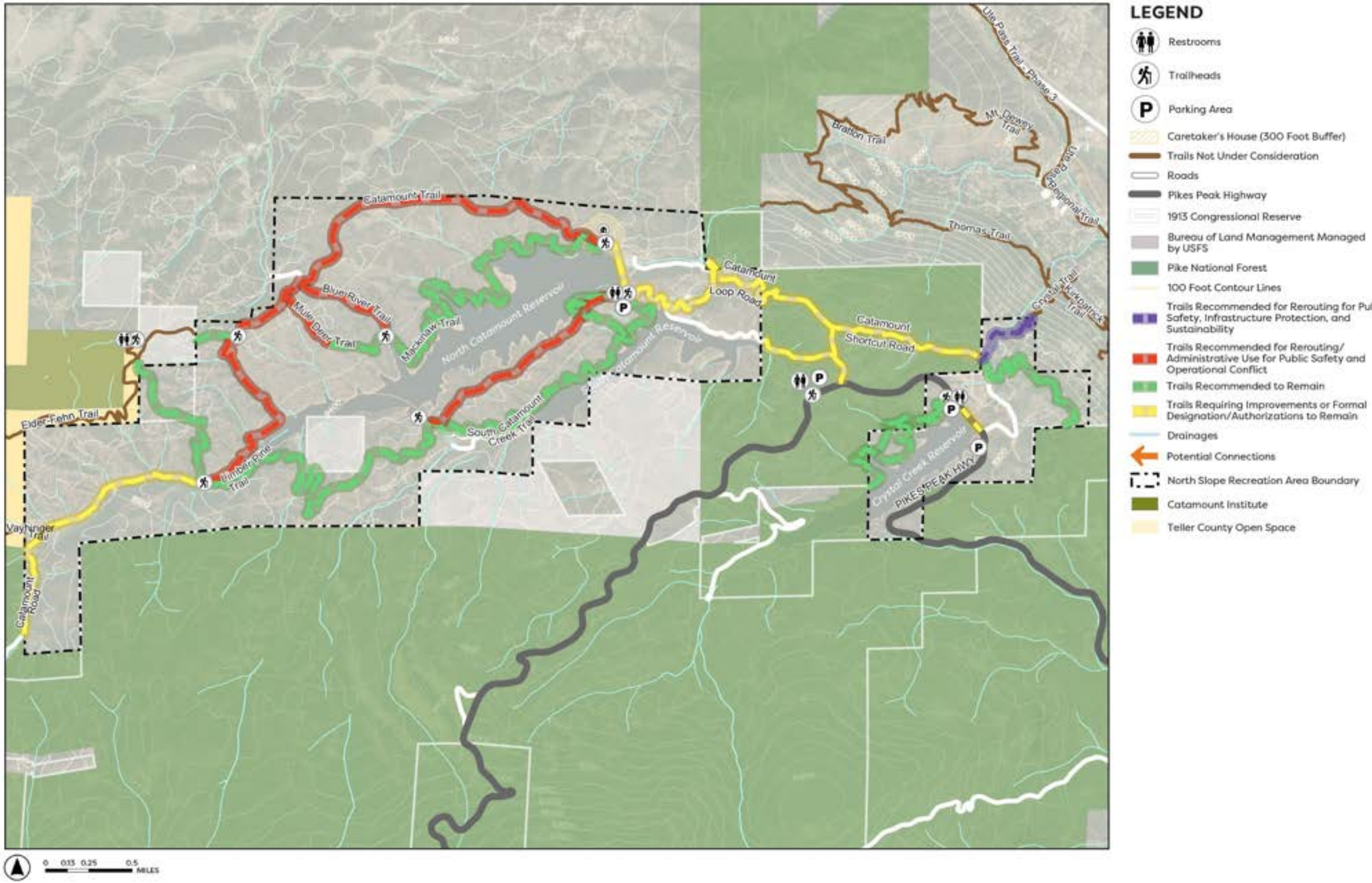


Figure 23: Proposed Connections, Map 4

Figure 24: Proposed Connections, Overview



Best Management Practices & Design Recommendations

In many areas, including the NSRA, existing trails and routes are not sustainable in their current alignments because many were never designed or constructed as recreational trails. Instead, they originated as game trails, routes used to access materials or service infrastructure, or former vehicular paths. As a result, these routes often have steep grades and poor alignment with the natural landscape, leading to impacts on natural and cultural resources, diminished user experience, and increased maintenance needs and costs.

Springs Utilities and the USFS have established best management practices (BMPs) and design guidelines for sustainable trail development that should guide all proposed improvements. Additional locally utilized resources for trail sustainability include guidance from the International Mountain Bike Association (IMBA), Volunteers for Outdoor Colorado, and the Kootenay Adaptive Trail Standards.

Colorado Springs Utilities BMPs

There are two main Springs Utilities documents that establishes relevant BMPs for similar watershed lands - “Plan for Recreation Uses on Municipal Watershed Lands” (see Appendix G for full document) and “North Slope Recreation Area: Commercial Guided Activities Review” (See Appendix J for full document). The “Plan for Recreation uses on Municipal Lands” was developed in 2010 and focused on the Springs Utilities watershed lands, specifically the South Slope watershed, but many of the guidelines and BMPs established also apply well to the NSRA. An overview of these recommendations can be seen in the tables taken from the plan below, with additional details found in the full plan located in Appendix G.

Table 1: Typical BMPs by Use Type

Activities or Components	Typical BMPs
Trails	
Walking and hiking, nature photography	Erosion control (water and wind), velocity controls, stormwater runoff management (rain and snow melt), trail drainage, stopping/ vista areas, vegetation management, wetland, and riparian avoidances
Mountain Biking	Erosion control (water and wind), velocity controls, stormwater runoff management (rain and snow melt), stabilization, sediment barriers, retaining walls (revetments), erosion controls, runoff controls, buffers areas, vista areas, vegetation management, wetland and riparian avoidances, dust controls
Trailhead/Day Use Areas	
Parking Areas (cars, trucks, motorcycles)	Grade maintenance, stormwater management, drainage management, trash management, oil/grease contamination, invasive species (plants and animals) control, signage
Restrooms	Waste management (vault or composting), septage hauling and frequency, insect control, graffiti removal, trash management, paper management, odor issues, facility maintenance (after winter/ pre-winter)
Picnic facilities (tables, trash collection	Trash clean up and removal, graffiti removal, erosion controls, maintenance, invasive species control, signage, bearproof trash receptacles
Lake/Fishing	
Fishing	Waste management, trash/ debris management, signage, access points, wetland, and riparian avoidance
Shoreline and non-motorized boat launch	Waste management, trash/ debris management, signage, access points, wetland, and riparian avoidance
Roads	
Cars, trucks, motorcycles, pull-offs	Erosion control, velocity controls, stormwater runoff management (rain and snow melt), stabilization, sediment barriers, retaining walls (revetments), cribbing, filter strips, buffers areas, vista areas, vegetation pruning, culverts, bridges, grade controls, water quality swales, sediment basins, dust controls
Non-Structural	
Education	Signage, voluntary support programs (e.g., adopt a reservoir, trailhead)
Code and Regulation	Federal, state, and county regulation, city code
Public Outreach	Educational programs, training, newsletters, website information, flyers
Wetlands and Riparian Areas	
Photography	Select boardwalks, viewing areas/ platforms, signage

General BMPs

Trails Best Management Practices

- Use design and drainage features to keep water off the trail tread surface.
- Build on the contour and use frequent grade reversals - surf the hillside.
- Follow the half-rule: A trail's grade should not exceed half the grade of the side slope.
- Maximum grade should be 12 percent (except for natural or built rock structures).
- Average grade should stay under 10 percent (with grade reversals).
- Route trails to positive control points (viewpoints, water, or other attractions).
- Complete surveys to appropriately identify cultural resources and protect by redirecting or avoiding disturbance.
- Use bench-cut construction and excavate soil from the hillside.
- For highly technical trails where grade will sometimes exceed 12 percent, use natural rock, rock armoring, or other rock features to add challenge and improve sustainability.
- Avoid the fall line: Fall-line trails usually follow the shortest route down a hill - the same path that water flows. The problem with fall-line trails is that they focus water down their length. The speeding water strips the trail of soil, exposing roots, creating gullies, and scaring the environment.
- Ensure that users stay on the trail tread through design and education.
- For re-routes, reclaim old trail corridors thoroughly, including the visual corridor as well as the trail tread.
- Provide education, signage, and clearly delineated trails when eliminating or relocating public access on Springs Utilities service roads

Trailhead Best Management Practices

- Parking facilities should include drainage structures and velocity controls.
- Drainage from parking lots can be directed through grass swales, using natural vegetation to reduce runoff and erosion. These swales can mimic natural hydrology and not appear as structural BMPs.
- Instead of vault toilets, which have potential to cause water quality problems if they leak or are not maintained, consider composting toilets that do not discharge. Solar composting toilets (functional at high altitudes) reduce overall maintenance demands and decrease the risk of water contamination.
- Provide easy turnaround that keeps vehicles within boundary of parking lots.
- Minimize soil disturbance and retain desirable vegetation in and around developed areas to the maximum extent possible.
- Trailhead users will produce trash, so provide a wildlife-proof trash collection and management system.
- Provide educational signage on watershed functions, resources, sensitivities, and allowed uses.
- Use certified weed-free mulch, straw, or hay for landscaping at trailheads.
- Use locally native material, including seed mixes.
- All individuals working, volunteering, or recreating should clean mud, dirt, and plant parts off vehicles, equipment, and boots before going onto the watershed to reduce the possibility of introducing invasive species.
- Provide notice that all harvesting (wood, rocks, plants, cultural resources, and artifacts, etc.) is prohibited.
- Do not allow charcoal or wood fires and remove any fire pits that may develop. Propane stoves in designated stable areas are permitted.
- After a ground disturbing activity, monitor infested areas annually for at least three growing seasons following completion of

activities and provide for follow up treatments based on inspection results.
- Ongoing maintenance of trailhead drainage structures

Education/Training Best Management Practices

- Public education and outreach involve using effective mechanisms and programs, guided by a detailed outreach strategy, to engage the public interest in preventing recreational use impacts.
- The public has varying levels of background knowledge of the need for recreational use management and their role in causing recreational use impacts. This requires a multi-pronged approach to outreach efforts by (1) generating basic awareness of impact types, (2) educating at a more sophisticated level using more substantive content, and (3) building on existing recognition of the issue to prompt behavior changes that reduce impacts (or the opportunities for impacts).
- Specifically address the integration of public outreach with the implementation of other program management measures (like trail maintenance).
- Outreach could involve more substantive education, possibly live presentations and slideshows, handouts, posters with educational content and captioned illustrations, and web-based training modules, or website with photos of good and bad practices.
- Signage types include kiosk (determine person responsible for maintaining kiosk information), trail directional signs, interpretive environmental educations signs, and regulatory signs.

Source Water Protection Best Management Practices

- Prevention is the most cost-effective practice.
- Maintain natural hydrology.
- Design runoff controls to keep excessive runoff from source water area (e.g., reservoir, intake point on stream).
- Reduce opportunities for pathogens to enter waterways and sources through design and management.
- Use velocity controls to manage stormwater runoff.
- Natural vegetation is remarkably effective at filtering contaminants. Vegetation is effective in promoting filtering or infiltration, while minimizing changes to natural hydrology and land disturbances.
- Post local and state regulations related to source protection (e.g., maintain City Code provisions 12.804-806, prevent aquatic nuisance species transport to reservoirs, and avoid disturbing wetlands and fens).
- Develop emergency response plans for wildfire and visitor safety for recreational areas.
- Ensure proper waste storage, treatment, and disposal to minimize potential water quality degradation.
- Maintain knowledge of the ecology of the habitats. Mixed conifer habitat in the Rocky Mountains specifically has steep, rugged topography, high erosion potential of the soils, and a shorter growing season, and therefore requires careful long-term monitoring and management.
- In cooperation with CPW, regularly monitor wildlife, such as elk and moose, to determine whether recreation is negatively impacting populations, and redirect efforts if necessary (with special emphasis for species that are at risk of declining).
- Implement habitat monitoring programs to establish baseline data and identify changes to habitat quality (both positive and negative) through time.
- Determine surface water and groundwater potential contamination pathways and monitor for water quality compliance.

- Provide for secondary containment against spills for above or underground fuel storage to prevent impacts to waterways or water supplies

Wildlife and Vegetation Best Management Practices

- Conserve unique representatives or core areas of rocky cliffs, fens, and other important habitat types. Identify and preserve local sites important for the conservation of priority species that depend on these habitats, cliffs, fens, and other important habitat types. Identify and preserve local sites important for the conservation of priority species that depend on these habitats.
- Enforce areas closed to protect sensitive wildlife species.
- In mixed conifer high elevation habitats, pay considerable attention to the types of vegetation and soils that are present and their susceptibility to change. Monitor for unauthorized use and associated habitat impediments due to recreation.
- Consider both long- and short-term impacts of activities at high altitude. Limit activities that degrade or remove wildlife habitats (e.g., heavy recreational use, overgrazing, and invasion by exotic plants). Manage forested environments and known habitat areas for sustainable use without excessive disturbance over the long-term.

Invasive Species Best Management Practices

- At parking lot or trail entrance, install gravel pads designed for mud removal.
- Train staff to recognize invasive species common to the area.
- Increase awareness by recreational users of the threat posed by invasive species and appropriate actions to minimize that threat.
- Stay on designated trails, roads, and other developed areas.
- Report invasive species infestations to Springs Utilities to be included in the invasive species monitoring program. Signage should provide a contact for reporting invasive species.
- Prior to moving equipment onto or out of the property, inspect vehicles, and trailers onto and off of an activity area, spray, scrape, or brush soils, seeds, plant parts, or invertebrates from exterior surfaces to the extent practical, to minimize the risk of transporting invasive species.
- Hikers, bicyclists, and bicycles have the potential of unintentionally carrying invasive species from one area to another. Soils, seeds, plant parts, or invertebrates may cling to gear, bicycles, and clothing. Encourage education for cleaning gear and mountain bikes before entering the area.
- Use certified weed-free mulch, straw, or hay for all restoration or landscaping.

Site Specific Best Management Practices

In addition to general BMPs, there are also watershed specific BMPs recommended for recreational facility construction and subsequent maintenance.

Erosion and Sedimentation

A significant resource concern with trail construction and maintenance on watershed lands is always erosion and subsequent sedimentation into waterbodies. In trail system design, erosion and sedimentation control practices help to protect water quality, maintain recreational trails, and reduce maintenance costs. Maintenance of existing vegetation along the trail is a fundamental aspect of erosion and sedimentation control as vegetation filters run off, and provides protective cover for existing soil, reducing potential erosion from rain, snow, and flowing water.

It is also important in trail design to locate and construct sediment-trapping features at high runoff locations, such as sediment basins and constructed grass or vegetative swales, to minimize sedimentation in waterways and wetlands.

Consideration of waterway crossings and facilities to reduce the potential for erosion and water quality contamination at these crossings is also important.

Slopes along trails are particularly susceptible to erosion due to slope grades and increased velocity of water runoff. This requires cross-drainage design features and slope stabilization both up-gradient and down-gradient of the trail. Careful consideration of potential drainage issues during trail construction can reduce future maintenance needs and improve trail sustainability. Many times, riprap drainage traps are sufficient to reduce erosion potential at the downstream edge of a water bar or other drainage feature along a trail. However, in some cases additional design elements like J-hook trail design are needed to pool runoff and reduce water velocity. Correct spacing of drainage features relative to trail grades is another important key to success as seen in the chart below.

Trail Grade (%)	Spacing between Drainage Features (feet)
2%	250
5%	135
10%	80
15%	60

In general, slopes less than or equal to 5% are most desirable to minimize potential erosion and sedimentation problems. Slopes greater than 10% have increased maintenance needs and greater potential for erosion so trails at these slopes require greater care and control practices. Observation or photographic platforms or pads along trails can be strategically placed to serve as erosion control features and can be constructed in places where undesirable trail shortcutting might be, serving as a deterrent. This would allow the feature to both enhance water control and trail sustainability while also providing benefits to trail users.

Trails intended to be multi-use must also consider varying impacts from different user types. For example, bicycle use causes greater trail impacts and associated maintenance than hiker-only trails. This must be considered in trail design so that proper water control features can be selected and appropriate precautions taken at crossings. The following tables recommend BMPs by activity type, both during any construction activity and long term.

Table 2: Recommended BMPs by Recreation Construction Activity

Recreation Construction Activity	Types of Structural and Construction BMPs	Permanent BMP Requirements
Trail Construction		
Trails (hiking, single track)	Grass buffer, riprap, logs or water bars, check dams, erosion control blankets or fiber rolls, grass swale, mulching, seed bed preparation, surface roughening, straw bales, wattle, fiber matting, terracing and slope stabilization, retaining walls (revetments), cribbing, crossing protections (e.g., riprap, instream check dams, velocity controls)	Grass buffer, riprap, logs or water bars, check dams, grass swale, permanent revegetation, terracing and slope stabilization, retaining walls (revetments), cribbing, sediment basins, stream buffer setbacks, proper use of pesticides, herbicides, and fertilizer, education, signage
Observation areas/pads	Riprap, logs or water bars, check dams, erosion control blankets or fiber rolls, temporary revegetation, terracing and slope stabilization, retaining walls (revetments), cribbing, mulching	Permanent revegetation, terracing and slope stabilization, retaining walls (revetments), cribbing, proper use of pesticides, herbicides, and fertilizer, education, signage
Trailhead and Day Use Area Construction		
Parking lot, picnic area, fishing access, waste management	Grass buffer, riprap, logs or water bars, check dams, erosion control blankets or fiber rolls, grass swale, mulching, seed bed preparation, temporary revegetation, straw bales, wattle, fiber matting, terracing and slope stabilization, retaining walls (revetments), cribbing, surface roughening, sediment basins, slope drains	Grass buffer, riprap, logs or water bars, check dams, grass swale, permanent revegetation, terracing and slope stabilization, retaining walls (revetments), cribbing, sediment basins, stream buffer setbacks, proper use of pesticides, herbicides and fertilizer, education, signage
Access Road(s) Construction		
Road Construction	Roadside swales, riprap, logs or water bars, check dams, erosion control blankets or fiber rolls, slope drains, sediment basins, terracing and slope stabilization, retaining walls (revetments), cribbing, straw bales, wattle, fiber matting, surface roughening, seed bed preparation	Grass buffer, riprap, logs or water bars, check dams, grass swales, permanent revegetation, terracing and slope stabilization, retaining walls (revetments), cribbing, sediment basins, stream buffer setbacks, proper use of pesticides, herbicides, and fertilizer
Water Crossings	Crossing protections (e.g., riprap, instream check dams, velocity controls), sediment basins, straw bales, wattle, fiber matting	Stabilize natural channels
Reservoir Shoreline		

Shoreline trails and bank stabilization	Riprap, logs or water bars, check dams, terracing and slope stabilization, retaining walls (revetments), cribbing, temporary revegetation, erosion control blankets, or fiber rolls	Permanent revegetation, terracing and slope stabilization, retaining walls (revetments), cribbing

Adaptive Management

Given the changing nature of water quality and natural resource conditions, as well as recreation demand on watershed lands, Springs Utilities needs an adaptive planning and management framework that allows them and any managing recreation partner to be flexible and responsive to future opportunities, issues, and needs. Adaptive management is a watershed-based tool to address short-term and long-term outcomes from implementation of recreational programs. It is meant to be a flexible, iterative (feedback based) process, based on understanding that goals, inventory, and available knowledge and technology are perpetually changing, and that future events and scenarios are unpredictable. Strategies and action are continually identified, implemented, monitored, and evaluated over time, with opportunities for modification. By using this type of approach, it will be possible for Springs Utilities to effectively manage and monitor changing conditions related to recreational activities.

Adaptive management concepts are common in most watershed plans in Colorado and generally include a basic four-component feedback process:

1. An easily updated management and implementation plan, including feedback loops to address contingencies and meet long-term goals
2. Monitoring programs designed to address near-term activities, long-term trends, natural events, and unforeseen circumstances
3. An active process or management team to analyze and interpret data and outcomes
4. A mechanism to adjust management strategies and objectives, and incorporate results from monitoring and information analyses into future actions and plans

Further information on Adaptive Management BMPs for this area can be found in the full plan located in Appendix G.

Commercial Guided Recreation BMPs

Another plan that includes relevant BMPs for the NSRA is the "North Slope Recreation Area: Commercial Guided Activities Review." In this 2023 plan, Springs Utilities examined community benefits, water operations, watershed impacts, recreational user impacts, best management practices, and financial sustainability to inform policy around commercial for-profit recreation on the three reservoirs in the NSRA.

Public benefits were discussed with stakeholders and outlined in the BMP section of the study. General benefits include enlisting assistance from commercial users with carpooling/shuffling for traffic management, garbage maintenance and stewardship of public areas, provide education for responsible recreation and safety, Leave No Trace principles and history of water systems and lands, and provide opportunities for limited populations to recreate was desired. These types of activities would be agreed upon in the permit and be included in the evaluation criteria for permit applications.

A summary of these BMPs can be found in the tables below, with full details found in the full plan in Appendix J.

Table 3: Commercial Outfitter BMPs, BMPs for On-Water Activities – Commercial Permit Administration

BMP	Strategies
a – Establish commercial permit **administrative responsibilities** for Springs Utilities and, if applicable, the management partner for watershed lands and reservoirs.	1. Establish regular meetings between Springs Utilities (Operations staff, Business Communications, Security) and Managing Partner for first year of partnership. Adjust meetings as needed for following years. 2. Determine responsibility for promulgating rules and policies, permit requirements, permit qualifications criteria, and permit issuance, communication, and others. a. When needed, coordinate with multiple land and water owners. 3. If needed, determine and integrate unique attributes for each watershed lands and reservoirs area, as considered. 4. Establish a Springs Utilities Watershed Lands and Reservoirs Commercial Permit document. a. Develop a NSRA - specific commercial Permit document. 5. Establish an executive agreement or revocable permit agreement between Springs Utilities and the management partner for each watershed lands and reservoirs area. e.g., PPAM and Springs Utilities will require an Executive Agreement with an Operations Plan.
b – Ensure appropriate **staff and resources** to manage and monitor Springs Utilities Watershed Lands and Reservoirs Commercial Permits.	1. Identify and assess current staff and resource allocations. a. Establish baseline of time dedicated to commercial outfitter management for Springs Utilities and Partner(s). 2. Monitor the need for additional staff and resources to implement adjusted Springs Utilities Watershed Lands and Reservoirs Commercial Permit policies. a. Monitor staff and resources needs as number of Utilities Watershed Lands and Reservoirs Commercial Permits increase or decrease

Table 4: Commercial Outfitter BMPs, BMPs for On-Water Activities – Commercial Outfitter Permits

BMP	Strategies
a – Establish **Goals for commercial outfitter participation** on Springs Utilities watershed lands and reservoirs.	1. Establish Community Support and Establish Equitable Access goals. a. Goals may include underserved population participation, youth participation, watershed stewardship, and others. ***2. If needed, determine and integrate unique attributes for each watershed lands and reservoirs area, as considered.*** a. When needed, coordinate with multiple land and water owners 3. Establish goal for commercial outfitter permit holders to comply with the **Outfitter Requirements** set forth in the Springs Utilities *Watershed Lands and Reservoirs Rules and Regulations, Commercial Outfitter Specific Requirements, and Community Support Requirements*.
b – Designate and or promulgate **Watershed Lands and Reservoirs Rules and Regulations** applicable to Commercial Outfitter participation in Springs Utilities Watershed Lands and Reservoirs.	1. Establish Watershed Lands and Reservoirs Rules and Regulations. a. Watershed protection ordinance, city code provision 12.4.801-806. 2. If needed, determine and integrate unique attributes for each watershed lands and reservoirs area, as considered. a. Review and adjust for unique NSRA attributes. b. NSRA Open Season (review annually based on annual weather and changing climate). c. NSRA closed dates to commercial outfitters: e.g., existing closure Pikes Peak International Hill Climb. d. NSRA access is currently limited by parking reservations. Gates may be useful for other high use times.
c. Define the **Commercial Permit Application and Distribution System**	1. Utilize and /or establish the Utilities Watershed Lands and Reservoirs Commercial Permit documents. a. Establish NSRA specific Commercial Permit and application documents. b. Establish customer satisfaction survey for use by all commercial outfitters. 2. Determine the types of commercial permits to allocate on Springs Utilities watershed lands and reservoirs. a. If Water-based – consider if permit allocations should be based on the type of water-based activity. b. If Land-based – consider if permit allocations should be based on the type of land-based activity. c. Long term d. Seasonal e. Determine whether some or all permit types will or will not be transferable. 3. Determine the total number of Commercial Permits for each activity type that will be allotted annually based on the Adaptive Management Approach findings for each watershed lands and reservoirs area. 4. Commercial Permit Distribution - Determine how limited permits will be distributed. a. The potential for more qualified applicants than available commercial permits is high. The selection process should be fair and equitable.

	i. The recommended process is to issue a competitive RFP & bid and to follow City and Springs Utilities contracting rules. • Annual permit with option to renew for 4 additional years. After 5 total years, a competitive RFP & bid is required. ii. Other selection methodologies discussed and dismissed included lottery, seniority, and potential revenue generation.
d. **Commercial Outfitter Specific Requirements**	1. Complete, fulfill, and agree to uphold all requirements of the Utilities Watershed Lands and Reservoirs Commercial Permit Application. 2. License, Certification, and Insurance. State and CPW requirements vary by Commercial outfitter activity. Springs Utilities and the management partner for each watershed should verify and stipulate the requirements for each use in each area. a. Department of Regulatory Agencies - DORA b. Colorado Parks and Wildlife Requirements (input and support for requirements, boating safety) c. Liability insurance d. First Aid Certification e. Guide Certification – Wilderness first aid, EMT, satellite phone, peer organization certifications, Lifeguard 3. Mandatory attendance at both Preseason and Postseason Commercial Outfitter Meeting. 4. Visitation Limits and Rationing – Consider if controls on commercial outfitter guided group size or visitation frequency optimize Springs Utilities and the management partner goals for each watershed. Controls may include: a. Maximum Group size b. Guide/guest ratio – this could be a recommendation or requirement based on type of use c. Maximum number of visits / season d. Rationing of visits or timing of visits on peak days/weekends 5. Education Requirements – Commercial outfitters will be required to present their protocols for guest education including: a. Utilities Watershed and Lands Rules and Regulations b. Leave No Trace ethic and adherence c. Community and watershed history 6. Community Support and Equitable Access Requirements a. Establish the Community Support Requirements to achieve the goals set forth in II.a.1 of this section. b. Consider allowing each commercial permit holder to suggest their own approach for Community Support and Equitable Access. i. How would you accomplish equitable access? c. Share criteria to determine if commercial outfitter proposed approach meets the goals set in Iya. of this section. d. Determine what, if any, role the Springs Utilities management partner takes in connecting community groups with commercial outfitters. i. For NSRA, the outfitter will identify, contact, and coordinate with groups per their RFP proposal. e. Determine consequences for commercial permit holders for not meeting their community support program. 7. Reporting

	a. Submit End-of-Season CPA certified report to Managing Partner to include attendance, entry fees, and revenue by month. b. Submit customer satisfaction surveys from all guests with End-of-Season submission. c. Report all accidents and incidents in compliance with Springs Utilities requirements. 8. Review and modify as appropriate per the Adaptive Management Approach in section 5.
e. Adjust BMPs for Outfitter Responsibilities and Outfitter Management to **support decisions and adjustments of this section.**	1. See section below for Outfitter Responsibilities BMPs. 2. See section below for Outfitter Management BMPs.

Table 5: Commercial Outfitter BMPs, BMPs for On-Water Activities – Outfitter Responsibilities

BMP	Strategies
a. Adhere to **Outfitter Requirements** stipulated in the Utilities Watershed Lands and Reservoirs Commercial Permit Compliance with Watershed Lands Rules and Regulations, Compliance Outfitter Specific Regulations, and Community Support Requirements	1. Determine outfitter reporting protocol and report submission process to either Springs Utilities or management partner for each watershed lands and reservoirs area. Refer to section 2.d above
b. Implement, record, and report completion of **Community Support** activities as agreed to in each outfitter's Utilities Watershed Lands and Reservoirs Commercial Permit.	1. Determine outfitter reporting protocol and report submission process to either Springs Utilities or management partner for each watershed lands and reservoirs area.
c. **Protect the watershed** by: i. Educating and managing your guests. ii. Each guide should be prepared to document (via license plate or name) and report other outfitter immoral behavior" or unauthorized use/activities by other commercial outfitters/guides (poaching). iii. Document and report general recreators not complying with the Rules and Regulations of the property.	1. Determine outfitter reporting protocol and report submission via email to either Springs Utilities or management partner for each watershed lands and reservoirs area. 2. Outfitters shall contact Spring Utilities managing partner to engage/ educate the user.

Table 6: Commercial Outfitter BMPs, BMPs for On-Water Activities – Outfitter Management

BMP	Strategies
a- **Monitor compliance** with all requirements and stipulations of the Utilities Watershed Lands and Reservoirs Commercial Permit	1. Determine whether Spring Utilities or management partner will be responsible for monitoring compliance implementation for each watershed lands and reservoirs area. 2. Implement framework for Drop-in audits.
b- Implement a method to **verify vehicles** belonging to Utilities Watershed Lands and Reservoirs Commercial Permit holders.	1. Determine responsibility for verification strategy development and implementation to either Spring Utilities or management partner for each watershed lands and reservoirs area. 2. Discuss with management partner and outfitters to determine the best option for each watershed lands and reservoirs area. 3. Consider vehicle stickers, hang tags with id number, or company id to show at gate.
c- Establish **enforcement strategies, procedures, and penalties** for commercial outfitters.	1. Implement a procedure for current Utilities watershed lands and reservoirs commercial permit holders to report visitor use problems/issues or unauthorized use/activities by other commercial outfitters/guides (poaching) as well as general recreational users. 2. Implement a procedure for Rangers to report "bad behavior" or unauthorized use/activities by commercial outfitters/guides (poaching) as well as general recreational users. 3. Implement a recording/monitoring protocol and penalties procedure to follow-up on the reported information. a. There is zero-tolerance for aggression/abuse towards rangers or other users. b. Establish warning and due process procedures.

Table 7: Commercial Outfitter BMPs, BMPs for On-Water Activities – Monitoring Commercial Use Impacts – Adaptive Management

BMP	Strategies
a- Establish an **Adaptive Management Approach** to measure and respond to resource, recreational, and community impacts from Utilities Watershed Lands and Reservoirs Commercial Permit holders' activities.	1. Determine whether Springs Utilities or management partner is responsible for establishing the Adaptive Management Approach for each watershed lands and reservoirs area. 2. Determine responsibility for implementing the Adaptive Management Approach (AMA) to either Springs Utilities or management partner for each watershed lands and reservoirs area. 3. If needed, determine and integrate the unique attributes for each watershed lands and reservoirs area, as considered. AMA's may include: a. Items/Categories to measure, such as water quality, recreationists experience impacts, outfitter experience impacts, resource sustainability, maintenance/operational sustainability, financial sustainability, community benefit. b. Methods to solicit recreationists and outfitter input c. Methods to collect empirical data. d. Frequency and Timeframe of AMA monitoring. e. Steps to make appropriate adjustments. 4. Establish a watershed (NSRA) specific Adaptive Management Approach document.
b- **Implement the Adaptive Management Approach.**	1. Determine when to start Adaptive Management Approach. 2. Determine the optimal time of year to initiate and implement the Adaptive Management Approach. 3. Implement Adaptive Management Approach. 4. Complete report/memo of findings.
c- Make **Appropriate Adjustments.**	1. Recommend appropriate adjustments to address needs or shortcomings. 2. Assign responsibility, resources, and schedule to implement the adjustments. 3. Schedule or identify the next Adaptive Management Approach implementation.

Table 8: Commercial Outfitter BMPs, BMPs for On-Water Activities – Monetizing Commercial Use

BMP	Strategies
a. Understand the **current and ongoing operational and management cost** to manage recreation for both PPAM and Utilities	1. Tracking the current and ongoing operational and management cost to facilitate the Utilities Watershed Lands and Reservoirs Commercial Permit holders' activities by Springs Utilities and PPAM to allow for meaningful decisions regarding commercial permit fees and requirements. 2. Tracking the current and ongoing operational and management cost to facilitate the general recreation activities on Springs Utilities watershed lands and reservoirs by Springs Utilities and PPAM to allow for more meaningful decisions regarding both general recreation fees and commercial permit fees and requirements.
b. Consider what is **fair, equitable, and consistent**.	1. Any commercial permitting and fee system should be fair and equitable for all outfitters. a. Review and adhere to all applicable DEI principles, goals and mandates established by the City of Colorado Springs and Spring Utilities. b. While long-term permits are important for businesses to plan, lack of new or "permit turnover" can bar new businesses legal access to Springs Utilities watershed lands and reservoirs. c. Flexible and systematic turnover of commercial permits may minimize poaching – unauthorized use - by unpermitted outfitters. 2. Any commercial permitting and fee system should consider consistency with adjoining land manager systems. The potential Commercial Fee Permit and Fee System for Spring Utilities watershed lands and reservoirs may include: a. Permit Application Fee. b. Entrance Fee per guest. c. Seasonal Fee/permit holder d. Percentage of Gross Income with commercial outfitter reporting requirements.
c. Consider **how commercial fees will be allocated.**	1. Consider what is legal/possible as stipulated within City Code and within existing PPAM and Springs Utilities Enterprise Agreements for the collection of various fee systems. 2. Determine how the fees will be collected. 3. Determine where the fees will be deposited and distributed annually, if not the City General Fund. 4. Determine how commercial permit fees should be allocated. Options could include: a. Ranger salaries b. Improvements - general recreation c. Improvements - commercial outfitter facilities d. Maintenance – PPAM e. Maintenance – Springs Utilities f. Signage g. Education h. Others
d. Consider **City Enterprise options**	1. Consider benefits and drawbacks to establishing NSRA and SSRA as a joint City Enterprise or sub-enterprise to PPAM.

	2. Consider if this approach is applicable to other Springs Utilities watershed lands and reservoirs. 3. Consider the executive agreement requirements needed between Springs Utilities and PPAM. 4. Implement if the City Enterprise structure optimizes outcomes for Springs Utilities, PPAM, recreational users and the general community.

US Forest Service BMPs

As stated in the February 2025 Trail Maintenance and Construction Notebook (see Appendix H for full document) by the USFS, trail sustainability is based on the three concepts of environmental, social, and economic sustainability. All of these are important for the longevity and viability of trails both individually and as part of a larger trail network. Sustainable trails are "planned, designed, constructed, managed, and maintained in a way that will not negatively impact the adjacent natural and cultural resources, meets trail visitor expectations, and is affordable, now and into the future."

- **Environmental Sustainability:** trails avoid or minimize impacts to natural and cultural resources
- **Social Sustainability:** trails meet the needs and expectations of users, provide high-quality, varied trail experiences, and clearly lead users to desirable areas so off-trail ventures are minimized
- **Economic Sustainability:** trails are planned, designed, and constructed to enhance visitor experience and keep users on the trail while minimizing necessary maintenance through tools like erosion control, following natural contours, proper drainage, etc.

There are a variety of factors that contribute to the physical sustainability of a trail, such as the alignment of the trail, the location on the landscape, soil type, and water control. How the trail and trail features are designed will determine how well a trail holds up to heavy use by recreationists as well as whether and other natural conditions. According to the USFS, the characteristics of a physically sustainable trail include the following.

- Requires only light seasonal maintenance.
- Has moderate trail grades less than 7%, is routed across sloping terrain, and where soils and local rainfall patterns allow, may have short steeper segments with up to a 15% grade.
- Located on stable soils that are not easily erodible and with features that can withstand use and minimal erosion or damage to the trail tread.
- Designed to anticipate the effects of the type of severe weather events, wildfires, and other natural disasters most likely to occur in a given area.
- Is "hydrologically invisible" on the landscape. In most cases, the trail follows the contour of the hillside and does not disrupt the flow of water down the hillside or has reversals in grade (a.k.a. undulation) that forces water to drain off the tread without constructed drainage structures

In the NSRA, many of the existing trails fall in the category of "unsustainable," for a variety of reasons such as location/alignment, slope, erosion/drainage concerns, or conflict with vehicles and operations. As part of this plan, the existing trails were evaluated and the above proposed recommendations seek to improve the sustainability of the trail network by both improving existing trails in accordance with sustainable trails best practices, and by ensuring any new trails be planned, designed, and constructed from the beginning with such practices in mind.

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IMPLEMENTATION & NEXT STEPS

This document identifies existing conditions, operational constraints, and recreational demands within the North Slope Recreation Area (NSRA) while outlining a set of conceptual access and trail recommendations. These recommendations are intended to improve safety, sustainability, and the overall visitor experience while maintaining critical watershed infrastructure and natural resources. This plan is intended to serve as a guiding framework. Recommended improvements are expected to be pursued incrementally and phased over time as funding, staffing, permitting, and interagency coordination allow. Further data collection, environmental review, detailed design, and engineering will be necessary for each recommended improvement to ensure regulatory compliance, refine alignments, and ultimately provide trails and recreation opportunities that visitors can enjoy while balancing the needs of the watershed long into the future.

Existing and future recreation plans may have proposals that could affect NSRA recreation as well as Springs Utilities water system infrastructure, watershed lands and water supply. Springs Utilities, under the direction of the CEO, may coordinate with such plans as long as the overall goals can improve the overall visitor experience while addressing safety, sustainability, and protection of critical watershed infrastructure and natural resources as outlined in this Plan.

Estimated Unit Costs of Various Types of Improvements and Funding Opportunities

By outlining conceptual improvements to recreation and access in the NSRA this plan serves as the first step towards future implementation. Further information will be gathered and site-specific design decisions made at the time of implementation that will be critical to more detailed determinations of implementation costs. To get a general idea of potential cost ranges for various improvements, a chart of high-level unit costs can be found in Appendix K, however, these are subject to change and will be updated at the time of design and construction.

Funding for the projects resulting from this Plan may include grant sources and other funding opportunities and will be leveraged to reduce financial impacts to Springs Utilities ratepayers. Possible grant sources include Colorado State Trails Grant and Colorado's Regional Partnerships Initiative (RPI), and other state and local grants. For El Paso, Teller, and Fremont counties, the Pikes Peak Outdoor Pikes Peak Initiative (OPPI) Vision Plan identifies regional recreation projects that are eligible to receive RPI funding.

Projects designed to support the implementation of this Plan that are reviewed and approved by Springs Utilities for construction should be incorporated by Springs Utilities into this Plan in the future.

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APPENDIX

A. Executive Summary North Slope – Mobility Dashboard and Analysis
B. Mobility Dashboard
C. North Slope Survey Report 2025
D. NSRA Public Meetings_June2025
E. NSRA Public Meetings_October 2025
F. Questions Catalog and Public Comments
G. Plan for Recreational Uses on Watershed Lands
H. USFS Train Maintenance and Construction Notebook
I. Field Work Check Sheet Summer 2025
J. NSRA Commercial Guided Activities Review
K. High Level Unit Costs

OVERVIEW

This analysis of mobile location data focuses on visitation patterns within the North Slope Recreation Area, part of the broader watershed lands managed by Colorado Springs Utilities. The study supports ongoing recreation planning efforts aimed at balancing public access with infrastructure protection, security and safety considerations, and the preservation of water quality across the watershed.

To inform this analysis, mobile location data were acquired for a broad area encompassing and surrounding the North Slope Recreation Area. This broader spatial extent was necessary to calculate metrics such as dwell time, which require observations both before and after visits to the study area, and to assess potential adjacent-area impacts. Although these adjacent areas were not a primary focus of analysis, they are included in the dashboard for context and reference. Within the study area, three reservoirs, Crystal Creek, North Catamount, and South Catamount, were mapped and analyzed; however, they represent a relatively minor share of observed use compared to other recreation sites.

METHODS

Data were collected for the following time periods: December 2022 through September 2023, and December 2025 through September 2025. After data cleaning and processing, the final dataset included 44,196 unique devices, representing 103,481 visitor days and over 133 million total device observations. These figures represent the sample size of devices detected within the study area and should not be interpreted as total visitation counts. Mobile location data are derived from a subset of all devices, typically representing less than 10 percent of total visitation. Nonetheless, the sample size obtained is sufficient to support robust trend and pattern analysis.

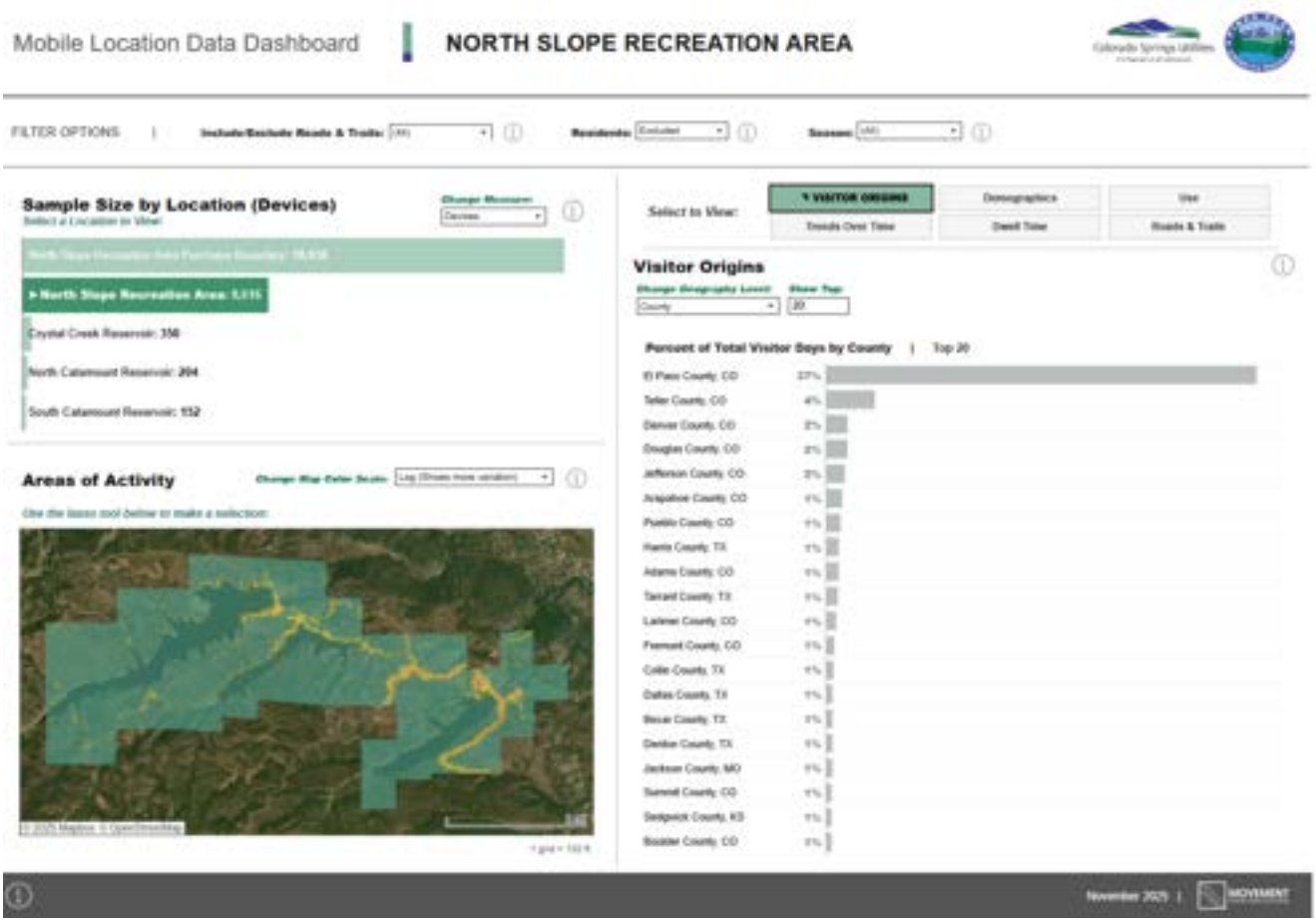
Spatial data for roads were sourced from the TIGER/Line database, while trail alignments were obtained from COTREX (Colorado Trails Explorer). These layers allow users to interactively include or exclude trail and road-based activity within the Tableau dashboard. This functionality enables differentiation between on-road and off-road visitation and helps inform management questions related to infrastructure and user experience.

RESULTS

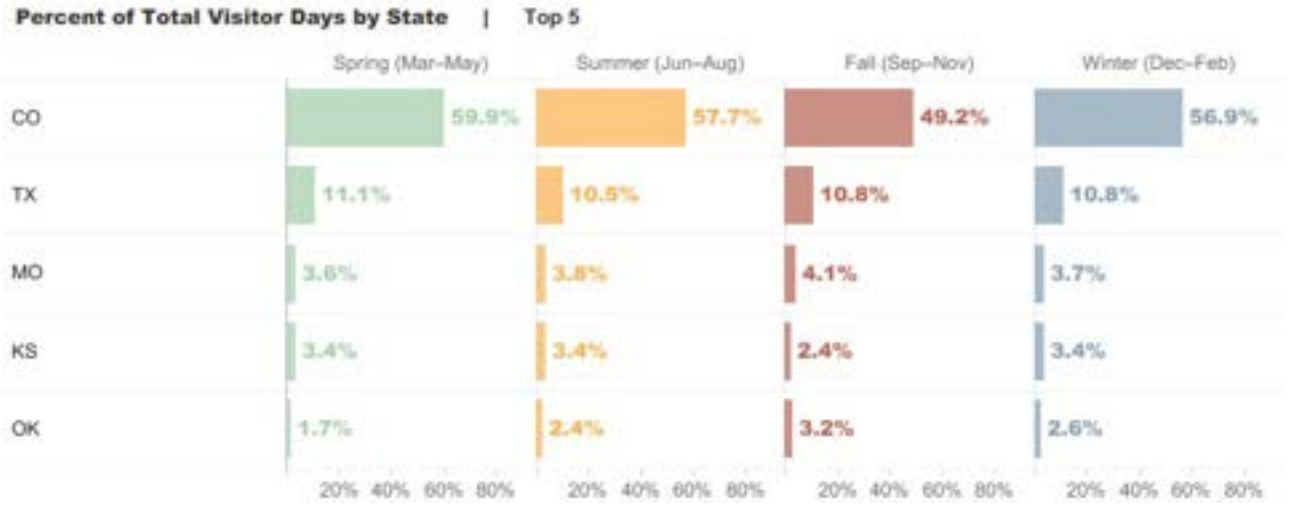
Results show that 56 percent of visitor days originated from Colorado residents, followed by Texas (11 percent), Missouri (4 percent), and Kansas (3 percent). By county, El Paso County accounted for 36 percent of visitor days, followed by Teller County (4 percent), and the Douglas, Denver, Arapahoe, and Jefferson Counties. Visitor origin patterns were broadly consistent between weekends and weekdays. However, weekend visitation included a slightly higher share of local visitors with 38 percent of weekend visitor days originating from El Paso County, compared to 35 percent mid-week.

Within the North Slope Recreation Area, 24 percent of observed visitors were recorded on trails, while 16 percent were observed on roads, excluding the Pikes Peak Toll Road. The Crystal Trailhead area showed the highest density of use among all sub-locations, not including the Pikes Peak Highway corridor. Use was higher on weekends overall, with Saturdays accounting for 17 percent and Sundays for 16 percent of total visitor days. Visitation generally peaked mid-day, between 11 a.m. and 12 p.m. Across the study period, July (17 percent) had the highest visitation over the course of a year.

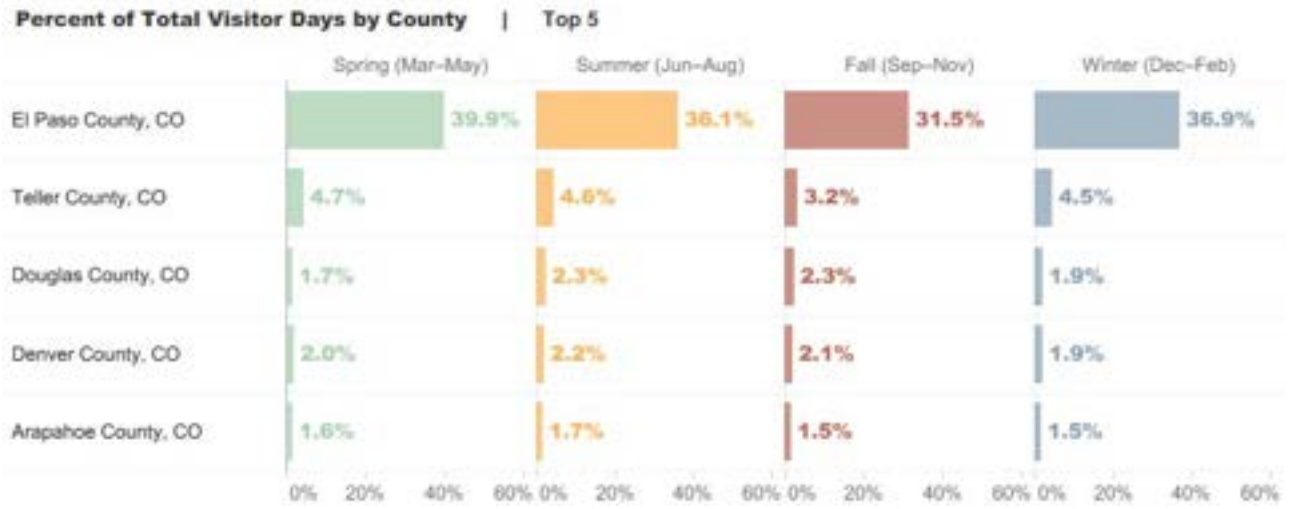
The resulting interactive Tableau dashboard enables exploration of these findings at multiple spatial and temporal scales. Users can investigate individual locations, analyze sub-areas within the study region, and adjust filters for roads, trails, and time periods. By illustrating how, when, and where visitors access the North Slope Recreation Area, this analysis provides a data-driven foundation for future management decisions, infrastructure investments, and recreation policy development.



Visitor Origins by Season



Visitor origins are heavily Colorado-driven year-round, with Texas consistently the most significant out-of-state market. Missouri, Kansas, and Oklahoma are smaller shares of visits to the area, ranging from approximately 2-4% of visitation throughout the season. All other states make up the remaining ~20% of visitation throughout the year.



El Paso County alone accounts for about a third of all visitor days in every season, with other nearby Front Range counties adding small but consistent shares. Seasonal patterns shift slightly in magnitude, but the ranking of top origins is stable year-round. It's not surprising that El Paso County represents the highest percentage as the area is not as heavily promoted to out of region visitors with locals being the primary user group today.

Appendix B – Mobility Dashboard

To:

From:

Copies:

Date:

Subject:

Project No.:

!"#$% &' (!) $* ' (' $* ' +, ' -.

! " #$ % &' # ' (') ! * #) ')

/ #' -0$12 "'3

Colorado Springs Utilities
It's how we're all connected

56%789$; 76 <4:

Include/Exclude Roads & Trails: 2'"

Residents: 8>&"?. #.

Filter by Year: 12"'3

Season: 12"'3

Sample Size by Location (Visitor Days)

*! "#$#%&! $'"&(#&#) ' * +*

Change Measure:
@+!(-$ ' A+

$< -(, $4" B#$9 #&-#' (!) $2 -#' $?-& ' +#$C ?) . ' -A+#(- . /01,

$>North Slope Recreation Area+#21/3. .

$D-A+(' "$D-##G$9 #+#-F !-+#(/0- 5

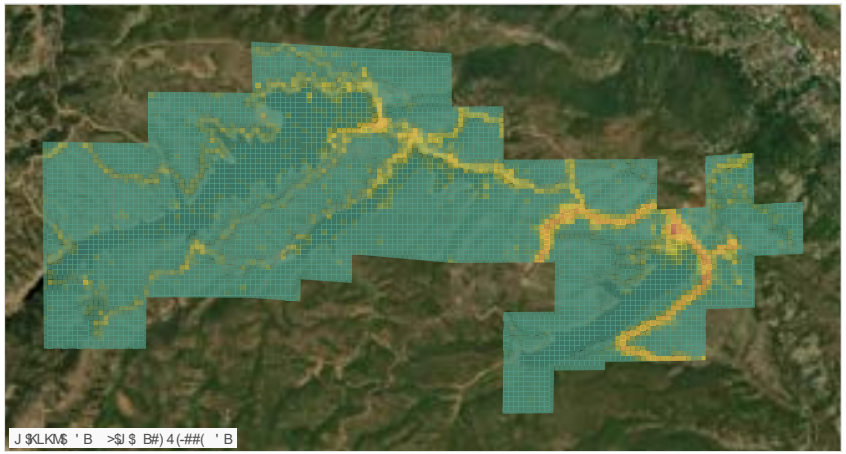
$< -(, $D' (' E ?) ($9 #+#-F !-+#5, -

$4 ?(, $D' (' E ?) ($9 #+#-F !-+#3,

Areas of Activity

Change Map Color Scale: % H$4, I +$E -#$F -!' (!) 3

, - #. #$- - &#'&& # & #'&#D $1 #$# ! "'&(+*



N$H-!. ONPK$QR

*! "#'&#) ' * +*

#K VISITOR ORIGINS	#B7= >C6?DE<F:	#H: 7
# 6789: # ; 76# <= 7	#BG7A#K <= 7	# >?9: #@# 6?<A

Visitor Origins

Change Geography Level:
6) $F+R$?(S G$4 (' (#

Show Top:
KL

Percent of Total Visitor Days by In vs. Out-of-State | **! >D#2-**

< F#E #-$KLKT$$$-

MOVEMENT
Mobility Data Consulting

!"#$% &' (!) $* ' (' $* ' +, ' -.

! " #$ % &' # ' (') ! * #) ')

/ #' -0$121131214$$$$$$$$$$5#' +) 0$67 "8

Colorado Springs Utilities
It's how we're all connected

9:% <= $> ?; :> @5$$$$$$$$A Include/Exclude Roads & Trails: 7 "" Residents: <B&'C. #. Filter by Year: 121131214 Season: 67 "8

Sample Size by Location (Visitor Days)

*! "$#&! $ "'& (#&#) ' * +*

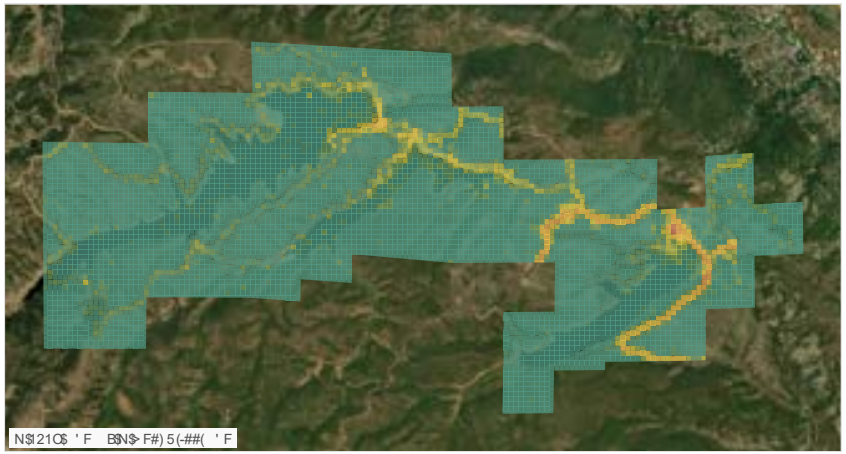
Change Measure: D!+!(-$ ' E+

$@ -(, $5 " F#$- #&-#' (!) $7 -#' $? C-& ' +#$G C) . ' -E+#(- ., / 0
$>North Slope Recreation Area +#12.3, 3
$H-E+(' "$H-##K$- #+#-J !-+#233
$@ -(, $H' (' I C) ($- #+#-J !-+# 02
$5 C(, $H' (' I C) ($- #+#-J !-+#844

Areas of Activity

Change Map Color Scale: % L$65, M+$ -#$J' -!' (!) 8

, - #. #$- - &#'&& # & #'&#D $1 #$# ! "'&(+*



P$L-!. CP41$RS

*! "'#&#) ' * +*	#A VISITOR ORIGINS	#A6< =B5>CD;E9	#E96
	# 56789# : 65# ;< 6	#AF 6@ ;< 6	# =>89#' # 5>;@

Visitor Origins

Change Geography Level: :) $J+$> C(T R5 (' (# Show Top: 12

Percent of Total Visitor Days by In vs. Out-of-State | ! =C#8H

@ J#I #-$121U$$$A MOVEMENT Mobility Data Consulting

!"#$% &' (!) $* ' (' $* ' +, ' -.

! " #$ % &' # ' (') ! * #) ')

/ #' -0$121341215$$$$$$$$$$6#' +) 0$78 "9

: ;%<=> $? @<;? A6 $$$$$$$B

Include/Exclude Roads & Trails: 8 ""

Residents: =C&'D. #.

Filter by Year: 121341215

Season: 78 "9

Sample Size by Location (Visitor Days)

*! "$%#&! $ "'&(#&#) ' * +*

Change Measure:
E!+!(-$ ' F+

$A -(, $6 " G#$> #&#' (!) $8 -#' $@D-& ' +#$H D) . ' -F+#, - / ,

$> North Slope Recreation Area +#00-120

$ -F+(' "$ -##L$> #+#-K !- +#45,

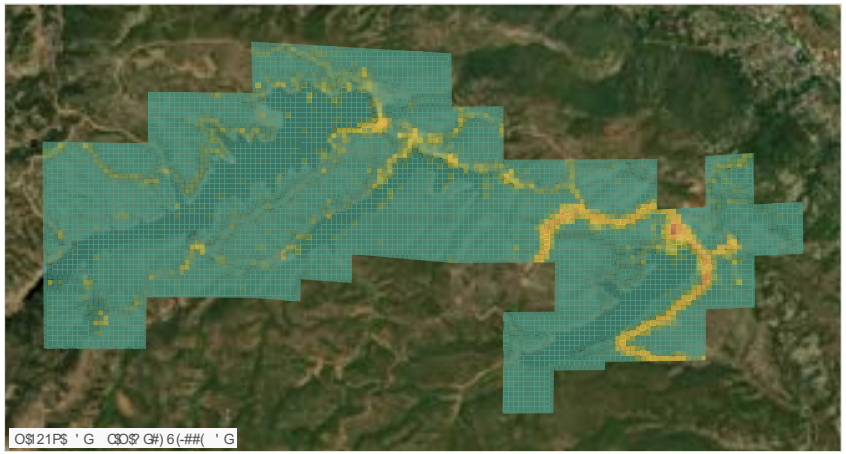
$A -(, $ ' (' J D) ($> #+#-K !- +#/ 1

$6 D(, $ ' (' J D) ($> #+#-K !- +#843

Areas of Activity

Change Map Color Scale: % M$76 , N+$J -#$K -!' (!) 9

, - #. #$- - &#'&& # & #'&#D $1 #$# ! "'&(+*



C$M!. ROS1$TU

*! "#'&#) ' * +*

#K VISITOR ORIGINS	#B7= >C6?DE<F:	#H: 7
# 6789: # ; 76# <= 7	#BG7A#K <= 7	# >?9: #G# 6?<A

Visitor Origins

Change Geography Level:
;) $K+L$? D(V T\6 (' (#

Show Top:
12

Percent of Total Visitor Days by In vs. Out-of-State | **! >D#8.**

!"#$% &' (!) $* ' (' $* ' +, ' -.

! " #$ % &' # ' (') ! * #) ')

/ #' -0$12 "3 #' +) 0$4 5-!) 6$1 ' -7 ' 83

Colorado Springs Utilities
It's how we're all connected

9:% <= $> ?; :> @A Include/Exclude Roads & Trails: 2"" Residents: <B&'C. #. Filter by Year: 12"3 Season: 45-!) 6$1 ' -7 ' 83

Sample Size by Location (Visitor Days)

*! "$#&!$"'&(#&#) ' * +*

Change Measure: D!+!(-$ ' 8+

$@ -(, $4 " 5#$- #&#' (!) $2 -#' $? C-&, ' +#$E C) . ' -8+#(- .- / 0

$>North Slope Recreation Area+# ./ 1-

$F -8+(' "$F -##I $- #+#-H !-+#(, 0

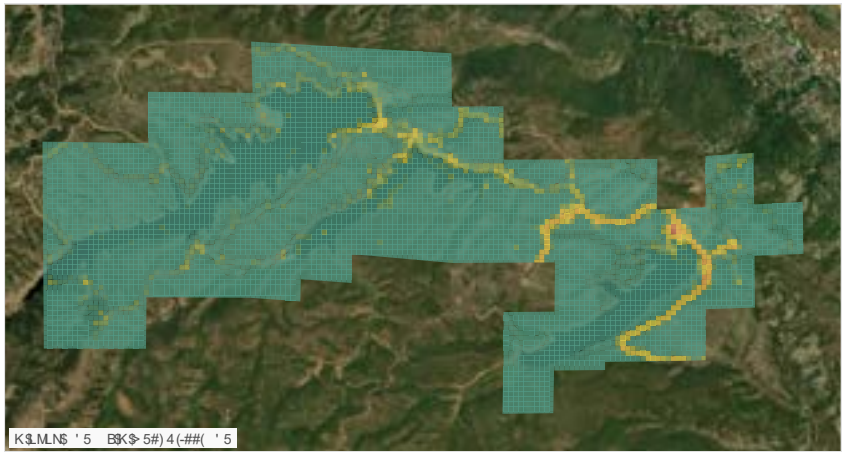
$@ -(, $F ' (' G C) ($- #+#-H !-+# 20

$4 C(, $F ' (' G C) ($- #+#-H !-+# 2-

Areas of Activity

Change Map Color Scale: % 6$4 , J +$G -#$H -!' (!) 3

, - #. #$- - &#'&& # & #'&#D $1 #$# ! "'&(+*



O$6-!. POOLR

*! "'#&#) ' * +*

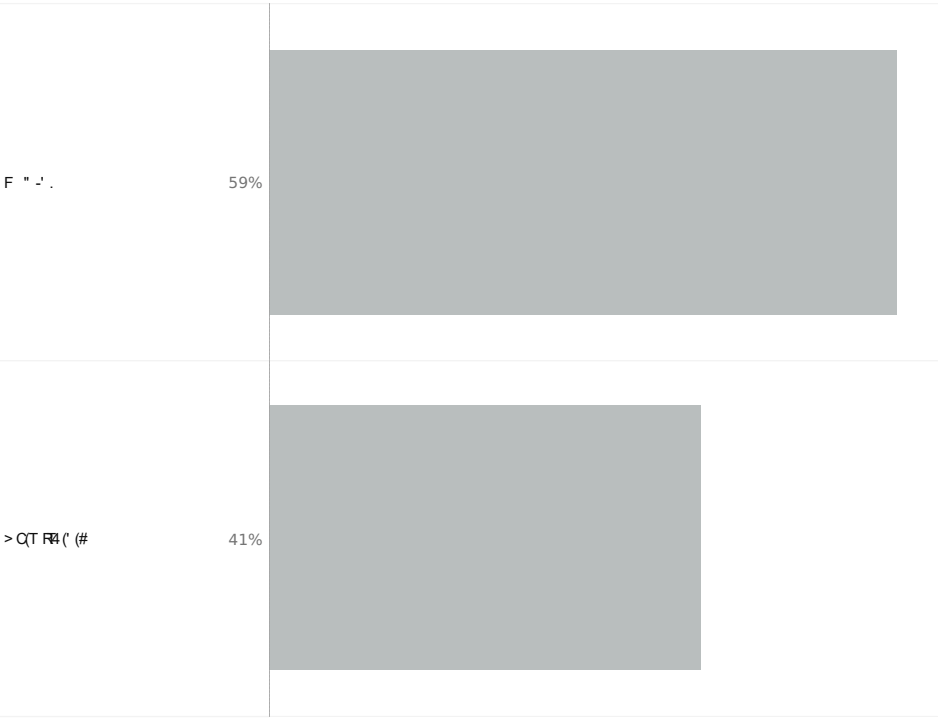
#K VISITOR ORIGINS	#4: ; @?<AB9C7	#E74
# 34567# 843# 9 4	#D4>=# 9 4	# ; <67#=# 3<9?7

Visitor Origins

Change Geography Level: :) $H+$> C(T R4 (' (#

Show Top: LM

Percent of Total Visitor Days by In vs. Out-of-State | ! ; A#; F



@ H#G #-$LMLU$$A MOVEMENT Mobility Data Consulting

!"#$% &' (!) $* ' (' $* ' +, ' -.

! " #$ % &' # ' (') ! * #) ')

/ #' -0$12 "'3 #' +) 05 !) (#-$!* #&67# 3

Colorado Springs Utilities
It's how we're all connected

78%9: ; $< =98< > 4 $ Include/Exclude Roads & Trails: 2'" Residents: : @&'A. #. Filter by Year: 12'"3 Season: 5 !) (#-$!* #&67# 3

Sample Size by Location (Visitor Days)

*! '"$&#%&! $'"&(#&#) ' * +*

Change Measure:
B!+!(-$ ' C+

$> -(, $!" D#$ #&-#' (!) $2 -#' $= A-& ' +#$E A) . ' -C#(- ./ / /

$> North Slope Recreation Area +#0.1- 2

$F -C+(' "$F -##! $ #+#-H !- +#(- 0

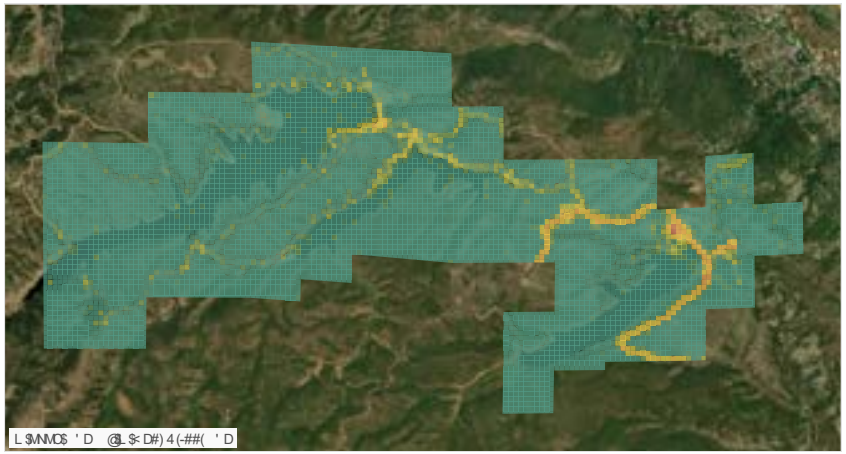
$> -(, $F ' (' G A) ($ #+#-H !- +#8, /

$! A(, $F ' (' G A) ($ #+#-H !- +# 1-

Areas of Activity

Change Map Color Scale: % J$!4 , K+$G -#$H -!' (!) 3

, - #. #$- - &#'&& # & #'&#D $1 #$# ! '"&(+*



P$J -!. OPRV$$T

*! '"#&#) ' * +*

#! VISITOR ORIGINS	#@05; <A4=BC:D8	#F 85
# 45678# 954#! :; 5	#@E 57#! :; 5	# <=78#> # 4=:78

Visitor Origins

Change Geography Level:
8) $H+T$< A(U $!4 (' (#

Show Top:
MN

Percent of Total Visitor Days by In vs. Out-of-State | ! <B#8/

> H#G #-$MNV$$?

MOVEMENT
Mobility Data Consulting

!"#$% &' (!) $* ' (' $* ' +, ' -.

! " #$ % &' # ' (') ! * #) ')

/ #' -0$12 "3[illegible]4 #' +) 0$4 56 6 #-$175) 82593

: ;%<=> $? @<;? A4 [illegible]B

Include/Exclude Roads & Trails: 2"" ⓘ

Residents: =C&'5. #. ⓘ

Filter by Year: '12""3

Season: 456 6 #-$175) 82593 ⓘ

Sample Size by Location (Visitor Days)

*! "#$#%&! $ "'&(#&#) ' * +*

Change Measure:
D!+!(-$ ' E+ ⓘ

$A -(, $4" F#$> #&-#' (!) $2 -#' $@5-& ' +#$G 5) . ' -E#4 - ./ 0,

$>North Slope Recreation Area+#/ .0- 0

$H-E+(" "$H-##J$> #+#-I !-+#4, 2

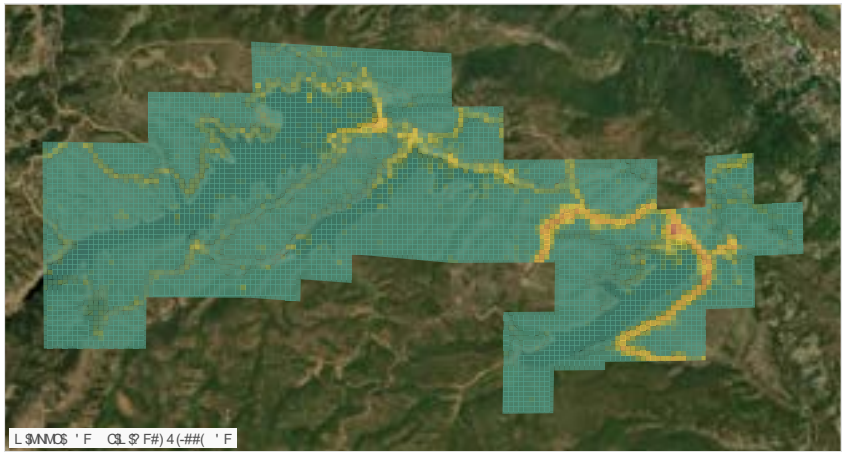
$A -(, $H' (' 6 5) ($> #+#-I !-+#4 33

$4 5(, $H' (' 6 5) ($> #+#-I !-+#4 / 2

Areas of Activity

Change Map Color Scale: % 9$4, K+$6 -#$ ' -!' (!) 3 ⓘ

, - #. #$- - &#'&& # & #'&#D $1 #$# ! "'&(+*



P$9-!. $O3PRM$$T

*! "#'&#) ' * +*

#4 VISITOR ORIGINS	#A6< =B5>CD;E9	#E96
# 56789# : 65# ;< 6	#AF 6@ ;< 6	# =>89#' # 5>;@

Visitor Origins ⓘ

Change Geography Level:
;) $ +$? 5(U S4 (' (#

Show Top:
MN

Percent of Total Visitor Days by In vs. Out-of-State | ! =C#4-

!"#$% &' (!) $* ' (' $* ' +, ' -.

! " #$ % &' # ' (') ! * #) ')

/ #' -0$12 "'3 #' +) 05' "'$14 #678 93

Colorado Springs Utilities
It's how we're all connected

5:% <= $> ?; :> 8 4 @ Include/Exclude Roads & Trails: 2'" Residents: <A&'B. #. Filter by Year: 12'"3 Season: 5' "'$14 #678 93

Sample Size by Location (Visitor Days)

*! '"$&#/&! $'"&(#'&#) ' * +*

Change Measure: C!+!(-$ ' D+

$B -(, $4 " 6#$- #&-#' (!) $2 -#' $? B-& ' +#$E B) . ' -D#(-. . /

$> North Slope Recreation Area +#0-1/ 2

$F -D+(' "$F -##H$- #+#-9 !-+# 04

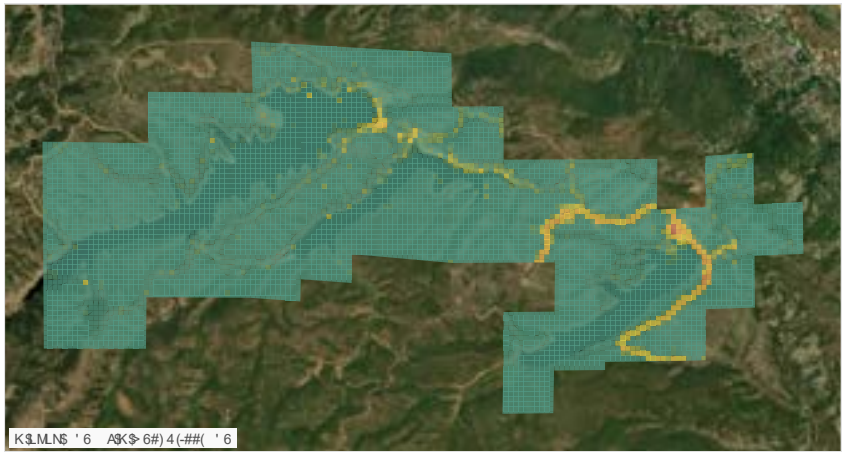
$B -(, $F ' (' G B) ($- #+#-9 !-+#8,

$4 B(, $F ' (' G B) ($- #+#-9 !-+#20

Areas of Activity

Change Map Color Scale: % ! $14 , J +$G -#$9' -!' (!) 3

, - #. #$- - &#'&& # & #'&#D $1 #$# ! '"&(+*



O$ -!. POOLR

*! '"#&#) ' * +*

#A VISITOR ORIGINS	#A6< =B5>CD;E9	#E96
# 56789# : 65# ;< 6	#AF 6@ ;< 6	# =>89#? # 5>;@

Visitor Origins

Change Geography Level: :) $9+$> B(T R4 (' (# Show Top: LM

Percent of Total Visitor Days by In vs. Out-of-State | ! =C#04

8 9#G #-$LMLU$$@ MOVEMENT

5678789$; 76 <4:

Include/Exclude Roads & Trails: 2'"

Residents: 8>&'?. #.

Filter by Year: 12'"3

Season: 12'"3

Sample Size by Location (Visitor Days)

Change Measure: @+!(-$ ' A+

*! '"$&#&! $'"&(#&#) ' * +*

$< -(, $4" B#$9 #&-#' (!) $2 -#' $?-& ' +#$C ?) . ' -A## - . /01,

$>North Slope Recreation Area#21/3. .

$D-A+(' "$D-##G$9 #+#-F !-#5 /0- 5

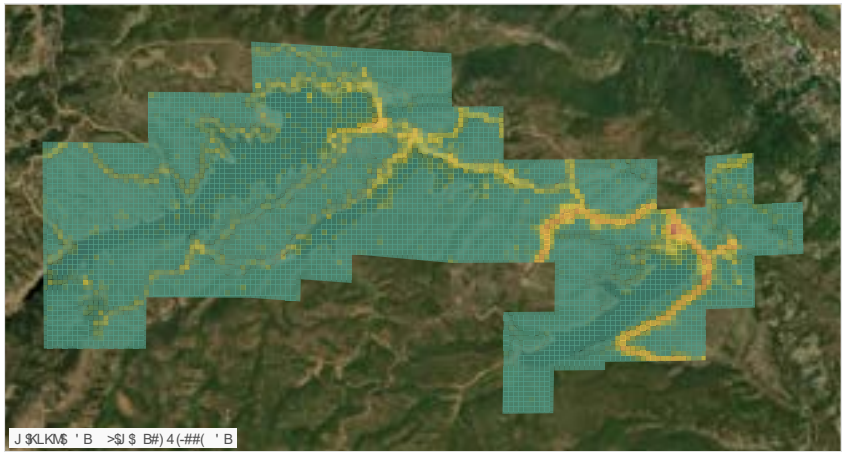
$< -(, $D' (' E ?) ($9 #+#-F !-#5, -

$4 ?(, $D' (' E ?) ($9 #+#-F !-#43,

Areas of Activity

Change Map Color Scale: % H$4, I +$E -#$F -!' (!) 3

, - #. #$- - &#&& # & #&#D $1 #$# ! '"&(+*



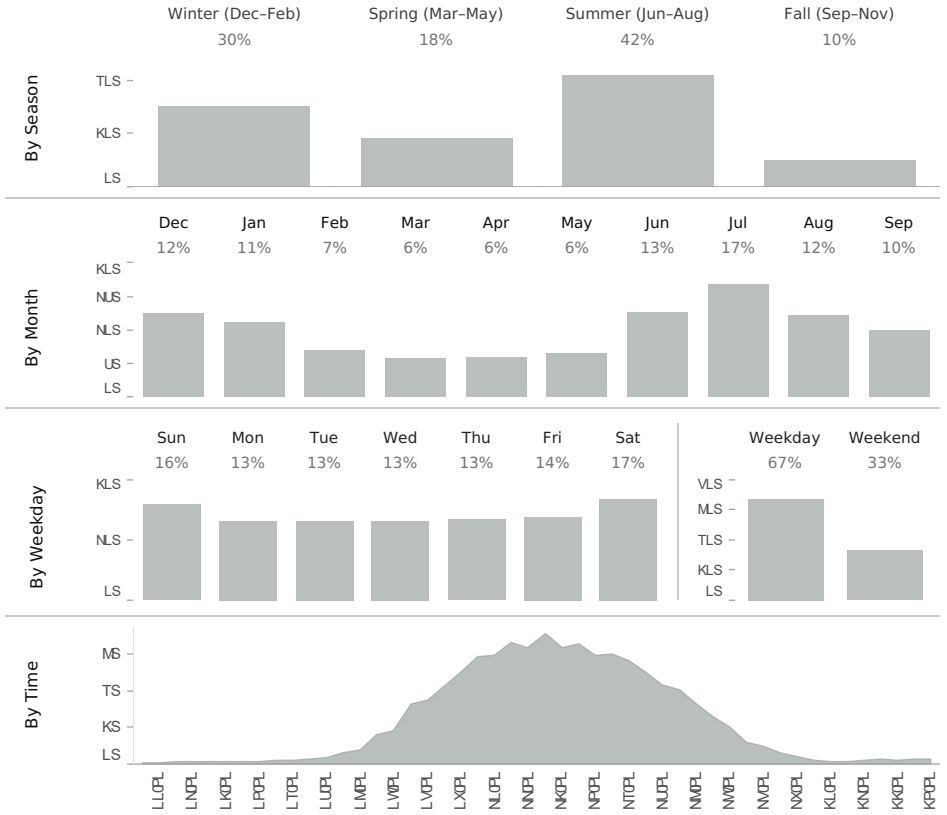
N$H-!. ONPK$QR

*! '"#&#) ' * +*

#E<9<F6;# ;<A<G9 | #> ?@6A;7BC<D9 | # 9?

#> TRENDS OVER TIME | #> H?=# <@? | # 6789# # ;7<=9

Trends Over Time



!"#$% &' (!) $* ' (' $* ' +, ' -.

!"#$% &' # ' (') ! * #) ')

/ #' -0$12 "'3

Colorado Springs Utilities
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5678789$; 76 < 4 Include/Exclude Roads & Trails: 2'" Residents: 8>&'?. #. Filter by Year: 12'"3 Season: 12'"3

Sample Size by Location (Visitor Days)

*! '"$%#'&! $'"&(#'&#) ' * +*

Change Measure: @+!(-$ ' A+

$< -(, $4" B#$9 #&-#' (!) $2 -#' $?-& ' +#$C ?) . ' -A## - . /01,

$>North Slope Recreation Area 421/3. .

$D-A+(' "$D-##G$9 #+#-F !-#4 /0- 5

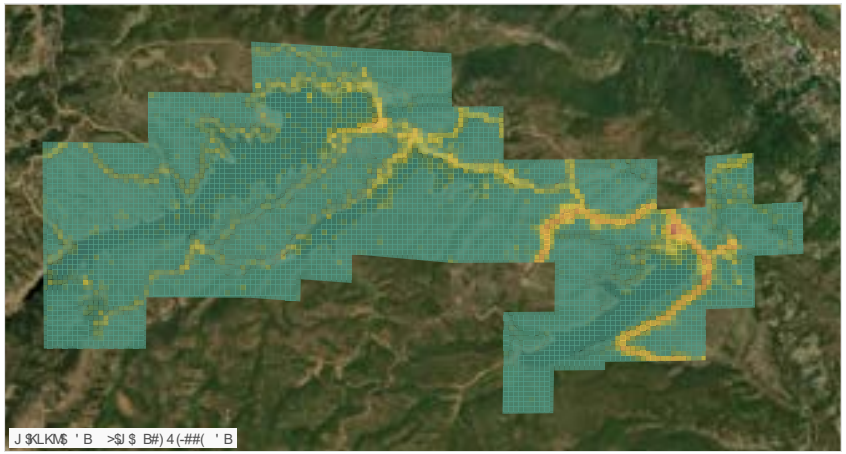
$< -(, $D' (' E ?) ($9 #+#-F !-#5, -

$4 ?(, $D' (' E ?) ($9 #+#-F !-#43,

Areas of Activity

Change Map Color Scale: % H$4, I +$E -#$F -!' (!) 3

, - #. #$- - &#'&& # & #'&#D $1 #$# ! '"&(+*



N$H-!. ONPK$QR

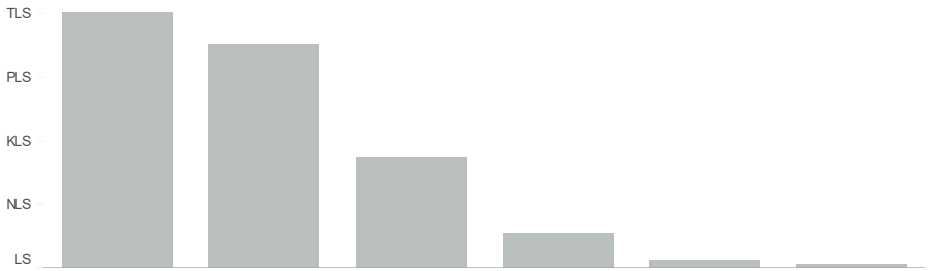
*! '"#&#) ' * +*

#B< 4+6# 6<C<8:	#B7= >C6?DE<F:	# : 7
# 6789: # ; 76# <= 7	#K DWELL TIME	# >?9: #G# 6?<A

Dwell Time

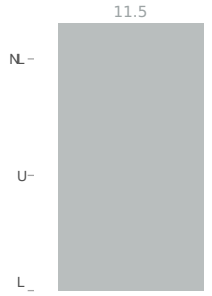
Percent of Visitor Days by Dwell Time

%7: : #E?8#4# <8J	4#K 4# <8J	, 4#K - # <8J	. - #K8 - # <8J	, #K2#E>L6:	2#E>L6: #>6# >67
40%	35%	17%	5%	1%	1%



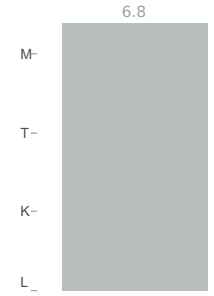
Average Dwell Time (Minutes)

) ; 76?C7 $7A FH79# 67?



Median Dwell Time (Minutes)

M79<?8 #$7A FH79# 67?



MOVEMENT
Mobile Data Consulting

!"#$% &' (!) $* ' (' $* ' +, ' -.

! " #$ % &' # ' (') ! * #) ')

/ #' -0$12 "'3 #' +) 0$12 "'3

Colorado Springs Utilities
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56%789$; 76 <4 Include/Exclude Roads & Trails: 2"' Residents: 8>&"?. #. Filter by Year: 12"'3 Season: 12"'3

Sample Size by Location (Visitor Days)

*! "#$#%&! $'"&(#&#) ' * +*

Change Measure: @+!(-$ ' A+

$< -(, $4 " B#$9 #&-#' (!) $2 -#' $?-& ' +#$C ?) . ' -A## - . /01,

$>North Slope Recreation Area#21/3. .

$D-A+(' "$D-##G$9 #+#-F !-#5/0-5

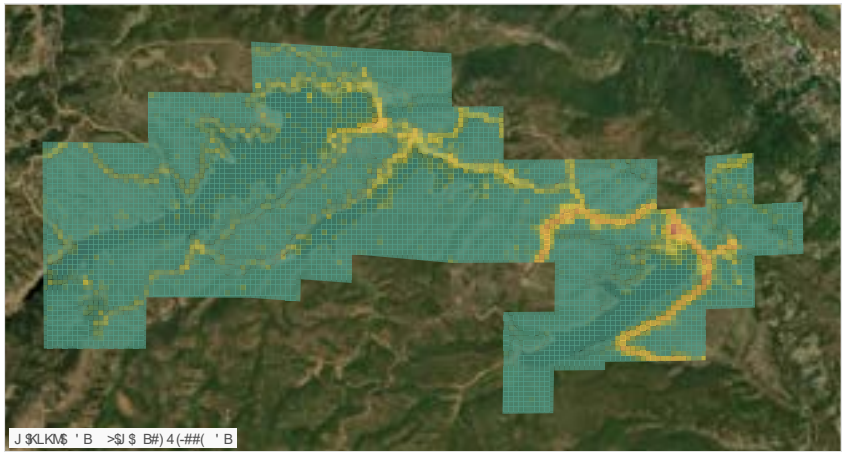
$< -(, $D' (' E ?) ($9 #+#-F !-#5, -

$4 ?(, $D' (' E ?) ($9 #+#-F !-#43,

Areas of Activity

Change Map Color Scale: % H$4 , I +$E -#$F -!' (!) 3

, - #. #$- - &#'&& # & #'&#D $1 #$# ! "'&(+*



N$H-!. ONPK$QR

*! "#'&#) ' * +*

#E< <F?6# 6<@8:	#7= ?@ABC<D:	#: 7
#6789: # ; 76# <= 7	#G7H# <= 7	#ROADS & TRAILS

Roads & Trails

Percent of Total Visitor Days

?GFC#$HPB7# 7D67AF?8#) 67A#LM#) 67A

: C$9 ' .	: C$9 ' .	J, K
9 ' .	; !G#+$ #' G$7 "'$9 .	55K
	S)) ' E#. $9 ' .	, 5K
	D' (' E ?) ($9 #+#-F !-$9 .	- K
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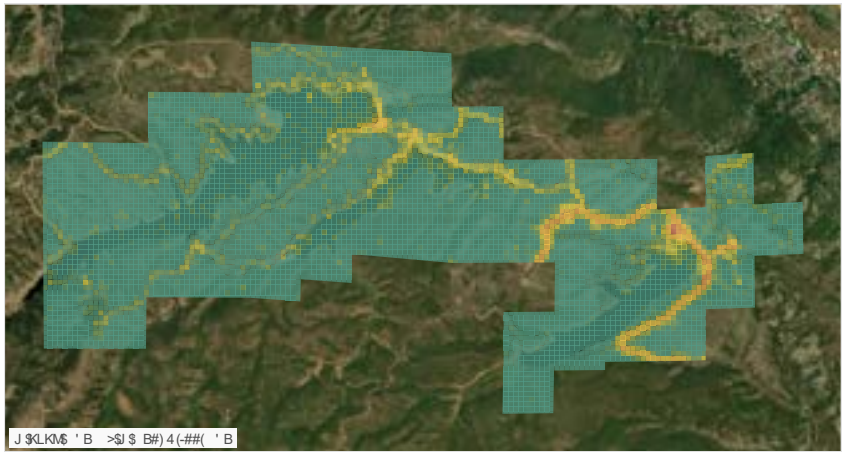

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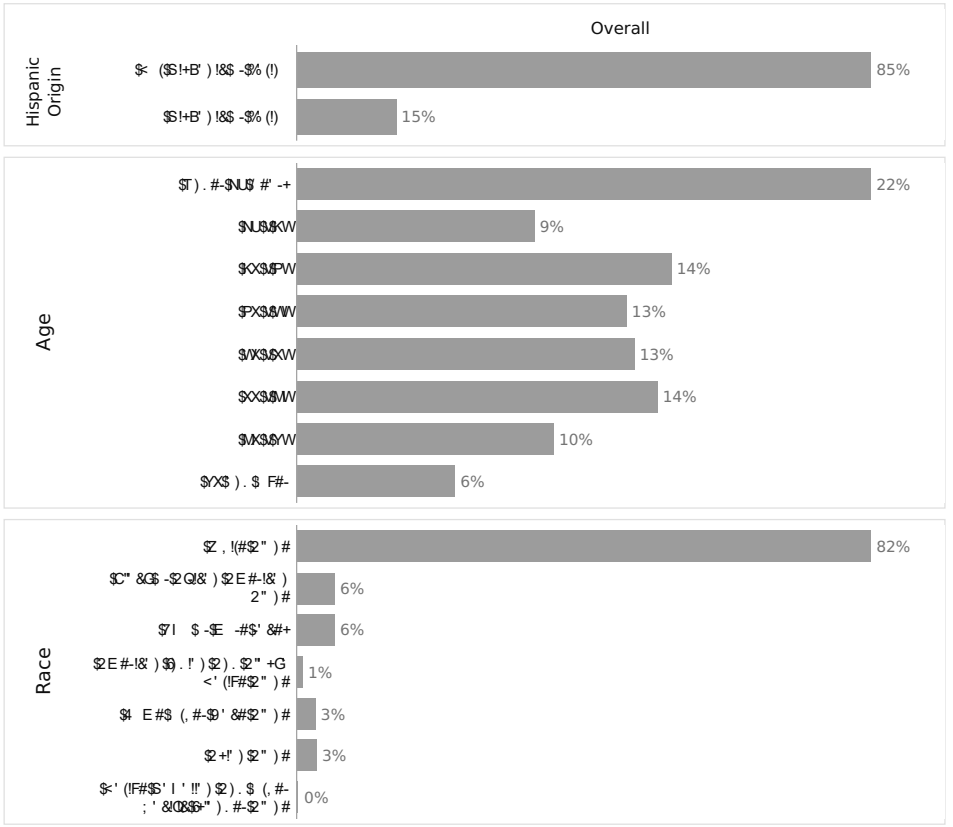

RRC

Colorado Springs Utilities
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NORTH SLOPE RECREATION AREA
2025 Summer Visitor Survey Results

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INTRODUCTION

The 2025 North Slope Recreation Area (NSRA) Visitor Survey was a multi-mode effort to capture visitor perceptions of outdoor recreation across the region. NSRA is owned and operated by Colorado Springs Utilities as it serves as a primary source of drinking water for residents of the city. Outdoor recreation is currently allowed at NSRA, but due to its designation of importance for utilities, there are restrictions on where visitors can recreate and during which specific times of the year. With the City's growing population, demand for outdoor recreation sites continues to grow. The survey effort documented visitor's perceptions, desires, and interests during the 2025 summer season.

The survey covered the following major topics:

- Types of activities participated in at NSRA
- Desired amenities for outdoor recreation
- Preferences for prioritization at NSRA
- Opinions on managing costs from outdoor recreation
- Personal values placed on goals for NSRA
- Recreation characteristics and demographics

RESEARCH METHODS

The 2025 NSRA Visitor Survey was distributed through two primary methods:

1) A postcard was handed out to visitors as they entered the North Slope Recreation Area.
    a. The postcard included a QR code and website to take the survey after their visit.
2) An online link distributed via various channels to users of North Slope Recreation Area.
    a. The online link was promoted and pushed out by Colorado Springs Utilities to reach as many NSRA users as feasible.

In total, 937 respondents participated in some form of the survey between May 21st to September 17th, 2025. Of those respondents, the vast majority used the online link (88%) as it had a broader reach than the postcards. Approximately 12% of respondents participated via the postcard with most using the QR code scan (10% of the total 12%) and 2% using the URL link.

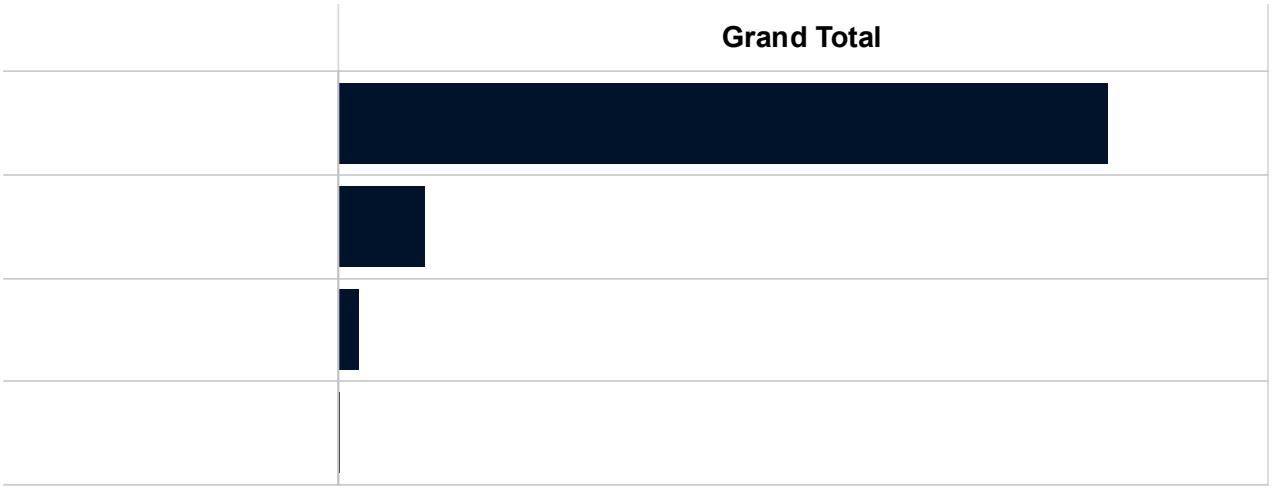

Figure 1: Sample Sizes by Survey Mode

The postcard was created as a way to hand out a physical survey link to users who were on the NSRA throughout the 2025 summer season. The Pikes Peak Highway entry gate was the delivery point for the postcard during the season. Since visitors must pay to use the highway, it provided an opportunity to randomly sample any visitors who were also recreating on NSRA. While the bulk of the surveys came from the online link, the postcard was the only direct communication with visitors that were recreating at NSRA when first contacted.

Figure 2: Survey Postcard

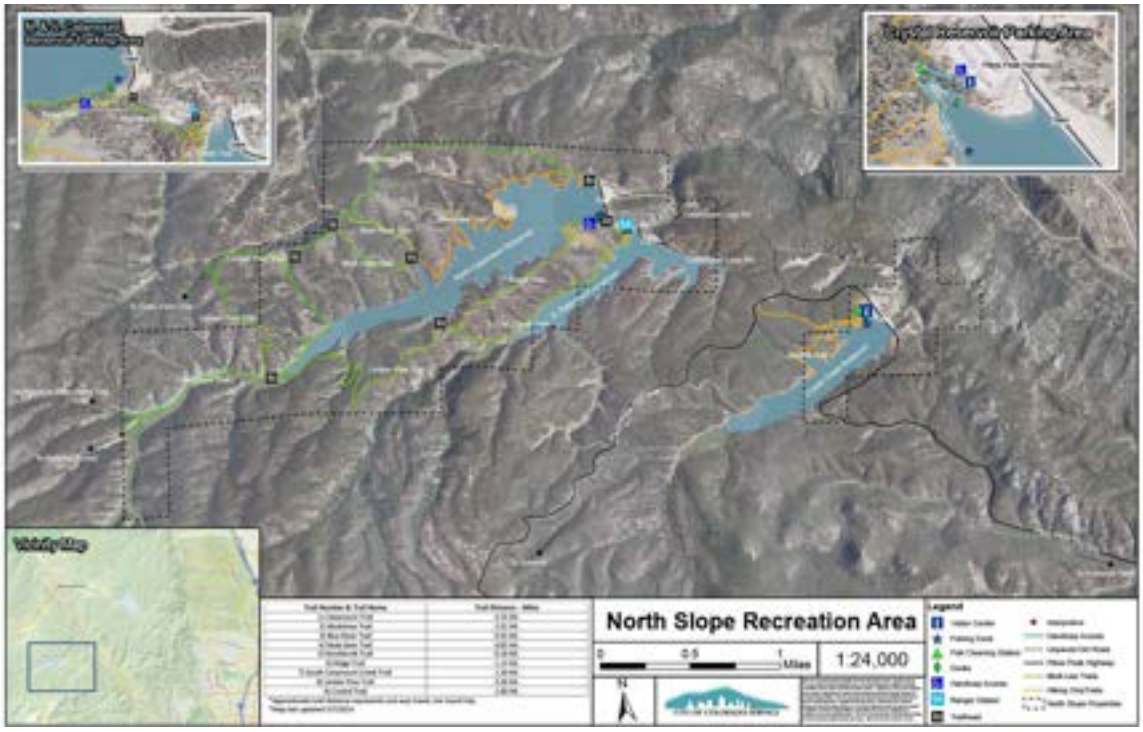

Figure 3. Map of North Slope Recreation Area

The above map displays the area contained within NSRA. Visitors were asked about their entire experience at NSRA and not a specific date/time. Therefore, the widest range of users could be contacted for this study to capture their perspectives and opinions about recreation on NSRA.

RESULTS

The following section details the results of the survey from the summer season of 2025. The questions are presented with a crosstabulation of residency defined by ZIP code. The crosstabulation groups are defined as:

- CO Springs Residents
  - Defined as any respondent with a ZIP code in the Colorado Springs metro area.
- Out-of-region
  - Includes non-local visitors from Colorado and out-of-state visitors.
- Unspecified
  - Some respondents did not provide a ZIP code to identify their location. Because this group had a fairly large percentage of the overall sample, the research team opted to show it as its own grouping.

What types of outdoor recreation do you participate in? Please select all that apply.

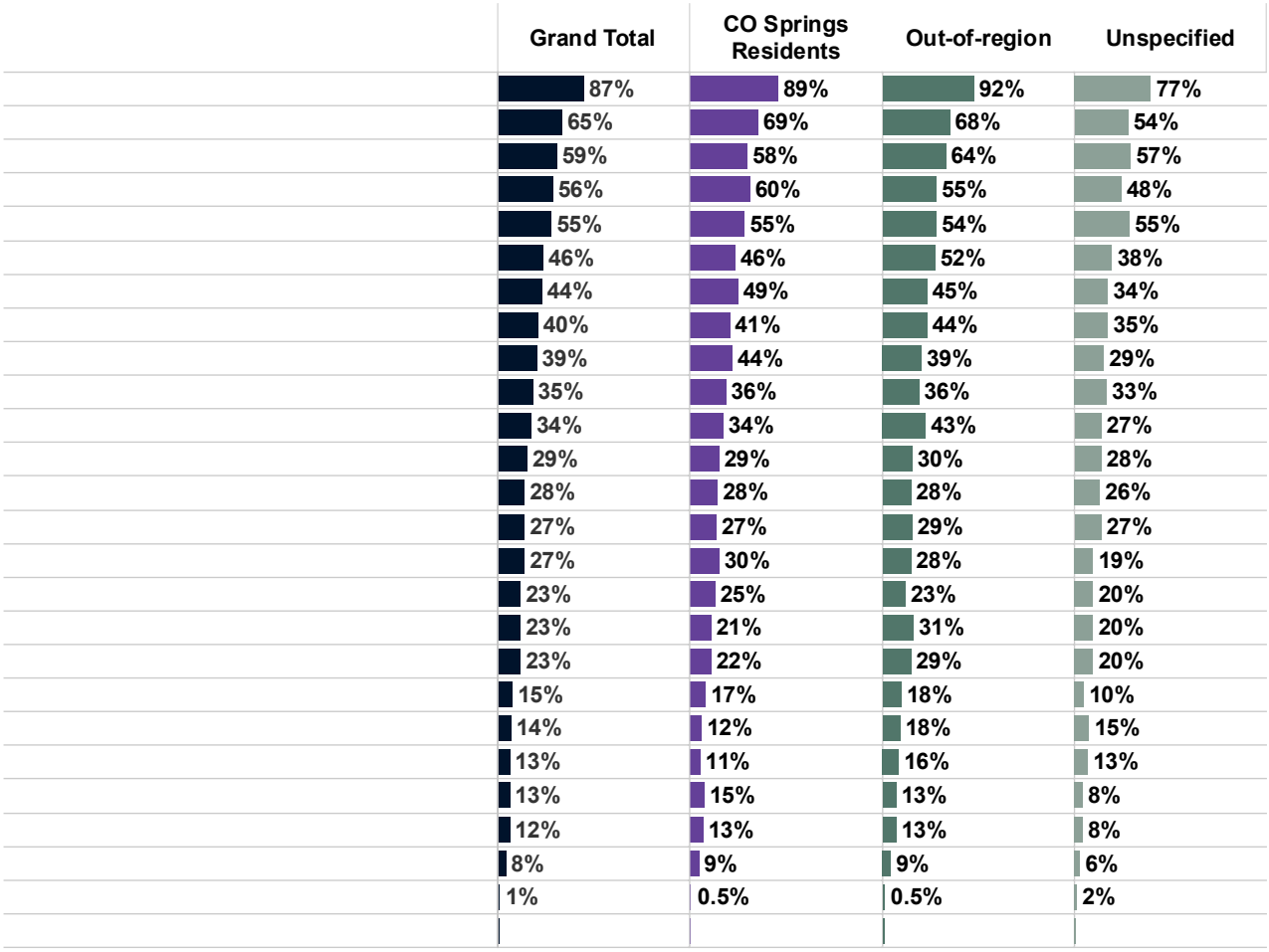

Figure 4. Outdoor recreation participation by residency status.

- Hiking (87%) and walking (65%) were identified as the most common outdoor recreation activity participated in by respondents. By residency, a similar pattern was observed with slight differences between specific activities.
- Only 1% of respondents identified that they do not participate in outdoor recreation. While small, even the least participated in activities (overnight hut usage, organized events, and boating) see over 10% of respondents participating.

On average, how often do you participate in any of the previously selected outdoor recreation activities?

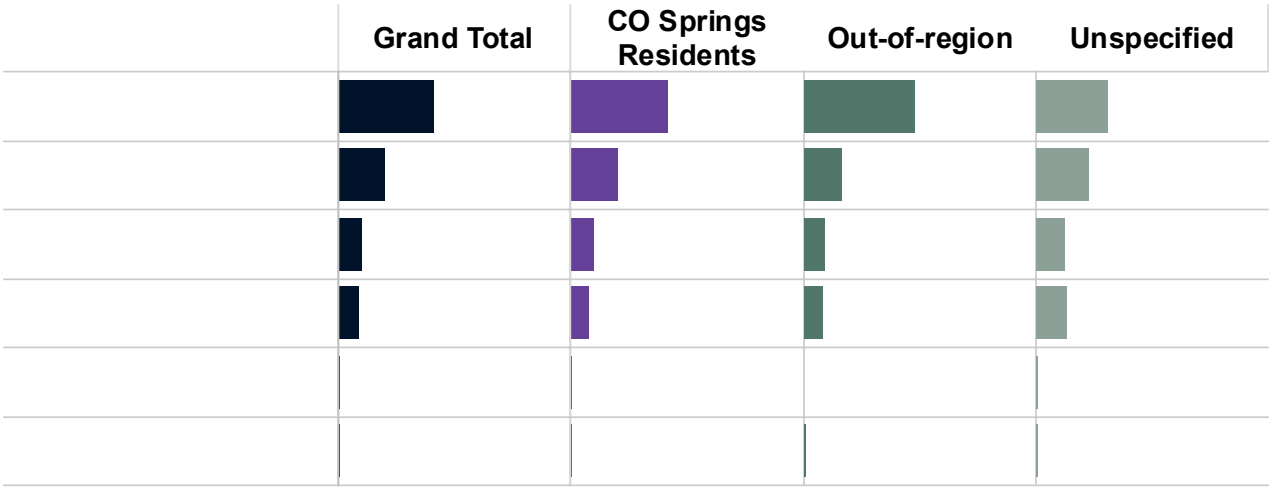

Figure 5. Average duration of outdoor recreation participation by residency status.

- A majority of respondents (51%) participate in outdoor recreation several times a week with an additional 24% citing at least weekly participation. Less than a percent of respondents participate as little as once a year.
- By residency status, locals as well as out-of-region visitors have a similar participation rate as the overall total. Those with an unspecified geography have a lower rate of participation with only 38% stating they take part in an activity several times a week.

Where do you typically go for outdoor recreation? Please select all that apply.

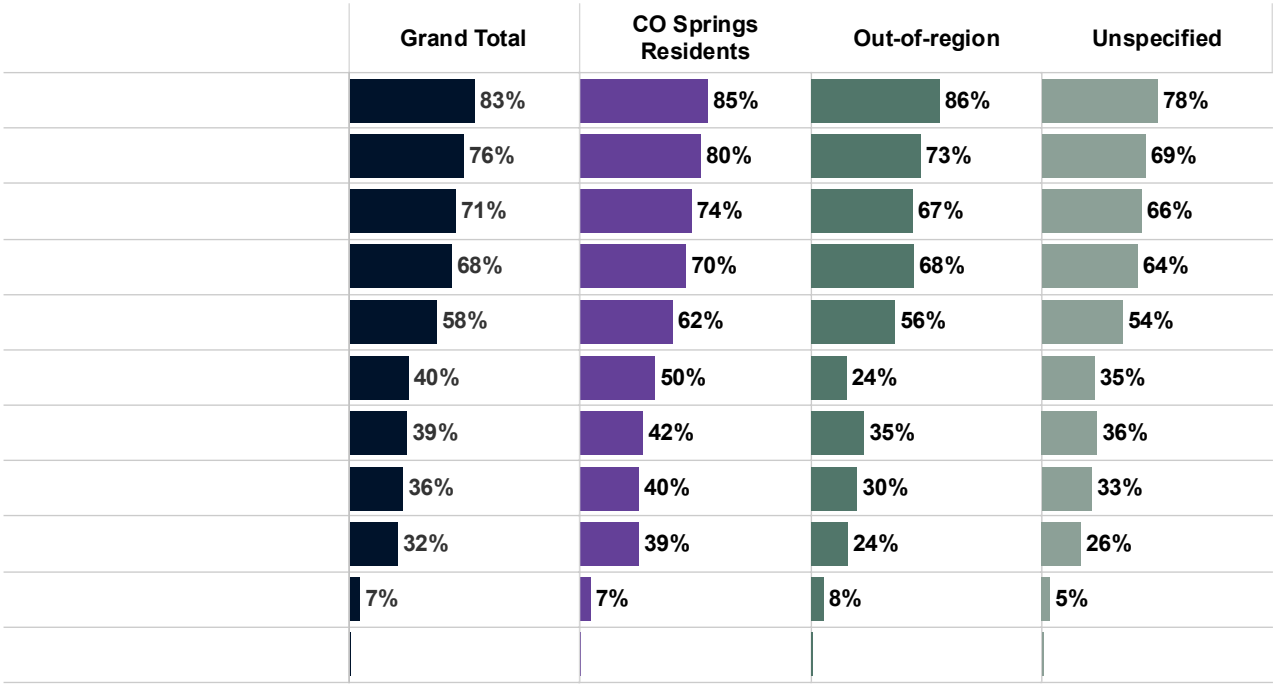

Figure 6. Outdoor recreation site use by residency status.

- Respondents are varied in the areas they tend to recreate in. National forests are most prevalent with 83% of respondents indicating they utilize them for outdoor recreation, followed by Colorado State Parks (76%), open spaces (71%), and NSRA (68%). All recreation sites listed saw at least 30% of respondents saying they use them for recreation.
- Little change was observed between residency groups. Even those without a defined residency had over 50% of respondents stating they visited NSRA. In general, NSRA is one of the most commonly utilized locations across the entire sample, reflecting its growing demand among locations in the region.

Of the activities you participate in, please select those in which you have participated in at NSRA? Please select all that apply.

	Grand Total	CO Springs Residents	Out-of-region	Unspecified
	78%	80%	86%	59%
	52%	57%	43%	52%
	46%	45%	48%	43%
	43%	44%	47%	34%
	34%	38%	30%	31%
	31%	33%	32%	26%
	28%	30%	28%	23%
	23%	24%	24%	17%
	18%	21%	16%	15%
	16%	16%	17%	15%
	15%	14%	19%	11%
	14%	13%	17%	11%
	11%	9%	15%	9%
	10%	10%	12%	6%
	9%	9%	9%	9%
	9%	9%	6%	11%
	8%	6%	15%	5%
	6%	7%	5%	4%
	4%	4%	5%	3%
	4%	3%	4%	5%
	3%	2%	5%	
	2%	3%	3%	
	2%	2%	1%	2%
	1%	1%		1%

Figure 7. NSRA outdoor recreation participation by residency status.

- Of those who said they recreated in NSRA, hiking was by far the most popular activity (78%) with fishing along the shore following at 52% and wildlife watching at 46%. A second tier of activities includes kayaking/canoeing (34%), photography (31%) and picnicking (28%).
- Hiking remains the top choice for all residency groups, but the unspecified group of respondents had a lower propensity for hiking (59%) compared to locals (80%) or out-of-region visitors (86%). Fishing was also more common for locals (57%) than out-of-region (43%) visitors.

What amenities would enhance your visit or experience at the North Slope Recreation Area?

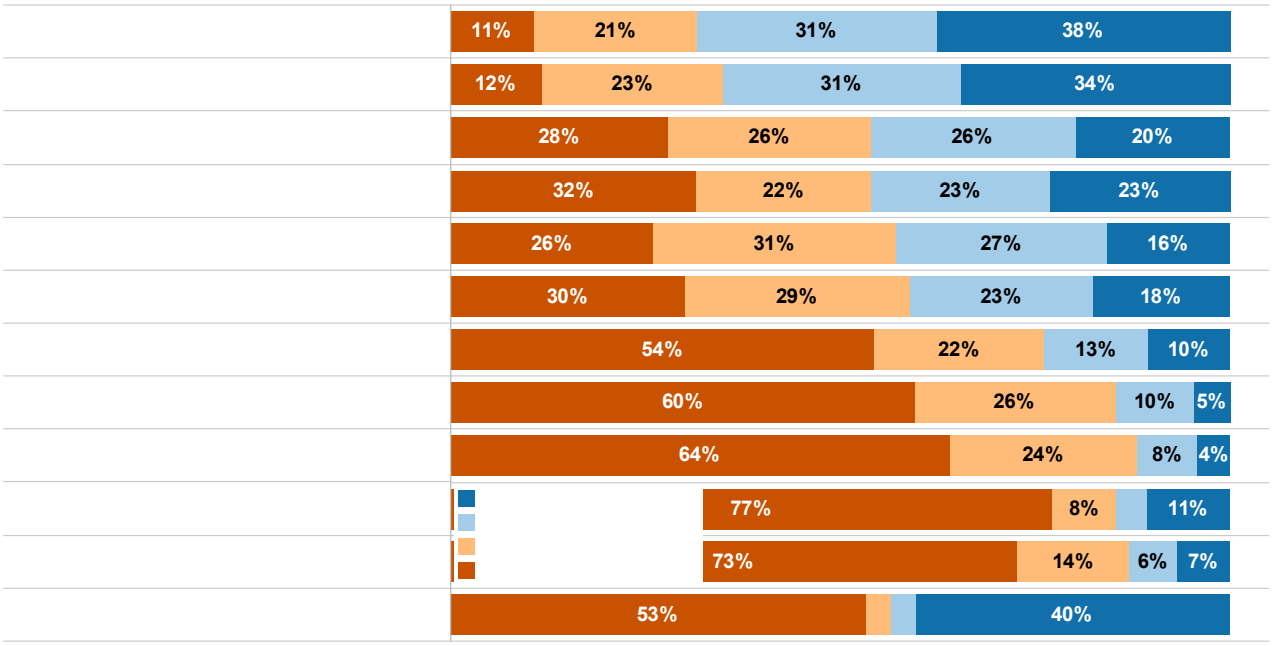

Figure 8. Amenities which would enhance visitor experience at the NSRA.

- Respondents were asked what types of amenities would enhance their visit/experience at NSRA on a scale where 1 = "No effect" to 4 = "Greatly enhance".
- Restrooms and trash cans saw the highest enhancement ratings from respondents with over 60% indicating these amenities would either "greatly" or "moderately" enhance their experience. Additional wayfinding at trailheads (46% greatly or moderately enhance), dog waste stations, and rest areas/shelters also saw a large percentage of respondents that noted at least some enhancement to their visit.
- Public transit connections, guided tours, bike/gear repair stations, gear cleaning stations, and reservable parking areas all were found to have a majority of respondents indicating the amenity would not have any effect on their experience.

What amenities would enhance your visit or experience at the North Slope Recreation Area?

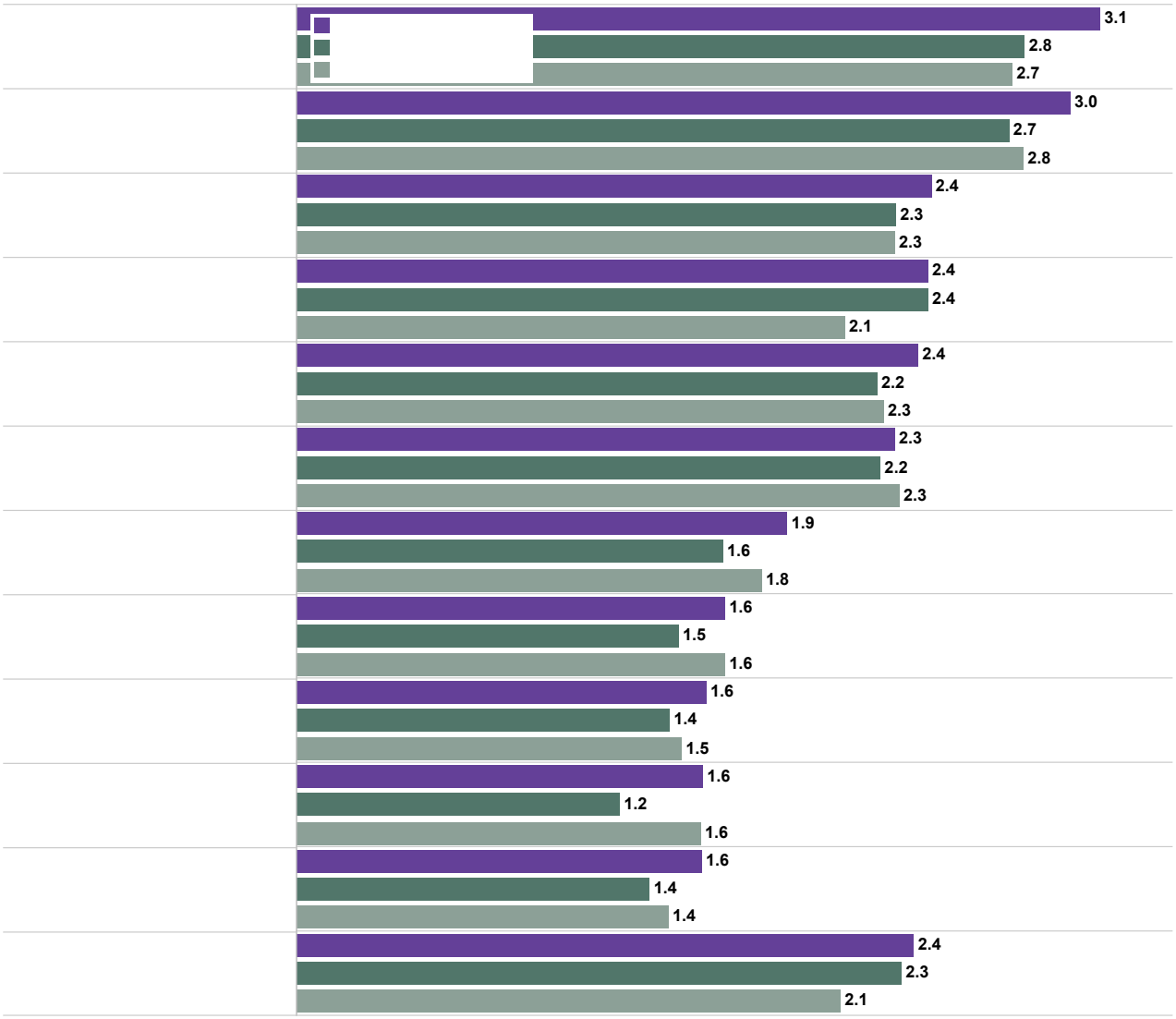

Figure 9. Amenities which would enhance visitor experience at the NSRA by residency status.

- By residency status, most amenities had a similar average rating, but some differences were found. For example, local residents had a higher average rating on almost all amenities in whether it would enhance their experience at NSRA. This finding is likely driven by the fact that locals utilize the area more frequently than those from out-of-region.
- Public transit, while low on the enhancement list for all groups, was particularly low for out-of-region visitors. It's more likely that those who are visiting the area already have transportation options as it can be difficult to reach the area without having a vehicle already.

What amenities would enhance your visit or experience at the North Slope Recreation Area?

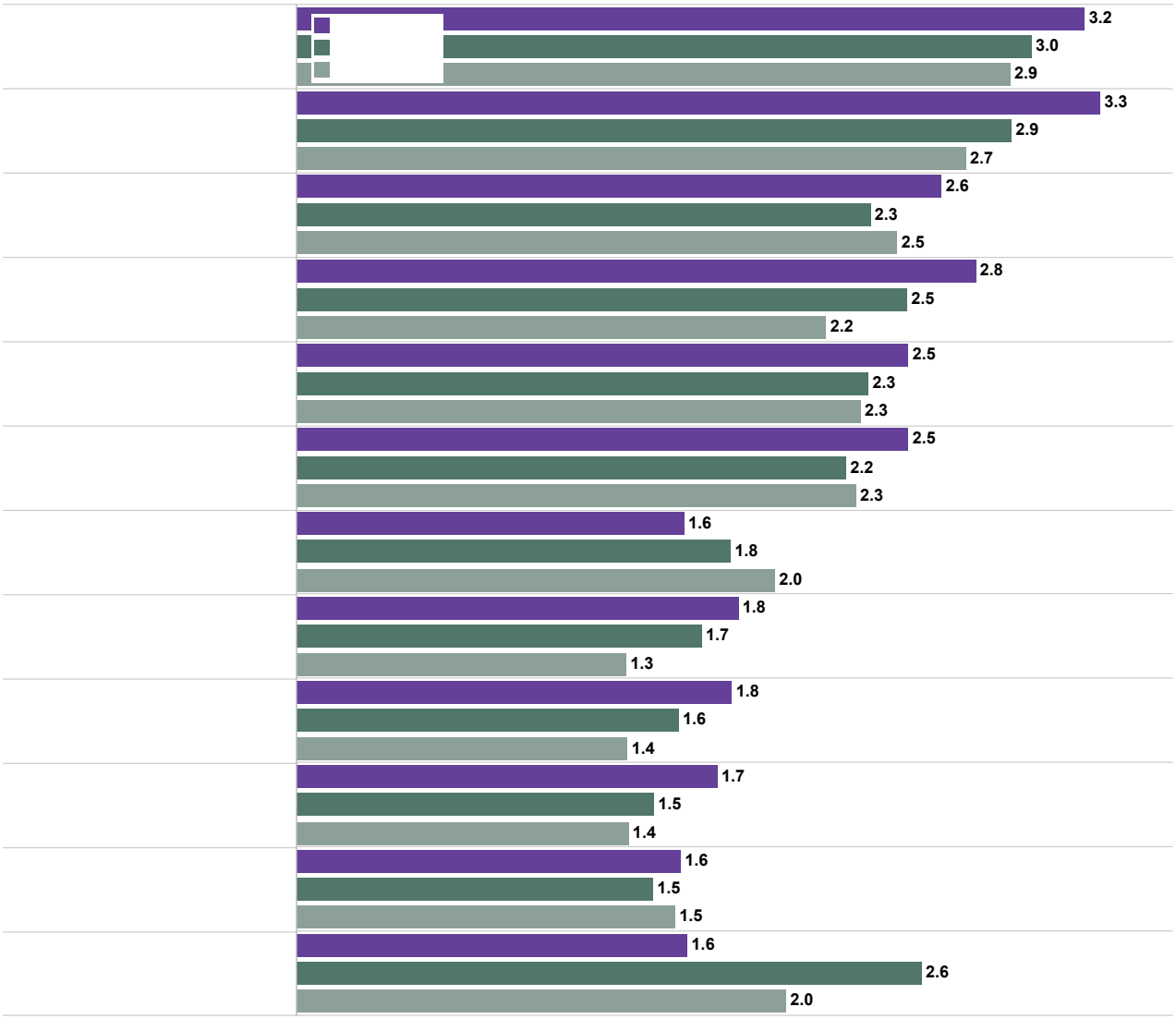

Figure 10. Amenities which would enhance visitor experience at the NSRA by age cohort.

- Examining these amenities by age groups, those under 35 have generally higher average ratings on most amenities and their enhancement on their experience than those 35-64 or 65 and older. However, those under 35 have a lower rating on reservable parking areas than those 35-64 and 65 and older. Data appears to show a correlation with the ability to have convenient parking and age.
- All age groups still rank restrooms and trash cans as the top amenities. These amenities are consistent across all cross-tabulations as aspects that would enhance the experience.

What types of outdoor recreation do you support being available at the North Slope Recreation Area? Please select all that apply.

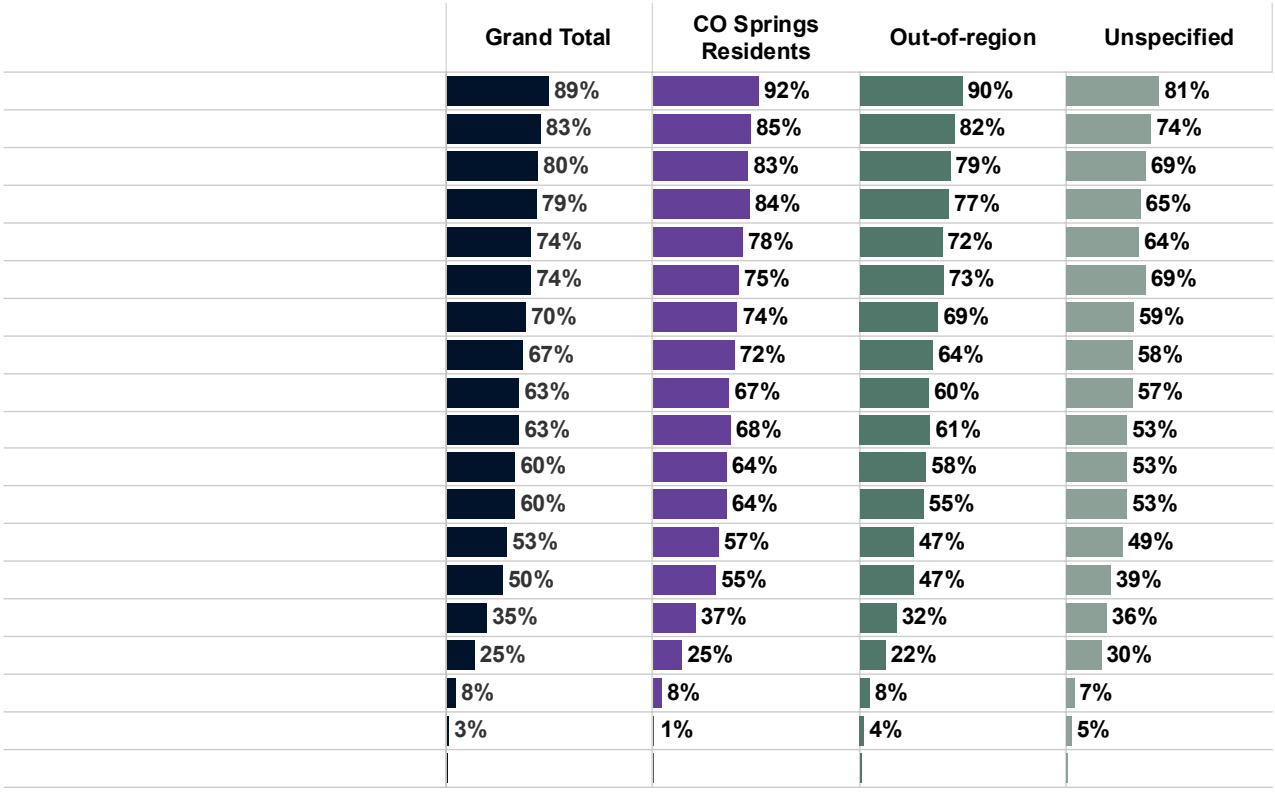

Figure 11. Support across the types of outdoor recreation at the NSRA by residency status.

- Support for outdoor recreation opportunities was high at NSRA. Across the sample, hiking, fishing, wildlife viewing, walking, picnicking, and kayaking/canoeing all were supported by approximately 3/4 of respondents or more. The activities that are lower on the list in terms of support are boating (25%) and organized events (35%). All other activities had over 50% of respondents supporting.
- Very little deviation was observed across the residency groups. The only noticeable trend was a higher share of local residents supporting most activities compared to out-of-region visitors.

Which FOUR activities are most important for you and members of your household?

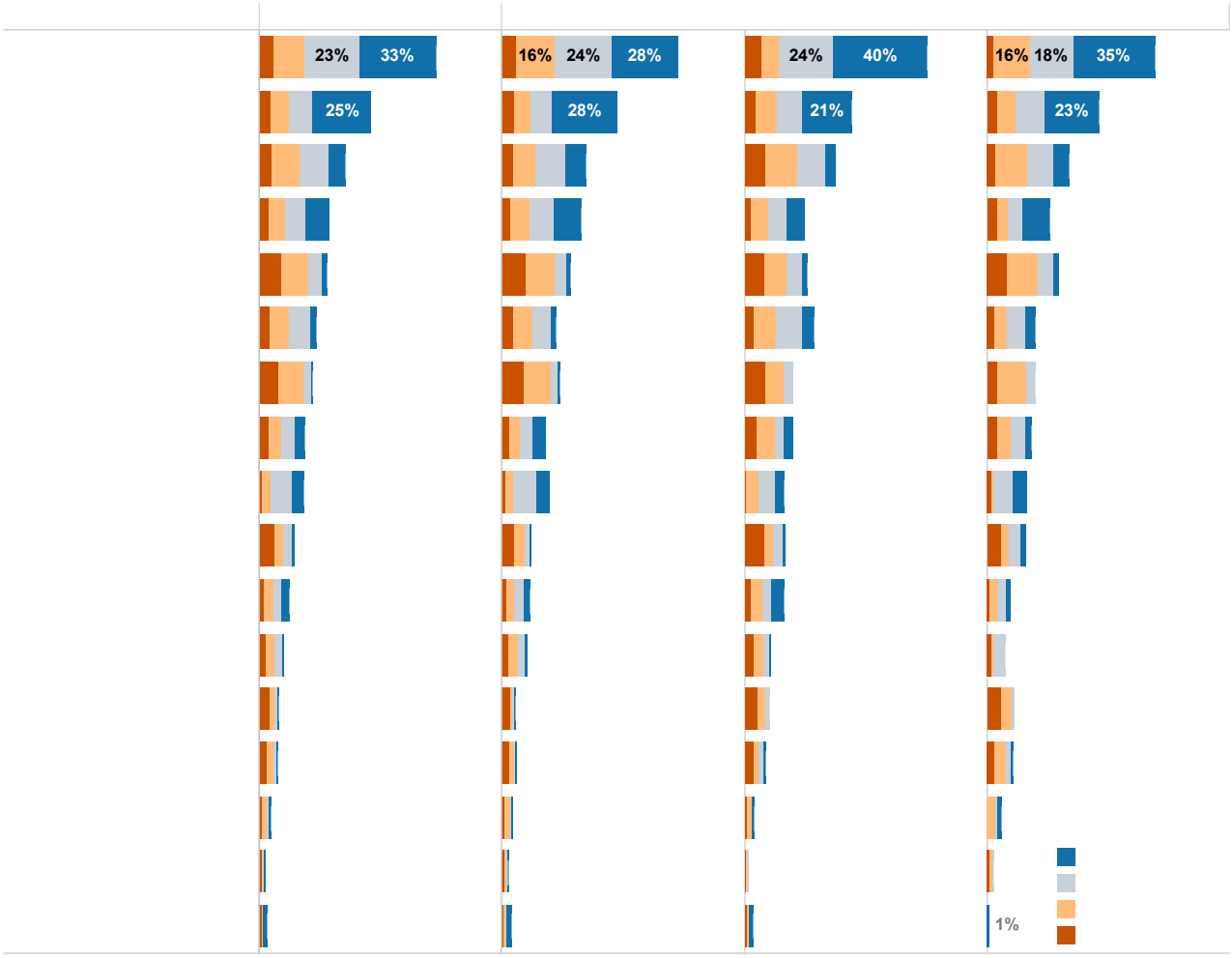

Figure 12. Top four activities most important to respondents by residency status.

- When asked to choose their top four most important activities to participate in at NSRA, hiking was the clear favorite with 76% providing a rank between one to fourth most important. Fishing on shore trailed in second at 48% of respondents providing a similar ranking.
- No major differences were found between residency groups. Results continued to show consistency in agreement in overall activity importance.

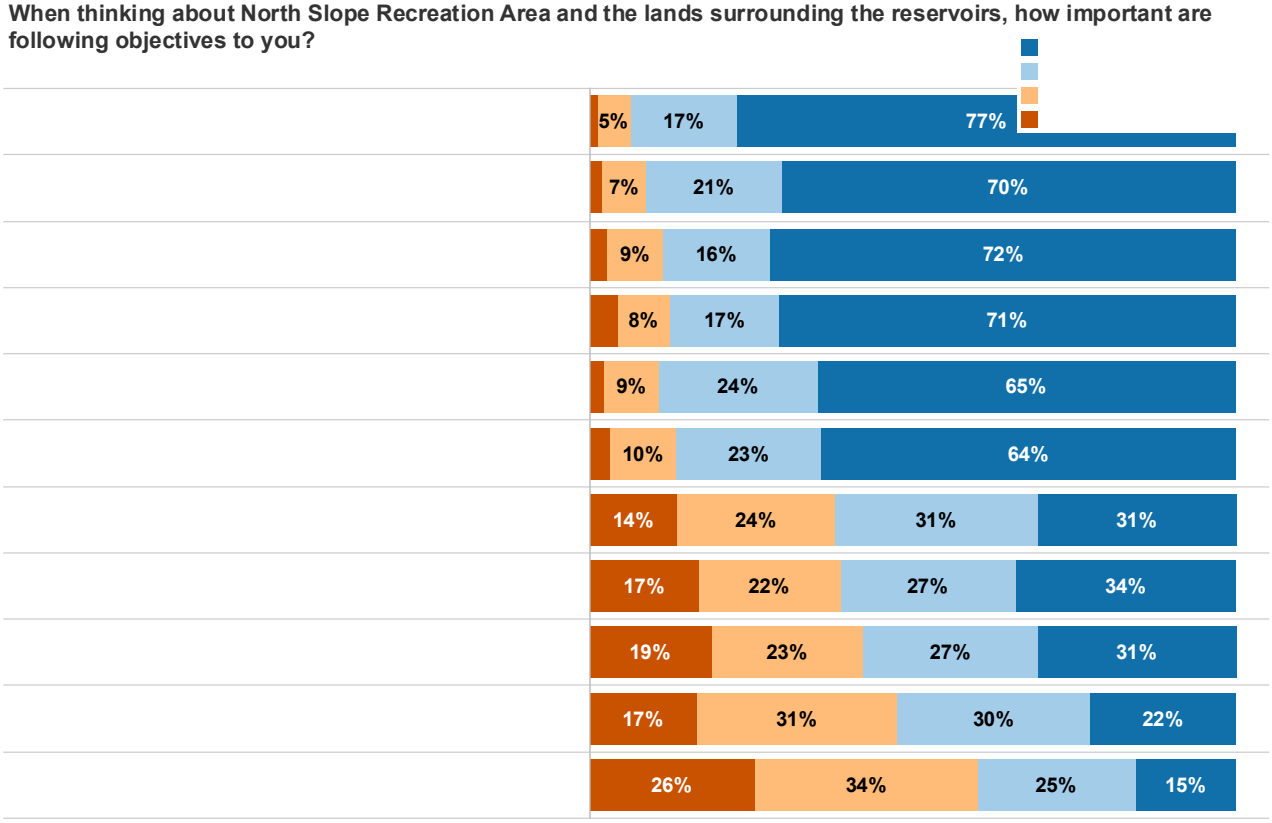

Figure 13. Importance of the objectives of the NSRA.

- NSRA serves multiple purposes with various objectives that are balanced by Colorado Springs Utilities. Visitors were asked to rank how important a selection of objectives is to the NSRA and surrounding lands.
- Six objectives had relatively similar importance ranking, falling between 3.5-3.7 out of 4.0 on the importance scale, indicating the majority of respondents stating the objective as extremely important. These include:
    - Protect wildlife, environment, and ecosystem health
    - Provide resilience to wildfires
    - Protect water supplies including system infrastructure and water quality and watersheds
    - Protect access to recreational opportunities
    - Protect scenic views
    - Protect spaces for solitude and connection to nature
- As indicated, the highest rating objectives indicate a desired balance for protection of ecosystem needs along with opportunities for accessing recreational sites.
- A second tier of objectives fell behind these relatively high importance objectives. While the average rating of these objectives was considerably lower (2.3-2.8 in importance), most, apart from outdoor education/interpretation/volunteer opportunities, had over 50% of the sample responding that they were either moderately or extremely important, too.

When thinking about North Slope Recreation Area and the lands surrounding the reservoirs, how important are following objectives to you?

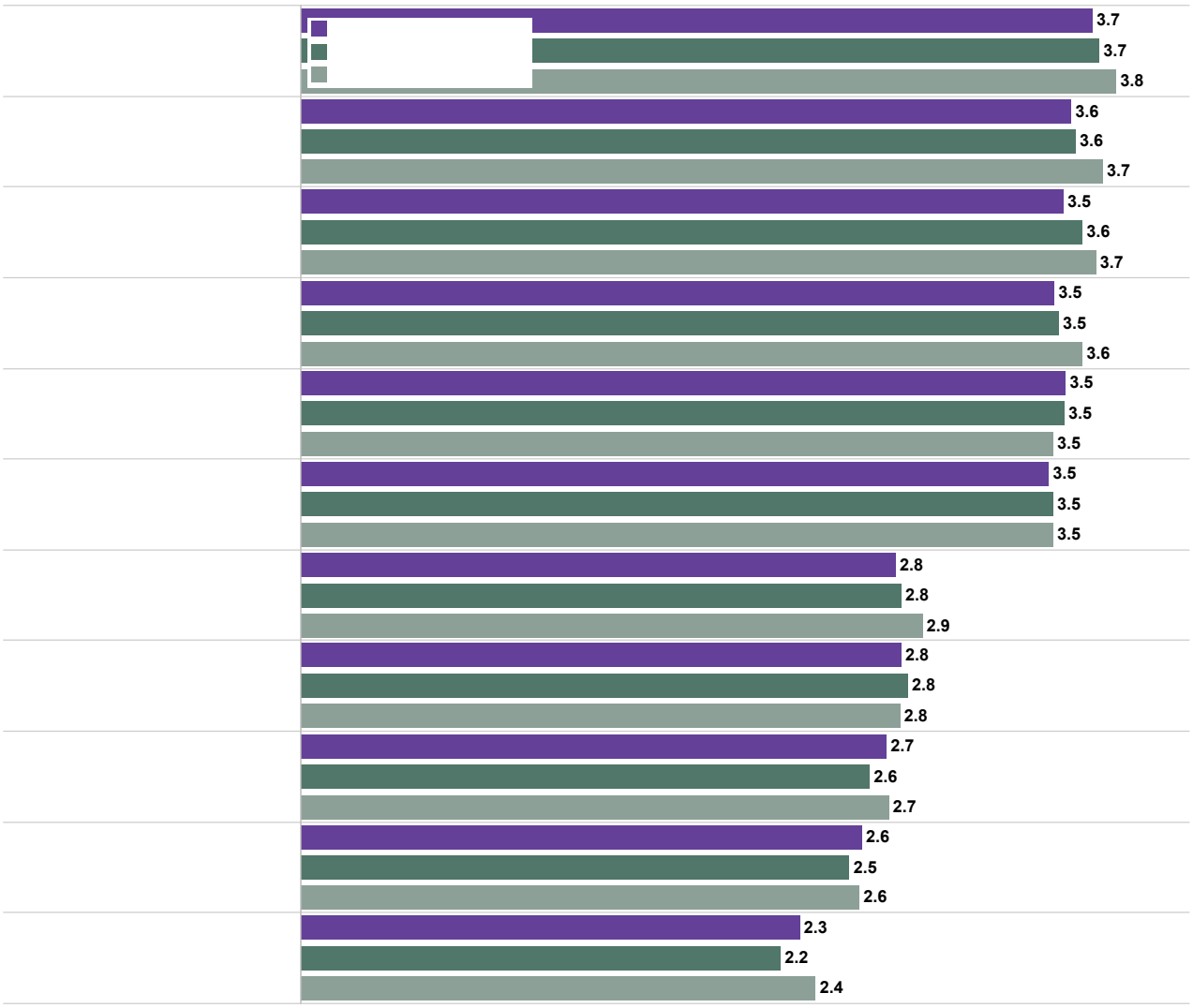

Figure 14. Importance of the objectives of the NSRA by residency status.

- Very little variation was observed in objectives for NSRA by visitor residency. In fact, the ranking was almost identical for all objectives across each group.
- This finding continues to show where users are mostly aligned with priorities and objectives for NSRA. Even those who are not from the area see the value of resource protection with some recreational access.

When thinking about North Slope Recreation Area and the lands surrounding the reservoirs, how important are following objectives to you?

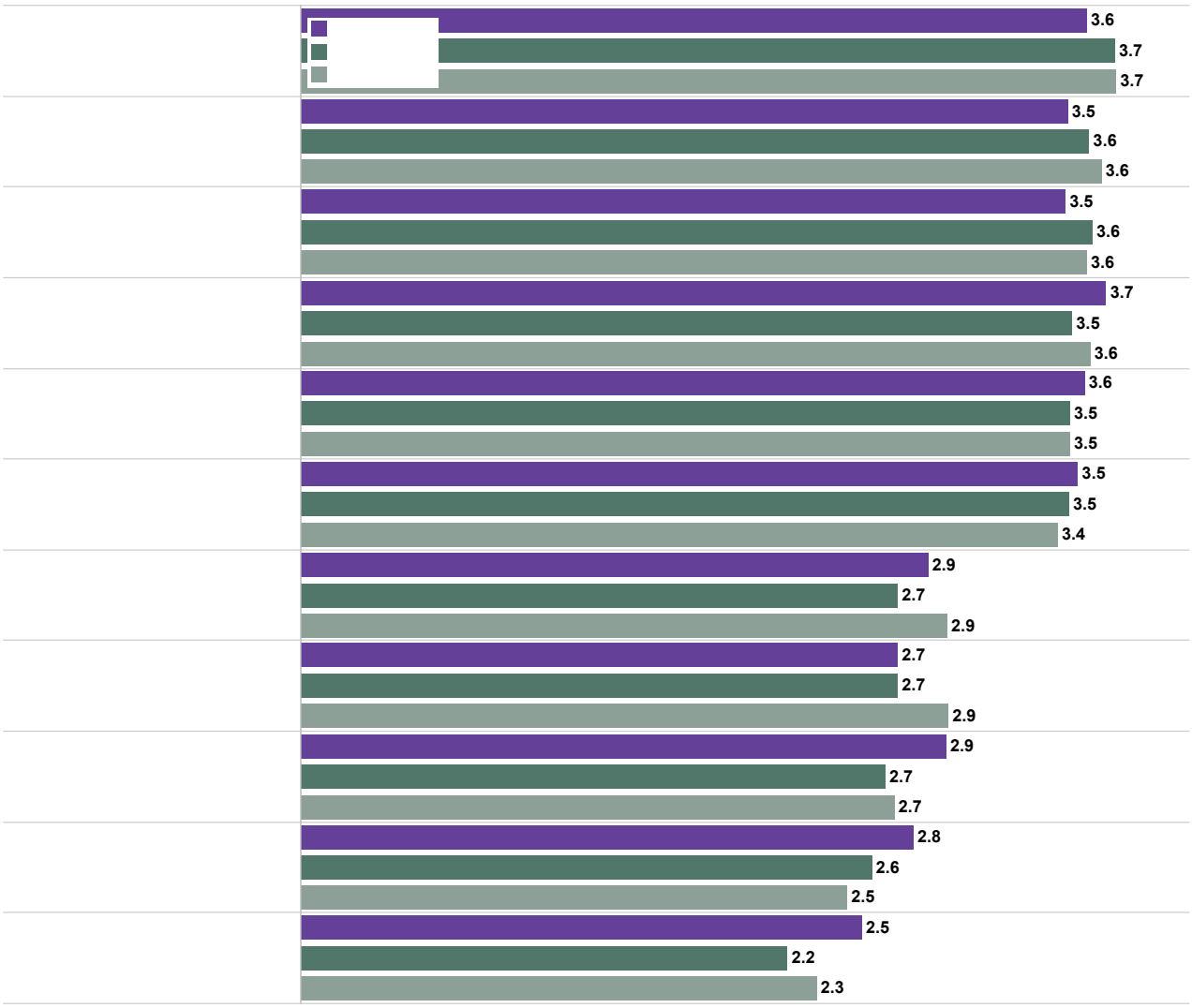

Figure 15. Importance of the objectives of the NSRA by age cohort.

- By age, some differences are observed between groups responding to the importance of objectives. The youngest generation places slightly higher importance on access to recreational opportunities than those older than 35. They also place slightly less importance on the ecosystem health-type objectives. However, the overall ratings still place the top six objectives in the top tier.

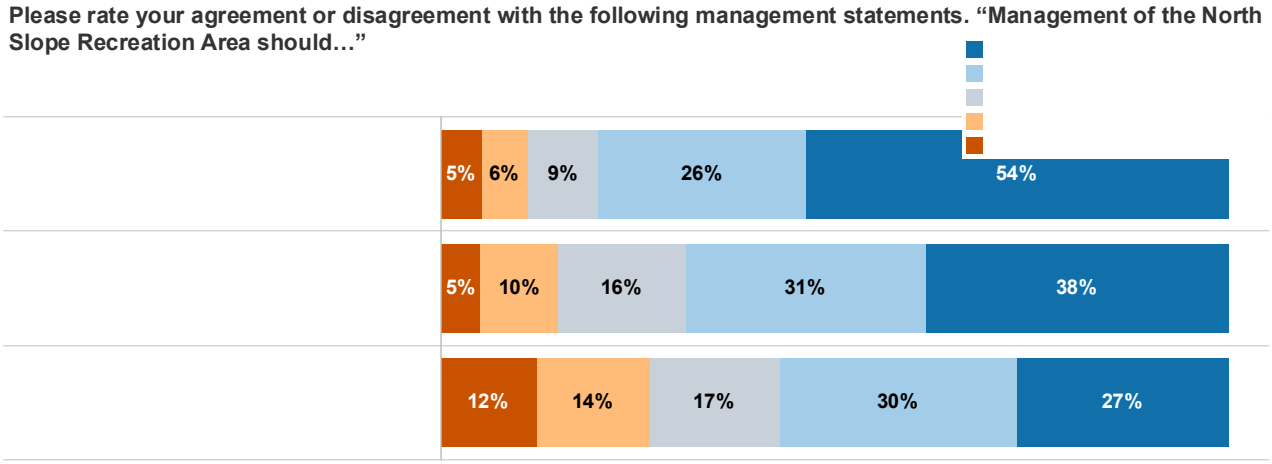

Figure 16. Management priorities of the NSRA.

- Respondents were asked about their preference towards different types of priorities Colorado Springs Utilities should consider for NSRA. These priorities included balancing water supply and operations with recreational use, water supply and operations only, and maximizing recreation opportunities.
- Similar to other results in the survey, respondents agree the most with a balance of water supply/operations, and recreational use (80% agree). Prioritizing water supply had the second highest percentage with 69% of respondents agreeing with that priority. Finally, 57% of respondents agreed with maximizing recreation opportunities as a priority.

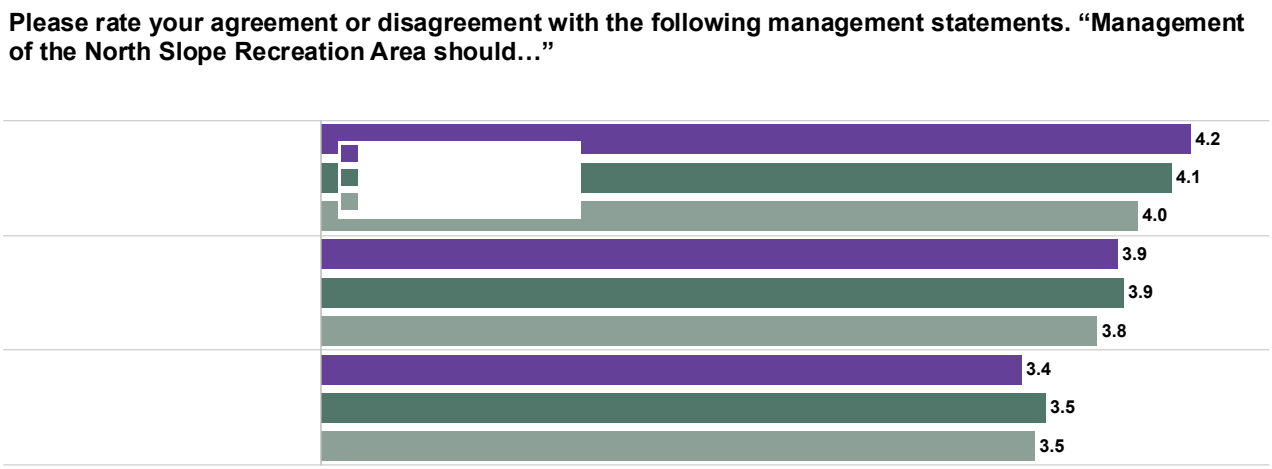

Figure 17. Management priorities of the NSRA by residency status.

- Across all residency groups, prioritizing the balance of water supply/operations and recreational use remains the highest agreed upon option.

Please rate your agreement or disagreement with the following management statements. "Management of the North Slope Recreation Area should…"

Figure 18. Management priorities of the NSRA by age cohort.

- Continued consistency is seen across age groups on prioritization of management statements, too. The only difference was a slightly higher average rating on water supply/operations only by those 65 and older.

As recreation demands increase at the North Slope Recreation Area, how should Colorado Springs Utilities address the potential for increased costs for recreation management associated with this increase in recreation?

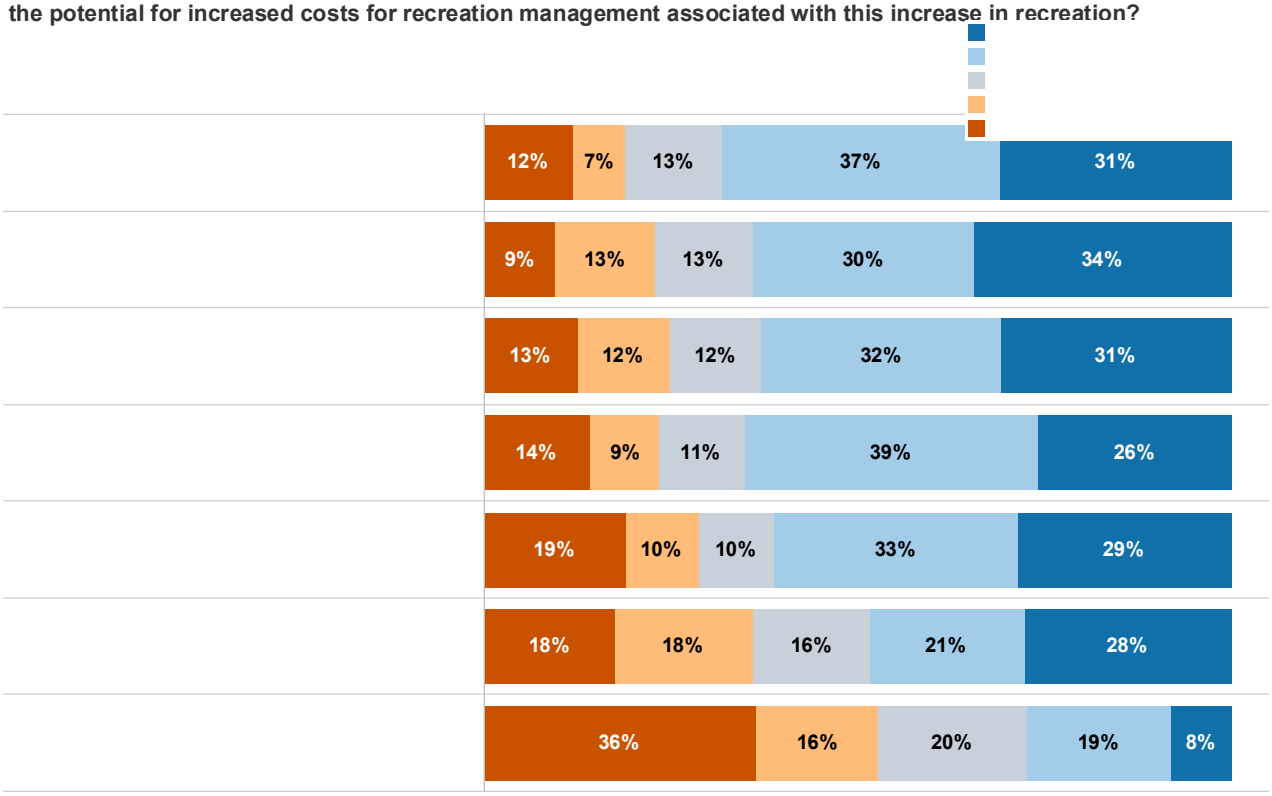

Figure 19. Management of potential increased costs for Colorado Springs Utilities.

- To account for increased demand in recreation, respondents were asked if there was a preferred way in which Colorado Springs Utilities should handle potential increased costs.
- The top option in terms of agreement was establishing a revenue generation from Pikes Peak America's Mountain enterprise programs, events, equipment rentals and tours with 68% of

respondents agreeing. Other options that had higher levels of agreement included limiting the types of recreation according to an evaluation of the appropriate level of use (3.7 average), limiting the volume of users according to an evaluation of the appropriate amount of use (3.6 average), and increase recreation entry/parking fees (3.5 average).

- Passing increasing costs to Colorado Springs Utilities customers was the least supported option with 52% disagreeing (36% of them strongly disagreeing)

As recreation demands increase at the North Slope Recreation Area, how should Colorado Springs Utilities address the potential for increased costs for recreation management associated with this increase in recreation?

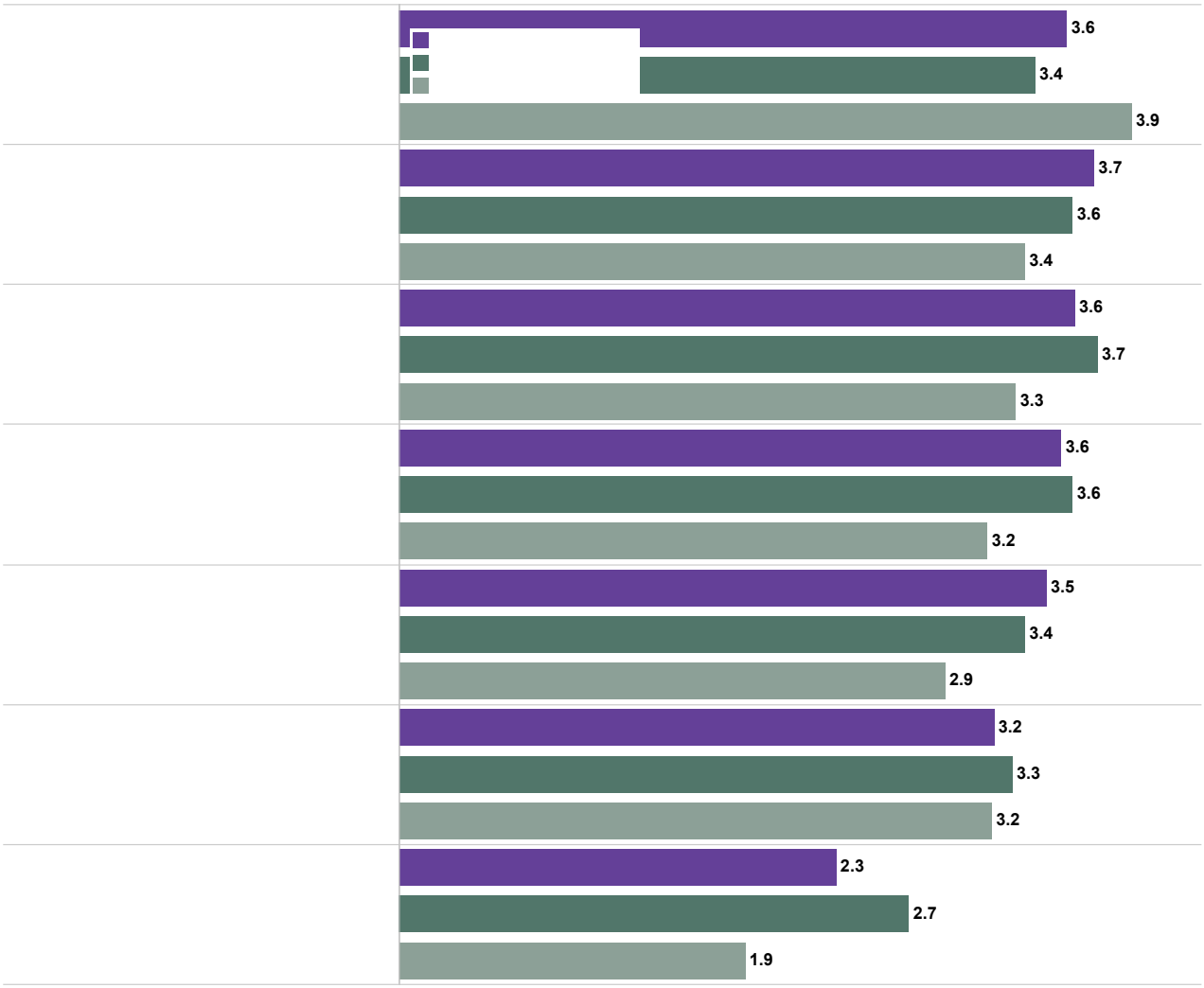

Figure 20. Management of potential increased costs for Colorado Springs Utilities by residency status.

- Variation was seen among some of the option choices by residency status; however, a smaller sample size for the "unspecified" group drove some of the differences. Out-of-region respondents were more likely to suggest passing the cost on to customers, as they are not part of that paying group.
- The "unspecified" residency group is a small sample for this question, and results should be treated with caution.

As recreation demands increase at the North Slope Recreation Area, how should Colorado Springs Utilities address the potential for increased costs for recreation management associated with this increase in recreation?

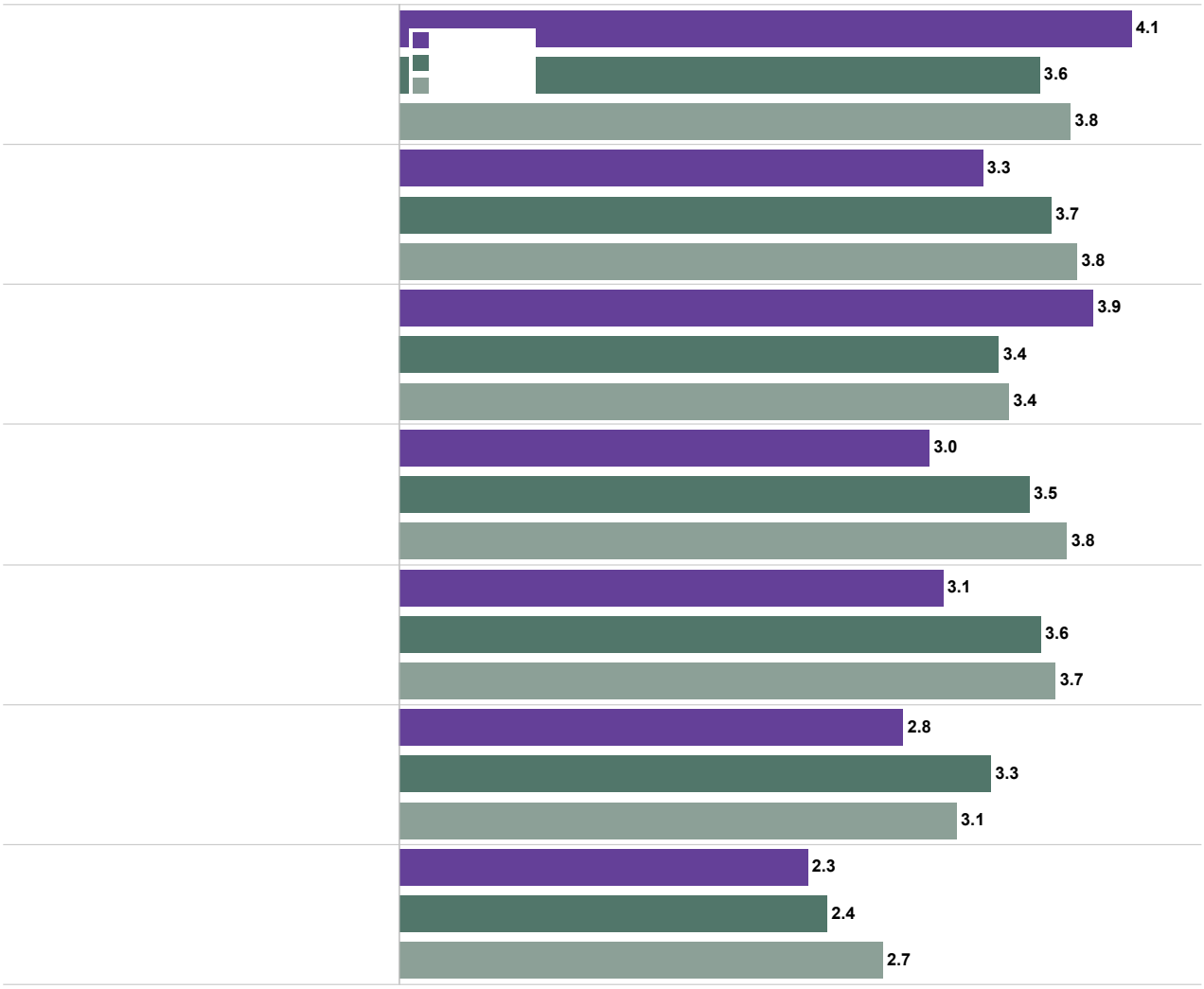

Figure 21. Management of potential increased costs for Colorado Springs Utilities by age cohort.

- Management of potential costs has some of the largest differences by age groups of all question within the survey. Primarily, there is a direct correlation with increases in age and increases in the willingness to use additional fees or visitor limits at NSRA.
- More notably, those under 35 were more likely to support establishing revenue generations from Pikes Peak America's Mountain enterprise program or from commercial tours than those older than 35. However, all groups show this option as one of their top choices.
- Those over 35 were increasingly more supportive of limits to the volume of users and/or types of activities, along with more supportive of increasing recreation entry/parking fees. There may be more of a desire among younger people to find ways to support recreation through other financial means as they are not as established financially yet.

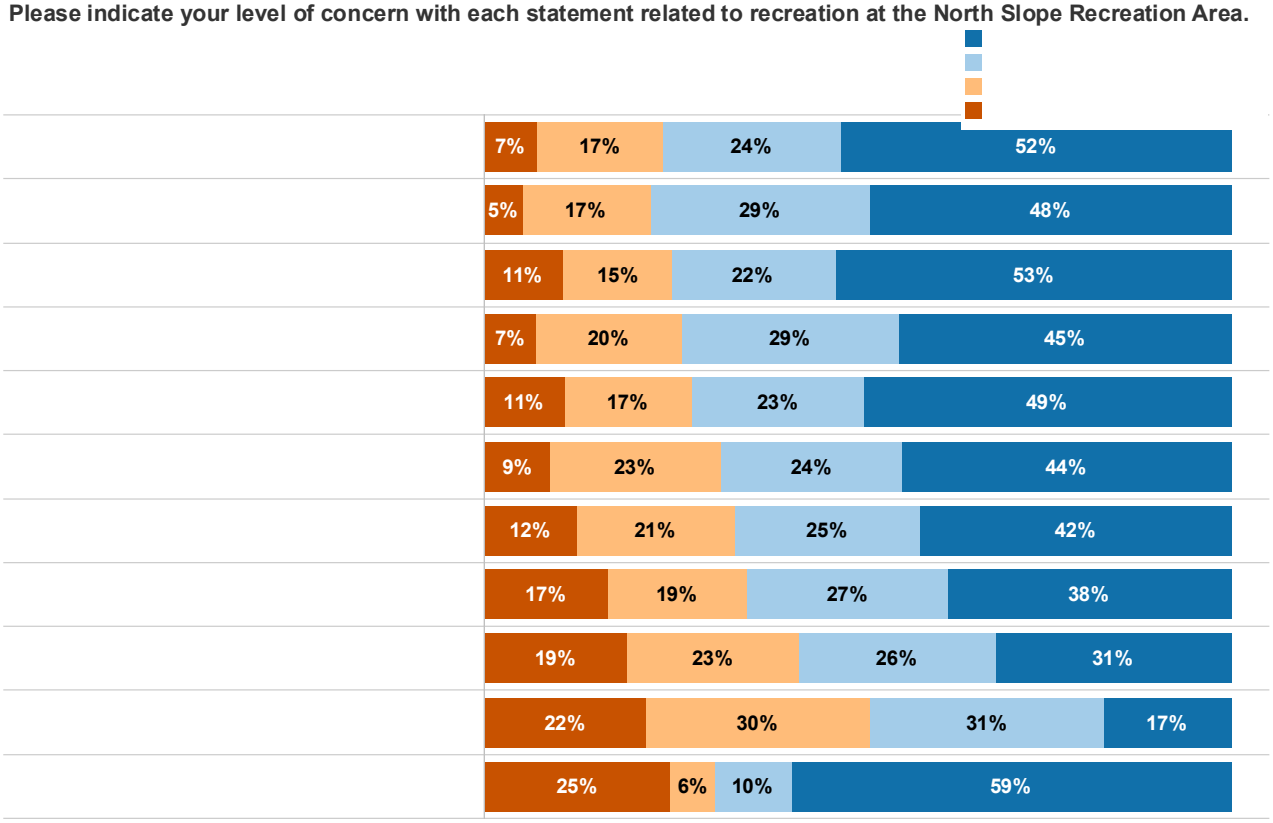

Figure 22. Level of concern related to recreation at the NSRA.

- Some visitors may have concerns about specific issues at NSRA. Respondents were asked to rate how concerned they are with a variety of potential issues.
- Overcrowding of usable recreation space, impacts to the natural ecosystem, and commercial activity creating resource damage were listed as top concerns with all having a 3.2 rating out of 4.0.
- Impacts on the wilderness experience (3.1), operation of commercial activity without a permit (3.1), fire dangers from recreation (3.0), and impacts to water quality (3.0) followed in their level of concern.
- Of least concern was availability of parking (2.4) and increased tourism (2.7). However, all aspects had some level of concern among respondents.

Please indicate your level of concern with each statement related to recreation at the North Slope Recreation Area.

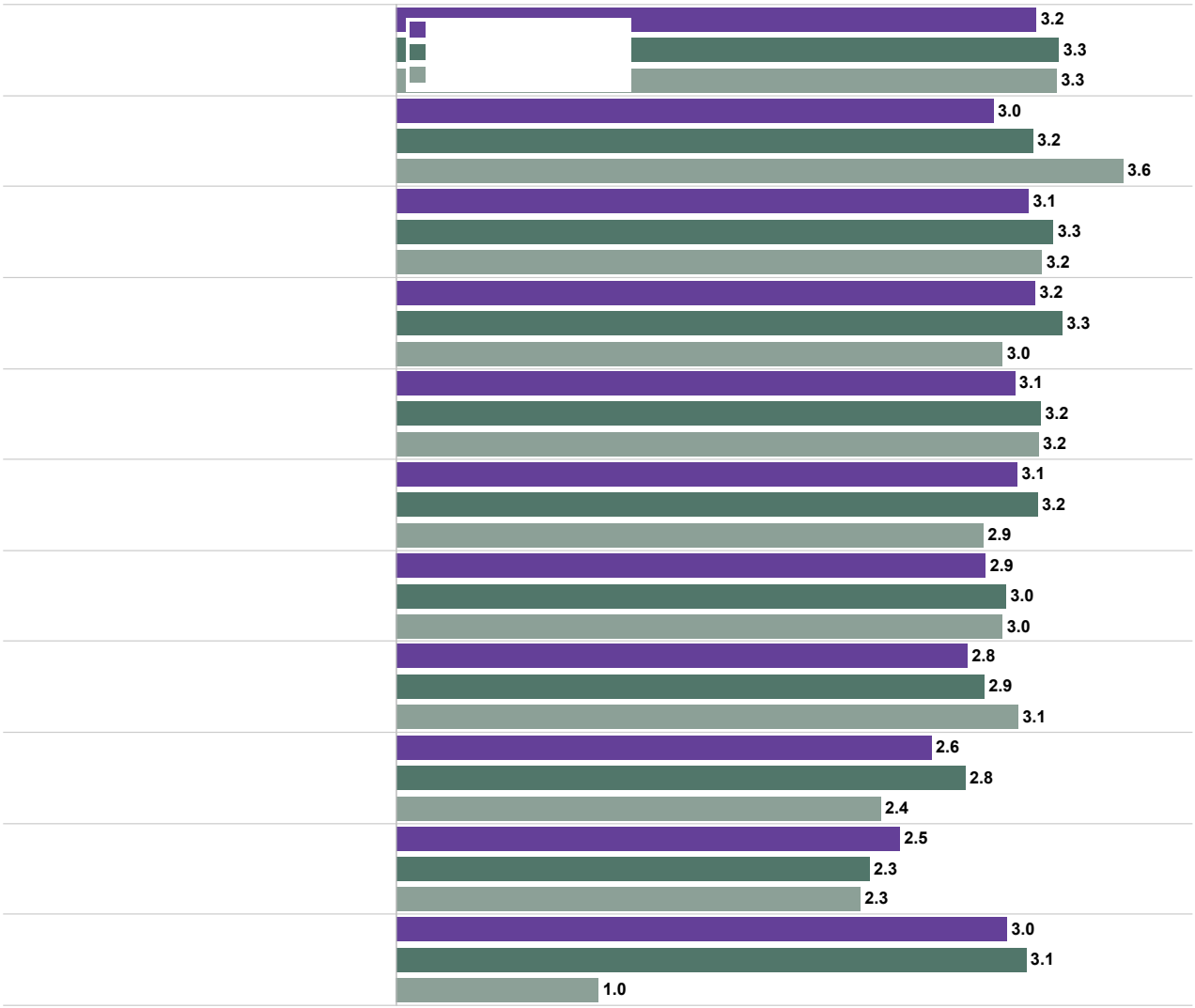

Figure 23. Level of concern related to recreation at the NSRA by residency status.

- Residency status did not play a major role in the differences in average rating of specific concerns. Locals tended to have a slightly lower level of concern, on average, on most topics compared to non-locals, but the difference is marginal.
- Surprisingly, non-locals had a higher level of concern of fire danger from recreation, the largest difference observed between the two groups.
- The "unspecified" residency group is a small sample for this question, and results should be treated with caution.

Please indicate your level of concern with each statement related to recreation at the North Slope Recreation Area.

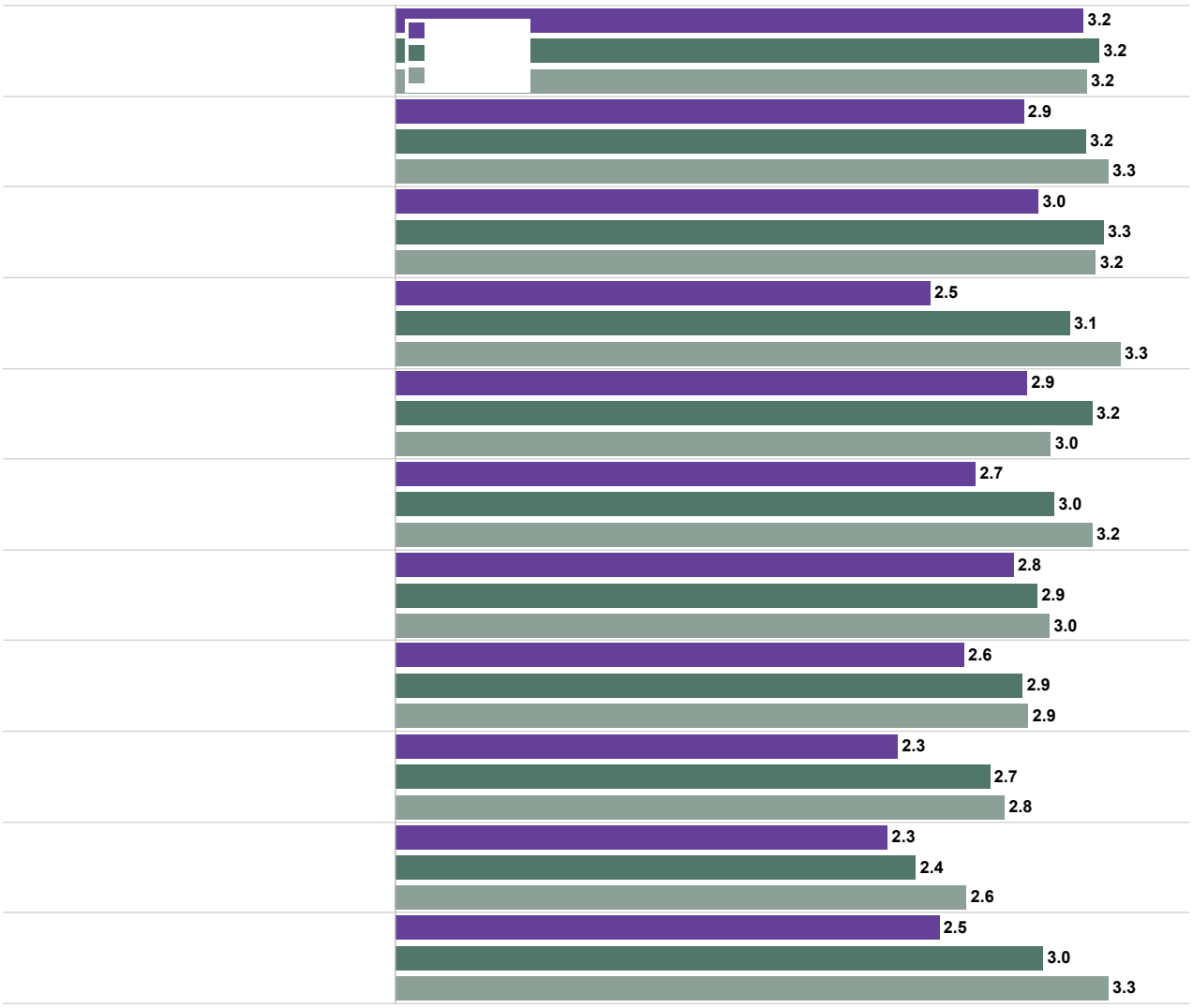

Figure 24. Level of concern related to recreation at the NSRA by age cohort.

- By age, more differences are observed in regard to concern over various statements related to recreation. Those under 35 years old tended to have a lower level of concern of most topics compared to those over 35.
- The main differences were seen in the following topics:
    - Overcrowding of usable recreation space
    - Operation of commercial activity without a permit.
    - Fire dangers from recreation
    - Impacts to the water supply
    - Increased tourism
- While those under 35 were less concerned overall, they still had a high level of concern for the top comments, just not to the same effect as those over 35.

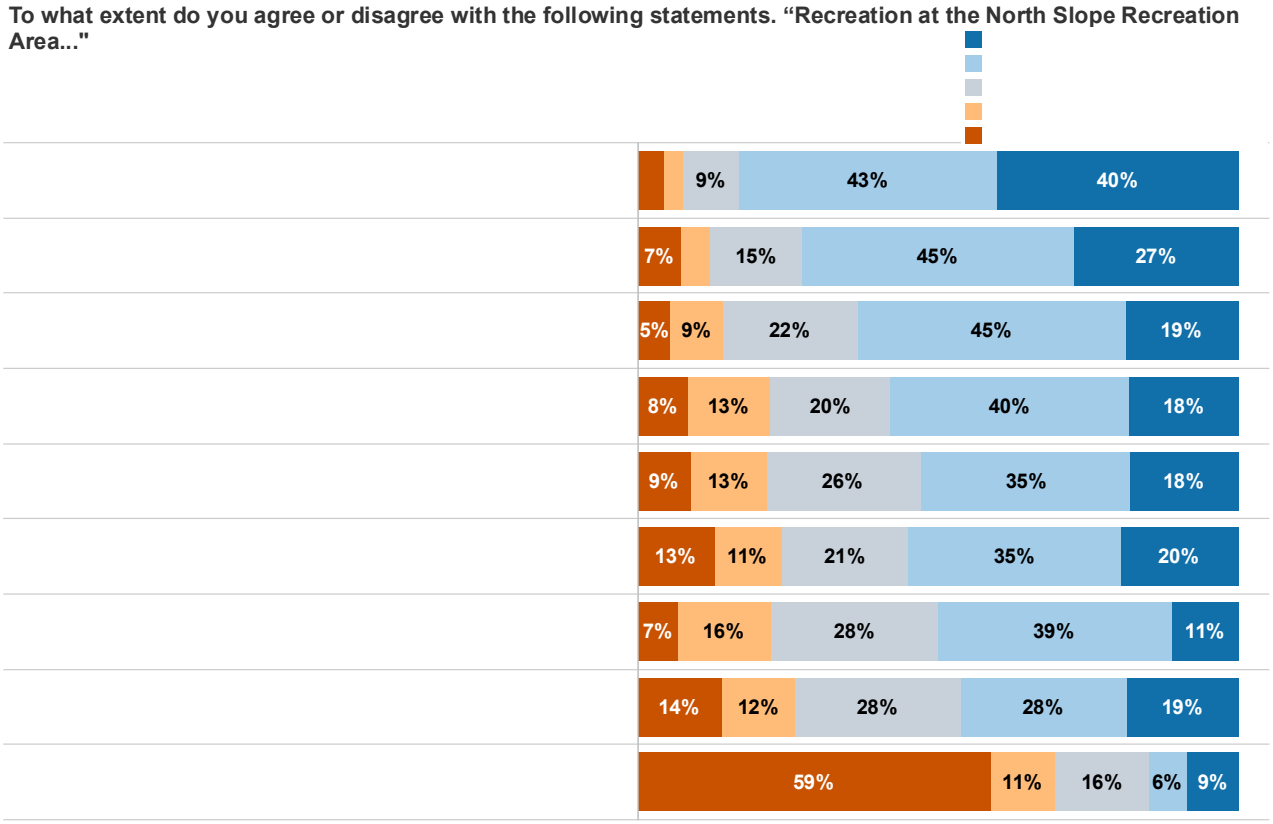

Figure 25. Benefits of recreation at the NSRA.

- Respondents were also asked to rate their agreement on scale of 1= "strongly disagree" to 5 = "strongly agree" on statements about recreation at NSRA.
- The most agreed upon statement was that "recreation at NSRA provides a space of responsible recreation" (83% agreed) with "recreation at NSRA enhances the opportunities for different types of recreation experiences to explore" following with 72% of respondents agreeing.
- All statements had a fairly high level of agreement with an increase in the neutral responses. The lowest agreed upon statement was "I do not see any benefit" (70% disagreed, 59% strongly disagreed).
- A key takeaway from this question is that most respondents realize that recreation at NSRA has a variety of benefits.

To what extent do you agree or disagree with the following statements. "Recreation at the North Slope Recreation Area..."

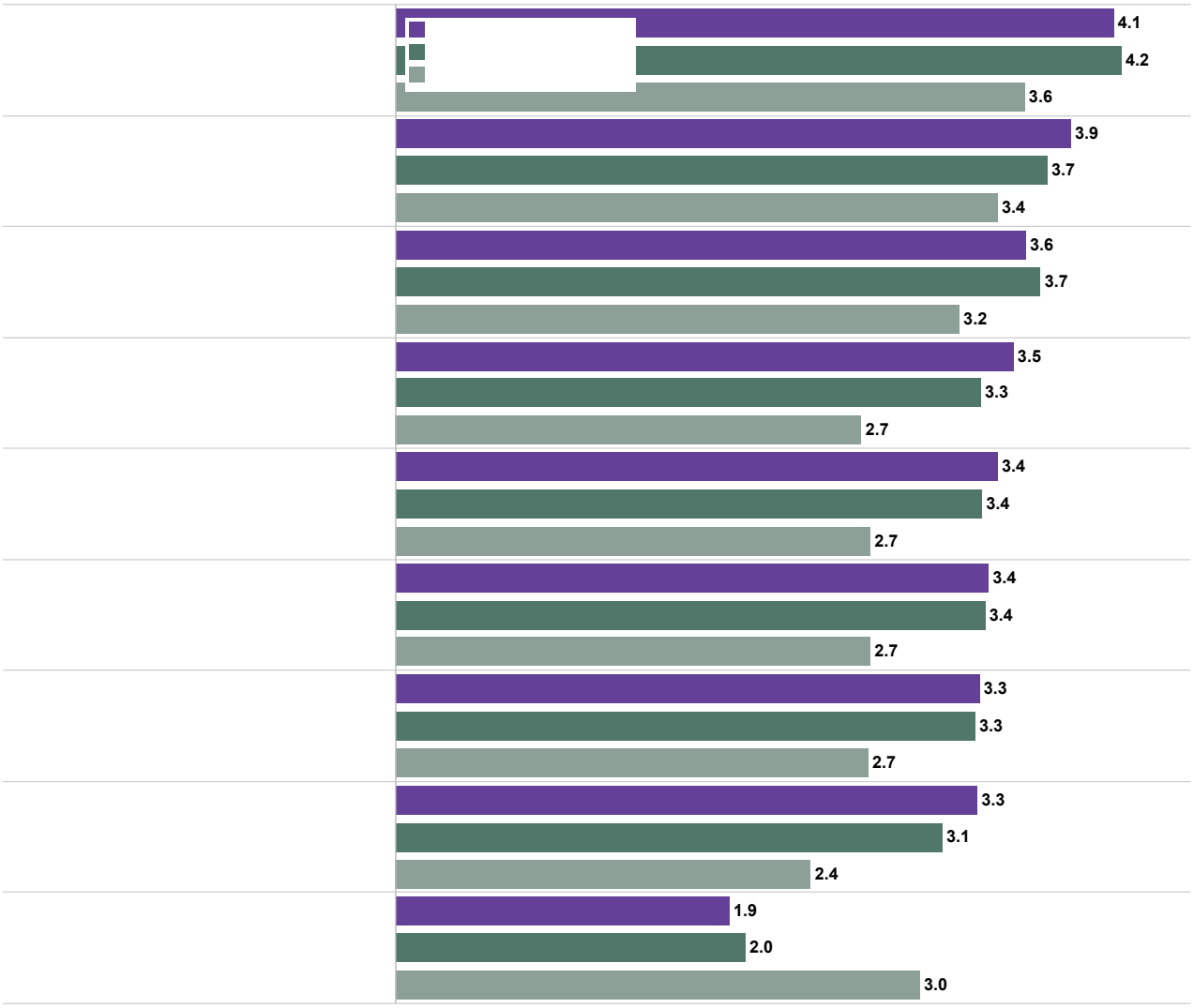

Figure 26. Benefits of recreation at the NSRA by residency status.

- For most statements, the average rating of locals and non-local users was very similar. The two groups were slightly more similar on some topics while slightly less aligned on others. However, there was not a noticeable pattern between the groups.
- The "unspecified" residency group is a small sample for this question, and results should be treated with caution.

To what extent do you agree or disagree with the following statements. "Recreation at the North Slope Recreation Area..."

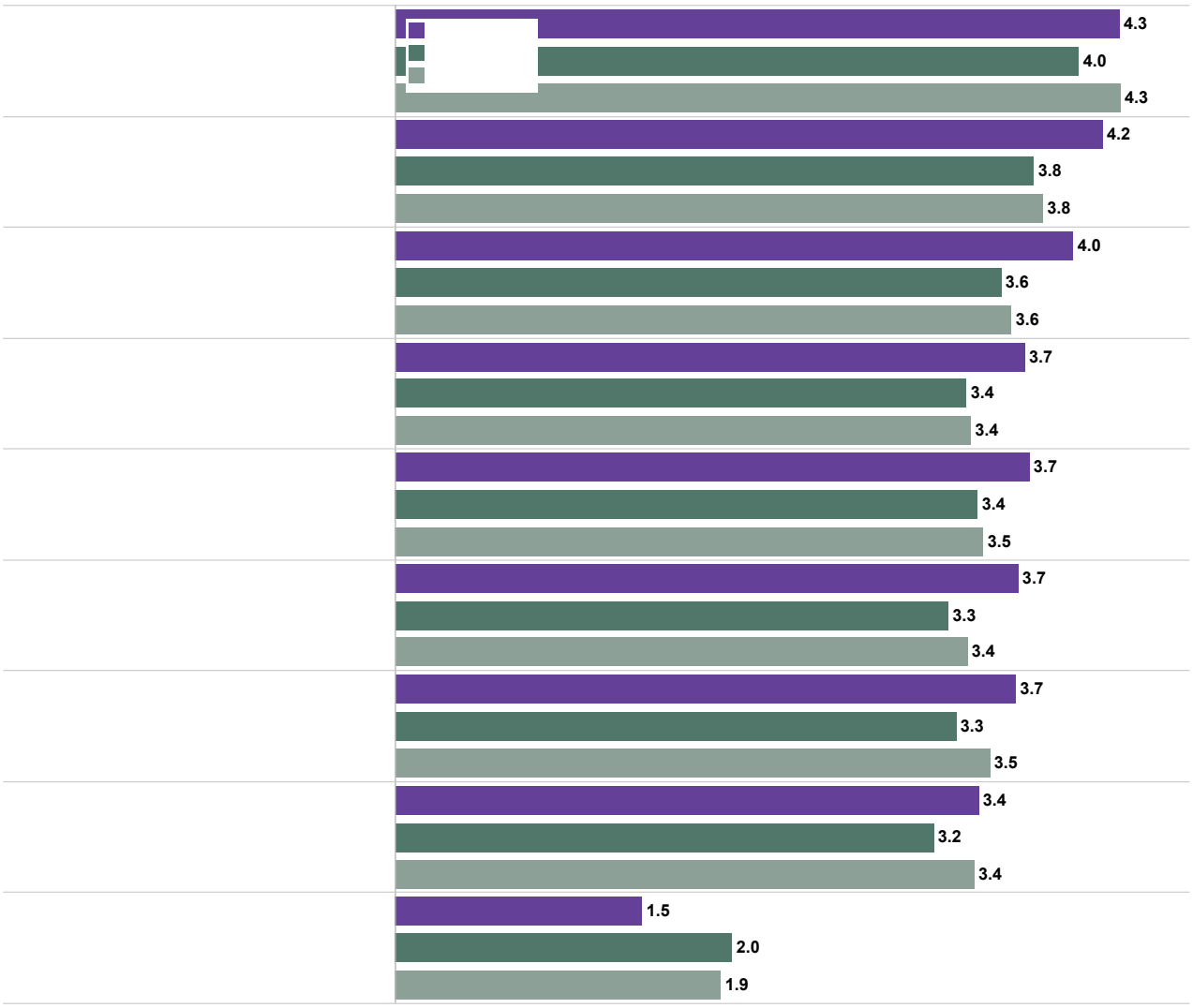

Figure 27. Benefits of recreation at the NSRA by age cohort.

- By age, those under 35 years old have a higher level of agreement than those 35-64 on most topics, to some degree. However, they tended to have a fairly similar agreement rating of most topics with those 65 and older.
- The youngest age cohort generally was more supportive of all topics regarding recreation at NSRA than those over 35. In fact, the average rating for "I do not see any benefit" was much lower for those under 35 years old.

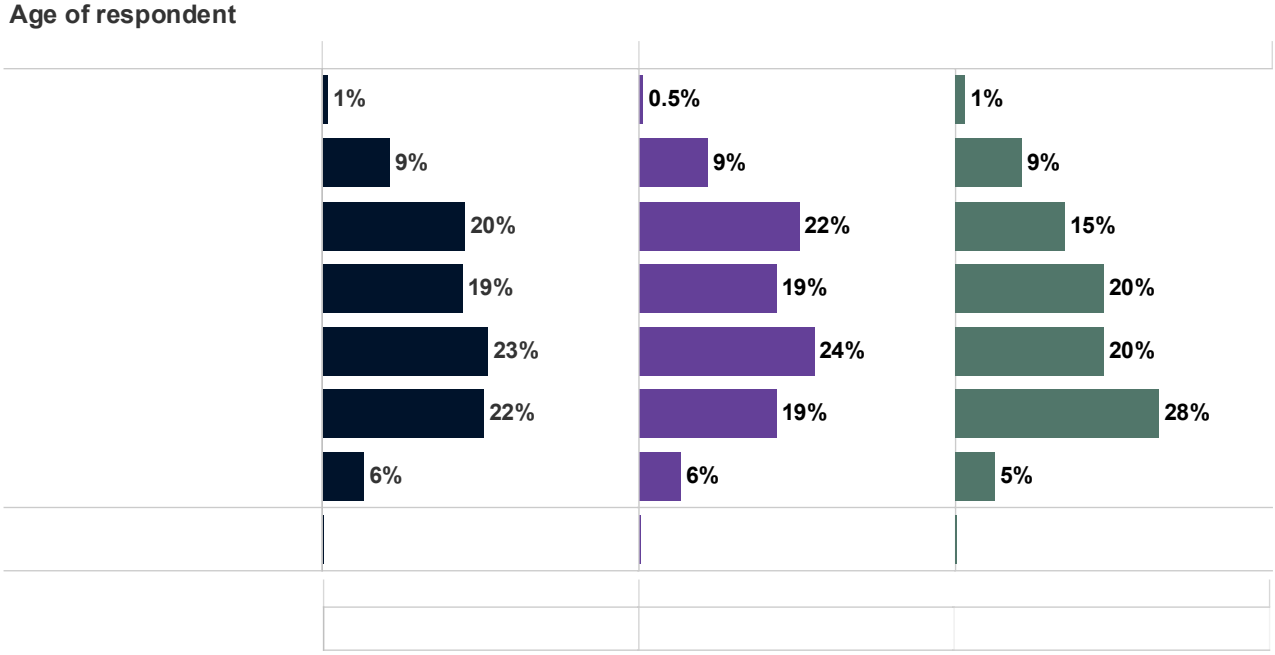

Figure 28. Age of respondents by residency status.

- To provide context of all respondents, demographics were split out by residency status throughout the survey.
- Colorado Springs Residents were slightly younger (53 years old) on average than those visiting from outside the region (55 years old). The overall age gravitated towards 54 years old.

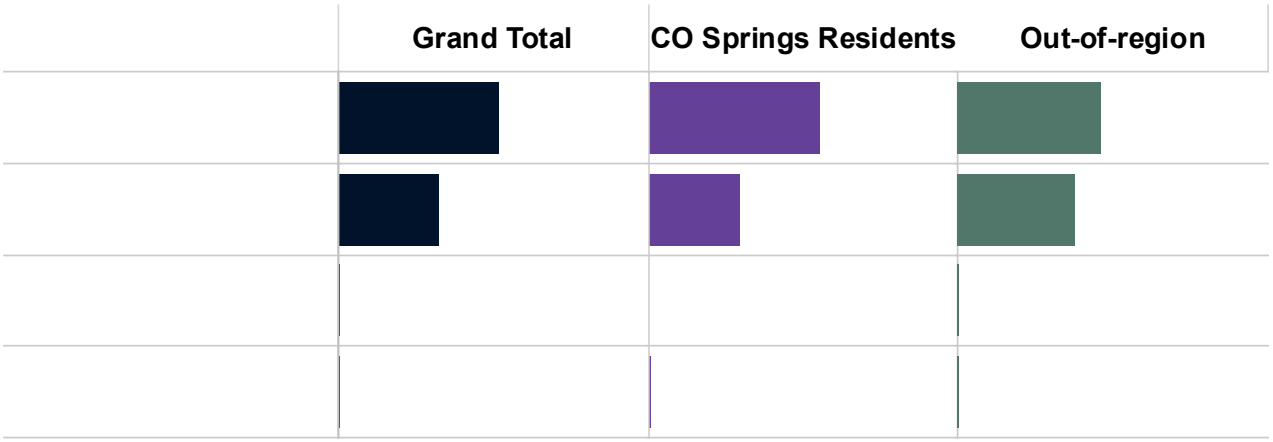

Figure 29. Gender by residency status.

- Males were more likely to respond to this survey with 61% of all respondents identifying as male. Locals were more likely (65%) than non-locals (55%) to be male.

Which of these categories best describes the total gross annual income of your household (before taxes)?

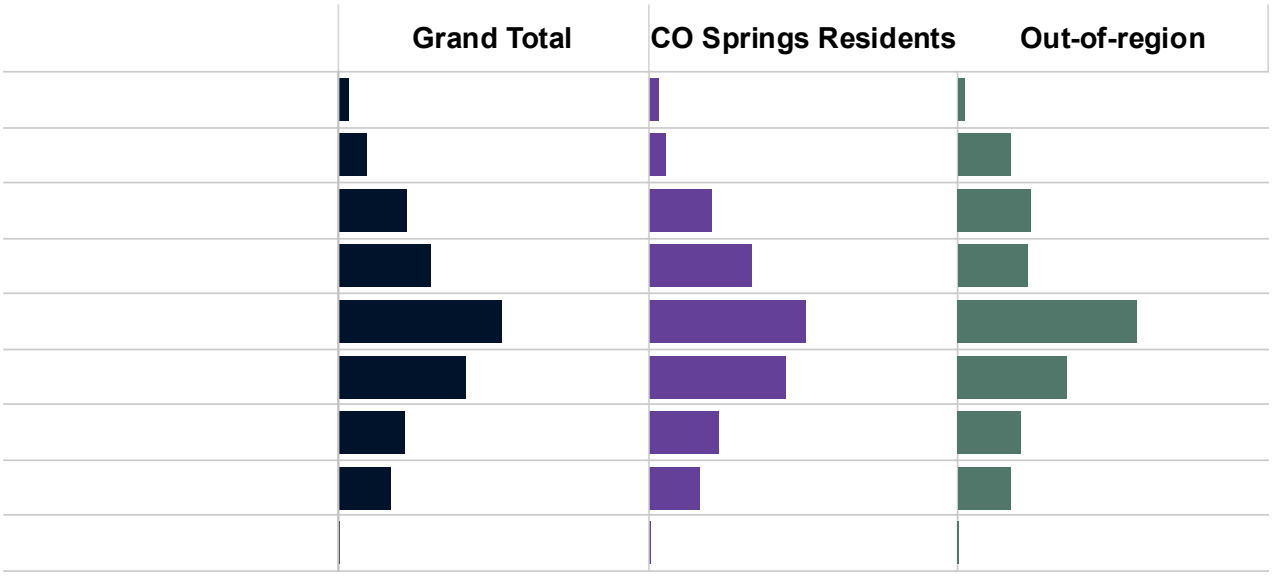

Figure 30. Household income by residency status.

- Household income followed a similar distribution among locals and non-locals. The highest respondent income category was $100,000-$149,999 (27%) among both residency groups.

Are you of Spanish, Hispanic, or Latino origin?

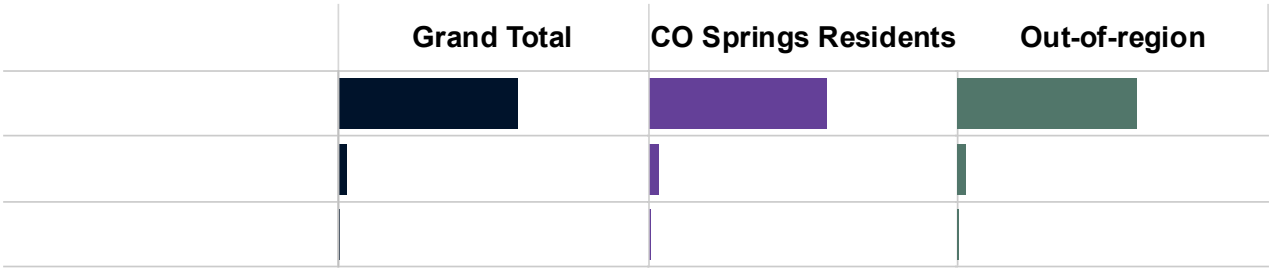

Figure 31. Spanish, Hispanic, or Latino origin by residency status.

- The large majority of respondents (95%) in both groups do not identify as Spanish, Hispanic, or Latino origin.

What race do you consider yourself to be? Please select all that apply.

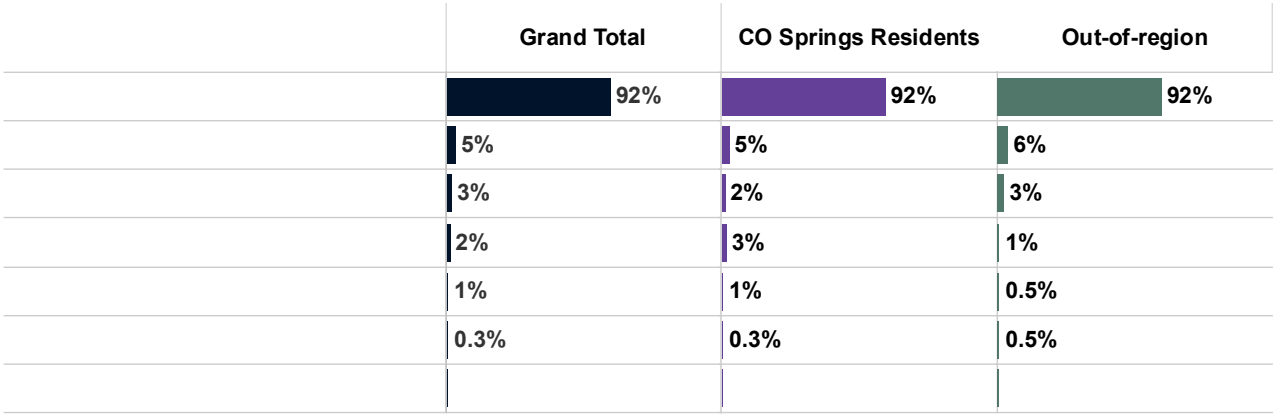

Figure 32. Race by residency status.

- Finally, the racial distribution of respondents was very similar in both residency groups with 92% identifying as White, 5% as some other race, 3% American Indian and Alaska Native, 2% Asian, and 1% Black or African American.

RECOMMENDATIONS

PRIORITIZE CORE AMENITIES TO IMPROVE THE RECREATION EXPERIENCE

Survey findings highlight that restrooms and trash cans are the most critical amenities for improving visitor experiences. For Colorado State Utilities, these facilities should be prioritized for investment and maintenance before considering more specialized offerings. Trailhead signage, dog waste stations, and shelters could follow as secondary amenities to look into for improvements, particularly given strong support across all age groups. Amenities such as guided tours or public transit connections should be viewed as lower priorities, as they received little interest.

MANAGE RECREATION GROWTH THROUGH BALANCED STRATEGIES

Visitors expressed clear support for balancing Colorado Springs Utilities' primary mission, protecting water supply and infrastructure with recreation opportunities. No single priority was seen as more important to prioritize. Striking a balance between protecting resources and providing outdoor recreation opportunities is the clear choice that most visitors prefer. Management actions should continue to emphasize ecosystem protection, wildfire resilience, and water quality safeguards, while allowing for compatible recreational use. As we know, Colorado's natural resources are extremely important to local communities' long-term health, which visitors understand, too. Expanding recreation should be done carefully through a balanced approach to offset any kind of resource impacts that could exacerbate top visitor concerns such as ecosystem impacts, overcrowding, and commercial permit issues.

IMPLEMENT COST-RECOVERY APPROACHES THAT REFLECT VISITOR PREFERENCES

To address potential cost increases associated with recreation, visitors favored revenue generation through enterprise programs, tours, rentals, and events. These options spread costs to direct users rather than Colorado Springs Utilities' customer base. In fact, passing the costs to customers was the least desired choice from respondents' perspectives. Entry or parking fee adjustments also received moderate support, mostly among older visitors. However, fees tend to have a negative perception once implemented by visitors. Increasing fees should come with a planned communication strategy to ensure visitors know where their money would be spent. Any new fee structures should be framed transparently as reinvestments in resource protection and facility maintenance.

FOCUS ON HIGH-DEMAND ACTIVITIES

Hiking, fishing, and wildlife viewing consistently emerged as the most valued and supported activities at NSRA. Management and infrastructure should prioritize these uses as they balance a mix of activity-types. While kayaking/canoeing and photography also had significant support, lower-interest activities such as boating and organized events should not be emphasized unless future demand shifts. However, CSU will need to prioritize support for activities that also align with their required management strategies for the ecosystem.

ADDRESS VISITOR CONCERNS THROUGH PROACTIVE MEASURES

Concerns about crowding, ecosystem damage, and fire danger are issues that visitors share concerns about. As a way to proactively solve these issues, a targeted approach to deliver information on how best

to mitigate these issues at NSRA may be valuable. Furthermore, CSU can lean on these concerns as a way to ensure that visitors recognize the need to balance recreation and preservation of the resource.

CONCLUSIONS

The 2025 North Slope Recreation Area Visitor Survey demonstrates that NSRA is a highly valued recreational resource that must balance multiple priorities: safeguarding water supply and ecosystem health, while providing meaningful outdoor experiences for residents and visitors alike.

Survey participants overwhelmingly support a dual mission of protection and recreation. They place high importance on objectives such as protecting wildlife, water quality, and scenic resources, while also recognizing the need for accessible, quality recreation opportunities. At the same time, visitors expressed clear expectations for the management of growth: investments in core amenities, proactive management of crowding and ecological impacts, and user-based cost recovery mechanisms.

The findings suggest a pathway forward: strengthen infrastructure around high-demand activities like hiking and fishing, improve visitor services through targeted amenities, and establish sustainable funding streams that do not burden utilities customers. Equally important, managers should adopt monitoring tools and adaptive strategies to respond to shifting recreation pressures while keeping ecosystem protection at the forefront.

In conclusion, NSRA is well-positioned to continue serving as a unique space where water protection and recreation coexist. Implementing these recommendations will help ensure that the area remains resilient, inclusive, and enjoyable for future generations—while safeguarding the vital resources upon which the City of Colorado Springs depends.

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After action report

Project: North Slope Recreation Area (NSRA) Review

Date: June 10 and June 12, 2025

Tactic: In-person public meeting and virtual public meeting

Objectives

- Introduce the NSRA recreation impact study process at a high level.
- Provide background on the NSRA and existing infrastructure and trails.
- Establish scope and process of the study.
- Obtain general feedback via Mentimeter polling tool.
- Address customer questions.
- Outline the project timeline and future engagement opportunities.

Resources

- **Mentimeter** = An engagement tool that allows meeting participants to share feedback in real time. This tool was used during both the in-person and virtual meetings.
- Meeting recording: North Slope Recreation Area Review Information Webinar
- June 10 Mentimeter results: NRSA-Survey-Responses.pdf
- June 12 Mentimeter results: NSRA_ Mentimeter_ June 12.pdf
- June 10 and 12 presentation: Presentation_ 250612.pdf
- June 12 meeting transcription: North Slope Recreation Area Review Webinar_ TRANSCRIPT.docx

Invested communities

Present

- Pikes Peak - America's Mountain
- Colorado Parks & Wildlife
- United States Forest Service
- Teller County
- Green Mountain Falls
- Trails and open space advocates
- Commercial-guided tour advocates

- Ring the Peak trail advocates
- General recreation advocates (fishing, hunting, etc.)
- Youth recreation advocates
- Environmental interests
- Wildlife advocates
- Tourism
- Residential customers and community members

Other presenters and attendees

- Otak Associates – consultant, co-presenters

Participation

- June 10 In-person Public Meeting
  - Attendees: 14 attendees, plus 2 Otak representatives, several Springs Utilities employees and Utilities Board member David Leinweber.
  - Meeting Duration: 5:30 to 7:15 p.m.
- June 12 Public Meeting
  - Attendees: 18 total – 8 attendees plus 7 Springs Utilities employees and 3 Otak representatives. 25 people pre-registered.
  - Meeting Duration: 1 hour, six minutes

What we expected

- Potential argumentative discussion based on historical discussions about increased recreational access and potential conflicts with our operational needs on both the North Slope and South Slope of Pikes Peak.
- Higher attendance at both meetings due to previous interest in the topic.
- A high volume of questions during the meetings.
- Potential technical challenges with the virtual meeting due to the introduction of Mentimeter polling feature.

What actually happened

- **Tone**: As expected, the in-person meeting was mostly dominated by recreational interests, Ring the Peak Trail advocates and commercial-guided recreation interests.

- **Engagement**: Several questions were asked toward the end of the in-person meeting and during the display board discussions after the presentation.

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  - More than one attendee asked for specific examples of conflicts between recreators and utilities operations.
  - There was concern that the Ring the Peak trail was not referenced on the maps.
  - There was concern that we had not collaborated with trail advocates and other recreational groups early in the process to assemble study data and determine criteria.
  - Multiple attendees were concerned about the attendance and felt it was a sign that we could have done more to notify interest groups.
  - One attendee suggested an additional round of public meetings during the summer.
  - One attendee felt the virtual meeting option was a waste of time if it was going to be a recap of the June 10 meeting.
  - The virtual meeting attendance was even lower than the in-person meeting, which reflected in lower overall engagement.
- There were fewer community members than expected at both meetings, but we are optimistic that the public will continue to engage with us by taking the community survey, watching the virtual meeting recording on YouTube, providing feedback via engage@csu.org and attending the next round of public meetings in October.

What went well

- Strong collaboration between Community Engagement, Public Relations, Creative Services, and technical teams.
  - Prior to the meetings, our subject matter experts vetted the meeting content for accuracy and consistency with our organization's messages.
  - Prior to the virtual meeting, several practice runs were conducted to minimize the risk for technical glitches.
- The integration of the Mentimeter polling tool went much smoother than expected and provided important insight into major themes of interest to the public.
- There were limited technical and/or network glitches during the virtual meeting.
- Overall, the presentation for both meetings was well-structured and effectively conveyed the study's purpose.

Areas for improvement

- Find ways to increase engagement across a broader range of community interests – recreation, watershed protection, environmental concerns and wildfire risk.

- At the conclusion of in-person meeting presentations, quickly disperse attendees to display board ‘stations’ for Q&A.
- Automation: Set up Power Automate for registration confirmations, reminders (7 days and 24 hours), and post-event follow-up with survey and materials.
- Platform optimization for virtual meeting: Clarify platform requirements (e.g., Teams app download) in reminders; continue to assess alternative platforms or meeting types for virtual meetings to encourage better interactivity.
- The posted virtual meeting link on the csu.org project page was incorrect and was caught after the meeting had started.
    - Pre-registered attendees did have the correct meeting link.
- Meeting dropped off csu.org events calendar at start time (6 pm), potentially limiting virtual attendance for those trying to join after 6 pm. This is a system problem that Public Affairs is working with IT to correct.

Conclusion

The events were a success at an organizational and logistics level, even if attendance was much lower than expected.

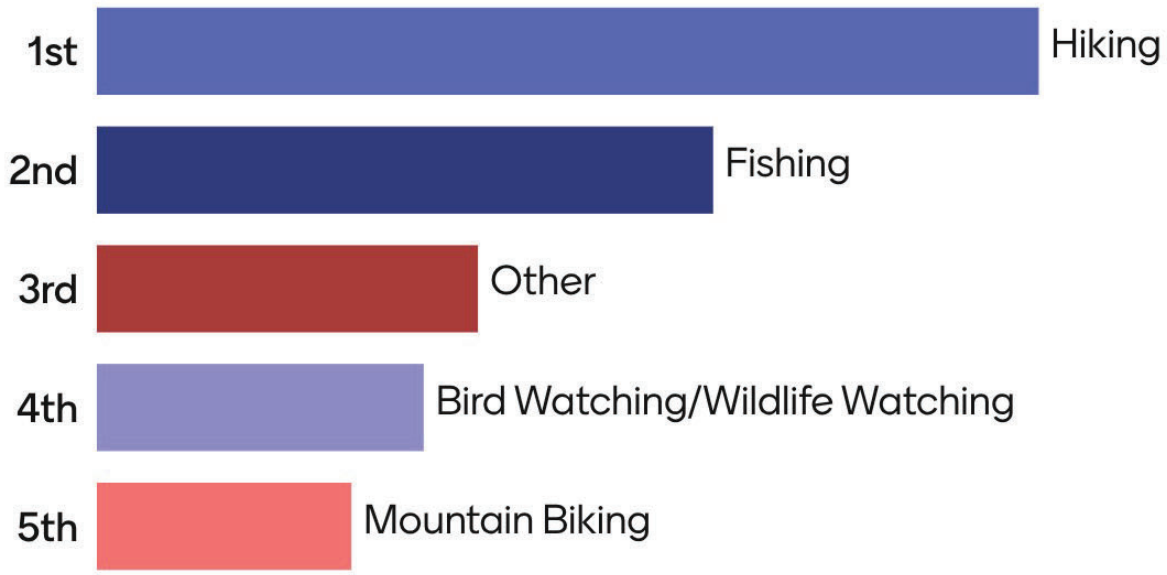
These initial meetings gave us a critical opportunity to clarify the realistic scope for the study and reiterate that our priority remains the protection of our customers’ water resources and the critical watersheds on Pikes Peak.

Action Plan

- Distribute post-meeting survey and review feedback (distributed on 6/16/2025).
- Follow up with key community interest groups to diversify and increase future engagement.
- Story scheduled for July issue of Southern Colorado Business Forum & Digest to promote survey throughout their distribution area.
- Encourage attendees to share information about community survey, project web page and future meetings.
- Monitor YouTube analytics and social media feedback.
- Respond to inquiries via engage@csu.org and 668-7765.
- Begin planning for in-person and virtual meetings in October 2025.

Mentimeter

What recreational activities do you participate in regularly?



6 13

Mentimeter

In a word or two, please tell us what you like best about the North Slope Recreation Area.

3 13

Mentimeter

Are there any additional issues, challenges, or concerns to note?

Lack of recreation opportunities

Why is there no recognition of Ring the Peak trail ?

Some connections are on Federal lands

Can you highlight some of the conflict concerns?

Continued affordability and accessibility.

There is no shelter for safety

Ring the Peak Trail segments - moving off the roads for improved experience

Quality of our water supplies Harm to the environment; Pollution; Preservation of the natural environment

11

Mentimeter

Are there any additional issues, challenges, or concerns to note?

- Parking
- Lack of guided experiences
- Seems narrow in scope. We should condider expanding opportunities. For more miles of trails. Increased rec perhaps expanded into winter. Camping?
- Connectivity of trails
- No ADA conversation
- Ring the peak?
- Trail connectivity with neighboring land owners , government and private. Emergency evacuation routes E-bike use Safe shelters
- Would like to know how Ring the Peak segment/s will be considered during this process.

11

Mentimeter

Are there any additional issues, challenges, or concerns to note?

More hiking, more rec opportunities

New trails would enhance the experience and mitigate conflicts. Win-win

Difficulty for volunteers to help in care of the area

Proving facilitated recreation for users who want a coach

Expanded recreation opportunities such as picnicking, camping, designated view opportunities

Want to see this process utilize / be informed by the data from the Outdoor Pikes Peak Initiative and input from that public process

Access for youth and underserved

Working from scarcity mindset... if good ideas let's see how we might be able to make things happen/ find solutions

11

Mentimeter

Are there any additional issues, challenges, or concerns to note?

Looking at management with enforcement capabilities should be considered

Thousands of municipalities have water resources and provide far more access. Lack of finding balance between recreation and water protection

This process should not be done in a silo but alongside other planning processes

Restrooms

This is a diverse resource that offers opportunities that are distinct in types of recreation Keep these values

11

Mentimeter

Within the goals that Colorado Springs Utilities has outlined for this project, are there any additional opportunities to explore?

- Are there increased fees to cover management costs?
- Winter access, snow shoing and cross country skiing
- Wedding pavilion with Pikes Peak view
- Non motorized boating for kayaks canoes paddleboarding
- Guided tours meets a number of the goals- safety, limits people, educator, ethics, insurance, and financial support to CSU
- Disbursed camping. Additional miles of trails.
- Recreation opportunities in winter
- Better regional trail connectivity

1 13

Mentimeter

Within the goals that Colorado Springs Utilities has outlined for this project, are there any additional opportunities to explore?

- Floating dock for safe boat launch
- Web page that has up to date conditions restrictions
- Use the professional guides as a resource to help educate users.
- More bathrooms
- This plan should be visionary. Lets see what is working elsewhere sustainably
- Connectivity of trails- loops, etc
- It's impossible to have ZERO risk. Recreation within critical infrastructure can and should be done.
- Fishing

1 13

Mentimeter

Within the goals that Colorado Springs Utilities has outlined for this project, are there any additional opportunities to explore?

- Winter recreation
- Kayak opportunities/ sups
- Group educational site for group use
- Maintain crystal reservoir at dock levels during rec season
- Better way finding
- Accessible areas
- Expanded year-round access to allow for snowshoeing and fishing.
- Habitat for beavers

1 13

Mentimeter

Within the goals that Colorado Springs Utilities has outlined for this project, are there any additional opportunities to explore?

- Dog swimming allowed
- Handicap accessiblity
- Winter rec opportunities
- Capacity concerns We don't want this beauty overrun
- Working with a larger landscape perspective and including other land managers input
- Knowing you wont do another plan for sometime, your scope is too limited and not visionary enough. Its an amazing resource. Lets use it!
- Cost recovery mechanism; ideally new programs should cover costs of additional security, maintenance, restrooms, etc.

1 13

Mentimeter

What are we missing (related to evaluation considerations)?

Trail non profit is cost effective to get people of conflicting zones

Coordinate with partners- nonprofits, other land managers, local businesses

More focus on collaborations within the community

Regional impacts, how changes fit in to the state backed Outdoor Pikes Peak Initiative

Deeper level of partnership with all organizations and businesses that are stakeholders in this process and not have so many behind stage CSU fortress walls.

Improve signage to educate users to the resource, watershed values, the bigger story of the place and its role in our water, etc

Trail realignment has always been the opinion of locals to improve the recreational experience

Capacity concerns
Strategically plan for recreation expansion in some areas but don't open the entire area for recreation. Keep this area beautiful and sustainable

6

Mentimeter

What recreational activities do you participate in regularly?

Mentimeter

In a word or two, please tell us what you like best about the North Slope Recreation Area.

Mentimeter

Are there any additional issues, challenges, or concerns to note?

Expand the seasons for more use.

Are there bighorn sheep in this area? Is there habitat being impacted? I know they are already struggling with pneumonia.

Need a route for Ring the Peak .

How will wildlife be protected?

What about fire response and mitigation

the reroute of the limber pine got put through marsh... it will never be dry.

Parking

Continue with reservations to limit over crowding..

0

Mentimeter

Are there any additional issues, challenges, or concerns to note?

I dont think the q&a is enabled

Creating sustainable outdoor recreation capacity.

0

Mentimeter

Within the goals that Colorado Springs Utilities has outlined for this project, are there any additional opportunities to be explored?

- Will Ebikes be allowed??
- winter access
- Archery practice range
- Seasonal closures of sensitive habitat areas, as needed for wildlife.
- Sustainable fishing access trails
- Have real time weather on site for wind conditions for boater safety.
- getting trail users off roads could need some new connector trails
- Additional recreation opportunities, trails connectivity within the area, and maintain the distinct recreation experiences within the NSRA.

6

Mentimeter

Within the goals that Colorado Springs Utilities has outlined for this project, are there any additional opportunities to be explored?

Ways to ensure water quality is maintained or improved.

0

Mentimeter

What are we missing (related to evaluation considerations)?

Is the dam considered infrastructure with limited access for trail users?

make sure trails are still connected if access to roads is eliminated.

Need to build new trails before eliminating use of service roads.

What is role of City of Colorado Springs Parks Department who manages some of the rec at North Slope??

When will work on South Catamount be finished and open to public??

2

Otak

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PIKES PEAK America's Mountain

North Slope Recreation Area Recreational Access Plan Public Meeting

Tuesday, June 10, 2025

5:30 pm to 7:00 pm

Welcome & Introductions

Agenda

- Welcome & Introductions
- Background Information
  - *Where is the North Slope Recreation Area?*
  - *Previous Commercial Survey*
- Current Project
  - *Project Scope and Process*
  - *Existing Conditions*
  - *Goals*
  - *Areas of Focus*
- Next Steps
  - *Virtual Public Meeting*
  - *Surveys*
  - *Further Stakeholder Engagement*

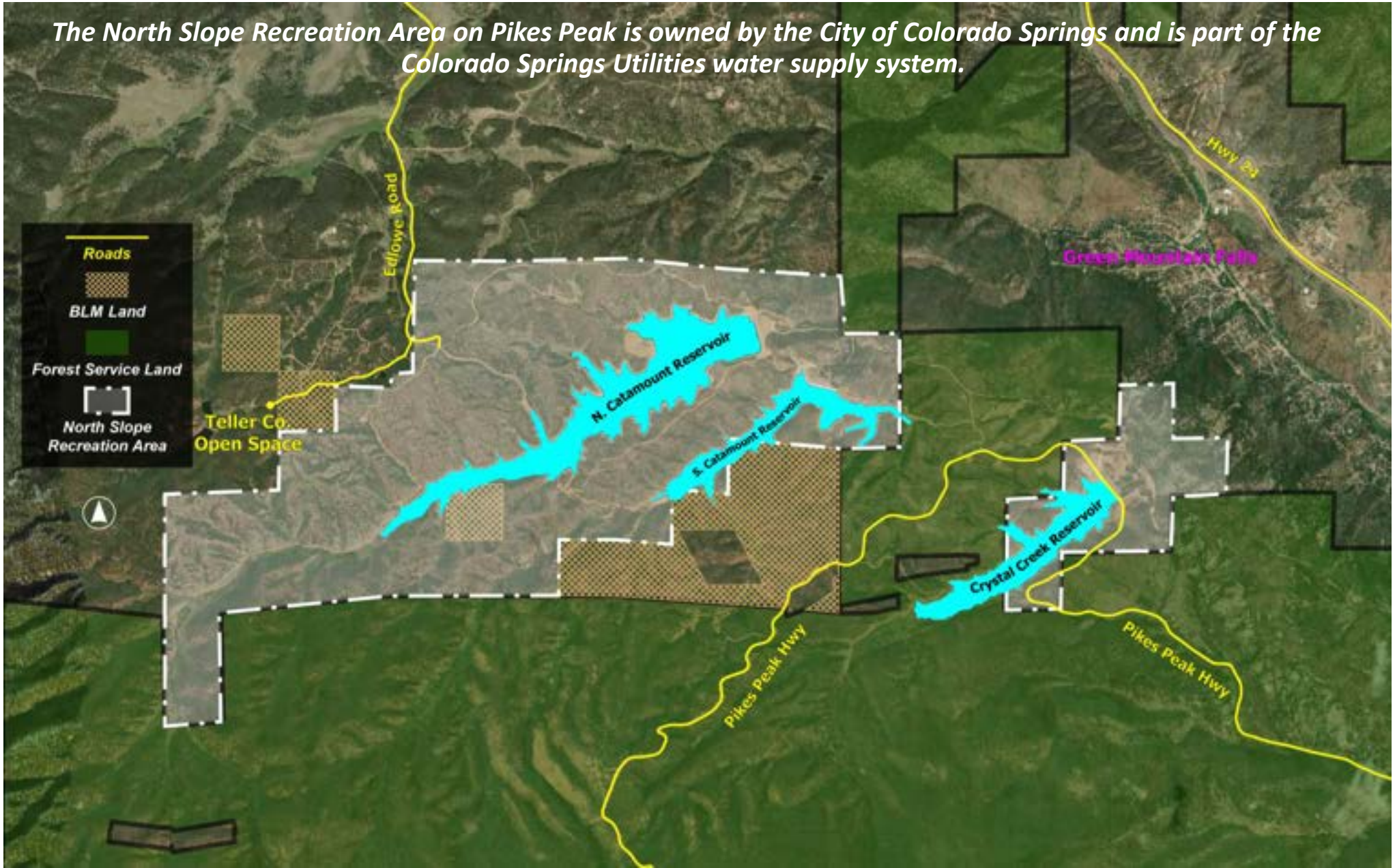
Interactive Mentimeter Question

What recreational activity do you participate in regularly?

JOIN AT MENTI.COM | 6712 8434

Background Information

North Slope Recreation Area



Interactive Mentimeter Question

What do you like best about the North Slope Recreation Area? (in a word or two)

JOIN AT MENTI.COM | 6712 8434

Previous North Slope Review (2023)

- Gathered feedback on commercially guided tours and the potential effects on Colorado Springs Utilities' managed watershed lands
- Surveys sent to Colorado Springs Utilities' customers and recreational users of the NSRA
- Included review of benchmark programs from experienced agencies
- Researched best management practices to consider for sustainable program implementation

Key Findings

The public values the North Slope Recreation Area for its watershed and recreational uses.

Opinion is split about whether commercially guided activities affect the quality of the general public's experience or should be allowed.

If commercially guided activities are permitted, the public wants the process to be managed fairly and for the outfitters to help with staffing costs, litter cleanup, stewardship education, and other amenities.

The issue deserves appropriate consideration within the context of existing recreation, as a policy decision.

North Slope Recreation Area Recreational Access Plan

Goals

- Enhance security measures and strengthen infrastructure protection to safeguard critical drinking water assets.
- Develop and enforce clear rules, regulations, and procedures to ensure the safety of the public, staff, and infrastructure.
- Support public access and recreational activities that align with Colorado Springs Utilities' core operations and are financially and environmentally sustainable.
- Ensure adequate resource allocation for the sustainable management of the North Slope Recreation Area (NSRA), now and in the future.

Scope

- Analyze current public access and recreation activities in the North Slope Recreation Area (NSRA).
- Assess existing trails and access points for improvement opportunities.
- Recommend enhancements that prioritize infrastructure protection and security, public safety, and sustainability.
- Develop alternatives that reduce impacts on existing operations, drinking water sources, natural resources, and visitor experience.

Process

Summer/Fall/Winter 2024

Data Collection and Analysis

- Initiate Project
- Technical Team
- Existing Conditions Analysis
- Desired Futures

Winter/Spring/Summer 2024-2025

Develop and Analyze Access Alternatives

- Stakeholder Engagement
- Field Work
- Develop Alternatives
- Evaluate Alternatives

Fall/Winter 2025-2026

Draft Report

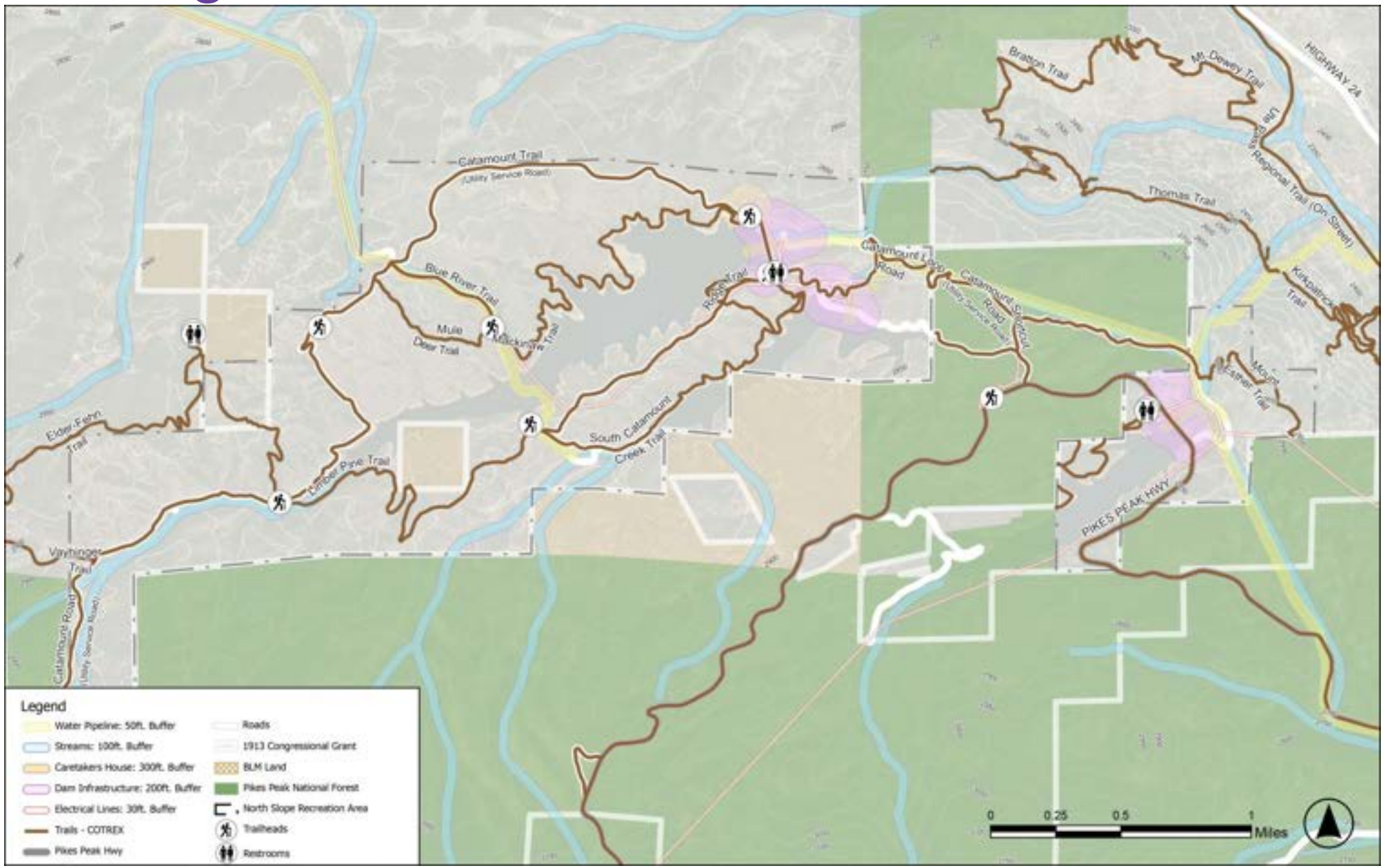
- Preliminary Draft Recommendations
- Review & Coordination
- Refined Draft Recommendations

Spring/Summer 2026

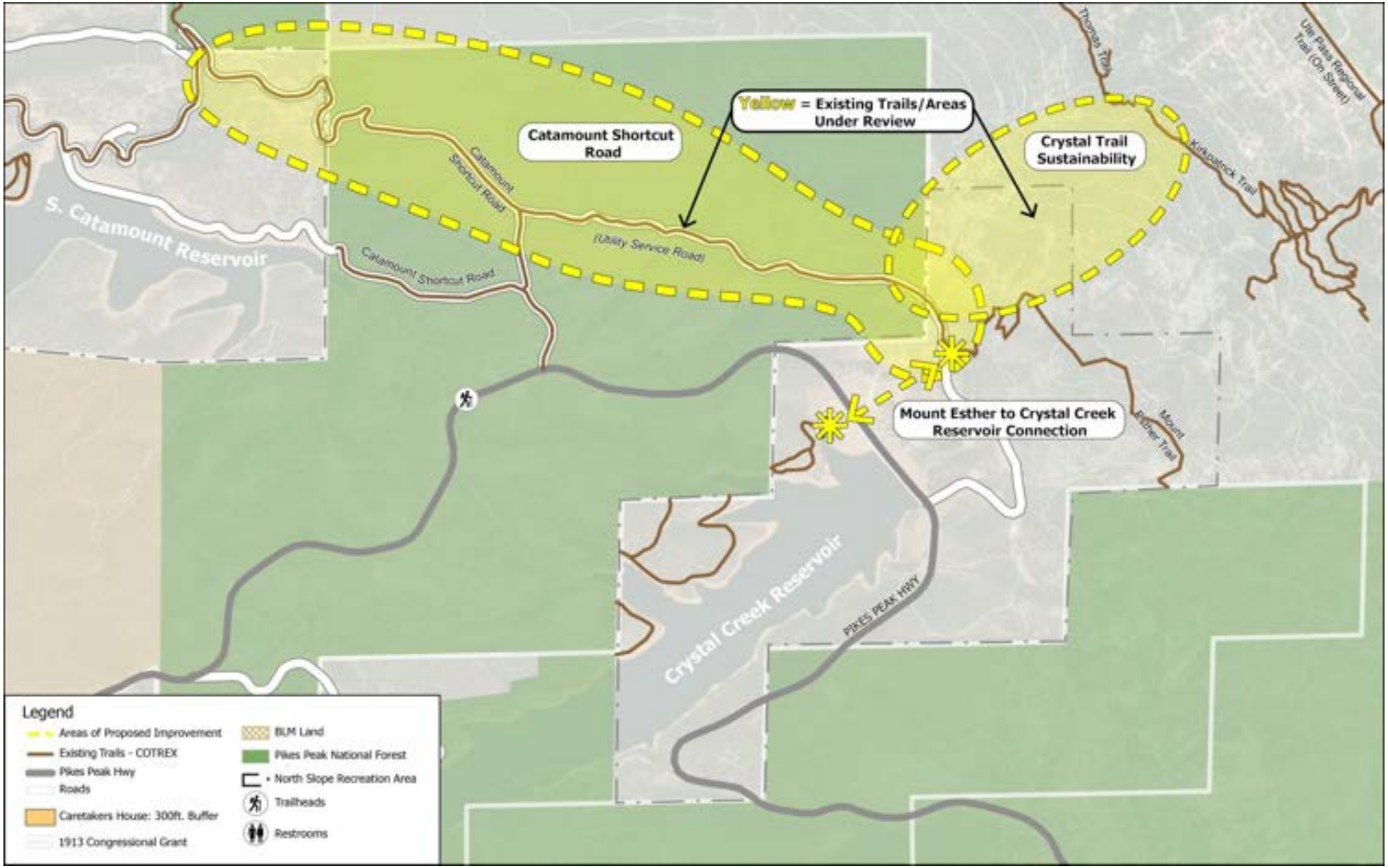
Final Report

- Final Recommendations
- Launch Implementation & Ongoing Coordination Efforts

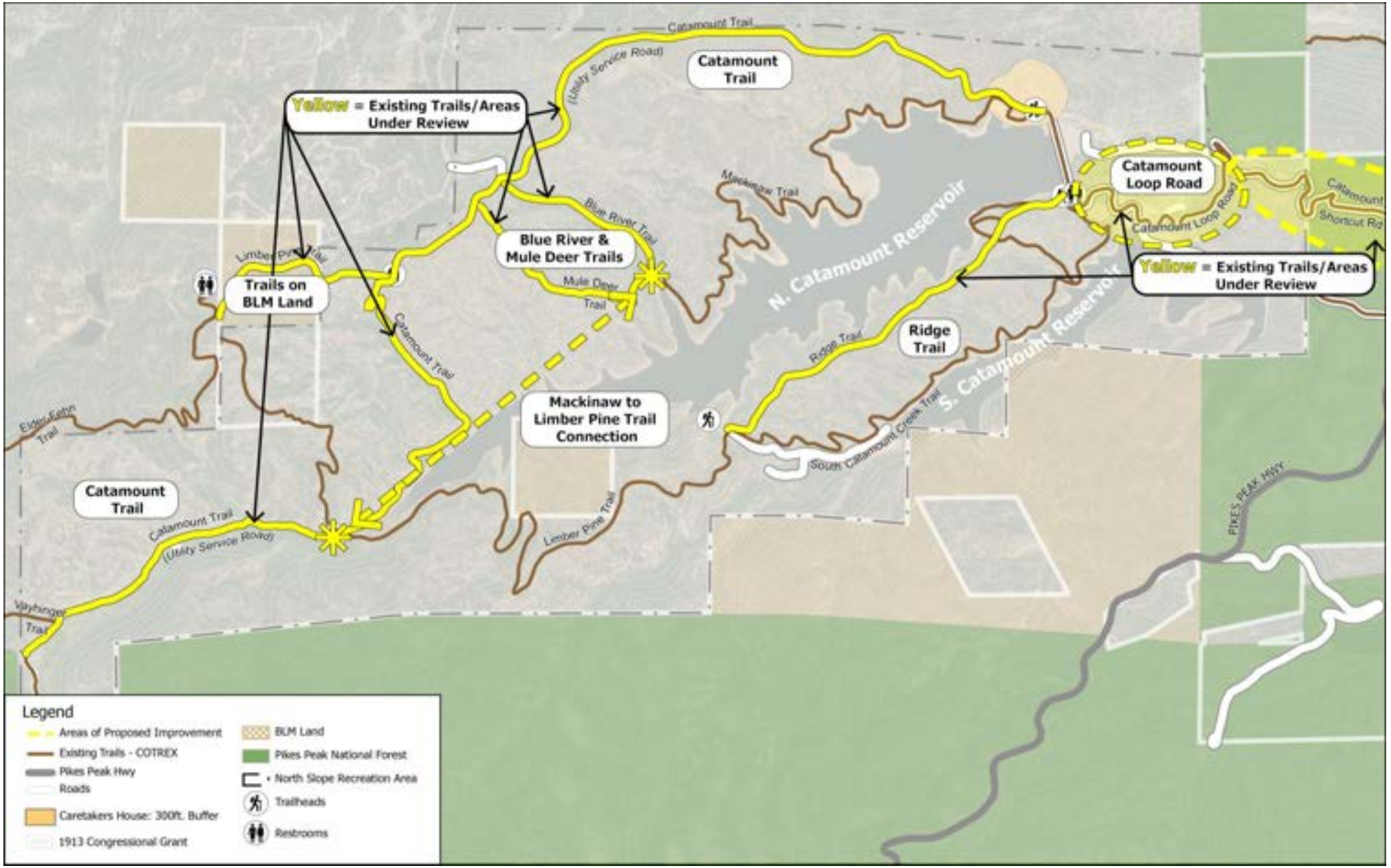
Existing Conditions Overview



Areas of Focus - Crystal



Areas of Focus - Catamounts



Interactive Mentimeter Question

Are there any additional issues, challenges, or concerns to note?

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Interactive Mentimeter Question

Within the goals that Colorado Springs Utilities has outlined for this project, are there any additional opportunities to explore?

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DRAFT Evaluation Considerations

- Potential for relocation of trails off service roads
- Potential to move trails away from utility infrastructure
- Potential to improve or avoid areas with existing conflicts
- Consider necessary partner coordination and permitting
- Opportunity for improved or additional recreation access
- Opportunity for improved trail sustainability and maintenance
- Estimated cost

Interactive Mentimeter Question

What are we missing?
(related to evaluation considerations)

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Next Steps

Upcoming Dates & Events

- Virtual Public Meeting: Thursday, June 12, 2025
- Recreation Survey: Spring 2025 – Summer 2025
    - Link: CSUrec.org/online
- Further Stakeholder Engagement/Involvement
    - Next In Person and Virtual Public Meetings – October 2025
    - Visit website for further information
        - Link: csu.org/NSRAreview
        - Phone #: 719-668-7765
        - Email: engage@csu.org

Questions?

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North Slope Recreation Area virtual public meeting transcript

June 12, 2025, 11:51PM

Lisa Walters 8:59

Welcome and thank you for joining our public meeting for the North Slope Recreation Area recreational access public planning process.

This meeting is scheduled from 6:00 PM to 7:00 PM and we'll have a short presentation and opportunities to ask questions to our panel.

This meeting is being recorded and materials from this meeting and previous meetings will be posted to CSU org/Nsra review.

This will be posted into our Q&A, so keep track of our website links and e-mail addresses and other information there.

If you have questions for our team, please enter it into the Q&A. If you are having connectivity issues, please notify us either in Q&A or e-mail us at engage at CSU org.

We have moderators to help. Your questions are all be reviewed and answered as time allows. The questions and answers will also be recorded and shared to our web page at a later time.

Again, that is at CSU org slash nsrareviewcsu.org/nsra review.

We'll be using a mentimeter program within the presentation, so have your cell phone or web browser handy to put in your answers.

We are putting this link in access code into the QA section now. You want to go to menti.com. And enter the code to participate.

We will repeat this for you within the presentation.

Lisa Walters 11:44

All right.

So again, I would like to welcome you to this public meeting.

Will we be able introducing you to the North Slope Recreation area, recreational access planning process and receiving your initial thoughts and questions?

I am Lisa Walters, project manager with Colorado Springs Utilities, and I would like to introduce our two speakers for today. Otak associates representatives Mandi Roberts.

Mandi Roberts 12:13
Hello everyone.

Lisa Walters 12:13
And Kelsey Blaho.

Thank you everybody for coming again with utilities.

Wanted to just describe that we've had a lot of interest in the North Slope Recreation Area currently working on a S Catamount construction project to enhance the safety of our dam and construction project associated with that that has.

Impacted our recreation area and you know, delayed access to that reservoir for a couple years now.

So, this became a popular time, a great time for us to review our existing watershed access. And recreation access for the North Slope Recreation area.

So, I'll go ahead and let Mandi take it off.

Mandi Roberts 13:24
Thank you. Good evening everyone.

As Lisa mentioned, I'm Mandy Roberts with OTEC and our firm does consulting around recreation, planning and natural resource areas.

I'm a principal planner and analyst with our firm.

We've done a lot of work with land managers and agencies around the West and throughout the country. So, we're excited to be working with Colorado Springs Utilities and partners.

And working with all of you. So tonight, we're going to give you a little bit of background information about the North Slope Recreation area and some previous work that's that has been done.
And then we'll talk about our current study project, the scope and the process and some of the existing conditions in the study area.

And we will cover our goals for the study as well as some areas of focus that will be focused on.

In our study work and then we'll close out the evening with just a reminder of next steps.

So, with that, I think we can go to the next slide.

So as Lisa mentioned, we're using this online program. It's called Mentimeter and it's a way for people to give us input immediately and also to see the input of others on screen. So, if you'd like to participate this way, you can go to your phone.

Smartphone or to another web browser screen on your laptop or desktop and go to menti MENTI com and it will ask you for this code 67828434.

And we're just doing a little test here to see if people are going to participate this way.

So, if you would like to answer this question, what recreational activity do you participate in regularly?

Thoroughly. I'm going to go over to the mentee screen and we'll see if we have some answers. So, hold on tight here.

You want to toggle on the screen.

Kelsey Blaho 15:36
There we go.

Mandi Roberts 15:42
OK, we've got a few answers, so that's great.

3 responses so far.

So, our program is working.

That's excellent.

So, we'll go back to the presentation.

Kelsey, if you want to share your screen.
Hiking is by far the most popular recreation activity.
Alright, we go to the next slide.
And Lisa, we turn it back over to you to provide some background information.

Kelsey Blaho 16:17
Actually, I'll background a little bit and then Lisa will help.

Kelsey Blaho 16:25

So, the map you see now outlines in those areas in white, there are the North Slope Recreation area that we'll be focused on for.
This analysis, this effort that we're talking about here this evening.

So, the North Slope recreation areas on Pikes Peak, owned by the City of Colorado Springs and part of the Colorado Springs Utilities water.

Water supply system.
It's about a little over 2600 acres and includes forested watershed land and includes contains the three reservoirs that you can see kind of in teal there on the screen, the Crystal Creek Reservoir, South cat and N Cat reservoirs.

There's recreational access in the area from May through October, and that includes mostly fishing, non-motorized biking and non-motorized boating and biking.

Hiking and picnicking. And then there is vehicular access off of the Pikes Peak Highway.

Lisa Walters 17:25
Yep, great.
Great points.

Long term water supply for us here at Colorado Springs Reservoirs, Crystal Creek and S Catamount were built in the 1930s and N Catamount was built later in the 60s, so been around for a long time.

Kelsey Blaho 17:44
Yeah.
And now we have another millimeter question.

Mandi Roberts 17:48
Oh, good. OK, I that's right.

I apologize.

So, we're going to go for those of you who have already logged into mentimeter. Great. If you haven't and want to participate, just go to mentee. Com 67128434 is the code.

And I'll share my quick my screen to see if we have any answers about what do you like best about the North Slope Recreation area in a word or two.

And I also want to let you know if you don't have access to menti or you don't want to participate. That way you can just put your answers in the Q&A and they'll be published there about what you like best about the North Slope Recreation area.

So let me share my screen and see the answers that we have so far.

Lisa Walters 18:56
Yeah, clicking the screens to share.

Kelsey Blaho 18:57
Too many screens. Too many, yeah.

Mandi Roberts 18:59
Too many screens, and I'm gonna go.

Kelsey Blaho 19:01
All the tabs.

Mandi Roberts 19:02
I'm in preset mode and I need to go to the next question.

Here we go. My apologies.
OK.

Anybody put any words in about a word or two? Please tell us what you like best about N slope.

And maybe people decided to just use the Q&A.

Lisa Walters 19:32
Look at that.

Mandi Roberts 19:37
'Cause I'm not seeing any words come up that's interesting.

Oh, wait, here we go. Give it a minute.

Lisa Walters 19:44
Mm hmm.

Mandi Roberts 19:46
Excellent.

Kelsey Blaho 19:48
Think solitude. Just a good one.

Mandi Roberts 19:48
And by the way, you can enter as many words in different responses as you'd like. Excellent. That's great.

Lisa Walters 20:08
Natural feel.
Quite nice.
Quiet solitude.

Mandi Roberts 20:14
Clean. That's great.
All right.
Thank you.

And again, if you'd rather just put your responses into the Q&A, we'll capture them that way. But we appreciate your input.

Kelsey Blaho 20:32
Kind of fun to see him come up this way.

Mandi Roberts 20:35
Mm hmm.
Most definitely.
All right. Well, shall we move on to our through the presentation?

Kelsey Blaho 20:47
Oh.

Lisa Walters 20:59
So, with looking at the recreation and access for North Slope Recreation Area, we actually started a smaller look at commercial guided recreation.

We wanted to know more about this program because we hadn't had a formalized process to address commercial guided tours or or guided recreation on the North Slope Recreation area.

So, we wanted just to collect background information on the potential effects on utilities managed watershed lands.

So, one of the tactics that we did was first initially just to go out and get some surveys that were sent to not only utilities customers, but additional recreation users of the North Slope Recreation area. We wanted to get ourselves introduced to this type of user. We wanted to

know things like how is their experience, what type of activities do they normally see? And then if the commercial guided recreation had any impact on their daily visit or their visit to the North Slope Recreation area?

We did interview and talk with agencies that are well experienced in commercialized recreation and so, for example, we talked with the Forest Service with Colorado Parks and Wildlife.

And even another utility, Denver water, to get an idea of how they manage commercialized recreation and what impacts or tricks of the trade or best management practices were really going to be helpful for a commercial recreation program.

One of the other things that we were able to do was just go out and research these best management practices to consider on how to make a successful program.

From implementation, this was a program our commercialized recreation again hasn't been formally authorized for the North Slope. So, this was a project just to find out more information and what we found out. Kelsey, if you'd go to the next slide, here's the key findings that we had for.

This process, you know, obviously the public definitely values the North Slope Recreation area.

It's watershed, the water, the water resources.

The reservoirs in addition to the existing recreational uses to go out and picnic to bike and hike and.

Do some boating and do some fishing out on the reservoirs.

So it was the opinion that the opinion is split about whether or not commercial guided activities affect the quality of a general public users experience, or even if it should be allowed if.

The commercially guided activities were permitted. The public wants a process to be managed not only fairly.

But to figure out how we can get additional help with staffing costs, litter cleanup, doing stewardship education, or look at other amenities and offerings there.

Final key finding was that this needed a little bit more study within the context of a comprehensive use and policy review.

So, this is something that right now we haven't decided if this will be utilized for the North Slope Recreation area. We wanted to let our Utilities Board and our City Council have more information and make a good case decision with this. But we're wrapping this question up along with our N slope Recreational access plan. And want to pair these projects together. While we're doing this. I'm just going to take a quick check and see if there's any questions that have popped up.
OK.
I think we're good.

Kelsey Blaho 25:21
OK.

Mandi Roberts 25:23
OK, we will carry forward. Then. I'm going to go over some aspects of our current study effort.

Then we are in the early stages of our study work and pull pulling together the plan for the recreation area and these are some of the goals that we formulated to guide our work so.

You know one thing to just note is.

The area is growing.

Colorado's growing Colorado Springs is growing the West is growing and it's putting a lot more demand on our recreation lands and this includes the North Slope Recreation Area. So as we think about this plan, it's a great opportunity to really think long term about how we want to manage the recreation access and use of this area while also enhancing security measures and strengthening protect.

Ton of infrastructure, which is really critical.

For drinking water and the drinking water that a lot of folks enjoy every day that live in Colorado Springs and surrounding areas, we also want to make sure that the public is safe and secure in their use of these of these lands.

So we want to develop and enforce clear rules, regulations and procedures to ensure safety of the public as well as.

The staff who manage Colorado Springs utilities infrastructure. And uses in that area.

We want to continue to support public access and recreation activities that also align with Colorado Springs Utilities core operations and that are financially and environmentally sustainable over the long term.

And then we want to ensure that that there's adequate resource allocation for sustainable management of the North Slope Recreation Area for now and in the future. And what we mean by that is we want to make sure that we have the staff and resources available to take care of recreation in a sufficient way so that people can continue to use these areas safely. So, we really want to be realistic about what we implement and make sure that we're providing A level of service in REC.

That that can be managed over the long term effectively. OK. Next slide. Our scope really calls for analyzing the current public access and recreation activities.

That are happening in the recreation area, assessing existing trails and access points and as we look at those existing trailheads and access points to determine if there are potential opportunities for improvements and that could include things like formalizing parking areas, expanding parking could be providing wayfinding, providing more public education and other types of improvements.

We want to recommend enhancements that prioritize infrastructure protection and security, public safety and sustainability. So in alignment with the goals that I just mentioned and then develop alternatives that reduce impacts on existing operations, drinking water resources, natural resources and visitor experience.

So we want to continue to provide recreation access and enhance visitor experience but also protect the infrastructure and operations that are key to preserving the drinking water sources and the natural resources and wildlife of the area.

OK. Next slide.
Here's our process.

So, we started late last year in data collection and analysis. We are continuing to collect data and information to inform the study process. And as we are working now towards the summer, we'll be developing and analyzing potential alternatives.

For access and improvements and then we'll be bringing those back out to the public in the fall of this year.

So, we'll have another public meeting and another online meeting and between now and the fall, we'll have a lot of opportunities for public input. We have an online survey, for example, that we'll talk about at the end of this presentation.

But that's a great way for everyone to have input.

And then there'll be various events throughout the summer that people can learn about the project and provide input.

As well as through the website that was placed in Q&A. So you can follow the project and continue to provide input that way as well.

And then by later this fall and into the winter, we'll be providing a draft report with preliminary draft recommendations that will go through review. It'll go through public review and then we will have final recommendations and launch implementation and coordinate with partners.

There are other Land Management entities besides Colorado Springs Utilities. So we'll be working with them as well throughout our process and then publishing our final report and going into implementation next year. So next slide.

Kelsey Blaho 30:40
OK. And then looking starting to kind of zoom in a little bit more about what were the data we're gathering, what we're looking at, how we're progressing with that, the map on your screen now is giving?

Just kind of a general overview of some existing conditions that are in the North Slope Rec area, mostly focused on utilities, infrastructure and existing trails as the recreation access is going through the area currently.

Have a lot of functional areas on here that are highlighted where they're operational areas for utilities management. As Mandi was talking about the management of the watershed and the various activities that utilities undertake in the area there, areas where there's then conflict between utilities operations and recreational us.

Because of how some of those trails are being used. They're overlapping in a lot of areas with roads that were that are utility access roads that were originally routed and designed for that purpose. So, they're taking people to places that are sensitive for management reasons with utilities operations, but also, they're just not the areas that you really want to be in as a recreational user.

Not necessarily focusing on some of those areas that are a little bit more pleasant, a little more enjoyable to access as a recreational user.

Lisa Walters 32:01
OK.

Kelsey Blaho 32:02
So, I wanted to look at those areas, see where we can improve conditions to create a safer experience for recreational users, remove some of those conflict points.

Make it easier for staff to do their jobs, make it easier for visitors to stay safe, and then also provide a better recreational experience for recreational users in the area if they have nicer trails, nicer places to hang out, nicer amenities, look for those sorts of opportunities.

Lisa Walters 32:30
Yeah. Thank you, Kelsey.

I just also wanted to point out that there's a lot of different color swatches on this map as well and where we have the utilities managed properties that's owned by the City of Colorado Springs. We also have our neighbors. We have federal partners that we must consider with our in our planning processes as well. the US Forest Service and Bureau of Land Management parcels that are kind of tucked in and right nearby our planning area.

Also, other communities and trailhead access points. So, we have a Green Mountain Falls and the Highway 24 corridor, but also Teller County Teller County open space access points as well.

Kelsey Blaho 33:22
Continue zooming in a little bit more, so this kind of focused area on the Crystal Creek Reservoir kind of vicinity. As Mandi mentioned, we're early in some of our planning process.

We've where we've kind of started is looking at areas to focus on areas that are under review, to look at the conditions, look at various things that are happening in those areas. That's what those yellow bubbles on this map are highlighting.

So, you have a big yellow bubble around the Crystal Trail sustainability area -- looking at how the sustainability of those trails can be managed, Mandi talked a little bit about wanting to create facilities that are sustainable from a financial perspective as well as maintenance and operations and user experience.

There's also a connection between the amount of Sur Trail and the Crystal Creek Reservoir and some of the gift shop and some of the amenities that are existing in that area. And then the Catamount Shortcut Rd. is bubbled there in yellow as well. That's another one of those roads where you have sets of roads that are functioning as utilities, their utilities, service roads.
But they're also functioning as hiking and trail access, which leads to those safety concerns. Conflict points between vehicles and pedestrians. Recreational users and people doing their jobs.

This leads to some of those issues that we'd like to improve conditions for.

Then move a little bit further W into the Catamounts area. The trails and areas around the North and South Catamount Reservoir, so a lot of those areas, the trails highlighted in yellow. There are other examples of those roads where those areas where it's a utilities service road that also function as hiking and trail access. So we remove those points of conflict.

Look at how that's functioning so we can again get people off the roads, get them a little bit safer, better experience when you're recreating when they're recreating out in that area.

And then there's also some bubbles there over towards be the right side of your screen or right side of the map with the Catamount Loop Rd. Same condition with service road conflicts with trail access.

Ridge Trail and then looking at a better connection or another connection between the existing Mackinaw Trail and the Limber Pine Trail that does not involve those service roads and those sensitive or unsafe areas for people to be in.

Lisa Walters 36:09
Yeah. So, I just wanted to, you know, looking at this screen, just remind folks that these are considerations that we're looking at to again, you know take people off of utility service roads in this conflict, conflict points and put them on to better manage trail systems. So there.

Kelsey Blaho 36:10
I think that's all.

Lisa Walters 36:27
A lot of opportunity to maintain our recreational access, just giving them a better experience. For this project and I, I think that this will be a good goal for all of us and including here at utilities, is to continue to support recreation.

But just to, you know, provide a better experience and a better method of recreating on our property.

Kelsey Blaho 36:56
Absolutely. And now a couple more mentimeter questions.

Mandi Roberts 37:02
Great. I also just wanted to mention that I think we had a question the other night about the ring, the peak Trail and that is part of what will also be evaluating is how that access way continues through so. Don't worry, it's on the table. We're looking at that, OK.

So yeah, let's go to share mentimeter screen.

Same if I notice we had maybe a couple people join us. So, if you want to participate with some answers through mentee. You just go to menti com on your smartphone or on your web browser and then it'll ask you for this code 67128434.
And we'll go there and see if anyone's put some input in.

So. Here we are. You want to toggle on the screen. The question, by the way is are there any or are you seeing the screen?

Kelsey Blaho 38:03
No, it's not shared yet.

Mandi Roberts 38:04
OK.
Hold on. Let me go back. My apologies.
Share screen.

Lisa Walters 38:11
Yeah. We just want to make sure that everybody knows the URL and the code to get in.

Kelsey Blaho 38:14
The question and yeah.

Kelsey Blaho 38:17
Can be thinking about your answers. OK, there we go.

Mandi Roberts 38:22
We go, OK and just a reminder that if you are having trouble getting into menti or you don't want to use it totally fine, you can just put responses in the queue and a window and that will be part of our project record as well.
Thank you.

We'll give you a few more minutes if you guys want to ask any other questions.

There's a couple of good questions on here and I'm wondering we may need to take these back to our wildlife experts and put together some responses because we are going to be responding to questions online. Just so you know.

But we are being mindful of, you know, sensitive wildlife habitat areas, buffers around creeks, wetlands, things like that.
As far as our planning work.

Kelsey Blaho 39:36
As Lisa mentioned, we also have project partners from other agencies who will help look at some of those things.

Mandi Roberts 39:48
Yeah, great input so far. And by the way, you can put multiple responses in if you'd like.
Do we have any responses coming in through Q&A?

Lisa Walters 40:01
I don't see any in Q&A.

Mandi Roberts 40:04
OK. Oh, I don't want to rush the process, but it looks like we're kind of going to pause for input here, so we'll go to our next question. Oh, I was.

I need to stay on. Yeah, hold on.

Kelsey Blaho 40:17
It's another, yeah, another mentimeter.

Mandi Roberts 40:29
Sorry, I'm just having all kinds of issues here, OK?
Can you guys let me know if we need to respond to any questions that are in?
QA. OK, we got smart input since I went away.

All right. So, thank you. Some of the. So just to let me know in case you're not on menti some of the additional issues, challenges and concerns people have noted or wildlife protection.

Fire response and mitigation, which definitely will be part of our consideration emergency access. There's a comment to continue with reservations to limit overcrowding. There's also a comment to expand the seasons for more use.

So actually those two things could go together if there was expanded shoulder season use, for example, parking is identified as an issue challenge concern that there's a note here about need a route for ring the peak.

And then this one comment says the reroute of limber pine got put through March. It will never be dry.
And someone just said, oh, we better check this. I don't think that Q&A is enabled.
So, let's have our moderators check in on that. And then I'm going to go to the next slide.

All right. So, we wanted to give you an opportunity to give us some input on opportunities. Remembering the goals that we talked about earlier about, you know, realistic manageable, sustainable ideas for enhancing recreation and access.

We're really interested to know your thoughts about some additional opportunities that should be explored through this study.
Process, so feel free to either put notes here in mentee.com or to use Q&A.

Lisa Walters 43:13
Yeah, it looks like we do have Q&A working, so should be able to put in your comments. If you're not using mentimeter, it's awesome because, we can see it live. But if yeah, if there's any questions or any comments to put in Q and A, it does look like it's working.

Mandi Roberts 43:37
So, a couple ideas. Or questions winter access. We've heard that a few times.
Question about E bikes if they'll be allowed. That can be kind of challenging to manage on trails, as I'm sure everyone's aware.

Archery practice range is an idea somebody mentioned. Seasonal closures of sensitive habitat areas as needed for wildlife.
Great comment there.

We'll give it a few more minutes because I know sometimes people need time to think and we have plenty of time.
So just give it another couple minutes.

Let us know if there's anything in Q&A to relay verbally.

Lisa Walters 44:40
I have something for you. Just taking a look.

Mandi Roberts 44:44
Yeah.

Lisa Walters 44:48
Just making sure that there is a question that wasn't related to the additional opportunities, but I guess it's road paving for erosion control. Will that be considered? Will water contact be allowed for people or dogs? Was another question that was asked.

Mandi Roberts 45:08
Mm hmm.
Yeah. And I don't think we know specific answers yet, but what we're trying to do is really gather ideas and questions and make sure that we do address these through the study process one way or another, so.

Lisa Walters 45:26
Real time.

Mandi Roberts 45:26
Follow along with us.
Yeah, go ahead. Sorry.

Lisa Walters 45:29
Yeah, I was just saying real time weather on site for wind conditions.

Mandi Roberts 45:33

That's a great idea.

Kelsey Blaho 45:34
That's a good idea.

Mandi Roberts 45:37
Sustainable fishing access trails. Oh yeah. Great.

This is really at the heart of some of what we're thinking about South getting trail users off roads, which we really think could be beneficial from a safety perspective, but that that would need some new connector trails, which of course we know and we are starting to study some potential routes for those. So great input there.

Additional recreation opportunities. Trail connectivity within the area and then maintain the distinct recreation experience.
That are there in the north-south for recreation area. So that's great. Thank you so much.

Well, I think we will slowly move on then. To the to the slide presentation, Kelsey, if you go on share that again.

Mandi Roberts 46:47
All right. So, as we go through this study and planning process, we want to be thinking about important considerations and how we'll evaluate potential solutions.

So, some of the ideas that were just mentioned can fit into this mix. But so far some of the things we've identified for evaluation as part of our planning and alternatives would be the potential for relocation of trails off service roads, the potential to move trails away from utility infrastructure and the potential to improve or avoid areas with existing conflicts.

Considering necessary partner coordination and permitting, so we are working with other Land Management agencies in the area.
We're considering their permitting procedures, for example.

On federal lands managed by the Forest Service, if we make a lot of changes or introduce new improvements, that would typically need to go through an environmental review process like an environmental assessment or environmental impact statement, and that can be a lengthy process. So again, you know, we're not saying that that can't happen, but if that is a potential pathway for the future, just being aware that it will take time.

And then implementation might occur in phases over time, depending on the permitting pathways and the costs associated with certain improvements. Another couple of evaluation considerations, the opportunity for improved or additional recreation access opportunity for improved trail sustainability and maintenance and then of course estimated costs.

Well, we've got some new posts.

I was just going to see if there's anything to be added. I think we got that covered. So, we'll go with one final mentimeter question and we'll get to that now. But regarding the evaluation considerations I just mentioned, can anybody think of anything else that they want to be sure we need to cover?

Mandi Roberts 49:39
So, are we missing anything? Is there something else we need to be aware of?

I sure appreciate a lot of the wildlife comments that we've received, so we are definitely thinking about that and probably need to make sure we explicitly reference that in our evaluation considerations. But are there other things?

Other folks want to offer here or any just kind of off the cuff comments that are important to you that you want to make sure we're considering in the study process.

Kelsey Blaho 50:20
We will be developing alternatives looking at different options next.

So, these evaluation considerations then will help us as we start to develop those to kind of vet those and kind of have a lens to look through as we evaluate and kind of look at what works, what doesn't, what accomplishes the goals and how that could be done.

Mandi Roberts 50:52
Is the dam considered infrastructure with limited access for trail users?
I don't know, Lisa, if you want to address that. Just here live, it might be good to touch on that.

Lisa Walters 51:07
Yeah.

Mandi Roberts 51:07
It is considered infrastructure.

Lisa Walters 51:10
Absolutely it is. It's one of our biggest ones. It's one of the holding all the water. There are components of the dam that, you know, are critical infrastructure components, but there is a way to, you know, can safely convey users or visitors through. One big example is the location of Crystal Creek Reservoir and the Pikes Peak Highway. So that's vehicle access that goes across that top of that dam. It was considered a part of that highway alignment.

It's one of those big pieces that we're considering, you know, maintaining the vehicle access through there, but it is a challenge to try and get people and cars through that section. So, how can we improve, move or modify that type of foot access or bicycle access when we have vehicles in the same spot.

There are other locations. The other two dam areas where we recognize that to form a good route or to provide that looping experience may need to consider utilizing the dam to get from point A to point B. So that is something that we are looking at and want to figure out the ways to make it safer, reduce the conflict with vehicles coming up to a pedestrian or to a biker.

We want to make it a safe situation as well while protecting our infrastructure.

So there are some things that again we're looking forward to working with Otak to help us find those solutions. So that's a great question to consider as we move forward.

Mandi Roberts 53:07
Yeah. And again, another comment about just making sure that the trails are still connected if access to certain road segments is eliminated. And that's definitely a big part of our study that we'll be focusing on.

Anything else before we close out, Mentimeter or Q&A on this question?

Lisa Walters 53:33
Yeah.
I did get a question here and I think I will go ahead and share it just to like say that we're wanting to share this type of information and we may not have all the answers.

There was a question asked related to ring the peak. Very specific too. It asks what's the proposed route for Ring the Peak?
To connect from Mount Esther the Crow Gulch area. Again, you have to be really familiar with this location and know where these are, but that's for service trail 754 through the North Slope to Forest Service 385.

That is a great question. You know, we're trying to reduce that conflict, get people off of service roads, find those alternative trail route systems. This will accomplish two goals. It'll help with utilities goal and protecting our infrastructure, reduce that conflict. But then there would be a path that we could designate and identify as a trail system for Ring the Peak.

This is part of the process and we're glad to be at the table for Ring the Peak discussions and. Understand that it does require us to work with all of the land managers who are impacted by that system. But we're willing to be at the table and talk these things through and find some of those alternatives.

Mandi Roberts 55:16
Ready.
Any other questions coming through?

Lisa Walters 55:28
Might be a little slow.

Mandi Roberts 55:37
Now is the time for any other questions.

Lisa Walters 55:51
I found another one. Our moderators looking at one question. Since we talked about it. But the question is, will we consider permitting for guided recreation?

And that is a good question, because our job at the first part of this study in 2023 was just to gather information and understand what commercial guided recreation could mean on North Slope Recreation area. This is going to be discussed and provided to the Utilities Board and City Council for consideration.

And as we're working through our planning process for this recreational and access plan is to bundle those two pieces together and provide it to the Utilities Board altogether. So, it will be considered and looked at.

Mandi Roberts 57:18
OK. Well, we can give it another minute or two if there's any other questions folks want to ask through the Q and A. Not seeing anything else coming through.

Kelsey Blaho 58:01
Move on to our next steps and continue to put anything in the Q&A if it comes to you later.

Lisa Walters 58:05
Absolutely. And of course, we have our engage@csu.org where anyone at anytime can submit questions or ask for feedback to that e-mail address, and we will be able to communicate with you.

Mandi Roberts 58:28
So just a reminder, I mentioned this earlier, but we do have an online survey and it asks a few more questions in addition to those that we asked this evening.

So, we would love to get everyone's input on that. You can access the survey at CSU REC CSU rec org online. That's a direct link to the survey. So please share that around with folks that you know and please give us your input through that survey.

In October, we'll have another in person public meeting and another virtual or online public meeting. And at that point, we'll have some preliminary ideas and alternatives to share with you to get your further input on those, and then we'll continue to gather input throughout the summer through the online survey and other events and through our web engagement as well.

And so you can visit the website here to kind of track with us. And then we have an e-mail address if anybody would like to send emails and give us input that way. I think I'll turn it back over to Lisa because there might be some questions that have come in.

Lisa Walters 59:58
I see a comment published in the chat or sorry the Q&A that there's a person who is generally interested in mitigating impacts to wildlife, particularly the bighorn sheep population, which is already struggling with pneumonia. I think that that is a very interesting question. We already have a lot of our bighorn sheep habitat concerns in our South Slope area.

So being aware of that impact for the North Slope and other large game and other wildlife is definitely warranted.

Mandi Roberts 1:00:56
I see one that is asking how does the plan fit with asking CPW to manage Ring the Peak?

Lisa Walters 1:01:05
Oh, that's a good question.
Regarding CPW management of Ring the Peak... Well, it is a collective management of Ring the Peak with CPW providing a great resource to help plan and provide some additional resources to that project.

We recognize that we're a part of the Ring the Peak, but we are one of many land managers currently.

We have a great recreational partner in Pikes Peak, America's Mountain. And even though they manage quite a bit of the highway going up to the Summit House on Pikes Peak, they also manage recreation for us. They have a staff of Rangers to interact with visitors and help them out with any of questions that they may have or their safety concerns, providing that oversight for the recreation as well, and that they're a great partner. And so I think that we're, we're always willing to look at additional partners and how we can collectively come up with a good management strategy. It's always a challenge.

When you look at financial resources being strained, staffing resources being strained, we want to make sure that we keep our recreation areas pristine as possible and managed well. So that's a good question.

OK. Are there any other questions?

Kelsey Blaho 1:03:06
I think that's all we have in terms of our presentation. So, any other?
Any other questions or anything anyone wants to ask about?

Lisa Walters 1:03:16
Just give it another minute or so.
OK. Well, this will be active for a little while. And like I said, we can always utilize engage@csu.org. For more information, go to our website.

I just want to remind folks that this recording and other meeting materials that were presented this week will be available on the website at CSU org slash nsra review. And that will be the place where most up to date information. We'll post information for the next set of meetings and of course that is also where you can take the survey, provide your feedback and then address any additional questions or comments that you may have.

We thank you for your time coming to this virtual platform. It's always a learning curve for us, so we appreciate your patience. But feel free to reach out if there's any follow up.

With that, I want to thank Mandi and Kelsey for presenting with me today. And I hope you all have a good night.

Mandi Roberts 1:04:40
Thank you.

Kelsey Blaho 1:04:42
Thank you.

AFTER-ACTION REPORT

North Slope Recreation Area fall public meetings | Oct. 14 and 23, 2025

Prepared by: Pattie Benger, Sr. Community Engagement Specialist

IAP2 – COLLABORATE

We will seek your input to help shape solutions and inform decisions wherever possible.

Meeting overview

To ensure key stakeholders, partner agencies, recreation groups and customers were informed and had an opportunity to engage, the following communications and outreach methods were used:

- Direct emails were sent to approximately 100 stakeholders, partner agencies, and recreation groups.
- Requested meeting notices to be shared in recreation group newsletters, communications and websites.
- Meetings listed on the project webpage and main organizational events page.
- Promotion included social media posts (with partner agencies tagged), a notice in *Insight* and a media release.

The in-person meeting was held on Oct. 14, and the online meeting was held on Oct. 23. Both sessions were recorded and will be posted online.

The in-person meeting featured a public presentation and a Q&A session. Attendees were invited to ask general study questions and provide feedback on each concept map after the presentation.

The online meeting used the Town Hall format on Microsoft Teams. It included a presentation with opportunities to ask questions throughout. Each map was subdivided for easier online viewing and discussion.

Objectives

- Review Colorado Springs Utilities history and significant events
- Review Colorado Springs Utilities current policies
- Review the NSRA recreation impact study
- Review input collected through surveys, community events, and stakeholder meetings
- Introduce the proposed concept maps and collect feedback
- Address customer questions
- Outline the project timeline and future engagement opportunities

Audience and attendance summary

- In-person meeting
    - Registered: 66
    - Attended: ~78 people, including employees, partner representatives, and contractor
    - Agency/Business Representation:
        - Angler's Covey
        - Barr Camp
        - City of Colorado Springs Parks Board
        - City of Colorado Springs/Pikes Peak-America's Mountain
        - Colorado Parks and Wildlife
        - Dragonfly Paddle Yoga
        - El Paso County Commissioner Bill Wysong
        - El Paso County Parks Department
        - Friends of the Peak
        - Friends of the Ute Pass

  - Medicine Wheel
  - Pikes Peak Outdoor Recreation Alliance
  - Pikes Peak Region Attractions
  - Resort Outfitters
  - Rocky Mountain Field Institute
  - Town of Green Mountain Falls Mayor
  - Town of Green Mountain Falls Parks, Recreation and Trails Committee
  - Trails and Open Space Coalition
  - Utilities Board member David Leinweber
- Online meeting
  - Registered: 14
  - Attended: 7, including employees
  - Agency/Business Representation:
    - Pikes Peak-America's Mountain
    - Palmer Land Conservancy

Conclusions and recommendations

The in-person meeting was highly successful, resulting in stronger engagement from those impacted by the study, and improved relationships and trust. While the online meeting had lower attendance, it provided an excellent recording and clear explanation of each concept map.

Public comments will remain open through Nov. 24, 2025, prior to drafting the plan.

To maintain positive momentum, the following recommendations are proposed:

- Share the existing South Slope Recreation Area plan on our website in the appropriate section.
- Conduct additional documented engagement with the Town of Green Mountain Falls and the City of Woodland Park.

- Share the draft North Slope Recreation Area plan and allow feedback before submitting it to the Utilities Board.
- Invite meeting feedback earlier and separate meetings to maximize input. (Note: The Microsoft feedback form was sent on Oct. 24, after the online meeting, and included attendees from both sessions.

Resources

- Project Webpage: https://www.csu.org/current-projects/north-slope-impact-study
- In-Person Meeting Slide Deck: Presentation 10.1.25LW.pdf
- Online Meeting Slide Deck: Online Presentation October 23 2025.pdf
- Meeting Recordings: https://youtube.com/playlist?list=PL16dRF5-rvf51TWl8XcSfIrUEbCurbexH&si=D3lCptOmePdy11rm

Otak

Colorado Springs Utilities

It's how we're all connected

PIKES PEAK America's Mountain

North Slope Recreation Area Fall Meeting

Tuesday October 14, 2025

5:30pm – 7:00pm

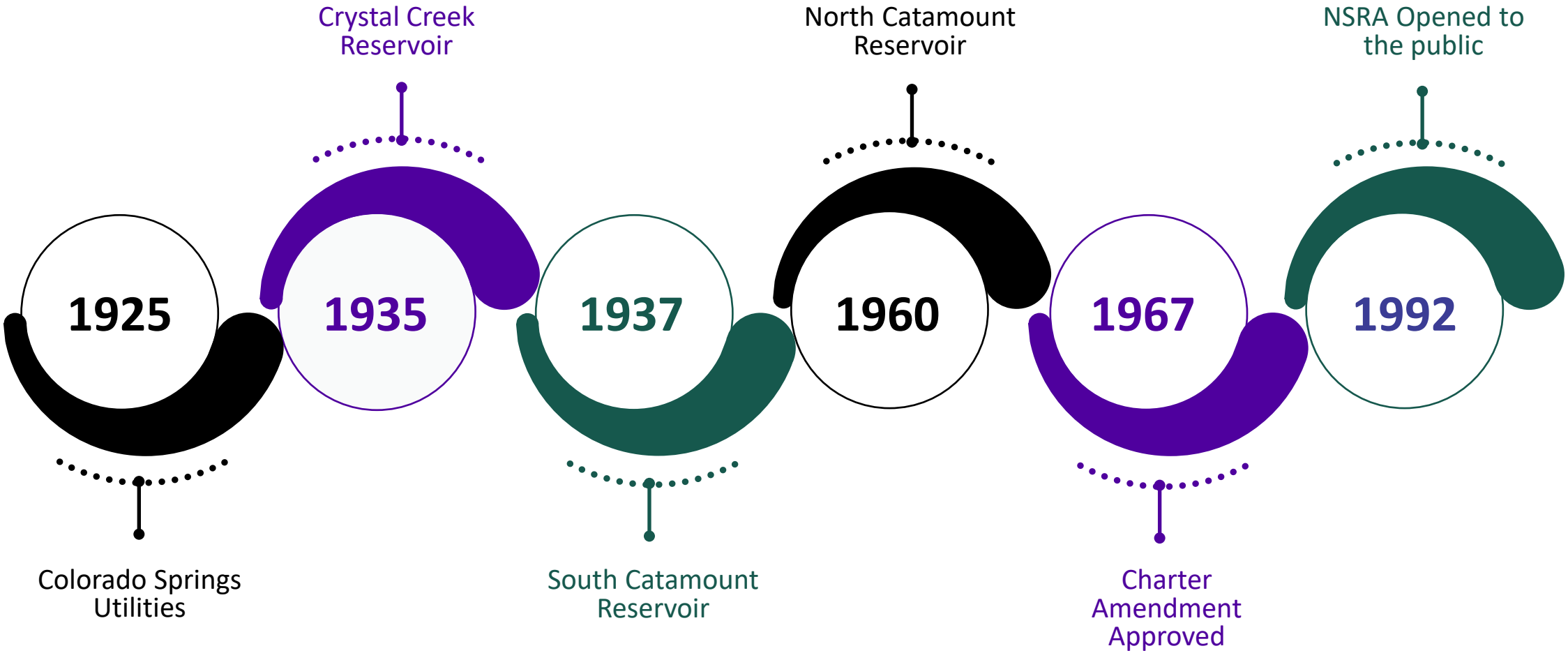
Welcome & Introductions
Project Team

Agenda

- History and Current Policies
- Study Overview
- Plan Goals, Objectives, Process and Status
- Input Collected
- Proposed Trail Concepts
- Next Steps
- Q&A
- Trail Concept Input Opportunity

History and Current Policies

History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- Recreational uses within the NSRA are managed by Pikes Peak America's Mountain, an enterprise of the City of Colorado Springs.
- Recreation uses include:
  - Fishing
  - Non-motorized boating
  - Hiking
  - Biking
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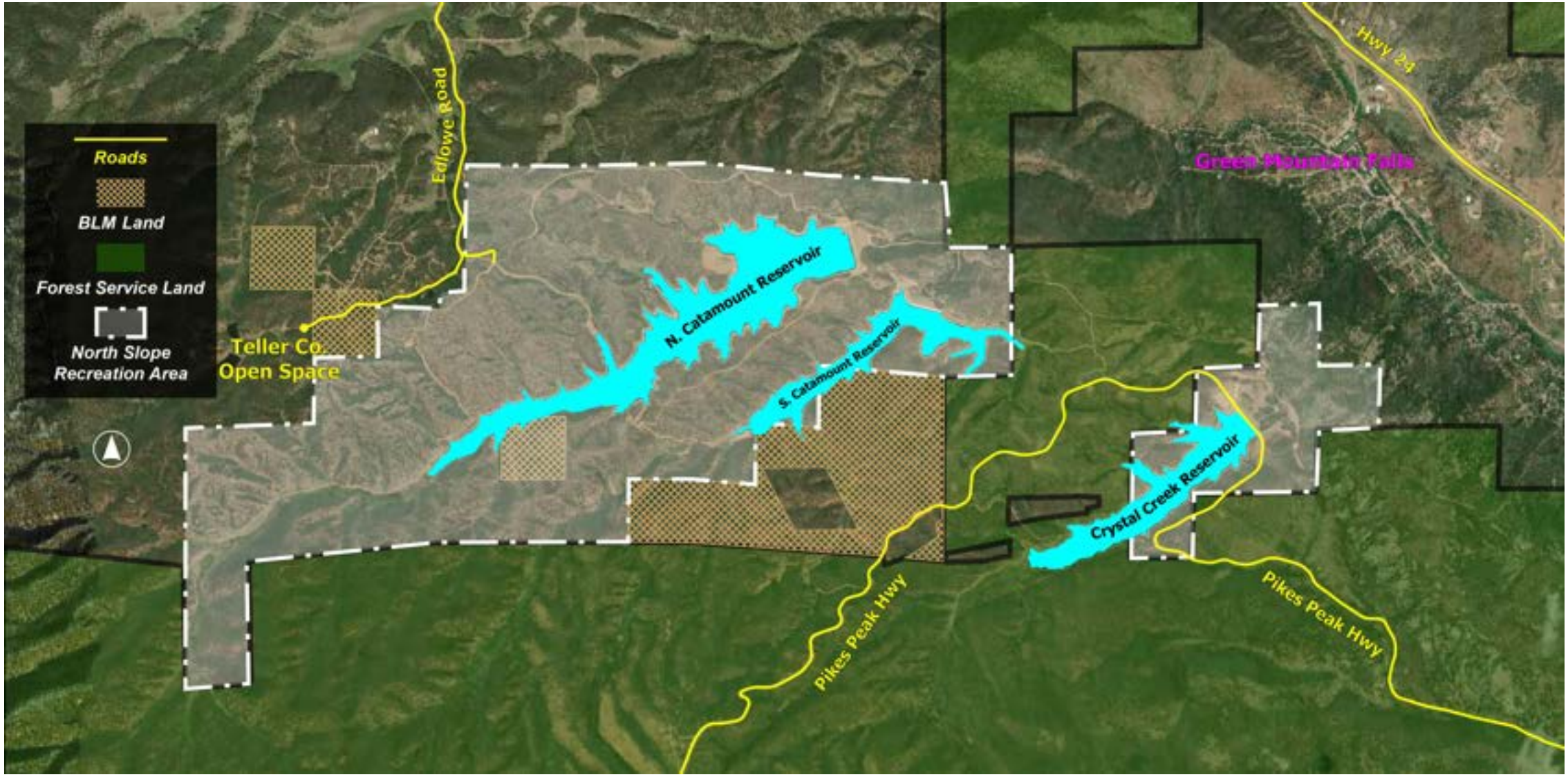
Study Overview

North Slope Recreation Area



Plan Goals, Objectives, Process and Status

Goals

- Enhance security and strengthen protection of critical drinking water assets.
- Ensure public, staff, and infrastructure safety through clear rules and procedures.
- Accommodate recreation that is compatible with our mission and is financially and environmentally sustainable.
- Ensure resources for the sustainable management of the NSRA now and into the future.

Objectives

- Analyze current public access and recreation activities.
- Assess existing trails and access points for improvement opportunities.
- Recommend enhancements that prioritize infrastructure protection and security, public safety, and sustainability.
- Develop concepts to minimize impacts on operations, drinking water, natural resources, and visitor experience.

Process & Status

Summer/Fall/Winter 2024

Data Collection & Analysis

- Initiate Project
- Technical Team
- Existing Conditions Analysis
- Desired Futures

Winter/Spring/Summer 2024-2025

Develop & Analyze Access Concepts

- Stakeholder Engagement
- Field Work
- Develop Concepts
- Evaluate Concepts

We are Here

Fall/Winter 2025-2026

Draft Report

- Preliminary Draft Recommendations
- Review & Coordination
- Refine Draft Recommendations

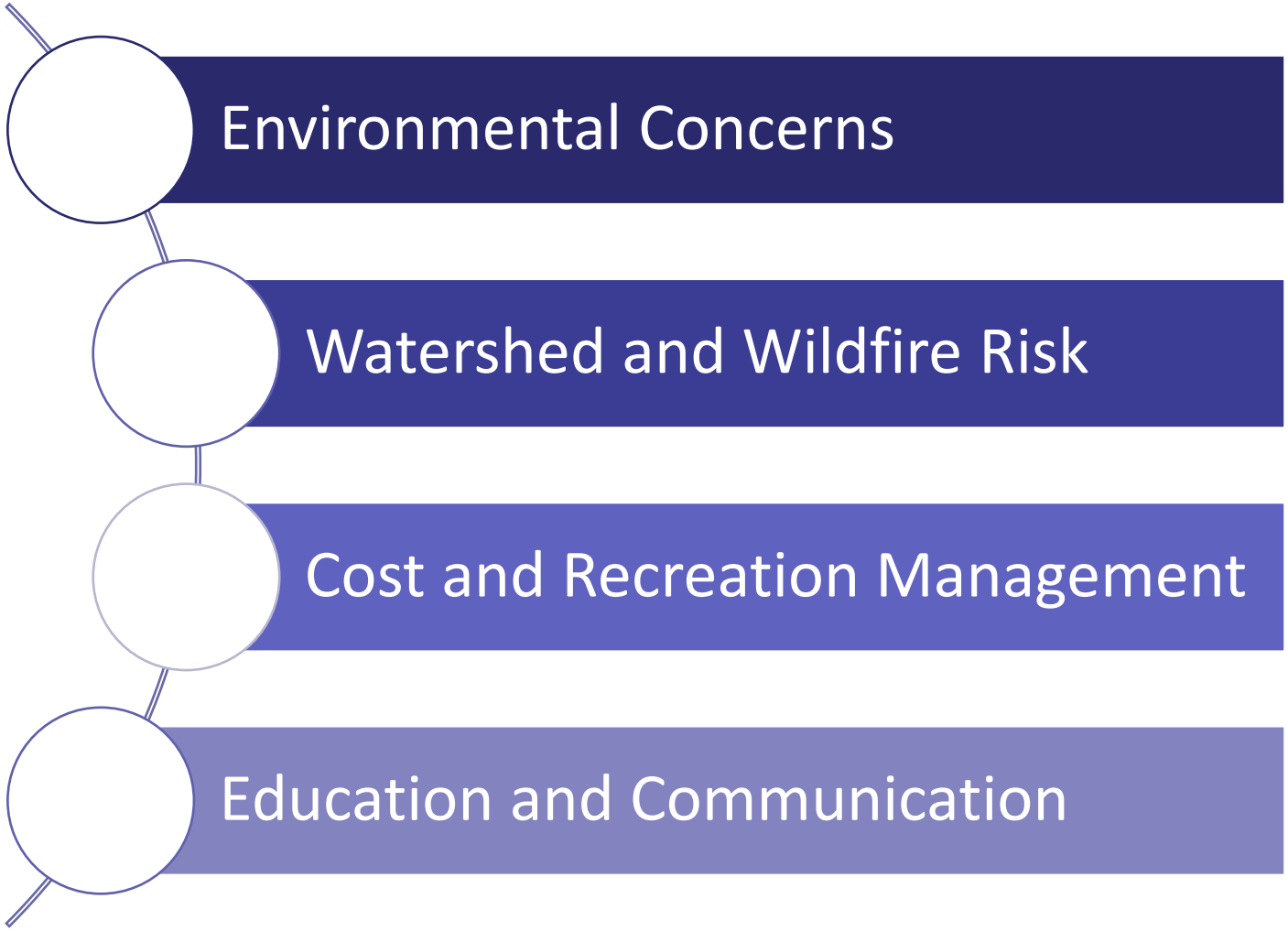
Spring/Summer 2026

Final Report

- Final Recommendations
- Launch Implementation & Ongoing Coordination Efforts

Input Collected

Summary of Public Engagement



Customer Counts Survey

Key Takeaways

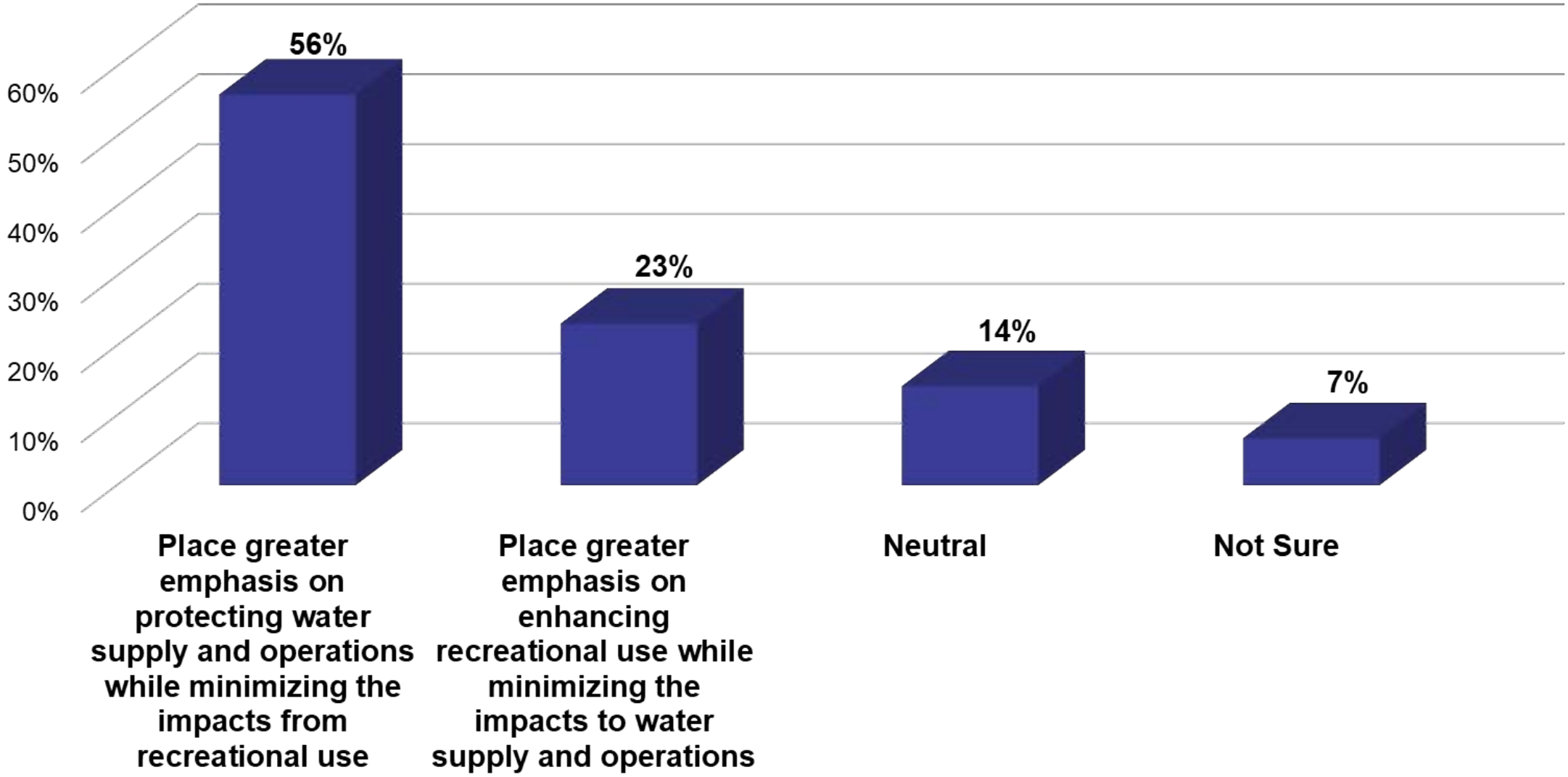
Customers Prefer Protecting Water Supply And Operations

Environmental Protection And Water Quality Top Objectives

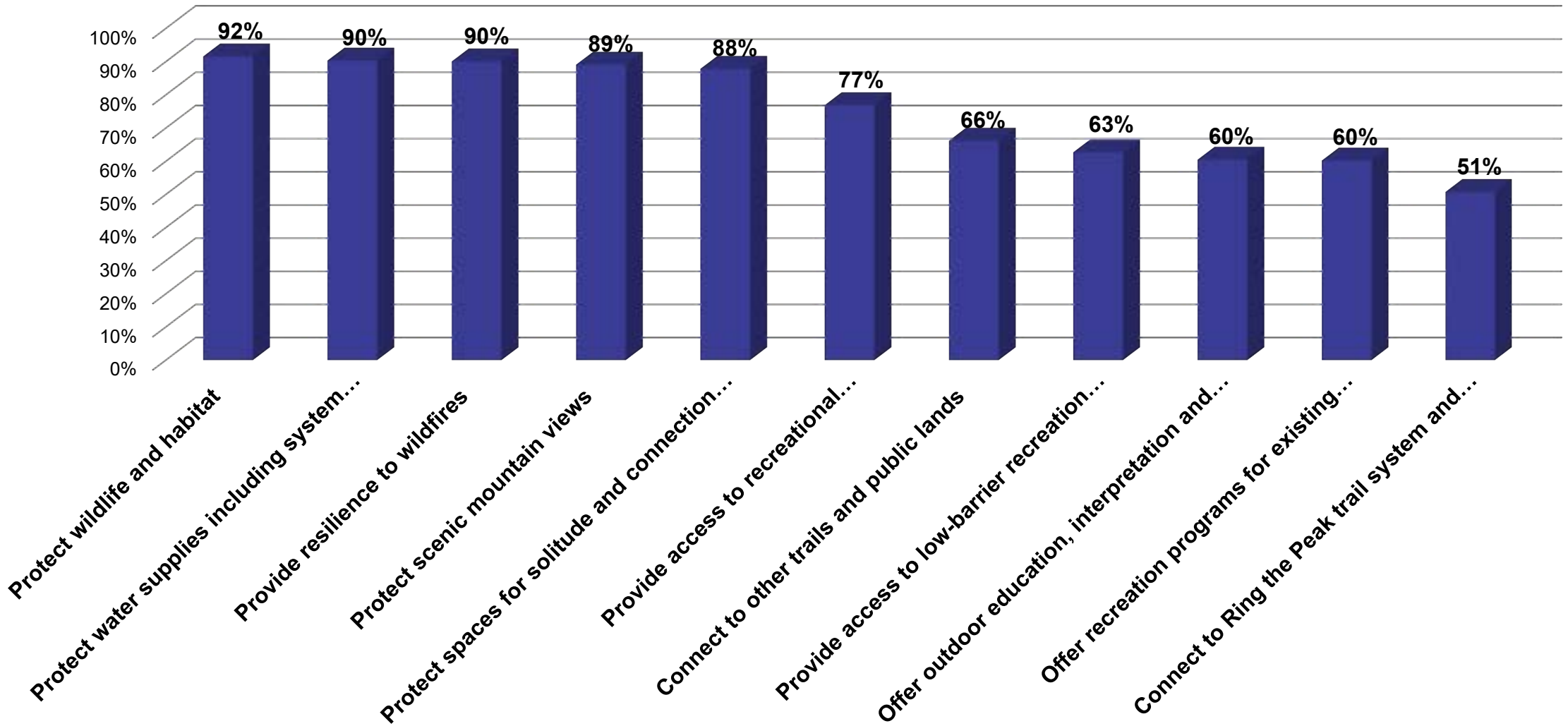
Belief That Those Who Recreate at North Slope Recreation Area Should Pay For Increased Costs

Customers Favor Revenue Generation Strategies and Increased Fees Over Recreation Limitations

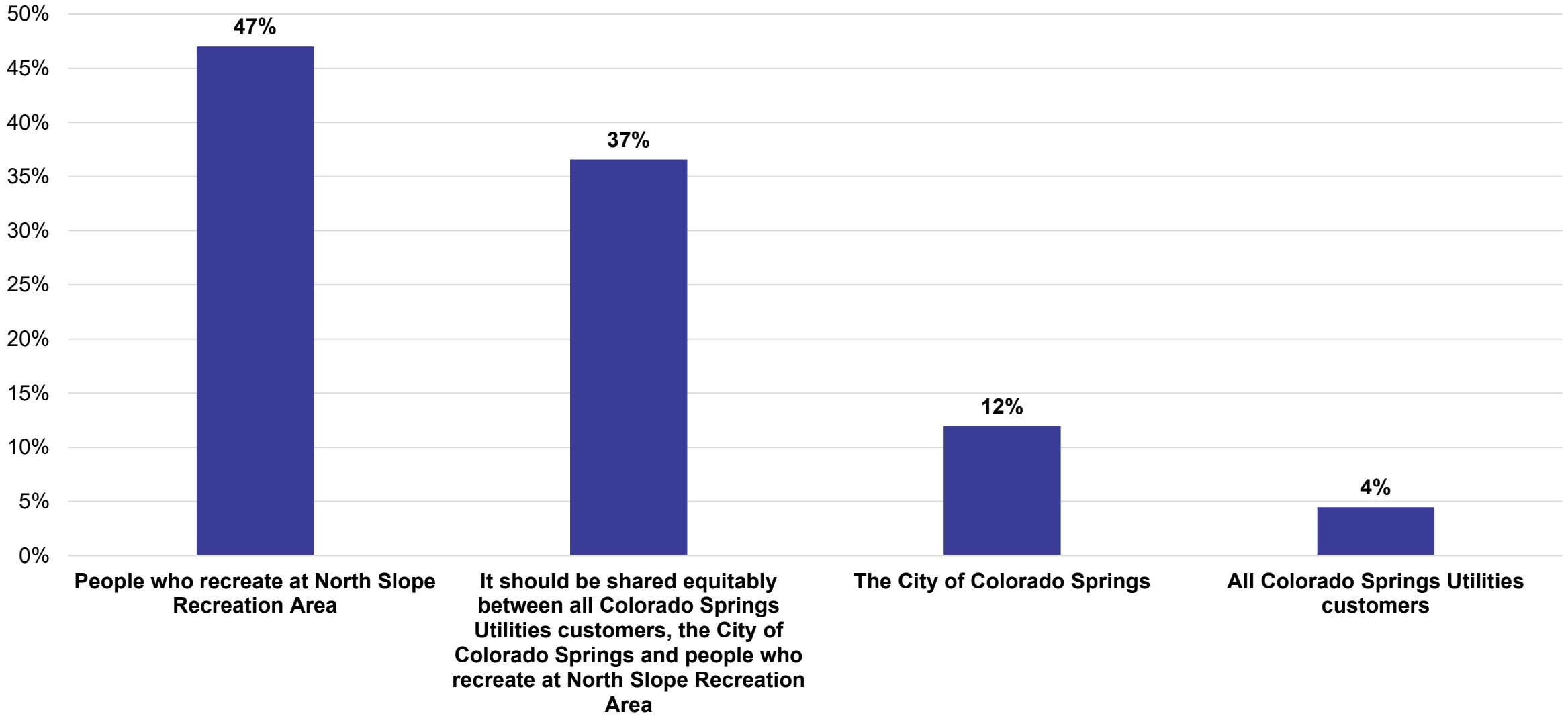
Management Strategy



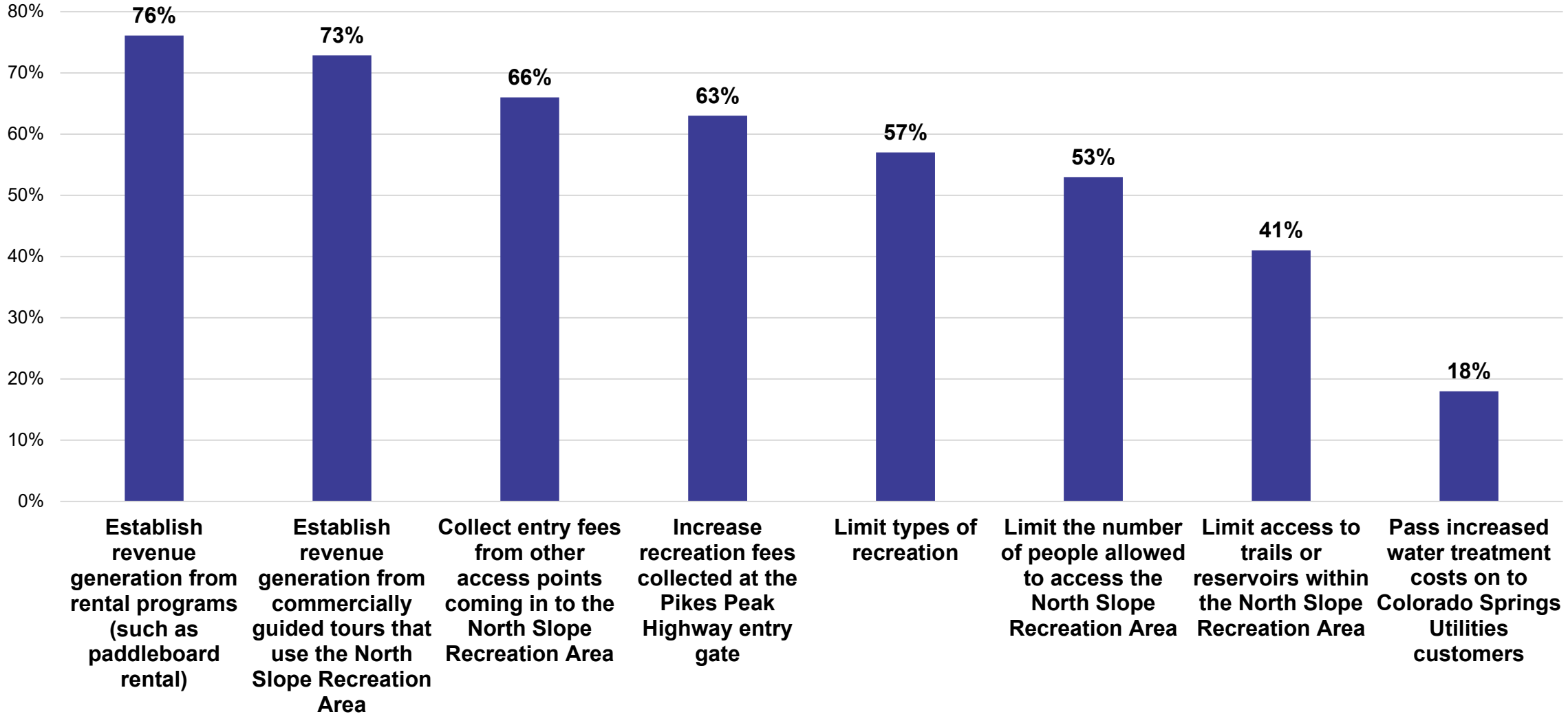
How Important are these Objectives to You?



Who Should Pay for Increased Costs?



How should we address higher costs associated with impacts from this increase in recreation?



Recreational Visitor Survey

Recreational Visitor Survey

- Conducted May 21st through September 17th
- 937 respondents
- Responses were tabulated by ZIP code
  - Colorado Springs (CO Springs) Residents
  - Out-of-region
  - Unspecified (individuals who did not provide a ZIP code)

Key Takeaways

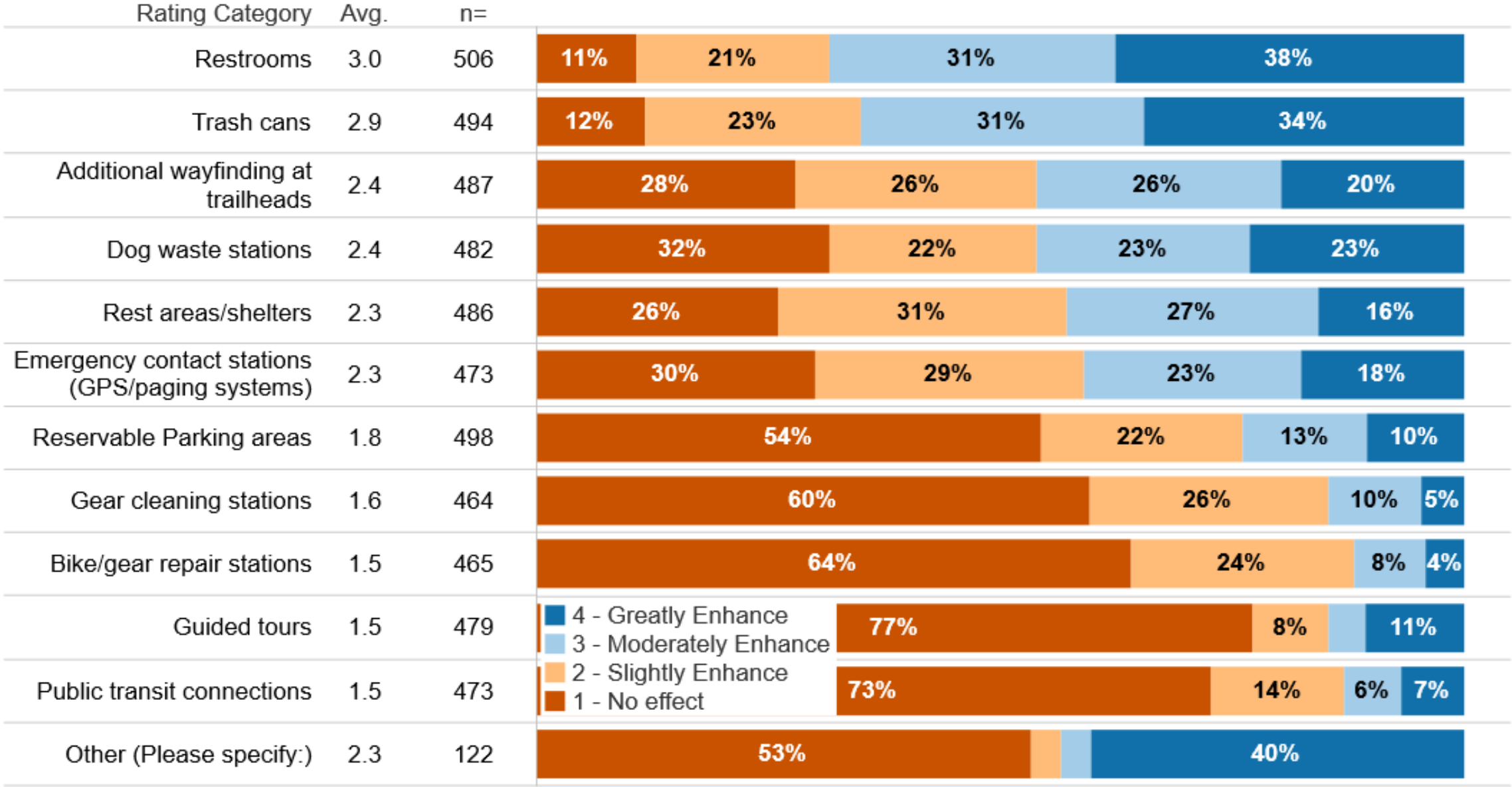
Recreators support dual mission of protection and recreation.

Recreators expect management of amenities, crowding and ecological impacts, and user-based cost recovery mechanisms.

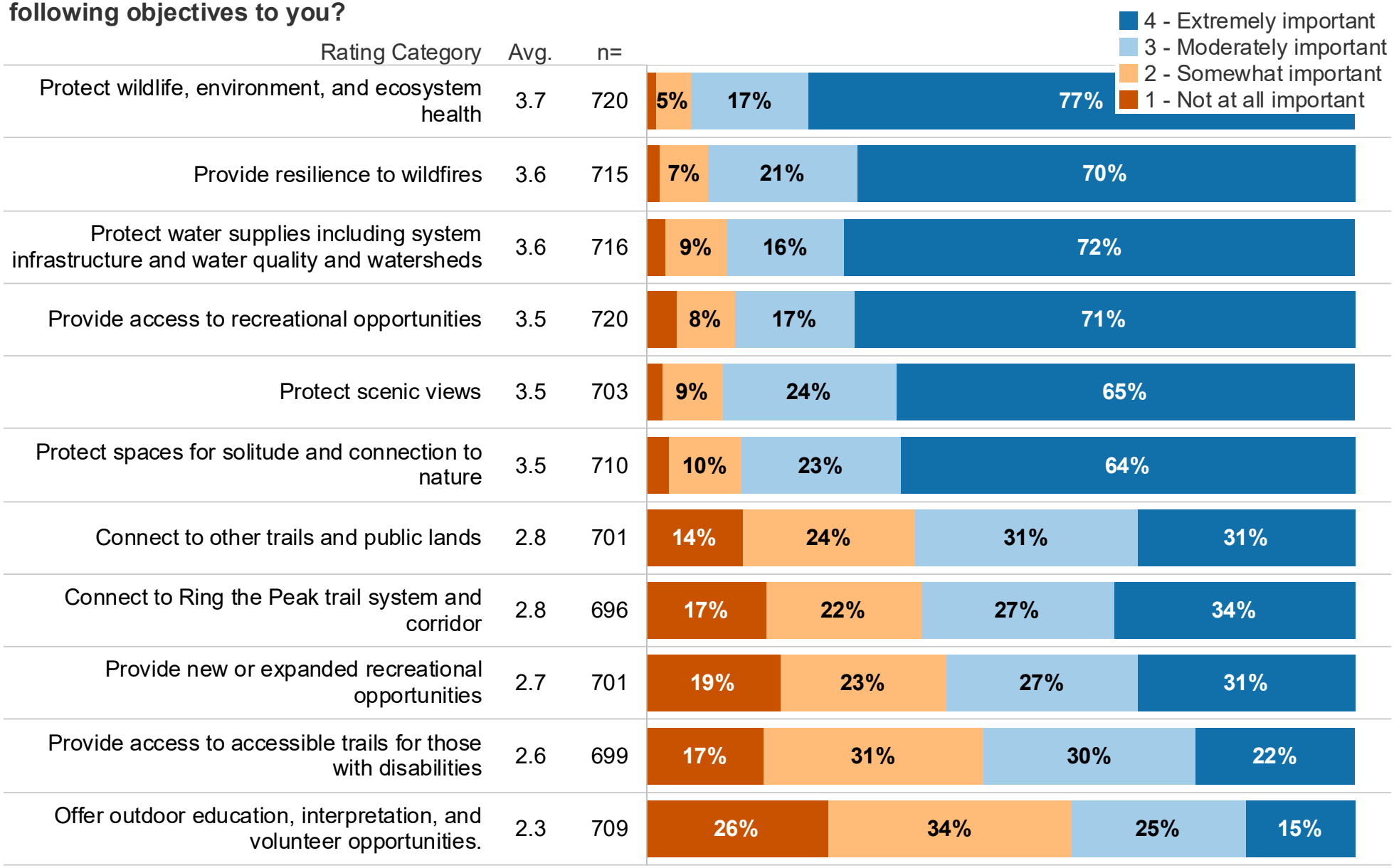
Management should strengthen infrastructure around hiking and fishing, improve targeted amenities, and establish sustainable funding.

Adopt monitoring tools and adaptive strategies to respond to recreation pressures for ecosystem protection.

What amenities would enhance your visit or experience at the North Slope Recreation Area?

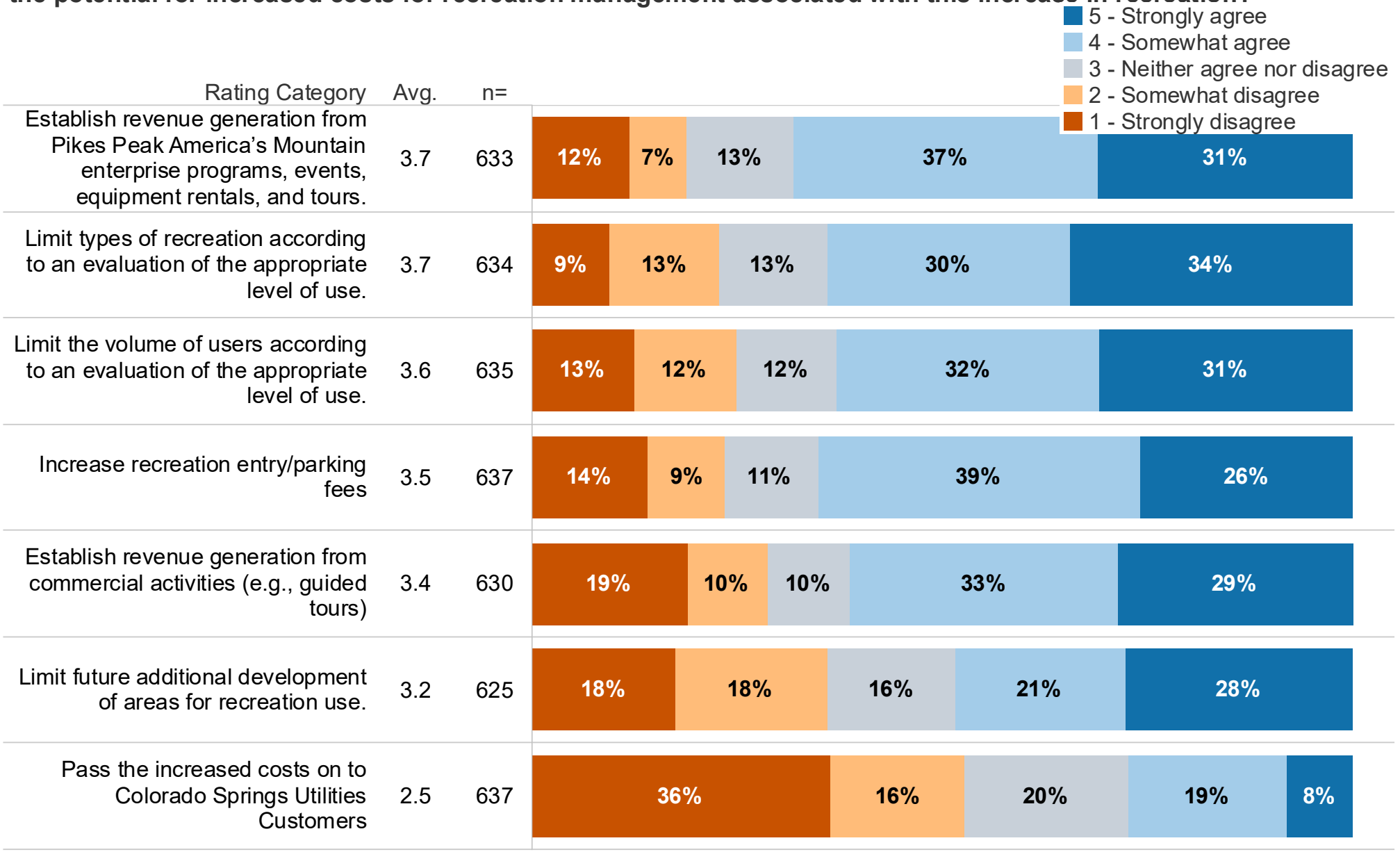


When thinking about North Slope Recreation Area and the lands surrounding the reservoirs, how important are following objectives to you?



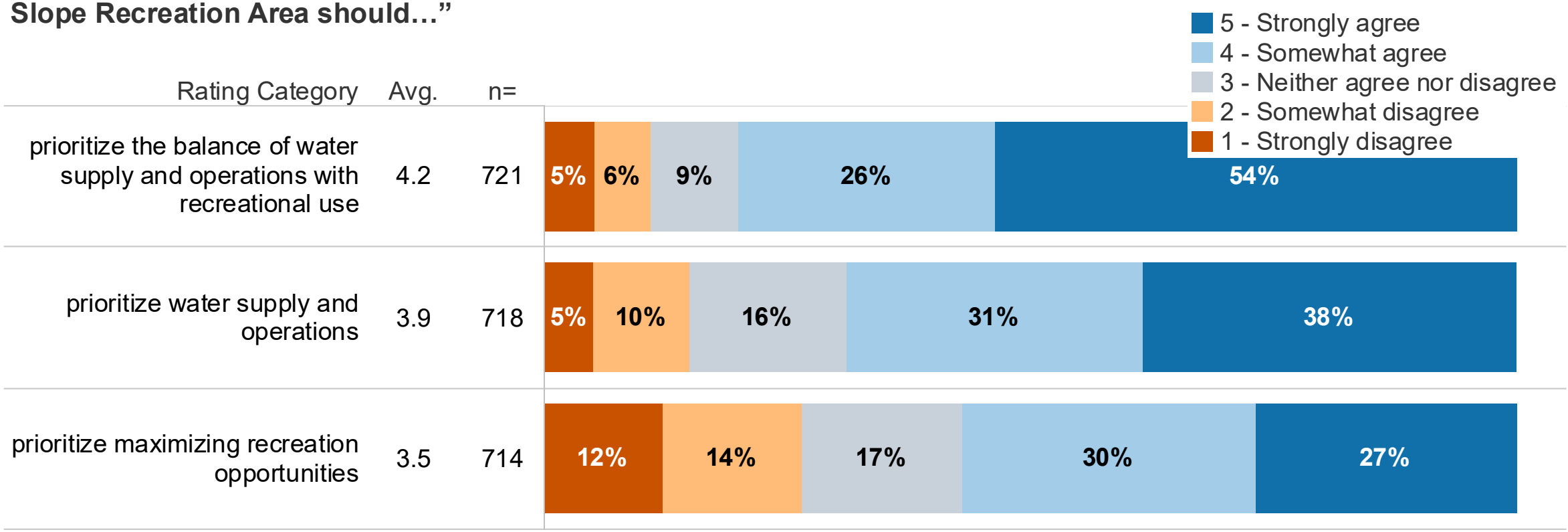
Rating Category	Avg.	n=	4 - Extremely important	3 - Moderately important	2 - Somewhat important	1 - Not at all important
Protect wildlife, environment, and ecosystem health	3.7	720	77%	17%	5%	
Provide resilience to wildfires	3.6	715	70%	21%	7%	
Protect water supplies including system infrastructure and water quality and watersheds	3.6	716	72%	16%	9%	
Provide access to recreational opportunities	3.5	720	71%	17%	8%	
Protect scenic views	3.5	703	65%	24%	9%	
Protect spaces for solitude and connection to nature	3.5	710	64%	23%	10%	
Connect to other trails and public lands	2.8	701	31%	31%	24%	14%
Connect to Ring the Peak trail system and corridor	2.8	696	34%	27%	22%	17%
Provide new or expanded recreational opportunities	2.7	701	31%	27%	23%	19%
Provide access to accessible trails for those with disabilities	2.6	699	22%	30%	31%	17%
Offer outdoor education, interpretation, and volunteer opportunities.	2.3	709	15%	25%	34%	26%

As recreation demands increase at the North Slope Recreation Area, how should Colorado Springs Utilities address the potential for increased costs for recreation management associated with this increase in recreation?



Rating Category	Avg.	n=	5 - Strongly agree	4 - Somewhat agree	3 - Neither agree nor disagree	2 - Somewhat disagree	1 - Strongly disagree
Establish revenue generation from Pikes Peak America's Mountain enterprise programs, events, equipment rentals, and tours.	3.7	633	31%	37%	13%	7%	12%
Limit types of recreation according to an evaluation of the appropriate level of use.	3.7	634	34%	30%	13%	13%	9%
Limit the volume of users according to an evaluation of the appropriate level of use.	3.6	635	31%	32%	12%	12%	13%
Increase recreation entry/parking fees	3.5	637	26%	39%	11%	9%	14%
Establish revenue generation from commercial activities (e.g., guided tours)	3.4	630	29%	33%	10%	10%	19%
Limit future additional development of areas for recreation use.	3.2	625	28%	21%	16%	18%	18%
Pass the increased costs on to Colorado Springs Utilities Customers	2.5	637	8%	19%	20%	16%	36%

Please rate your agreement or disagreement with the following management statements. “Management of the North Slope Recreation Area should…”

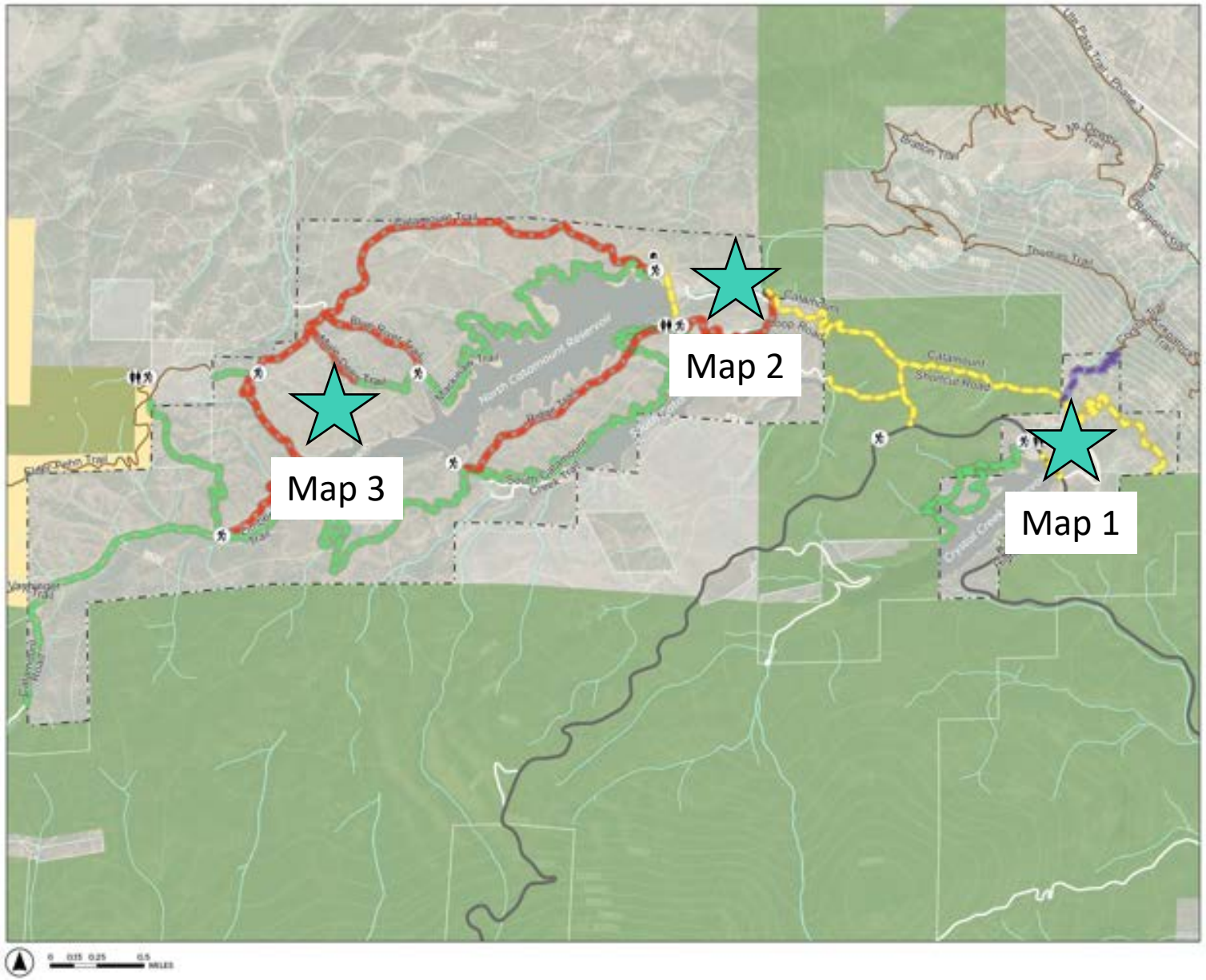


Rating Category	Avg.	n=	5%	6%	9%	26%	54%
prioritize the balance of water supply and operations with recreational use	4.2	721					
prioritize water supply and operations	3.9	718	5%	10%	16%	31%	38%
prioritize maximizing recreation opportunities	3.5	714	12%	14%	17%	30%	27%

Proposed Trail Concepts

DRAFT

NORTH SLOPE RECREATION AREA OVERVIEW



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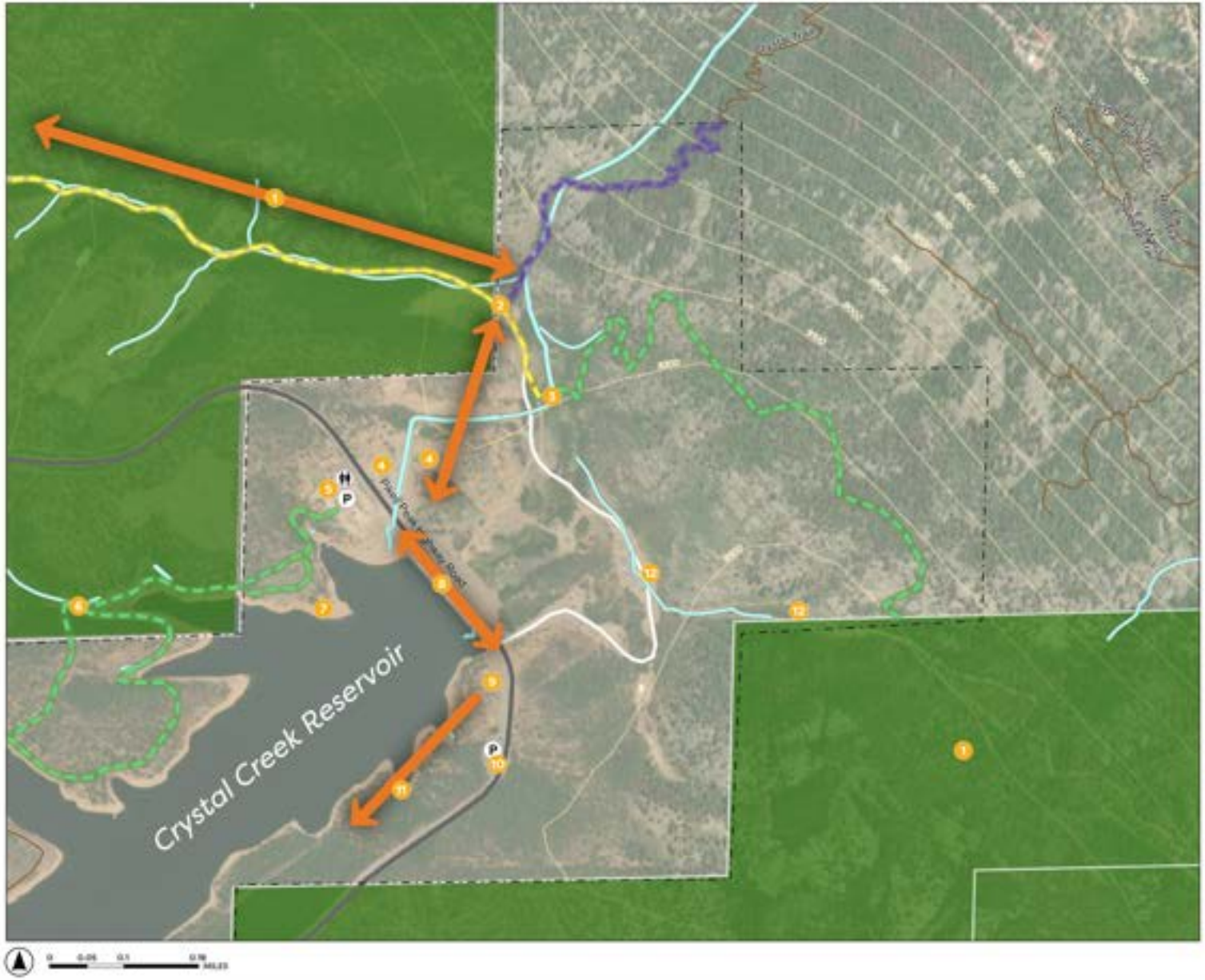
MAP 1



LEGEND

- Restrooms
- Trailheads
- Parking Area
- Caretaker's House (300 Foot Buffer)
- Trails Not Under Consideration
- Roads
- Pikes Peak Highway
- 1913 Congressional Reserve
- Bureau of Land Management Managed by US Forest Service
- Pike National Forest
- 100 Foot Contour Lines
- Trail to be Decommissioned
- Trails Recommended to Remain
- Trails Requiring Improvements or Formal Designation/Authorizations to Remain
- Drainages
- Potential Connections
- North Slope Recreation Area Boundary

CONCEPTUAL RECOMMENDATIONS AND POINTS OF INTEREST

1. Potential new trail; coordination and NEPA environmental review required for trail segments on US Forest Service land
2. Proposed trail route from Crystal Creek Reservoir and gift shop to connect with route to North and South Catamount Reservoirs
3. Connections from existing trails to new trails will need to address existing flume and provide for water crossings
4. Potential trail additions to tie into Crystal gift shop access while avoiding spillway and hotspot infrastructure
5. Crystal Reservoir Gift Shop and parking area
6. Coordination and NEPA environmental review required for trail segments on US Forest Service land (including recommended trail connection here)
7. Shoreline area is a desirable point of interest
8. Improvements and signing needed to support trail/pedestrian crossing over dam
9. Further evaluation of connections needed for routing trail users closer to road instead of near water
10. East parking area
11. Access to south side of Crystal Creek Reservoir for fishing is desirable
12. Recommended closure of social trails through area to decrease conflicts with Springs Utilities staging areas

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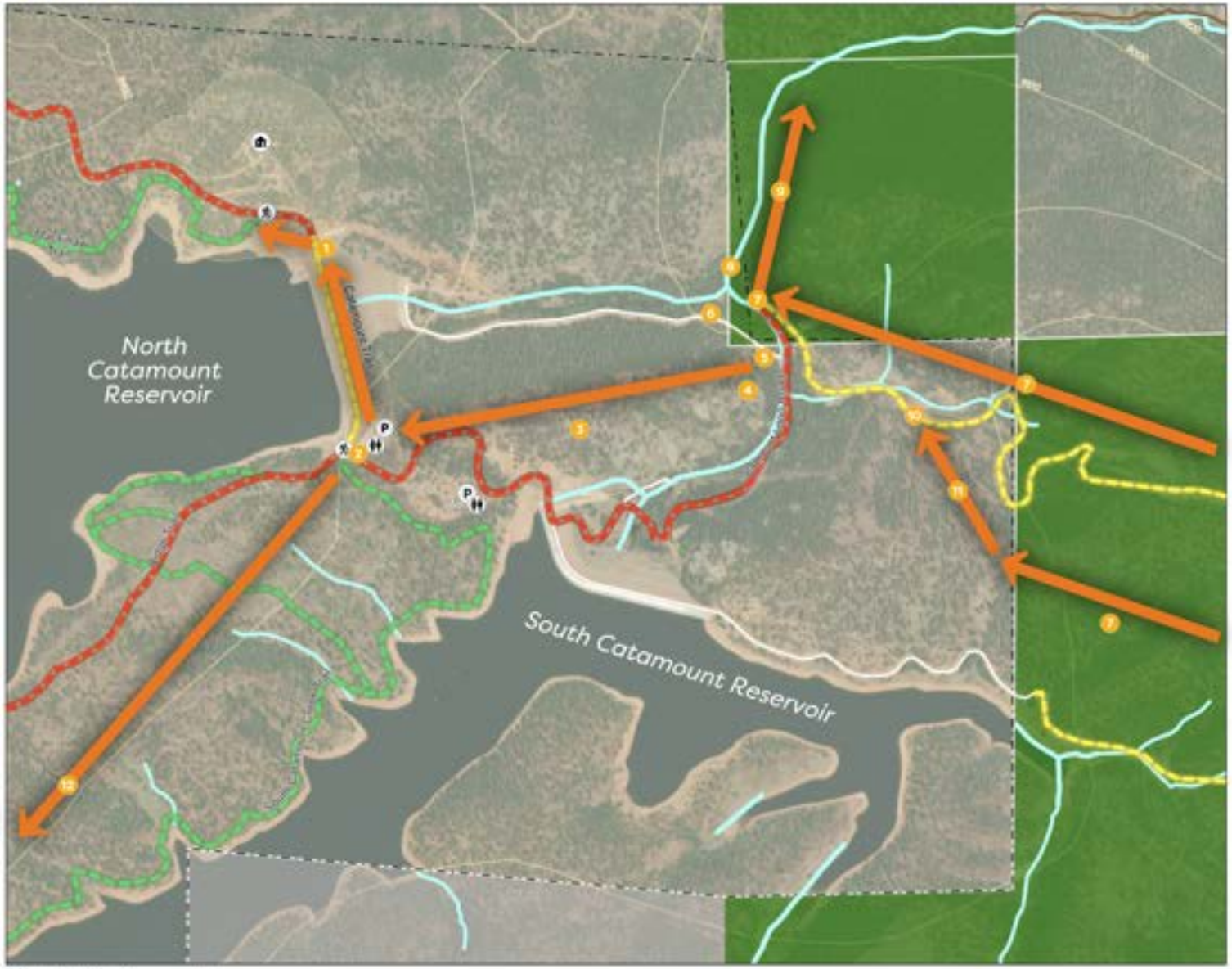
MAP 2


North Catamount Reservoir
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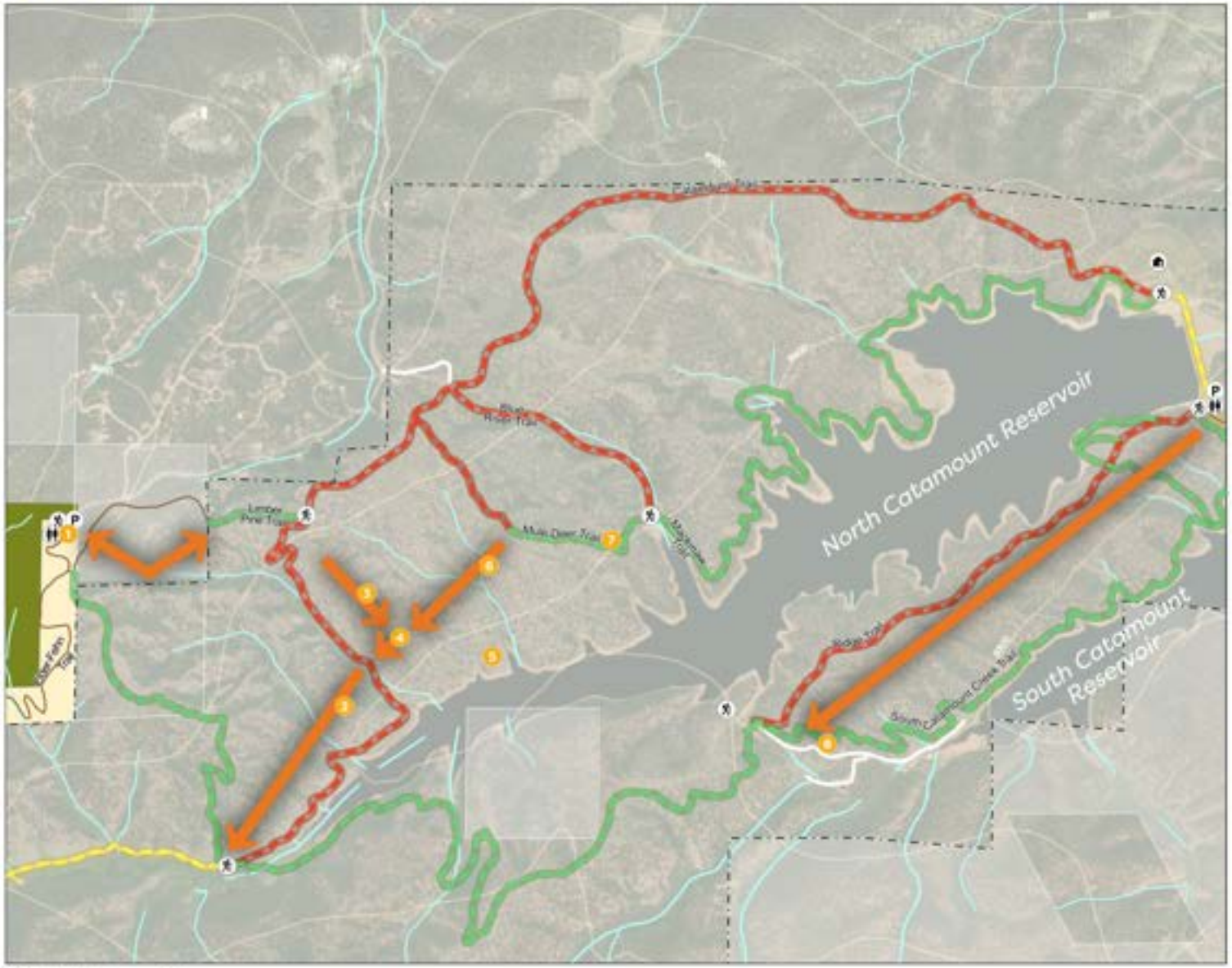
CONCEPTUAL RECOMMENDATIONS AND POINTS OF INTEREST

DRAFT

MAP 3



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- Drainages
- Potential Connections
- North Slope Recreation Area Boundary
- Catamount Institute
- Teller County Open Space

CONCEPTUAL RECOMMENDATIONS AND POINTS OF INTEREST

1. Potential connection to BLM/US Forest Service managed land and Teller County Open Space Trailhead (coordination and NEPA environmental review required for trail segments on US Forest Service land)
2. Potential connection to Limber Pine Trail and on to property boundary
3. Potential realignment of Limber Pine Trail and provision of crossing to new trail
4. Potential trail connection area to provide connection to fishing access and connection to other trail routes
5. Recommended fishing access location
6. Recommended removal of trails from service roads by adding alternative connection mid-slope
7. Need to evaluate and implement trail improvements to address erosion in this area
8. Potential off-road trail between the existing Ridge Trail and South Catamount Creek Trail

Next Steps

Next Steps

- Online Public Meeting Opportunity – Oct. 23, 2025, 6 p.m.
- Information at csu.org/NSRAreview
- Public comments received through Nov. 24, 2025, at engage@csu.org
- Ongoing coordination with Utilities leadership
- Utilities Board and Colorado Springs City Council: Spring 2026
- Upon approval, implementation will occur over time
  - Changes will be communicated as they are implemented

Questions?

Colorado Springs Utilities

It's how we're all connected

Otak

Colorado Springs Utilities

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PIKES PEAK America's Mountain

North Slope Recreation Area Fall Meeting

Thank you for joining the conversation!

We will begin the meeting at 6:00 p.m

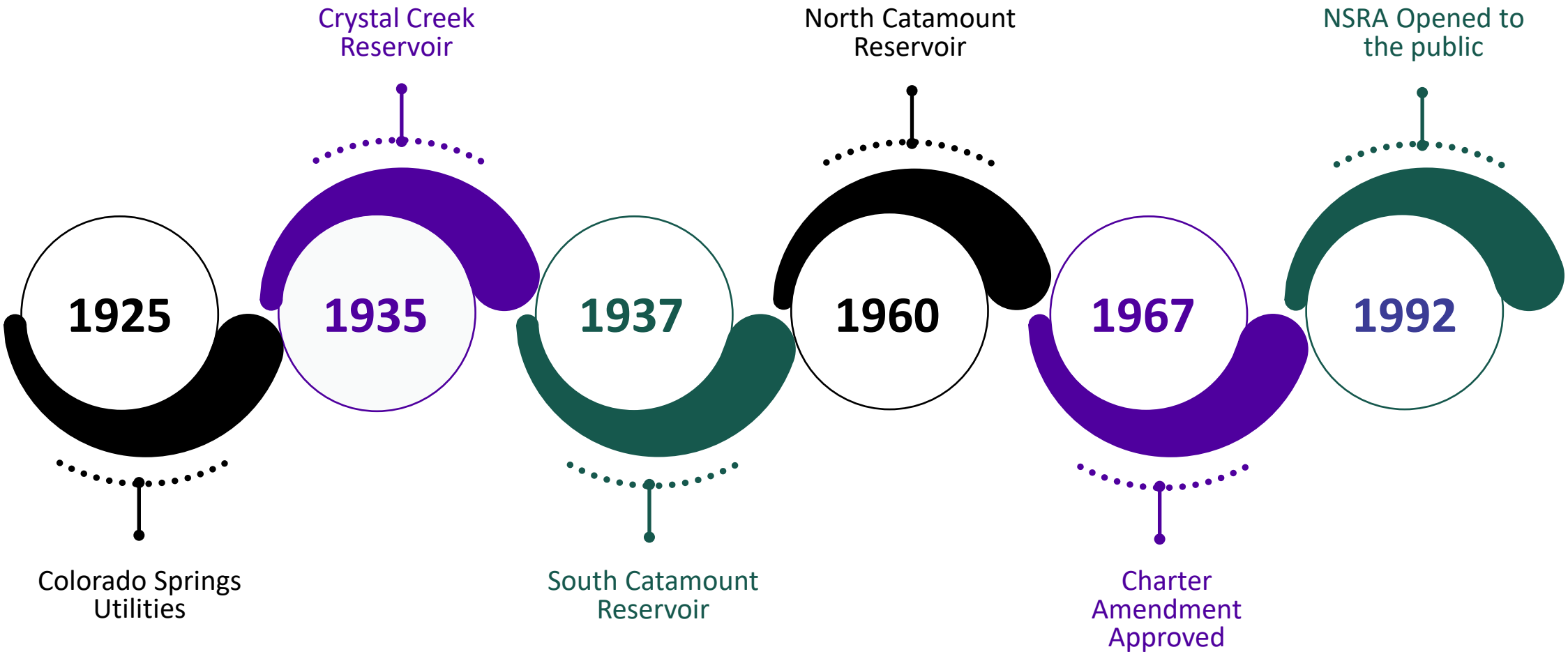
Welcome & Introductions
Project Team

Agenda

- History and Current Policies
- Study Overview
- Input Collected
- Proposed Trail Concepts
- Next Steps
- Q&A

History and Current Policies

History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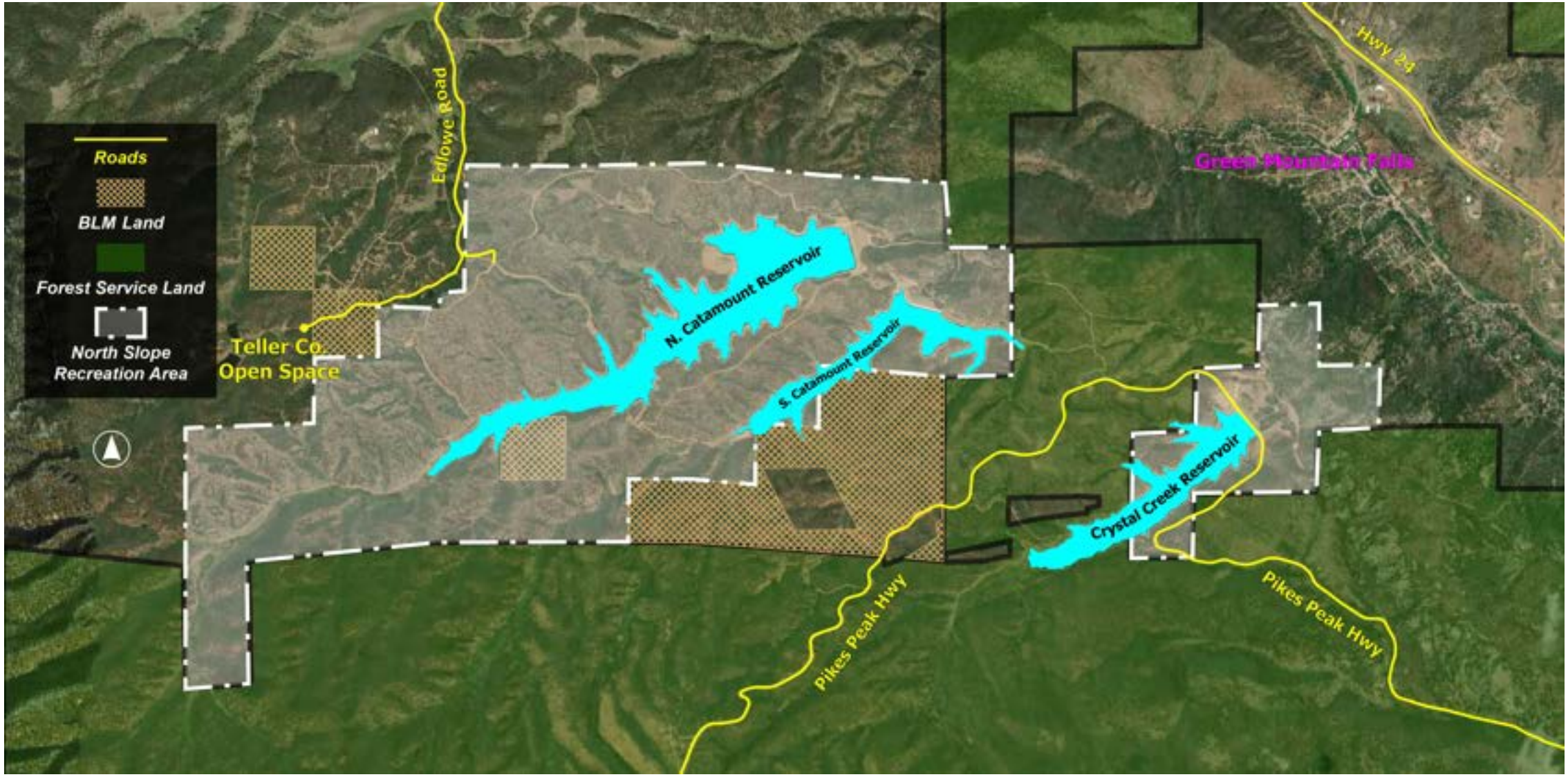
Study Overview

North Slope Recreation Area



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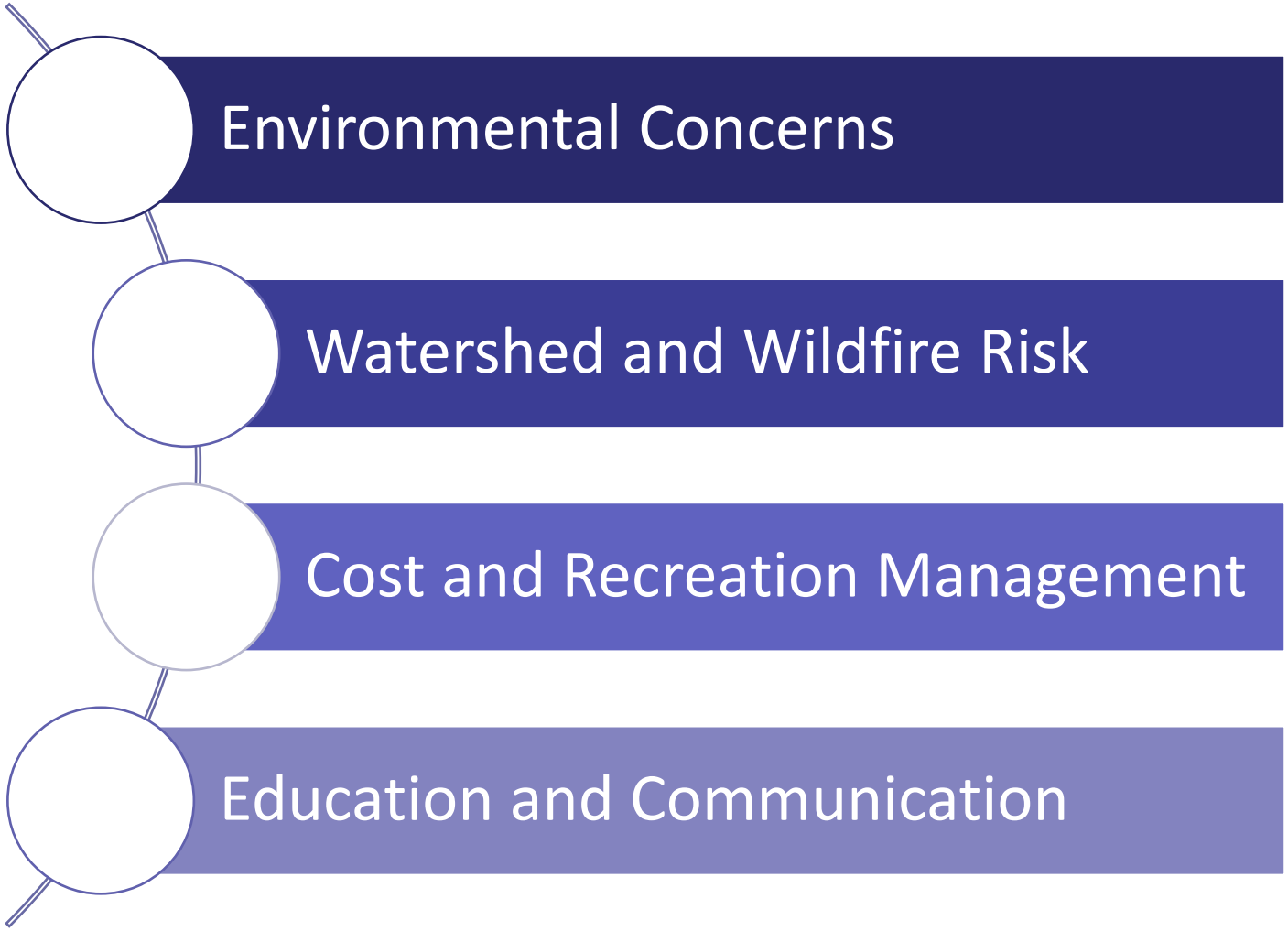

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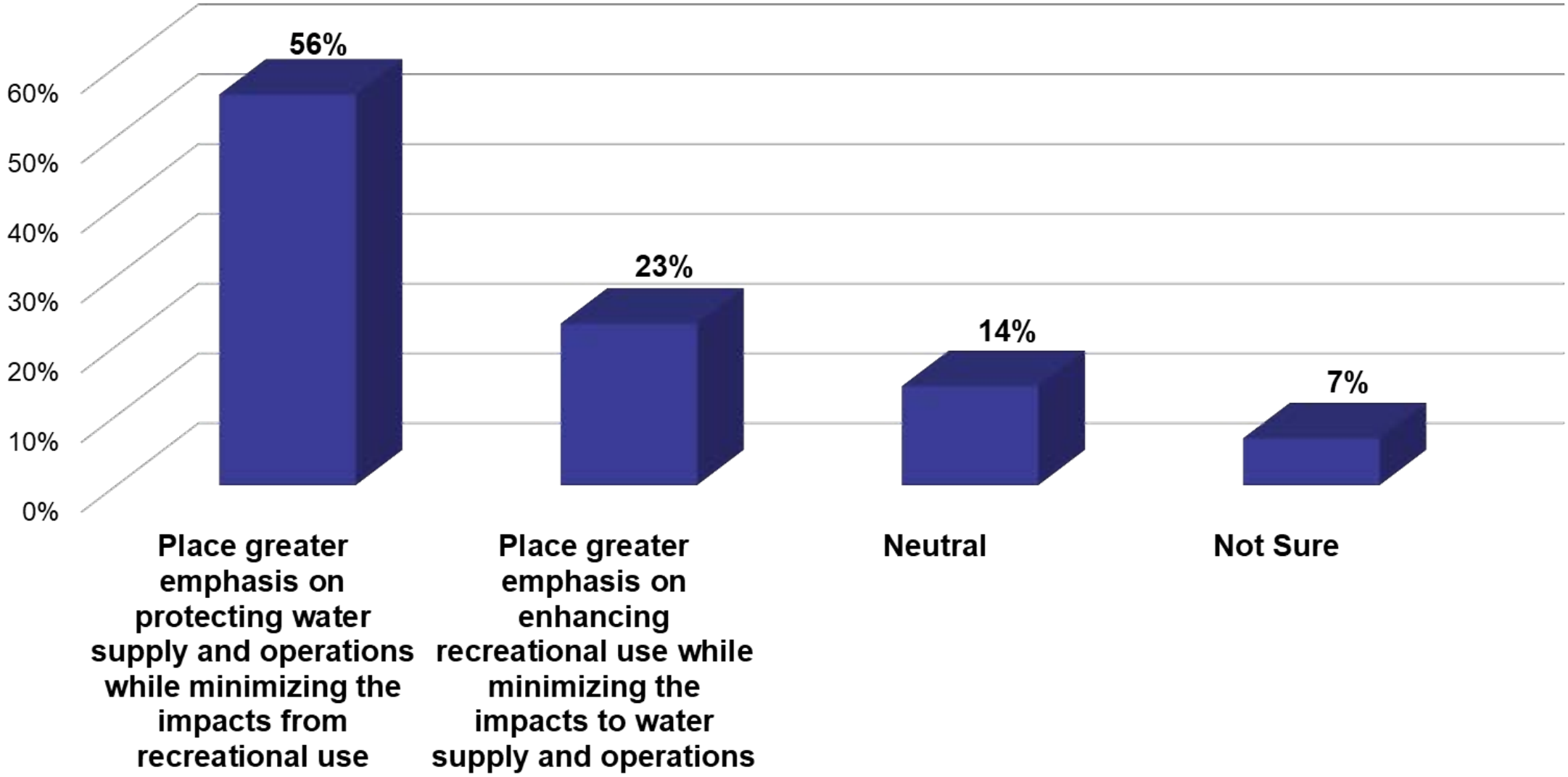
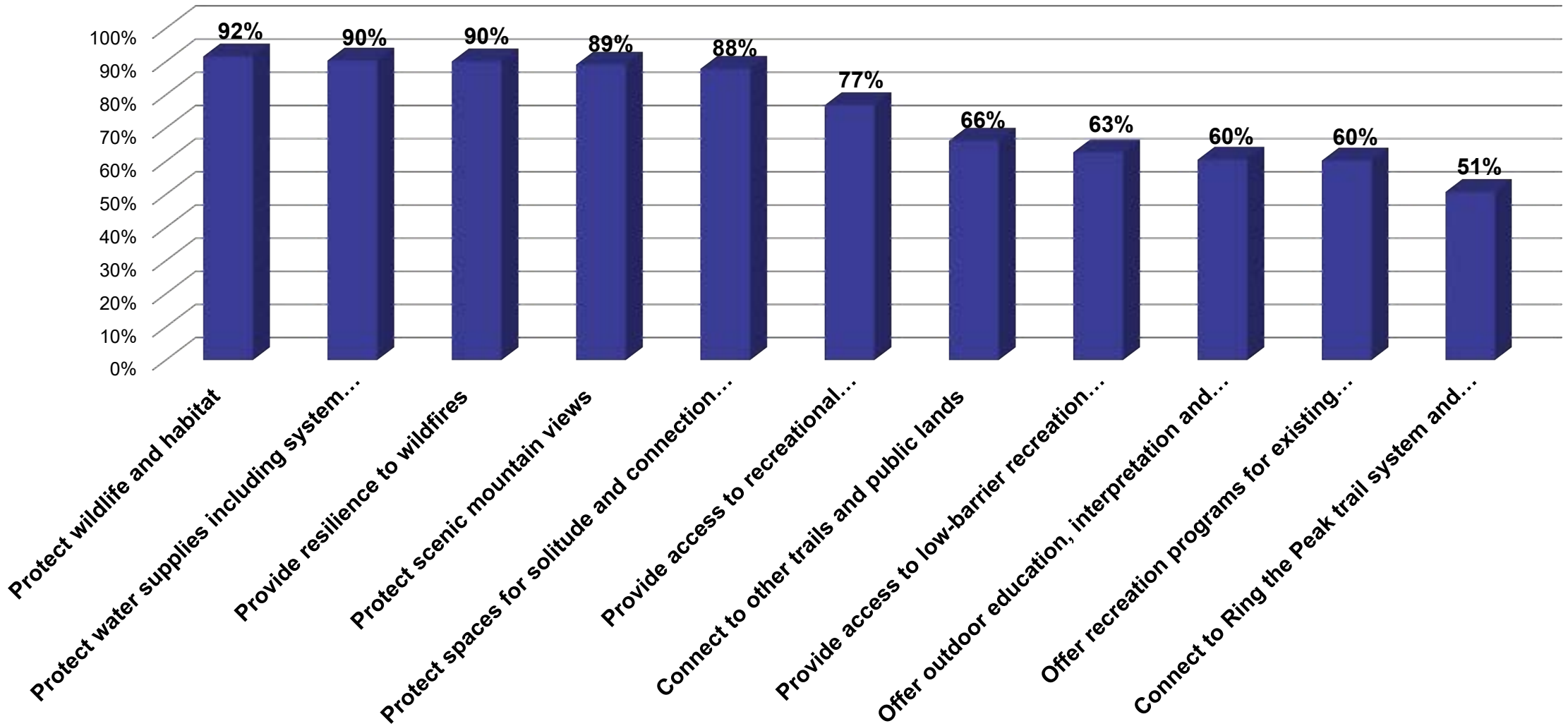
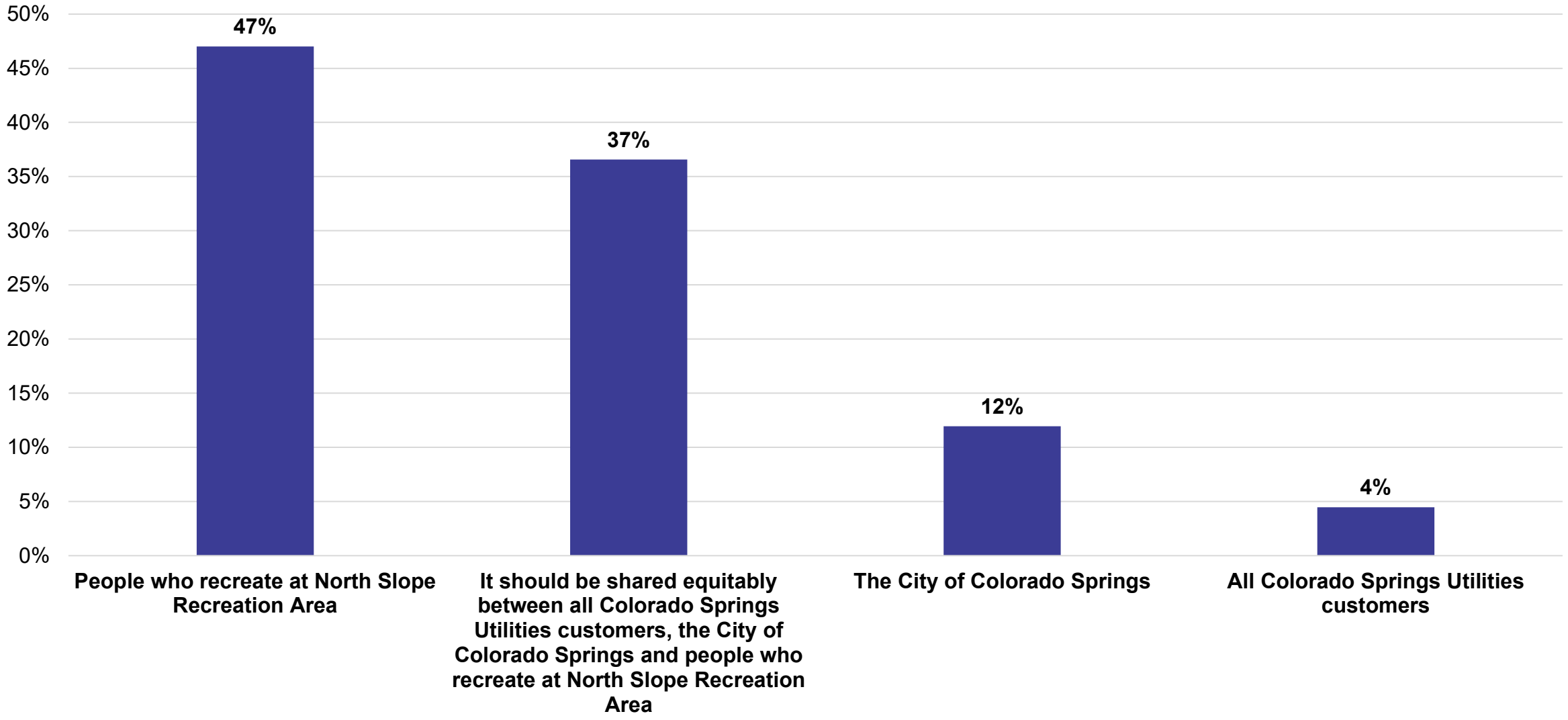


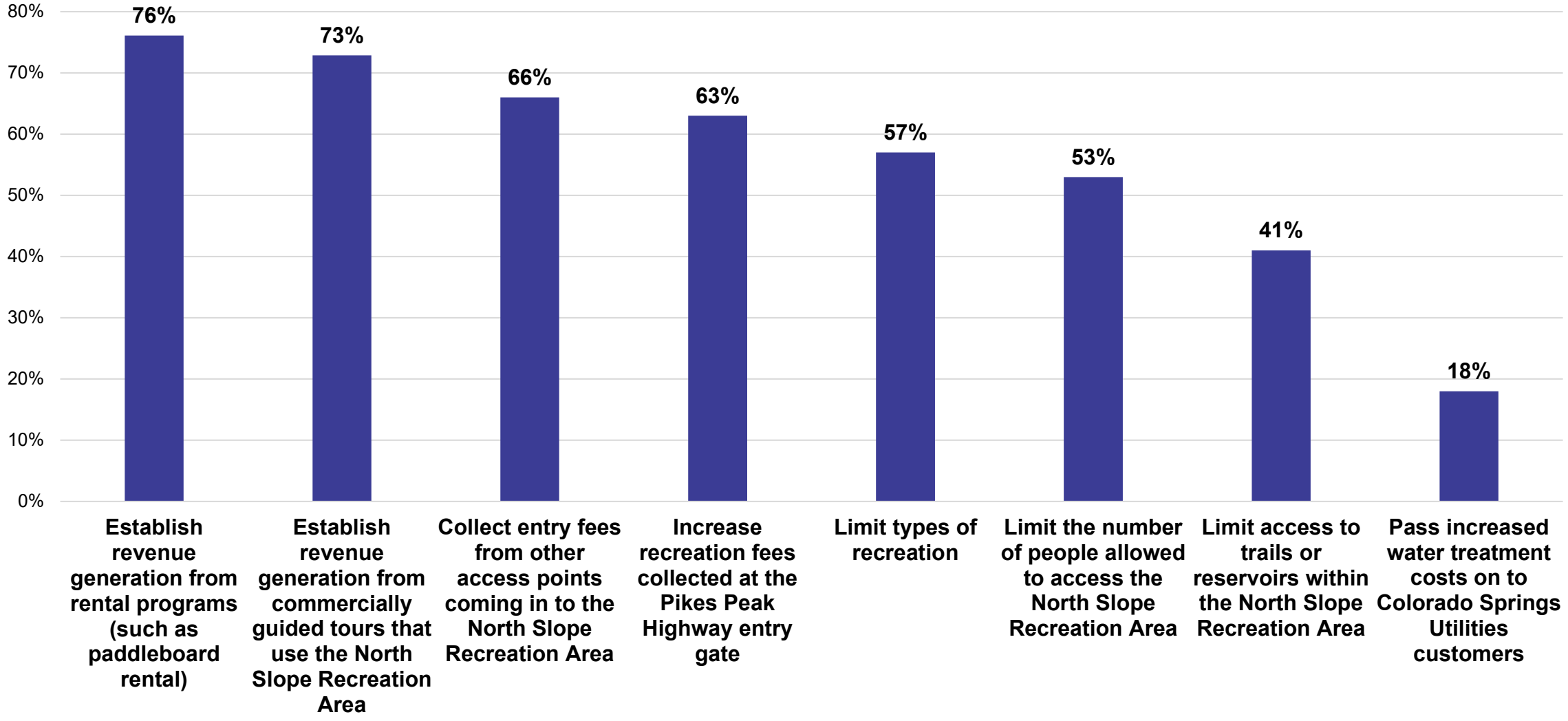
How Important are these Objectives to You?



Who Should Pay for Increased Costs?



How should we address higher costs associated with impacts from this increase in recreation?



Recreational Visitor Survey

Recreational Visitor Survey

- Conducted May 21st through September 17th
- 937 respondents
- Responses were tabulated by ZIP code
  - Colorado Springs (CO Springs) Residents
  - Out-of-region
  - Unspecified (individuals who did not provide a ZIP code)

Key Takeaways

Recreators support dual mission of protection and recreation.

Recreators expect management of amenities, crowding and ecological impacts, and user-based cost recovery mechanisms.

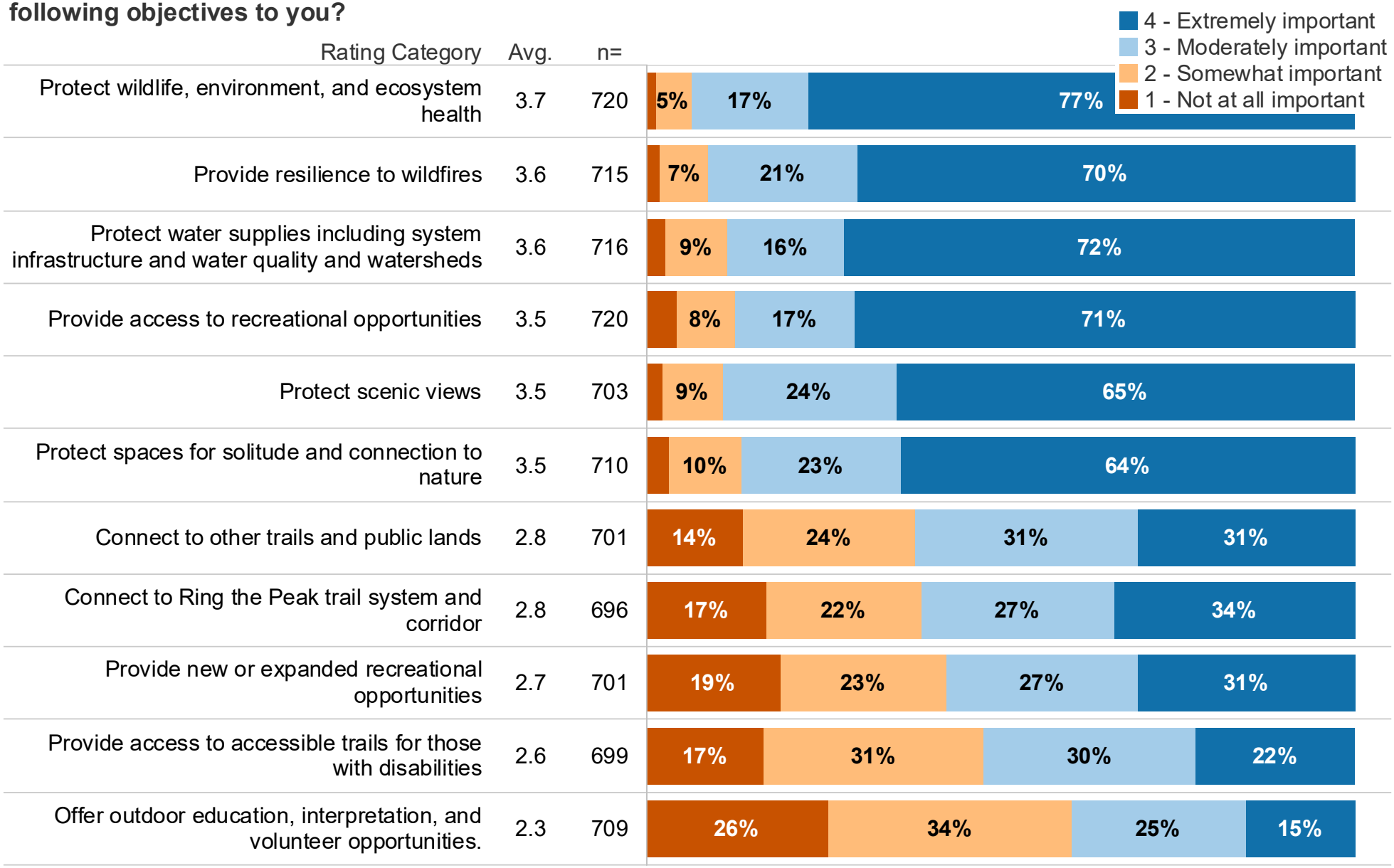
Management should strengthen infrastructure around hiking and fishing, improve targeted amenities, and establish sustainable funding.

Adopt monitoring tools and adaptive strategies to respond to recreation pressures for ecosystem protection.

What amenities would enhance your visit or experience at the North Slope Recreation Area?

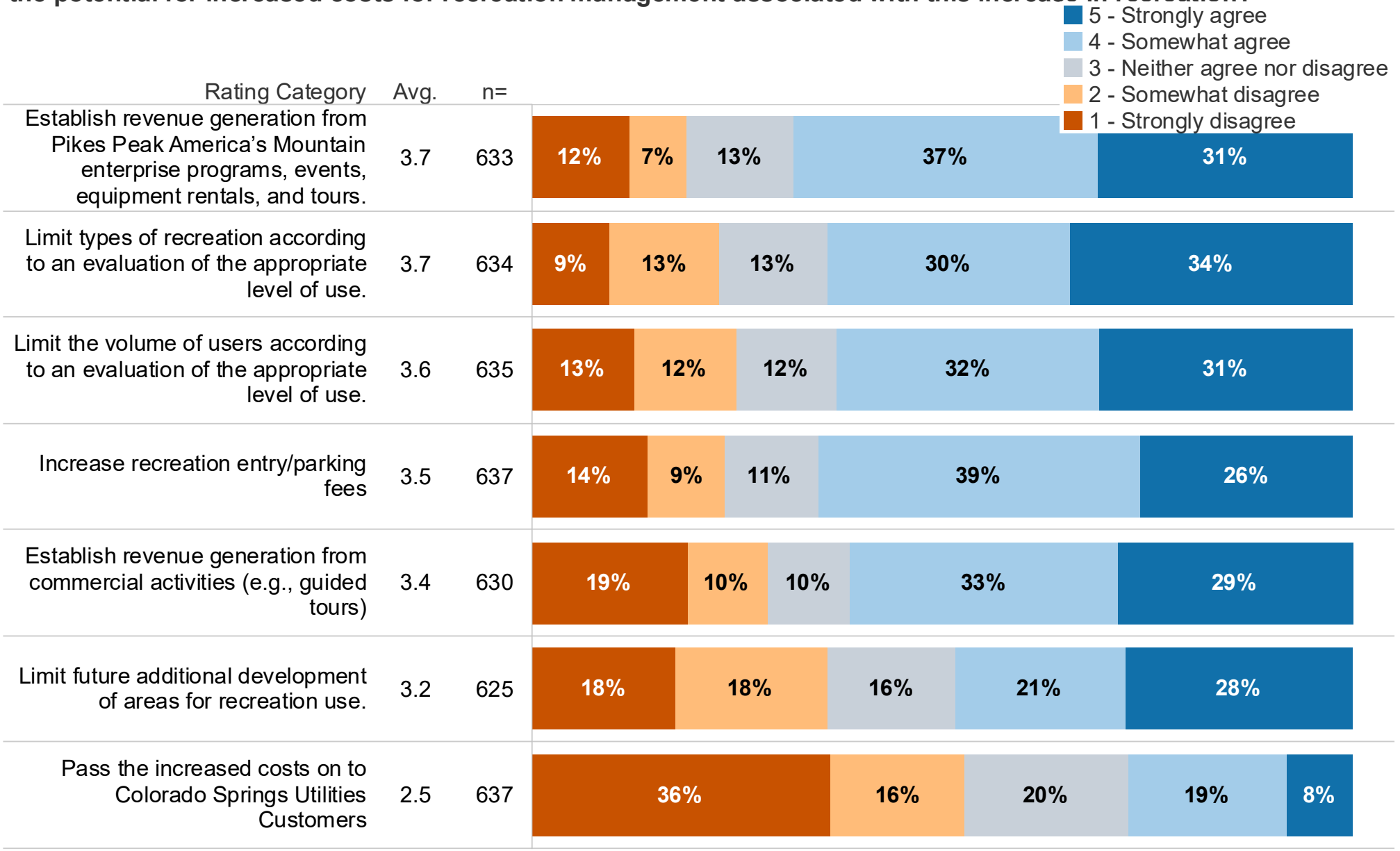
Rating Category	Avg.	n=	1 - No effect	2 - Slightly Enhance	3 - Moderately Enhance	4 - Greatly Enhance
Restrooms	3.0	506	11%	21%	31%	38%
Trash cans	2.9	494	12%	23%	31%	34%
Additional wayfinding at trailheads	2.4	487	28%	26%	26%	20%
Dog waste stations	2.4	482	32%	22%	23%	23%
Rest areas/shelters	2.3	486	26%	31%	27%	16%
Emergency contact stations (GPS/paging systems)	2.3	473	30%	29%	23%	18%
Reservable Parking areas	1.8	498	54%	22%	13%	10%
Gear cleaning stations	1.6	464	60%	26%	10%	5%
Bike/gear repair stations	1.5	465	64%	24%	8%	4%
Guided tours	1.5	479	77%	8%		11%
Public transit connections	1.5	473	73%	14%	6%	7%
Other (Please specify:)	2.3	122	53%			40%

When thinking about North Slope Recreation Area and the lands surrounding the reservoirs, how important are following objectives to you?



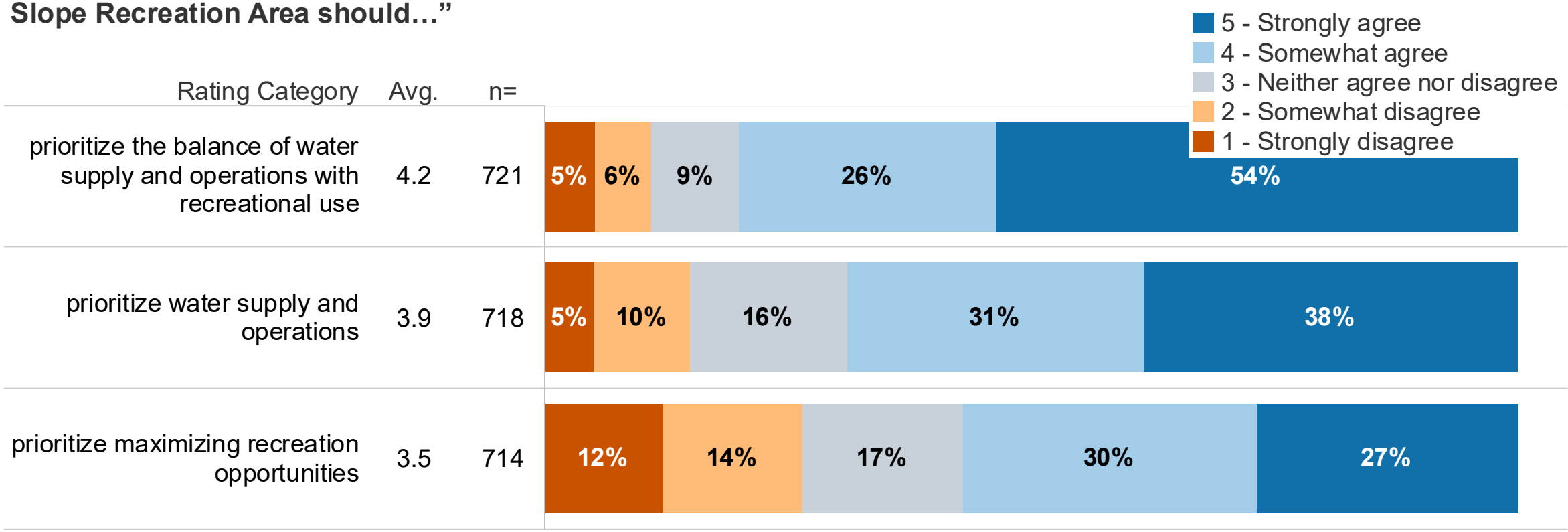
Rating Category	Avg.	n=	4 - Extremely important	3 - Moderately important	2 - Somewhat important	1 - Not at all important
Protect wildlife, environment, and ecosystem health	3.7	720	77%	17%	5%	
Provide resilience to wildfires	3.6	715	70%	21%	7%	
Protect water supplies including system infrastructure and water quality and watersheds	3.6	716	72%	16%	9%	
Provide access to recreational opportunities	3.5	720	71%	17%	8%	
Protect scenic views	3.5	703	65%	24%	9%	
Protect spaces for solitude and connection to nature	3.5	710	64%	23%	10%	
Connect to other trails and public lands	2.8	701	31%	31%	24%	14%
Connect to Ring the Peak trail system and corridor	2.8	696	34%	27%	22%	17%
Provide new or expanded recreational opportunities	2.7	701	31%	27%	23%	19%
Provide access to accessible trails for those with disabilities	2.6	699	22%	30%	31%	17%
Offer outdoor education, interpretation, and volunteer opportunities.	2.3	709	15%	25%	34%	26%

As recreation demands increase at the North Slope Recreation Area, how should Colorado Springs Utilities address the potential for increased costs for recreation management associated with this increase in recreation?



Rating Category	Avg.	n=	5 - Strongly agree	4 - Somewhat agree	3 - Neither agree nor disagree	2 - Somewhat disagree	1 - Strongly disagree
Establish revenue generation from Pikes Peak America's Mountain enterprise programs, events, equipment rentals, and tours.	3.7	633	31%	37%	13%	7%	12%
Limit types of recreation according to an evaluation of the appropriate level of use.	3.7	634	34%	30%	13%	13%	9%
Limit the volume of users according to an evaluation of the appropriate level of use.	3.6	635	31%	32%	12%	12%	13%
Increase recreation entry/parking fees	3.5	637	26%	39%	11%	9%	14%
Establish revenue generation from commercial activities (e.g., guided tours)	3.4	630	29%	33%	10%	10%	19%
Limit future additional development of areas for recreation use.	3.2	625	28%	21%	16%	18%	18%
Pass the increased costs on to Colorado Springs Utilities Customers	2.5	637	8%	19%	20%	16%	36%

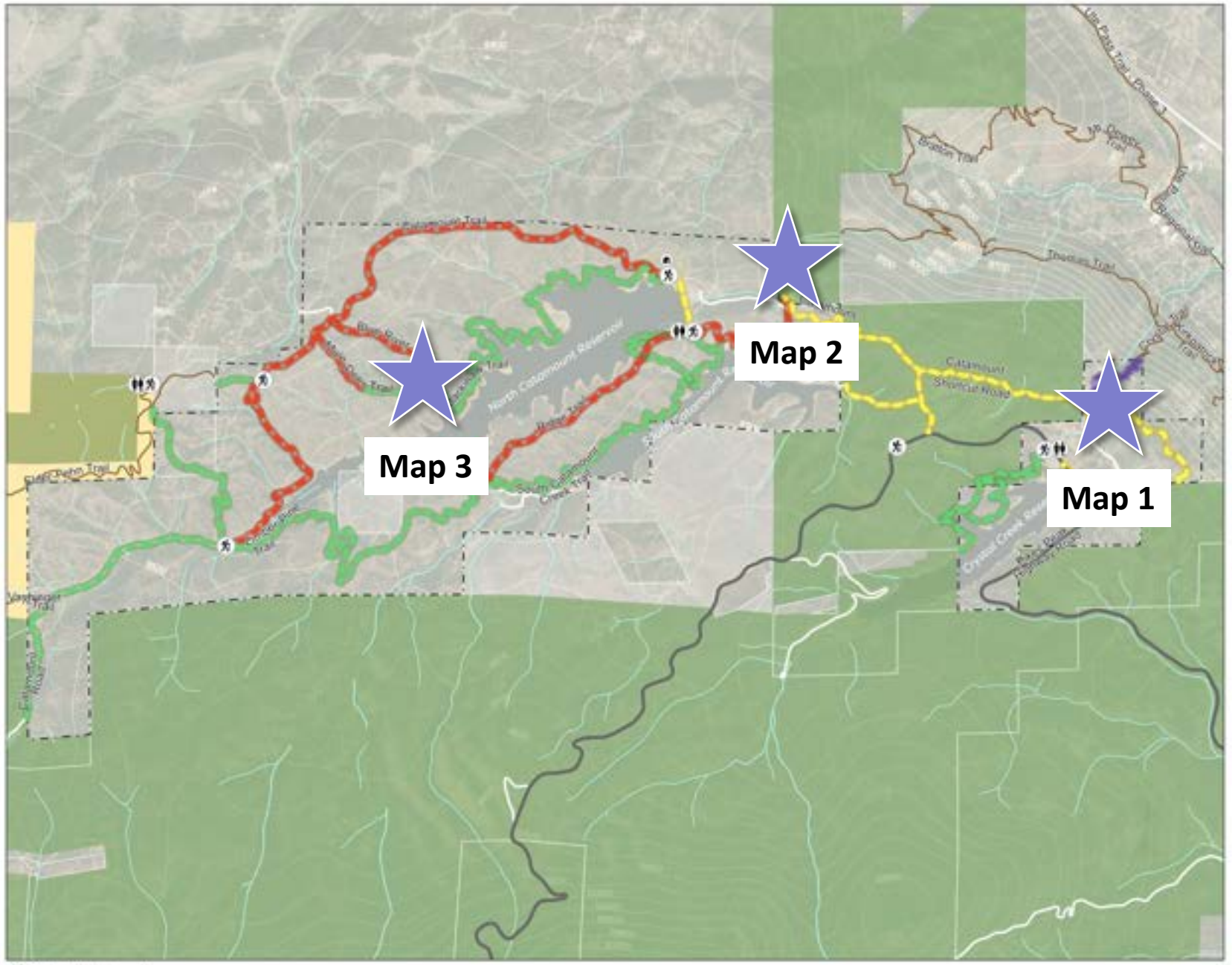
Please rate your agreement or disagreement with the following management statements. “Management of the North Slope Recreation Area should…”



Rating Category	Avg.	n=	5	4	3	2	1
prioritize the balance of water supply and operations with recreational use	4.2	721	54%	26%	9%	6%	5%
prioritize water supply and operations	3.9	718	38%	31%	16%	10%	5%
prioritize maximizing recreation opportunities	3.5	714	27%	30%	17%	14%	12%

Proposed Trail Concepts

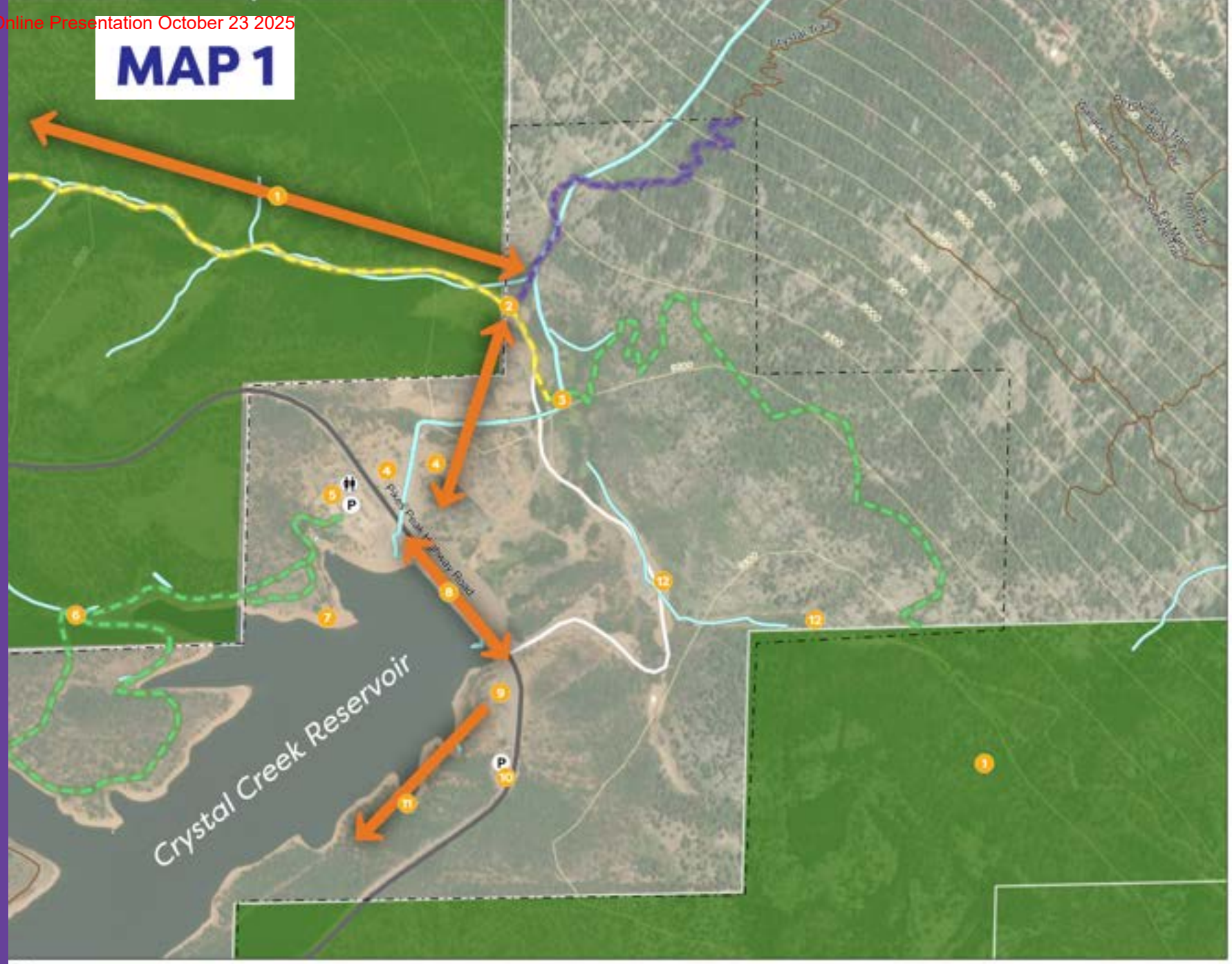
NORTH SLOPE RECREATION AREA OVERVIEW



LEGEND

- Restrooms
- Trailheads
- Parking Area
- Caretaker's House
- Caretaker's House (300 Foot Buffer)
- Trails Not Under Consideration
- Roads
- Pikes Peak Highway
- 1913 Congressional Reserve
- Bureau of Land Management Managed by US Forest Service
- Pike National Forest
- 100 Foot Contour Lines
- Trail to be Decommissioned
- Trails Recommended for Re-Routing
- Trails Recommended to Remain
- Trails Requiring Improvements or Formal Designation/Authorizations to Remain
- Drainages
- North Slope Recreation Area Boundary
- Catamount Institute
- Teller County Open Space

MAP 1



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- Potential Connections
- North Slope Recreation Area Boundary

CONCEPTUAL RECOMMENDATIONS AND POINTS OF INTEREST

1. Potential new trail; coordination and NEPA environmental review required for trail segments on US Forest Service land
2. Proposed trail route from Crystal Creek Reservoir and gift shop to connect with route to North and South Catamount Reservoirs
3. Connections from existing trails to new trails will need to address existing flume and provide for water crossings
4. Potential trail additions to tie into Crystal gift shop access while avoiding spillway and helipad infrastructure
5. Crystal Reservoir Gift Shop and parking area
6. Coordination and NEPA environmental review required for trail segments on US Forest Service land (including recommended trail connection here)
7. Shoreline area is a desirable point of interest
8. Improvements and signing needed to support trail/pedestrian crossing over dam
9. Further evaluation of connections needed for routing trail users closer to road instead of near water
10. East parking area
11. Access to south side of Crystal Creek Reservoir for fishing is desirable
12. Recommended closure of social trails through area to decrease conflicts with Springs Utilities staging areas

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MAP 2

MAP 2

LEGEND

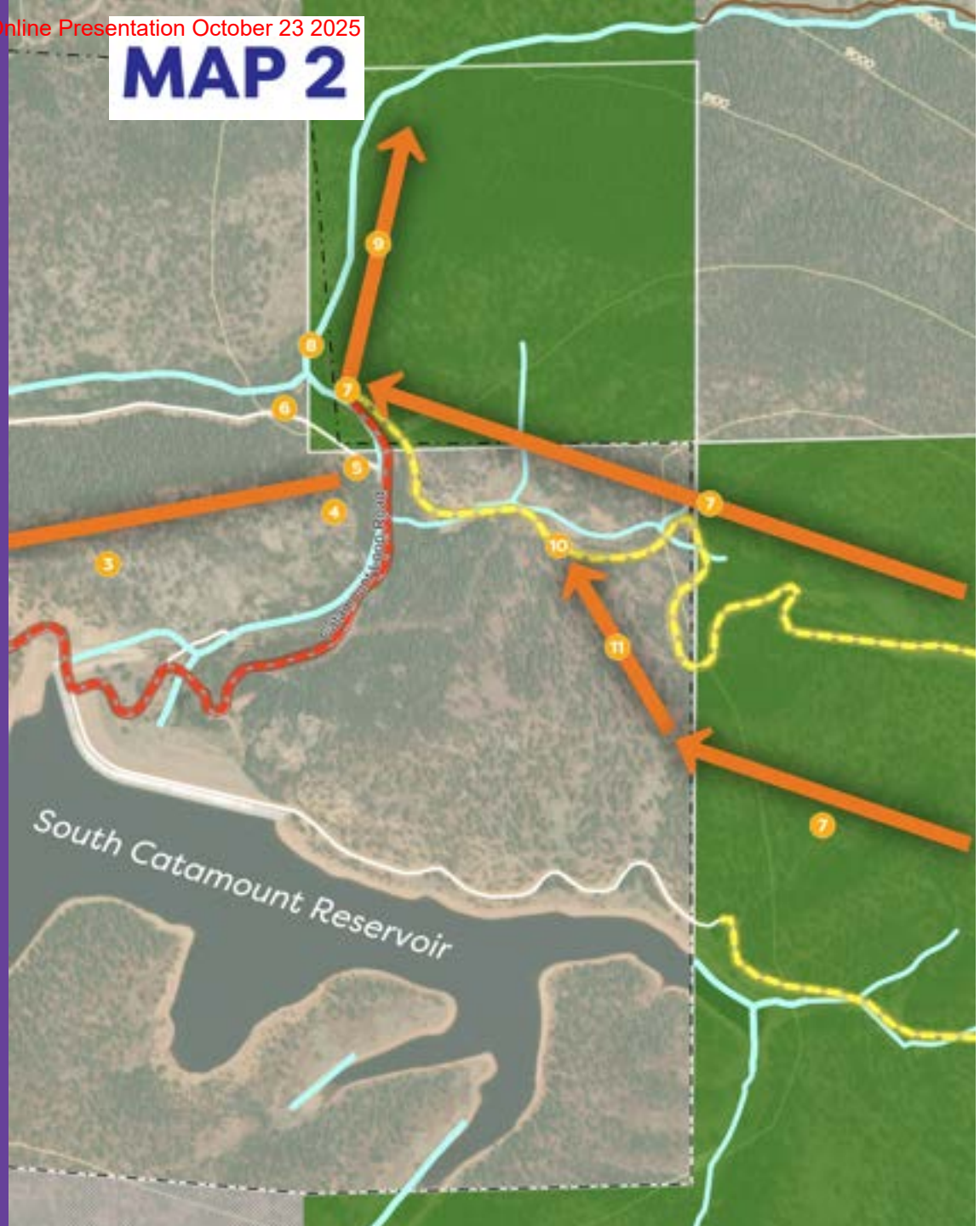
- Restrooms
- Trailheads
- Parking Area
- Caretaker's House
- Caretaker's House (300 Foot Buffer)
- Trails Not Under Consideration
- Roads
- Pikes Peak Highway
- 1913 Congressional Reserve
- Bureau of Land Management Managed by US Forest Service
- Pike National Forest
- 100 Foot Contour Lines
- Trails Recommended for Re-Routing
- Trails Recommended to Remain
- Trails Requiring Improvements or Formal Designation/Authorizations to Remain
- Drainages
- Potential Connections
- North Slope Recreation Area Boundary

MAP 2

CONCEPTUAL RECOMMENDATIONS AND POINTS OF INTEREST

1. Need for improved trail/pedestrian connection across dam
2. Beginning of Kinnikinnick Trail
3. Recommended removal of trails from service roads by adding alternative connection
4. Control rock - trail needs to route above this area
5. Potential road crossing location
6. Potential boardwalk /marsh crossing
7. Potential new connections to "Hairpin Turn"; coordination and NEPA environmental review required for trail segments on US Forest Service land
8. Potential creek crossing location
9. Potential connection to Green Mountain Falls; coordination and NEPA environmental review required for trail segments on US Forest Service land
10. Possible road crossing locations
11. Potential off-road route to reach crossing to the north. If trail remains on south side of the service road, a side path would be needed
12. Potential off-road trail between the existing Ridge Trail and South Catamount Creek Trail

MAP 2



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MAP 3

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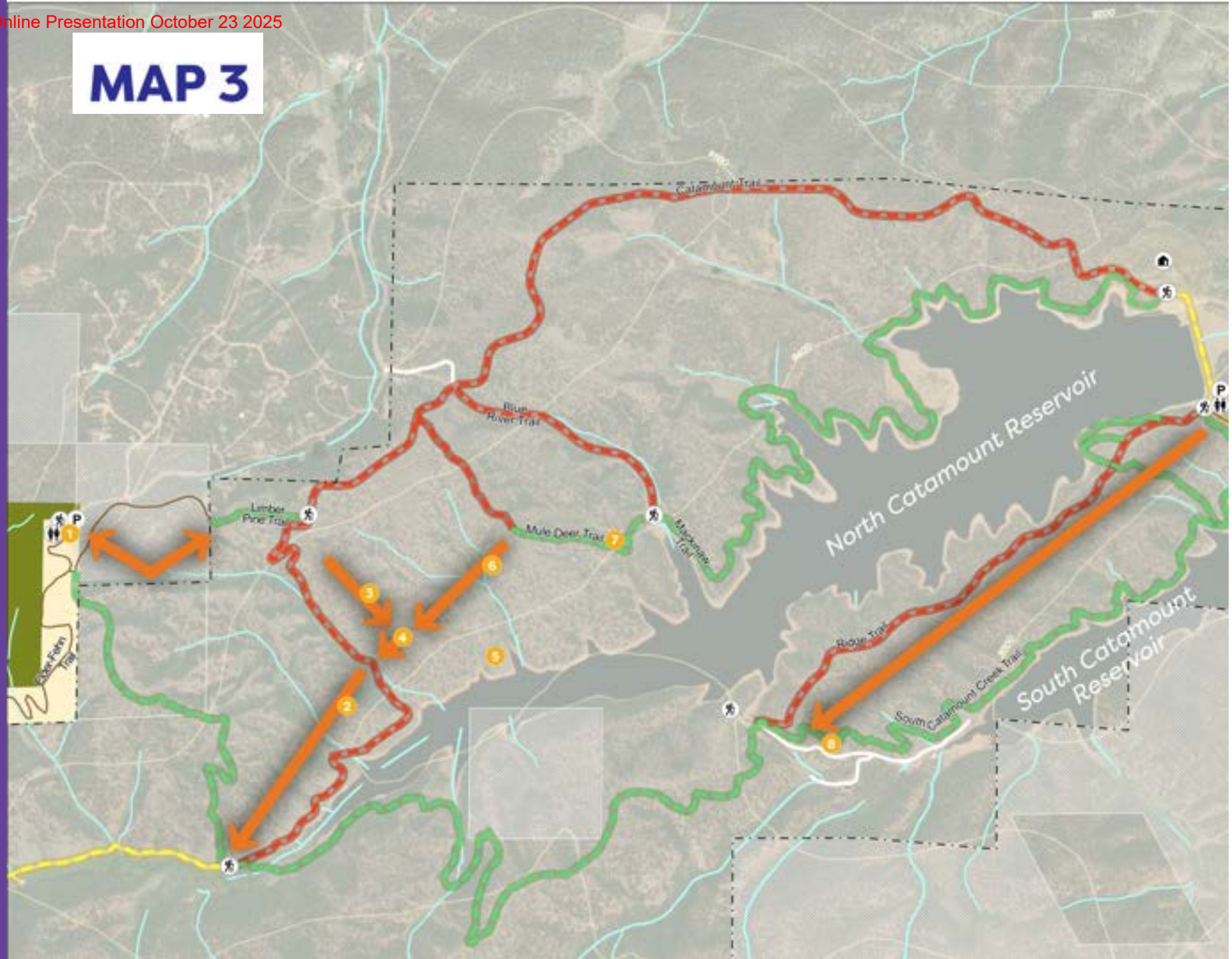

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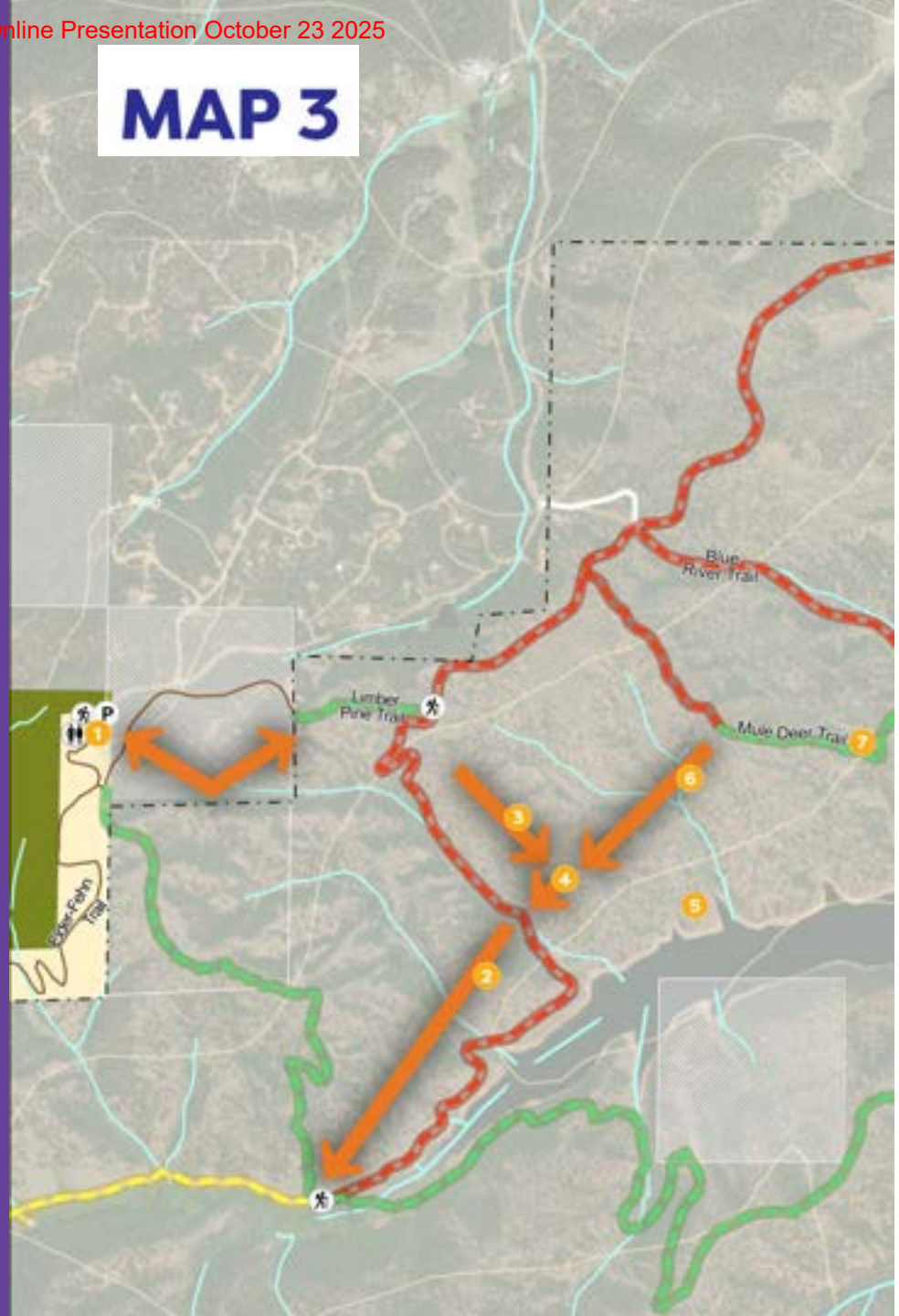
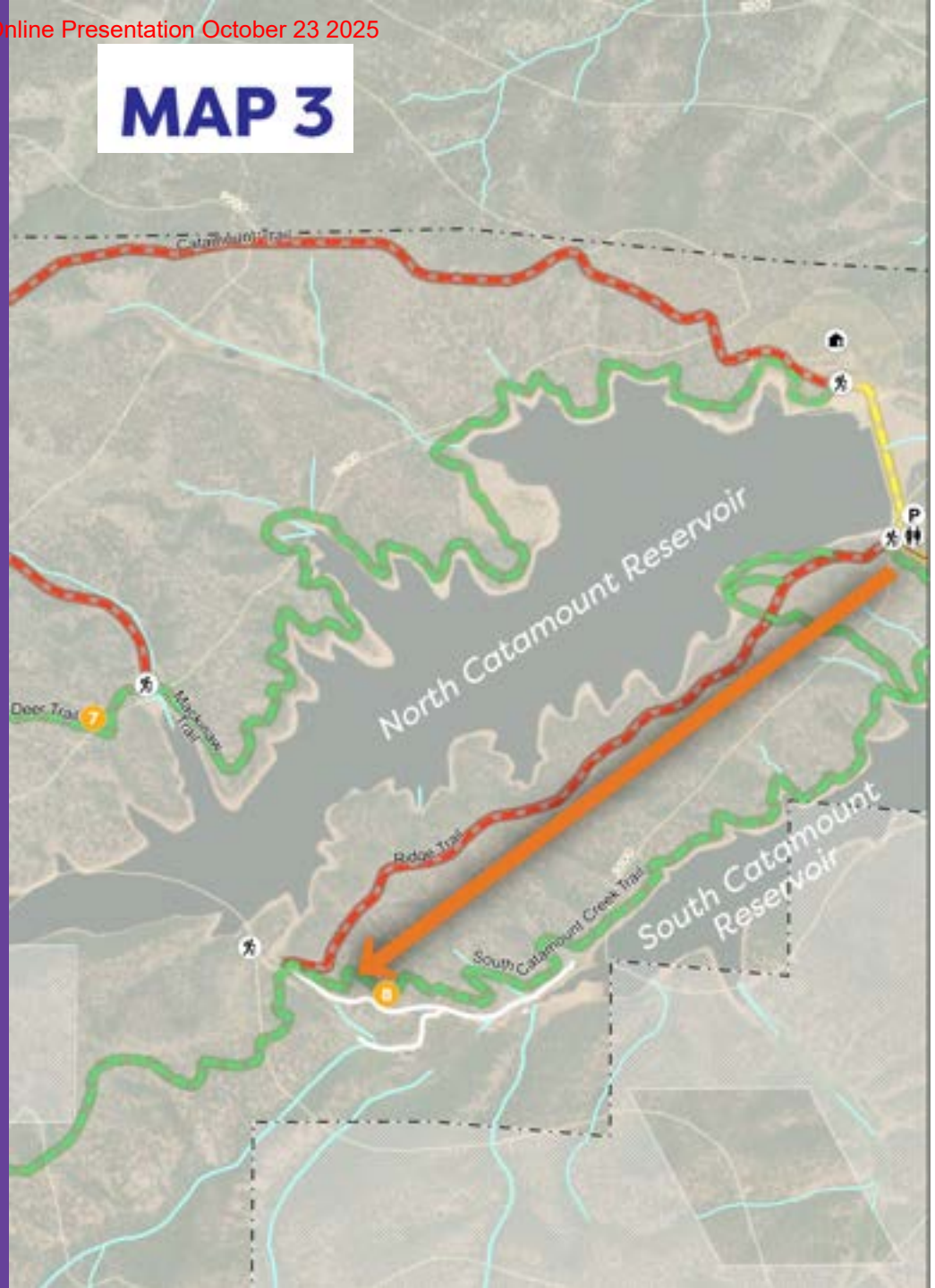


CONCEPTUAL RECOMMENDATIONS AND POINTS OF INTEREST

1. Potential connection to BLM/US Forest Service managed land and Teller County Open Space Trailhead (coordination and NEPA environmental review required for trail segments on US Forest Service land)
2. Potential connection to Limber Pine Trail and on to property boundary
3. Potential realignment of Limber Pine Trail and provision of crossing to new trail
4. Potential trail connection area to provide connection to fishing access and connection to other trail routes
5. Recommended fishing access location
6. Recommended removal of trails from service roads by adding alternative connection mid-slope
7. Need to evaluate and implement trail improvements to address erosion in this area
8. Potential off-road trail between the existing Ridge Trail and South Catamount Creek Trail



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Questions?

Next Steps

- Public comments received through Nov. 24, 2025, at engage@csu.org
- Ongoing coordination with Utilities leadership
- Utilities Board and Colorado Springs City Council: Spring 2026
- Upon approval, implementation will occur over time
  - Changes will be communicated as they are implemented
- Information at csu.org/NSRAreview

Colorado Springs Utilities

It's how we're all connected

Q#	**Question received**
1	What ecological carrying capacity studies or water quality impact assessments have been conducted to guide recreation decisions at NSRA? Will those findings be made publicly available?
2	How will CSU monitor and mitigate cumulative environmental impacts such as sedimentation, nutrient runoff, wildlife displacement, and vegetation loss if recreation is expanded?
3	How is CSU integrating wildfire risk into its long-term recreation and watershed protection planning?
4	What is CSU's projected annual cost for recreation management under expanded access and how will these costs be covered without burdening ratepayers?
5	Will CSU implement a user fee, conservation pass or permit-based access model to fund staffing, infrastructure, and ecological monitoring? If so, how will revenue be transparently reinvested?
6	How will CSU enforce boundaries, seasonal closures, and compliance with Leave No Trace and public use rules given current enforcement capacity?
7	Will additional rangers or partnerships (e.g., with conservation corps) be established?
8	What role will environmental education play in CSU's recreation model?
9	Will there be interpretive signage, guided programming, or collaboration with schools and nonprofits to foster stewardship?

10	How will CSU address the public misconception that NSRA is a recreational park rather than a protected water supply zone?
11	What communication strategies will be used to reframe expectations?
13	Will CSU prioritize mission-aligned programs such as youth conservation education, family-based outdoor learning, or nonprofit-guided stewardship in creation access decisions?
14	How is CSU ensuring that underserved, military-connected, and underrepresented communities are involved in the planning process not just high-use recreation stakeholders?
15	What metrics will CSU use to evaluate the ecological and operational impacts of expanded recreation (e.g., water quality, trail erosion, visitor compliance)?
16	Will CSU publicly report on these metrics annually, and is there a clear threshold or adaptive management plan in place to scale back or suspend access if degradation occurs?
17	Will there be permitting for paddleboard excursions by Dragonfly Paddle Yoga?
18	Infrastructure improvements- road paving for erosion control and to remove washboard gravel roads?
19	Allow water contact - people and dogs?

20	What is the proposed route for Ring the Peak to connect from the Mt Esther / Crowe Gulch trail (Forest Service 754) through North Slope to Forest Service 385?
21	Access for kayaking and fishing with artificial bait (fly fishing).
22	I'd like to learn more about input already received, trail connectivity and alignment, Ring the Peak Trail segments, recreational opportunities today and into the future such as hiking and fishing, opportunities for guides and outfitters on the reservoirs and trails such as guided hiking, photography classes, paddle boarding, kayaking, fishing...
23	Why we can put 1 time use codes on the gate to facilitate entry/exit for when the ranger isn't there.
24	Will there be talk of limiting access to North slope?
25	What is the route for Ring the Peak?
26	What role will CPW play in Ring the Peak?
27	Any plans for opening in winter?
28	Will commercial use be allowed? If so, will they have to pay for use?
29	Will the recreation as in kayaking etc be limited
30	Through my business, Dragonfly Paddle Yoga, I operated paddleboard excursions on N and S Catamount Reservoirs. I'd like to resume those excursions, which were about 4-5 over an entire season.
31	Public access and recreational opportunities.

32	Plans for the area
33	Review of the considerations made in developing the draft maps for the plan
34	Future access to North Slope Recreation Area including Ring the Peak Trail for hikers and mountain bikers.
35	Why does the area close from Oct 1 - May 1 each year?
36	What, if any, changes in area recreational use are in store for the future?
37	What existing trails if any does CSU propose to close or relocate?
38	when will access to north and south catamount be reopened?
39	I will be representing the Green Mountain Falls Parks, Recreation, and Trails committee. I am also an active hiker and paddler in the North Slope area. With this combination I am very interested in any changes CSU proposes for access to this area.
40	Ring the Peak Trail route
41	What is the future of guided opportunities on North Slope rec area?
42	Are the water levels of the North Catamount Reservoir going to be increased to the normal level and when?
43	What limits, if any, do you plan to impose in hiking and mountain biking in the NSRA?
44	Trail updates. Expanded shoulder seasons.
45	All of them ;-)
46	When will hiking access to reservoirs be opened from Green Mountain Falls?
47	Personally, my family enjoys fishing and hiking on the NS. Professionally, I help communicate with visitors to the region, and I'm looking for information to share with them.
48	What is the plan for watercraft rentals at Crystal Reservoir? What is the new timeline for opening the other two reservoirs on Pikes Peak?
49	What is the overall intended plan and what is the projected timeline for the NSRA?
50	What funding is available?

51	Who is providing the manpower, tools, and oversight?
52	Are volunteer or employment opportunities available?
53	Will there be training or certification opportunities?
54	Do these plans expand the Ring the Peak trail system?
55	Will management of the NSRA change? If so, how?
56	Will plans eventually also include the South slope RA and/or other areas of PPAM and surrounding areas?
57	What methodology did CSU use when developing the questionnaire/survey.
58	What regional groups & stakeholders did you solicit input from when developing the survey? If you did not coordinate with regional partners, why not? Who do you consider stakeholders in this effort?
59	How will the reopening of North and South catermonts(sp Catamounts) affect the changes that will come?
60	What maintainence is in place for the future of our water source?
61	Anticipated use authorizations to include watercraft use, angler restrictions (tackle/# of anglers), parking access, commercial guiding opportunities
62	Why were Ring the Peak signs removed?
63	What are the plans for the trails?
64	What access is going to be allowed?
65	Reopening of the trails you've closed for the dam reconstruction work, and continuing efforts to complete the ring the peak trail system.
66	Future of Ring the peak trails and RTP signs .
67	Fishing and Watercraft recreation rules and regulations (Colorado fishing is a year-round activity).
68	Will improvements to existing, or additional trails ever be integrated to area.
69	Will future improvement plans feature: ADA ramps and parking, additional and/or expanded guest parking.
70	minimalistic "Shelter In place" shelters for extreme weather events in remote sections.

71	Add benches or seating with helpful/informative animal/environmental interpretive signs/plaque alone shoreline and trailways.
72	Operational Kiosks at trail heads.
73	Is there any chance of keeping the Crystal Trail from Green Mountain Falls open?

Comments received 12/1/2025.

Dear CS Utilities North Slope Planning Team,

Medicine Wheel Trail Advocates (MedWheel) appreciates the opportunity to provide input on the North Slope Recreation Plan. This is an important step forward for the community, and we thank you for the time, effort, and public engagement invested in this process.

Our members have used and stewarded trails in this area since the early 1990s. During that time, MedWheel has completed trail work, particularly on the Limberpine Trail, and has assessed the area for network improvements. Our analysis has considered:

- Potential mountain bike access points, including via the toll road, existing parking lots, and Edlowe Rd
- Winter hiking/snowshoeing access when North Slope Road is closed
- Looping and stacked loop opportunities from various access points, to add variety to the overall network and disperse users
- Strong demonstrated user interest in accessing reservoir shorelines

All proposed routes were evaluated for grade using computer mapping. Some alignments have also been field-checked, though not flagged or surveyed. We will be happy to provide .GPX files for the noted trail proposals

We offer these recommendations to help maximize recreational value with moderate resource impacts, while improving safety and supporting Utilities operations. MedWheel is eager to partner with CS Utilities and other stakeholders to further refine and advance these concepts over time, toward a connected, sustainable trail system.

The North Slope network has the potential to provide cooler summer recreation, regional trail dispersion benefits, and added value through toll-based access. With thoughtful design and implementation, this system can serve both operational needs and growing community demand for high-quality outdoor access.

Throughout this document we followed the color coding used in the public meeting documents.

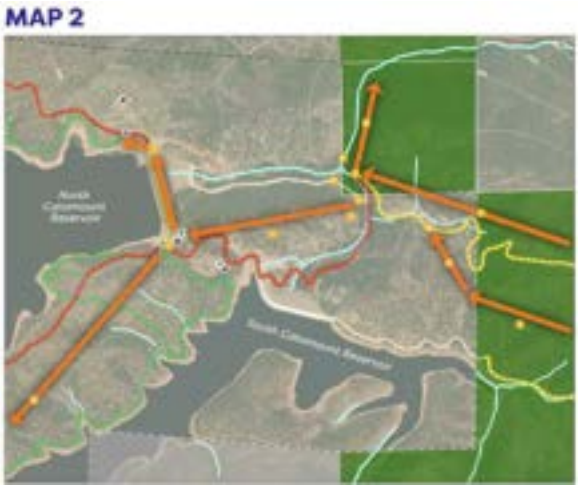
Green - Existing trails that are proposed to remain
Yellow - Existing trails that require improvements
Orange - Recommended re-route alignments (left on the maps for reference)
With the addition of:
Pink - MedWheel specific proposed trails to meet plan objectives, plus additional recommended connections in areas of high interest.

MEDICINE WHEEL
TRAIL ADVOCATES

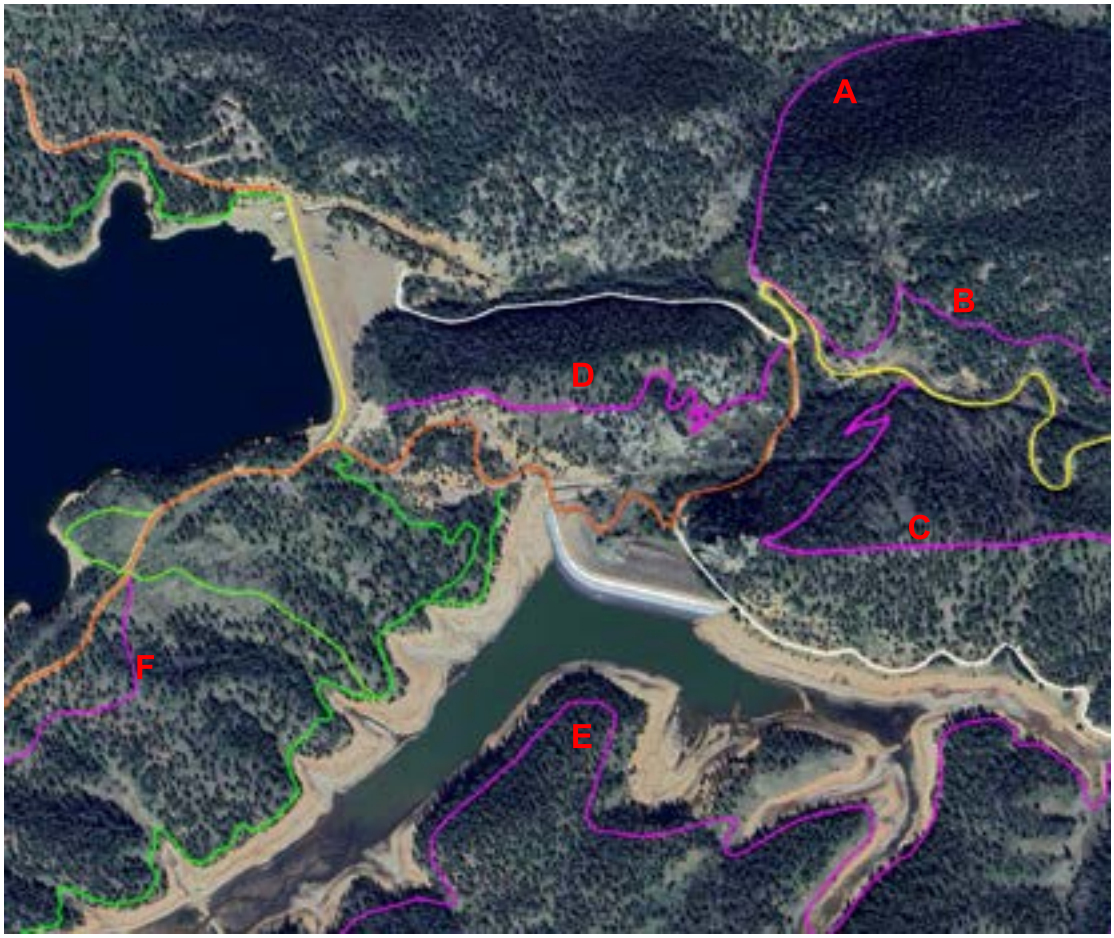
Comments received 12/1/2025.

A. Proposed alignment to meet desired corridor in the plan.
B. Proposed alignment to meet desired corridor in the plan.
C. Proposed alignment to meet desired corridor in the plan.
D. This shows a popular EXISTING trail that provides both a desirable RTP connection with nice ridgetop views AND connects to PPAM. We request the CSU portion be acknowledged as aspirational for the future, when RTP discussions proceed with USFS.
E. Crystal Trail - MedWheel supports improvement, rather than decommissioning, of this popular connection to Green Mountain Falls

Comments received 12/1/2025.



A. Proposed alignment to meet desired corridor in the plan.
B. Proposed alignment to meet desired corridor in the plan.
C. Proposed alignment to meet desired corridor in the plan.
D. Proposed alignment to meet desired corridor in the plan.
E. Desirable shoreline access that would connect to the existing parking lot at Mile 7
F. We have an alignment proposed for this desired reroute



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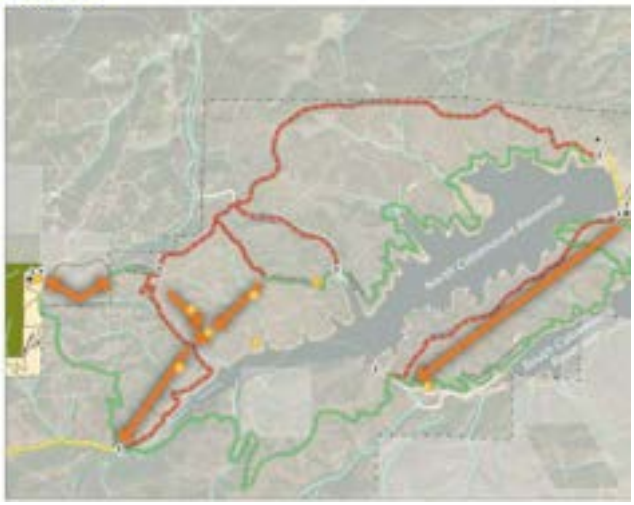
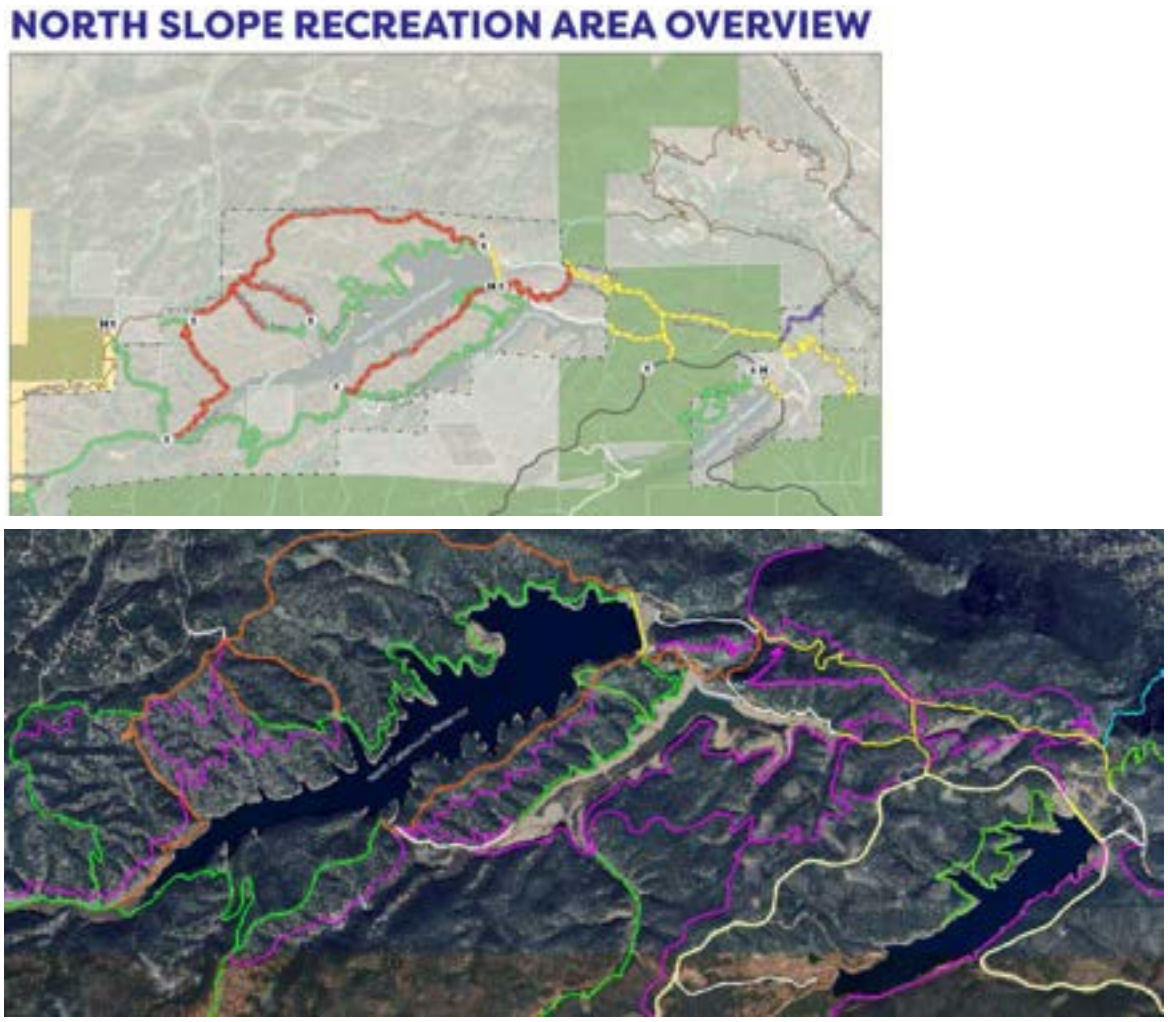


A. Proposed alignment to meet desired corridor in the plan.
B. Proposed alignment to meet desired corridor in the plan. The alignment we're proposing shows increased connectivity to Edlowe Rd and an improvement to the mackinaw trail to the boat ramp.
C. Proposed alignment to meet desired corridor in the plan.
D. Full alignment shown for the desired plan reroute.
E. Provides a valuable connection to the east shoreline of South Cat reservoir, and to the Mile 7 parking lot.
F. The recent realignment of Limberpine should be included in the plan.
G. Mackinaw trail should be shown in the plan as bike/multi-use access, and would benefit from some improvements.

Comments received 12/1/2025.



North Slope Trail Overview

#	Zip code	What is your interest in the North Slope Recreation Area plan?	Please provide the page and/or map number of the draft plan and your comment or suggested change.
1	80904	Springs Utilities customer; Outdoor lover;	New trail alignment looks good we need more trails & no commercial use is my suggestion.
2	80904	NSRA Recreator; Springs Utilities customer;	To the planning team, While I do not have specific page numbers to cite, I want to offer some general feedback on the overall plan. First, please consider keeping this space free of charge for non-commercial users. This area has been closed for quite a while now and it is really time to open it back up for people to enjoy. Also, the proposed changes for the North Catamount Dam specifically seem unnecessary to me. This short stretch already works great for hikers and the limited number of cars that pass it just the way it is. My biggest hope is that none of the changes being considered will delay the reopening of this space for outdoor enthusiasts in the Colorado Springs area. Thank you very much for your time and for taking these comments into consideration.
3	80906	NSRA Recreator; Springs Utilities customer;	Pgs 28 and 29. I strongly oppose allowing any commercially guided recreation. The beauty of this place is also due to the tranquility. Let the public pay to use this place to responsibly recreate, but do not expand this to tourism. Keep it the quiet gem it is. Commercial fishing and boating will ruin this place and pack it with tourists rather than the taxpayers who live in the area. We cater too much to tourism in this region as it is. Think of the beauty of the place and the citizens FIRST. Everyone I know who recreates here is opposed to commercial use of this precious area. “Mixed” feelings about this issue, as stated on p 29, tells me to err on the side of caution. Not charge ahead with commercial use. Please move ahead with improvements but I think more public input needs to be taken in in the commercial use issue. Thank you for considering.

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4	80919	NSRA Recreator; Springs Utilities customer; Organization representative;	Page 47 - Guided recreation: Im glad to hear this is being considered. Guided recreation is actually the easiest and most effective way to create responsible users in the outdoors. Guides care a great deal for the resources, a lot better than most users. There is a great opportunity to collaborate with them and utilize their expertise in ways to help educate the general public. PPAM is the outdoor centerpiece of our region. This attracts people from all over the world. Visitors want to hire a coach to enhance their experiences. These visitors are more likely to spend more dollars in the community if commercial guided recreation is available. They make more trips. Utilize more lodging, eat at more restaurants, shop in more stores, etc. CSU needs to look at the outfitters as partners, because together we can accomplish every goal listed in this plan.
5	80919	Springs Utilities customer; NSRA Recreator; recreational uses and connectivity to CSUtililies properties;	I suggest a main trail connection from the parking area at the NSRA Catamount reservoir entrance be included to reduce folks driving into the NSRA. Also a plan for a public access road that does not cross the under and across the dams; this new road alignment could utilizing the lands that are part of 1913 Congressional Reserve.
6	80904	NSRA Recreator; Springs Utilities customer;	Pg 38 - Concern about lack of connectivity to nearby trail systems - This plan proposes to decommission a connection between Crystal Trail and the rest of the NSRC trail system. If this is to move forward, I believe there should be a plan for a new connection between the trail system east of NSRC, which would expand (not limit) trail connectivity in the area. For example, it would be neat if there was a trail connecting the Thomas/Bratton trail to the NSRC trail system.
7	80906	Springs Utilities customer;	North Slope Recreation Area Study - I'm against commercial guided fishing and boating tours in the area. It will lead to overcrowding and too many people in that area.
8	80403	Area resident;	What are the plans to counter the additional traffic through Woodland Park and especially to Edlowe Rd. I don't see hardly any consideration for local residents that enjoy the solitude of this area.
9	80906	NSRA Recreator; Springs Utilities customer;	p 32 (p 38 in the pdf) Mackinaw should allow both hiking and biking, especially if it will be the only connection in that area. The paragraph on Mackinaw describes it as hiking-only, which it currently is, but never says that designation will change to allow bikes.

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10	80906	NSRA Recreator; Springs Utilities customer;	in general, the plan does not seem to address e-bikes. Several places mention nonmotorized biking or nonmotorized mountain biking. Don't remember exactly when, but to allow e-bikes under the TOPS ordinance, city council defined class 1 e-bikes as nonmotorized. If you want to allow that, then the terminology is fine. If you don't, you probably want to change the term you use. You might just want to address the issue of e-bikes explicitly, whichever way you want to go with that. allow or prohibit.
11	80819	Elected Official;	Pg 14 - Crystal Creek Trail to Green Mountain Falls. The statements in this section lead one to believe that the entire Crystal Trail is a social trail and not maintained. This is not accurate. The only section that is not maintained is on CSU property. All other portions of the trail, either on Green Mountain Falls or Historic Green Mountain Falls Foundation property, have and will continue to be maintained and used. The portion of the trail that is not on CSU property is an official Town trail.Pg 14 - Catamount Trail to Bratton Trail. The statements in this section lead one to believe that the entire trail from Pike National Forest property to the connection to the Bratton trail are unauthorized social trails and not maintained. This is not accurate. The Catamount Trail from the intersection of the Bratton trail to the end of Green Mountain Falls public property (beginning of Pike National Forest property) is very well maintained and is an official Town trail.There may be other areas that need significant clarification regarding these types of statements. These type of statements are not accurate and can be damaging to the Town of Green Mountain Falls.
12	80904	NSRA Recreator; Springs Utilities customer;	Hugely support the commercial recreation proposal in the draft! Great BMP's to make it sustainable.
13	80904	NSRA Recreator; recreation guide;	Pg 30, Alternatives & criteria considered: Please consider restoring commercially guided recreation in the NSRA. As a guide for Angler's Covey, I have conducted numerous half day trips for flyfishing on N Catamount before the current ban started 2 years ago with the repair to the dam. Many of our clients indicated to me they wouldn't have explored the NSRA without a guide, as it was overwhelming to undertake a 1/2 day or 1 day trip, with all the logistgics involved. Licensing, driving, the entry fee, parking and all the gear that goes with the fishing were simplified by hiring us to provide all of that in a simple package. Our ability to provide an educational and exhilerating experience on PPAM for many folks who might never have attempted a trip was a highlight of their entire trip to Colorado Springs for many of our clients, one they would not have had without our ability to provide the same! The stories that will travel back across America are better than any advertising any of us (stakeholders) could do.

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14	80827	Recreation business owner;	I would really like to ensure that the guiding opportunities are not biased towards Angler's Covey, which is a significant personal asset of the people who are on the Board, overseeing this project.
15	80909	Springs Utilities customer; NSRA Recreator;	Recommend that North Slope Recreation Area recreational amenities not be expanded. If anything, watershed access should be diminished to protect source water and water system operations. For too long, Pikes Peak recreation has been unduly influenced by special interests who do not have the best interests of the watershed and citizens in mind and are only interested in making a profit off of City-owned lands, or who would like to turn these watersheds into their own special interest playground (e.g., Jim Bensberg, Medicine Wheel, etc.). Pikes Peak is already loved to death.
16	80909	NSRA Recreator; Springs Utilities customer;	Pg 6: I only have one thought on the access to NSRA from May-October. It seems extremely arbitrary to close it the third Sunday in October, or whatever it is. I know you cite safety reasons, but at the same time people are allowed to drive up the Pikes Peak Highway and ski to their death. I fail to see why people are not allowed to park in the large lot at the entrance to NSRA, and gain access via foot (towards S Catamount). I understand that you will never allow ice fishing, but why not allow people to use the area well beyond the "third Sunday in October?"
17	80908-3008	Professional Fly Fishing guide for Anglers Covey;	Pg 47-54 - I'd like to support allowing guided fly fishing. It's a low impact activity and the fly fishing community would actually have a positive impact on the recreational areas, and guides help people follow the rules, take care of the fish, and respect the area, all other guides I know pick up trash when they see it anywhere. Having guided trips also helps manage use in a more controlled and responsible way!
18	80906	use the area frequently for kayak, hiking;	I do not believe commercial activity in the area is necessary or wanted by the majority of users of the catamount north slope. I would not change what we have today and start allowing commercial activities. I think improving trails is good for the area and usage. Many of the trails are on road services which is not the best situation for hikers.
19	80921	Springs Utilities customer;	Please keep area closed to the public. This is a critical water supply and bad actors may try to pollute our water.

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20	80904	NSRA Recreator;	Pg 32–33 (Catamounts / Network Impacts) Comment: Multiple major trail segments are proposed for decommissioning (Ridge, Catamount, Blue River), which currently function as core connectivity routes. Recommendation: Provide a network replacement plan showing how users will: Travel east–west; Access both reservoirs; Complete loop routes; Ensure replacement trails: Maintain loop options (not just out-and-back);Preserve reservoir adjacency where feasible; Do not concentrate all movement onto a single corridor (Mackinaw) Rationale: Removing parallel routes without equivalent redundancy reduces network resilience and user experience.Pg 32–33 (Mackinaw Trail Expansion) Comment: The plan relies heavily on the Mackinaw Trail extension to replace multiple removed connections. Recommendation: Do not treat Mackinaw as the sole replacement corridor. Add: Secondary connectors to shoreline access; Loop-forming links to Limber Pine and Catamount areas; Distributed access to fishing/viewpoints (not centralized) Pg 33 (Crystal Trail Closure) Comment: The plan proposes full decommissioning of Crystal Trail due to safety and operational conflicts. Recommendation: This is a key regional connection to Green Mountain Falls. Require: A replacement connection before closure; Coordination with USFS and Green Mountain Falls; Reroute prioritized over elimination where feasible. Closure without replacement will sever a key access point and result in persistent re-creation of informal trails. BOTTOM LINE: Trails—whether formal or informal—are expressions of user demand to connect meaningful places. Decommissioning trails without replacing those connections does not eliminate that demand; it displaces it. A successful plan must translate existing desire lines into sustainable infrastructure, not remove them. Every removed trail should be treated as data, and every closure should be paired with an equal or better connection.
21	80904	NSRA Recreator;	Generally speaking: If you close trails without replacing them, folks will just pound out new social trails. Relatedly, any trails being removed need to be replaced with equivalent or improved connectors. It's really important to preserve access to the resevoirs and key existing vistas/views. It's REALLY important to maintain loop options . . .out and back routes are absolutely not the same in important ways.
22	80819	Elected Official; NSRA Recreator;	Pg. 6/14, do not close the Crystal Creek Trail to Green Mountain Falls or the Catamount Trail to Bratton Trail. These are essential parts of the Green Mountain Falls trail system, and would significantly disappoint/disadvantage the numerous people that come to GMF to hike up to the reservoirs to go fishing.
23	80918	NSRA Recreator; Springs Utilities customer;	Why would you decommissioned a perfectly good trail that comes up from the HB Wallace OS? We have lost so many trails to fires that it makes no sense to take away nice option which allows a loop hike from Green Mountain Falls.

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24	80904	Springs Utilities customer; NSRA Recreator;	Please consider including commercial guided activities in NSRA including guided fly fishing. Thank you!
25	80819	Neighboring community citizen; NSRA Recreator;	Page 33 recommends that Crystal Trail be 'decommissioned.' I objects to this finding, but agree with Page 29, which seeks a temporary closure of Crystal Trail 'until a safe, sustainable alternative route is identified.' Allow a joint assessment of conditions and be open to a get-well plan for Crystal Trail
26	80819	NSRA Recreator; neighboring community citizen;	Page 14 calls Crystal Trail, Catamount Trail, and Mt Esther Trail 'unauthorized trails.' Several areas in the draft plan note 'informal and unauthorized social trails' accessing NSRA from Ute Pass. -- Crystal Trail, Catamount Trail, and Mt Esther Trail have linked Ute Pass to the North Slope for generations, predating the designation of the North Slope Recreation Area. -- CSU has known, and allowed, access via these historic trails which predate the 'opening' of North Slope in 1992. -- CSU meeting summaries and articles featured in regional newspapers indicate tacit understanding of a trail on or along the current Crystal Trail alignment for decades.
27	80819	NSRA Recreator; neighboring community citizen;	Page 21 provides an assessment of Crystal Trail. -- This assessment was conducted in a vacuum, without coordinating with the Town of GMF. -- This assessment fails to account for no trails maintenance occurring along the upper portions of the trail for at least 6 years.
28	80819	NSRA Recreator; neighboring community citizen;	- Page 2 The plan was developed by 'internal stakeholders and partner agencies.' -- By their own admission, the planning team developed goals and objectives without coordinating with the surrounding communities or a full representation of all NSRA stakeholders. -- Such planning is incomplete and the findings do not take into account the wider historical, cultural, and economic interests of the surrounding affected communities.
29	80809	NSRA Recreator;	Page 33 recommends that Crystal Trail be decommissioned. Id prefer it's not decommissioned and or as a second an option an alternative route is found prior. Thank you for considering
30	80809	NSRA Recreator; Springs Utilities customer; Recreation business owner;	Page 14 calling Crystal, Catamount, and Esther trails unauthorized is wild. For decades, these have been the primary three ways people in Cascade, Chipita Park, and GMF have accessed the forest. I personally have worked on them and run on them for many years. This report is propaganda from someone who clearly doesn't live in this area. Page 33 calls for decommissioning Crystal Trails. I advocate for improving over this.

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31	80907	Springs Utilities customer; Member of Ute Pass Trails group;	Page 33 recommends that Crystal Trail be 'decommissioned' which Friends objects to. However Page 29 seeks a temporary closure of Crystal Trail 'until a safe, sustainable alternative route is identified.' Remove decommissioning/closure language related to Crystal Trail. Allow a joint assessment of conditions and be open to a get-well plan for Crystal Trail. Page 14 calls Crystal Trail, Catamount Trail, and Mt Esther Trail 'unauthorized trails.' Several areas in the draft plan note 'informal and unauthorized social trails' accessing NSRA from Ute Pass. Crystal Trail, Catamount Trail, and Mt Esther Trail have linked Ute Pass to the North Slope for generations, predating the designation of the North Slope Recreation Area. CSU has known, and allowed, access via these historic trails which predate the 'opening' of North Slope in 1992. CSU meeting summaries and articles featured in regional newspapers indicate tacit understanding of a trail on or along the current Crystal Trail alignment for decades. In fact, 1993's North Slope Recreation Area Progress Report developed by the North Slope Watershed Advisory Committee with the City of Colorado Springs recommends these trails 'be incorporated into the overall trails system.' Page 21 provides an assessment of Crystal Trail. This assessment was conducted in a vacuum, without coordinating with the Town of GMF. This assessment fails to account for no trails maintenance occurring along the upper portions of the trail for at least 6 years. Friends of Ute Pass Trails stands ready to address the deficiencies listed on page 21 at no cost to CSU or the ratepayers. Page 2 The plan was developed by 'internal stakeholders and partner agencies.' By their own admission, the planning team developed goals and objectives without coordinating with the surrounding communities or a full representation of all NSRA stakeholders. Such planning is incomplete and the findings do not take into account the wider historical, cultural, and economic interests of the surrounding affected communities.
32	80819	NSRA Recreator; Springs Utilities customer;	Why close an existing well established trail I hike that trail from my house 3-4 times a week with my dog Other than being steep thus the moderate to difficult rating there is nothing wrong with the crystal trail. Any upkeep will be done by the volunteers based out of green mtn falls

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33	80819	NSRA Recreator; Springs Utilities customer;	Here we go again the utilities overstepping their bounds Instead of providing customer service they attempt to bully the very people they WORK FOR. Didn't you learn from your public relations disaster when you tried to be assholes and bully concrete couch and the manitou incline People in Colorado get outdoors and recreate and your not going to stop that What are you going to do? Waste money putting up fences and hiring guards to harass the people that will continue to hike That trail is all over the internet hiking apps
34	80819	NSRA Recreator; Springs Utilities customer;	CSU only exists because they have people to provide service to not deprive them of their legal right to access and recreate on public land
35	80905	Springs Utilities customer; NSRA Recreator; Hiker that loves the trail and helped maintain it.;	Pg 12 - recommend new trail/Pg 23 - I like this new trail alignment)
36	80907	NSRA Recreator	I cannot do this (provide a page). From what I have seen, everything that is shown is off the Pikes Peak highway. I want accessibility off Hwy 24. Not everyone can pay those city fees to access this site via the Pikes Peak Highway. Families are struggling with costs. This is a great way to provide a FREE way to access a great Pikes Peak opportunity for local residents without pricing them out. For many years my family and I have walked in from Hwy24 to enjoy this area, without the extra fee of going up Pikes Peak. Stop making local recreational opportunities only accessible to those who have money.
37	80919	NSRA Recreator; Springs Utilities customer	I'm supportive of allowing bikes and hiking on the mackinaw trail. With trail realignments you've proposed, please preserve the ability to make a complete loop around north catamount res. Please consider single track trail connections from crystal reservoir to the catamounts.

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38	80819	Organization representative	Pg 14 - Unauthorized Trails - this section lists all the trails from Green Mountain Falls used to access NSRA as unauthorized. The portions of those trails on GMF or Historic GMF Foundation land are maintained via service agreement with the local trail organization, Friends of Ute Pass Trails. The hiking community originating hikes from Green Mountain Falls and Cascade request access to the NSRA from the area. The request is to recognize the the CSU portion as authorized and include them as positive aspects of the NSRA Plan. Pg 33 - Recommends Crystal Trail be 'decommissioned' Pg 29 - Seeks a temporary closure of Crystal Trail 'until a safe, sustainable alternative route is identified. The portion of Crystal Trail north of CSU's property are maintained by a local Friends organization. The town of GMF is willing to commit resources to work with CSU to find an alternative route for Crystal Trail on CSU property and commit resources toward construction and maintenance. Crystal Trail is an important link to the NSRA from Green Mountain Falls.
39	80920	NSRA Recreator; Springs Utilities customer; Volunteer trail worker	Page 14 calls Crystal Trail, Catamount Trail, and Mt Esther Trail 'unauthorized trails.' Several areas in the draft plan note 'informal and unauthorized social trails' accessing NSRA from Ute Pass, despite the fact that Crystal Trail, Catamount Trail, and Mt Esther Trail have linked Ute Pass to the North Slope for generations...predating the designation of the NSRA in 1992! These are authorized, established trails that are important for the community and decrease congestion on other trails in the region. To address Page 21 concerns: Friends of Ute Pass Trails (an organization I proudly volunteer with) stands ready to address the deficiencies listed on page 21 at no cost to CSU or the ratepayers.

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40	80819	NSRA Recreator; Springs Utilities customer; Organization representative; Resident of Green Mountain Falls	Pg 33 & 29, related re: Crystal Trail; Remove 'decommissioning' / closure language related to Crystal Trail. Allow a joint assessment of conditions and be open to a get-well plan for Crystal Trail; Page 14 calls Crystal Trail, Catamount Trail, and Mt Esther Trail 'unauthorized trails.' Several areas in the draft plan note 'informal and unauthorized social trails' accessing NSRA from Ute Pass. Crystal Trail, Catamount Trail, and Mt Esther Trail have linked Ute Pass to the North Slope for generations, predating the designation of the North Slope Recreation Area. CSU has known, and allowed, access via these historic trails which predate the 'opening' of North Slope in 1992. CSU meeting summaries and articles featured in regional newspapers indicate tacit understanding of a trail on or along the current Crystal Trail alignment for decades. In fact, 1993's North Slope Recreation Area Progress Report developed by the North Slope Watershed Advisory Committee with the City of Colorado Springs recommends these trails 'be incorporated into the overall trails system.' Page 21 provides an assessment of Crystal Trail. This assessment was conducted in a vacuum, without coordinating with the Town of GMF. This assessment fails to account for no trails maintenance occurring along the upper portions of the trail for at least 6 years. Friends of Ute Pass Trails stands ready to address the deficiencies listed on page 21 at no cost to CSU or the ratepayers. Pge 2 The plan was developed by 'internal stakeholders and partner agencies.' By their own admission, the planning team developed goals and objectives without coordinating with the surrounding communities or a full representation of all NSRA stakeholders. Such planning is incomplete and the findings do not take into account the wider historical, cultural, and economic interests of the surrounding affected communities. Thank you for your consideration of these matters that are so important to residents and recreators alike!

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41	80819	Springs Utilities customer; NSRA Recreator; Member Green Mountain Falls Parks and Trails Committee	Page 33 recommends Crystal Trail be decommissioned - I strongly object, this trail which has been in documented use for over 100 years would impact the town of Green Mountain Falls economically by reducing the number of hikers that visit our town and visit our businesses as well as taking away hiking opportunities for residents. However a temporary closure would allow time to work on a safe and sustainable alternate route to be identified. Page 14 - Identifying Crystal Trail, Catamount Trail and Mount Esther as social trails - These trails have linked Ute Pass, Chipita Park, and Cascade for generations and predate the opening of the North Slope in 1992 by over a 100 years Page 21 - provides an assessment of Crystal Trail. This does not account for the lack of maintenance the past 6 years. Friends of Ute Pass Trails is a qualified well trained trail building and maintenance organization and is willing work with CSU to do the work at no cost.Page 2 - The plan was developed by internal shareholder and partner agencies - which indicates those that know the area best were not given the chance to share the historical, cultural, and economic significance of these trail to the communities of Ute Pass
42	80809	NSRA Recreator; Springs Utilities customer	My objections to the recommendations in this study largely can be referred to: Page 29 of section 3 – paragraph 5. And page 33 of section 4. (pages 35 & 39 of the PDF master document). In those paragraphs, CSU recommends the closure of the upper Crystal Tail with the assistance and compliance of the Township of Green Mountain Falls. Illustrations of that proposed closure can be found on maps located on: The maps on section 4 of section 4, the maps on pages 37-38 on section 4, and the maps on pages 30-31 on Appendix E. (pages 40. 43,44, 211, and 212 of the PDF master documents respectively). In the recommendation, it is proposed that the township of Green Mountain Falls (GMF) to be complicit in Colorado Springs Utilities (CSU's) desire to permanently close the upper access to the Crystal Falls Trail completely. On the CSU public input meeting held on 14 October 2025, both the Mayor of Green Mountain, Todd Dixon, and the President of the local trails committee, the Friends of Ute Pass Trails Committee (FoUPTs), Rocco Blasi, objected to this proposal since neither entity had been consulted about this beforehand. From the Mayor of GMF's perspective, the financial impact of losing a time honored trail might have a negative impact on the wellbeing of a town that relies heavily on the contributions of tourist that lodge in the hotels, VRBOs, and multi-generational cabin owner that use these trails and restaurants and bars that cater to this cliental. In Appendix J, page 6 (page 719 in the PDF master document), the township of GMF was not included in the list of commercial stakeholders. From the FoUPTs perspective, they were never contacted by CSU to address their concerns and propose viable solutions. These primary stakeholders were never contacted in CSU's studies. On page 16 of Appendix G. (page 292 of the PDF master document) there is no mention made of the Township of Green Mountain Falls, its Parks, Trails, and Recreation Committee (PRT), or the valley's primary philanthropic entity, The Historic Green Mountain Falls Foundation (HGMFF) as a primary stakeholder in any of these discussions. The HGMFF has provided literally hundreds of thousands of dollars to better preserve the historic landscape of GMF, yet the CSU study had concluded that

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			making the Crystal Falls Trail accessible would be cost prohibitive. Nobody from CSU has ever contacted GMF, its PRT, the FoUPTs, or the HGMFF for any input into what it would take to make a suitable solution for all entities involved. In CSU's own finding, the main interest in accessing the areas addressed in this study was for hiking – See Appendix D. (page 126 in the PDF master document). Except for the out-of-town tourists that see the reservoirs as a destination, most of the local hikers do not. We are more about the journey instead of the destination. For those who want to recreate on any of the reservoirs, hiking from GMF is not an option since one cannot bring one's paddle boards, canoes, or fishing ice chest up these steep and difficult trails. As for the infrastructure concerns this study cites, there was no objection from CSU regarding the Ute Pass Trail that was constructed in coordination with the El Paso County Parks Department (See Appendix G, page 27 on page 303 of the PDF master document). This trail comes far closer to critical infrastructure for CSU's water pipelines, with a much higher concentration of hikers that could cause potential mischief. What is the difference here? The Crystal Falls Trail has existed longer than anyone currently alive reading this study. Unless CSU is willing to post an armed sentry at the CSU boundary of the Crystal Trail, hikers will continue to use it as they have for generations, regardless of any sign or fencing that can be easily removed. If ever there was a case for Adverse Possession, this would be a prime example. Why not come up with a solution that meets both the needs of CSU and the affected community of GMF.

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43	80819	Springs Utilities customer; NSRA Recreator	I am writing in support of preserving the Crystal Trail and urge CSU to remove all decommissioning language from the North Slope Recreation Area plan. I have hiked the trails of Green Mountain Falls extensively, and the connectivity they provide is central to what makes this area special. The ability to complete circular routes and access a variety of terrain is not a minor convenience; it is the foundation of the hiking experience here. Losing Crystal Trail would fundamentally diminish that. I strongly support the position put forward by Friends of Ute Pass Trails: do not decommission Crystal Trail. Page 33 recommends decommissioning the trail, while Page 29 calls for a temporary closure until a safe, sustainable alternative route is identified. I urge CSU to remove the decommissioning language entirely and commit to no permanent action until a viable alternative exists and a joint assessment with community stakeholders has been completed. The planning process itself raises serious concern. Page 2 acknowledges the plan was developed by internal stakeholders and partner agencies, and by CSU's own account, goals and objectives were established without coordinating with surrounding communities or the full range of NSRA stakeholders. The Crystal Trail assessment on Page 21 was conducted without coordinating with the Town of Green Mountain Falls and fails to account for the absence of trail maintenance along the upper portions for at least six years. Friends of Ute Pass Trails has stated they are ready to address those deficiencies at no cost to CSU or ratepayers. Additionally, Page 14 labels Crystal Trail, Catamount Trail, and Mt. Esther Trail as unauthorized, but these trails have linked Ute Pass communities to the North Slope for generations, predating the 1992 designation of the North Slope Recreation Area. Notably, the 1993 North Slope Recreation Area Progress Report recommended these trails be incorporated into the overall trail system. Crystal Trail deserves recognition, not removal. I urge CSU to pursue a collaborative, community-informed approach before taking any irreversible action.
44	80906	Springs Utilities customer; NSRA Recreator	I would like to retain connections from Green Mtns Falls and other surrounding recreation areas.
45	80819	Springs Utilities customer; Property owner & Year round resident below Crystal Falls	This trail is very historic and provides wonderful access to a great view of Pikes Peak. It is well maintained and requires moderate skills for hikers. It is a vital part on where we live!!
46	80819	Property Owner	Based on the current draft 1. Overreliance on “Unauthorized” Classification Without Strategic Evaluation. The plan repeatedly characterizes several trails—including Mt. Esther Trail and portions of Crystal Trail—as “unauthorized social trails” and therefore candidates for removal. However: These routes are actively used connectors into the NSRA; They represent existing user demand—not incidental use; The plan itself acknowledges they were created “as a means of informally connecting the NSRA to other trails or destinations” The designation of “unauthorized” is being used as justification for closure without

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			a full evaluation of their functional role in the broader trail network. 2. Inconsistency With Stated Goals of Improving Access. The plan explicitly states a goal to: “Support public recreational access options… and improved trail/recreational access” Yet: Crystal Trail is one of the highest-use areas outside the highway corridor (mobility data) Mt. Esther Trail is identified as a potential connection that could be improved or realigned (not eliminated) Catamount Trail is a primary spine connecting multiple trails and access points; Closure of these trails directly contradicts the plan’s own access and connectivity objectives. 3. Failure to Fully Evaluate “Improve vs. Close” AlternativesThe document itself identifies: Mt. Esther Trail as a candidate for improvement or realignment; Unauthorized trails as opportunities for designation and improvement; Yet closures are still advanced without: Defined criteria for when improvement is infeasible; Comparative analysis of: Cost to improve vs. close; Impact to user access; Long-term management implications; There is no transparent decision framework showing why closure is preferred over improvement. 4. Risk of Unintended Consequences. The plan already acknowledges: Widespread unauthorized access and social trail creation; Ongoing user conflicts due to lack of controlled access points; Closing established routes will likely: Increase—not reduce—unauthorized trail creation; Push users into more environmentally sensitive or unsafe areas; Create enforcement challenges and reputation; Page 33 recommends that Crystal Trail be ‘decommissioned’ which I objects to. However Page 29 seeks a temporary closure of Crystal Trail ‘until a safe, sustainable alternative route is identified.’ Remove 'decommissioning' / closure language related to Crystal Trail. Allow a joint assessment of conditions and be open to a get-well plan for Crystal Trail. Page 14 calls Crystal Trail, Catamount Trail, and Mt Esther Trail ‘unauthorized trails.’ Several areas in the draft plan note ‘informal and unauthorized social trails’ accessing NSRA from Ute Pass. These trails offer key access to the "Ring-the-Peak" trail. Discontinuing will reduce access. Crystal Trail, Catamount Trail, and Mt Esther Trail have linked Ute Pass to the North Slope for generations, predating the designation of the North Slope Recreation Area. CSU has known, and allowed, access via these historic trails which predate the ‘opening’ of North Slope in 1992. CSU meeting summaries and articles featured in regional newspapers indicate tacit understanding of a trail on or along the current Crystal Trail alignment for decades. In fact, 1993’s North Slope Recreation Area Progress Report developed by the North Slope Watershed Advisory Committee with the City of Colorado Springs recommends these trails ‘be incorporated into the overall trails system.’ Page 2 The plan was developed by ‘internal stakeholders and partner agencies.’ By their own admission, the planning team developed goals and objectives without coordinating with the surrounding communities or a full representation of all NSRA stakeholders. Such planning is incomplete and the findings do not take into account the wider historical, cultural, and economic interests of the surrounding affected communities.

#	Zip code	What is your interest in the North Slope Recreation Area plan?	Please provide the page and/or map number of the draft plan and your comment or suggested change.
47	80819	NSRA Recreator; Springs Utilities customer	Page 2 - the plan was developed by 'internal stakeholders and partner agencies,' however I am a resident of Green Mountain Falls who moved here specifically for the access to these trails and you did not include GMF in your plan development, despite us being your closest neighbor and the user of these very trails. I propose that CSU, the manager of these lands, take into account the needs and wishes of those who regularly use the land.Page 14 - please remove the word "unauthorized" as a descriptor of the Crystal, Catamount and Ester Trails These trails have been in popular existance long before CSU became stewards of this land. Page 33 - please take out the word "decommission" in reference to the Crystal Trail. CSU has not performed any maintance or allowed local groups to maintain this trail and it has suffered from the lack of maintenance. This trail, which has been in existance for far longer that CSU, is a public resource that requires care, not decommissioning.I understand that there is a balance that CSU needs to strike in the management of the trail system, however these are important public resources, and it is impossible to explain to people who do not use these trails and only think of them as a nuisance or liability how valuable they are to the public. Please allow local trail groups the opportunity to improve and maintain these trails (free of charge).
48	80921	NSRA Recreator	#1 Page 33 recommends that Crystal Trail be 'decommissioned' which I object to. However Page 29 seeks a temporary closure of Crystal Trail 'until a safe, sustainable alternative route is identified." Remove 'decommissioning' /closure language related to Crystal Trail and allow a joint assessment of conditions and be open to a get-well plan for Crystal Trail (which should include the town of GMF and the Friends of Ute Pass Trails whom can assist and provide maintenance on this area-free of charge). #2 Page 14 calls Crystal Trail, Catamount Trail, and Mt Esther Trail 'unauthorized trails.' Several areas in the draft plan note 'informal and unauthorized social trails' accessing NSRA from Ute Pass. Crystal Trail, Catamount Trail, and Mt Esther Trail have linked Ute Pass to the North Slope for generations, predating the designation of the North Slope Recreation Area. CSU has known, and allowed, access via these historic trails which predate the 'opening' of North Slope in 1992. CSU meeting summaries and articles featured in regional newspapers indicate tacit understanding of a trail on or along the current Crystal Trail alignment for decades. In fact, 1993's North Slope Recreation Area Progress Report developed by the North Slope Watershed Advisory Committee with the City of Colorado Springs recommends these trails 'be incorporated into the overall trails system.' These trails have been a part of recreation for decades. Decommissioning these trails or labeling then as unauthorized trails will hurt the land, hikers, the town of GMF/other towns in the area, and future generations. We should be making the land sustainable. People will continue hike and use the land. Let's make this area safer and more sustainable for generations to come #3 Page 21 provides an assessment of Crystal Trail. This assessment was conducted in a vacuum, without coordinating with the Town of

#	Zip code	What is your interest in the North Slope Recreation Area plan?	Please provide the page and/or map number of the draft plan and your comment or suggested change.
			GMF. This assessment fails to account for no trails maintenance occurring along the upper portions of the trail for at least 6 years.Friends of Ute Pass Trails (FOUPT) stands ready to address the deficiencies listed on page 21 at no cost to CSU or the ratepayers. FOUPT has over 30 volunteers on any given trail work day. Allow the town of GMF and FOUPT to do what they have done for decades; manage, steward, and protect the land. #4 Page 2 The plan was developed by 'internal stakeholders and partner agencies.' By your own admission, the planning team developed goals and objectives without coordinating with the surrounding communities or a full representation of all NSRA stakeholders. Such planning is incomplete and the findings do not take into account the wider historical, cultural, and economic interests of the surrounding affected communities. Not taking into account the neighboring towns, the historical and cultural context of these trails, or the future generations who will recreate in this area is negligible. We can ALL work together to make this area sustainable and safer. We can ALL work together to ensure these trails have a plan that make them safe and well maintained for more generations to come. We can ALL enjoy this beautiful land and area if we work together. People will hike. These trails predate NSRA. Let's work together to make this area safe, sustainable, and fun! Thank you.
49	80863	NSRA Recreator	Page 33 - recommends that Crystal Trail be 'decommissioned' - This trail has been here way over 30 years (years I have hiked it). Suggest having Friends group upgrade and maintain it. Page 14 calls Crystal Trail, Catamount Trail, and Mt Esther Trail 'unauthorized trails.' - These trails have been here way over 30 years (years I have hiked them). Suggest having Friends group upgrade and maintain them. - Page 21 provides an assessment of Crystal Trail. - Suggest performing assessment with other management groups (e.g. Pike National Forest, Green Mountain Falls, Friends of Ute Pass Trails).
50	80907	NSRA Recreator; Springs Utilities customer	I'm a member of the Friends of Ute Pass Trails and a volunteer trail worker. I've worked on most trails in the North Slope over the past ten years so know the land fairly well. I believe Crystal Trail need not be decommissioned as mentioned on page 33 but should be temporarily closed as mentioned on page 29. Friends of Ute Pass stands ready to address the deficiencies listed on page 21 at no cost to CSU or the ratepayers. A shared assessment of the trail will provide a way forward to improving safety and sustainability.
51	80863	Individual outdoors enthusiast	Please consider additional hunting opportunities within the watersheds.

#	Zip code	What is your interest in the North Slope Recreation Area plan?	Please provide the page and/or map number of the draft plan and your comment or suggested change.
52	80918	NSRA Recreator; Springs Utilities customer	Page 29, sec 5. Crystal trail. This whole section is filled with "May" (three times) statements tied to closing this trail. Being ambiguous is very disingenuous to the folks who use it. Very close-minded to state it is "not sustainable". It is, if you ask the right people. On that note, I see no mention of leaning on 'Friends' groups to help. If CSU does not believe they can trust the community for "sustaining" trails, then maybe you can get funds from CPW for work to farm the work out? They have been earmarked to be a part of Ring the Peak. Why are they NOT part of CSU's discussion of RTP? It was mentioned at the meeting. But CSU folks danced around the subject. IE - RTP "is a topic", "on the table", "recognize". So if it's recognized, why don't we see it mentioned here as CPW partnering with CSU? In general, why can't service vehicles co-exist with hikers? Look at Garden of the Gods. The have a ped/bike section right along their park road. Perfectly fine for both to co-exist. It. can. be. done. And the service roads are wider below Crystal res. Why is CSU concerned about heavy traffic below Crystal reservoir? There's waaaay more foot traffic around the other reservoirs. To end this submission, your meeting notes from the last meeting stated there was 'Action Item' to "respond to inquires". I've given input twice. I have yet to hear back. Maybe this one will get some feedback? Inquiring minds would love to know.
53	80863	NSRA Recreator; Biking, hunting, fishing	I'd like to see more hunting and fishing opportunities instead of closures. The trails are good for mountain biking though!
54	80819	NSRA Recreator; Springs Utilities customer	Page 14, I have lived in Green Mtn Falls for over 30 years and have been a user of the trails here since the 1980s. I'm also a volunteer with Friends of Ute Pass Trails. I strongly encourage CSU to find a way to incorporate these so called "unauthorized" trails (Crystal, Catamount and Mt Esther trails) into the NSRA system of trails. I like the idea of realigning trails off of the access roads. Please don't cut off access to NSRA from GMF.
55	80901	Organization representative	Please see MedWheel comments emailed into Lisa Walters and the Engage email address.
56	80819	Organization representative; Recreation business owner; Elected Official; Partner agency representative	The Town of Green Mountain Falls agrees with North Slope Recreation Area Watershed Access and Recreation Plan policy recommendation 5 on page 29 (page 35 of pdf): temporary closure of Crystal Trail 'until a safe, sustainable alternative route is identified.' In fact, the Town acknowledges that the current trail on Utilities land has not been maintained in the past 6 years and there is a maintenance backlog. The Town of GMF stands ready to conduct a site visit with Colorado Springs Utilities (CSU) and several regional trails organizations to jointly determine deficiencies and corrective actions. However, the Town of GMF objects to the finding on page 33 (page 39 of pdf) that Crystal Trail be 'decommissioned.' Several areas of the Plan note 'informal and unauthorized social trails' accessing NSRA from Ute Pass. In the case of Crystal Trail and

#	Zip code	What is your interest in the North Slope Recreation Area plan?	Please provide the page and/or map number of the draft plan and your comment or suggested change.
			Catamount Trail, these routes have linked our community to the North Slope for generations, predating the designation of the North Slope Recreation Area. CSU has known, and allowed, access via these historic trails which predate the 'opening' of North Slope in 1992. CSU meeting summaries and articles featured in regional newspapers indicate tacit understanding of a trail on or along the current Crystal Trail alignment for decades. In fact, 1993's North Slope Recreation Area Progress Report developed by the North Slope Watershed Advisory Committee with the City of Colorado Springs recommends these trails 'be incorporated into the overall trails system.' It is paramount that these access points be acknowledged and formalized in the Plan: the Town of GMF – our community – since its inception has accessed the North Slope area. For example, in his 1889 work, The Great West: A Vast Empire, author F.L. Dana describes the scene unfolding at the summit of Mt. Esther after his uphill hike beside Crystal Creek: "here begins a panorama kaleidoscope…the wonder of one who sees, the despair of one who wishes to tell others what he saw." Crystal Trail marks the historic location of Dana's pilgrimage and requires recognition. We understand the need to balance watershed protection with recreation on public lands. For decades, there have been no documented problems or instances of threats to infrastructure on or along these trails. Additionally, an active volunteer group, Friends of Ute Pass Trails, monitors and maintains the area trails to a remarkable degree. The Town of Green Mountain Falls now offers a valuable partnership to formally acknowledge and manage the trails. Given the historic, cultural and economic significance of Crystal Trail and Catamount Trail, leading from the Town of GMF to NSRA, every effort should be given to support the continuance of these routes, to include CSU coordinating with adjacent land managers in the support of NEPAs and official recognition
57	80905	NSRA Recreator; Springs Utilities customer; Organization representative; Recreation business owner; Partner agency representative; Elected Official	Thank you to Colorado Springs Utilities staff for the significant work that has gone into the draft North Slope Recreation Area (NSRA) Recreation Plan. Updating a recreation plan originally adopted in 1992 is both necessary and timely. Visitation across the Pikes Peak region has grown substantially over the past three decades, and it is clear that the North Slope Recreation Area is experiencing many of the same pressures seen throughout the region.I appreciate the effort staff has made to gather public input and to balance recreational access with the protection of critical drinking water infrastructure. The emphasis on improving trail connectivity while maintaining watershed protection reflects an important and thoughtful approach to managing recreation in a sensitive landscape. Collaboration with adjacent land managers—including the U.S. Forest Service, Teller County, and the Bureau of Land Management—is also an important element of the plan and should continue to be strengthened as visitation continues to increase.Recreation plans often guide management decisions for decades. Because of this, the way opportunities are described within a plan can unintentionally shape how future recreation ideas are evaluated. If a recreation format, facility, or connection is not contemplated in the plan, it can sometimes be interpreted later as being outside the scope of what the plan allows. For this reason, it is important that plans preserve flexibility so future managers can evaluate new opportunities

#	Zip code	What is your interest in the North Slope Recreation Area plan?	Please provide the page and/or map number of the draft plan and your comment or suggested change.
			that support stewardship, safety, and responsible recreation—even if those opportunities were not envisioned when the plan was written.One area where flexibility will be particularly important is trail connectivity with adjacent lands. The U.S. Forest Service manages a large landscape surrounding the North Slope Recreation Area and, like many land management agencies across the country, is facing increasing visitation with limited staffing and resources. In many places, visitors have effectively "voted with their feet," creating informal or social trails that connect to other recreation opportunities on surrounding lands. While not all of these routes should be formalized, they do reflect patterns of public use and interest that may eventually warrant evaluation. Because of the importance of maintaining strong working relationships with neighboring land managers, the plan should allow room for future adjustments if opportunities arise to formalize connections or realign trails in coordination with partners such as the Forest Service.In addition to these local considerations, it is important to recognize that the North Slope Recreation Area exists within the broader recreation landscape of the Pikes Peak region. Significant regional work has recently been undertaken through the Outdoor Pikes Peak Initiative (OPPI), which evaluated nearly one hundred existing planning documents and engaged stakeholders across El Paso, Teller, and Fremont counties. That effort reflects strong public interest in addressing recreation management across the Pikes Peak massif as a connected regional system rather than as a series of isolated properties.Given the scope of that regional effort—and the growing importance of coordinated recreation planning across the Pikes Peak massif—it is notable that the draft North Slope Recreation Plan does not explicitly acknowledge or reference the OPPI framework. Because the North Slope Recreation Area is an important component of the broader Pikes Peak recreation system, recognizing the OPPI plan and demonstrating how the NSRA plan aligns with regional recreation planning would strengthen the document and provide important context for future management decisions. This is particularly relevant given that recent state funding, including the $2.5 million grant awarded to the Pikes Peak Outdoor Recreation Alliance, will support trail realignment and im

#	Zip code	What is your interest in the North Slope Recreation Area plan?	Please provide the page and/or map number of the draft plan and your comment or suggested change.
58	80904	NSRA Recreator; Springs Utilities customer; Organization representative; Recreation business owner	Thank you for the opportunity to comment on the draft plan. One suggestion I have is that you explain RRC's role in the Executive Summary. They are in the Acknowledgments section and I couldn't figure out the role they played until I did a search and found info on P. 28. It's a small thing, but could help otherwise understand roles. I was surprised to see that the draft plan does not reference or draw from the Outdoor Pikes Peak Initiative (OPPI) Vision Plan, particularly given the scale and relevance of that effort to this landscape.OPPI represents one of the most comprehensive regional planning processes undertaken for the Pikes Peak area in recent years, drawing from nearly 100 existing plans and incorporating extensive input from residents and stakeholders across El Paso, Teller, and Fremont counties. That work reflects a clear public desire to approach recreation and stewardship across the Pikes Peak region as an interconnected system.The omission feels especially significant given that Colorado Springs Utilities was actively involved throughout the full four-year OPPI Task Force process. Their participation helped shape the Vision Plan, which establishes a shared regional framework grounded in extensive public input and existing plans.There is also a direct connection to implementation: one of the early projects advancing through OPPI is trail work on the North Slope itself, supported by recent state investment at a sizable dollar amount exceeding $300,000. Not acknowledging that alignment—or the broader regional framework it sits within—misses an opportunity to demonstrate how this plan contributes to a shared vision and leverages substantial public input, much of it from Utilities ratepayers.Recognizing the OPPI Vision Plan and articulating how this effort complements regional priorities would add important context, strengthen transparency, and better position the North Slope Recreation Area within the larger Pikes Peak recreation system.I also think there is an opportunity to define "Commercial Use" as it is intended here, because that broad term can mean anything from oil and gas extraction, grazing, timber harvesting to guiding or outfitting or providing educational classes or workshops. It would help readers better understand what is being considered and why the guiding and educational purposes can both improve recreational experiences and also make for more responsible use.Thanks again for the opportunity to comment!

Comments received 3/31/2026.

MEDICINE WHEEL
TRAIL ADVOCATES

Dear Ms. Walters and Colorado Springs Utilities North Slope Planning Team,

Medicine Wheel Trail Advocates (MedWheel) appreciates the opportunity to provide input on the North Slope Recreation Plan. We recognize the substantial effort invested in balancing watershed protection, operational needs, and public access, and we value the continued engagement on this important planning effort.

MedWheel submitted detailed comments and mapped recommendations (Attached) during the previous review phase, including specific proposed alignments and connections both within and beyond the North Slope Recreation Area (NSRA). While we appreciate elements of those concepts reflected in the current draft, the plan does not meaningfully incorporate or depict the potential on-property routes we proposed. More importantly, the plan doesn't show several of the crucial off-property connections identified in our prior submittal.

We want to reiterate the importance of including **conceptual off-property trail connections** in this plan.

The current draft includes off-property connections where they are necessary to support Utilities operations. This establishes a clear precedent and sets CSU up for future discussions with neighbors, including federal review processes (e.g., NEPA) where applicable. However, additional connections that reflect **community recreation needs and regional connectivity** are not shown, despite the fact that they would require similar coordination and federal review processes. From a planning perspective, these connections differ in purpose, but not in complexity or importance.

During our follow-up discussions, there was agreement that the plan could include **conceptual or "vague arrow" representations** of desired off-property connections, with clear acknowledgment that such connections would require future interagency coordination and approvals. Including these conceptual connections would not commit Utilities to implementation, but would provide important planning value as adjacent and regional plans are advanced.

Specifically, inclusion of these connections would:

- Inform adjacent land managers and support coordination with future planning efforts
- Help preserve viable corridors before constraints limit future options
- Provide transparency to the public regarding long-term connectivity goals
- Strengthen the role of the North Slope within the broader regional trail network

Even schematic representations would meaningfully improve the plan's usefulness as a long-range planning document. This master plan does not require or imply the availability of resources for implementation. A lack of current resources should not limit the long-term vision of a plan intended to guide this area for decades.

Comments received 3/31/2026.

Related to this, the plan would benefit from explicit reference to and alignment with regional planning efforts, including the Outdoor Pikes Peak Initiative and the Ring the Peak Trail. The North Slope occupies a critical position within the Pikes Peak landscape, and decisions made here will directly influence the feasibility of regional connectivity. Referencing these efforts would better position the plan within established community priorities and support interagency coordination. We respectfully request that both RTP and OPPI are specifically referenced in this plan.

The plan also does not directly address electric bicycle use. While “non-motorized mountain biking” is referenced, the document does not clarify whether or how electric-assist bicycles may be considered. E-bike use continues to increase across regional trail systems. Identifying a future process to evaluate where and how e-bikes may be appropriate would improve clarity and consistency with surrounding land managers while maintaining Utilities’ ability to manage site-specific constraints.

MedWheel continues to support the plan’s direction to relocate recreation from service roads to purpose-built trails, improve safety, and reduce conflicts with infrastructure. We remain ready to partner on trail planning, design, and implementation to help achieve these goals.

The North Slope presents a unique opportunity to create a connected, sustainable, and high-quality trail system that serves both Utilities operations and our community’s vision for recreation around Pikes Peak. The plan already demonstrates that off-property coordination is feasible where needed for Utilities operations; extending this same planning approach to recreation-driven connections would improve consistency and long-term outcomes. Incorporating conceptual off-property connections will strengthen the plan’s long-term value and enable it to guide future coordination and decision-making. We respectfully request inclusion of these potential connections.

Thank you again for this opportunity to provide feedback on this exciting plan, and for all the time that you have put into this effort. It will benefit our community for many years.

Sincerely,

Medicine Wheel Trail Advocates

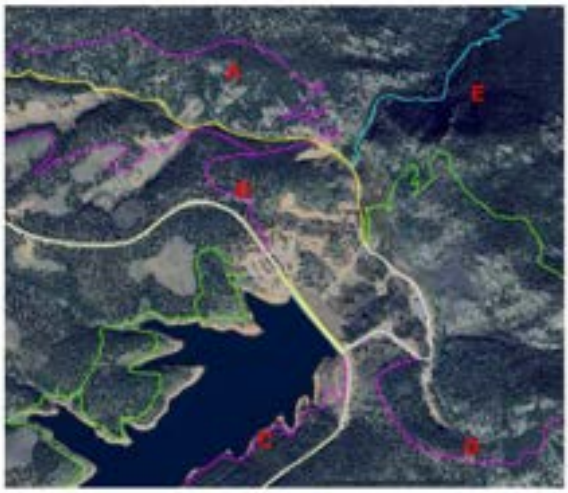
Comments received 3/31/2026.

Appendix: Previously submitted proposals for additional trails to be shown in the plan, including off-property connections not possible today but essential for future planning.

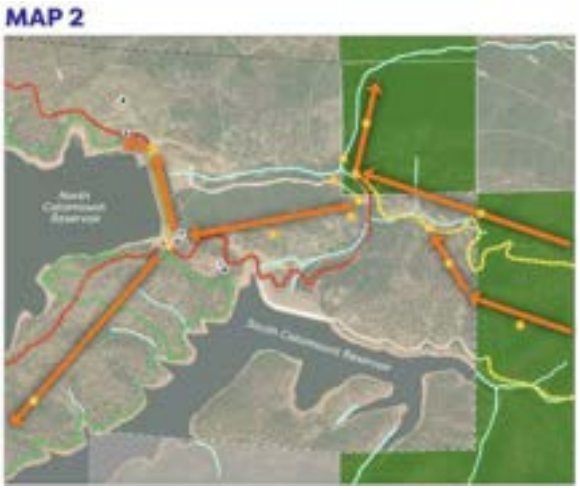
Green - Existing trails that are proposed to remain
Yellow - Existing trails that require improvements
Orange - Recommended re-route alignments (left on the maps for reference)
With the addition of:
Pink - MedWheel specific proposed trails to meet plan objectives, plus additional recommended connections in areas of high interest.

MAP 1

A. Proposed alignment to meet desired corridor in the plan.
B. Proposed alignment to meet desired corridor in the plan.
C. Proposed alignment to meet desired corridor in the plan.
D. This shows a popular EXISTING trail that provides both a desirable RTP connection with nice ridgetop views AND connects to PPAM. We request the CSU portion be acknowledged as aspirational for the future, when RTP discussions proceed with USFS.
E. Crystal Trail - MedWheel supports improvement, rather than decommissioning, of this popular connection to Green Mountain Falls

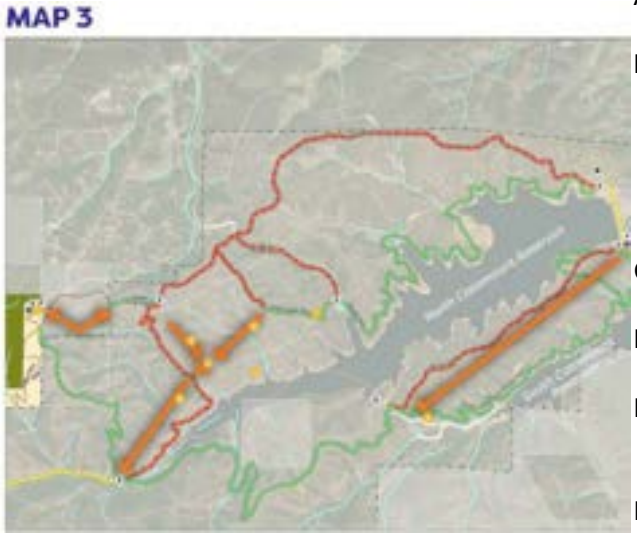


Comments received 3/31/2026.

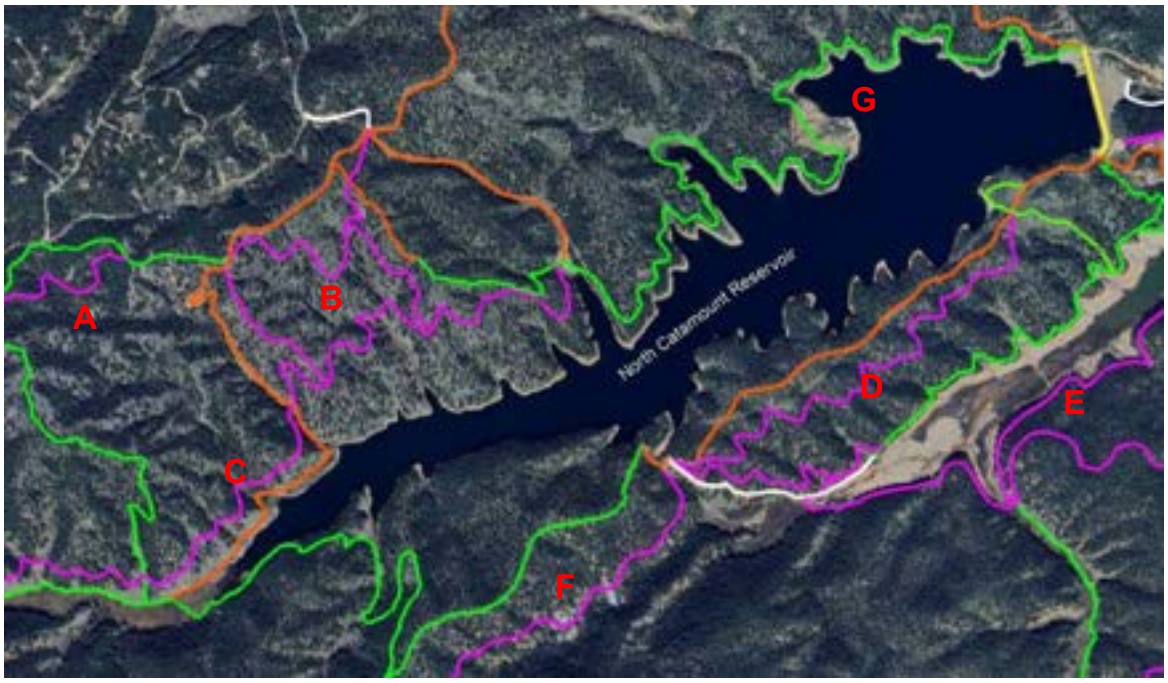


A. Proposed alignment to meet desired corridor in the plan.
B. Proposed alignment to meet desired corridor in the plan.
C. Proposed alignment to meet desired corridor in the plan.
D. Proposed alignment to meet desired corridor in the plan.
E. Desirable shoreline access that would connect to the existing parking lot at Mile 7
F. We have an alignment proposed for this desired reroute

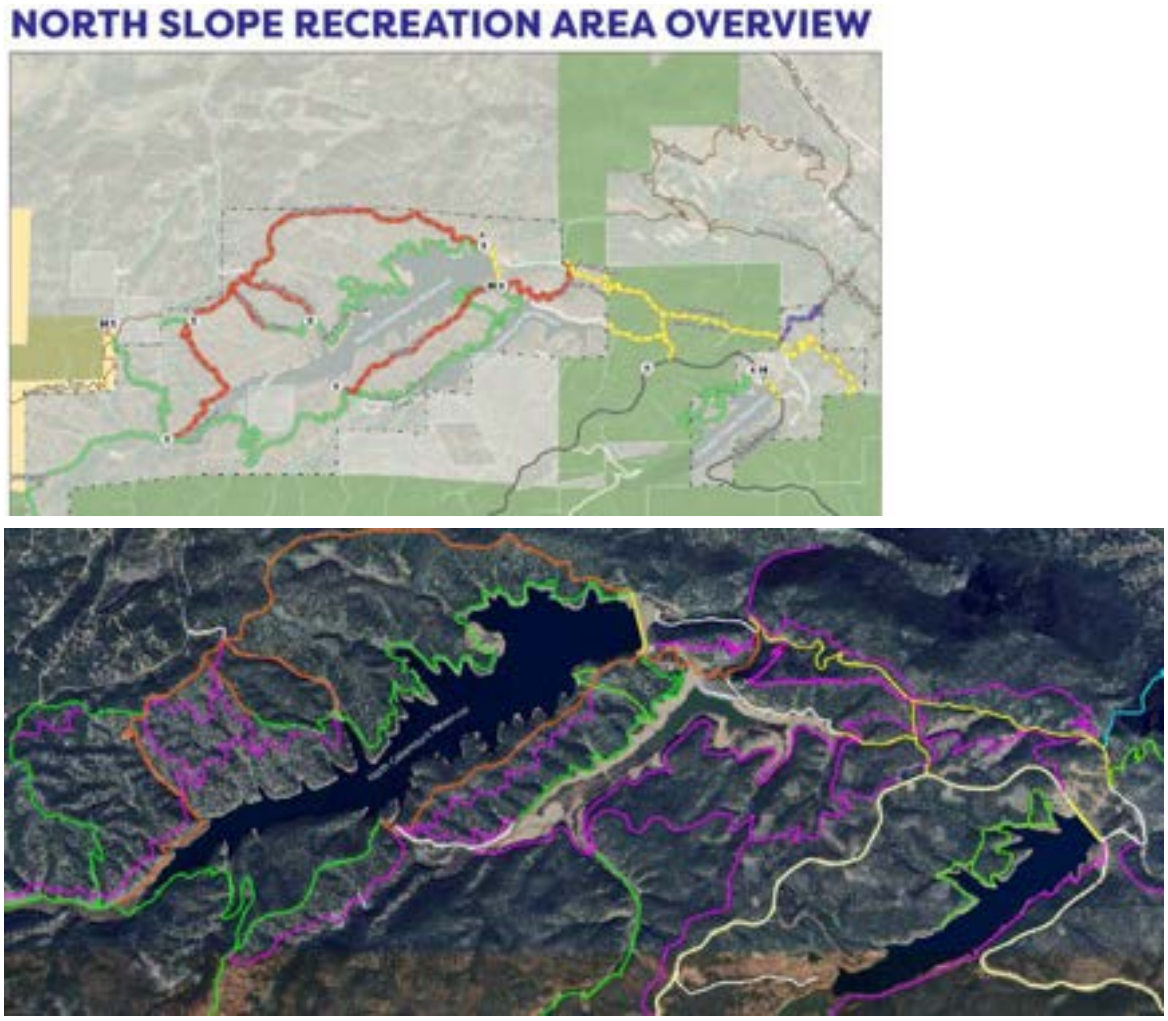
Comments received 3/31/2026.



A. Proposed alignment to meet desired corridor in the plan.
B. Proposed alignment to meet desired corridor in the plan. The alignment we're proposing shows increased connectivity to Edlowe Rd and an improvement to the mackinaw trail to the boat ramp.
C. Proposed alignment to meet desired corridor in the plan.
D. Full alignment shown for the desired plan reroute.
E. Provides a valuable connection to the east shoreline of South Cat reservoir, and to the Mile 7 parking lot.
F. The recent realignment of Limberpine should be included in the plan.
G. Mackinaw trail should be shown in the plan as bike/multi-use access, and would benefit from some improvements.



Comments received 3/31/2026.



North Slope Trail Overview

Plan for Recreational Uses on Municipal Watershed Lands

Colorado Springs Utilities
It's how we're all connected

FINAL
August 6, 2010

Plan for Recreational Uses on Municipal Watershed Lands

Prepared for Colorado Springs Utilities

Prepared by AECOM Design + Planning

FINAL

August 6, 2010

Contents

Introduction

This recreational use plan is focused on the Colorado Springs Utilities (Springs Utilities) watershed lands with particular focus on the South Slope watershed. The intent of the project is to design and implement a plan for recreational use on watershed lands compatible with watershed protection. The South Slope Watershed lands consist of approximately 9,000 acres located adjacent to Pikes Peak, at elevations ranging from approximately 10,500 feet to over 12,000 feet. Although the site is located within 20 miles of the western end of Colorado Springs, on a direct line, the watershed lands are situated in a remote setting and requires a drive of approximately 1 ½ hours. Some sections include road that is narrow and steep or rough and unpaved.

View of Pikes Peak

The mission of Springs Utilities is to provide safe and reliable electric, natural gas, water, and wastewater services to its citizen owners and customers. Springs Utilities has primary responsibility for watershed, source water quality, and collection system infrastructure protection on City-owned watershed lands. Springs Utilities is governed by the Utilities Board, which is comprised of the members of the Colorado Springs City Council.

The Plan for Recreational Uses on Municipal Watershed Lands contains three chapters:

- Chapter 1: Concept Plan
- Chapter 2: Implementation Plan
- Chapter 3: Monitoring Plan

Chapter 1 provides an introduction to the project and concept plan, including background information, a description of project methods, a summary of public involvement, and proposed recreational activities and facilities on the South Slope Watershed. In addition, this chapter provides a plan for upgrading and making sustainable a portion of the Ute Trail, a social trail located on Springs Utilities lands near Manitou Springs. This trail receives a substantial amount of public use.

Chapter 2 discusses the construction, operations, and management of recreational use on the South Slope. This chapter includes information on implementation priorities, grant funding, and the Springs Utilities Recreational Use Policy.

Chapter 3 presents a monitoring plan for the South Slope Watershed, a framework for adaptive management, and measures to assure that recreational uses on watershed lands do not result in unacceptable changes in water quality or other resource conditions.

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Chapter 1. Concept Plan

The planning process used to develop the plan was collaborative, involving a range of stakeholders and the general public. The need to provide a balance between operational needs, environmental stewardship, and recreational uses was the primary consideration.

PROJECT HISTORY

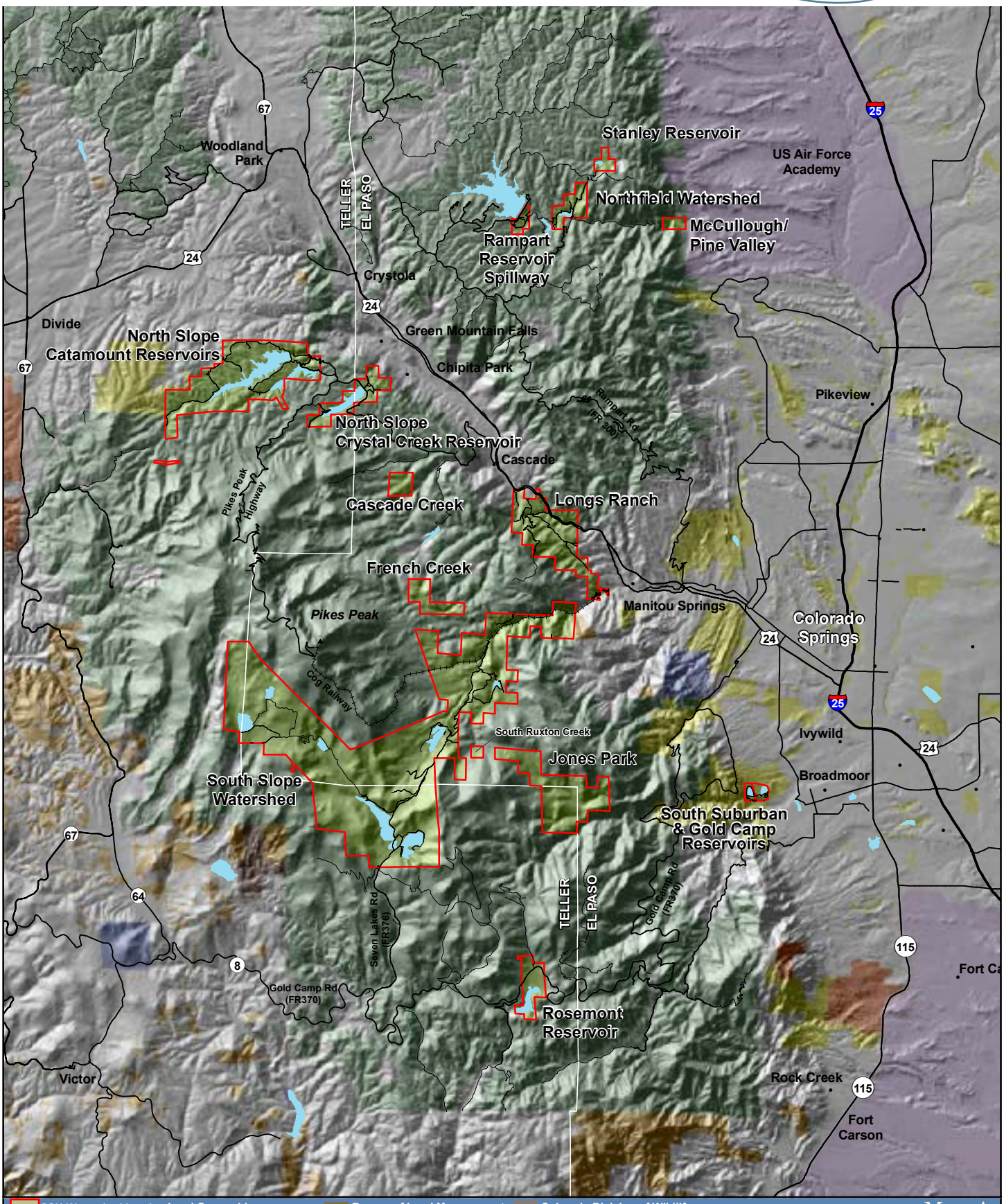
Throughout its history, the City of Colorado Springs has acquired lands to be used and protected for municipal water supply (see Map A, Regional Context). In addition, the U.S. Congress designated specific federal lands on Pikes Peak as municipal water supply reserves for the City of Colorado Springs, City of Manitou Springs, and the Cascade Town Company. Table 1, Springs Utilities Properties, lists properties owned by the City of Colorado Springs and managed by Springs Utilities, including acreage, access status, and allowed uses. The properties listed in Table 1 have been opened by various processes. Springs Utilities reserves the right to re-evaluate and modify the type of access to, and recreational uses of, these properties should such access or use cause adverse impacts to infrastructure and facilities, system operations, or water quality, water quantity, or other resources.

Historically, some of these Springs Utilities watershed lands have been open for public use, while others have been closed for over 100 years. In 1967, a Charter Amendment was passed by the people of Colorado Springs to open the Northfield system and the North Slope of Pikes Peak for recreational use, as deemed appropriate. In 1991, the North Slope Watershed Advisory Committee was established by the Colorado Springs City Council to analyze the benefits and constraints of recreational uses on watershed lands. The resulting North Slope watershed recreation plan allowed recreational use to occur on North and South Catamount and Crystal Reservoirs.

Boehmer Reservoir with Pikes Peak in the background

With the Pikes Peak Highway located close to these reservoirs, the recreation experience on the North Slope is mostly "front country" in nature.

Due to strong public interest in providing recreational access to the South Slope watershed, the Watershed Access Advisory Group (WAAG) was formed in September 2007 to advise Springs Utilities on management of these lands. After being formed, the WAAG requested an expansion of the scope to include all possible recreational uses on all local watershed lands (see Map A, Regional Context). Springs Utilities agreed to this expansion in project scope. However, after further discussion, the WAAG recommended changes only on the South Slope and Long's Ranch properties. Specifically, the WAAG developed a list of potential recreational uses that should be considered for the South Slope watershed. This Concept Plan is a direct result of the WAAG's recommendations and has been further refined using the methods discussed below.



Map A.
Regional Context

TABLE 1. SPRINGS UTILITIES PROPERTIES

Property	Springs Utilities Acres	Public Access
North and South Catamount Reservoirs	2177	Non-motorized boating, fishing, hiking and biking trails, picnicking
Crystal Reservoir	486	Non-motorized boating, fishing, hiking trails, picnicking
Rampart Reservoir	98	Motorized boating, fishing, camping
Northfield/ Nichols Reservoirs	274	Equestrian, hiking, biking, fishing at Nichols only
Stanley Reservoir	97	Equestrian, hiking, biking from Air Force Academy
Rosemont Reservoir	355	Fishing
Jones Park	1187	Equestrian, hiking, biking, off-road motorcycles
South Suburban/ Gold Camp Reservoirs	113	Hiking, dog walking at South Suburban only
South Slope	9275	Proposed
Longs Ranch	1177	Proposed

PROJECT METHODS

This plan is based on a comprehensive planning process appropriate for determining recreational uses on watershed lands. This process included data collection, site inventory, base and resource mapping, field research, stakeholder interviews, and public open house meetings.

Data Collection and Analysis

As a starting point, data from existing sources was collected, focusing on site conditions and resources. Background literature, supplementary documents, and field research contributed to a more thorough understanding of the watershed (Table 2, Resource Analysis Data). A review of literature and case studies related to concentrated and dispersed recreational use provided background information on potential recreation impacts (Appendix A, Literature Review). This research was used to inform recommendations for recreational activities. The data highlighted successes and lessons learned from other recreation facilities on watershed properties.

In 2009, a team of recreation planners, biologists, landscape architects, and fire specialists visited Springs Utilities properties, focusing on the South Slope Watershed, to collect reconnaissance-level information on water operations infrastructure, landscape features, sensitive wildlife and habitat, fire fuel loads, and ignition potential. A variety of travel modes was utilized, including driving on watershed roads, hiking potential recreation corridors, and riding the Cog Railroad. Specific reconnaissance methods included field observations, digital photography, and GPS tracking and data input. Site visits occurred in July, August, September, and October of 2009.

TABLE 2. RESOURCE ANALYSIS DATA

Data	Data Source
Natural Resources	
Botany studies	CNHP/Colorado College
Natural Resource Assessments	EDM International, Inc.
Pikes Peak Watershed Forest Management Plan	Colorado State Forest
Catamount Landscape Assessment (SINF)	CEEM
Colorado Division of Wildlife (CDOW) Riparian Mapping	CDOW
Colorado Vegetation Classification (CVCP)	CDOW
CDOW Bighorn Sheep Lambing/Winter Use	CDOW
Fire Behavior Model	Anchor Point
2009 Baseline water quality	Wendy Asay
Class I Cultural Resource Inventory	WCRM Inc.
General late summer surveys	EDAW/AECOM
Infrastructure	
Mesa Water Treatment Plant Master Plan	Carollo Engineers
Various Springs Utilities Watershed infrastructure data	Springs Utilities
Various Springs Utilities Watershed timeline documents	Springs Utilities
Impact Analysis Procedure 09-2008	Springs Utilities Technical Team
Recreation	
Pikes Peak Multi-Use Plan	Design Workshop, Inc.
City Charter and Code	City of Colorado Springs
Middle Boulder Creek Water Source Management Work Plan	Boulder Utilities
Denver Water Recreation Visions for the Present & Future	Denver Water
North Slope Recreation Planning Process	Various
Watershed Access Application Review Process	Springs Utilities
Peak area Recreation concept	Springs Utilities
Rec. Opportunities for Pikes Peak Area	Springs Utilities
1992 North Slope Watershed Recreation Plan	North Slope WAC
Pikes Peak Atlas GIS format	Pikes Peak Atlas
El Paso County Ute Trail Project Overview	Springs Utilities
Pike San Isabel Land and Resource Management Plan Map	US Forest Service
Friends of the Peak Maps and potential trail descriptions	Friends of the Peak
Various news articles	Gazette and others
Public meetings	EDAW/AECOM

Opportunities and Constraints Analysis

Resource mapping, produced from existing and new data, was compiled and analyzed in a GIS model, which was used to produce an opportunities and constraints analysis. The opportunities and constraints analysis is a way to consider including recreation on watershed lands while minimizing the impacts to water quality and delivery, as well as sensitive resources and habitat.

Water Quality

Maintaining high water quality is a primary goal of Springs Utilities. The water from the South Slope is known as a blending supply. It is of such high quality that mixing it with lesser quality waters collected within the Pikes Peak region helps to keep the cost of water treatment low and overall quality high. Maintaining the South Slope water integrity is essential to Springs Utilities' water treatment standards.

Water quality or water purification is often referred to as an ecosystem service. In most circumstances, keeping a healthy ecosystem in place is the most cost effective, efficient way to maintain water quality. Ecosystem services are provided by a complex web of conditions and processes found in the natural world, and many of these webs cannot be replaced by technology. In the case of the Springs Utilities watershed lands, the biggest threats to the ecosystem services the South Slope provides are stand-replacing forest fire (increased risk of ignition), invasion of exotic plant, invertebrate, or vertebrate species (carried into the property on foot, boat, or vehicle), releases of toxic substances (e.g. fuel, antifreeze, etc.), or disruption of native plant, invertebrate, or vertebrate species (via trampling or annoyance).

Stream on the South Slope watershed

Intact native vegetation on hill slopes and in wetlands purifies water by filtering it slowly down-grade with minimal erosion or contact with hazardous materials. The entire ecosystem plays a role in keeping water quality high. The plant roots are the anchors, holding soils in place and allowing for beneficial fungi and bacteria to break down organic matter and maintain a relatively neutral pH level. The vegetation is dependent on insects and wildlife such as elk, beaver, and birds to pollinate, disperse seeds, and graze. Disruption of any part of the web of life can potentially have a direct effect or a complex chain effect on how the system works. For example, a loss of predators in an area can lead to over-abundant elk populations that could over graze the willows and riparian vegetation, causing increased stream bank erosion and thus diminished water quality.

Avoiding impacts to ecosystem services is complex. However, there are proven methods to guide development of a science-based recreation plan for watersheds. These are discussed in the resource constraints section below.

Water Delivery

To maintain the quantity of water in response to demand at predictable rates, Springs Utilities personnel maintain a variety of infrastructure, including gages, pipes, tunnels, dams, etc. Respecting the ability of the watershed operators to efficiently perform their duties will be paramount in the development of a sustainable recreation plan. Roads on watershed lands cannot become obstructed by recreation activities; potentially hazardous situations involving operations vehicles and recreationists must be avoided. Other infrastructure must also be protected and avoided by trails and recreational activities, where possible, to minimize the risk of vandalism or inadvertent damage. Further, Springs Utilities operators should not be burdened with issues related to recreation management that would deter them from their necessary routine duties.

Recreation

A third and "junior" potential use of Springs Utilities watershed lands is recreational use. Recreational access must be sustainable from a long-term economic, resource, and management perspective.

Composite Suitability Analysis

The analysis was conducted by weighting resources based on impact avoidance or minimization (see Appendix B, Opportunities and Constraints Analysis). Maps 2 through 4 (in Appendix B) depict the various resource considerations on the South Slope, including slope, topography, biodiversity, infrastructure, and bighorn sheep habitat. Table 3, Resource Weighting and Buffering, describes the resource buffers used in the constraints analysis model.

The South Slope watershed infrastructure and roads were identified as areas of avoidance. The road network used by Springs Utilities was given a 100 foot buffer and assigned a high avoidance value in the model. Other infrastructure, such as solar panels and diversion structures, were buffered by

View of Pikes Peak from the South Slope

TABLE 3. RESOURCE WEIGHTING AND BUFFERING

Resource	Criteria	Buffer (feet)
Highly Erodible Soils	Minimize impacts using Best Management Practices (BMPs)	
Infrastructure and Historic Sites	Avoid	300
Springs Utilities Roads	Cross perpendicular only	100
Tundra	Avoid all areas	
Slopes 30-40%	Minimize impacts using BMPs	
Slopes 40-50%	Avoid where possible	
Slopes 50% +	Avoid all areas	
Bighorn Core Winter Habitat	Avoid all areas	
Overall Bighorn Lambing Areas	Minimize impacts (e.g. seasonal closures)	
Bighorn Core Lambing Areas	Avoid all areas	
Intermittent Streams	Cross perpendicular only	50
Perennial Streams	Cross perpendicular only	100
Areas of Outstanding Biodiversity	Avoid	
Wetlands, Fens, Riparian	Avoid	200

300 feet and also considered high avoidance areas. It was understood in the modeling process that crossing Springs Utilities roads with a trail might be necessary to complete a trail system. However, the number of road crossings was minimized and the crossings will be made with a perpendicular trail alignment. Historic and cultural resources on the South Slope were buffered by 300 feet and were given a high avoidance value in the model.

The natural resource data was analyzed to identify sensitive areas on the South Slope watershed. Fens are a type of wetland with deep organic soils that develop over thousands of years. Fens are often associated with fragile plant species, and are among the most sensitive areas on the South Slope. Fens have a low resiliency for impact; as such, it takes fens a particularly long time to recover even from minor impacts. Wetlands and riparian areas are very important to water quality. All fen, wetland, and riparian areas were given high avoidance values Trails may need to occasionally cross riparian or wetland areas. Riparian and wetland crossings would be accomplished with sensitive bridge designs at locations that minimize impacts and the desire to walk or fish in the creek. No crossings of fens are proposed.

Another high priority natural resource consideration is bighorn sheep habitat, including lambing areas. Bighorn sheep data was acquired from the Colorado Division of Wildlife (CDOW) terrestrial research team, which has collected over 3 years of data points from 50 radio-marked bighorn sheep. The core areas for lambing were given high avoidance values in the constraints model.

Areas with slopes above 50 percent were also classified as high avoidance areas due to the risk of soil erosion.

After these highly sensitive areas were classified in the model as areas of high avoidance, a weighted, additive model process was run to produce a composite score for other resource values. Each resource was given a weighted score based on its relative sensitivity. Resources considered included overall bighorn sheep lambing areas, bighorn sheep core winter areas, tundra, 50 foot buffers of intermittent streams, 100 foot buffers of perennial streams, Colorado Natural Heritage Program (CNHP) outstanding biodiversity areas, slopes over 40% and 200 foot buffers around wetlands, fens, and riparian areas. The additive process then calculated a number for each area on the South Slope watershed. Based on an additive composite of each of the individual resources described above, the results graphically show areas of the watershed that range from least constrained to most constrained.

The results of this model graphically depict areas of opportunities and areas of avoidance for potential recreational uses and facilities. Map B, South Slope Composite Suitability Analysis, illustrates a composite analysis showing areas of highest and lower constraint. Diagram 1 (in Appendix B) is a graphic representation of how the model was constructed and the individual inputs.

Regulatory Constraints

Springs Utilities has expressed a desire to develop a management plan for recreational uses on watershed lands in a manner that is consistent with surrounding U.S. Forest Service (USFS) lands. Springs Utilities has also committed to not make decisions that may affect other landowners or partner agencies without consulting with affected parties.

A large majority of the land surrounding Springs Utilities watershed lands is publicly owned and managed by the U.S. Forest Service, particularly those around the South Slope watershed. This portion of the forest is part of the Pike National Forest, managed by the Pike Ranger District in Colorado Springs. Management direction for the Pike National Forest is provided by the 1984 Pike San Isabel National Forests; Comanche and Cimarron National Grasslands Land and Resource Management Plan. Lands to the east and southeast of the South Slope are managed under a 2A designation, which has a management emphasis on semi-primitive motorized recreation opportunities. The WAAG determined that motorized recreation on watershed lands would not be considered.

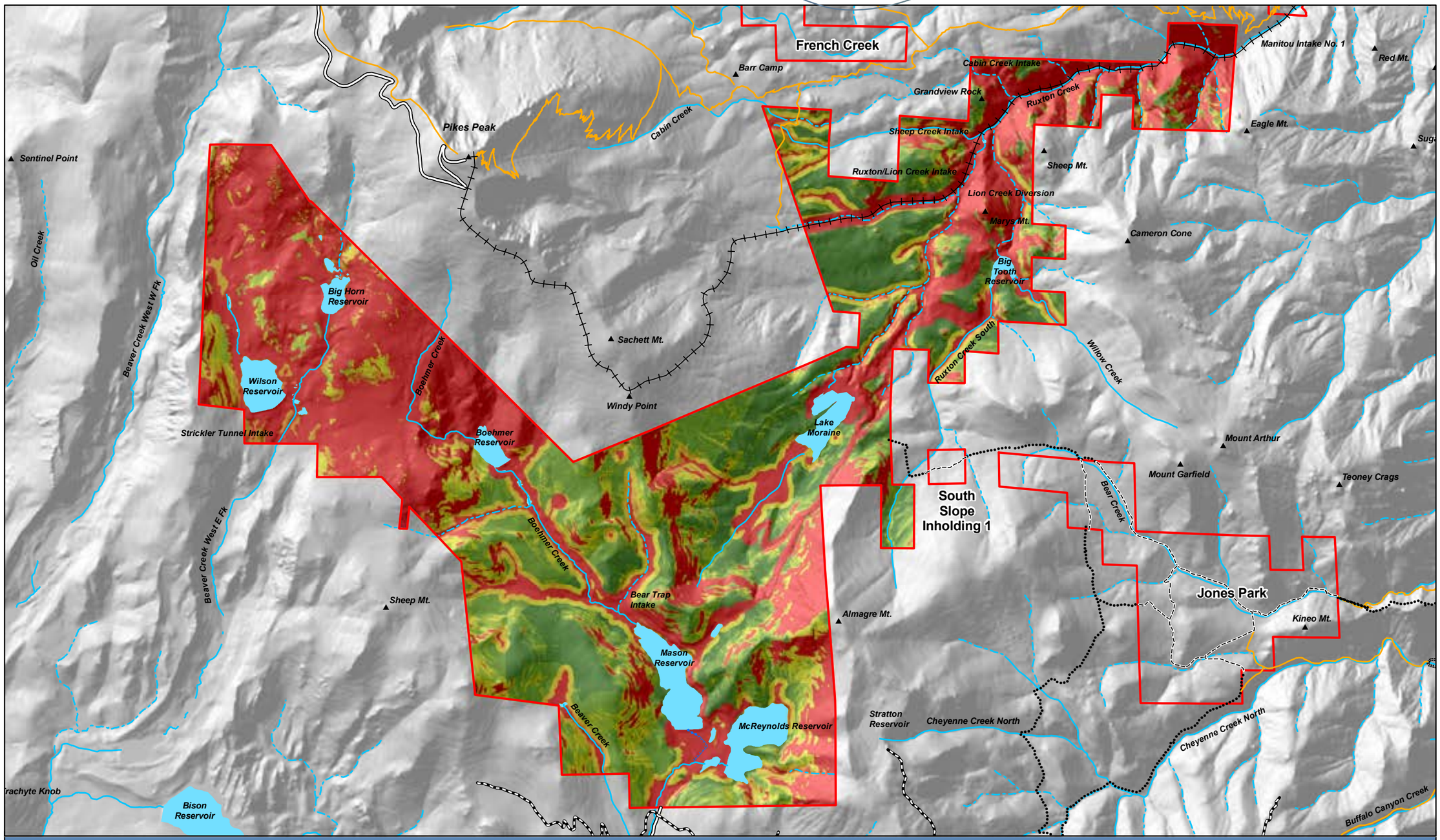
Lands to the north of the South Slope are managed under a 10E designation, which provides for the management of municipal watersheds to protect or improve water quality and quantity. Guidance for dispersed recreation under 10E suggests that motorized travel will only be allowed on designated roads. It also states that watersheds will be closed to all travel when the road or trail surfaces could be damaged to the degree that would degrade water quality.

Lands to the west and southwest of the South Slope are managed under a 5B designation, which emphasizes the management of wildlife habitat. Transportation system management guidelines suggest that new roads will only be allowed to meet priority management goals outside of the management area or to meet big game goals in the management area. Temporary roads are to be obliterated within one season after any planned use occurs. It also suggests that non-motorized use will be managed to prevent stress on wildlife. In 2010, the USFS released a bighorn sheep position paper outlining potential impacts of new trail construction on bighorn sheep on the South Slope (Appendix C). In addition, representatives from the Pikes Peak Ranger District have indicated that, due to the current forest plan management direction in 5B areas, they cannot entertain the establishment of any new trails or roads on Forest Service lands that might lead from Springs Utilities' South Slope watershed. As such, it would be imprudent to propose any such routes from the South Slope at this time, unless it is connected to an existing USFS system trail.

Opportunities

Physically, the South Slope watershed is very similar to the surrounding USFS lands; much of the recreation potential on the South Slope can also be found on surrounding lands. The recreational uniqueness of the South Slope is its remote setting, opportunities for solitude, and the presence of several reservoirs and associated fisheries. With this in mind, combined with the list of proposed uses developed by the WAAG and Springs Utilities' recreational use policy (see Chapter 2, Implementation), guiding statements for recreation on Springs Utilities watershed lands were developed. Guiding statements (see pages 13-14) clarify the most basic assumptions about use and management of the watersheds, in addition to providing context for what types of recreation are appropriate and how recreation should be managed. These foundation elements form the boundaries that frame decisions concerning recreational use on watershed lands.

Scenic view on the South Slope



Map B.
South Slope Composite Suitability Analysis

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View from the proposed Lake Moraine Trail

SPRINGS UTILITIES WATERSHED RECREATION GUIDING STATEMENTS

Values

Springs Utilities values responsibility, collaboration, people, trust, safety, and continuous improvement.

- Future recreational activities and facilities will strive to ensure these values are upheld through a balance of operational needs, environmental stewardship, and appropriate recreational uses.

Safety

Springs Utilities fosters an Incident and Injury Free (IIF) culture.

- All recommendations for future recreational activities and facilities on watershed lands will place a high priority on ensuring public safety.
- To minimize vehicular and pedestrian conflict, recreational activities and facilities will be planned and designed in such a way that minimizes public use of watershed system roads.

Water

One of Springs Utilities' primary responsibilities is to provide a high-quality, reliable source of drinking water.

- Future recreational activities and facilities will be managed to avoid impacts to water quality, quantity, and delivery. If full avoidance is not possible, any adverse impacts from future recreational activities will be monitored and mitigated appropriately.
- Recreational activities and facilities will be designed and located to avoid conflicts with existing infrastructure and water supply operations as much as possible.

Environment

Springs Utilities is committed to being a steward of the environment.

- Recreational activities and facilities will be designed and managed in such a way that avoids sensitive flora, fauna, and their habitat.
- Recreational activities and facilities will be designed and managed to avoid impacts on critical water resources, such as wetlands and fens.
- Recreational activities and facilities will be located, designed, and constructed in a sustainable manner to ensure their long-term continued operation with minimal impact on the environment.
- Any adverse impact on natural or cultural resources, as a result of direct or indirect effects from recreational activities, will be monitored and mitigated.

Rocky Mountain Bighorn Sheep on the South Slope Watershed

SPRING UTILITIES WATERSHED RECREATION GUIDING STATEMENTS (CONTINUED)

Fire

Fire poses serious risk to the safe and effective delivery of high quality drinking water.

- Recreational activities and facilities will be designed and managed to minimize increased risk of wildland fire on watershed lands or adjacent properties.

Desired Visitor Experience

A diversity of non-motorized uses will be provided on watershed lands, as is consistent with other guiding statements.

- The South Slope Watershed provides a unique opportunity for solitude and respite from everyday stresses. Recreational activities and facilities will be developed and managed to promote this type of experience.
- A diverse range of recreational activities and facilities on watershed lands will be available and accessible to visitors.
- Interpretive amenities will be provided that celebrate the unique history of water delivery, the majesty of Pikes Peak, and the surrounding natural resources.
- Recreational activities and facilities will contribute to improving the quality of life for Colorado Springs residents, surrounding communities, and visitors.

Partners

Springs Utilities strives to be a good neighbor.

- No decisions will be made that may affect other landowners or partner agencies without consulting with affected parties.
- Proposed trails or trail networks on watershed lands will be designed to connect only with existing or planned system routes on adjacent properties.

Financial

Springs Utilities currently does not have a mechanism for funding recreational use on City-owned watershed lands.

- The design, development, operation and maintenance of recreational infrastructure will be done in a manner that does not place an undue financial burden on Springs Utilities customers.
- Recreational facilities will be located, designed and constructed in a manner that ensures long-term continued operation with minimal ongoing financial commitments.
- A funding strategy that is sustainable over the long term will be sought for continued operation and maintenance of recreational facilities.
- Partnerships and volunteers will be critical to this long-term financial success.

Public Involvement

The involvement of the public and interested stakeholders was a critical component of the recreation planning effort on Springs Utilities watershed lands. The first public meeting was held on September 29, 2009, and was attended by 55 people, with 65 comment forms filled out. In addition, 42 stakeholders were invited to half-hour interviews; 18 group representatives participated (Table 4, Contacts Made for Interviews). A summary of the feedback from the interviews is listed on the "Condensed Stakeholder Comments" sidebar.

A major directive of this planning process was that Springs Utilities would not make unilateral decisions that could have an impact on other landowners or partner agencies without receiving buy-in from affected parties. Involvement of partner agencies ("Partners") throughout the planning process was used to create a sound and scientifically-based plan. Partners included the USFS Pikes Peak Ranger District, CDOW, City of Colorado Springs Parks, Recreation, and Cultural Services Department, Colorado State Forest Service, Colorado State Parks, Catamount Institute, and Teller and El Paso County Parks. Examples of key input received include:

- USFS 5b management designation, which "emphasizes the management of forage and cover on big game winter ranges" in Pike San Isabel Forest Plan on lands adjacent to the South Slope;

CONDENSED STAKEHOLDER COMMENTS

Natural Resources and Ecosystems

- Concern about forest health, wildlife, tundra, historic resources, and water quality
- Concern about the introduction of invasive aquatic species in the reservoirs from boats

Recreation Activities and Access

- Preference for leaving watersheds as is
- Concern that group bicycle and equestrian rides need specific rules and policies
- Reasonable user fees are acceptable
- Provide access that is consistent with USFS land use
- Opinion that allowing access would help prevent vandalism
- Interest in the Ring the Peak Trail
- Interest in access for fishing and hand-launch boats on large reservoirs, opposition to gas motors
- Opposition to camping
- Opposition to competitive events and concern about impacts of crowding
- Concern about impacts of bikes and unleashed dogs
- Opinion that only a small number of people are interested in accessing the South Slope

Trails and Facilities

- Interest in multi-use trails that are built sustainably
- Support for controlling the feed of horses to limit the introduction of invasive species from horse manure
- Trails routed to avoid impacts to bighorn sheep
- Support for connector trails and spoke trails from the Peak
- Opinion that impacts would be minimized if trails and facilities are well-developed
- Interest in a connection between the Jones Park area and the Barr Trail area
- Concern about ADA accessibility
- Support for a short loop trail

Recreation Management

- Recommendation to work with the local fire agencies for coordination on fire risk
- Recommendation that a recreation concessionaire be used
- Concern about proper management of the area to minimize impact
- Concern about cost of management and impact on water rates
- Concern about damage to facilities through vandalism and sedimentation

- USFS bighorn position paper outlining potential impacts of new trail construction on bighorn sheep on the South Slope (Appendix C);
- Resource issues identified by CDOW such as bighorn sheep, greenback cutthroat trout, and wetlands.

A science-based analysis, public input, stakeholder interviews, Partner input, and the Springs Utilities Watershed Recreation Guiding Statements produced a concept plan that protects the watershed while providing appropriate recreational opportunities and responding to public input.

Rocky Mountain Bighorn Sheep on the South Slope Watershed

TABLE 4. CONTACTS MADE FOR INTERVIEWS (INTERVIEW ATTENDEES ARE SHOWN IN BOLD)

American Discovery Trail	Pikes Peak Area Council of Governments (PPACG)
American Trail Running Association	**Pikes Peak Atlas (Robert Houdek)**
Audubon Society	**Pikes Peak Range Riders**
Bike Colorado	Road Runners
Catamount Institute	Rocky Mountain Big Horn Society
Cavalier Trail Riding Club	Rocky Mountain Elk Foundation
City of Woodland Park	Rocky Mountain Goats Foundation
Colorado Division of Wildlife (CDOW)	**Sierra Club**
Colorado Motorcycle Trail Riders Association (CMTRA)	Southern Rockies Conservation Alliance
Colorado Mountain Club (CMC)	State Parks
Colorado Springs Convention and Visitors Bureau	Teller County Division of Parks
Colorado Springs Parks, Recreation and Cultural Services (Parks Department)	Teller County Public Works
Colorado State Forest Service	The Wilderness Society
Colorado Trail Foundation	**Toyota 4-WD Club**
City of Cripple Creek	**Trails and Open Space Coalition (TOSC)**
El Paso County Parks	**Trout Unlimited**
Friends of the Peak (FOTP)	**US Forest Service (USFS)**
Manitou City Planning	City of Victor
Manitou Springs Trails & Open Space Coalition (MSOSAC)	**Watershed Access Advisory Group (WAAG)**
Medicine Wheel Mountain Bike	Wild Connections
North American Trail Ride Conference	Woodland Park Chamber of Commerce

Example of a day-use picnic site

RECREATIONAL USES

Resource sensitivity and the challenge of managing recreational activities while maintaining operational efficiency on watershed properties result in a determination that some uses are incompatible with the guiding statements. Although consideration was given to a variety of potential recreation activities and facilities, certain uses were determined to have unsustainable impacts and were therefore eliminated from further consideration. Due to the primary necessity of maintaining high water quality, protecting the resources that are unique and critical to these watershed lands is of utmost importance. Therefore, off-trail, dispersed recreational activities have been largely eliminated from further consideration. Dispersed recreation can lead to a number of conflicts and impacts in areas where there are sensitive resources. Table 5, Public Recreation Types Analysis and Recommendations, provides a synopsis of the recreational uses that have been proposed for further consideration and those that have been eliminated. Dogs would not be permitted at any of the facilities or trails in the South Slope watershed, due to concerns about natural resource impacts, wildlife disturbance, and off-trail use.

SOUTH SLOPE CONCEPT PLAN

The uniqueness of the South Slope watershed lies in its remoteness, opportunities for solitude, and the presence of the reservoirs. These are values and experiences desired by the public participants, and as such they have shaped the guiding statements for the South Slope and subsequently the proposed facilities in this concept plan. In accordance with the philosophy that the South Slope should be maintained in a natural state, proposed recreational facilities are minimal in scope and the intended recreational experience emphasizes opportunities for solitude. Map C, Concept Plan, provides a conceptual layout of all proposed facilities on the South Slope watershed. Graphic illustrations and representative photos of the locations of potential facilities are provided for reference.

Feedback on the Concept Plan

Public comments were collected from verbal comments and written forms at a well-attended (more than 120 participants) public meeting held on January 26, 2010. Additionally, a month long comment period was opened to accept written feedback. An online comment form was placed on the Springs Utilities website, and comments were also accepted via e-mail and letters. Stakeholder groups were encouraged to participate in the Concept Plan feedback process. The top topics identified at the open house and during the comment period are quantified by the number of forms or letters received (Table 6, Input from

TABLE 5. PUBLIC RECREATION TYPES ANALYSIS AND RECOMMENDATIONS

Recreation Type	Allowed	Reasoning
Hiking	Yes	On trail only
Equestrian	Yes	On trail only
Bicycle	Yes	On trail only
Wildlife/nature viewing/ photography	Yes	On trail only
Fishing - reservoir	Yes	McReynolds, Mason, and Moraine only; only allowed on designated shoreline areas; no body contact
Picnicking	Yes	Day use area
Non-motorized boating	Yes	McReynolds Reservoir only; only hand-launched boats; no body contact
Vehicular access	Yes	Access to trailhead and day-use area only
Hunting	Yes	Limited capacity dependent on collaboration between Springs Utilities and CDOW; not likely to coincide with peak recreational use season
Permitted events (races, invitationals)	No	Dependent on whether funding source used to fund recreational infrastructure permits
Fishing- stream	No	Impacts to fens/sensitive wetlands
Fishing- ice	No	Safety issues
Camping developed	No	High development and on-going operations and management costs; vegetation trampling; fire risk; impact to water quality
Camping primitive	No	Human waste issues; soil compaction/erosion, vegetation trampling; fire risk; impact to water quality
Overnight hut system	No	Human waste issues; vegetation trampling; fire risk; increased operations and management costs and burden; impact to water quality
Commercial recreation permittees	No	Public participant opposition
Rock climbing	No	Assumes off-trail use - bighorn sheep disturbance
Dogs	No	Resource impacts; wildlife disturbance; off-trail use; waste

the Second Open House). In addition to the top ten topics addressed during the comment period, comments in support of multi-use trails, support for equestrian access, desire for minimal facilities and infrastructure, a designated spoke trail to the Pikes Peak summit, organized climbing or camping opportunities, an adaptive/phased approach to recreation management, and seasonal closures for wildlife and protection of bighorn sheep habitat were expressed. Concerns raised during the open house and comment period included opposition to opening the South Slope to recreation, impacts to sensitive natural resources, trash and illegal activities that may occur on the watershed, potential user conflicts on multi-use trails, access and availability of emergency services, and safety of users on the existing Ute Trail alignment.

Stakeholder groups submitted various comments and concerns. Groups expressed support for allowing hunting on the watershed. There was opposition to horse traffic on Captain Jacks, due to parking issues at the base of the trail, increased chance of whirling disease introduction, trail widening, and the lack of a practical way for horses and motorcycles to pass one another. Multiple

groups favored connecting the Ute Trail alignment to French Creek and preserving the Ute Trail alignment in the original route to French Creek. Support for Ring the Peak was widely expressed. Various groups also wrote in favor of allowing bikes on the Mason Loop, as well as creating a trail connection between the Mason Loop and Lake Moraine Trail. In general, there was appreciation for opening the watershed to recreation and support for the plan. Other than the South Slope and Long's Ranch, there was no feedback from the public requesting consideration of changes to recreation on other local watershed lands.

The Final Concept Plan reflects changes made as a result of public feedback on the draft plan.

Third Open House

A third open house was held on April 27, 2010 to gather additional public feedback on the Concept Plan (Chapter 1) and Implementation Plan (Chapter 2). The meeting was attended by 61 individuals and representatives of various organizations and groups. At the open house, attendants had the opportunity to sign up to volunteer on the South Slope and/or participate in future guided tours of the watershed. Six meeting attendants indicated interest in volunteering. Eight people signed up for guided tours.

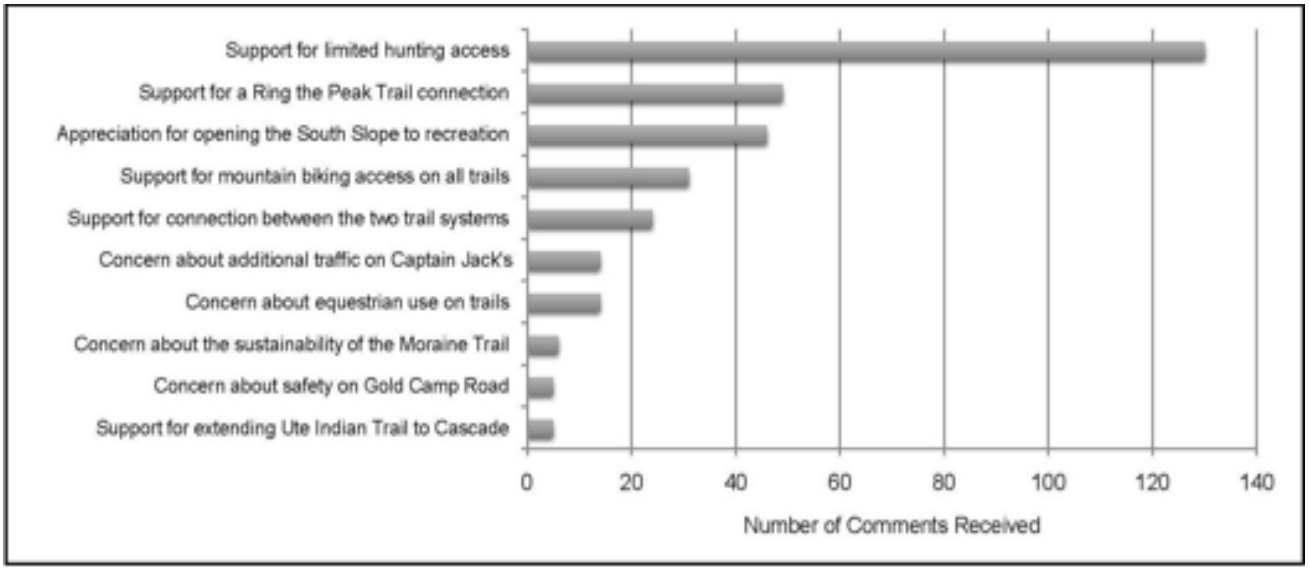
Fourteen comment forms were collected at the meeting. Three letters and one email were received in the three-week comment period that followed.

The comments received addressed a variety of plan components and topics. Comments included:

- Concern about the proposed trail tread width
- Support for year-round use of trails
- Support for seasonal closure of trails
- Suggestion for a website providing information on conditions and closures of trails
- Support for the use of volunteers for trail building and maintenance
- Concern about funding
- Support for user fees
- Request for more information on adaptive management and monitoring
- Concern about parking availability and overflow
- Routing suggestions for the Trail Connection
- Routing suggestions and concerns for the Ute Trail
- Concerns about hunting safety and wildlife disturbance
- Appreciation of the addition of hunting to the plan
- Concern about the addition of non-motorized traffic to the Captain Jack's trail
- Comments on the prioritization of construction and trail building projects

The most commonly expressed concern was the proposed width of the trail tread (48 inches). In response to these comments, the proposed trail tread has been adjusted to be more flexible (36-48 inches), depending on the location, level of use, and conditions of a trail section.

TABLE 6. INPUT FROM THE SECOND OPEN HOUSE



CONCEPT PLAN

Mason/Boehmer Reservoir Trailhead

A trailhead is proposed adjacent to the main access road approximately ½-mile inside the Springs Utilities South Slope watershed gate. This trailhead would serve the proposed Mason/ Boehmer Reservoir Trail. The trailhead would be designed to accommodate up to 15 vehicles, including one ADA parking space, and seven horse trailer parking spaces on a crushed gravel surface. The trailhead would also provide either a vault or composting toilet and bear proof trash receptacles. Signage would include a welcome sign for the South Slope Recreation Area, as well as an educational, interpretive, and regulatory kiosk or signs. An enlargements of the core proposed recreation area and trailhead are shown in Map C1, Trailhead Area Enlargement and Map C2, Day Use Area Enlargement (See Map C for a conceptual layout of all proposed facilities).

Mason/Boehmer Reservoir Trail

An 8-mile trail is proposed along the west side of Mason Reservoir, which creates a loop and provides a spur trail leading to Boehmer Reservoir. The trail would begin at the trailhead located on the main access road. It would accommodate several recreation activities, including hiking, mountain biking, equestrian use, and nature viewing. Fishing (fly and lure only) would be allowed along the west shoreline of Mason Reservoir. Due to sensitive wetlands and fens, fishing would not be allowed along Boehmer Creek or in Boehmer Reservoir. The north side of Boehmer Reservoir lies at the edge of critical bighorn sheep habitat. Therefore, the spur trail to Boehmer Reservoir is designed with adaptive management in mind and may require seasonal restrictions and/or closures. Any seasonal restrictions would be developed in close coordination with CDOW. An overlook oriented toward Pikes Peak would be the terminus of public access. A watershed system road lies along the east shore of the reservoir, and would not be open for public use.

The Mason/Boehmer Reservoir Trail is intended to be a natural surface, sustainably built trail. The trail would be designed and constructed to avoid sensitive resources and create the least visual impact on the landscape, while still providing an exceptional recreation and viewing experience. Construction of this trail would likely require at least four footbridges and four larger bridges (elevated boardwalk crossings) over Boehmer Creek and adjacent wetlands. Sustainable trail requirements will be followed during design and construction of the trail. The trail would primarily be constructed with a natural surface, but there may be a need for sections of aggregate-surface trail to reduce resource impacts and allow for proper drainage. The trail would have relatively easy to moderate grades. A trail tread of 36 to 48 inches (3 to 4 feet) would accommodate multiple uses. The exact trail tread would be dependent on the location, condition, and level of use of a trail segment. The trail would provide opportunities to see and learn about watershed natural resources. Figure 1 is a cross-section of the proposed trail.

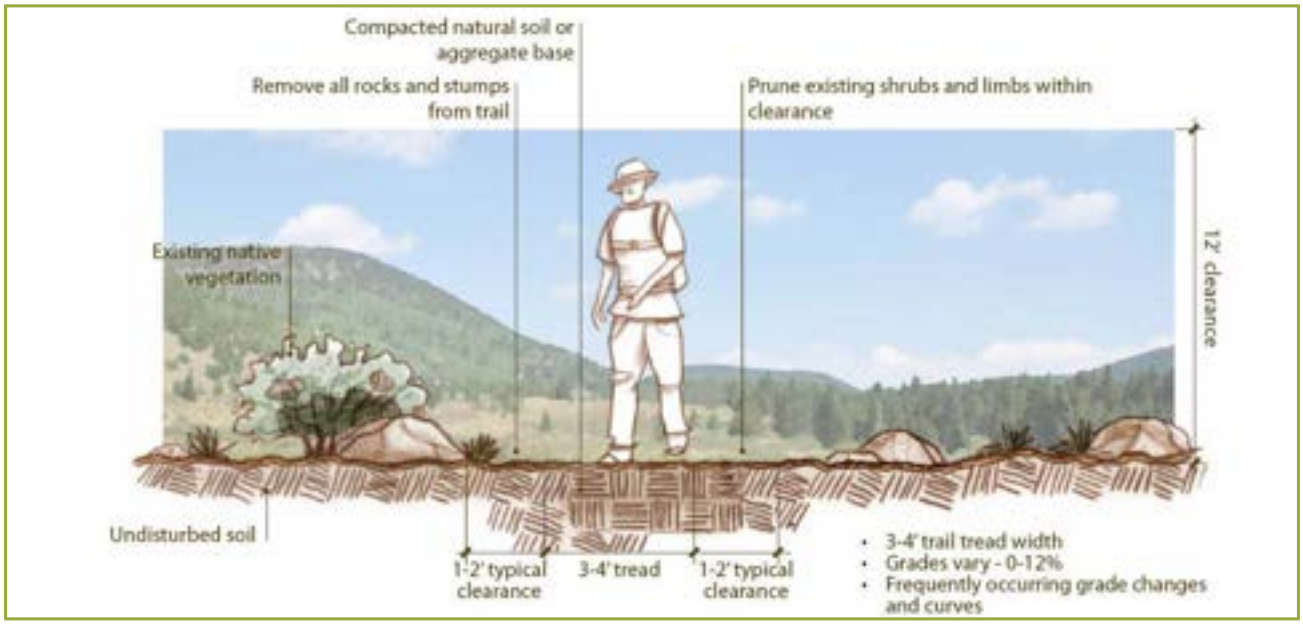
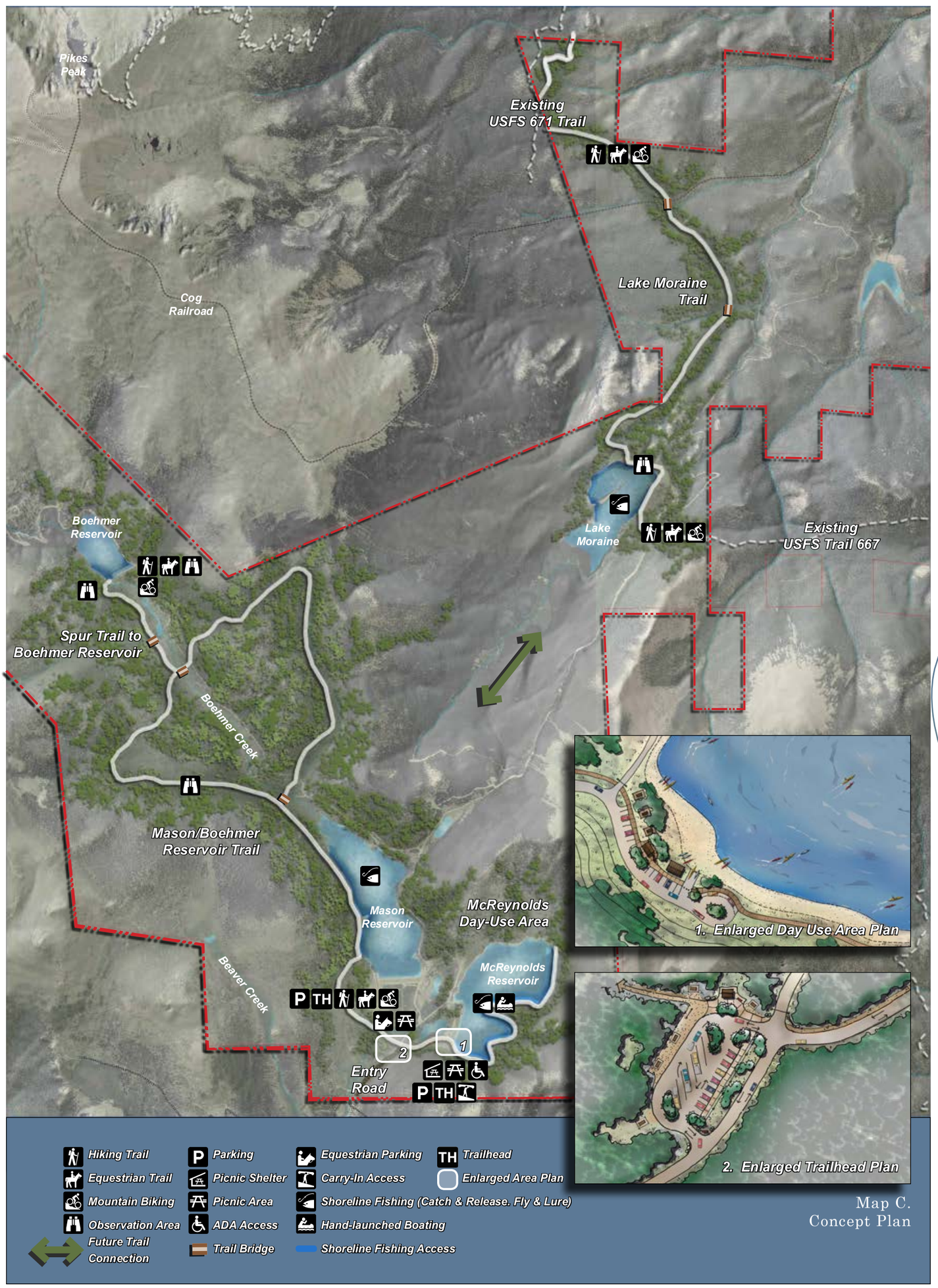


FIGURE 1. TYPICAL TRAIL DIMENSIONS



Map C.
Concept Plan

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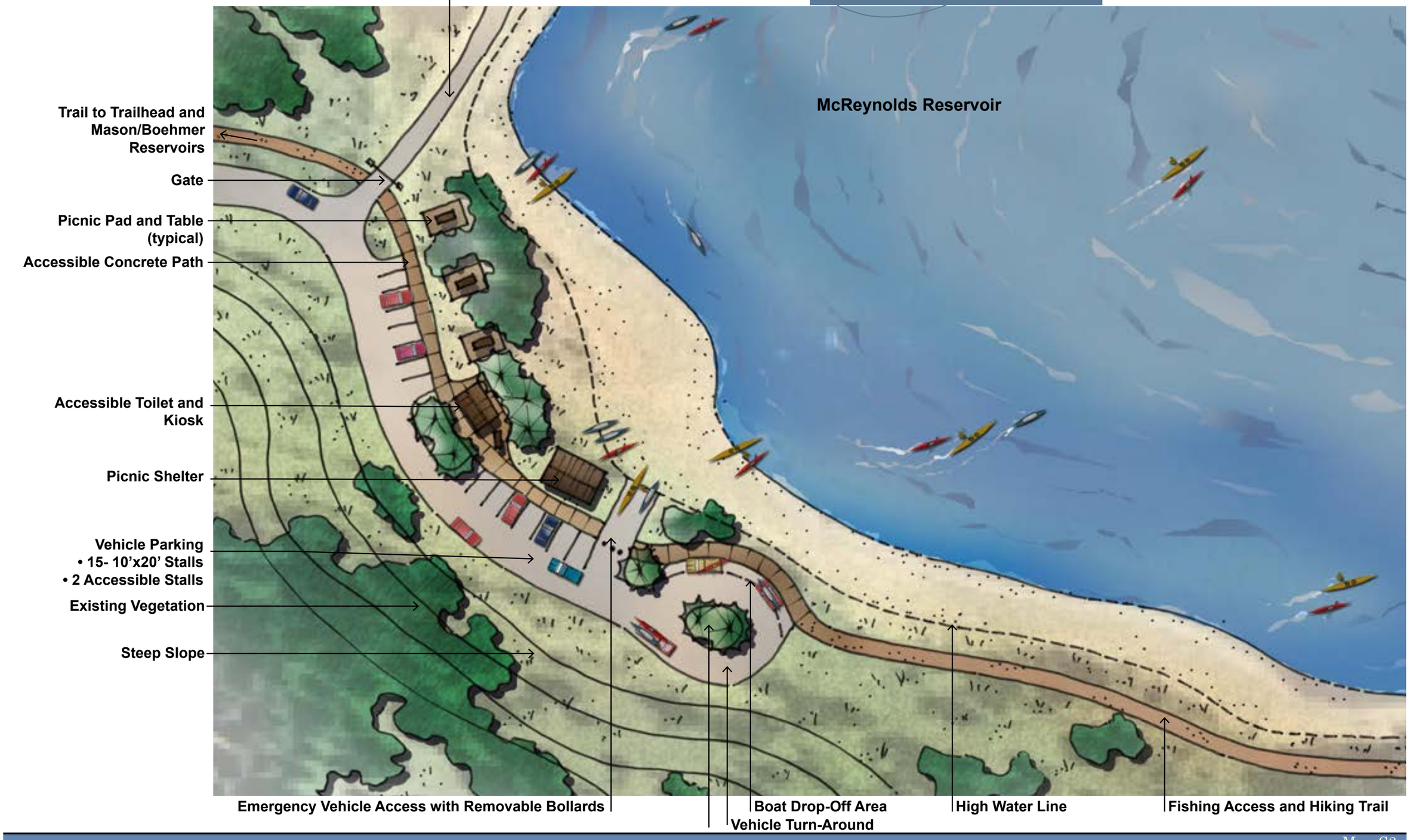
Map C1.
Trailhead Area Enlargement



Map C2.
Day Use Area Enlargement

McReynolds Day Use Area

McReynolds is the only reservoir on the South Slope where drive-in access would be provided to a reservoir. A developed day-use area is proposed on the southwest shoreline of McReynolds Reservoir. The site provides a beautiful setting for day-use recreation and is intended to provide recreational opportunities for a wide range of visitors. The area is designed to accommodate up to 16 vehicles, including two ADA parking spaces, on a crushed gravel surface. The area would also provide either a vault or composting toilet, bear proof trash receptacles, and picnic tables. A kiosk would include regulatory and interpretive information. There would be a designated hand-launch area for non-motorized boats. Bollards would be installed to prevent vehicles from directly accessing the shoreline. An operator's residence on the northwest shoreline of the reservoir would provide a presence to remind visitors that their activities might be observed; this area would be closed to public access. Regulatory signs would be provided to inform the public of current regulations and identify areas that are off-limits for public access.

A 1.2-mile trail would parallel the south and east shoreline of the reservoir to provide fishing access, a short hiking opportunity, and to help reduce vegetation trampling from fishing activities (fly and lure only). Another 0.3-mile trail would lead from the day use area to connect to the Mason/ Boehmer Reservoir Trail and trailhead (see Map C2 for a concept rendering of the day-use area). This day use area can also serve as a trailhead, providing an overflow area on days when the main trailhead is at capacity.

Public Access Road

With the establishment of a day-use area at McReynolds Reservoir, it would be necessary to allow public access on 0.6-mile of watershed roads. Directional signage would be needed, and gates would need to be installed to keep vehicles from driving on areas closed to public use. A new 0.2-mile access road would need to be constructed from the South Slope main access road to the southwest shoreline of McReynolds Reservoir. The proposed alignment of this road is displayed on Map C, Concept Plan.

Typical composting toilet with improved exterior

Typical entrance sign

Lake Moraine Trail

A trail connection from the terminus of Captain Jack's Trail (USFS Trail 667) to Mountain View Trail (USFS Trail 671), through the South Slope watershed is proposed. This trail would provide a connection to the Barr Trail, which provides a route to the summit of Pikes Peak. Since Captain Jack's is a well-used motorized trail, the existing gate at the watershed boundary would be replaced by one that allows for the passage of hikers, bicycles, and horses but not motorized vehicles. The trail would provide access to the north shoreline of Lake Moraine and avoid steep slopes adjacent to the dam. Fishing is also provided at Lake Moraine, on the north half of the lake shoreline only; no body contact would be allowed. A trail would not be provided to circumnavigate the lake due to the presence of sensitive wetlands, fens, and other

Example of a picnic site (Horsetooth Reservoir)

fens, and other resources south of the reservoir. One portion of the trail would require a bridge at a creek crossing. An at-grade crossing of one track of the Cog Railroad, with a clear line of sight to the railroad, would be necessary. An existing 0.5-mile portion of USFS Trail 671 crosses through Springs Utilities property. This trail would become a designated section of the Lake Moraine Trail. The final alignment of Lake Moraine Trail would be designed and constructed according to principles of sustainable trail design. Map C, Concept Plan, illustrates the proposed alignment of this trail.

Trail Connection

A trail connection between the Lake Moraine Trail and the Mason/Boehmer Reservoir Trail is considered a future priority of this concept plan. This connection would expand recreation on the South Slope by providing a longer distance trail opportunity and an alternative base area and route to the Pikes Peak summit. A specific alignment for this trail has not been defined; however, a sustainable route with the least impact will be evaluated in the future. Map C indicates the potential for a connection, but does not identify a potential alignment at this time.

FUTURE CONSIDERATIONS

After implementation of the concept plan, recreational use of the site would be evaluated, and appropriate adjustments would be made in order to protect resources and enhance the recreational experience. A review of allowed recreational uses, including a public comment period, would occur approximately ten years after all elements in this plan have been completed. Restriction or expansion of recreational use, in addition to other topics, will be considered at this time.

Given the sensitivity of the South Slope Watershed and the importance of meeting Springs Utilities' operational needs, it is anticipated that any new uses not addressed in this document would be limited. New uses would be subject to review and approval by Springs Utilities and the Parks, Recreation and Cultural Services Department. Any uses that conflict with resource conservation goals, water quality and delivery needs, and existing recreational uses would not be considered.

The Perimeter Loop Trail (PLT, a.k.a. Ring the Peak) is a concept that emerged in the 1999 Pikes Peak Multi-use Plan (PPMUP). The concept is to have "a multi-use system of connected trails that circles Pikes Peak…. Relying on existing roads and trails, both designated and undesignated." The realization of the PLT would require a multi-agency effort and Springs Utilities is dedicated to be an active participant in proposed future alignments on or adjacent to Springs Utilities property.

Lake Moraine

Ute Trail

UTE TRAIL CONCEPT PLAN

A social trail is located on the Longs Ranch parcel of Springs Utilities lands and extends from the Town of Manitou Springs northwest to a location near the Town of Cascade. This trail receives a substantial amount of use but has evolved rather than having been deliberately aligned to accommodate the types of uses it receives, terrain, and other resource considerations. As a result, portions of the current social trail are located on areas with excessively steep slopes and are in need of improvements. El Paso County, the trail proponent, is proposing the designation and improvement of this trail. Proposed improvements include incorporating sustainable design elements, such as functional drainage features, switchback alignment in steep areas, removal of an abandoned gas pipeline, and user-friendly amenities like overlooks and signage. El Paso County Parks has expressed an interest in completing the Ute Trail on Springs Utilities property, as well as connecting this trail on either end of Springs Utilities property. Springs Utilities is working with the El Paso County Parks Department to reach an agreement on management and monitoring of the Ute Trail. It is the intention of Springs Utilities that El Paso County Parks would be the long-term manager of the Ute Trail.

The Ute Trail between the towns of Manitou Springs and Cascade is also addressed in this Concept Plan. Map D, Ute Trail, illustrates the proposed re-alignment of the Ute Trail and other needed improvements.

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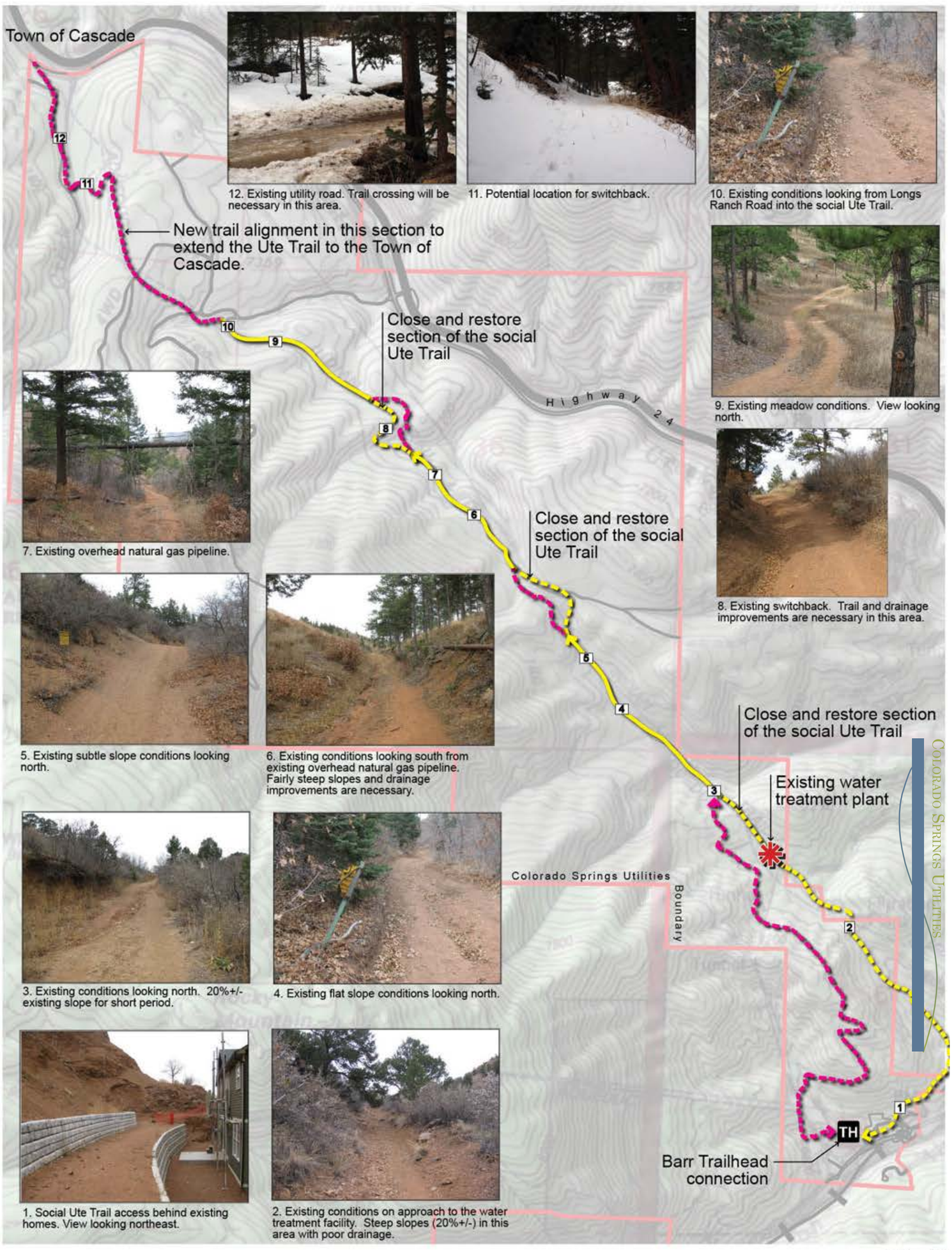

12. Existing utility road. Trail crossing will be necessary in this area.

11. Potential location for switchback.

10. Existing conditions looking from Longs Ranch Road into the social Ute Trail.

9. Existing meadow conditions. View looking north.

7. Existing overhead natural gas pipeline.

8. Existing switchback. Trail and drainage improvements are necessary in this area.

5. Existing subtle slope conditions looking north.

6. Existing conditions looking south from existing overhead natural gas pipeline. Fairly steep slopes and drainage improvements are necessary.

3. Existing conditions looking north. 20%+/- existing slope for short period.

4. Existing flat slope conditions looking north.

1. Social Ute Trail access behind existing homes. View looking northeast.

2. Existing conditions on approach to the water treatment facility. Steep slopes (20%+/-) in this area with poor drainage.

LEGEND

- Social Ute Trail
- Proposed Closed Social Ute Trail Section
- Proposed Ute Trail Re-Alignment
- Water Treatment Facility
- 1 Photo Points
- TH Existintg Trailhead

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Map D.
Ute Trail Proposed Alignment

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Chapter 2. Implementation Plan

One of the primary goals of this planning effort was to help Springs Utilities make strategic decisions about project implementation. In this chapter, existing funding sources are discussed and potential designs for developing the site in a sustainable way for the recommended recreational uses are identified. The recreational opportunities to be implemented are identified in the Concept Plan, including the recommended changes to the plan identified during the public comment periods. One of the key components for sustainable implementation is a prioritized list of projects. Some projects will be addressed in the near-term while a timeline for implementing long-term actions (future considerations) will be developed.

SPRINGS UTILITIES RECREATIONAL USE POLICY

Springs Utilities' mission includes providing safe and reliable water to its customers. As such, Springs Utilities is responsible for watershed health, source water quality, and collection system infrastructure protection on City-owned watershed lands. Springs Utilities' recreational use policy ensures protection of watersheds, source water quality, and collection system infrastructure on all City-owned watershed lands, while striving to accommodate compatible recreational activity.

Springs Utilities is mandated by the Colorado Department of Public Health and Environment (CDPHE) and U.S. Environmental Protection Agency (USEPA) to ensure Springs Utilities' public water supplies meet all national drinking water standards, designed to protect consumers from any harmful contaminants regulated under the Safe Drinking Water Act. Springs Utilities must also assist the CDPHE with the implementation of the Colorado Source Water Assessment and Protection Plan relevant to any City-owned, granted or permitted watershed lands serving as a source of supply to consumers. Springs Utilities must adhere to all regulations, mandates and/or permits under the Clean Water Act to restore and maintain the chemical, physical, and biological integrity of state and national waters. Springs Utilities manages its watersheds in compliance with its Security Threat Management Plan.

Springs Utilities, its designated representatives, or partnering agencies may access and/or conduct operations that support the operational management goals of Springs Utilities within any and all watersheds, regardless of any restrictions that may be placed on public access due to any conditions or limitations defined in this plan. Springs Utilities will continue to protect its water supply and operate its infrastructure in an environmentally-sensitive manner and will actively manage, with partnering agencies when appropriate, natural and cultural resources using Best Management Practices (BMPs). All City-owned watershed lands shall be subject to prohibitions enumerated in the Code of the City of Colorado Springs 2001, as amended, in particular sections 12.4.801 through 12.4.806.

Regardless of whether a watershed is open to public access, individuals or users who want to conduct observational studies, scientific research, guided public education tours, or special or unique events (for non-profit organizations conducting activities that have a direct, tangible benefit to the community) must apply and be granted a permit before conducting such activities on watershed

lands. Springs Utilities reserves the right to revoke permits or close watershed lands, seasonally and otherwise, for reasons including, but not limited to, drought conditions, wildfire danger, national security threat level, threats to water quality, wildlife activity, Utilities operations, environmental recovery and non-conformance with permit conditions.

CITY COUNCIL RESOLUTION NUMBER 46-10

On April 13, 2010, the Colorado Springs City Council approved Resolution Number 46-10 to allow opening of the South Slope watershed to recreational access. This resolution supersedes the Interim Watershed Access Policy approved by the Colorado Springs City Council on April 12, 2007. As a result of this resolution, Springs Utilities commits to:

- Provide recreational access to the South Slope watershed in accordance with the Plan for Recreational Uses on Municipal Watershed Lands
- Fund design of the Plan for Recreational Uses for Municipal Watershed Lands

CITY OF COLORADO SPRINGS PARKS, RECREATION, AND CULTURAL SERVICES DEPARTMENT

The City of Colorado Springs Parks, Recreation, and Cultural Services Department (Parks Department) will be the primary recreation manager on the South Slope Watershed. The Parks Department aims to serve the citizens of Colorado Springs with integrity, through the provision and management of trails, open space, parks, recreation areas, and recreational opportunities, among other duties.

As part of the Plan for Recreational Uses on Municipal Watershed Lands, and as approved in Colorado Springs City Council Resolution Number 46-10, the Parks Department commits to:

- Provide oversight of construction, operations, and maintenance of recreation facilities
- Collaboratively manage recreation on the watershed with Springs Utilities in accordance with adaptive management considerations

IMPLEMENTATION PRIORITIES

The construction of recreational facilities on the South Slope Watershed will occur in phases. These phases are organized into preliminary implementation priorities that may occur either simultaneously or progressively. The phases do not necessarily show the order in which projects will be completed. The availability of funding, volunteers, and other resources will ultimately determine when individual projects are implemented. Construction of soft surface trails will begin in the 2010 summer season. Construction of facilities will begin as funding is secured. Implementation priorities, or potential phasing, are shown in Table 7, Implementation Priorities. Public access will begin only after recreational infrastructure is complete, including, parking, restrooms, trails, and other facilities.

TABLE 7. IMPLEMENTATION PRIORITIES

Activity	1st Priority	2nd Priority	3rd Priority	4th Priority
Mason/Boehmer Reservoir Trailhead		X		
Trail to Mason Reservoir	X			
Trail to McReynolds Reservoir	X			
Mason/Boehmer Loop Trail		X		
McReynolds Day-Use Area	X			
McReynolds Reservoir Trail	X			
Lake Moraine Trail			X	
Connecting Trail (between loop and Moraine)				X

VISITATION

Visitation levels on the South Slope can vary based on season, day of the week, weather, road conditions, and other influencing factors. Although overflow parking may occur at a designated site during high use periods, parking availability would likely limit daily visitation during times of peak use. Visitation would be highest during the summer months (June, July, and August), and lower during the spring and fall months (May, September, and October). The watershed could be subject delayed openings, early closure, or temporary closures mid-May to mid-October due to inclement site conditions (e.g. snow cover, weather events).

The South Slope would be seasonally closed to recreation between mid-October and mid-May. These seasonal closures avoid winter safety risks, including access for emergency service vehicles, and reduce annual management and operating costs for the South Slope. Winter closures also prevent recreational use in key bighorn sheep wintering habitat. The spur to Boehmer Reservoir from the Mason/Boehmer Reservoir Trail would be seasonally closed during bighorn sheep lambing season from May 15 to July 15, or as designated by CDOW. Fishing in McReynolds and Mason Reservoirs will be closed through June 30 to protect greenback cutthroat trout during spawning.

Potential visitation levels, based on parking capacity and turnover rates, are displayed in Table 8, Potential Visitation. Maximum visitation (approximately 108 vehicles per day) is unlikely to occur often, and would probably only take place on major weekends and holidays including Memorial Day weekend, Fourth of July, and Labor Day weekend.

Wildflowers on the South Slope

High visitation is likely to occur on weekends during the peak summer season (late June to late August). Demand and turnover would likely be high during these times, so the estimated visitation is 72 vehicles per day. Average visitation may occur on weekdays during the peak summer season and off-peak weekends, and is estimated at 36 vehicles per day. Off-peak or low visitation would be expected on weekdays during the spring and fall months (late-May, early-June, late August, September, early-October) and on days with poor weather or road conditions. Low visitation could range from zero vehicles per day to 18 vehicles per day.

Overall visitation estimates are difficult to derive at this point in time, due to the lack of prior operating experience and the uniqueness of the site. Although the site offers a special setting and some excellent recreation opportunities, it is somewhat remote from Colorado Springs and requires a challenging drive to access. It is likely that interest in visiting the site will be high following its initial opening for public use, but may diminish somewhat as the public becomes more accustomed to the recreational opportunities it offers. Visitation levels will be monitored and appropriate adjustments made to manage resources effectively and ensure a high-quality recreational experience.

TABLE 8. POTENTIAL VISITATION

	Turnover Rate (Vehicles)	Day Use Area (Vehicles)	Trailhead Area (Vehicles)	Total (Vehicles)
Parking Capacity	-	15	21	36
Maximum Visitation	3 /day	45 /day	63 /day	108 /day
High Visitation	2 /day	30 /day	42 /day	72 /day
Average Visitation	1 /day	15 /day	21 /day	36 /day
Low Visitation	.5 /day	8 /day	10 /day	18 /day

FUNDING SOURCES

Site Design

Springs Utilities will fund the initial site design with its internal budget. The aforementioned resolution approved by City Council on April 13, 2010 supports this approach.

Construction, Operations, and Maintenance Funding Options

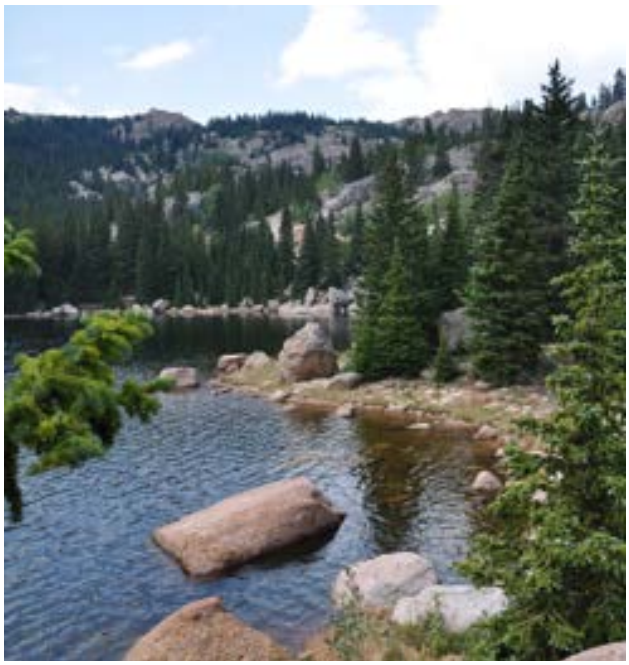
The Parks Department will be responsible for funding the construction, operations, and maintenance of the area. At the time of writing, funding sources are limited, and are discussed in further detail below.

Implementing the Plan for Recreational Use on Municipal Watershed Lands is eligible for a variety of grants and funding sources for recreation, trails, and resource protection (Table 9, Grant Sources and Funding Options). The Parks Department would pursue grant funding for construction and ongoing operations and management costs.

An option for funding new capital projects of this size is the Trails, Open Space, and Parks (TOPS) Program, which generates revenue from sales tax, and is specific to Colorado Springs. The amount of available funding is based on a one-tenth of one percent (0.01%) sales tax in the city. The program funds initial construction of projects that conserve natural or visual resources, provide passive outdoor recreation, or protect sensitive natural areas and ecosystems. This program often provides funding as a match for Great Outdoors Colorado (GOCO) and other grants.

Funding from GOCO grants is another option for initial and ongoing development costs on the South Slope watershed. GOCO provides grant money to municipalities, counties, and park and recreation special districts. GOCO is funded by 50 percent of the Colorado lottery proceeds. A match of 25 percent is required for projects, which may consist of cash and in-kind support from the applicant and partners. The project sponsor must provide at least 10 percent of the total project cost in cash. There is no funding limit for GOCO grants, and they may be used to support open space conservation, outdoor recreation facilities, and trails.

Other smaller granting opportunities that may fund additional recreation amenities include CDOW's "Fishing is Fun" grant, Colorado Water Conservation Board's (CWCB) Fish and Wildlife



Resources Fund Grant, Colorado State Trails Program's (CSTP) Trail Construction Grants, and the Department of Local Affairs (DOLA) Conservation Trust Fund.

CDOW's "Fishing is Fun" program supports new and improved fishing opportunities, fishing and river access, and restoration of fish habitat. Infrastructure, including boat ramps, docks and restrooms, may be funded. These grants are available to local governments, recreation departments, water districts, and other groups. "Fishing is Fun" grants reimburse project sponsors for up to 75 percent of the project expenses, and the remaining funding must be in the form of non-federal in-kind or financial support. Funding may range from $40,000 to $80,000.

CWCB's Fish and Wildlife Resources Fund Grant supports the protection of fish and wildlife resources by providing funding to operators of water diversion, delivery, and storage facilities and projects. Grants may support river restoration and projects designed to "directly mitigate or significantly improve the environmental impacts of existing water facilities." Grants should not exceed $250,000, and up to 25 percent of the project cost must be provided as a match. Projects that rely on volunteer support are encouraged.

The CSTP Trail Construction Grants are for local, county and state governments, federal agencies, recreation and metro districts, and non-profit organizations with management responsibilities

TABLE 9. GRANT SOURCES AND FUNDING OPTIONS

Grant	Funding limit	Match	Eligibility	Conditions & Allowed Uses
TOPS Program (Colorado Springs)	60% min. for open space 20% max. for parks 20% max. for trails	Often used as a match	New capital improvement projects for the City of Colorado Springs	Trails, open space, and parks. New capital projects only.
GOCO Trails Grant	No limit	At least 25% of the project cost, in-kind or cash	Municipalities, counties, park and recreation special districts	Large or small recreational trail grants, trail planning, and trail support grants
Fishing is Fun Grants (CDOW)	$40,000-80,000	Up to 75% of project cost, non-federal, in-kind or cash	Local governments, recreation departments, water districts, etc.	Fishing and river access and restoration
Fish and Wildlife Resources Fund (Colorado Water Conservation Board)	$250,000	Up to 25% of project cost, in-kind or cash	Includes operators of existing water diversion, delivery or existing storage facility projects	To protect fish and wildlife resources. Includes appropriation of water rights, acquisition of water rights, and river restoration.
Trail Construction Grants (Colorado State Trails Program)	$25,000 (small) $150,000 (med) $200,000 (large)	25% match for small, equal match for medium and large scale	Local, county and state governments, federal agencies, recreation and metro districts, and non-profits managing public land	Trailhead construction, maintenance, planning, signage, or trails equipment
Conservation Trust Fund (Department of Local Affairs Office of Smart Growth)	Varies based on local population estimates, funds allocated to local governments	None required	Towns, cities, counties, and special districts	Outdoor recreation master plans, construction of trails and/or riverwalks, open space, or recreation facilities

over public land. Funding may be used for trailhead construction, maintenance, planning, signage, trails or equipment. Grants may fall into one of three categories: Small (up to $25,000), mid-size (up to $150,000), and large (up to $200,000). The matching requirement for project sponsors ranges from 25 percent match for small grants and 100 percent match for mid- and large scale grants.

The DOLA's Office of Smart Growth provides grant funding to towns, cities, counties, and special districts through the Conservation Trust Fund. Funding is allocated quarterly to local governments in Colorado, and the amount of funding is determined by both a formula (based on demographic information) and on a discretionary basis. Grants are available for outdoor recreation master plans, the construction of trails and/or riverwalks, open space, and recreation facilities. Funding may be provided for acquisition, maintenance, and improvements.

Various local companies and/or businesses may have giving programs that offer grants for upcoming projects that support the community.

Fee based Operations and Management

Revenue from user fees is a potential source of ongoing funding for operations and management of recreation on the South Slope watershed. Potential daily and annual revenue scenarios based on maximum, high, average, and low visitation levels are outlined in Table 10. Each year, about nine days of maximum visitation are expected to occur during the Memorial Day weekend, Fourth of July, and Labor Day weekend. Weekend visitation between late June and late August would result in 18 days of high visitation. There would be around 68 days of average visitation (summer weekdays and off-peak weekends), and 58 days of low visitation (off-peak weekdays).

Fee Collection

It is anticipated that visitors to the South Slope watershed would be required to pay an entrance fee. There are several options for on-site fee collection, depending on the level of use and availability of staff, financial resources, and volunteer support. A combination of the following strategies could be used for fee collection:

- Unstaffed kiosk for payment of user fees
- Staffed fee collection kiosk at the gate
- Random parking lot patrols to issue citations for unpaid user fees
- Use of volunteers to patrol or collect fees

Table 10, Potential Revenue Based on Visitation Levels and Entrance Fees, presents an indication of potential revenue that would be generated by a user fee, based on visitation scenarios and a user fee of either $5.00 or $10.00 per vehicle. No specific decision has been made to date regarding user fees. The need and level of user fees will evolve as operational costs, visitation levels, and other information becomes available.

Site Tours

Private guided hikes may offer an additional fundraising opportunity for construction, operations, and management of recreation on the South Slope watershed. Prior to allowing public recreational access on the watershed, the Parks Department will host guided hikes for interest groups, the media, and members of the public. These hikes will actively engage participants by allowing a "first look" at the site and providing information on the design, construction, operations, and management of recreational activities and facilities. Hikes will occur at a cost to the participants, to raise money for the project.

TABLE 10. POTENTIAL REVENUE BASED ON VISITATION LEVELS AND ENTRANCE FEES*

	Vehicles per day	Number of days per year	$5.00 fee per vehicle		$10.00 fee per vehicle	
			Revenue per day	Total Revenue	Revenue per day	Total Revenue
Maximum Visitation	108	9 days	$540	$4,860	$1,080	$9,720
High Visitation	72	18 days	$360	$6,480	$720	$12,960
Average Visitation	36	68 days	$180	$12,240	$360	$24,480
Low Visitation	18	58 days	$90	$5,220	$180	$10,440
Total Annual Revenue			$28,800/ year		$57,600 / year	

*Based on a 5-month use period from mid-May to mid-October.

SITE COMPONENTS

Site Design

Site design, based on the Concept Plan, will occur in the summer of 2010. Specific designs for trails, trailheads, picnic and day-use areas, parking lots, restrooms, and other facilities will be developed in this stage. All components of the plan will be designed based on Best Management Practices (BMPs) and sustainability considerations.

Construction Mitigation BMPs

A set of temporary or temporary-to-permanent BMPs is needed for construction activities on the trail system, trailheads/day-use areas, and access roads. Some of these BMPs prevent construction erosion runoff problems and are only necessary until vegetation is re-established. Some BMP features, like grass swales, serve as water velocity controls during and well after construction. These BMPs may include education and training efforts, trail building techniques, and signage. See below for a more detailed description of BMPs.

Operations and Management

The annual costs of managing recreation on the South Slope watershed will include a seasonal ranger, routine facility maintenance, trail maintenance, vehicle maintenance and fuel, continuous monitoring and response to natural disasters. Potential duties for this ranger include regular trash collection and restroom cleaning, maintenance, and fee collection. Vehicle maintenance and fuel may create additional annual costs on the South Slope. Monitoring efforts, as described in Chapter 3: Monitoring Plan and Mitigation Measures, would require an annual budget as well.

Law enforcement on the South Slope will be provided by the El Paso and Teller County Sheriff's Departments, depending on the exact location of a problem. CDOW will provide enforcement for wildlife-specific laws and statutes on the South Slope. There may be additional costs associated with vandalism and response to natural disasters (e.g. wildfire).

Volunteers

The community of Colorado Springs has a strong volunteer ethic. Volunteers will be critical to the implementation of recreational facilities on the South Slope. Accordingly, the Parks Department will depend on volunteer support for construction, ongoing trail maintenance, and regular "clean up days." As a result of volunteer assistance, costs for construction, operations, and maintenance will be reduced. Local recreational user groups, other organizations, and individuals have expressed an interest and willingness to contribute to the construction and maintenance of trails and facilities on the property.

Communications

Springs Utilities and the Parks Department would coordinate ongoing communication with recreational users and the public for the South Slope watershed. The public would be seasonally notified of the opening and closure of the site through websites, press releases, and/or other outreach methods. Regular updates, trail closures, and other important information will be communicated through these methods, as well.

SITE PERMITTING

There are regulatory issues that need to be addressed as part of implementation. Springs Utilities may need to apply for county, state, and/or federal permits to construct recreation infrastructure. Local permits for land use change in both El Paso and Teller Counties may need to be approved.

Springs Utilities may need to permit any impacts to waters of the U.S., cultural resources, and/or federally listed species. The Concept Plan includes six creek crossings: two of the crossings are designed as boardwalk structures; the other four crossings would either avoid or span jurisdictional wetlands or waters found on the South Slope. A wetland delineation using the 1987 Corps Delineation Manual would be required to identify the expanse of the wetlands and to determine the area of impact for compliance with section 404 of the Clean Water Act. The draft delineation would be submitted to the U.S. Army Corps of Engineers (USACE) for concurrence and a preconstruction notification (PCN) would be required, to be permitted under Nationwide Permit 42.

Impacts to historic resources are not expected in the Concept Plan. All known historic resources were intentionally avoided in the planning process. Some areas, including the Ute Trail, may potentially have unknown historic resources.

Impacts to the greenback cutthroat trout may result from implementation of the Concept Plan. Current impacts to the greenback cutthroat trout are authorized on the South Slope through an Incidental Take Permit; the population of greenback cutthroat trout in the South Slope reservoirs is an experimental population managed by CDOW. The current permitted activities allow for "take" related to water collection, storage, and delivery. This agreement would need to be modified to include "take" related to recreational activities such as fishing under this plan.

UTE TRAIL

The Ute Trail alignment includes three sections of trail to be constructed, totaling 2.3 miles of trail overall. In addition to trail construction costs, the Ute Trail may potentially have unknown historic resources, and would require associated permitting. The implementation of the Ute Trail realignment is dependent on approval and funding from El Paso County Parks, the proponent of the Ute Trail.

GENERAL BEST MANAGEMENT PRACTICES

This section identifies the general set of considerations and BMPs to address recreational uses and the development of recreational facilities in the South Slope watershed. Table 11, Working Definitions of Commonly Used Terms Associated with BMPs, provides working definitions used to describe elements of BMP use and management. As with any good management plan, the types and use of BMPs must be periodically reviewed and adjusted to account for changes in long-term use and changing conditions. As such, it is important to keep track of a broader set of potentially available BMPs and control strategies. This process is a form of watershed adaptive management, as described in Chapter 3.

A large number of BMPs and management strategies are available to reduce potential impacts of recreational uses on the South Slope watershed. Because the South Slope watershed management strategy is a phased and adaptive process, BMPs will be necessary at all stages of the program. BMPs may be implemented during construction, once recreational use begins, or through ongoing operations and maintenance. Some BMPs may be appropriate for the mitigation of impacts. The general phasing of management considerations is described below.

TABLE 11. WORKING DEFINITIONS AND COMPONENTS OF COMMONLY USED TERMS ASSOCIATED WITH BMPS

Best Management Practices (BMPs)	• Structural and non-structural methods, measures or practices implemented to prevent, reduce, or mitigate adverse water quality impacts resulting from construction, operations, maintenance, and recreational uses
Structural BMPs	• Facilities constructed to passively treat runoff before it enters the receiving waters. • Used on a construction or development site, trail networks, roadways, and other areas. • Can be either temporary or permanent, depending on the duration of their application. • Designed to reduce sediment pollution and other pollutants in runoff, and can protect aquatic or riparian areas. • Some construction BMPs result in permanent sediment and erosion control structures, which work beyond the construction period. • Colorado has established a set of high altitude BMPs, which are applicable to the South Slope watershed[1].
Nonstructural BMPs	• Pollution prevention practices and source control activities, designed to minimize or eliminate a problem before it occurs. • "Good housekeeping" measures. • Site planning and design of BMPs may, in and of itself, be considered a nonstructural BMP.
Project Types	• General categories and types of construction or development projects that are likely to require mitigation measures/ BMPs. • Crossing structures, channel work, utility construction, site development, trails, roads, parking lots, trailheads, reservoir maintenance, recreational activities.
Sediment Problems	• Can occur in constructed or developed sites, trail networks, roadways, and other areas where sediment and erosion controls are necessary to prevent sediment pollution. • Examples are: Sediment deposits and loading, steep slopes, stream bank instability, runoff or velocity controls, and wind erosion.
Aquatic or Riparian Problems	• Can occur in constructed or developed sites, trail networks, roadways, and other areas where control practices are needed to protect aquatic or riparian environments or conditions. • Concerns include: protecting bank habitat and associated vegetative cover, preservation of habitat, life cycle impacts to plants and animals, and water quality impacts that affect fish and wildlife.
Velocity controls	• Steep terrain can significantly increase runoff velocities and requires consideration of stream-stability control practices. • Silt fence will not serve as a velocity control practice under Colorado conditions.
High altitude construction	• Alpine areas are characterized by a short growing season, steep and rocky slopes, thin soil, high winds, fragile environments, and vegetative-type limitations. • Specialized BMPs are recommended for construction at high altitude.
Seasonal planting limitations	• Re-establishment of vegetation in areas disturbed by construction are dependent on appropriate soil texture, nutrient, and solar radiation conditions for plant growth, which will limit seeding dates. • Soil surface roughening, mulching, and geo-fabric application are particularly useful where temporary revegetation cannot be established due to seasonal planting limitations.

[1]CDPHE Regulation Number 82, 401 Certification. "Potential Best Management Practices for 401 Certification." 5-CCR-1002-82.

TABLE 12. TYPICAL BMPS BY USE TYPE

Use Type	Activities or Components	Typical BMPs
Trail	Walking and hiking, nature photography	Erosion control (water and wind), velocity controls, stormwater runoff management (rain and snow melt), trail drainage, stopping/ vista areas, vegetation management, wetland and riparian avoidances
	Bicycle	Erosion control (water and wind), velocity controls, stormwater runoff management (rain and snow melt), stabilization, sediment barriers, retaining walls (revetments), erosion controls, runoff controls, buffers areas, vista areas, vegetation management, wetland and riparian avoidances, dust controls
	Equestrian	Designated horse crossings, erosion control practices, manure management, designated approved water stations
Trailhead/ Day Use Area	Parking areas (cars, trucks, motorcycles)	Grade maintenance, stormwater management, drainage management, trash management, oil/grease contamination, invasive species (plants and animals) control, signage
	Horse unloading and paddock (designated horse corral or staging area)	Manure management, erosion controls, drainage controls, signage (encourage use of designated staging areas and manure removal/ composting)
	Restrooms	Waste management (vault or composting), septage hauling and frequency, insect control, graffiti removal, trash management, paper management, odor issues, facility maintenance (after winter/ pre-winter)
	Picnic facilities (tables, trash collection)	Trash clean-up and removal, graffiti removal, erosion controls, maintenance, invasive species control, signage, bear-proof trash receptacles
Lake/Fishing	Fishing	Waste management, trash/ debris management, signage, access points, wetland and riparian avoidance
	Shoreline and non-motorized boat launch	Bank erosion control, stormwater runoff from parking/trails, hiking trail maintenance, signage, invasive species control (plants and invertebrates), trash/debris management
Roads	Cars, trucks, motorcycles, horse trailers, pull-offs	Erosion control, velocity controls, stormwater runoff management (rain and snow melt), stabilization, sediment barriers, retaining walls (revetments), cribbing, filter strips, buffers areas, vista areas, vegetation pruning, culverts, bridges, grade controls, water quality swales, sediment basins, dust controls
Non-structural	Education	Signage, voluntary support programs (e.g., adopt a reservoir, trailhead)
	Code and regulation	Federal, state, and county regulation, city code
	Public outreach	Educational programs, training, newsletters, website information, flyers
Wetlands and Riparian Area	Photography	Select boardwalks, viewing areas/ platforms, signage

Phase I

In this phase, a BMP manual will be developed to include a set of temporary or ongoing BMPs for construction activities on the trail system, parking lots/areas, and access roads. Detailed information on these general considerations is provided in Chapter 3. BMPs will address the following:

- Prevent construction erosion runoff problems (only necessary until vegetation is re-established)
- Provide water velocity controls during construction and well after construction
- Provide public education and outreach
- Establish good housekeeping measures and standard practices for maintenance

Phase II

BMPs will be reevaluated once construction and recreation use have begun. Revised BMPs are adapted based on the level and intensity of recreational use, environmental responses and impacts, and changes to water quality as indicated by annual monitoring. Activities in this phase include:

- Adopt a permanent set of maintenance practices for recreational facilities
- Make adjustments to the education program and signage to ensure effectiveness
- Evaluate compliance with state-adopted standards and classification of waterbodies
- Evaluate the watershed-monitoring program and adjust as necessary
- Update the BMP manual as necessary

Phase III

Activities in Phase III include restoration or re-establishment of habitat as a result of any degradation, if needed. Possible mitigation BMPs are recommended in Chapter 3. This could be caused by recreational use, wildland fires, or natural events (e.g., beetle kill of pine trees). Significant problems in the watersheds could lead to use limitations, new regulations, local ordinances or code changes.

General Best Management Practices

Table 12, Typical BMPs by Use Type, lists general considerations and BMPs by recreational use type and activities. The specific BMPs recommended for the South Slope are described in more detail later in this chapter. Some of these BMPs will be required during the development of the recreational use infrastructure (e.g., trail development, trailhead/day use parking, access road construction), and other BMPs are directed toward the recreational users once recreation begins. No single BMP will protect source waters or the watershed, so a combination of BMPs and management strategies will be necessary. Ongoing monitoring, as described in Chapter 3, will be critical to the successful implementation of BMPs on the South Slope.

Potential trail alignment

The following BMPs and general considerations are color-coded by category:

- Purple = Design and Construction
- Orange = Recreation Management
- Green = Monitoring and Mitigation

Trails Best Management Practices

- Use design and drainage features to keep water off the trail tread.
- Build on the contour and use frequent grade reversals - surf the hillside.
- Follow the half-rule: A trail's grade should not exceed half the grade of the side slope.
- Maximum grade should be 12 percent (except for natural or built rock structures).
- Average grade should stay under 10 percent (with grade reversals).
- Route trails to positive control points (viewpoints, water, or other attractions).
- Use bench-cut construction, and excavate soil from the hillside.
- For highly technical trails where grade will sometimes exceed 12 percent, use natural rock, rock armoring, or other rock features to add challenge and improve sustainability.
- Avoid the fall line: Fall-line trails usually follow the shortest route down a hill - the same path that water flows. The problem with fall-line trails is that they focus water down their length. The speeding water strips the trail of soil, exposing roots, creating gullies, and scarring the environment.
- Ensure that users stay on the trail tread through design and education.
- For re-routes, reclaim old trail thoroughly, including the visual corridor as well as the trail tread.

Trailhead Best Management Practices

- Parking facilities should include drainage structures and velocity controls.
- Drainage from parking lots can be directed through grass swales, using natural vegetation to reduce runoff and erosion. These swales can mimic natural hydrology and not appear as structural BMPs.
- Instead of vault toilets, which have a potential to cause water quality problems if they leak or aren't maintained, consider composting toilets that do not discharge. Solar composting toilets (functional at high altitudes) reduce overall maintenance demands and decrease the risk of water contamination.
- Provide easy turn-around that keeps vehicles within boundary of parking lots.
- Minimize soil disturbance and retain desirable vegetation in and around developed areas to the maximum extent possible.
- Trailhead users will produce trash, so provide a wildlife-proof trash collection and management system.
- Provide educational signage on watershed functions, resources, sensitivities, and allowed uses.
- Use certified weed-free mulch, straw, or hay for landscaping at trailheads.
- Use locally native material, including seed mixes.
- All individuals working, volunteering, or recreating should clean mud, dirt, and plant parts off vehicles, equipment and boots before going onto the South Slope watershed to reduce the possibility of introducing invasive species.
- Provide notice that all harvesting (wood, rocks, plants, cultural resources and artifacts, etc.) is prohibited.
- Do not allow fires, and remove any fire pits that may develop.
- After a ground disturbing activity, monitor infested areas annually for at least three growing seasons following completion of activities and provide for follow up treatments based on inspection results.
- Ongoing maintenance of trailhead drainage structures, including equestrian runoff trenches.

Equestrian Best Management Practices

- A parking lot paddock (corral or specific staging location for horses) should be set up on high ground. It should be surrounded with a hardy native grass and, if possible, a trench to capture runoff. Paddocks can significantly reduce the impacts of horse waste on water quality.
- Design stream crossings to provide a safe, easy way for horses to ford streams.
- Manage manure at parking areas. Prevent runoff from staging areas from running into waterways. Based on EPA manure calculator, a 1,000 pound horse produces about 45 lbs manure/day (1 cubic foot/day), 5 horses per day will potentially leave 225 lbs manure/day. Manure management is needed for trails, parking lots, and paddocks.

- Require users to pack out horse manure or establish a waste composting system for horse waste at the parking lot and paddock. This keeps waste products from entering runoff and potentially contaminating water sources.
- Require weed-free feed and manage manure to prevent introduction of invasive species.
- Parking lot paddocks, trails, and pasturing areas are continuously disturbed areas, under constant physical stress from horses' hooves.
- Bare soil can easily erode, so monitor for excessive erosion or runoff problems.

Education/ Training Best Management Practices

- Public education and outreach involves using effective mechanisms and programs, guided by a detailed outreach strategy, to engage the public's interest in preventing recreational use impacts.
- The public has varying levels of background knowledge of the need for recreational use management and their role in causing recreational use impacts. This requires a multi-pronged approach to outreach efforts by (1) generating basic awareness of impact types, (2) educating at a more sophisticated level using more substantive content, and (3) building on existing recognition of the issue to prompt behavior changes that reduce impacts (or the opportunities for impacts).
- Specifically address the integration of public outreach with the implementation of other program management measures (like trail maintenance).
- Outreach could involve more substantive education, possibly live presentations and slideshows, handouts, posters with educational content and captioned illustrations, and Web-based training modules, or website with photos of good and bad practices.
- Signage types include kiosk (determine person responsible for maintaining kiosk information), trail directional signs, interpretive environmental educations signs, and regulatory signs.

Source Water Protection Best Management Practices

- Prevention is the most cost effective practice.
- Maintain natural hydrology.
- Design runoff controls to keep excessive runoff from source water area (e.g., reservoir, intake point on stream).
- Reduce opportunities for pathogens to enter waterways and sources through design and management.
- Use velocity controls to manage stormwater runoff.
- Natural vegetation is remarkably effective at filtering contaminants. Vegetation is effective in promoting filtering or infiltration, while minimizing changes to natural hydrology and land disturbances.
- Post local and state regulations related to source protection (e.g., no body contact in reservoirs, complete avoidance of wetlands and fens).
- Develop emergency response plans for wildfire and visitor safety for recreational areas.
- Ensure proper waste storage, treatment, and disposal to minimize potential water quality degradation.
- Determine surface water and groundwater potential contamination pathways and monitor for water quality compliance.

Wildlife and Vegetation Best Management Practices

- Conserve unique representatives or core areas of alpine tundra/grasslands, rocky cliffs, fens, and other important habitat types. Identify and preserve local sites important for the conservation of priority species that depend on these habitats.
- Use appropriate fire suppression tactics (e.g. limit the use of retardants, fire lines, etc.).
- Enforce areas closed to protect sensitive wildlife species.
- Maintain knowledge of the ecology of the South Slope habitats. Alpine habitat specifically has steep, rugged topography, high erosion potential of the soils, and a short growing season, and therefore requires careful long-term monitoring and management.
- In cooperation with CDOW, regularly monitor key wildlife, such as bighorn sheep, to determine whether recreation is negatively impacting populations, and redirect efforts if necessary (with special emphasis for species that seem to be declining).

- Implement habitat monitoring programs to establish baseline data and identify changes in habitat quality (both positive and negative) through time.
- In alpine habitats, pay considerable attention to the types of vegetation and soils that are present and their susceptibility to change and destruction. Monitor for unauthorized use and associated habitat destruction. Consider that alpine vegetation recovers very slowly after destruction.
- Consider both long- and short-term impacts of activities at high altitude. Limit activities that degrade or remove alpine habitats (e.g. heavy recreational use, overgrazing, and invasion by exotic plants). Manage alpine habitat for sustainable use without abuse over the long-term.

Invasive Species Best Management Practices

- At parking lot or trail entrance, install gravel pads designed for mud removal.
- Train staff to recognize invasive species common to the area.
- Increase awareness by recreational users of the threat posed by invasive species and appropriate actions to minimize that threat.
- Inspect and clean off coat and feet of horses and clothing/gear before and after recreating.
- Stay on designated trails, roads, and other developed areas.
- Report invasive species infestations to the Parks Department. Signage should provide a contact for reporting invasive species.
- Prior to moving equipment, vehicles, and trailers onto and off of an activity area, spray, scrape, or brush soils, seeds, plant parts, or invertebrates from exterior surfaces, to the extent practical, to minimize the risk of transporting invasive species.
- Use volunteers to help control invasive species.
- Hikers, bicyclists, and bicycles have the potential of unintentionally carrying invasive species from one area to another. Soils, seeds, plant parts, or invertebrates may cling to gear, bicycles, and clothing. Clean bicycles before entering area.
- Use certified weed-free mulch, straw, or hay for all restoration or landscaping.
- Establish an invasive species monitoring program.

SITE-SPECIFIC BEST MANAGEMENT PRACTICES

In addition to general BMPs, there is a set of watershed-specific BMPs recommended for the recreational facility construction phase and the subsequent maintenance of these facilities on the South Slope. These recommended BMPS are based on the State of Colorado's list of approved BMPs[1]. Combinations of these watershed-specific BMPs are needed during both the construction of the recreational facilities and for long-term watershed protection and maintenance. Chapter 3 discusses long term BMPs in more detail. All BMPs are subject to review and approval by local governing agencies. Additional information on BMPs used in Colorado is available from the Colorado State Forest Service and the Bureau of Land Management.

Table 13 (see page 47, at the end of the chapter) lists recommended practices and BMPs for the construction of specific recreational facilities (trails, trailheads and day-use areas, access roads, and reservoir shoreline). Some BMPs may be implemented initially, while others could be implemented in response to problems that may be observed after recreational use of the watershed begins (as mitigation measures). This discussion of BMPs includes BMPs for the construction of recreational facilities, definitions of recommended BMPs, and information on potential erosion and sedimentation concerns.

Table 14 (see pages 48-50, at the end of the chapter) provides descriptions and recommended applications of the selected BMPs for the South Slope watershed that are listed in Table 13. Many of the descriptions were adapted from the Urban Drainage and Flood Control District Drainage Criteria Manual, Volume 3. This criteria manual is widely used in watersheds throughout Colorado and is the best available guidance document for most BMPs. There are additional practices that address special Colorado conditions and non-urbanized areas.

[1] Colorado Water Quality Control Division. The Selection of Best Management Practices for Clean Water Act Section 401 Certifications. December 2000.

Erosion and Sedimentation

A major resource concern during construction will be erosion and subsequent sedimentation into waterbodies. Erosion is a natural process, which loosens and removes the soil. Erosion is accelerated during construction, as soil is left bare and unprotected by vegetation. There are five types of erosion (see text box). Splash and sheet erosion are prevented by protecting the land surface with vegetation, mulch, or erosion control blankets. Sheet, rill and gully erosion can be controlled by limiting runoff velocities. Trail, access road, and parking facility construction will lead to increased erosion.

In trail system design, it is critical to note that soil erosion and sedimentation control practices will help protect water quality, maintain recreational trails, and reduce the cost of maintenance. The maintenance of existing vegetation along the trail system is a fundamental principle of erosion and sedimentation control. Vegetation filters runoff and provides a protective cover to existing soils, which reduces the potentially erosive impact of rain, snowmelt, and flowing water. The vegetative cover also serves as a filter for horse waste products along the trail system.

- **Splash erosion** results from the direct impact of falling drops of rain on soil particles. This impact breaks the bonds between soil particles, dislodges them, and splashes them into the air. The dislodged soil particles are easily transported by surface water runoff.
- **Sheet erosion** is the removal of a thin layer of exposed surface soil by raindrop splash and runoff. The water moves in broad sheets over the land, accumulates particles and carries them downhill. As the runoff moves down a slope, it cuts small paths, or rills.
- **Rill erosion** occurs when water flowing along a path detaches more soil from the side and bottom of the path. Further down the slope, water concentrates in channels and picks up speed.
- **Gully erosion** is the removal of soil by water moving rapidly over the uphill end of the gully. Concentrated flow scours the sides and bottom of the gully and the water removes soil that has fallen from the sidewalls. A nearly vertical headcut allows water falling over the surface to undermine the bank so that the gully migrates upslope. Large earthmoving equipment is required to reshape or control gullies.

Sedimentation results when soil particles are transported, usually by water, and settle in downstream waterbodies. Erosion BMPs can minimize sedimentation, but some amount of sedimentation naturally occurs in waterways. As such, in the trail design, it is important to locate and construct sediment-trapping features at locations of higher runoff. Sediment basins and constructed grass or vegetative swales minimize the amount of sedimentation in waterways and wetlands. Trail design must also consider waterway crossings and use facilities to reduce the potential for erosion and water quality contamination at these crossings.

Slopes along a trail system are especially susceptible to erosion due to slope grade and increased velocity of runoff water and snowmelt. Cross-drainage design features and slope stabilization are required both up-gradient and down-gradient of the trail layout. In some cases, this requires protection against existing erosion features. Fixes to drainage problems during trail construction can lessen the future maintenance requirements of the trail system. Generally, a riprap drainage trap is sufficient to reduce the erosion potential at the downstream edge of a water bar or other drainage feature along a trail. In some cases, a J-hook trail design is needed to slightly pool runoff and reduce water velocity. A common mistake is not placing enough closely-spaced drainage features on trails with steeper grades (see guidelines below).

SPACING FOR DRAINAGE FEATURES

Trail Grade (%)	Spacing between Drainage Features (feet)
2 %	250
5 %	135
10 %	80
15 %	60

In trail planning and construction, the most desirable slope grade is generally less than or equal to 5%. This grade will minimize potential erosion and sedimentation problems. Slope grades in excess of 10% increase the need for maintenance and the potential for erosion. It is apparent that the South Slope watershed trail system will have grades greater than 5%. Consequently, greater

care must be taken to utilize control practices at a higher frequency than would normally occur along a trail with lower grades.

The construction of observation or photographic platforms or pads can serve multiple functions. These areas can be strategically located along the trail system to serve as erosion control features (e.g., small riprap sediment basins, runoff controls, and vegetative swales). The platforms can also be constructed in areas where undesirable shortcutting of trails is likely, and would serve as a deterrent. As such, the feature would reduce erosion potential, but also benefit recreational users.

The multi-purpose trail system that will include hikers, bicycles, and horses creates some erosion control challenges. Horses can create more damage to trails than humans on foot. Horseback riding contributes to soil disturbance by causing more soil exposure, trampling of vegetation, increased soil compaction (increases runoff velocities), loosening of soil due to hoof actions (causes soft trails) and increased wind erosion potential. Impacts to soils can be particularly noticeable in areas where riders congregate.

Trails created by 1000 horse passes as shown in several studies are up to 3-times as wide and 7-times as deep as trails used by the same number of hikers.

It is recommended that the observation platforms or pads consider a design feature to allow for a horse rest stop. This would include a place to tie horses off-trail, and could include vegetative filter strips, grass swales, sediment basins (horses often paw at the ground when resting), and runoff controls. Vegetative strips and grass swales can help with natural manure management. Bicycle riding causes similar but lower impacts to trails, compared to equestrian use. As such, the use of erosion controls along the trail system must consider these erosive uses. This includes adding more runoff, sedimentation, and filtering controls, as well as taking necessary precautions at all crossings. Equestrian and bicycle use will require increased trail maintenance compared to hiking-only trails.

Vault Toilets

If a standard vault toilet(s) wastewater solution is used rather than solar composting toilets on the South Slope, then additional monitoring and management practices are recommended to help meet source water protection objectives. See Chapter 3 for further discussion of human waste management options. Specialized vault toilet management practices include, but are not limited to the following:

1. The vault toilet should be located as far from any water source as feasible, within the boundary of the recreational area.
2. The vault toilet should be limited in size (1,000 gallons) to minimize the amount of waste product held and reduce the potential for source water contamination.
3. An active inspection and maintenance program for vault toilets should be implemented at the beginning and end of each use season.
4. Septage should be hauled monthly during the recreational season, and the vault toilet should be pumped dry at the end of the recreation season, before winter conditions begin.

TABLE 13. RECOMMENDED BMPS BY RECREATION CONSTRUCTION ACTIVITY

Recreation construction activity	Types of structural and construction BMPs	Permanent BMP requirements
Trail Construction		
Trails (hiking, equestrian, single track)	Grass buffer, riprap, logs or water bars, check dams, erosion control blankets or fiber rolls, grass swale, mulching, seed bed preparation, surface roughening, straw bales, wattle, fiber matting, terracing and slope stabilization, retaining walls (revetments), cribbing, crossing protections (e.g., riprap, instream check dams, velocity controls)	Grass buffer, riprap, logs or water bars, check dams, grass swale, permanent revegetation, terracing and slope stabilization, retaining walls (revetments), cribbing, sediment basins, stream buffer setbacks, proper use of pesticides, herbicides, and fertilizer, education, signage
Observation areas/ pads	Riprap, logs or water bars, check dams, erosion control blankets or fiber rolls, temporary revegetation, terracing and slope stabilization, retaining walls (revetments), cribbing, mulching	Permanent revegetation, terracing and slope stabilization, retaining walls (revetments), cribbing, proper use of pesticides, herbicides, and fertilizer, education, signage
Trailhead and Day-Use Area Construction		
Parking lot and horse paddock, picnic area, fishing access, waste management	Grass buffer, riprap, logs or water bars, check dams, erosion control blankets or fiber rolls, grass swale, mulching, seed bed preparation, temporary revegetation, straw bales, wattle, fiber matting, terracing and slope stabilization, retaining walls (revetments), cribbing, surface roughening, sediment basins, slope drains	Grass buffer, riprap, logs or water bars, check dams, grass swale, permanent revegetation, terracing and slope stabilization, retaining walls (revetments), cribbing, sediment basins, stream buffer setbacks, proper use of pesticides, herbicides and fertilizer, education, signage
Access Road(s) Construction		
Road construction	Roadside swales, riprap, logs or water bars, check dams, erosion control blankets or fiber rolls, slope drains, sediment basins, terracing and slope stabilization, retaining walls (revetments), cribbing, straw bales, wattle, fiber matting, surface roughening, seed bed preparation	Grass buffer, riprap, logs or water bars, check dams, grass swale, permanent revegetation, terracing and slope stabilization, retaining walls (revetments), cribbing, sediment basins, stream buffer setbacks, proper use of pesticides, herbicides and fertilizer
Water crossings	Crossing protections (e.g., riprap, instream check dams, velocity controls), sediment basins, straw bales, wattle, fiber matting	Stabilize natural channels
Reservoir Shoreline		
Shoreline trails and bank stabilization	Riprap, logs or water bars, check dams, terracing and slope stabilization, retaining walls (revetments), cribbing, temporary revegetation, erosion control blankets or fiber rolls	Permanent revegetation, terracing and slope stabilization, retaining walls (revetments), cribbing

TABLE 14. DEFINITIONS AND APPLICATIONS OF BMPS LISTED IN TABLE 13

Selected BMPs	BMP Definitions and Applications[1]
Grass buffer	Grass buffers are uniformly graded and densely vegetated areas of turf or native grass. They require sheet flow to promote filtration, infiltration, and settling to reduce runoff pollutants. They are designed to accommodate overland sheet flow, rather than concentrated or channelized flow. They remove larger sediment from runoff.
Filter strip	A filter strip is an area of undisturbed soil, vegetation, and forest litter situated between an area of exposed soil, such as a trail, and a body of water or a wetland. A filter strip allows surface runoff to drop sediment before it reaches environmentally sensitive areas.
Riprap, logs or water bars, check dams	All of these BMPs use native or fabricated materials that are installed to reduce the flow velocity of rill, gully, or sheetflow to minimize erosion potential on roads and trails. Structures function as energy dissipaters of runoff from rainfall and snowmelt.
Erosion control blankets	Erosion control blankets are usually woven from a chosen material and are designed to slow the speed at which water moves across a surface. The material chosen is usually something with numerous ridges and obstructions to slow the water flow. There are many different types of erosion control blankets (synthetic, natural, or a combination). Blankets can be made out of straw, coconut fiber, aspen fiber, and jute.
Fiber rolls	Fiber rolls are made of the same materials used in erosion control blankets but are rolled into large diameter "logs." These logs can be of varying diameter and are usually encased in netting, sewn into the desired shape. The purpose of these logs is to pool and slow water flow long enough for sediment to settle. The three primary materials used in fiber rolls are coconut fiber, rice wattle, and wheat wattle.
Grass swale	Grass swales are densely vegetated drainageways with low-pitched sideslopes that collect and slowly convey runoff. The slope and size of a grass swale forces flow to be slow and shallow, thereby facilitating sedimentation while limiting erosion. Berms or check dams should be installed perpendicular to the flow to limit velocity and encourage settling and infiltration.
Extended detention basin	An extended detention basin (EDB) is a sedimentation basin designed to completely drain sometime after stormwater runoff ends. The EDB uses a smaller outlet that extends emptying time for frequently occurring runoff events, in order to facilitate pollutant removal. The EDB's drain time for the brim-full water quality capture volume (i.e., time to fully evacuate the design capture volume) is 40 hours, which removes a significant portion of fine particulate pollutants found in stormwater runoff. This may be necessary for mitigation of construction impacts.
Constructed wetland basin[2]	A constructed wetlands basin is a shallow retention pond that requires a perennial base flow to permit the growth of rushes, willows, cattails, and reeds. These plants slow runoff and allow time for sedimentation, filtering, and biological uptake. It is a sedimentation basin and provides a form of water treatment. This may be necessary for the mitigation of any disturbance to wetlands.
Retention pond	A retention pond is a sedimentation facility and a form of water treatment that retains a permanent pool of water. The pool is replenished with stormwater, in part or in total, during storm runoff events. A temporary detention volume is provided above this permanent pool to capture storm runoff and enhance sedimentation. The excess captured volume of stormwater runoff is released over 12 hours.
Constructed grass or riprap channel	Constructed channel, lined with either grass or rip-rap, designed to provide drainage, modify flows, or carry water away from a site. The water quality benefit associated with these channels is the reduction of severe bed and bank erosion that can occur in the absence of a stabilized channel. This enhances water quality and wetland habitat.

TABLE 14. DEFINITIONS AND APPLICATIONS OF BMPS LISTED IN TABLE 13 (CONTINUED)

Selected BMPs	BMP Definitions and Applications[1]
Stabilize natural channels	Small grade control structures sized for a 5-year or larger runoff event that provide stabilization by establishing a mild slope for the baseflow channel. This arrests stream degradation. Severe bends or cut banks may also need to be stabilized. Such efforts to stabilize a natural waterway also preserve and promote natural riparian vegetation, which can enhance aesthetics, habitat, and water quality.
Stream buffer setbacks	Establish a setback from streams, wetlands and fens to prevent construction activities within setback. A minimum setback of 10 feet is recommended.
Proper use of pesticides, herbicides and fertilizer	Pesticides, herbicides, and fertilizers maintain landscaping or prevent invasive species establishment. These substances are usually toxic and can contaminate surface runoff if not properly used. Encourage proper use and application of pesticides, herbicides, and fertilizers, consistent with source water protection.
Ongoing operation and maintenance	Good housekeeping requires keeping potential areas where pollutants exist clean and orderly. Regularly pick up and dispose of garbage and waste material.
Preventative maintenance	Routinely inspect equipment and processes for leaks or conditions that could lead to discharges of chemicals or contact between stormwater and waste materials, products used on-site, or natural areas.
Stormwater prevention education	Include signage about potential pollution caused by stormwater runoff. Request that users report runoff and drainage problems at trailheads, day use parking, trails, and other recreational facilities.
Surface roughening	Surface roughening provides temporary stabilization of disturbed areas from wind and water erosion by breaking up the texture of a surface. This prevents sheet runoff, as well as dust problems. It is particularly useful where temporary revegetation cannot be immediately established due to seasonal planting limitations.
Mulching	Mulching is the laying down of wood chips, straw, compost, or other material to reduce wind and water erosion. All areas with a large land disturbance (such as edges of parking lots or erodible sections of trail) must be mulched, or seeded and mulched, within 14 days after a final grade is reached on any portion of the site not otherwise permanently stabilized. Areas that will remain in an interim condition for more than one year should also be seeded. Only weed-free mulch will be used.
Seed bed preparation	Under certain conditions, soil amendments and treatments may be necessary to provide an adequate growth medium to sustain vegetation. Areas to be revegetated should have soil conditions capable of supporting vegetation. Grading will oftentimes bring subsoils that have low nutrient value, little organic matter content, few soil microorganisms, rooting restrictions, and conditions less conducive to infiltration of precipitation to the surface.
Revegetation, temporary and permanent	Revegetation is the re-establishment of native vegetation. Temporary revegetation should be used for all disturbed areas with a period of exposure prior to final stabilization of one year or longer. All permanent seeding should be protected with mulch.
Roadside swales	Roadside swales are densely vegetated drainageways with low-pitched sideslopes that collect and slowly convey runoff. A number of smaller hillslope segments will be created by construction of roads. These areas will require erosion control, such as roadside swales.

TABLE 14. DEFINITIONS AND APPLICATIONS OF BMPS LISTED IN TABLE 13 (CONTINUED)

Selected BMPs	BMP Definitions and Applications[1]
Terracing and slope stabilization; retaining walls (revetments), cribbing	Sediment can be controlled on slopes that are particularly steep by the use of terracing. During grading, relatively flat sections, or terraces, are created and separated at intervals by steep slope segments. The steep slope segments are prone to erosion, however, and must be stabilized in some manner. Retaining walls, gabions, cribbing, deadman anchors, rock-filled slope mattresses and other types of soil retention systems are available for use. Structures used to provide stability and strength to the edge of a trail are usually made of logs or rocks or fabricated materials, which are designed as permanent structures.
Slope drains	There are certain instances when runoff must be directed down a slope within the disturbed area. A temporary slope drain can be used to protect these hillslope areas from scour and additional erosion. A number of alternative designs and materials can be used for a slope drain.
Straw bales, straw wattle, fiber matting	Straw bales can be placed at the base of a hillslope to act as a sediment barrier. These are not recommended for use within a swale or channel. Straw bales are temporary in nature and may only perform for a period of weeks or months. Proper installation and maintenance is necessary to ensure optimum performance.
Sediment basins	Areas draining more than 1 acre must be routed through a sediment basin. The outlet from a sediment basin should empty its volume in 40 hours. The basin's length shall be no less than twice the basin's width. The inflow structures at the entrance of the basin should be designed to dissipate inflow energy and to spread the flow so as to achieve uniform flow throughout the basin's width. Sediment basins may be necessary for steep parts of trails, observation platforms, parking areas, or other eroded areas.
Waterway crossing protections and crossing structures	The goal of these BMPs is to minimize the movement of sediments resulting from construction activities that take place within any waterway. Temporary facilities can be installed to divert flowing water around such sediment-generating construction activities within waterways. This practice also includes crossing structures for hikers and horses, use of instream velocity controls at site of crossing, check dams, instream restoration, and avoidance of sensitive habitat.
Inlet and outlet protection	Inlets and outlets of reservoirs, streams, channels and other water bodies should be protected from sedimentation. Stable inlets and outlets are necessary to avoid sedimentation.

[1]Urban Drainage and Flood Control District. Drainage Criteria Manual (V. 3) Best Management Practices. June 2002. (Available electronically at http://www.udfcd.org/downloads/down_critmanual_volIII.htm). BMPs in this manual are defined for broader application in watersheds in Colorado, and are apprpriate for application beyond urban stormwater management. These BMP recommendations have been specifically adapted for use on the South Slope watershed.
[2] See Table 27 (in Chapter 3) for references to constructed wetland basins.

Chapter 3. Monitoring Plan

An ongoing monitoring program is needed to effectively manage recreation while protecting the unique natural resources and water quality of the South Slope watershed. Monitoring will provide quantifiable feedback for adaptive and sustainable management of watershed resources over time. This monitoring plan provides metrics for source water and natural resource impacts that may occur as a result of the proposed recreational uses.

In general, Springs Utilities is responsible for the monitoring of water quality and natural resources, in coordination with CDOW. The Parks Department is responsible for the monitoring of recreation.

Based on the proposed recreational uses and potential level of impact, a range of monitoring strategies and mitigation measures may be necessary to protect water and environmental quality. This chapter presents:

1. Information on the existing and proposed source water monitoring program
2. Description of water quality and natural resource considerations
3. Potential impacts of recreational use on water quality and watershed health, and management recommendations
4. Proposed monitoring programs for the South Slope watershed
5. An adaptive management strategy to guide management actions in future years
6. Site-specific best management practices and considerations for the South Slope watershed

The monitoring plan outlines the criteria being monitored as well as standards and expectations, which would require a management response if unmet. The standards and expectations relate to various areas of concern, including:

- Source water quality and quantity
- Sedimentation and erosion
- Vegetative cover
- Sustainable wildlife populations
- Invasive species
- Forest health
- Fire risk
- Security risk
- Safety risk and liability
- Creation of social trails
- Preservation of cultural resources
- Operations and facilities

EXISTING AND PROPOSED SOURCE WATER MONITORING PROGRAM

In 2007 Springs Utilities completed a "Source Water Assessment Report: Surface Water Sources and Ground Water Sources under the Direct Influence of Surface Water" (Public Water System Id: C0121150). This assessment report provides the basis for protection of water resources in the South Slope watershed, based on the methodology and criteria developed by the Colorado Department of Public Health and the Environment. The existing Springs Utilities monitoring program formed the basis for the program recommended in this plan. Springs Utilities' current water quality monitoring data is available through 2009. This program targets a number of potential drinking water and source water parameters. The current monitoring program defines sample locations (associated with the existing water collection and storage system), site identification, parameters, reporting limits, and analysis methodologies. The existing monitoring data was compared to adopted water quality standards and classifications for Colorado.

A comprehensive monitoring plan has a set of selected management measures that are prescriptive to the physical properties of the South Slope watershed, recreational uses, other land uses, and potential contaminants. Because the existing monitoring program is directed at source water protection, it remains a critical element of the overall watershed monitoring program and is an essential element of the recommended monitoring program. The proposed monitoring program identifies recommended changes to improve source water protection monitoring, begin a more comprehensive watershed monitoring effort, and provide a characterization of the lakes and reservoirs in the watershed over time. These practices need to be flexible and adaptive, and include ongoing monitoring and assessment to remain effective.

The proposed monitoring design helps minimize cost while providing for quality assurance and adequate data collection, as well as compliance with adopted water quality standards. Generally, it is assumed that the Springs Utilities' laboratory will conduct any laboratory analyses and adopt the appropriate methodology to comply with standards.

WATER QUALITY AND NATURAL RESOURCE CONSIDERATIONS

The protection of existing sources of water is the established method for protecting public health and minimizing treatment costs while meeting Safe Drinking Water Act (SDWA) standards. An effective source water protection and monitoring plan provides a management strategy that minimizes degradation to critical water resources. A baseline seasonal profile and set of chemical characterizations will require data collection for a period of at least 3 years.

The application of water quality and environmental monitoring in the South Slope watershed requires consideration of existing conditions, state water classifications and standards, and source water protection. Recreational uses and development of recreational infrastructure must be compatible with the protection of a high-quality water supply and natural resources in the sub-alpine and alpine ecosystems found on the South Slope.

Chemical and microbiological contaminations may enter surface water from a variety of pathways, including direct discharges, stormwater runoff, groundwater inflow, and atmospheric deposition. Contaminants can be natural or human-caused. For example, erosion is a natural phenomenon in mountainous terrain; however, human activities can greatly accelerate this process, which results in sediment contamination. The accelerated change in quantity and frequency compared to natural erosion rates constitutes the contamination. Source water protection strives to keep erosion rates close to natural conditions, recognizing the natural fluctuation in these rates.

Water Quality Standards and Use Impairments

The Colorado Water Quality Control Commission (WQCC) adopts water quality standards and classifications for all waters in Colorado, as required by section 303(d) of the federal Clean Water Act. Section 303(d) requires that states submit to the U.S. Environmental Protection Agency a list of waters for which technology-based effluent limitations and other required controls do not meet water quality standards, based on established criteria.

The WQCC Regulation #32 lists three classified stream segments in the South Slope watershed: Fountain Creek Segment 1a, Fountain Creek Segment 3b, and Upper Arkansas River Segment 24. Segment 1a includes all streams, lakes, wetlands, and reservoirs that are tributary to Fountain Creek from the source to a point immediately above the confluence with Monument Creek, in Manitou Springs. Segment 3b is the Bear Creek Tributary in Jones Park, above 8,200 feet elevation. Segment 24 is the main stem of East and West Beaver Creeks, including all tributaries, wetlands, lakes, and reservoirs, from the source to the confluence with Beaver Creek. Tributaries to Fountain Creek (including Ruxton Creek, Sheep Creek, Cabin Creek, and Lion Creek), Bear Creek (in Jones Park), and East and West Beaver Creek are shown on Map E.

The WQCC regulation #93, or 303(d) list, identifies waters in Colorado with impaired water quality. The most recent 303(d) list identifies Segment 1a as use impaired, as a result of *E. coli* bacteria and selenium exceedances. The state standards for *E. coli* and selenium are 126/100 mL and 4.6 ug/L, respectively.

The *E. coli* listing is a high priority, which means a total maximum daily load (TMDL) analysis must be completed by the State Water Quality Control Division within 5 years. Springs Utilities

is responsible for completing an implementation plan within 5 years, as well. Since this impairment listing applies to all tributaries of Fountain Creek, it includes Ruxton Creek and other tributaries present on the South Slope. However, this does not necessarily mean that waterbodies on the South Slope are actually impaired by these two pollutants. Ongoing monitoring can determine if any mitigation is required for specific streams or tributaries.

Segment 3b is designated as outstanding waters, which means the WQCC has determined this water to have exceptional recreational or ecological significance, and has not been modified by human activities in a manner that substantially detracts from their value as a natural resource. Outstanding waters are expected to have no level of degradation and meet all state standards for metals, physical, biological, and inorganic parameters.

Reservoir and Lake Trophic States

Water quality in lakes and reservoirs can be complex, as water quality changes both spatially and temporally. Spatial differences include vertical changes in water layers caused by stratification, or the separation of the waterbody into distinct layers. Stratification can be caused by physical factors, including temperature or water chemistry, such as dissolved minerals. Lakes and reservoirs in Colorado naturally stratify with a fall "turnover", where temperature changes cause the bottom waters to mix with surface waters. Water quality can also vary spatially by the region of a lake or reservoir, and is often influenced by input sources. For example, water quality may be different where a stream enters a lake than where it exits, or where different recreation uses primarily occur.

Temporal changes in water quality occur due to seasonality within a given year or long-term climate conditions and fluctuations. Periods of drought and high water can dramatically influence the water quality of lakes and reservoirs.

Reservoir systems are often characterized as resilient, as the water quality remains relatively stable until enough alteration in either physical characteristics or chemical constituents results in dramatic "shifts" in quality. Because a simple set of quality measurements may not show an impending potential "shift" in quality, the evaluation of water quality parameters cannot always provide a complete characterization of water quality.

As such, lake and reservoir managers must rely on a collective measurement system that generally describes a waterbody type. This classification system measures the potential of a waterbody to degrade in quality (eutrophication). The more nutrients that are introduced into a waterbody, the more eutrophic the waterbody becomes and the more water quality problems arise. . This system (Table 15) measures the productivity, or nutrient richness, of the waterbody. Using a set of trophic indicators allows more responsive and more effective management of lakes and reservoirs.

TABLE 15. TROPHIC CLASSIFICATION OF LAKES AND RESERVOIRS

Trophic Type	Nutrients	Trends
Oligotrophic	Very low	• Clean, clear water; no vegetation problems; low food base; some algae; poor fishing • Secchi reading of water clarity > 30 feet
Mesotrophic	Moderate	• Some vegetation; murky water; low bottom water dissolved oxygen; some good fish, but cannot sustain fishery with much fishing pressure • Secchi reading of water clarity = 10-30 feet
Eutrophic	High	• Vegetation; increased algae; increased nutrients; periods of low dissolved oxygen throughout waterbody; best fishing and can sustain fishing pressure • Secchi reading of water clarity = 3-20 feet
Hypereutrophic	Extremely high	• Vegetation and algae very dense; increased nutrients; water quality problems; low dissolved oxygen; some fish kills, declining fishery • Secchi reading of water clarity < 3 feet

RECREATION AND POTENTIAL ASSOCIATED WATER QUALITY IMPACTS

A diligent monitoring program to track lakes and reservoirs is necessary to guard against possible degradation. This monitoring becomes a key component of an adaptive management plan for these waterbodies. The high altitude lakes and reservoirs of the South Slope watershed are considered oligotrophic or mesotrophic, which indicates high water quality and limited productivity. Reservoirs have a tendency to shift tropic states more rapidly, compared with natural lakes. The prospect of accelerated eutrophication in the lakes and reservoirs from increased recreational use, which would decrease water quality, is probably minimal as lakes and reservoirs are highly resilient to changes in trophic states. However, a management and monitoring plan is necessary to prevent any changes to the trophic state on the South Slope watershed, as restoration can be a long and expensive process.

Recreational uses and development activities on the South Slope watershed can potentially cause water quality degradation. The primary pollutant of concern is excess sedimentation caused by water and wind erosion. Nutrient loading and *E. coli* as a result of equestrian and other uses is also a concern. In addition, oil products can easily migrate through thin soil types, and these products, even in small quantities, can taint drinking water supplies and disrupt water treatment processes.

Forest fires pose a significant threat to water quality within a watershed. Increased human presence and recreational use can potentially raise the risk of a forest fire. Forest fires can pose a number of risks including, but not limited to:

- Increased nutrient enrichment (eutrophication) of water bodies
- Sedimentation
- Increase in fine-particle sediments
- Soil erosion (from wind and stormwater events)
- Impacts to fish spawning and aquatic habitat
- Higher water temperature in streams (less canopy allows more sunlight to the forest floor)
- Potential fish kills from higher temperatures
- Reduced dissolved oxygen
- Reduced soil moistureDebris flows
- Organic loading
- Changes in hydrology
- Human safety issues
- Reduced drinking water quality

Human Waste Management

Contaminants associated with human waste can adversely affect drinking water quality, including the inadvertent introduction of bacteria and pathogens into surface and shallow groundwater. The Environmental Protection Agency (USEPA) has proven viruses can persist in shallow Colorado groundwater for up to two years[1]. Nitrogen and phosphorus from human waste can result in algae growth in surface waters and accelerate eutrophication. Increased algal growth can cause taste and odor problems, along with increased production of by-products in drinking water supplies. Therefore, the need for source water protection can limit the selection of a sanitary waste management system. Toilet facilities in the South Slope Watershed recreation areas can utilize composting, standard vault, or conventional flush toilets; however, each of these options has limitations.

Composting Toilets

The recommended waste management option for the South Slope is a composting or evaporative treatment system. Composting and evaporative toilet systems require little water and are well-suited for remote recreational areas with shallow soils and rough terrain, such as the South Slope watershed[2].

A composting toilet system effectively treats excrement, toilet paper, and other organic wastes. Composting toilet systems divert nutrient- and pathogen-containing effluent from surface water and groundwater, reducing treatment needs. If sized and maintained properly, the aerobic bacteria in a composting toilet break down waste to 10 to 30% of its original volume. The resulting soil-like material is called “humus”, and can be applied to vegetation and serve as a natural soil amendment.

[1] *USEPA Manual of Methods for Virology*, EPA/600/4-84/013, http://www.epa.gov/nerlcwww/about.html
[2] USEPA, Water Efficiency Technology Fact Sheet Composting Toilets, September 1999, EPA 832-F-99-066.

While there may be increased operation and maintenance requirements for composting or evaporative systems, these costs offset the greatly increased protection of drinking water sources. Composting and evaporative systems are self contained, so they keep the treated waste products on site and eliminate the need for septage hauling and disposal. This system provides a solution that is more sustainable and efficient in the long term.

Standard Vault and Flush Toilets

Standard vault and flush toilets can adversely impact water quality, and pose a challenge for source water protection. Standard flush toilets require a septic tank and leach field. The addition of a leach field is not a viable alternative for the South Slope watershed recreational area, and would not meet the source water protection objective.

Although vault toilets are designed to be water tight, numerous examples exist throughout Colorado where standard vault toilets leak. Often this leakage begins shortly after use and continues undetected for many years, as remote standard vault toilets are not generally equipped with leak detection systems. The potential for a standard vault toilet to impair adjacent shallow groundwater and surface water sources poses a moderate to high risk on the South Slope, depending on the level of recreational use. Vault toilets frequently have unpleasant odors associated with them, and are vulnerable to users depositing inappropriate materials.

Along with the typical concerns about odor, waste solids can build up and compact in the bottom of the vault, making septic pumping and hauling more difficult. The pumper truck, which operates by vacuum, can inadvertently remove only the liquids and leave the solids behind. The accumulation of solids over time can cause additional odor problems and may require more frequent pumping to compensate for a loss of holding capacity. Unlike flush toilets, no water dilutes the waste, so the waste is concentrated. This increases the cost of vault toilet waste disposal as well[3].

[3] Marina Connors, Center for Design and Interpretation, USFS Rocky Mountain Region, http://www.americantrails.org/resources/trailbuilding/valutevap.html

MONITORING PROGRAMS

This monitoring plan will provide quantifiable feedback to the South Slope watershed managers for sustainable protection of critical watershed resources. A monitoring plan is an iterative process with built-in feedback loops, based on definable, measurable goals. Five distinct monitoring programs comprise this overall monitoring plan. No single monitoring program will completely characterize the overall state of the watershed, so all should be considered together.

The monitoring plan and selected monitoring programs require regular review. The first review process after the recreational use begins (end of first season) will help evaluate water quality, based on an initial set of measurable goals. These goals may change in the future, after construction of the recreational facilities and recreational use has begun.

The five monitoring programs needed for the South Slope watershed are described in more detail below:

1. **Watershed Stream Standards and Classifications Compliance Monitoring.** Monitor for key parameters in streams, lakes and reservoirs to measure long-term trends, short-term changes, and anthropogenic (human-caused) influences;
2. **Lake and Reservoir Monitoring.** Obtain seasonal profile data for selected trophic indicators, changes to trophic or quality states, biological responses, fishery quality, water quality, and potential use impairment parameters;
3. **Source Water Protection Monitoring.** Continuously monitor and build a data set of chemistry characterizations (Springs Utilities has an existing program) at critical source water protection points to establish trends and assurance criteria that might indicate changes in drinking water quality;
4. **Watershed Biological Health Monitoring.** Observe, quantify, and qualify introduction of invasive species and changes to biodiversity and the health of populations for plants and wildlife;
5. **Public Perceptions and Recreational Uses Monitoring.** Assess user and public perceptions about recreational management on Springs Utilities lands, as well as recreational use and demand.

The five monitoring programs are divided into a two-tiered approach. Tier I monitoring is more resource intensive compared with tier II monitoring. Tier I monitoring should begin before the recreational facilities are developed or improved. Generally, tier II monitoring begins after recreational users gain access, and is dependent on the intensity of recreational use. Tier I monitoring establishes water quality baseline data for watershed and reservoir/lake monitoring, and contributes to the source water protection data that Springs Utilities began collecting in 2007. Tier II monitoring is generally conducted in response to observed changes or impacts.

In most existing Colorado watershed management programs, a baseline of water quality data and environmental characterizations has been established within a 3-10 year timeframe. A longer-term baseline of data and information is necessary for the watershed adaptive management program. Generally in Colorado, a 5-year baseline data set is used for regulatory and impairment assessments. All regulated Colorado watershed organizations re-evaluate their water quality data sets every three years. Tier I monitoring needs to occur before, during, and after construction of the recreational facilities. Ideally, tier I monitoring should begin during spring runoff periods (May) and extend through the first snows (September or October). If stream segments are listed on the Colorado 303(d) list of impaired waters, it may require the collection of more water quality data over a much longer timeframe.

Tier II monitoring should be adaptive. Tier II categories can provide information and data to better understand the source and cause of the measured water quality or environmental degradation or alterations. If invasive species become a problem, for example, this category could require more extensive surveys and corrective actions.

Water Quality Monitoring Programs (Programs 1, 2, and 3)

Monitoring programs 1, 2, and 3 all characterize the chemical, aquatic, and physical aspects of the water resources in the South Slope watershed. These water resource-monitoring programs rely on measurable (quantifiable) results that can be compared to established state and local standards, specific trigger points, or a preferred range of results.

Monitoring programs 1, 2, and 3 can use either unique or common monitoring points. Valuable information for assessing drinking water quality may differ from the information needed to assess the overall health of a watershed's water resources or compliance with standards. The three water quality monitoring programs should be treated as completely separate programs, allowing for some duplicate testing to occur. Because this approach allows for replication and additional quality control and quality assurance, this is the best approach for monitoring on the South Slope watershed. This approach emphasizes sufficient data collection.

Since there are different parameters for various types of monitoring, a database should be developed to track data. This would include separate spreadsheets or databases for each monitoring program, and would contain all monitoring parameters. The organization of monitoring program data records will make subsequent data analysis and interpretation more straightforward.

Table 16 lists an optimum set of water resource monitoring stations in the South Slope watershed, including recommended monitoring in Jones Park. There are 24 monitoring stations, which provide optimal coverage and maximize the potential to predict changes in water quality caused by either natural or anthropogenic conditions. The monitoring program design provides an opportunity to understand nutrient loading, long-term trends, and short term changes. A field survey will establish the exact GPS coordinates for each monitoring station. These points are recommended either instead of or in addition to current Springs Utilities monitoring sites. Sampling sites are displayed on Map E.

The South Slope watershed monitoring program timing may be constrained by weather at higher elevations, snow accumulation, and melt-off conditions. Monitoring programs 1, 2, and 3 can be constrained to the May through September timeframe.

TABLE 16. OPTIMAL WATER QUALITY MONITORING STATIONS IN THE SOUTH SLOPE WATERSHED AND JONES PARK

Sample Site	Watershed Stream Standards and Classifications Compliance (Program 1)	Lake and Reservoir (Program 2)	Source Water Protection[1] (Program 3)
South Slope Watershed			
Strickler Tunnel Influent (flow in)			X
Strickler Tunnel Effluent (flow out)			X
Upper Boehmer Creek	X		
Boehmer Reservoir		X	
Boehmer Reservoir Effluent	X		
Sackett Creek			X
Mason Reservoir Influent	X		
Mason Reservoir		X	
Mason Reservoir Effluent	X		
McReynolds Reservoir		X	
St. John's Tunnel Effluent	X		X
Lake Moraine Influent	X		
Lake Moraine		X	
Lake Moraine Effluent	X		X
South Ruxton Creek at Big Tooth	X		X
Willow Creek	X		X
Big Tooth Reservoir		X	
Ruxton Creek	X		
Lion Creek	X		
Sheep Creek	X		
Cabin Creek	X		
Lower Ruxton Creek at Manitou	X		X
Jones Park Watershed			
Lower Bear Creek	X		
Upper Bear Creek	X		

[1]Drinking water parameters are currently monitored at these stations, as part of the existing Springs Utilities' monitoring program.

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LRUX_CR
CABIN_CR
SHEEP_CR
LION_CR
RUXTON_CR
BIGTOOTH
Big Tooth Reservoir
WILLOW_CR
SRUXTON_CR
MORAIN_EFF
MORAINE
Lake Moraine
MORAIN_INF
UBEAR_CR
LBEAR_CR
STRICK_INF
STRICK_EFF
UPBOEHM_CR
Boehmer Reservoir
BOEHM_EFF
STJOHN_EFF
SACKETT_CR
MASON_INF
Mason Reservoir
MASON
MASON_EFF
MCREYNOLDS
McReynolds Reservoir
Bighorn Reservoir
Wilson Reservoir
Bison Reservoir
Bison Creek
French Creek South Fk
Cabin Creek
Ruxton Creek
Fountain Creek #4
Sutherland Creek
Ruxton Creek South
Willow Creek
Bear Creek
Cheyenne Creek North
Buffalo Canyon Creek
Boehmer Creek
Beaver Creek West W Fk
Beaver Creek West E Fk
Beaver Creek Mid
Legend
Monitoring Sample Site
Springs Utilities Watershed Lands
USFS Roads Open to All Vehicles
USFS Roads Open to Licensed Vehicles
Other Public/ Private Roads
Springs Utilities Roads
Trail Alignment
Existing Access Road
New Access Road
Pikes Peak Cog Railway
Intermittent Stream
Perennial Stream
Lake/Reservoir
Public Shoreline Access
0
0.5
1 Miles
EDAW | AECOM
South Slope Water Quality Monitoring
Colorado Springs Utilities
Map E

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TABLE 17. RECOMMENDED MONITORING TIMEFRAME

Type of Monitoring	May	June	July	August	September
Watershed Stream Standards and Classifications (Program 1)	X		X	X	X
Lake and Reservoir Chemistry (Program 2)			X	X	X
Lake and Reservoir Phyto/Zooplankton (Program 2)				X	
Source Water Protection (Program 3)		X			X

Table 17 lists recommended monitoring timing for the three water resource-monitoring programs. This monitoring period will generally coincide with the recreational use period, and encompasses the warm season. If the results of the temperature data record are not compliant with state standards (after a minimum two-year period), the data collection for temperature should begin in April and extend into November. Once a reasonable level of data has been collected, the monitoring period for most of the biological and chemical parameters could occur from July through September only.

A project quality assurance and control plan for the monitoring program should be written before sampling begins. The plan would detail the analytical methods, including any quality assurance and quality control methods, to be used by both field personnel and laboratory staff in implementing the monitoring plan. This quality assurance plan would be reviewed annually and updated as needed.

Program 1: Watershed Stream Standards and Classifications Compliance Monitoring

Table 18 lists the recommended monitoring locations for the watershed-monitoring program. Since the site coordinates are based on aerial maps, the selection of sampling points requires field verification.

TABLE 18. WATERSHED PROGRAM SAMPLING LOCATIONS (PROGRAM 1)

Identity[1]	Description
UPBOEHM_CR	Upper Boehmer Creek
BOEHM_EFF	Boehmer Reservoir Effluent
MASON_INF	Mason Reservoir Influent
MASON_EFF	Mason Reservoir Effluent
STJOHN_EFF	St. John's Tunnel Effluent
MORAIN_INF	Lake Moraine Influent
MORAIN_EFF	Lake Moraine Effluent
RUXTON_CR	Ruxton Creek
SRUXTON_CR	South Ruxton Creek at Big Tooth
WILLOW_CR	Willow Creek
LION_CR	Lion Creek
SHEEP_CR	Sheep Creek
CABIN_CR	Cabin Creek
LRUX_CR	Lower Ruxton Creek at Manitou
UBEAR_CR	Upper Bear Creek Jones Park
LBEAR_CR	Lower Bear Creek Jones Park

[1]This site identification nomenclature specifically corresponds to the existing Springs Utilities monitoring program.
[2]The GPS coordinates presented in this table were map-verified and identify the preferred monitoring site, which may differ slightly from the existing Springs Utilities monitoring points.

Table 19 lists a recommended minimum set of parameters for program 1 watershed stream monitoring in the South Slope watershed and Jones Park. Temperature data loggers would be installed in the field during the first sampling event, checked during other field events, and downloaded at the final sampling event. Flow data is important in determining sediment, nutrient, and chemical loading, which are important factors in establishing potential changes to the lakes and reservoirs. A field flow meter or flow probe, using established methods, will provide reasonable instantaneous measures. Flow weirs (an artificially constructed flow channel which restricts natural flows and allows for accurate measurement of flow velocity) can also be used to better predict flows, but measurement of flow velocities is still required.

TABLE 19. BASIC WATER QUALITY PARAMETERS OR WATERSHED SAMPLE LOCATIONS

Field Data	• Temperature • Dissolved Oxygen • Specific Conductivity • pH • Flow/ Discharge
Laboratory Analyses	• Nitrate+Nitrite-Nitrogen • Total Ammonia • Total Nitrogen • Total Phosphorus • *E. coli* • Hardness • Fluoride • Magnesium (Total Recoverable) • Iron (Total Recoverable) • Selenium • Total Suspended Sediments • Turbidity

Program 2: Lake and Reservoir Trophic Condition Monitoring

Table 20 lists recommended reservoir and lake sampling locations. Table 21 lists recommended parameters for the lakes and reservoirs in the watershed. The lakes and reservoirs need to be profile sampled in July, August, and September. The database for many other lakes and reservoirs in Colorado includes a longer timeframe, generally from ice off to late fall. While a longer reservoir/ lake sampling timeframe may be useful in the future, the preliminary data collection can focus on the more critical growing season of July through September.

TABLE 20. RESERVOIR AND LAKE SAMPLING LOCATIONS

Identity[1]	Description
MASON	Mason Reservoir
MCREYNOLDS	McReynolds Reservoir
MORAINE	Lake Moraine
BIG TOOTH	Big Tooth Reservoir

[1]This site identification nomenclature specifically corresponds to the Springs Utilities existing monitoring program.

[2]The GPS coordinates presented in this table were map-verified and identify the preferred monitoring site, which may differ slightly from the actual monitoring points on the ground.

It will be important to measure the chemical and physical parameters for both surface and bottom waters. Lakes and reservoirs may have vertical variations, due to the stratification of water and nutrients. While there can be differences in chemistry over the surface area of the waterbody, generally surface differences will not be as great as vertical differences. As such, a single profile station in the middle of these waterbodies will generally provide a reasonable characterization of water quality for the entire lake or reservoir. However, initially, multiple field profiles should be taken for field parameters to test this assumption. It will be useful to measure the average depth of the reservoirs and lake, as well.

The measurement of chlorophyll in a lake or reservoir can be confined to the surface waters. The phytoplankton and zooplankton surveys only need to be collected once (in August); data will be collected from surface waters only.

TABLE 21. BASIC WATER QUALITY PARAMETERS FOR LAKES AND RESERVOIRS

	Parameter	Measurements
Field Data	Temperature	Field probe[1], 1-m intervals, continuous data loggers
	Dissolved Oxygen	Field probe, 1-m intervals
	Specific Conductivity	Field probe, 1-m intervals
	pH	Field probe, 1-m intervals
	Secchi Depth (clarity)	Linear measurement from surface
	Total depth	Linear measurement
	Average depth	One-time survey
Laboratory Analyses	Nitrate+Nitrite-Nitrogen	Top[2] and bottom[3]
	Total Nitrogen	Top and bottom
	Total Phosphorus	Top and bottom
	Total Dissolved Phosphorus	Top and bottom
	Chlorophyll a	Top only
	Phytoplankton	Species and density
	Zooplankton	Species
	Total Suspended Sediments	Top and bottom
	Hardness	Top only
	Iron (Total recoverable)	Top only
	Magnesium	Top only

[1]A field probe is a data logger that collects information on water parameters on site.

[2]Top water samples are generally collected from <.5 m to 1m below the water surface.

[3]Bottom water samples are generally collected 1m above the substrate of the waterbody.

Program 3: Source Water Protection Monitoring

The existing Springs Utilities Source Water Protection chemistry program was designed to characterize water sources in the watershed. Based on a review of the existing data, a few modifications to the existing monitoring program are recommended. A number of sampling locations would be removed from the existing program, and a few recommended sites would be retained. One new watershed sampling location would be added. Table 22 lists the recommended drinking water (source water) sampling locations.

TABLE 22. DRINKING WATER OR SOURCE WATER SAMPLING LOCATIONS

Identity[1]	Description
STRCK_INF	Strickler Tunnel Influent
STRCK_EFF	Strickler Tunnel Effluent
SACKETT_CR	Sackett Creek
STJOHN_EFF	St. John's Tunnel Effluent
MORAIN_EFF	Lake Moraine Effluent
SRUXTON_CR	South Ruxton Creek
WILLOW_CR	Willow Creek
LRUX_CR	Lower Ruxton Creek at Manitou

[1]This site identification nomenclature specifically corresponds to the existing Springs Utilities monitoring program.

[2]The GPS coordinates presented in this table were map-verified and identify the preferred monitoring site, which may differ slightly from the existing Springs Utilities monitoring points.

TABLE 23. RECOMMENDED PARAMETERS FOR THE SOURCE WATER MONITORING PROGRAM[1]

Parameter	Identity	Method Number[2]	Area of Analysis	Reporting Limit[3]	Units
Nitrate+Nitrite	NO2+NO3		General Chemistry	10	ug/L
Total Nitrogen	TN		General Chemistry	10	ug/L
Total Phosphorus	PHOSPHATE	SM 4500 P-E	General Chemistry	1	ug/L
Chloride	ANN_IC	EPA 300.0	Multifunction	0.2	mg/L
Organic Carbon (Total)	TOC	SM 5310 B	Multifunction	0.70	mg/L
Methylisoborneol (MIB) & Geosmin	GEOS_MIB	SM 6040 D	Multifunction	5.0 5.0	ng/L
E. Coli	CO_MPN	SM 9223 B	Micro	1	MPN
Turbidity	TUR_N_1	SM 2130 B	General Chemistry	0.00	NTU
Fluoride (Total)	FLUORIDE	SM 4500 F-C	General Chemistry	0.10	mg/L
Hardness as $CaCO_3$	HAR_TTN_2	SM 2340 C	General Chemistry	0	mg/L
Alkalinity (Total)	ALKALINITY	SM 2320 B	General Chemistry	15	mg/L
Total Recoverable: Calcium Iron Magnesium Potassium Sodium	TM_ICP	EPA 200.7	Metals	200 20.0 25.0 500 200	ug/L ug/L ug/L ug/L ug/L
Selenium	SE	e.g. EPA 0270.2 CL	General Chemistry	1	ug/L
Dissolved Oxygen	DO_FLD	SM 4500 O-G	Field	0.0	mg/L
pH	PH_FLD	EPA 150.1	Field	0.5	su
Temperature	TEMP_FLD	SM 2550 B	Field	0.2	degrees C
Conductivity	COND_FLD	SM 2510 B	Field	1	umhos/cm

[1]This table was adapted from the Springs Utilities existing monitoring program, and is consistent with current Springs Utilities laboratory methodologies.

[2]These method numbers reflect methods utilized by the existing Springs Utilities monitoring program.

[3]Reporting limits are recommended based on state adopted and proposed standards for water quality.

Table 23 lists the recommended parameters for the drinking water (source water) monitoring program. Some of the reporting limits have been modified from the existing program. While the program can continue measuring nitrite and nitrate separately, a test for the combined Nitrate+Nitrite-Nitrogen is sufficient to determine if there is a problem. The existing data set does not indicate any nitrate problems in the watershed.

Vault Toilets

If vault toilets are selected for waste management on the South Slope, close monitoring of these facilities will be necessary. The recommended biological, chemical, and physical parameters needed to assure that vault toilets are not compromising source water protection objectives are shown in Table 24.

A set of monitoring wells up and down gradient to the vault toilet should be installed, to serve as a leak detection system. These monitoring ports should include a pipe riser with a locking cap. Leak detection monitoring wells should be checked monthly during the recreational use period, at time of septage hauling.

A groundwater monitoring well should also be installed adjacent to the vault toilet. This monitoring well is separate from the leak detection monitoring wells described above, and should extend into the groundwater. This monitoring well should include a pipe riser with a locking cap. This well should be monitored monthly during the recreational use period.

TABLE 24. CRITICAL MONITORING PARAMETERS FOR VAULT TOILETS

Biological	• *E. coli* • Fecal coliform
Chemical	• Ammonia (NH3) • Nitrate (NO3) • Total nitrogen • Total phosphorus
Field Measurements	• Temperature • Specific conductance • Dissolved oxygen • pH • Water depth (in groundwater well)

The potential flow path from the vault toilets to nearby reservoirs should be mapped, and a monitoring point should be established on the reservoir shoreline within the predicted flow path. This site should be monitored monthly during the recreational use period. The presence of *E. coli* or fecal coliform in the shoreline sample should trigger additional monitoring to establish the source(s) of the contamination.

Program 4: Watershed Biological Health Monitoring

Wildlife and Vegetation Monitoring

The biological health monitoring program tracks trends or critical changes to sensitive plant and wildlife communities in the South Slope watershed. Existing assessment reports have identified critical sensitive species of interest within the watershed, including bighorn sheep and greenback cutthroat trout.

Springs Utilities has a long history of working cooperatively with the Colorado Division of Wildlife in its efforts to recover the federally-threatened greenback cutthroat trout. Springs Utilities remains committed to this partnership, with the understanding that the primary purpose of the South Slope watershed is to provide a safe and reliable drinking water supply.

Springs Utilities and the Parks Department will incorporate CDOW fishery monitoring data for the South Slope watershed into its ongoing management program. It will be the responsibility of Springs Utilities, the Parks Department, and CDOW to interpret the CDOW data and determine how recreational users may be affecting the fisheries on the South Slope and respond accordingly.

Program 4 monitoring uses naturally occurring or historic conditions for the watershed plants and wildlife (ambient conditions) as a baseline for determining biological health. The program will select predicted trigger conditions and decision-making practices that could require more, different or new mitigation measures. Decision making considerations and actions include:

- Set levels of acceptable disturbance that are compatible with maintaining species viability or recovery in relation to recreational uses (e.g. changes to migratory routes, herd sizes, or population sizes).
- Locate trail or travel routes in discrete, specified areas bounded by natural features (topography and vegetative cover) to provide visual and acoustic barriers and to ensure that secure habitat is maintained for key wildlife (e.g. bighorn sheep).
- Rely on assessment monitoring against baseline datasets for sensitive plants and animals, as well as critical habitat (formally designated or just important for survival) to identify changes in biodiversity or population health, in recreational use areas. This assessment monitoring information should be catalogued and regularly updated in a GIS database, to be used in the adaptive management logic model (Figure 2).
- Prohibit recreational use in critical habitat for sensitive species. This includes lambing areas and winter range for bighorn sheep on the South Slope watershed.
- Maintain large, unfragmented, undisturbed blocks of forestland with no trails or other recreational facilities. Maintain and improve usable habitat by protecting entire areas, rather than closing individual routes within an area.
- Conduct adequate nest searches, starting in May, to identify raptor nest sites.
- Raptor nest sites should be seasonally buffered from disturbance and recreational activities through signage and trail closures per the following distance and date guidelines:
  - Bald Eagle - 800 meters (11/15 – 07/31)
  - Burrowing Owl - 100 meters (04/01 – 07/31)
  - Golden Eagle - 800 meters (02/01 – 07/15)
  - Ferruginous Hawk – 800 meters (02/01 - 07/15)
  - Red-Tailed Hawk - 500 meters (03/01 - 07/15)
  - Swainson's Hawk - 400 meters (04/01 - 07/15)
  - Goshawk - 800 meters (03/01 – 09/15)
  - Osprey - 400 meters (04/01 – 08/31)
  - Peregrine Falcon - 800 meters (03/15 – 07/31)
  - Prairie Falcon – 800 meters (03/15-07/31)
- If trails, such as the spur trail to Boehmer Reservoir, are located in critical wildlife habitat, seasonal closures may be required:
  - Lambing areas for bighorn sheep (May 15 to July 15, or as designated by CDOW)
  - Calving/fawning periods for known key ungulate calving/fawning areas (e.g., May through June in the Rocky Mountain West)
  - Critical ungulate (deer and elk) wintering habitat/winter concentration areas (e.g., December through March in the Rocky Mountain West)
  - Migration corridors during migration periods for bighorn sheep and other wildlife species
- Develop public information and educational programs targeted at recreational users to raise awareness, such as information about wildlife species on the South Slope, key wildlife sign (e.g. tracks and scat), and the impacts of recreational use to those species. This could include information about Leave No Trace practices, the use of bear proof trash containers, and other topics.

Potential Wildlife Impacts from Recreational Users

- Increased stress from human presence
- Altered migration routes
- Increased disturbance
- Loss of habitat
- Reduced nesting site usage

Springs Utilities and the Parks Department will need to coordinate efforts with CDOW to determine a suitable large animal monitoring program, if necessary. Existing CDOW data has established a baseline to predict future effects of recreational use of the watershed for bighorn sheep, elk, and deer. As such, biological health monitoring can be initiated after the construction of the recreational facilities, and after recreation use has begun on the South Slope.

The biological health monitoring plan includes an occasional census of sensitive plant species on the South Slope. Census data should be collected for the following significant plant species found on Pikes Peak to gauge population health[4]:

- *Oreoxis humilis* (Pikes Peak spring parsley)
- *Pinus aristata/Trifolium dasyphyllum* (upper montane woodlands)
- *Draba exunguiculata* (clawless draba)
- *Aquilegia saximontana* (Rocky Mountain columbine)
- *Draba fladnizensis* (arctic draba)
- *Telesonix jamesii* (James' saxifrage)
- *Mertensia alpina* (alpine bluebell)
- *Papaver lapponicum* ssp. *occidentalis* (alpine poppy)

In addition, test plots should be established to monitor species composition and density over time for all plant species on the South Slope. Test plots are defined areas where the plant species are recorded and resurveyed at a desired frequency (once every 2-3 years).

Differences in species composition and density can help predict if recreational use is affecting selected parts of the watershed. A test plot should be set at each trailhead, the mid-section trails, and at water and wetland crossings to monitor plant species, as appropriate.

Invasive Species Monitoring

There is a high risk of invasive species introduction on the South Slope watershed with the addition of recreational use. Invasive species threaten the productivity of forests and waterbodies, and can reduce the diversity of wildlife and plant species in forest, alpine, and aquatic ecosystems within the watershed. Non-native plants and aquatic species can invade areas and outcompete native species, and as a result, multiple aspects of the ecosystem can be impacted. While the spectrum of invasive species that find habitat in watersheds in Colorado could include a wide range of life forms, threats posed by destructive insects and diseases, invasive mussels and aquatic species, and non-native plants are the most critical for Springs Utilities and the Parks Department to monitor.

Additional Invasive Species Management Information

USDA Forest Service Invasive Species Program - The goal of the USDA Forest Service invasive species program is to reduce, minimize, or eliminate the potential for introduction, establishment, spread, and impact of invasive species across all landscapes and ownerships.

- www.fs.fed.us/invasivespecies/
- Video – "Defending Favorite Places, How Hunter and Anglers Can Stop the Spread of Invasive Species."
- Video – "Dangerous Travelers: Controlling Invasive Plants Along America's Roadways"
- PDF – "National Strategy and Implementation Plan for Invasive Species Management"

Natural Resources Conservation Service (NRCS) - Adopts policy and requirements regarding invasive species.

- http://plants.usda.gov/index.html
- Colorado State-listed Noxious Weeds http://plants.usda.gov/java/noxious?rptType=State&statefips=08

The Colorado Weed Management Association - Dedicated to terrestrial and aquatic invasive species management.

- www.cwma.org/

Colorado Division of Wildlife – Key agency for wildlife management in Colorado, including prevention of the introduction of invasive aquatic species.

- http://wildlife.state.co.us/WildlifeSpecies/Profiles/InvasiveSpecies/ZebraandQuaggaMussels.htm

Colorado Department of Agriculture – Responsible for enforcing the Colorado Noxious Weed Act.

- http://www.colorado.gov/cs/Satellite/Agriculture-Main/CDAG/1167928159176

[4] Colorado Natural Heritage Program. Biological Survey of the Pikes Peak Area. February 1999 Final Report.

The state of Colorado has already adopted a number of working invasive species programs. Invasive species are identified as major threats to all Colorado lands that currently allow public access. Invasive species introduction will be nearly unavoidable on the South Slope; however, simple management practices can be used to minimize the threat. It will be critical to monitor for specific harmful plant and animal species.

Forested areas can be monitored for the spread of mountain pine beetle. Mountain pine beetle is an insect pest of ponderosa and lodgepole pine forests in Colorado. The current outbreak is killing large numbers of pines on the western slope and has recently moved into Front Range watersheds, including the Colorado Springs area. Mountain pine beetle infestation is a serious threat and could be a future problem in the South Slope watershed.

Trailhead areas, the entire trail alignment, and crossing areas should be annually surveyed for the presence of invasive plant and animal species. Recreational users should be encouraged to report the presence of any non-native species and noxious weeds.

Zebra and quagga mussels are invasive aquatic species that reproduce quickly and often spread from one waterbody to another. Mussels may be unintentionally transferred by attaching to boats or other equipment and re-establishing in new lakes and reservoirs. Mussels can multiply on structures, clog treatment systems, and increase management costs. While the presence of mussels has not been documented in lakes at higher altitudes, like those on the South Slope, invasive mussel species are still a potential threat. As such, only hand-launched boats will be permitted on the South Slope, and users are required to clean equipment before and after use in lakes and reservoirs.

Use of the BMPs identified in Chapter 2 will minimize the spread of invasive species.

Program 5: Public Perceptions and Recreational Uses Monitoring

Public education can improve the effectiveness of watershed management and enhance the recreational experience for users. In addition, ongoing and targeted public outreach efforts can help prevent adverse resource impacts. It is important for the managers of the South Slope watershed to understand the needs, attitudes, and behaviors of users in order to properly educate the public and build support for management objectives and actions.

This monitoring program gathers information on how users understand and respond to recreation management on the South Slope. Assessing public opinions and feedback can help managers better communicate with the public, respond to issues, and understand how users perceive the health of the watershed. The public perception monitoring program provides mechanisms for public input and feedback, and provides Springs Utilities and the Parks Department with a tool to adaptively manage recreational use. This program will target three general types of user and stakeholder groups:

1. **Frequent recreational users (more than three visits per year).** This is a key target group, since these users are more likely to have constructive opinions and observations of the how the recreational facilities meet their needs.
2. **Limited recreational users.** This includes those who visit the site fewer than three times per year. Some of these recreational users may come from outside the Springs Utilities service area.
3. **Other stakeholders.** Public within the Springs Utilities service area who do not use the recreational facilities but have an interest. This could include elected officials, non-profit organizations and special interest groups, news agencies, schools, and those that use the Springs Utilities or Parks Department websites.

Among recreational users, there may be groups or individuals more interested in preserving and protecting the environment with minimal disturbance to the natural ecosystems, users more interested in recreational use opportunities than environmental considerations, and a range of users in between. It is critical that the user perception surveys and tools target all public and recreational user types.

Prior to recreational use of the watershed, the watershed managers should establish a baseline understanding of public opinion related to the South Slope watershed. This baseline information has previously been collected through public meetings, public comment periods, local media articles, and other sources. This information should be synthesized and interpreted to form a baseline characterization of public opinions about recreational use on the South Slope.

Periodic surveys of recreational users in the first five years of use can provide valuable insights and assist with the adaptive management of the watershed. It will be important to Springs Utilities and the Parks Department to estimate the number of recreational users per day (weekend versus weekday) and a total for the recreational use season. Recreational conflicts and injury incidents should be monitored and tracked to determine the level of risk and liability associated with specific recreational activities on municipal watershed lands and to ensure the number of preventable incidents is minimized.

A number of good survey tools exist that are appropriate for gathering information on the perceptions and preferences of the public and recreational users of the South Slope watershed. Recommended survey tools include:

- Online comments from the Parks Department webpage, including associated website statistics and reports
- Surveys administered by staff to users on site (once or twice per recreational use season)
- Questionnaires and /or a comment log book maintained in a waterproof box at the information kiosks or trailhead
- A "hotline number" to report opinions, problems, or concerns
- Electronic "people counters" (solar powered) on the access road or trailhead to provide an estimate of the number of vehicles or people
- Other survey tools used in market research studies (e.g., a one-question pop-up survey on web-site(s) or information obtained from social media sources)

Once information on recreational use and public opinion has been gathered, the watershed managers will need to statistically analyze and interpret the survey data collected on the South Slope. This information will indicate trends in recreational use, user experience, and user perceptions related to watershed health. This data will also be used to identify demographics of users and provide feedback on recreational management of the watershed.

ADAPTIVE MANAGEMENT TOOL

Over time, the water quality and natural resource conditions, as well as demand for recreation on Springs Utilities watershed lands may change. Management of recreational uses needs to respond appropriately. An adaptive planning and management framework will allow Springs Utilities and the Parks Department to be flexible and responsive to future opportunities, issues, and needs.

Adaptive management is a watershed-based tool to address short-term and long-term outcomes from implementation of recreational programs. Adaptive management is meant to be a flexible, iterative (feedback based) process, based on the understanding that goals, inventory, and available knowledge and technology are perpetually changing, and that future events and scenarios are unpredictable. Strategies and actions are continually identified, implemented, monitored, and evaluated over time, with opportunities for modification. By using a conservative, phased approach, Springs Utilities and the Parks Department will be able to effectively manage and monitor changing conditions related to recreational activities. An adaptive management approach to decision making can ensure sustainable and responsible management of recreation on watershed lands.

Adaptive management concepts are included in most watershed plans in Colorado and across the country. Generally, there is a basic, four-component feedback process for adaptive management:

1. An easily updated management and implementation plan, including feedback loops to address contingencies and meet long-term goals
2. Monitoring programs designed to address near-term activities, long-term trends, natural events, and unforeseen circumstances

3. An active process or management team to analyze and interpret data and outcomes
4. A mechanism to adjust management strategies and objectives, and incorporate results from monitoring and information analyses into future actions and plans

The development of an adaptive management program as part of the monitoring plan will guide specific actions if certain expectations for water quality, watershed health, or recreational use are unmet. A range of management strategies could be appropriate for addressing problems that may be observed on the South Slope. Some management actions will require continuous implementation, while others are used periodically. Management actions may include, but are not limited to:

- Public education
- Limiting access or uses
- Ranger patrol
- Ecological restoration strategies
- Implementing additional BMPs
- Forestry management techniques

The advantages and tradeoffs of all possible management strategies should be evaluated before decisions are made and changes implemented. Some important considerations for selecting a management approach include:

- Potential effectiveness (short-term and long-term)
- Possible environmental impacts (short-term and long-term)
- Amount of time and resources required to implement
- Financial costs and constraints
- Climatic or seasonal constraints
- Legal or political factors
- Public support
- Long-term sustainability

An active watershed manager or management team is recommended to implement effective monitoring programs for the South Slope watershed. The manager(s) would:

- Oversee monitoring efforts
- Keep records of data and information
- Serve as a point of contact for the public and recreational users
- Track recreational use and type of users
- Document problems
- Recommend solutions
- Coordinate volunteer efforts
- Ensure general maintenance of recreational facilities

Example Logic Model

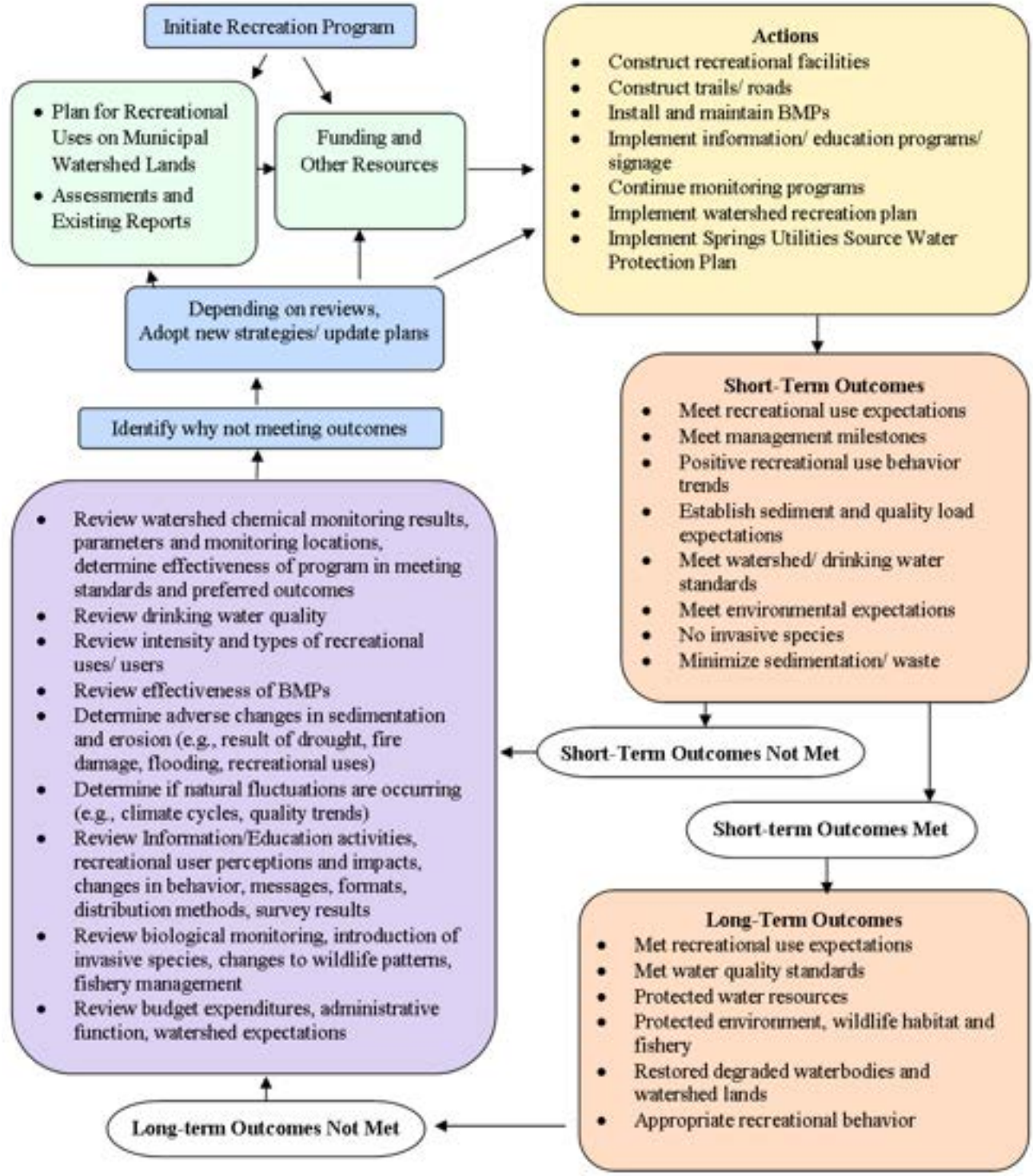
A logic model can help determine which management strategies are most effective for the South Slope. It also provides a mechanism to document the results of implementation actions in the watershed. A logic model evaluates inputs and outputs and considers potential outcomes. An evaluation of outcomes allows for the correction of problems, acknowledgement of success, and changes to the management plan. This type of model combines all information about the watershed program and helps summarize the complex management system.

Figure 2 depicts a preliminary logic model for the South Slope watershed, based on adaptive management. In this model, the recreation program initiates with the "Plan for Recreational Uses on Municipal Watershed Lands," as well as funding and other resources. Construction of recreational facilities, development of information and education programs, initiation of monitoring programs, and the development of supplementary management plans are the initial actions that comprise the recreation program. Recreational use, resource conditions, and other parameters are monitored over time and evaluated with respect to short- and long-term expected outcomes. Management of recreational use should respond as necessary to any issues or opportunities identified in this process.

This decision-support model can be easily integrated into recreation management on the South Slope. Implementation of this model requires:

1. Defined expectations for short- and long-term outcomes
2. Watershed managers
3. Clearly-defined timeline for implementation, monitoring, and review of management strategies and actions

FIGURE 2. SOUTH SLOPE WATERSHED ADAPTIVE MANAGEMENT LOGIC MODEL



Expected Actions and Outcomes

In order to define expected actions and resulting outcomes, the objective of the recreation monitoring programs is to: *Provide quantifiable feedback about the South Slope watershed for sustainable protection of critical watershed resources over time.*

Table 25 lists the primary trigger categories by tier type, as well as the associated logic model actions and expected outcomes. The table also notes whether trigger point categories are based on quantifiable or qualitative information. There are a number of "plans" identified, which are designed to supplement the overall recreation management plan. These supplemental plans provide specific guidance for management actions and decision-making, and are not necessarily expected to be extensive documents. Specific plans that should be developed concurrently with the implementation of the recreational program include:

- **Trail and recreational facility maintenance plan.** Provides detailed information on routine and periodic maintenance activities, schedules, standard procedures, and other considerations.
- **Public and stakeholder information and education plan**. Guides the development and distribution of information and education to the public, including guidance for signage, brochures, or other information and education programs.
- **Erosion and sediment evaluation plan.** Plan for monitoring and mitigating erosion and sedimentation impacts resulting from recreation use.
- **Fire incident plan.** Details fire prevention practices and response strategies in case of a fire event.

Based on the expected outcomes, Table 26 lists potential measures of success and relates these to both short-term and long-term outcomes for use in the logic model. Common administrative activities for monitoring outputs and outcomes include data entry, database maintenance, record management, web site updates, and quality assurance/ control procedures.

LONG TERM BEST MANAGEMENT PRACTICES

This section details long term BMPs that are most appropriate for use on the South Slope watershed. Table 27 lists the BMPs that may be required during later phases of the watershed recreational use program. For example, it is possible that regional sedimentation facilities will be necessary after recreation activities begin, or if there is a natural disaster, such as a major fire. Sedimentation facilities may be necessary to help address any existing water quality concerns, in addition to problems observed in the future. It is possible that some of these watershed management practices may be necessary during the construction phase, as well.

The general and site-specific BMP concepts for source water, invasive species, information and education, bicycle, high-elevation, and equestrian use described in Chapter 2 (pages 40-50) will likely be needed to complement the more permanent BMPs described in Table 27. Generally, non-structural BMPs will not be necessary until after construction activities either begin or are completed.

TABLE 25. TRIGGER CATEGORIES WITH GENERAL EXPECTED OUTPUTS AND TYPES OF OUTCOMES

Trigger Categories	Indicator Category	Actions	Type of Outcome Expected
Water Resources: (Stream standards, classifications, water quality, lakes and reservoirs, source water quality and quantity)	Tier I	• Implement monitoring plan[1] • Build data record • Conduct continuous monitoring	• Quantifiable numbers • Comparison with established standards and targets
Sediment: (Erosion control and sediment deposition, BMP effectiveness)	Tier I	• Develop erosion and sediment evaluation plan[2] • Develop trail and recreational facility maintenance plan[2] • Design BMPs • Install BMPs • Construct trails	• Quantifiable numbers and photographic record[3] • Erosion controls • Limited sediment deposition in waterbodies • Maintained trails
Public Involvement and Education: (Educational programs, signage, distribution, website)	Tier I	• Develop public and stakeholder interpretation and education plan[2] • Erect signage • Develop methods for distributing information to users and the public	• Qualitative information • Recreational use signage • Public information sources • Information on public use, perceptions, and opinions
Biological Integrity: (Vegetative cover, invasive species, sustainable wildlife populations, forest health, fire risk)	Tier II	• Refer to existing inventories • Implement monitoring plan • Conduct periodic monitoring after 1 year of recreation • Develop fire incident plan[2]	• Quantifiable numbers and photographic record[3] • Monitoring data • Invasive species control • Fuel reduction
Recreation Users: (Education, creation of social trails, misuse of recreation facilities, security risk, safety risk, recreational risk, preservation of cultural resources)	Tier II	• Implement recreational use plan[4] • Develop trail network • Develop trailhead and day-use area • Initiate fishing access • Develop safety and security risk management guidelines • Conduct periodic monitoring	• Qualitative information • Public involvement and support • Acceptable user behaviors • Ongoing recreational use • Protection of infrastructure • Reduction of safety risks
Source water operations and facilities	Ongoing	• Refer to existing Springs Utilities operations and programs • Develop source water plans (surface and groundwater) • Implement source water protection activities	• Protection of water sources • Adequate water quality and quantity for delivery

[1]Included in the Plan for Recreational Uses on Municipal Watershed Lands.

[2]These plans include management guidelines, expectations, and schedules.

[3]Photographic record consists of a series of photos of various key points in the watershed, taken periodically. This is used to visually analyze any changes in the watershed over time.

[4]Plan for Recreational Uses on Municipal Watershed Lands.

TABLE 26. EXAMPLE SHORT-TERM AND LONG-TERM OUTCOMES FOR THE SOUTH SLOPE WATERSHED

Measures of Success	Short-term Outcomes	Long-term Outcomes
Chemical Integrity		
Meet water quality standards	• Design monitoring program • Monitor parameters • Annual review of monitoring data • Annual compliance with state standards	• Develop 5-year compliance data set • Meet quantitative state standards
Maintain beneficial uses[1]	• Comply with beneficial use categories (aquatic life cold 1[2], recreation experience[3], water supply, agriculture[4]) • Complete use attainability analysis for recreational use[5]	• Meet all uses • Limit recreational uses, if necessary
Protect source water	• Design monitoring program • Identify standard exceedances (DO, Fluoride, Magnesium, Iron, pH) • Identify problems (total phosphorus, total nitrogen, temperature) • Identify solutions/ implementation strategies	• Meet standards • Implement controls • Develop 5-year compliance data set • Establish site-specific standards
Reduce pollutant load	• Establish ambient load rates for bed-load sediments, suspended sediments, nutrients, and other parameters of concern based on water quality data sets • Observe suspended sediment loading: < 20% increase above ambient • Observe bed-load sediments: < 15% increase above ambient • Observe nutrient loading: < 3% increase above ambient	• Sediment loading at ambient level • Nutrient loading at ambient level
Monitor 303(d) listings	• Design monitoring for *E. coli*, selenium • Parameter monitoring • Annual compliance with state standards determined	• Develop 5-year compliance data set • Modify segmentation, if necessary[6]

[1] Beneficial uses are state-adopted classifications for use of watershed lands. The classifications listed in this table have been identified and adopted for the South Slope watershed.
[2] Waters classified as Aquatic Life Cold 1 are those waters that (1) currently are capable of sustaining a wide variety of cold water biota, including sensitive species, or (2) could sustain such biota but for correctable water quality conditions. Waters shall be considered capable of sustaining such biota where physical habitat, water flows or levels, and water quality conditions result in no substantial impairment of the abundance and diversity of species.
[3]Waters classified as Recreation E are those surface waters used for primary contact recreation or have been used for such activities since November 28, 1975.
[4]Waters classified as Agricultural are those surface waters suitable or intended to become suitable for irrigation of crops usually grown in Colorado and which are not hazardous as drinking water for livestock.
[5]Recreational Use Attainability Analysis is a methodology to determine whether a watershed is meeting the state-adopted classifications for beneficial uses.
[6] Segmentation is the formal classification system for identifying how streams are connected. Modifying the segmentation of streams on the South Slope could separate tributaries from the impaired Fountain Creek segment.

TABLE 26. EXAMPLE SHORT-TERM AND LONG-TERM OUTCOMES FOR THE SOUTH SLOPE WATERSHED (CONTINUED)

Measures of Success	Short-term Outcomes	Long-term Outcomes
Physical Integrity		
Protect lakes and reservoirs	• Identify existing trophic state • Implement BMPs (pages 40-50) • Minimize stormwater runoff • Minimize litter and waste • Direct users to "pack out" trash that is generated • Provide central trash collection points	• Maintain existing tropic state, if appropriate • Prevent eutrophication • Protect shoreline • Control stormwater runoff • Control litter and waste
Protect streams	• Minimize stormwater runoff • Minimize litter and waste • Minimize disturbance of streambanks • Implement BMPs (pages 40-50) • Direct users to "pack out" trash that is generated • Provide trash collection at trailheads/day use areas	• Protect streambanks • Control stormwater runoff • Control litter and waste • Control water crossings on trails
Protect riparian corridors	• Minimize stormwater runoff • Minimize litter and waste • Minimize disturbance • Implement BMPs (pages 40-50)	• Protect shoreline • Control stormwater runoff • Control litter and waste • Maintain ambient levels of riparian health
Protect wetlands and fens	• Minimize stormwater runoff • Minimize litter and waste • Minimize disturbance	• Control stormwater runoff • Control litter and waste • Maintain ambient levels of wetland and fen health
Restore terrestrial and aquatic habitat	• Determine areas in need of restoration • Prioritize areas • Identify restoration BMPs (page 79)	• Restore priority areas • Implement BMPs (pages 40-50) • Maintain ambient levels
Manage stormwater	• Determine stormwater needs along trails and at other recreational facilities	• Implement BMPs (pages 40-50)

TABLE 26. EXAMPLE SHORT-TERM AND LONG-TERM OUTCOMES FOR THE SOUTH SLOPE WATERSHED (CONTINUED)

Measures of Success	Short-term Outcomes	Long-term Outcomes
Biological Integrity		
Protect plant species	• Monitor select sites • Minimize disturbance of select habitats • Minimize species loss • Maintain plant diversity	• Maintain ambient levels • Maintain plant diversity
Protect wildlife species	• Monitor target species • Minimize disturbance • Minimize species loss • Monitor wildlife diversity • Monitor population health	• Maintain ambient levels • Maintain wildlife diversity • Maintain population health
Prevent invasive species	• Minimize introduction by humans • Monitor for invasive species • Document invasive species types • Educate public on invasive species introduction and prevention	• Maintain at or below ambient levels • Manage invasive terrestrial and aquatic species • Prevent introduction by humans through education and public support
Manage fisheries	• Monitor waterbodies, species, and populations • Establish fishery management guidelines and expectations • Educate fishing public	• Manage invasive species • Maintain quality fishery • Improve management through public education and support
Protect ecological health	• Implement monitoring programs (pages 55-69) • Develop forest fuel reduction program • Monitor for ecological health • Create fire incident plan	• Maintain and implement an overall watershed plan • Reduce fuel load
Trail Integrity		
Minimize trail erosion	• Minimize water erosion • Minimize wind erosion • Incorporate erosion controls into design and plans • Implement BMPs (pages 40-50) • Monitor for BMP effectiveness • Develop trail and recreational facilities maintenance plan • Educate recreational public • Document locations of rill and gully erosion • Establish photographic record for locations	• Manage and maintain trails to prevent erosion • Evaluate BMP effectiveness • Prevent erosion through public education and support • Seasonally repair gully erosion • Maintain photographic history

TABLE 26. EXAMPLE SHORT-TERM AND LONG-TERM OUTCOMES FOR THE SOUTH SLOPE WATERSHED (CONTINUED)

Measures of Success	Short-term Outcomes	Long-term Outcomes
Minimize sedimentation	• Minimize sedimentation into waterways • Maintain velocity controls • Monitor for sediment deposition • Monitor for BMP effectiveness • Develop strategies to address any observed sedimentation problems (see pages 45-46)	• Prevent adverse sedimentation • Adjust management plan for natural events, such as flooding, fire, or drought • Maintain erosion control structures • Evaluate BMP effectiveness
Manage litter and waste	• Implement BMPs at trailheads • Educate recreational public	• Manage litter and waste on trails • Prevent waste products from entering source waters • Prevent waste management problems through public educations and support
Recreational Area Integrity		
Manage litter and waste	• Implement BMPs (pages 40-50) • Install zero discharge composting toilets or other non-discharging wastewater system[7] • Develop trail and recreational facility maintenance plan • Educate recreational public	• Manage litter and waste • Prevent waste products from entering source waters • Prevent waste management problems through public education and support • Evaluate BMP effectiveness
Minimize vehicle waste	• Implement BMPs (pages 40-50) • Educate recreational public • Establish guidelines for maintaining parking areas	• Maintain parking areas • Prevent waste products from entering source waters • Prevent waste management problems through public educations and support
Manage runoff	• Minimize water erosion • Prevent stormwater from reaching waterbodies • Incorporate stormwater controls into design and plans • Implement BMPs for short-term construction (pages 40-50) • Prevent horse waste runoff from reaching waterbodies	• Maintain trailheads • Prevent runoff problems through public education and support • Ensure no horse waste runoff in waterbodies • Ensure no stormwater runoff in waterbodies • Limit bank erosion into reservoirs

[7]If vault toilets are implemented instead of solar composting toilets, additional BMPs and monitoring measures would be required.

TABLE 26. EXAMPLE SHORT-TERM AND LONG-TERM OUTCOMES FOR THE SOUTH SLOPE WATERSHED (CONTINUED)

Measures of Success	Short-term Outcomes	Long-term Outcomes
Provide information and education	• Implement signage • Educate recreational public • Develop interpretation and education program • Increase public awareness of issues on the South Slope watershed • Develop complaint response program • Develop positive feedback mechanism for public input • Document vandalism • Provide information or education on Leave No Trace principles	• Establish effective public program • Generate and maintain public support • Manage and respond to recreational complaints • Prevent vandalism • Minimize risk to drinking water infrastructure • Minimize public safety risks
Accommodate recreational users	• Educate recreational public • Conduct public and user surveys • Catalog user behaviors • Determine recreational use • Determine user reaction to signage and interpretation/education efforts • Monitor use levels and determine recreational capacity	• If appropriate, change allowed uses • Generate public support for the recreational program on the South Slope watershed • Prevent creation of unwanted social trails • Manage appropriate recreational uses
Watershed Integrity		
Protect source water	• Maintain Source Water Protection Plan • Review implementation and surface susceptibility analysis with recognition of recreational uses	• Implement Source Water Protection Plan • Prevent degradation to drinking water sources/ supply • Successfully implement BMPs (pages 40-50)
Establish Recreational use goals	• Review recreational use plan regularly, as appropriate • Identify recreational stakeholders • Incorporate recreational use plan into watershed plan • Survey recreational users • Identify recreational use problems or concerns	• Update recreational use plan, as appropriate • Identify recreational users • Limit recreational use impact to overall watershed • Engage the public and build public support for watershed protection • Maintain a sustainable fishery • Manage for sustainable trail use

TABLE 27. RECOMMENDED LONG TERM BMPS FOR SOUTH SLOPE WATERSHED CONSTRUCTION ACTIVITIES[1]

BMP Types	BMP Purpose	Selected BMPs
Structural BMPs	Runoff Control	Grass buffer, vegetation buffer, filter strip, geotextile fabric
		Riprap, logs or water bars, check dams
		Erosion control blankets, fiber rolls, or wattles
		Retaining walls (revetments), cribbing
		Slope stabilization
		Revegetation
		Sediment basins
	Sedimentation Facilities[2]	Grass or vegetative swale
		Extended detention basin
		Constructed wetland basin[3]
		Retention pond
	Natural Waterway Stability and Protection	Constructed grass or riprap channel
		Stabilize natural channels
		Stream buffer setbacks
		Waterway protections
		Inlet and outlet protections
Non-Structural BMPs	Good Housekeeping	Proper use of pesticides, herbicides, and fertilizer
		Ongoing operation and maintenance
		Preventative maintenance
		Stormwater and runoff control and prevention education[4]
Construction BMPs	Erosion Control	Surface roughening
		Mulching
		Seed bed preparation
		Revegetation, temporary and permanent
	Sediment Control	Roads and roadside swales
		Terracing and slope stabilization, fencing, retaining walls (revetments), cribbing
		Slope drains
	Sediment Entrapment Facilities	Straw bales, straw wattle, fiber matting
		Sediment basins
	Waterway Protection	Inlet / outlet protection
		Crossing protections (e.g., riprap, instream check dams, velocity controls)
		Crossing structures (equestrian, mountain biking, and hiking)
	Visual Demarcation	Signage or fencing

[1]Descriptions of specific recommended BMPs are provided in Table 14.
[2]These sedimentation facilities may be appropriate mitigation measures, depending on construction and recreation impacts.
[3]Could be used to mitigate impacts to wetlands, or to improve water quality in the watershed.
[4]Stormwater and runoff problems could occur at trailheads, parking areas, social trails, and other recreational facilities.

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Appendix A. Literature Review

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PLAN FOR RECREATIONAL USES ON MUNICIPAL WATERSHED LANDS

LITERATURE REVIEW AND CASE STUDIES

A review of literature and case studies related to concentrated and dispersed recreation provided background information on recreation impacts. This research was used to inform recommendations for recreational use on Springs Utilities municipal watershed lands.

LITERATURE REVIEW

A curvilinear relationship between recreational use and natural resource impacts indicates that most of the impact of recreation on trails, campsites, wetlands, and water bodies occurs after minimal use. Concentrating use on designated trails and recreation sites can minimize the greater cumulative effects of recreational activities by reducing the amount of land that is exposed to impact. Certain surfaces are more durable than others, with rock surfaces being more durable than bare ground or vegetation. Meadows tend to be more tolerant of trampling impacts than forested areas, where the understory is more fragile. In terms of specific recreational activities, hiking causes less impact on soils and trails than equestrian use, which causes less impact than mountain biking. Poor trail construction and maintenance, excessive visitation, or improper recreational use can cause long-term adverse impacts to natural resources, particularly in wetlands.

Various studies have confirmed that dispersed (rather than developed or concentrated) camping is particularly damaging to natural resources. Even when use is low or infrequent and visitors camp responsibly, substantial vegetation loss and harmful soil impacts may occur.

Adverse natural resource impacts resulting from recreational activities include soil compaction, erosion, and sedimentation in water bodies, vegetation trampling, improper waste disposal and litter, and habitat fragmentation. These impacts can lead to improper water runoff, low soil moisture, decreased soil productivity, decreased vegetative productivity, water pollution, water temperature impairment and turbidity, decreased fish productivity, and changes in species composition over time. In addition, various recreational activities cause wildlife disturbance, displacement, and stress. In Santa Fe National Forest, for example, streams exceeded the standard for turbidity, sedimentation, stream bottom deposits, and temperature. These impacts from dispersed recreational activities necessitated an intensive restoration program to improve the health of the watershed[1].

CASE STUDY: DENVER WATER

Denver Water provides utilities services to over 1.3 million residents in the Denver Metro Area. Many of Denver Water's reservoirs and watershed areas are accessible to the public for recreation. Recreational facilities provided by Denver Water include reservoirs, streams, trails, educational centers, and ecological areas. A variety of activities are permitted at more than ten recreation sites, including stream, reservoir and ice fishing, waterfowl hunting, hiking, biking, running, snowmobiling, kayaking, camping, picnicking, bird watching, wildlife observation, and non-

[1] Webb, A. Respect the Rio—Forest Programs. USDA Forest Service, Santa Fe National Forest. Accessed from: http://www.fs.fed.us/rtr/forests-sfe.shtml

motorized boating. Denver Water also supports a strong educational program, encompassing environmental, science, angler, and historic education. Restrooms, picnic tables, shelters, and other facilities support recreational activities at the various sites.

MANAGEMENT

Each of Denver Water's recreation sites is managed for different activities and levels of demand. Denver Water contracts and partners with a variety of agencies and organizations to most effectively manage recreation on watershed lands. Colorado State Parks manages Eleven Mile Reservoir. Dillon Reservoir is managed by the Dillon Reservoir Recreation Committee, which consists of Denver Water, the United States Forest Service, Summit County, and the Towns of Frisco and Dillon. The Highline Canal is managed in sections by seven local jurisdictions. Fishing and angling education is managed by the Colorado Division of Wildlife. Source of Supply, a department within Denver Water, assists with construction, maintenance, and emergency response at various sites, though it prioritizes watershed protection before recreation. Various companies are contracted to provide routine maintenance of restrooms and facilities.

Denver Water uses law enforcement contracts to prevent crime and illegal use of watershed land and facilities. The Grand County Sheriff, Boulder County Sheriff, Park County Sheriff, and unarmed rangers provide law enforcement support at recreation sites that are particularly vulnerable to negative social issues. Effective law enforcement has helped reduce incidences of unauthorized camping, unauthorized swimming, drug use, vandalism, car break-ins, theft, sexual assault, and other crimes. Clear signage effectively communicates rules and regulations at recreation sites, as well.

SUCCESSES

Recreation management on Denver Water watershed lands has experienced success in multiple ways. The partnership with Colorado State Parks at Eleven Mile Reservoir has been very effective, and as a result there are few management concerns at that site. In addition, law enforcement contracts with local jurisdictions have effectively reduced illegal use and crime at recreation sites near urban areas, such as Gross Reservoir. Denver Water has made education a priority at some sites, and educational programs and classes run by the Thorne Ecological Institute, a non-profit organization, have been particularly successful.

CHALLENGES

Denver Water has identified several current issues associated with recreation management. Some recreation sites are currently "undermanaged," which has resulted in negative social problems, inadequate parking facilities, illegal activities, and public safety concerns. Routine maintenance, preventative maintenance, and repair response are ongoing challenges for Denver Water, particularly on sites that are not managed by other agencies or groups. Unregulated guiding occurs at some recreation sites, and Denver Water recognizes a need for better management of guiding operations. Organized running and biking events in Waterton Canyon also present concerns, as the number of participants in these events overwhelm the area and cause added natural resource impacts. The potential for wildlife encounters and conflicts is a challenge on some watershed lands, as well.

CASE-STUDY: BOULDER WATER

Limited information is available on management challenges and opportunities for Boulder Water properties. However, any management concerns at Boulder Water recreation sites could indicate future challenges for Springs Utilities on the South Slope.

BARKER RESERVOIR

Recreation activities at Barker Reservoir include scenic viewing, picnicking, shoreline fishing, hiking, and nature appreciation. Visitors often stop at the overlook of the dam. Several new regulatory signs have been posted by the city of Boulder: these indicate no boating, no swimming, no fires, no camping, no pets in the water, pets must be on leashes, no ice fishing, and no hunting. Shoreline fishing is allowed, and CDOW stocks the reservoir with both fingerlings and larger fish as budgets and availability of fish allow. Boating is not currently allowed, due to water quality concerns. Most water quality impacts occur from body-water contact and fecal waste contamination.

Because concerns and conditions are similar for Barker Reservoir as some of the South Slope reservoirs, this site could be used as a model for recreational use.

MIDDLE BOULDER CREEK

Recreation activities along Middle Boulder Creek include picnicking, scenic viewing, limited hiking, fishing, and nature appreciation. Access to Middle Boulder Creek varies from relatively easy to very difficult as a result of steep terrain and limited parking along SH 119. There are several picnic grounds near the creek. Limited parking availability in the canyon helps restrict use and reduce water quality impacts. Land ownership and management is a mix of Boulder County Parks and Open Space, USFS, subdivisions or platted areas, or unincorporated county land. Ongoing maintenance and fire risk are key issues in this area.

MAIN BOULDER CREEK

Main Boulder Creek provides an array of recreation activities, including fishing, kayaking, wading, tubing, nature study, trail use, picnicking, and socializing or general day use. The city of Boulder's Eben G. Fine Park provides an urban river park-like setting. Quality visitor amenities are available for people recreating around this reach of Main Boulder Creek. Protection of the fishery and management of recreational uses are top priorities for this segment of Boulder Creek.

KOSSLER RESERVOIR

Kossler Reservoir is closed to public access and recreation. The reservoir, when mostly full (12.25 surface acres), provides a scenic resource from several vantage points. However, the reservoir fluctuates rapidly and makes for unsafe recreation. There also is little ground to develop for recreational purposes. If similar safety concerns exist on any reservoirs on the South Slope, it would be reasonable to maintain closure of these sites.

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Appendix B. Opportunities and Constraints Analysis Maps

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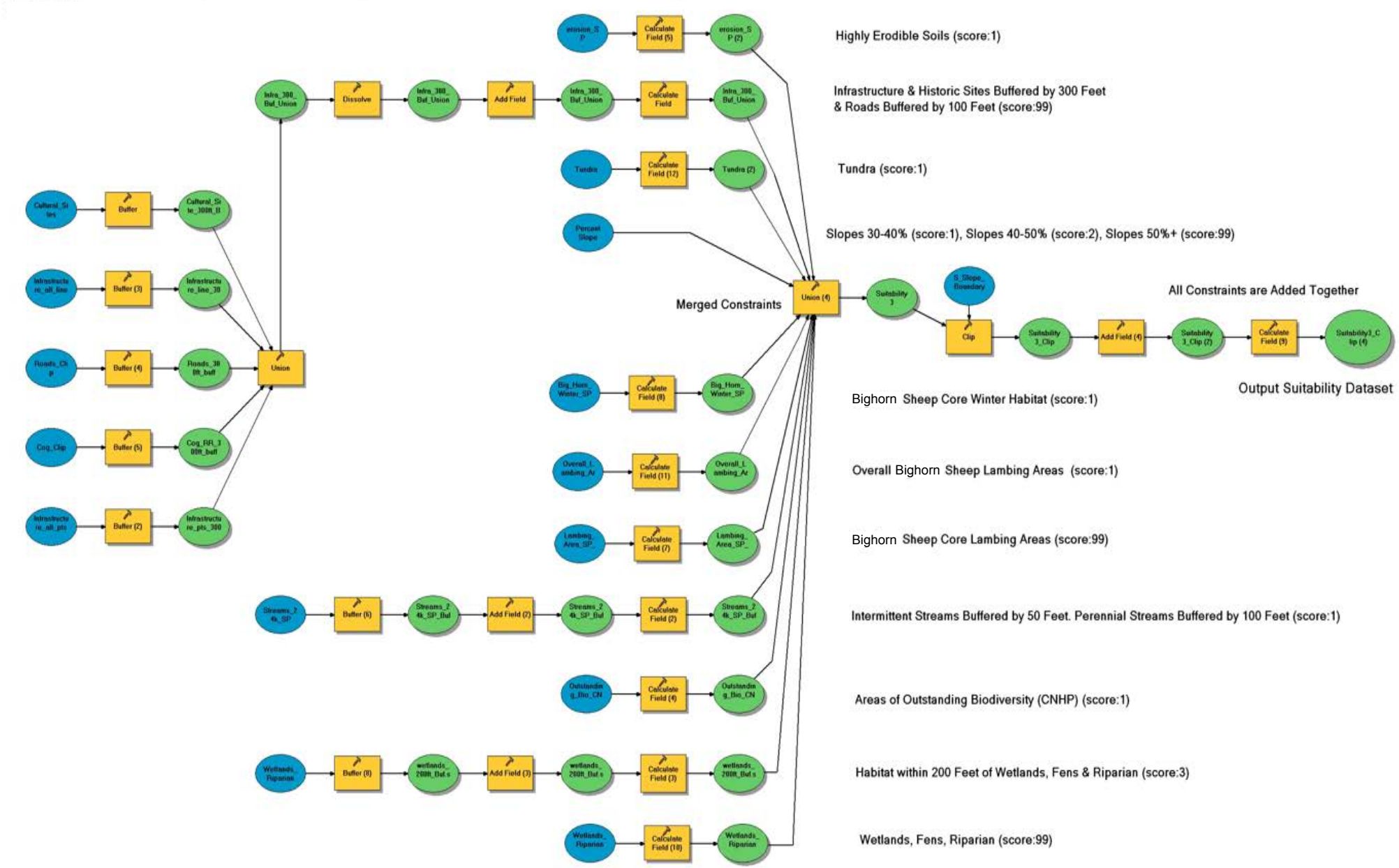
Appendix B, Diagram 1.
Public Access Composite Suitability Analysis Model for the South Slope Watershed



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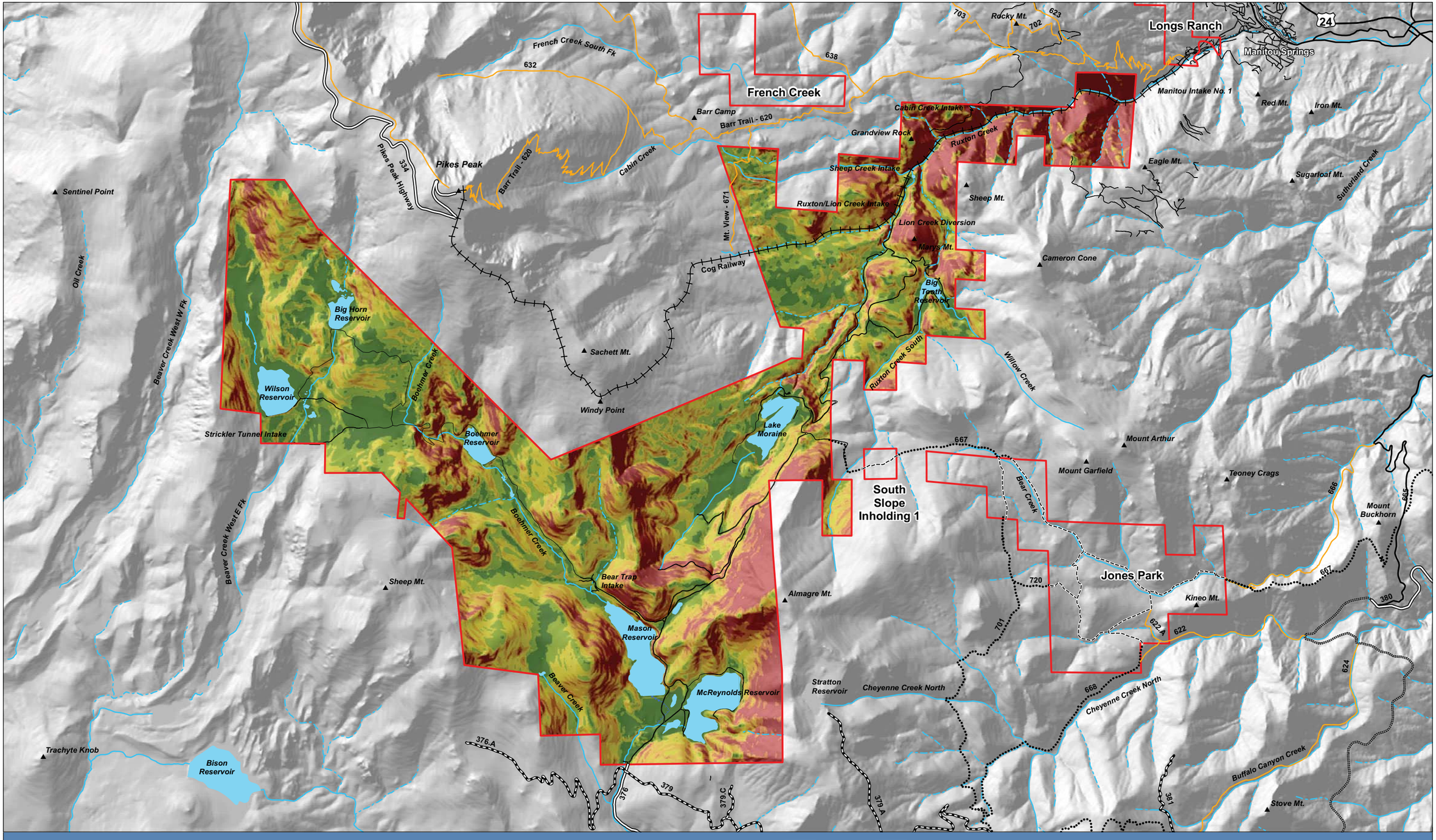
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Manitou Springs
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Rocky Mt.
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623
French Creek
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French Creek South Fk
632
Barr Camp
Barr Trail - 620
Pikes Peak
Pikes Peak Highway
334
Cabin Creek
Cabin Creek Intake
Manitou Intake No. 1
Red Mt.
Iron Mt.
Grandview Rock
Ruxton Creek
Eagle Mt.
Sugarloaf Mt.
Sutherland Creek
Sentinel Point
Sheep Creek Intake
Sheep Mt.
Ruxton/Lion Creek Intake
Lion Creek Diversion
Mt. View - 671
Marys Mt.
Cameron Cone
Cog Railway
Big Tooth Reservoir
Oil Creek
Beaver Creek West W Fk
Big Horn Reservoir
Sachett Mt.
Ruxton Creek South
Willow Creek
Wilson Reservoir
Boehmer Creek
Windy Point
Strickler Tunnel Intake
Boehmer Reservoir
Lake Moraine
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Mount Arthur
Mount Garfield
Teoney Crags
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665
Mount Buckhorn
South Slope Inholding 1
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Beaver Creek West E Fk
Boehmer Creek
Bear Trap Intake
Sheep Mt.
Almagre Mt.
Jones Park
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Kineo Mt.
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Mason Reservoir
Beaver Creek
McReynolds Reservoir
Stratton Reservoir
Cheyenne Creek North
668
Cheyenne Creek North
Trachyte Knob
Bison Reservoir
376.A
379
376
379.C
379.A
381
Buffalo Canyon Creek
Stove Mt.
USFS Roads Open to All Vehicles
USFS Roads Open to Licensed Vehicles
USFS Special Vehicle Designation Route
Other Public/ Private Roads
USFS Non-Motorized Trail
USFS Motorcycle Trail
CSU Watershed Lands
Precent Slope
0 - 10%
10 - 20%
20 - 30%
30 - 40%
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0
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1 Miles
EDAW | AECOM
South Slope Topography
Colorado Springs Utilities
Appendix B, Map 2

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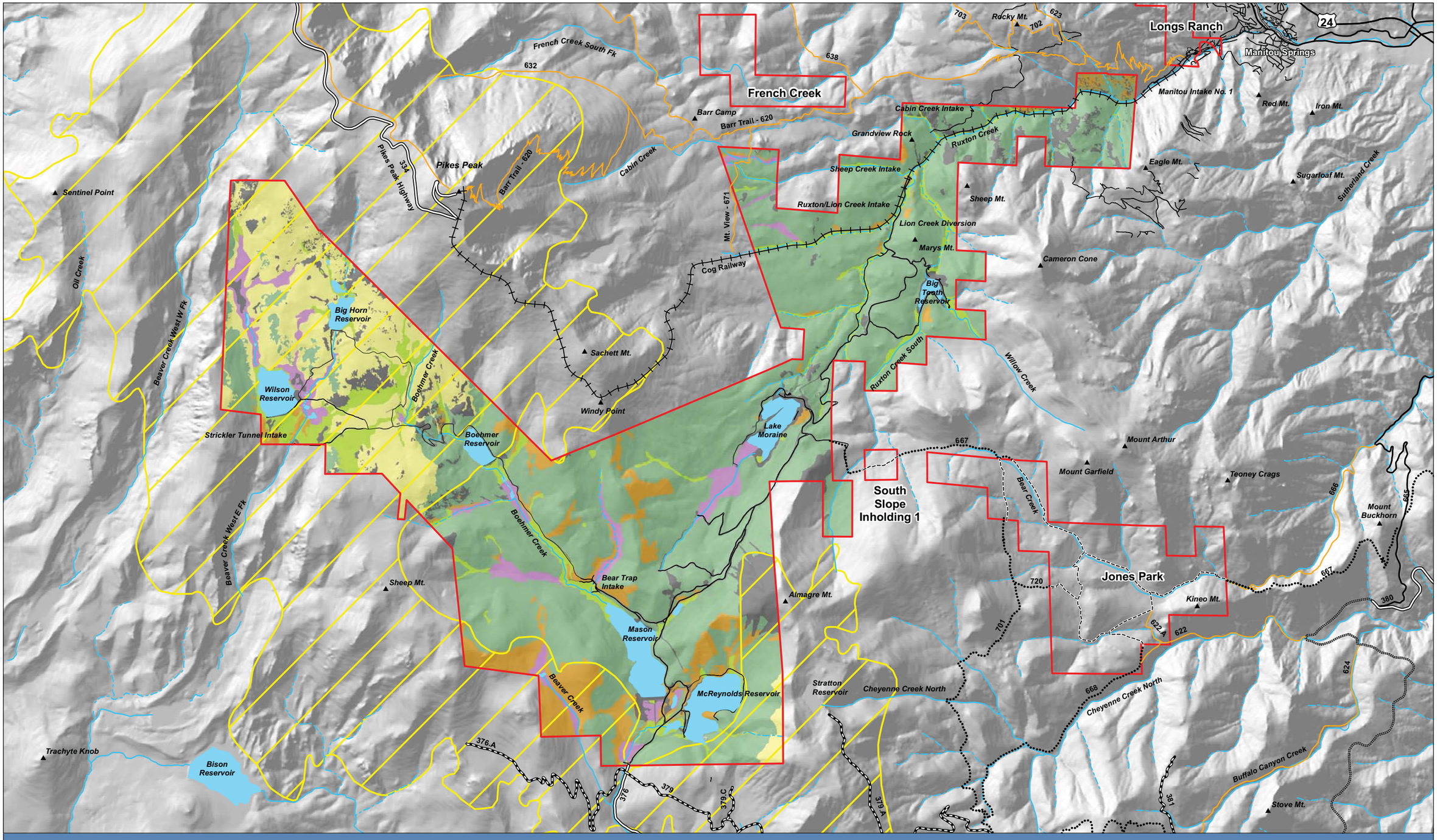
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Eagle Mt.
Sugarloaf Mt.
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French Creek
French Creek South Fk
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Barr Camp
Barr Trail - 620
Cabin Creek Intake
Grandview Rock
Ruxton Creek
Sheep Creek Intake
Ruxton/Lion Creek Intake
Lion Creek Diversion
Sheep Mt.
Marys Mt.
Cameron Cone
Big Tooth Reservoir
Mt. View - 671
Cog Railway
Pikes Peak
Pikes Peak Highway
334
Cabin Creek
Sentinel Point
Oil Creek
Beaver Creek West W Fk
Big Horn Reservoir
Wilson Reservoir
Strickler Tunnel Intake
Boehmer Creek
Boehmer Reservoir
Sachett Mt.
Windy Point
Lake Moraine
Ruxton Creek South
Willow Creek
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Mount Arthur
Mount Garfield
Teoney Crags
Mount Buckhorn
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South Slope Inholding 1
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Kineo Mt.
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Sheep Mt.
Bear Trap Intake
Mason Reservoir
Almagre Mt.
McReynolds Reservoir
Stratton Reservoir
Cheyenne Creek North
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Buffalo Canyon Creek
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Stove Mt.
Trachyte Knob
Bison Reservoir
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379.C
379.A
CSU Watershed Lands
Outstanding Biodiversity Significance (source: CNHP)
Perennial Stream
Intermittent Stream
Tundra
Grass/shrubland
Forested
Open Water
Fen Wetland
Riparian/Wetland
Non-vegetated
0
0.5
1 Miles
EDAW | AECOM
South Slope Biodiversity
Colorado Springs Utilities
Appendix B, Map 3

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Longs Ranch
Manitou Springs
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Rocky Mt.
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French Creek South Fk
French Creek
Barr Camp
Barr Trail - 620
Manitou Intake No. 1
Red Mt.
Iron Mt.
Cabin Creek Intake
Grandview Rock
Ruxton Creek
Pikes Peak Highway
334
Pikes Peak
Barr Trail - 620
Cabin Creek
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Eagle Mt.
Sugarloaf Mt.
Sutherland Creek
Mt. View - 671
Ruxton/Lion Creek Intake
Sheep Mt.
Lion Creek Diversion
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Cog Railway
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Big Tooth Reservoir
Beaver Creek West W Fk
Sachett Mt.
Ruxton Creek South
Willow Creek
Wilson Reservoir
Boehmer Creek
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South Slope Inholding 1
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Beaver Creek West W Fk
Boehmer Creek
Sheep Mt.
Bear Trap Intake
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Mason Reservoir
McReynolds Reservoir
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Cheyenne Creek North
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Beaver Creek
Trachyte Knob
Bison Reservoir
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381
Buffalo Canyon Creek
Stove Mt.

USFS Roads Open to All Vehicles
USFS Roads Open to Licensed Vehicles
USFS Special Vehicle Designation Route
Other Public/ Private Roads
USFS Non-Motorized Trail
USFS Motorcycle Trail
CSU Watershed Lands
Core Bighorn Sheep Lambing Area
Overall Bighorn Sheep Lambing Area
Core Bighorn Sheep Winter Habitat
Overall Bighorn Sheep Winter Habitat

0 0.5 1 Miles

EDAW | AECOM

South Slope Bighorn Sheep Habitat

Colorado Springs Utilities

Appendix B, Map 4

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Appendix C. Potential Impacts of New Trail Construction on Bighorn Sheep in the Pikes Peak Area of the Pike National Forest, USFS

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POTENTIAL IMPACTS OF NEW TRAIL CONSTRUCTION ON BIGHORN SHEEP IN THE PIKES PEAK AREA OF THE PIKE NATIONAL FOREST

A report prepared for the Pikes Peak Ranger District, U.S. Forest Service

24 DEC 2009

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INTRODUCTION

The Pikes Peak Area of the Pike National Forest is inhabited by a small herd of bighorn sheep (*Ovis canadensis*), the remnant of an historic population documented during early settlement times (Bear and Jones 1973). This area of the Pike National Forest lies in close proximity to Colorado Springs and thus experiences a high level of recreational use. Given the high level of recreational use occurring in this area, there are concerns that this population may be at risk from cumulative human disturbance.

The U.S. Forest Service classifies the bighorn sheep as a Region 2 Regional Forester Sensitive Species (U.S. Forest Service 2009). Designation as a sensitive species confers special protection, which includes a full analysis of effects prior to implementing projects. The Forest Service Manual (2670) states that, prior to project implementation a biological evaluation must be completed to determine potential effects on sensitive species. This document is not meant to serve as a biological evaluation; however, a full biological evaluation would be necessary should a project proposal be developed. The objectives of this analysis are 1) identify potential impacts to the Pikes Peak bighorn sheep herd that may result from new trail construction or designation of existing non-system routes on Forest Service land and 2) provide wildlife management recommendations to the Pikes Peak Ranger District to ensure the conservation and continued viability of the Pikes Peak bighorn sheep herd.

One of the more popular recreational activities in the area is hiking. Numerous trails are found within the Pikes Peak area, including the Ring the Peak Trail (Figure 1). Located near the City of Colorado Springs, the Ring the Peak Trail (formerly known as the Perimeter Loop Trail) is a collection of existing travel routes, such as trails, four-wheel drive roads, and paved roads that circumnavigate Pikes Peak. The trails cross federal, state, county, city, and private lands. The total length of the trail system is approximately 63 miles with 80% of the trails completed.

Within the past few years, Friends of the Peak have proposed completing the final portion of the Ring the Peak Trail. Friends of the Peak is a nonprofit organization dedicated to preserving, protecting, and restoring Pikes Peak. The uncompleted sections of trail are south and west of Pikes Peak and are located between Horsethief Park to Gillette and Gillette to Forest Service Road 376 (Figure 1; Portals 6, 7, and 8). Land ownership in the vicinity of the uncompleted trail section includes U.S. Forest Service, State of Colorado (Pikes Peak State Wildlife Area), Colorado Springs Utilities, and other private land. Although no proposal has been made for a location of the new trail section, connection of the trail between portals 6 and 8 could conceivably occur on National Forest Land.

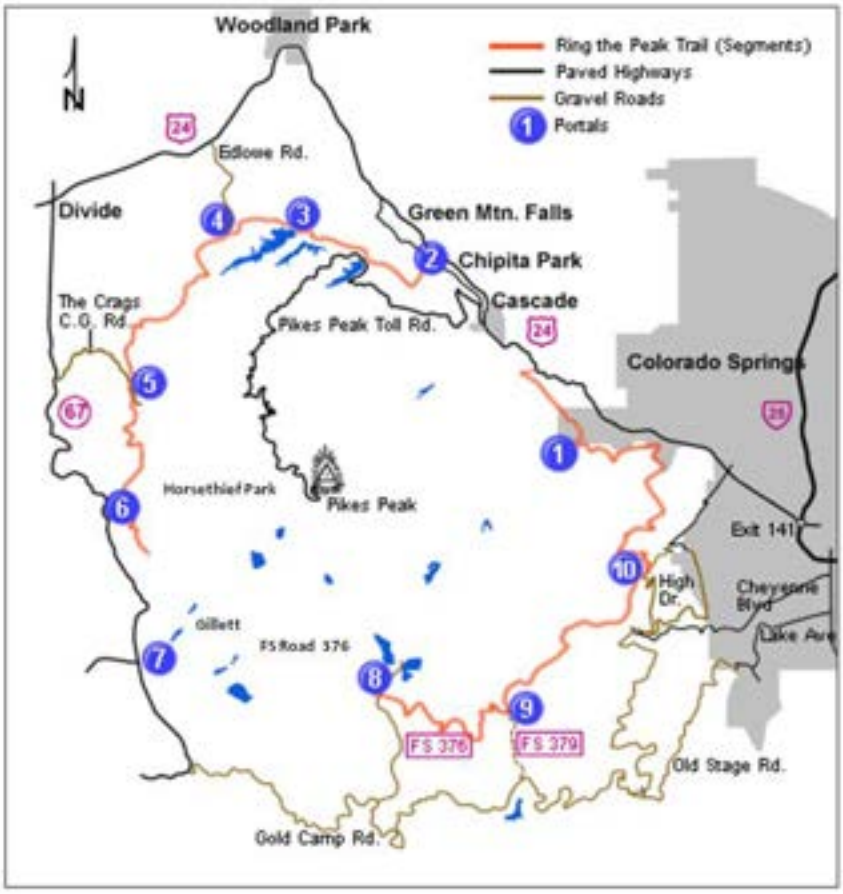

Figure 1. Map of the Ring the Peak Trail (http://www.fotp.com/ringthepeak/index.html).

In 1997, a cooperative planning process known as the Pikes Peak Multi-Use Plan (PPMUP) was initiated by Colorado Springs Utilities and the U.S. Forest Service with considerable public involvement. This plan offered a common vision and management philosophy for the future. The concept of The Perimeter Loop Trail, further mentioned as the Ring the Peak Trail (RTPT), received an overwhelming 94% public support as a high recreational value. The PPMUP further defines the RTPT as a multi-use system of connected routes that relies on existing roads and trails to complete the loop.

It is important to remember that the PPMUP was a vision, not a final decision, and that further analysis under the National Environmental Policy Act would be needed for various implementation phases. PPMUP states: "subsequent phases of planning and design should recognize that more detailed information is required to successfully develop desired uses without adverse impacts on critical natural resources and sensitive lands."

CURRENT STATUS OF PIKES PEAK BIGHORN SHEEP HERD

The following status summary (with minor additions) is from the Rocky Mountain Bighorn Sheep Technical Conservation Assessment (Beecham et al. 2007), published by the U.S. Forest Service.

Bighorn sheep inhabiting Pikes Peak and Dome Rock are functionally one sheep herd thought to consist of 275 to 375 sheep in the middle of the decade (Dreher 2005). Sheep range on Pikes Peak and Dome Rock was split into two management units by the Colorado Division of Wildlife in 1984 for hunting purposes. The Dome Rock Unit (GMU S-46) is located west of Pikes Peak and Horsethief Park in the vicinity of Dome Rock State Wildlife Area. The Pikes Peak Unit (S-6) is located east of highway 67 and north of the Gold Camp Road on Pikes Peak (Colorado Division of Wildlife 2009). Significant interchange has been documented by sightings of sheep marked on Dome Rock being observed on Pikes Peak. In addition, numerous marked Dome Rock sheep have been harvested on Pikes Peak. Although this analysis will center on the Pikes Peak Unit, movements and interactions between the two units should be considered when analyzing potential impacts of developed recreation.

Bear and Jones (1973) documented the historic distribution of the herd as all of the area on and surrounding Pikes Peak, the area to the west of Pikes Peak including the vicinity around Dome Rock on Fourmile Creek, and some ranges to the south of Pikes Peak. The current distribution of sheep does not differ from this historic account (Dreher 2005). The overall bighorn sheep range of the Pikes Peak Unit includes alpine areas above 10,000 ft. on and surrounding Pikes Peak.

Concentration areas for the Pikes Peak portion of the herd include Sheep Mountain, Sentinel Point, Bison Reservoir, the sheep viewing area on the Pikes Peak Highway, Bottomless Pit, East and West forks of Beaver Creek, and Sachett Mountain (Dreher 2005). Known lambing areas for sheep in the unit include Sentinel Point and the rugged area northeast of Bison Reservoir. Concentration areas in the Dome Rock Unit include Fourmile Creek, areas around Dome Rock, Cripple Creek Mountain Estates, and Lost Canyon. In the Dome Rock unit, lambing areas include Dome Rock and the surrounding rock formations. The specific migration corridor between Pikes Peak and Dome Rock is uncertain, but it is believed to exist along Oil Creek (Dreher 2005).

Disease, particularly *Pasteurella* pneumonia, is the primary management concern for the Pikes Peak herd. The first documented die-off of Pikes Peak sheep occurred during 1952-53, reducing the population from 300 to about 35 animals (Bear and Jones 1973 *in* Dreher 2005b). A herd of domestic sheep on private land adjacent to Pikes Peak was the likely cause (Bear and Jones 1973 *in* Dreher 2005b). The second Pikes Peak die-off, in the mid-1970's, reduced the herd by approximately 50 percent. Although no active domestic sheep allotments are on public land in

either the Pikes Peak or Dome Rock units, numerous landowners in the general vicinity run hobby flocks of sheep and goats. These domestic flocks pose a threat to bighorns in both units.

Rocky Mountain bighorn sheep prefer open habitat with good visibility in proximity to escape terrain to avoid predators. Advanced vegetative succession in the absence of fire probably has affected some bighorn sheep populations as maturing forests and shrublands increasingly restrict the availability of preferred ranges (Wakelyn 1987). The habitat quality in the Pikes Peak unit is generally good, but late successional stages characterize much of the habitat within the Dome Rock unit. This has resulted in reduced visibility and decreased amounts of forage, making much of the Dome Rock unit unusable to bighorns. Habitat manipulations that set conditions back to earlier successional stages would benefit bighorns in this unit.

There is little doubt that habitat loss and fragmentation by roads, recreation areas, residential developments, domestic sheep allotments, etc. has had and will continue to have major impacts on bighorn sheep populations. These impacts are often insidious and may manifest themselves through other limiting factors (George et al. 2009). Other management concerns within the Pikes Peak Unit include the recent large increase in recreational use, including off-highway vehicles, hiking, horseback riding, and domestic dogs frequenting sheep range.

Prior to 2007, the Colorado Division of Wildlife produced rough population estimates for the Pikes Peak sheep herd from one-day summer sheep counts conducted on Pikes Peak. Based on these counts, the CDOW estimated that there were 300-350 sheep on Pikes Peak from 2004-2006 (George et al. 2009). In December 2006, the CDOW initiated a mark-resight study to provide more precise population estimates for the Pikes Peak herd. The most recent population estimates for the Pikes Peak herd show a decline in abundance from 2007-2009 (Table 1; Stiver 2009). The mark-resight estimates suggest that numbers are much smaller than the 300-350 thought to be in the herd prior to 2007. The number of sheep observed on the mountain during one-day counts has also declined from 2004-2009 which also suggests that the herd has decreased in size.

Table 1. Colorado Division of Wildlife mark-resight population estimates for the Pike Peaks bighorn sheep population, Summers 2007- 2009. Ewe and ram estimates include 95% confidence intervals.

	Population Segment			
Year	Ewes (95% CI)	Rams (95% CI)	Lambs[b]	Total
2007	92 (83-103)	50 (43-59)	42	184
2008	85 (91-104)	42 (34-51)	36	163
2009[a]	60 (54-67)	32 (25-41)	14	106

[a]Preliminary Estimate

[b]Calculated based on ewe:lamb ratios

Aside from population estimates, another goal of the Colorado Division of Wildlife study is to "Examine sheep movements (i.e., range and distribution), lambing areas, and wintering areas using telemetry data gathered from radio-collared sheep." The Colorado Division of Wildlife is particularly interested in delineating important winter habitat and lambing habitat. These habitat types represent two critical periods for bighorn sheep. Lambing habitat is important because lambs are susceptible to predation and winter habitat is important because sheep are at a negative energy balance during winter (i.e., expending more calories than they consume; Stiver 2009).

Figures 2 and 3 depict winter habitat and lambing habitat for the Pikes Peak herd. Lambing habitat was generated from the GPS locations recorded between April and July in 2007, 2008, and 2009 for 32 radio-collared ewes. This time period encompasses the last trimester of pregnancy through the first month of life for lambs, when lambs are most vulnerable to predation. Winter habitat was generated from GPS locations gathered between December and February during the winters of 2006-7, 2007-8, and 2008-9 from 37 rams and ewes captured between 2006 and 2009 (Stiver 2009). Based upon these locations, winter habitat extends from north of Pikes Peak to south of the unfinished portion of the Ring the Peak Trail – Portals 7 and 8. Winter habitat also extends west to the unfinished trail sections between Portals 6 and 7. Similarly, lambing habitat extends south of Portals 7 and 8 and between Portals 6 and 7, but the area is smaller compared to winter habitat.

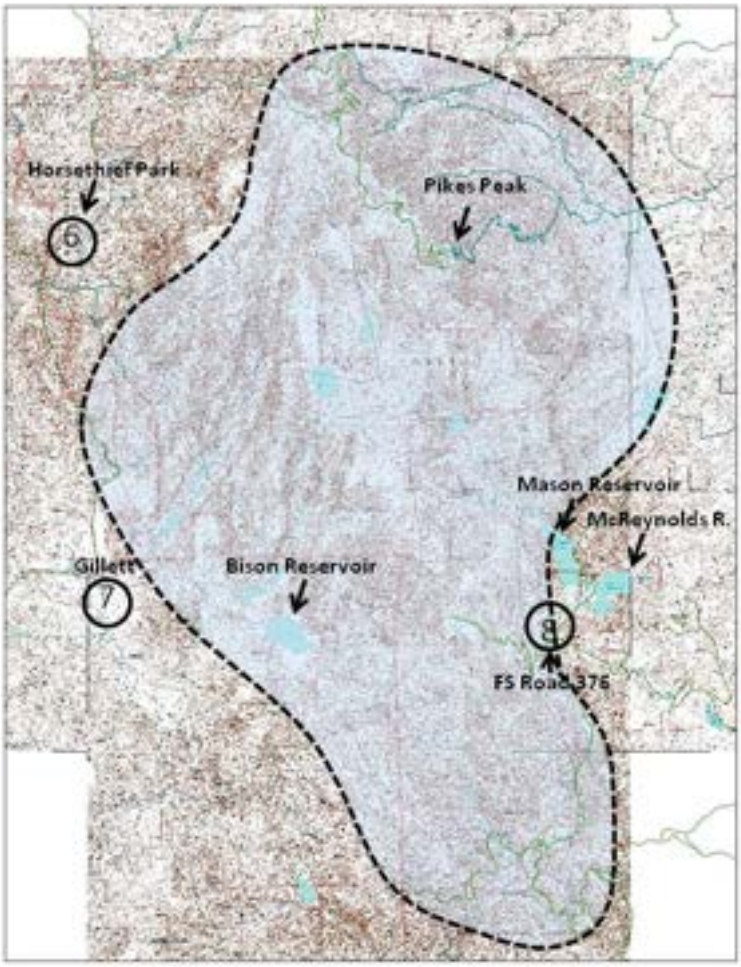

Figure 2. Winter habitat for Pikes Peak bighorn sheep herd (from Colorado Division of Wildlife). Bighorn sheep locations from December 2006-September 2009 were used to derive the winter habitats shown on the map.

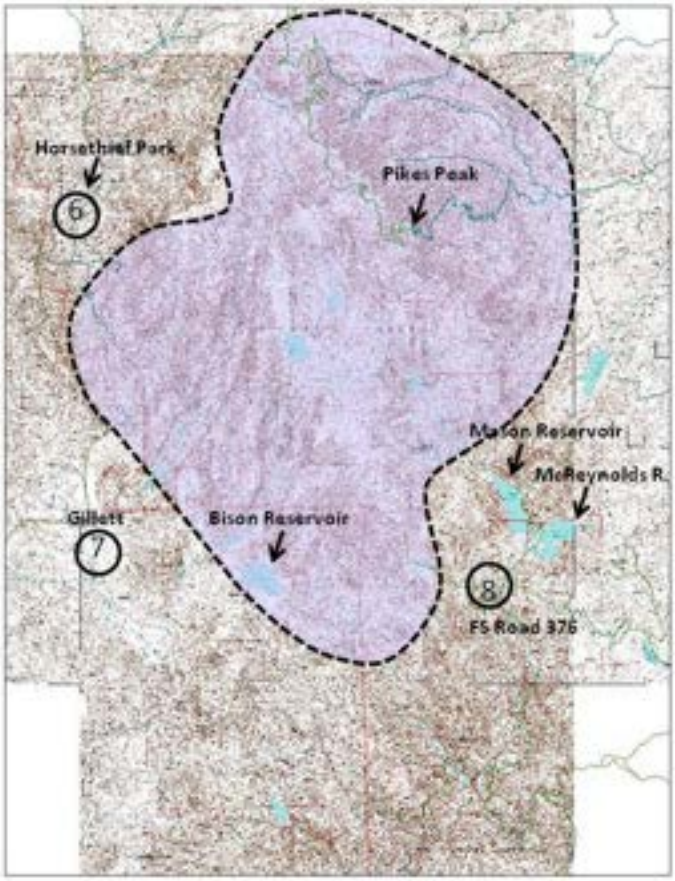

Figure 3. Lambing habitat for Pikes Peak bighorn sheep herd (from Colorado Division of Wildlife). Bighorn sheep locations from December 2006-September 2009 were used to derive the lambing habitats shown on the map.

LITERATURE REVIEW

Recreation and Bighorn Sheep Interactions

- Bighorn sheep often appear to habituate fairly well to human activity. However, under some circumstances it is possible that bighorns may be adversely affected by chronic exposure to anthropogenic stressors on the landscape (e.g., roads, reservoirs, mines, towns, wildfire suppression, habitat conversion for domestic livestock, etc; George et al. 2009). These and other stress-induced responses might increase susceptibility to diseases such as pasteurellosis in individual bighorns and thus could contribute to the onset of epidemics in some situations (Spraker et al. 1984, Kraabel and Miller 1997).
- Wild sheep have habituated to human activity in many areas where the activity is somewhat predictable, temporally and spatially. However, human disturbance and human presence near lambing sites may be detrimental to bighorns in some locales (Graham 1980; MacArthur et al. 1982; Etchberger et al. 1989).

- Several studies have found that sheep may habituate to predictable human activity (Wehausen et al. 1977; Kovach 1979), including hiking (Hicks and Elder 1979; Hamilton et al. 1982; and Holl and Bleich 1987). However, even in otherwise optimum habitat, sheep may abandon an area when their tolerance to disturbance is exceeded (Papouchis et al. 2001).
- MacArthur et al. (1982) reported "elevated heart rates and flight among mountain sheep approached by humans. Withdrawal distances and elevated heart rates were greatest when hikers approached from over a ridge or when they were accompanied by dogs. Reactions to hikers were greater than reactions to road traffic, helicopters, or fixed-wing aircraft."
- Cumulative effects of human disturbance have been implicated in the abandonment of bighorn sheep habitat (and extirpation of the population) in the Pusch Ridge Wilderness, Arizona (Etchberger et al. 1989), the San Gabriel Mountains, California (Graham 1971), and in some areas of southeastern Utah (King 1986).
- Human activities on bighorn sheep range are the most widespread threat to bighorn sheep (Boyd et al. 1986). These activities reduce the number of bighorn sheep by decreasing habitat, causing bighorn sheep to reduce or terminate their use of prime habitat, stop migration, or split from large herds into smaller herds (Boyd et al. 1986; Van Dyke et al. 1983). Human activities responsible for declines in sheep use of an area include hiking and backpacking and recreational development. When bighorn sheep are pushed from prime to marginal habitat, mortality usually increases and productivity decreases.
- Papouchis et al. (2001) reported on the responses of desert bighorn sheep to human recreation in Canyonlands National Park, Utah. The study compared behavioral responses, distances moved, and duration of responses to vehicles, mountain bikers, and humans on foot. Hikers caused the most severe responses in desert bighorn sheep (animals fled in 61% of encounters), followed by vehicles (17%), and mountain bikers (6%). The greater flight response from hikers was apparently the result of hikers being in unpredictable locations and directly approaching sheep.
- A study by Thompson et al. 2007 in Joshua Tree National Park, California compared habitat use and movement of desert bighorn sheep during periods of low and high recreational use. Ewes were found on steeper slopes, bedded farther from trails, and traveled greater distances during periods of high recreational use. The study results suggest that bighorn ewes are temporarily displaced from habitat during periods of higher human recreation use. Although some bighorn may habituate to human presence (Papaouchis et al. 2001), even bighorn that demonstrate no outward response to human presence may still be under physiological stress (MacArthur et al. 1979; Deforge 1981).
- Significant loss of habitat can result in a reduction in the population's carrying capacity (Light and Weaver 1973 *in* Thompson et al. 2007). Additionally, energetic losses due to flight, loss of foraging time, and an increase in cortisol levels can cause deleterious effects on physiology, behavior and the accumulation of fat reserves, all factors which can cause a reduction in survival and reproductive success of individuals,
- Disturbance by visitors in Saguaro National Park, Arizona was responsible for increased desert bighorn sheep mortality (Bath and Enck 2003).
- Bighorn sheep "have a high degree of philopatry, or site fidelity, which ties them closely to areas that are familiar and leads to slow rates of expansion. Such fidelity renders them vulnerable to increased stress level when disturbance to their range occurs" (Fitzgerald et al. 1994).

- "To reduce recreation-related displacement, managers should control the proximity, frequency, duration, and seasonal timing of disturbances, especially for species at high risk…managers may reduce displacement more effectively by concentrating recreational activities in busy, heavily altered sites, while not permitting expansion into previously undisturbed or mildly impacted areas" (Knight and Gutzwiller 1995).

Examples of Existing Management Recommendations

The Pike-San Isabel National Forest Plan (1984) has no standards and guidelines specifically for bighorn sheep. In the absence of specific management standards and guidelines in the Forest Plan, a review of other forest plans and analysis include the following conservation measures:

- The Dakota Prairie National Grassland Plan addresses protection of bighorn sheep habitat: 1) *Standard*: Resolve conflicts in favor of maintaining bighorn sheep habitat; 2) *Guideline*: Prohibit construction of new travel routes across bighorn sheep habitat; and 3) *Standard*: Protect bighorn sheep lambing areas from activities and land use disturbances if adverse impacts to the survival or reproduction are likely.
- The Arapaho & Roosevelt National Forest plan guidelines state "Restrict new developments, including new facilities, roads and trails, and concentrations of humans, within a one-mile sight distance of bighorn sheep lambing and mountain goat kidding areas if they would adversely impact lambing or kidding (1997 Revision of the Land and Resource Management Plan).
- An Environmental Assessment for new trail construction on the Dakota Prairie National Grasslands (Maah Daah Hey II Trail Extension) addressed concerns for bighorn sheep. The preferred alternative mitigated impacts to bighorn sheep by locating trails away from key bighorn sheep habitats (e.g., winter and lambing habitat). The closest trail location was 0.8 mile from a key bighorn sheep area.
- Management needs for the Rocky Mountain population: identification of seasonal ranges and migration corridors and identification of factors limiting range expansion; improvement of ranges by vegetation manipulation (burning, clearing); **protection of ranges from human encroachment**; and avoiding contact between bighorn and domestic livestock (NatureServe 2009).
- The key to management of bighorn sheep is habitat protection, maintenance, and enhancement. In addition, careful mapping of existing and potential bighorn habitats is essential in order to integrate management strategies with other land use interests (Schmidt and Gilbert 1978).

Population Viability – Minimum Population Size

- Singer et al. (2001) used empirical models to predict the effects of disease and habitat availability on the viability of bighorn sheep populations. Modeling suggested that herds of less than 250 individuals were more prone to extinction than large herds.
- Many sheep herds in the Rocky Mountain Region are vulnerable because they consist of small numbers of less than 100 animals. Many biologists consider herds with less than 200 at risk due to extrinsic factors (Beecham et al. 2007).

SUMMARY OF AVAILABLE SCIENCE – RECREATION AND BIGHORN SHEEP INTERACTIONS

Although there is evidence that bighorn sheep can become habituated to humans, the majority of available evidence indicates that bighorn sheep are negatively impacted by human activity. Even if sheep do become habituated to humans, the end result is less than positive. Close association with humans likely leads to increased predation and stress as well as a higher risk of disease.

Numerous studies indicate that bighorn sheep are susceptible to the impacts of recreational activities like hiking. As disturbance increases sheep may abandon even areas of good habitat and may cease to move through historical migration routes. These impacts are especially critical for the Pikes Peak herd, because of the limited amount of quality habitat available and because of the known migration between the Dome Rock and Pikes Peak areas. As stated by the Colorado Division of Wildlife, winter habitat and lambing habitat are critical for bighorn sheep. Any reduction in these habitat types will result in a lower carrying capacity.

It could be argued that recreational activities, such as hiking, are minor in comparison to predation, disease, urban encroachment, development on private land, and other factors. However, this would discount the cumulative effect of disturbance on a herd that may already be at risk due to other factors. For example, a trail that cuts off a migration route or forces sheep to abandon a lambing area may have a significant cumulative effect on an already weakened population. **Given the recent decline in abundance of the Pikes Peak herd, it is especially important to weigh the cumulative effects of proposed actions with past, present, and future actions that have impacted or may impact bighorn sheep.**

It is interesting to note that within the Forest Service, land management plans differ with respect to bighorn sheep. In older plans, like the Pike & San Isabel National Forest Plan (1984), guidelines are less specific. Conversely, in more recent management plans, guidelines for protection of sheep and their habitat are more specific. The best example comes from the Dakota Prairie National Grassland, where sheep-human conflicts are resolved in favor of sheep and new trail development is prohibited across sheep habitat.

Wildlife management and recreational management are interdependent. Important recreational activities like hunting, fishing, wildlife viewing, and photography rely upon recreational improvements and facilities (e.g., roads, trails, and campgrounds). The key is to balance recreational activity with the needs of wildlife to ensure the preservation of sensitive species like bighorn sheep.

MANAGEMENT RECOMMENDATIONS – RECREATION AND BIGHORN SHEEP INTERACTIONS

Fish and wildlife populations in the State of Colorado are managed by Colorado Division of Wildlife, while habitat is managed by the Forest Service and other land-management agencies. Given the separate management responsibilities it is critical that state and federal agencies work closely to protect and conserve habitat for rare and sensitive fish and wildlife species. As a land

management agency, the Forest Service solicits input from expert wildlife managers and researchers from the Colorado Division of Wildlife to determine potential effects on wildlife. The Forest should solicit and incorporate comments and concerns provided by Colorado Division of Wildlife when a formal proposal is developed.

Within the Colorado Bighorn Sheep Management Plan (George et al. 2009), the Division defines management goals and strategies necessary for conservation of bighorn sheep. One goal in particular is pertinent to recreational impacts:

"Within the scope of the Division's authority to comment on or manage roads or trails, the design and development of new roads and trails, improvement of existing roads and trails, and use of all-terrain vehicles should not expose bighorns to excessive activity of people and domestic animals (e.g., dogs and pack goats). Often, bighorn sheep will move away from otherwise suitable habitat due to increased human use. The Division should work closely with land managers while developing Travel Management Plans to ensure adequate human access is maintained while providing for secure undisturbed areas for all wildlife and resource protection. On some trails, domestic dogs and pack goats should be prohibited."

Aside from trail management, work with Colorado Division of Wildlife to determine areas in the vicinity of Pikes Peak that would benefit from prescribed burning. Much of the area is in the late stage of succession and would generally benefit from prescribed burning.

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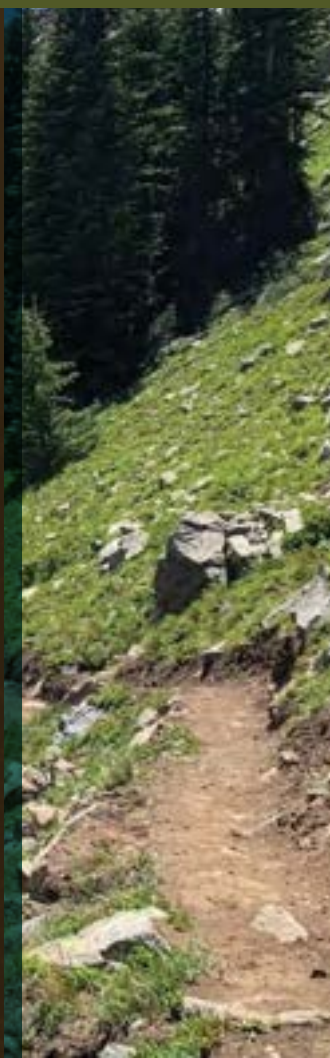
Trail Maintenance and Construction Notebook



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Trail Maintenance and Construction Notebook

2025 Edition

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1

INTRODUCTION

1. INTRODUCTION

The U.S. Department of Agriculture (USDA), Forest Service manages the largest trail network in the world, with over 164,000 miles of trails. Continued access to these well-loved and much-needed trails depends on the shared stewardship of agency employees, Tribes, partners, volunteers, contractors, permit holders, communities, and everyone who loves trails.

This notebook is a practical reference for trail maintenance and construction written in an easy-to-understand fashion, with a focus on sustainable natural surface trails. It is not a policy document, and it doesn't cover everything a trail professional needs to know. After reading this notebook, the authors encourage you to learn more and seek knowledge from other people and resources. Attend a trail skills training, invite a trail professional from another area, or explore the documents and websites listed in the "Resources" chapter of this notebook.

Most importantly: get out there, be safe, and do good work.

2025 Edition

This notebook replaces the 2007 version of the "Trail Construction and Maintenance Notebook." The new title reflects where trail workers spend most of their time and resources—maintaining trails. This edition highlights the skill and experience it takes to construct and maintain trails,

emphasizes collaborative trail planning, and underscores constructing trails with long-term maintenance in mind.

The notebook features eight chapters: **1. Introduction**, **2. Basic Trail Concepts**, **3. Maintenance**, **4. Structures**, **5. Signs**, **6. Construction and Decommissioning**, **7. Tools and Equipment**, and **8. Resources**. The "Maintenance" chapter describes general maintenance practices. Refer to the "Structures" chapter for maintenance tips about specific structures. The "Tread Construction" section in chapter 6 describes building new trail. The "Resources" chapter provides references and web addresses separated by topic.

Welcome to the trail community! The authors hope this notebook helps you care for the trails you love.

This notebook also draws on a few new resources.

High-resolution photos. Updated photos. Visit the online glossary on the trail terms web page to download high-resolution color photos.

Diagrams and 3D models. Diagrams based on engineer-approved Forest Service standard trail drawings. These are teaching aids and shouldn't be used for construction specifications. Some diagrams are also available as 3D models that can be viewed online (fig. 1–1). Visit the Forest Service Plans for Trail and Trail Bridge Structures web page or scan the QR code to access the 3D models and the full list of engineer-approved Forest Service standard drawings of trail and trail bridge structures.

Diagrams available as 3D models have the word "3D" and a QR code near the image.

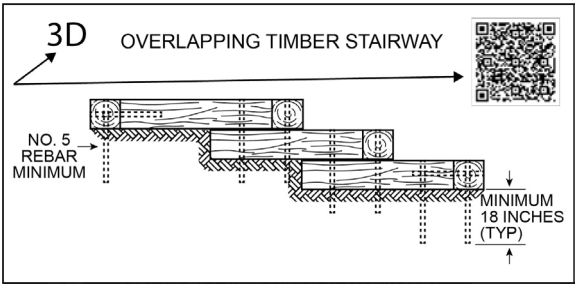

Figure 1–1. Some diagrams have a 3D model available; scan the QR code to access these models. More detailed diagrams of some structures and other resources are on the Plans for Trail and Trail Bridge Structures web page.

This version of the notebook promotes understanding and problem-solving. Understanding why things are done a certain way is as important as doing them a certain way. If you know why something is happening, you'll figure out how to solve the problem. Soak up the core concepts. Be curious and don't be afraid to fail. Experiment and keep track of the results. Add new techniques and tactics to your bag of tricks. Get dirty and HAVE FUN!

Readers are encouraged to consult Forest Service directives and the trail program website. A companion publication to this notebook, "Trail Structures for Wet, Unstable, and Sensitive Areas," provides an overview of techniques for building and maintaining trails in saturated soils. These publications are available on the Forest Service's national publications page.

Before Starting Work

Before starting any new trail project, consider how the project fits with current priorities and line officer support. Project planning should include the scope of the project, how to determine if it's successful, what environmental approvals you'll need, needed resources, and the timeline for completion.

In the Forest Service, a "line officer" is someone with decision-making authority delegated from the Chief. Local trail managers typically work with district rangers, who are line officers.

Sample Project Planning Checklist

- ☐ Consider environmental, social, and economic sustainability in trail planning. Refer to chapter 2.
- ☐ Does the proposed route support current priorities for the trail program and align with applicable land management plans (forest plan, wilderness management plan, etc.)?
- ☐ Will the proposed alignment be physically sustainable considering local soils, hydrology, and terrain? Will it affect historic sites or sensitive habitat?
- ☐ How does the proposed route fit into the landscape and larger trail system, which may include nearby trails managed by other entities?
- ☐ Does the proposed route satisfy a need for multiple user groups? Consider seeking public input and community engagement on project ideas and engaging nontraditional groups for new perspectives and to attract new trail visitors and potential new trail stewards.
- ☐ How will the new construction and long-term maintenance be funded? Are grants and other funding sources reliable?
- ☐ Considering the current workload, can the current or future arrangement of employees, partners, and volunteers conduct annual maintenance on the proposed route?

All trails aren't perfect for all locations. Just because a location appears perfect for a trail doesn't mean a trail is appropriate in that location (i.e., there may be unseen cultural and natural resources). Involve line officers and environmental and cultural specialists before starting work.

Every action that Federal employees, partners, and volunteers take is guided by laws and policies. Before starting work, consider the impacts to the environment and compliance with any Federal, State, and local laws and policies.

Applicable Laws

The National Environmental Policy Act (NEPA) requires Federal agencies to assess the environmental impacts of every action they take and disclose the decision-making process to the public. Forest Service procedures for implementing NEPA are in Title 36 of the Code of Federal Regulations (CFR) Part 220. Line officers must approve and sign an environmental study document for some activities, such as decommissioning routes and constructing new trail. The NEPA "decision document" usually describes how, where, and when work will occur and any required mitigation measures. The local line officer may decide that some actions are excluded from documentation in an environmental assessment or environmental impact statement because they don't significantly impact the environment (categories of action excluded from environmental documentation, a.k.a. "categorical

exclusions" are listed in FSH 1905.15, Section 32 – National Environmental Policy Handbook).

The following activities typically don't require a NEPA decision document or project file:

- Grading, cleaning, and maintaining drainage features.
- Grubbing, brushing, and removing downed trees.
- Repairing or replacing existing structures, including steps, retaining walls, puncheons, or bog bridges.
- Installing or replacing reassurance markers or informational signs (e.g., along a trail or at trail junctions, at trailheads and parking areas, or at overnight sites or bridges).
- Resurfacing to original condition, including native material cleanup, gravel replacement, or repaving.

A list of common trail maintenance and construction activities and associated required environmental analysis is available on the Trail Best Practices page of the National Trail Program SharePoint site *(Forest Service internal link)*. Conditions and resource needs vary, so consult the line officer or trail manager before starting work.

In addition to NEPA, other laws and regulations may apply such as the Clean Water Act, National Historic Preservation Act, Endangered Species Act, National Trail System Act, the Forest Service's Travel Management Rule. Working near water also requires special considerations to prevent disturbing sensitive riparian areas or adding sediment to the water source (a riparian area is the zone between the water body and dry land).

During trail maintenance and construction, the local trail manager must comply with all applicable laws and regulations and any mitigation measures described in the associated NEPA decision document.

Working With Partners and Volunteers

In many districts, partners (a.k.a. collaborators) and volunteers contribute substantially to trail work. Engaging partners and volunteers increases the capacity of trail managers to accomplish trail work and promotes public land stewardship. While some trail work requires years of hands-on experience and mentoring, other opportunities—some that don't require swinging tools or carrying heavy packs—engage people of any skill level and interest. The Forest Service invites people of all abilities to assist with gathering trail information, conducting trail inspections, sponsoring trainings, coordinating an event or project, or other less-physical tasks. Whatever task is assigned, partners and volunteers working on trails ideally have the experience or training in the type of trail work being done and the tools being used, are able to follow safe practices, and have approval of the agency trail manager.

Partners and volunteers working on National Forest System lands also need a written agreement signed by the local line officer. Partners typically work under a mutual benefit agreement. Individual and group volunteers work under a volunteer agreement, which provides workers'

compensation, tort liability coverage, and coverage for personal property damage or loss. Visit the Forest Service's Partnership Resource Center website for more details.

Partners and volunteers can only work under formal agreement and authorization from the Forest Service. Working independently might cause irreparable cultural or natural resource damage, lessen future recreation access for everyone, and have legal ramifications.

Safety

Personal safety is paramount in trail work. Safe workers demonstrate use of necessary personal protective equipment (PPE), adhere to site and environmental safety precautions, maintain situational awareness, and know what to do in an emergency. Seasoned trail workers will tell you, "nothing we do today is worth being injured for" and "safety is everyone's priority." Consult the Health and Safety Code Handbook (FSH 6709.11). Chapter 20, "Work Projects and Activities," and chapter 50, "Employee Safety, Security, and Health" are particularly important.

Project Risk Assessment and Safety Briefing

Each project or task requires preparing a risk assessment. Three methods are common in the Forest Service: the risk assessment code (RAC) matrix, job hazard analysis (JHA), and green-amber-red (GAR) assessment tool (FSM 6710). Trail managers and work leaders are responsible for

conducting or delegating a project risk assessment. The local line officer must approve the risk assessment for the particular task on an annual basis.

Review and discuss the risk assessment document with everyone working on the project before the work begins, when changing work sites, or if conditions change. The discussion should be documented in a tailgate safety form (FSH 6719.8 – Exhibit 06) and include:

- Itinerary (planned route of travel, destination, estimated time of departure/arrival)
- Names of crew members
- Forecasted weather conditions
- Work hazards and abatement actions (including working with specialized equipment and environmental hazards, such as lightning)
- Communication plan (check-in/check-out procedures and crew communication)
- Emergency evacuation plan (refer to the example medical incident report in chapter 8)

It is good practice to hold an after-action review (AAR) at the end of every shift. Example AAR discussion questions are on the back cover of this notebook.

Safety Equipment

A minimum set of PPE is required for all trail work (FSH 6709.11, chapter 70):

- **Forest Service–approved hardhat or helmet** that meets the American National Standards Institute standards (ANSI Z89.1). The line officer can also approve hardhats or helmets that are demonstrated to be at least as effective as the approved head protection.
- **Eye protection** with side protection that meets ANSI Z871.1 for any type of sawing or rock work.
- **Long pants and long-sleeved shirts** for most situations to protect from cuts and scrapes, insects, and sunburn. Short-sleeved shirts may be used based on the risk assessment.
- **Gloves** that protect against severe cuts, abrasions, and punctures.
- **Footwear** with nonskid outsoles that provide ankle support.
- **Other task-dependent safety items:**
  - Hearing protection when working near power equipment (louder than a vacuum cleaner or greater than 85 dB).
  - Dust masks for some types of rock work and in extremely dusty conditions.
  - Cut-resistant or leather laced boots when using a chainsaw or crosscut saw.

- Chaps or cut-resistant leg protection when using a chainsaw or crosscut saw that meets the requirements of Forest Service 6170–4 or ASTM F-1897 (current version). Chaps must overlap boots at least 2 inches.

Other essential items

- **Personal items** such as foul-weather layers, hat, water, snacks, sunscreen, sunglasses, insect repellent, lip moisturizer, headlamp or flashlight with batteries, and personal medications.
- **Communication devices** such as a radio, cell phone, personal locating beacon—or all three.
- **First aid kit** that includes standard first aid supplies and bloodborne pathogen protective equipment (rubber gloves, face masks, eye protection, and CPR clear-mouth barriers).
- **Mission-essential gear** (not necessarily safety related but will make you more effective) such as trail tools, clinometer, map, compass, GPS unit, flagging, tape measure, notepad, pen, permanent marker, and this notebook.

Don't start the job unless you are properly equipped!

Now that you have authorization and you and your crew are trained and properly equipped, how do you decide where to start?

Project Prioritization

Often the amount of trail work exceeds the capacity of people or time available to do it. Setting priorities ensures that the most critical and impactful work gets done first. Give priority to maintenance work on popular trails that are creating unsafe conditions, and then address erosion or other impacts on approved or user-created routes that are damaging adjacent natural or cultural resources. Forest Service policy does not allow improvements or maintenance to unauthorized user-created routes. Consider the existing maintenance backlog and long-term maintenance needs before adding new trails and when accepting new trail proposals from the public or partners.

The national quality standards for trails (FSH 2309.18 chapter 10) and the trail management objective (TMO) for each trail will help you identify departures from the standards and what maintenance is needed. Refer to the "Management Objectives" section in chapter 2 of this notebook for more information about national quality standards and TMOs.

Also consider the level of use, trail development class, public safety, resource protection, and crew capacity when setting priorities for trail maintenance. Accomplishing small, specific tasks in the proper manner can be more impactful than completing a lot of marginal-quality work.

2

BASIC TRAIL CONCEPTS

2. BASIC TRAIL CONCEPTS

Trail management in the Forest Service means building and maintaining trails that support the agency's mission. Familiarity with a few basic trail concepts helps trail managers think critically about and make decisions regarding trails and trail systems. These basic concepts also give trail managers a common language that describes trails across the system.

Sustainability

Trail sustainability is based on three overlapping concepts: environmental, social, and economic sustainability. All three are important to identify a fully sustainable trail, both individually and as part of the trail network. A sustainable trail is planned, designed, constructed, managed, and maintained in a way that doesn't negatively impact the adjacent natural and cultural resources, meets trail visitor expectations, and is affordable, now and into the future. Sustainable trail construction and maintenance reduces long-term costs, while still delivering high-quality experiences to the public.

Environmental sustainability. Avoids or minimizes impacts to natural and cultural resources. The trail tread and infrastructure can physically withstand the expected effects of human and natural forces.

Social sustainability. Trail users and the community like the trail, use it, and support it.

Economic sustainability. Trained workers and sufficient funds are available to construct, maintain, and repair the trail.

Many National Forest System trails, as well as many user-created routes, are not sustainable in their current alignment (fig. 2–1). Many of these trails, often called "legacy trails," were once game trails, paths between villages and hunting grounds, or routes to access minerals and timber and were not designed or constructed with sustainable principles in mind. Legacy trails suffer from overly steep grades, poor alignment on the landscape, and are difficult to manage. They can also be causing substantial soil loss and trail widening that can lead to damage to natural and cultural resources, poor user experiences, and increasing maintenance frequency and costs. Some may have been incorporated into the forest transportation system as official routes without environmental studies and, in many cases, are not being used for their intended purpose.

Trail managers continue to deal with legacy trails for a variety of reasons—lack of staff to complete an environmental evaluation, lack of resources to accomplish

a reroute, or the fact that the legacy trail is well-loved by the public. At some point though, trail managers should ask themselves if the cost of continuing to maintain an unsustainable trail exceeds the effort and cost to plan and implement a reroute.

Figure 2–1. The deeply rutted and abandoned trail on the left (solid line) was built without physical sustainability principles in mind. The trail on the right (dotted line) is nearby and is well-located on a hillside at an average grade appropriate for the prevailing hillside slope and with frequent grade reversals. Cibola National Forest, New Mexico. USDA photo by Kerry Wood.

Physical Sustainability

Physical sustainability is a subset of environmental sustainability. This notebook focuses mainly on physical sustainability concepts. The alignment of the trail and location on the landscape, as well as the prevailing soil type and the effect on surrounding natural resources, determine

if a trail or trail segment is physically sustainable. The way the trail and trail features are designed determines how the trail will hold up under the impacts of users and anticipated extreme weather events and natural disasters. The most physically sustainable trails are constructed without needing trail structures, such as waterbars, steps, retaining walls, or tread armoring (fig. 2–2).

Figure 2–2. A physically sustainable trail doesn't depend on building drainage structures to drain water off the tread and resist erosion. It is aligned along the elevation contour with an undulating pattern of crests and dips, called grade reversals. Pike-San Isabel National Forests, Colorado. USDA photo by Dani Cook.

Characteristics of a Physically Sustainable Trail

- Requires only light seasonal maintenance.
- Has moderate trail grades less than 7 percent, is routed across sloping terrain, and, where soils and local rainfall patterns allow, may have short steeper segments with up to a 15–percent grade.
- Located on stable soils that are not easily erodible and with features that can withstand use with minimal erosion or damage to the trail tread. Designed to anticipate the effects of the type of severe weather events, wildfires, and other natural disasters most likely to occur in a given area.
- Is "hydrologically invisible" on the landscape. In most cases, the trail follows the contour of the hillside and does not disrupt the flow of water down the hillside or has reversals in grade (a.k.a. undulation) that forces water to drain off the tread without constructed drainage structures.

You are attaining physical sustainability where you can:
Keep water from running down the trail.
Keep tread material well-drained and on the trail.

Water Flow

Water has the power to shape landscapes by moving soil. Improperly managed water can incise tread, remove vegetation, destroy habitat, and deposit sediment into waterways. Water volume, velocity, and dispersion or concentration influence erosion potential.

Figure 2–3. Water and gravity join forces to erode a physically unsustainable trail. Los Padres National Forest, California. USDA photo by Scott Johnson.

Volume measures the amount of water at any given time. The right amount of water increases soil moisture and helps soil particles stick together, making trail erosion less likely. Too much or too little water can make a trail dusty or muddy. Dusty or muddy trails are vulnerable to soil displacement from water, wind, and use, along with other negative impacts.

Velocity measures the speed at which water moves. Water with low velocity can enter and exit the trail without eroding soil or pooling. The faster the water moves, the more the erosion potential. Water with no velocity (or standing water) can make a trail muddy and vulnerable to use-caused soil displacement.

Dispersed flow, or "sheet flow," describes the way water is dispersed down a hillside without being concentrated into channels. Sheet flow reduces the erosion potential of water (fig. 2–4). Physically sustainable trails are designed so they don't capture and concentrate sheet flow coming down the hillside (fig. 2–5).

Concentrated flow occurs when sheet flow is captured and concentrated on a trail that has become rutted or incised. In general, trail managers design trails to avoid concentrated flow because it increases water volume and velocity, making erosion more likely (fig. 2–6). Concentrated flow is appropriate in limited situations, such as the inside ditch of a switchback, a seep(s) (or small spring) in the backslope, or a culvert.

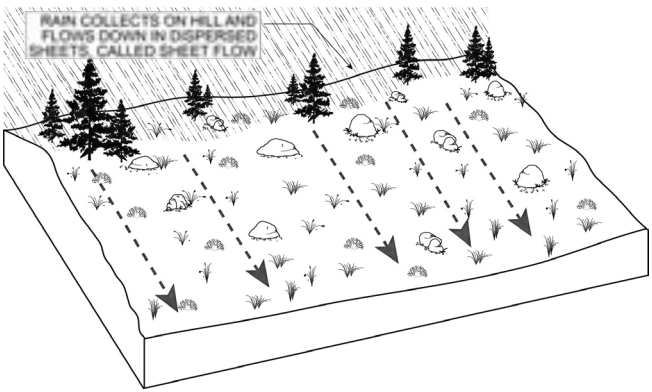

Figure 2–4. Sheet flow disperses across the slope when the soil is saturated.

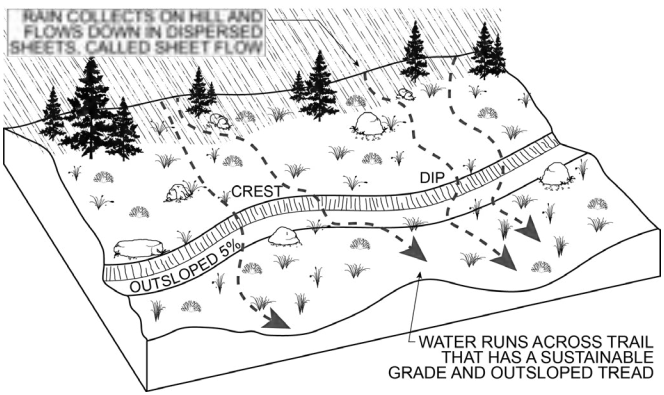

Figure 2–5. Grade reversals and outsloped tread are design elements of a rolling contour trail that promotes water "sheeting" across the trail. Sheet flow prevents water from being channeled down the trail where it will cause erosion.

Figure 2–6. Water has concentrated along the berm, causing erosion. Cibola National Forest, New Mexico. USDA photo by Kerry Wood.

Designing trail and trail structures that limit the time the water is on the tread is key to physical sustainability. More water carries more soil. Faster water carries even more soil. More soil loss and channeling leads to more and faster water that begins a cycle of increasing soil loss. The point is to keep water from running down the trail.

Soil

Terra trails are built on mineral soil. Most soils are overlain by an organic layer of twigs, leaves, and grass (a.k.a. duff) that has to be removed to uncover the mineral soil. Mineral soils are mixes of silt, sand, and clay. The percentages of the mineral material determine how a trail drains water and how it holds up under use. The mix greatly affects how trails are designed, maintained, and managed.

Protecting soil against erosion is critical in trail building. Since amending soil is impractical on a large scale, you're stuck with the soil you have. It's best to locate or relocate trails on stable soils that drain water well and hold up under use.

Soil types vary greatly from location to location. If you're not sure what soil exists in a certain area, you can ask a soil scientist or an experienced local trail builder and learn how to field identify different types of soils. The USDA Natural Resources Conservation Service web soil survey is a good source of information about soils common in your area; your local county cooperative extension service office can also provide helpful information.

Table 2–1. Soil types and suitability for trail work

Soil type	Feel or "texture"	Tips for trail work
Sandy	Grainy	Avoid in steep grades because the sand particles don't bind well together.
Silty	Floury	Avoid in low-lying areas that do not dry out as quickly.
Clay	Smooth	Avoid in low-lying areas that do not dry out as quickly.
Loam	Soft with some graininess	Best for trail work. Drains well while holding its structure.

Sandy soils are coarse with space between the particles, making them highly permeable and quick draining. The sand particles don't bind well together, so they compact poorly, displace easily, and should be avoided on steep grades. Over time, gravel and rock will pop out of the tread of sandy soils (fig. 2–7).

Figure 2–7. Sandy soils are easy to drain, but don't bind well together and are not desirable for trail building. USDA photo by Matt Able.

Silty soils are somewhat permeable. They hold some water and can become muddy and slick. They compact well and provide a stable surface when dry. In low-lying areas that are slow to dry out, structures may be required to provide a stable trail tread under heavy use. Silty soils can also be used to build trails with slightly steeper grades than in sandy soils. With sufficient gravel and rock, silty soils have moderate binding potential and reduce the frequency of rocks popping out of the tread (fig. 2–8).

Figure 2–8. Silty soils hold water when they are wet and are floury when dry. They are best suited for trail building when mixed with gravel and rock. USDA photo by Matt Able.

Clay soils compact very well when moist but become extremely sticky, slick, and susceptible to damage when wet. When occurring with adequate rock and gravel, clay soils can create a strong trail tread that resists erosion. However, when the clay is saturated, the tread can easily be displaced due to the swelling characteristic of clay (fig. 2–9).

Figure 2–9. Clay soils hold water and swell when wet. They can create a strong tread when combined with gravel and rock. USDA photo by Matt Able.

Loam is excellent soil for constructing trails. Loamy soil—a mixture of sand, silt, and clay—is the most desirable soil for constructing trails because it is permeable, compactable, and less of a mess when wet. Soil without a combination of clay, silt, or sand will fail in certain conditions (fig. 2–10).

Figure 2–10. Loamy soil is a mixture of sand, silt, and clay and is great for trail building. USDA photo by Matt Able.

Trail Use Impacts

Trail users affect the physical trail as well as surrounding plants, animals, and cultural areas. Different use types have different impacts (table 2–2). Trail creep, rutting, widening, and braiding are results of use compacting and displacing soil. Wildlife can also move out of an area due to noise and plants can be trampled. Greater access to public lands can also mean greater access to important cultural sites and sacred areas.

While water and soil characteristics determine physical and, in part, environmental sustainability, public satisfaction partially determines social sustainability. Savvy trail managers develop maintenance and construction strategies to balance impacts while providing a wide variety of trail opportunities for an equally wide variety of use types.

Compaction. The right amount of compaction, combined with good drainage, is necessary for a trail to hold up under use and to resist erosion. Too much soil compaction can decrease soil porosity, which limits infiltration and water drainage and leads to erosion and trail degradation. The resulting impacts are accelerated on steep trails with inadequate drainage. Too little soil compaction makes the trail tread loose and susceptible to displacement.

Displacement. Shoes, hooves, and tires flick muddy or dry and loose soil to the sides or even off the trail. Soil displacement will deepen trail tread over time, potentially trapping water, breaking down trail features, or causing users to create parallel routes.

Table 2–2. Common effects of different use types on natural surface (terra) trails

Use types	Common effects	Mitigation strategies
Foot travel	Trail widening (users avoid wet areas or travel side-by-side)	Reroute around low or wet areas; install causeway or drainage structure; use vegetation or barriers to constrict traffic width
Foot travel and equestrian riders	Trail "creeps" downhill (users travel on outside edge); trail damage in wet areas	Reroute around or fix wet areas; use barriers on outside edge
Mountain bike riders	Overly insloped or "banked" turns	Reroute to reduce frequency or severity of turns; armoring not recommended on bicycle trails
Motorized use	Rutted, wet soil; displaced rock in stream fords	Public education; remove large obstacles in stream fords; temporary closures for repair or maintenance

Management Objectives

The Forest Service manages many different types of trails. Some are minimally developed and challenging backcountry trails (fig. 2–11), others are highly developed and paved front-country trails. Providing a wide range of sustainable trails that are supported by the public requires the trail manager to think about what need or objective the trail is meeting. The purpose of this section is to describe how trail managers determine the trail design, based on the setting and desired uses and development scale.

Figure 2–11. A rough, narrow trail might be the right choice for foot traffic in a primitive area. Pike-San Isabel National Forests, Colorado. USDA photo by Adam Carroll.

Visit the Forest Service Plans for Trail and Trail Bridge Structures web page for more information about how to apply the design specifications for specific trail types and level of development. The Forest Service Trails Management Handbook, FSH 2309.18, also contains helpful information about trail design specifications.

All National Forest System trails are categorized per the list below. Trail managers use the information to determine the trail design (e.g., how wide to construct the trail or trail structure). They also use the information to establish maintenance standards (e.g., how far back to trim encroaching vegetation) (table 2–3).

- Visual and opportunity setting, also called the recreation opportunity spectrum (ROS) class (fig. 2–12 and table 2–4)
- Nonmotorized and motorized status
- Development scale, also called trail class (figs. 2–13 to 2–17)
- Uses, such as pedestrian or motorcycle

In addition, all trails are also required to meet the national quality standards for National Forest System trails, FSH 2309.18 chapter 10, section 15.

These categories and quality standards assure trails across the system are consistently constructed and maintained to meet the intended purpose of the trail. The design specifications for each trail are documented in a trail management objective (TMO).

Drafting a TMO is also a great way to communicate to line officers and specialists the basic characteristics of the planned trail. Note that standards may change along the length of the trail as appropriate for the landscape through which the trail traverses. For example, a trail that goes from a developed recreation site to a wilderness area would be less developed in the wilderness. In this case, the trail would have multiple segments with different management parameters in the same TMO.

Table 2–3. Design widths and heights for developed trails

Trail type	Tread width	Clearing height	Clearing width
Hiker/ pedestrian	18–36 in (46–91 cm)	7–8 ft (2–2.5 m)	3–5 ft (1–1.5 m)
Pack and saddle	18–48 in (46–122 cm)	10 ft (3 m)	6–8 ft (2–2.5 m)
Bicycle	18–36 in (46–91 cm)	8 ft (2.5 m)	5–6 ft (1.5–2 m)
ATV	60 in (152 cm)	6–12 ft (2–4 m)	5–6 ft (1.5–2 m)
Motorcycle	18–36 in (46–91 cm)	6–8 ft (2–2.5 m)	4–5 ft (1.2–1.5 m)

ATV = all-terrain vehicle

Recreation Opportunity Spectrum

Figure 2–12. Recreation opportunity spectrum (ROS) visual guide.

Table 2–4. Typical trail classes found in each recreation opportunity spectrum (ROS) setting

ROS class	Typical trail development class
Primitive	Minimally to moderately developed (trail class 1 and 2)
Semi-primitive nonmotorized	Moderately to highly developed (trail class 2 and 3)
Semi-primitive motorized	Moderately to highly developed (trail class 2 and 3)
Roaded natural	Developed to highly developed (trail class 3 and 4)
Rural	Developed to fully developed (trail class 3 through 5)
Urban	Highly developed to fully developed (trail class 4 and 5)

Trail Types

The Forest Service manages terra and water trails, and snow trails depending on the season.

- Standard or terra trails are on the ground.
- Snow trails are on snow or ice (and may be co-located on standard terra trails).
- Water trails are on water and may include land-based portages.

Common trail uses on terra trails. The Forest Service has developed design specifications for several trail uses, with more being added as needed. Other uses, including adaptive uses, are also welcome on trails managed by the Forest Service. Refer to the Trail Management Basics web page for more information about trail design specifications.

- Hiker/pedestrian
- Pack and saddle
- Bicycle
- Motorcycle
- All-terrain vehicle (ATV)
- Four-wheel drive vehicle >50 in (127 cm) wide

Trail Development Classes

The level of trail development is divided into five classes, with trail class 1 being the least developed. Tread material and width, presence of obstacles, clearing dimensions (a.k.a. clearing limits), and the amount and type of signs, bridges, and other trail structures vary depending on the development class, as illustrated in figures 2–13 through 2–17.

Figure 2–13. A minimally developed (class 1) trail has an inconsistent tread and native surface. White Mountain National Forest, New Hampshire. USDA photo by Deanna Eastman.

Figure 2–14. A moderately developed (class 2) trail has a rough and narrow consistent tread; obstacles can be continuous. Tonto National Forest, Arizona. USDA photo by Simon Cox.

Figure 2–15. A developed (class 3) trail has a consistent tread and less-frequent obstacles; imported materials may be present. Inyo National Forest, California. USDA photo by Jess May.

Figure 2–16. A highly developed (class 4) trail has a wide and smooth tread, trailside amenities, and likely meets accessibility guidelines. Chugach National Forest, Alaska. USDA photo.

Figure 2–17. A fully developed (class 5) trail has a firm and uniform tread, less than a 5–percent grade, and likely meets accessibility guidelines. Columbia River Gorge National Scenic Area, Oregon. USDA photo.

Accessibility

The Forest Service has an obligation to design a system of trails that provide opportunities to people of all abilities, including trails that meet all accessibility guidelines (fig. 2–18), and adaptive trails designed to accommodate as many types of users as possible (fig. 2–19). Accessibility information about National Forest System trails is typically documented in the TMO for each trail and reflected on the Interactive Visitor Map. Forest Service Manual (FSM) 2353.17 governs trail accessibility requirements. The technical requirements for trails and trail-side features designed for accessibility are operationalized in two documents:

- "Forest Service Trail Accessibility Guidelines" (FSTAG)—technical requirements that the trail meet accessibility standards.
- "Forest Service Outdoor Recreation Accessibility Guidelines" (FSORAG)—technical requirements for constructed features at trail termini and along trails. The requirements apply to all installed features, regardless of their distance from a trailhead, or occurrence in congressionally designated wilderness.

These and other resources are available on the Forest Service Accessibility Resources web page.

Figure 2–18. A trail that complies with trail accessibility guidelines with firm and uniform tread. Sequoia National Forest, California. USDA photo by Scott Johnson.

The FSTAG apply to National Forest System trails and trail structures that meet all three of the following criteria:

- New or altered
- Designed for hikers and pedestrians
- Connects to a trailhead or trail that mostly complies with trail accessibility guidelines

Exceptions to these standards should be a last resort. If an exception is unavoidable, line officers should confer with an accessibility program coordinator.

Characteristics of a typical terra trail and associated constructed features (including trail bridges) designed to meet accessibility guidelines include:

- Firm and stable surface at least 3 ft (1 m) wide
- Passing spaces every 1,000 ft (300 m) (if the trail is less than 5 ft [1.5 m] wide)
- Few obstructions (none over 2 in [5 cm] high)
- Trail grade and trail cross slope less than 5 percent. Steeper grades allowed for short segments or where necessary for drainage (with resting intervals where grades exceed 5 percent)
- Openings in tread surfaces in the direction of travel (e.g., the space between deck boards) are less than 0.5 in (1.3 cm)

Figure 2–19. Trail users of different abilities enjoying a trail designed for adaptive uses. Lake Tahoe Basin Management Unit. USDA photo by Garrett Villanueva.

Location

The location of a trail affects how it interacts with the physical environment, meaning the soil it's built on, the slope of the hillside, and the frequency and amount of rain. The ideal spots for building trails are on hillsides with moderate slopes, stable soils, and limited stream crossings (fig. 2–20). Physically sustainable trails are constructed away from flat areas and ridgelines where draining water is difficult and to minimize the need for switchbacks, retaining walls, or other structures except where unavoidable. Good trails consider vistas and other interesting features while

avoiding sensitive areas (fig. 2–21). Trail managers balance the popular desire to be near water with the disadvantages such as potentially allowing sediment flow into water sources, bank erosion, and other risks associated with recreation in riparian areas.

Figure 2–20. The ideal location of a trail is on a hillside with moderate slopes. Monongahela National Forest, West Virgina. USDA photo by Benjamin Shaffer.

Legacy trails—or trails that were not designed or constructed with sustainable principles in mind—are often too steep or too flat in areas and have required the installation of turnpikes, switchbacks, stairs, and other supporting features to make up for the poor location. These features can require frequent and costly maintenance. Prioritize rerouting these trails, especially those that

could be damaging the environment, to more sustainable alignments. Install trail structures only as needed to stabilize the tread and limit environmental damage. Chapter 3, "Maintenance," includes tips to mitigate the impacts of unsustainable trails.

Figure 2–21. Well-designed trails take advantage of natural land features. Tongass National Forest, Alaska. USDA photo by Laurent Deviche.

Trail Grade

The steepness of the hillside and the trail segment determines how fast water flows down the hillside or trail. Erosion potential increases substantially with steepness—even in the smallest increments. An overly steep trail is one of the strongest contributors to maintenance issues on existing trails.

Trail managers typically use percent grade when measuring the angle of a trail or hillside. The trail builder can't control the hillside slope or rainfall and drainage patterns, but they can control the trail grade during design and layout of a new trail or reroute. Physically sustainable trail grades can be as steep as 7 percent; short, steep sections of trail can exceed the average grade. Knowing the grades that are appropriate for the soil types and weather and drainage patterns in your area will help you identify the target sustainable trail grade.

To get familiar with sustainable trail grades in your area, use a clinometer in the field to measure percent grade on a sustainable trail segment and compare the grade to an eroded segment. The comparison will give you an idea of the maximum threshold for trail percent grade. In the design process, use a computer mapping system (such as ESRI ArcGIS Pro) to plot potential routes at the target grade and then validate the grade with a clinometer in the field. Refer to the "Using a Clinometer" section in chapter 6 for more information.

How Steep Is That Trail or Hillside?

Percent of grade or hillside slope =

$$\frac{\text{Amount of rise (or vertical distance)}}{\text{Amount of run (or horizontal distance)}} \times 100$$

Know the lingo: The angle of the natural terrain is referred to as "slope" or "hillside slope." The angle of a constructed trail is referred to as "grade" or "trail grade." Both measurements are expressed as a percentage and derived using the "rise over run" equation above.

Trails in different development classes have different specified maximum grades. For example, grades on minimally developed (class 1) trails open to nonmotorized users can vary widely from 5 to 25 percent, where grades on fully developed (class 5) trails designed to meet accessibility guidelines shouldn't exceed 5 percent. The target grade for a particular use and development scale is documented for each trail in the TMO. More information about target trail grades by trail type and development scale is also available on the Trail Management Basics web page.

Slope Ratio

The trail grade relative to the prevailing hillside slope is referred to as the trail's slope ratio. Trail managers use the slope ratio calculation to estimate how closely a trail segment aligns with the fall line. An appropriate slope ratio is perhaps the single most important thing you can do to make sure your trail requires less maintenance and results in the least amount of environmental impact possible.

Slope ratio values range from 0 to 1, where trails with a slope ratio of 0 are routed horizontally across the hillside and perpendicular to the fall line or across flat ground. Trails with a slope ratio of 1 are straight up the hill along the fall line. Trail segments with high slope ratios (above 0.5) on a hillside will likely need steps, switchbacks, or other constructed features to reduce soil loss—these things take time and resources to construct and maintain. Trail segments with a high slope ratio across flat terrain (i.e., low landform grade and low trail grade) could lead to chronically saturated soils, depending on climate patterns. Either situation is undesirable and should be avoided.

$$\text{Trail slope ratio} = \frac{\text{Trail grade}}{\text{Hillside slope (a.k.a.landform grade)}}$$

Fall Line

The fall line is the path that follows the most direct route downhill. It climbs or descends perpendicular to the contour of the landscape. Fall line trails at or near 1.0 slope ratio are a hallmark of legacy trails that are eroded and channelized. Many of these trails followed the easiest route downhill and in the fall line and were not constructed to follow the contour of the hillside (figs. 2–22 and 2–23). Fall line trails take significant investment in structures and maintenance to maintain their tread (fig. 2–22). Better constructed and more sustainable trails cross the hillside perpendicular to or at a lesser grade than the fall line.

Figure 2–22. Avoid routing trails parallel to the fall line. Fall line trails easily erode, are expensive to repair, and often cause environmental damage. Las Padres National Forest, California. USDA photo by Scott Johnson.

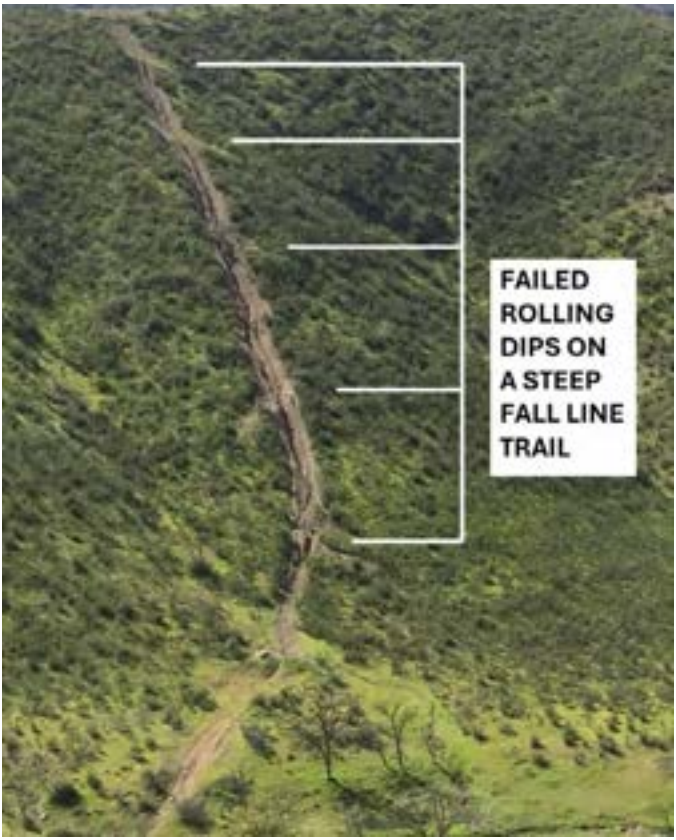

Figure 2–23. Heavily eroded fall line trail with several failed rolling dips. Mendocino National Forest, California. USDA photo by Scott Johnson.

The Half Rule

The "half rule" is a simplified version of slope ratio that refers to a practice of keeping a trail grade less than half of the hillside slope (or 0.5 slope ratio) (fig. 2–24). In general, water will more easily erode the tread if the trail is more than half of the prevailing hillside slope. The hillside slope measures the angle of the hillside where the trail is routed. The half rule becomes less relevant on hillsides with greater than 14 percent slope. The half rule doesn't dictate that trails can't be sustainably located on steep hillsides. Rather, in those situations, the half rule shouldn't be used to determine the maximum sustained grade.

The half rule can be quickly calculated in the field during layout. For example, if you're working on a hill with a 6–percent slope, your trail grade should be no more than 3 percent. Trails with grades more than half of the maximum hillside slope are considered "fall line" trails. Use your judgment and knowledge of local soils and other environmental conditions to establish the best trail grade that will sustain a stable tread over time.

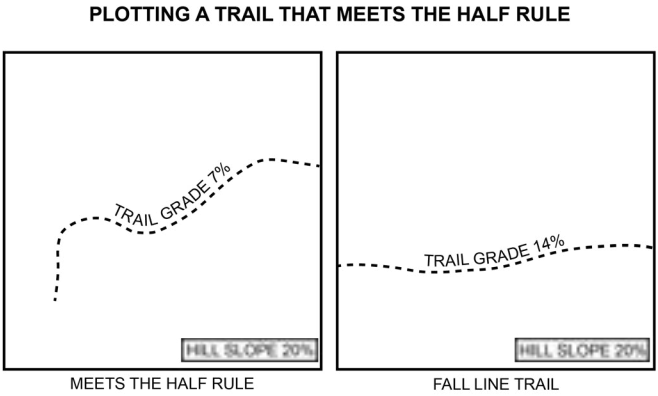

Figure 2–24. Plot a trail on the map with the half rule in mind. Trails with grades less than half of the prevailing hillside slope meet the half rule and will generally be more sustainable. Trail grades more than half of the prevailing hillside slope are fall line trails, will generally be prone to erosion, and require more frequent maintenance.

Rolling Contour Trails

Rolling contour trails are designed to be physically sustainable, requiring few to no drainage structures and the least amount of maintenance. The term "rolling" refers to the repeated reversals in grade or the rise (crest) and fall (dip) of the trail as it traverses the hillside (fig. 2–25). The combination of low slope ratios, repeated grade reversals, and outsloped tread directs water traveling down the hillside to flow off the trail without the need for constructed drainage features.

Trail managers in some places inslope trails to discourage stock from traveling on the outside edge. Check with an experienced trail builder in your area for local best practices for insloping or outsloping the tread.

Characteristics of a rolling contour trail:

- Follows the natural shape or contour of the landscape
- Low slope ratio
- Rolling grade reversals (refer to chapter 6 for more information)
- Tread outsloped 3–5 percent
- A full-bench trail excavated from the hillside to create the trail tread (preferred). Refer to the "Full-bench Construction" section in chapter 6.

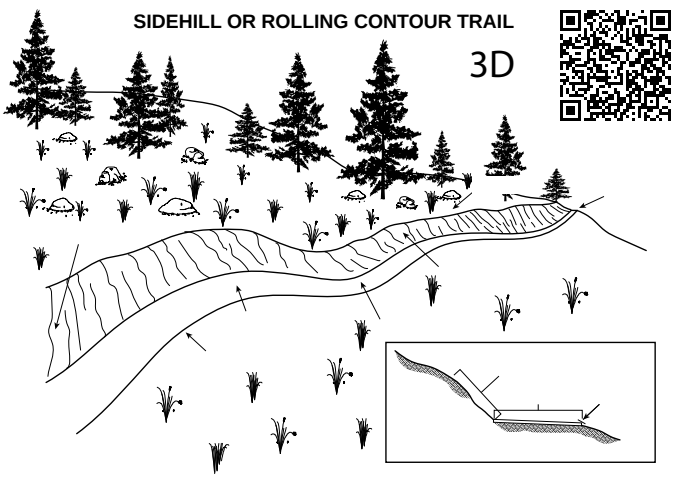

Figure 2–25. Anatomy of a sidehill or rolling contour trail.

3

MAINTENANCE

3. MAINTENANCE

For as long as a trail exists it will need some amount of maintenance. However, the more physically sustainable the trail, the less maintenance it will need. The goal of trail maintenance is to keep or return a trail to a condition that matches the design specifications for the use type and development scale, accounts for user safety and enjoyment, and minimizes environmental impact. We do this by treating the trail corridor and restoring the trail tread and associated features and signs. For more information about the design specifications for each trail, refer to the "Management Objectives" section in chapter 2. The trail management objective (TMO) lists the design specifications for each trail.

Maintenance should treat the problem, not just the symptom. When identifying a problem area on a trail that requires maintenance, find the source of the problem. For example, if a trail has a section that is puddling, figure out where the excess water is coming from. Often the source of the problem lies outside the trail corridor.

Prioritize maintenance projects based on unsafe conditions or where erosion or other impacts are damaging adjacent natural and cultural resources. A planned and prioritized maintenance program is essential to efficiently monitor, assess, report, prioritize, do the work, and document the accomplishments. Savvy trail managers also establish a

system for trail workers and the public to report needed repairs or maintenance.

Accurate trail maintenance accomplishment reporting summarizes the need for adequate staffing and maintenance costs. Agency leaders also annually share national reports of crew time, type, supply costs, and miles of accomplishment with Congress.

Trail Assessments

Use the results of trail assessments and trail logs that document your observations and those of your crew and the public to inform your maintenance plan. The data collected also describe the national costs for maintaining trails and addressing deferred maintenance. The information is shared with agency leaders and Congress to help them make informed decisions about priorities and budgets.

The Forest Service uses an established methodology to inventory trail features, document conditions, and estimate needed maintenance costs and resources. The documentation is stored in a database available to employees and partners and volunteers who are granted access. Properly trained employees, partners, and volunteers collect information in the field and enter it into the database. Experienced trail workers use the records to develop an annual maintenance plan.

Before an assessment

Before assessing a trail, review the trail design specifications for the use type, development scale, and other relevant standards. The information is documented in the TMO for each trail. During the assessment, compare the intended design specifications to the current conditions and note any departures.

Refer to the discussion in the "Management Objectives" section of chapter 2 for more information about the design specifications for established Forest Service trail types and development scales.

Components of a good assessment include:

- Good notes that describe the conditions
- Ideas about the material, crew, and timing needed to address problems
- Georeferenced pictures (or pictures with embedded location information) of maintenance needs that correspond to your notes

Conducting an assessment

- Get training in the trail assessment and condition survey techniques approved by the Forest Service.
- Become familiar with prior assessments to understand the effectiveness of previous repairs. For example, why did a rolling grade dip work in one location but not another?

- Starting at the lowest end of the section to be assessed, traverse the entire section first to familiarize yourself with the trail and current features, and then record needs on the way back down.
- Use a clinometer to measure and document the trail grades in areas that are stable and those that are eroding.
- Take pictures of maintenance needs on the tread, retaining walls, steps, boardwalks, signs, bridges, adjacent vegetation, and other trail features (including downed and standing hazard trees).

Assessment tips

- Don't just assess the symptoms of larger drainage issues. Investigate the cause of trail problems, which is often uphill of the symptom or related to the location and alignment.
- Consider how fast brush grows and the effect on the trail corridor when determining how to meet clearing limit standards.
- Identify areas that may require more brushing to maintain line of sight in turns.
- Walk the segment during a rainstorm to discover what drainage issues you may have missed when it is dry.
- Identify drainages that are working and need to be maintained and drainages that aren't working and shouldn't be maintained. Add new drainages only in locations that meet the half rule.

- Consider how materials will be transported to the site and staged for needed repairs.
- Include time estimates for mobilizing materials, tools, and people.

Common mistakes

- Only assessing the trail in dry conditions, when it might not be apparent where water flows or collects.
- Guessing trail grades and hillside slopes instead of using a clinometer.
- Identifying maintenance needs on drainage features that aren't working or are prone to failing (for example a rolling dip on the outside of a turn).
- Not scheduling enough time to complete the entire trail assessment.

Maintenance Plans

Trail managers use maintenance plans to itemize and prioritize maintenance needs, propose solutions, identify the needed crew and materials, and establish project timelines. They also use these plans to spot and diagnose maintenance patterns. If the same type of maintenance is needed year after year in the same spot, then you may be only treating the symptom.

Annual maintenance plans also serve as communication aids. They help you clearly communicate to the public, decision makers, and crews about the problem, material, and effort it will take to finish the project. Being clear about maintenance needs helps decision makers allocate

resources, helps you and the crew select the right tools for the job, and helps the public understand the work required to maintain public trails.

Common maintenance plan components

- Baseline inventory of all trails that includes development scale, major use types, typical percent grade, features, centerline locations, status as a national scenic, historic, or recreation trail, and other basic information.
- Results of trail logs, trail assessment and condition surveys, or problem area reports that identify work areas and help establish priorities.
- Identified priority maintenance projects to address safety issues, stabilize trail tread, and prevent resource damage.
- Determination of which project or project components need professional crews or are appropriate for trail partners and volunteers.
- Specialized tools, equipment, and materials needed for priority trail projects.
- Timing limitations for work.
- Documentation of project approval.
- Project status and accomplishments (for reporting).

Sign and Marker Maintenance

Maintain signs regularly by remounting loose or fallen signs, loosening screws as needed if mounted on trees, repairing or replacing signs, and resetting or replacing

leaning, damaged, rotting, or missing posts. Regular trail assessments will help you establish sign maintenance priorities and frequency. Refer to the "Trail Assessments" section, above, for more information about how to conduct a trail assessment.

If a sign is missing, consider why it is missing. If signs are repeatedly stolen, use theft-resistant hardware or techniques to mount the replacement (fig. 3–1). If the sign was eaten by wildlife, consider less-palatable materials. If weather or natural events damaged the sign, consider stronger materials, a different location, or a different system for mounting the signs.

Figure 3–1. Bending the ends of through bolts can help prevent sign theft. Mt. Hood National Forest, Oregon. USDA photo by Meckenzie Helmandollar-Powell.

Sign Inventory

Take before-and-after photos to document what is happening to signs in the field and how new signs appear. A good sign inventory with photos makes it easier to order replacements for missing or damaged signs.

Check with the sign manager or trail manager for guidelines that will help you decide when signs should be replaced. Signs in poor condition invite vandalism. If possible, replace signs that have bullet holes, chipped paint, missing or illegible letters, incorrect information, cracked boards, splintered mounting holes, or missing pieces. Consider the consequences of not repairing or replacing deficient signs. Take photos to help portray the situation and record them in the sign inventory.

Corridor Maintenance

The trail corridor includes the tread and the area above and to the sides of the tread (fig. 3–2). Overgrown brush, hanging branches, exposed rocks, and fallen trees are common encroachments into the trail corridor.

Experienced trail workers attest to the singular will and incredible power of plants. No sooner is a trail corridor cleared of plants, than new plants rush toward the new avenue of sunlight. Plus, as trees age, contract disease, or burn, they become weak and are eventually knocked down by wind, snow, and gravity. Cutting this vegetation

out is an important maintenance task. Sharp and properly maintained tools are essential for removing and pruning encroaching vegetation.

Only certified sawyers can use chainsaws and crosscut saws when doing work on National Forest System lands. Sawyer training, evaluation, and certification is available for Forest Service employees, partners, and volunteers. Visit the Forest Service crosscut and chainsaw program web page for more information about how to receive sawyer training, evaluation, and certification.

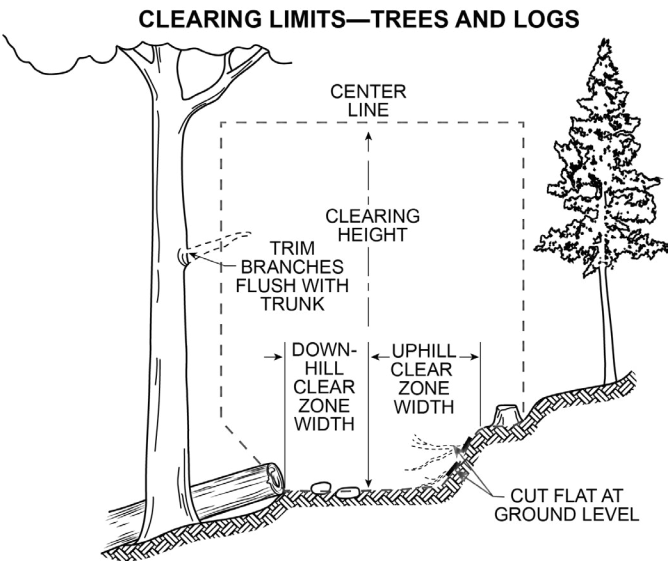

Figure 3–2. Corridor clearing height and uphill and downhill clearing widths differ depending on the type and development scale of the trail. Diagram based on Forest Service standard trail drawing STD 912–01.

Corridor Clearing Dimensions

The trail clearing dimensions (a.k.a. trail clearing limits) are determined by the trail type and development scale (see table 2–3), and objects are removed to a specified width and height. The widths of the trail corridor clearing limits will change depending on the trail type and development scale. The clearing specifications for the particular trail type, trail uses, and development scale are documented in the TMO, including the horizontal, shoulder, and vertical clearing dimensions. Check the TMO **before** heading to the field. Use the widest clearing limit suggested for the allowed uses of the trail (fig. 3–3). Prohibited and allowed uses are documented in the TMO for each trail. Go to the Forest Service Trail Management Basics web page for a full list of clearing limits for different trail use types and development scales.

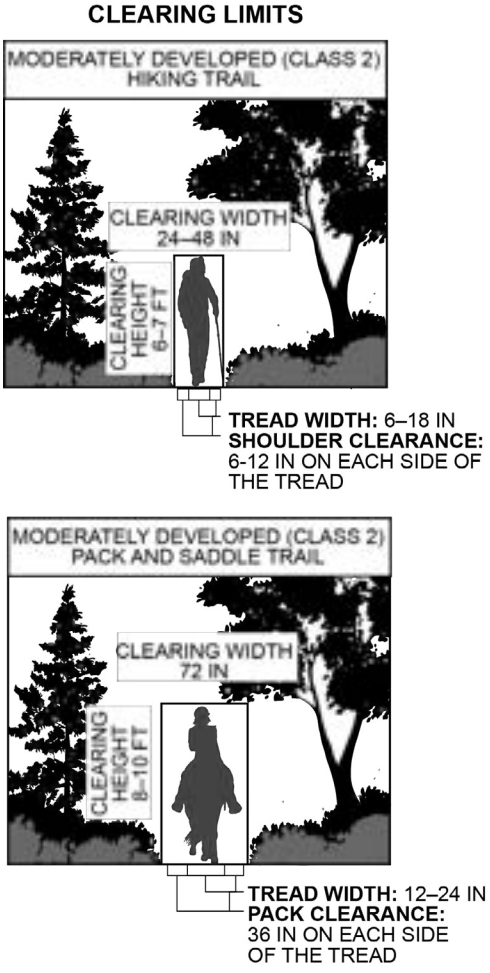

Figure 3–3. The clearing limit for a moderately developed (class 2) trail designed for pedestrians is narrower than a similar trail designed for equestrian users.

Sawyer Certification

Forest Service directive FSM 2358 governs the use of chainsaws and crosscut saws on National Forest System lands. Forest Service employees, volunteers, and partners (a.k.a. cooperators) can access consistent sawyer training, evaluation, and certification. The directives provide for properly qualified volunteers and cooperator groups to train and evaluate their members. Authorized partner organizations may also certify their members.

The Forest Service's "Developing a Thinking Sawyer" chainsaw and crosscut saw training emphasizes risk management, human factors, and sawyer safety. Volunteers and cooperator organizations working under an appropriate agreement can receive sawyer training, evaluation, and certification. Work with the local volunteer coordinator or saw program coordinator for sawyer training, evaluation, and certification opportunities. Visit the Forest Service crosscut and chainsaw program web page for more information.

Brushing

Plants growing into the trail corridor threaten a trail's integrity. Woody brush is a major culprit. Also, those cute little seedlings sprouting up through or adjacent to the tread eventually grow into pack-snagging adolescent trees. Seedlings are a lot easier to pull up by the roots when they are small than they are to lop when they grow up. Thistles, dense ferns, and other encroaching plants may

make travel unpleasant or even hide the trail completely (fig. 3–4). If people have trouble traveling the trail tread, they'll move over, usually along the lower edge, or make their own trail. It is important to keep a good line of sight, especially when wheeled traffic is allowed.

Brushing is a common task to engage partners and volunteers. Provide training that includes appropriate brushing and pruning techniques and clear direction about target corridor clearing limits.

Figure 3–4. This trail needs to be brushed. Cut the vegetation out to the specified clearing width for the trail type and development scale. In this case, a nonmotorized developed (class 3) trail open to hikers and equestrian users should be brushed back about 3.5 ft (1 m) from the center of the trail. Flathead National Forest, Montana. USDA photo by Jess May.

Maintenance tips

- Maintain the clearing dimensions documented in the TMO.
- Trim back vegetation before it overtakes the trail. Cutting out an overgrown trail takes a lot more work than simple maintenance.
- On level terrain, keep the trail corridor clear an equal distance on either side of the tread's centerline.
- Cut intruding brush back at the base of the plant rather than trimming at the clearing limit boundary (fig. 3–5).
- Cut all plant stems close to the ground and flush—don't create a sharp end.
- On steep terrain, cut the vegetation and logs further on the uphill side.
- Drag the brush out of immediate sight of the trail and deposit it cut side facing away from the trail.
- With a large amount of brush, use the keyhole (or window) technique. Cut an opening in the brush on the downslope side of the trail that opens into a larger clearing and drag the brush into it.

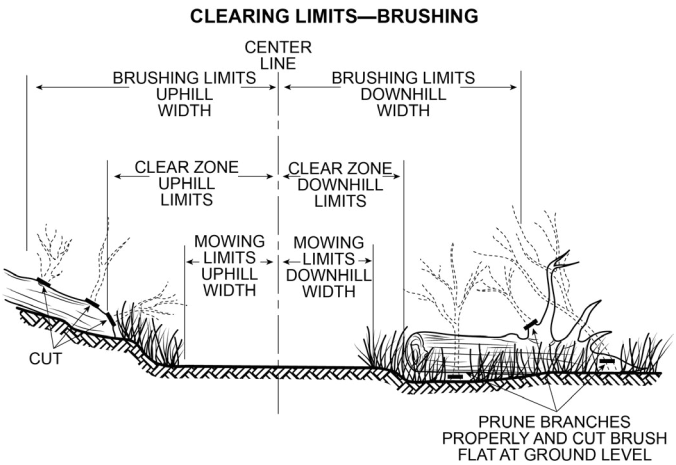

Figure 3–5. The trail corridor clearing dimensions change depending on the trail type and development scale. The clearing dimensions for each trail are documented in the TMO. Diagram based on Forest Service standard trail drawing STD 912–02.

Limbing

Trees in some environments grow faster than in others. Be selective with the branches you cut and prune them correctly (fig. 3–6). Pruning incorrectly can introduce disease and kill the tree. Use pruning to your advantage to create visual barriers that direct traffic and encourage users onto the inside or outside of the trail tread. Clearing more on the downhill side of the trail will help users to maintain an outslope on the trail tread.

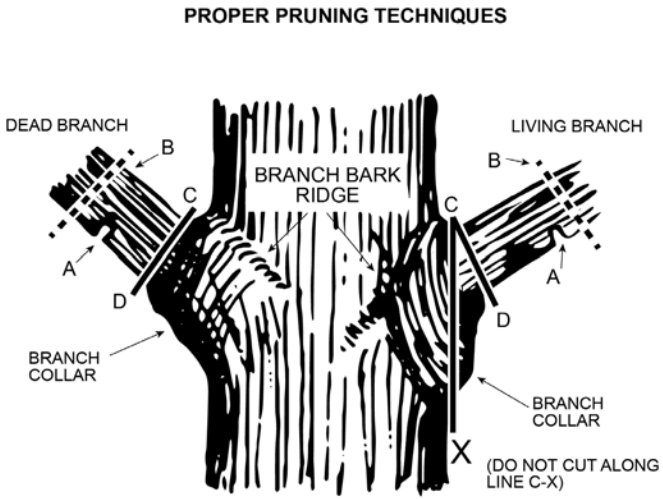

Figure 3-6. Use proper pruning techniques. Removing heavy branches is a three-step process. Make the undercut on the underside of the branch (A). Then make the upper cut (B), slightly to the outside from the undercut. Lastly, cut the remaining stob at an angle close to the branch collar (C-D). Drawing adapted from an illustration by the Arbor Day Foundation.

Maintenance tips

- Use the three-step pruning method (fig. 3–6).
- Use a hand saw (and pole saw for trails open to equestrian riders) to prune limbs correctly.
- Make a small cut on the underside of the branch first and then a second cut through the branch from the top. This will prevent peeling the bark on the tree trunk.
- Consider felling and removing the entire tree if more than half of it needs pruning (fig. 3–7).

- Limb trees in the rain during the growing season to find the branches that are sagging.
- Toss stems and branches so the cut ends lie away from the trail, out of sight, and generally downhill.
- Work with natural vegetation patterns to feather or meander the edges of your clearing work so you don't leave straight lines.

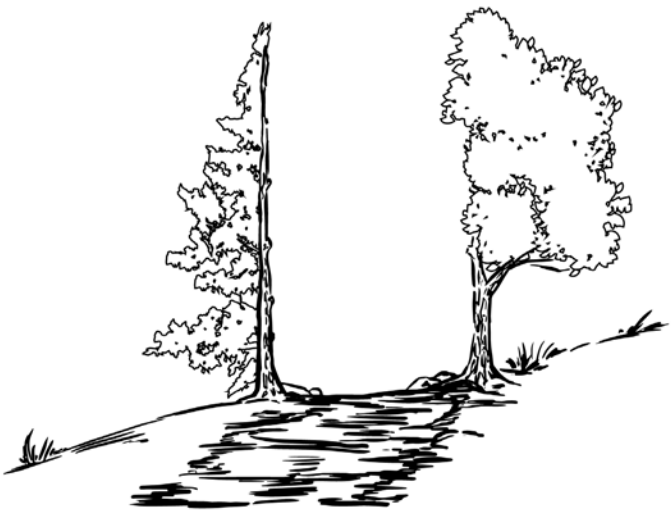

Figure 3–7. This is incorrect. Consider felling and removing trees at the edge of the trail that need excessive pruning.

Common mistakes

- Pruning with an axe.
- Over-pruning that harms trees or creates a visually unappealing setting (fig. 3–7).
- Not maintaining the vertical clearing limits and leaving branches hanging into the corridor that are a barrier to equestrian riders or others at certain times of year (ice and snow can weigh down branches during winter).

Bucking

Cutting out sections of a fallen tree to make smaller, more manageable sections is called bucking. Bucking is common when "logging out" a trail or clearing multiple fallen trees across or down a trail. Only cut out the width specified for the use type and trail development scale (fig. 3–8).

When deciding how and where to cut, keep in mind how bucking will affect water and use patterns. On occasion, a fallen tree can provide an opportunity to reduce the tread width back to the design width (fig. 3–9), for a forced uphill undulation, to create drainage, or to add an interesting bend in an otherwise straight section of trail. Refer to the Draining Water section in chapter 4 for more information about constructing a forced uphill undulation. Bucking trees consistently and thoughtfully also maintains the characteristics of the trail.

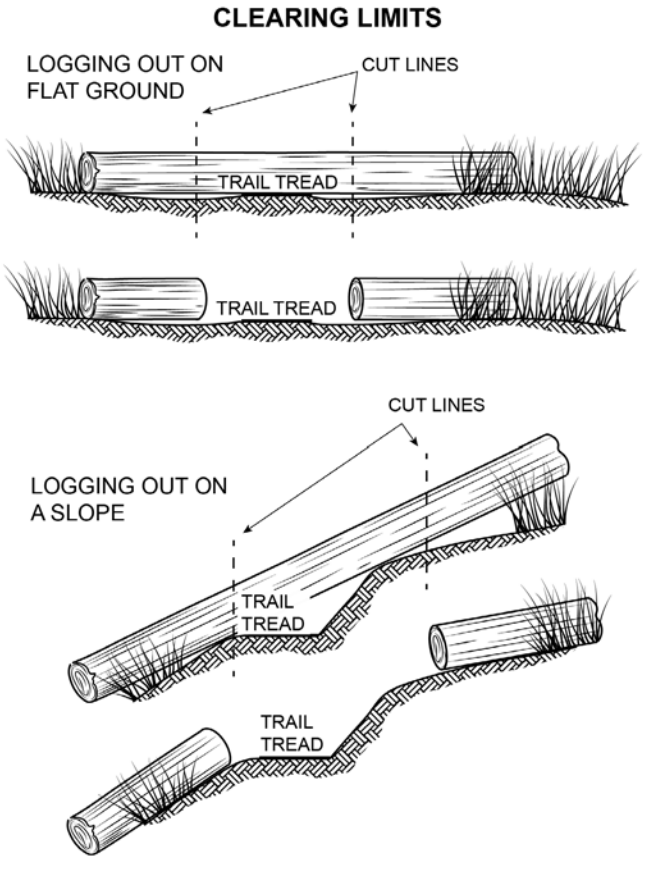

Figure 3–8. Clearing limits can change as the slope increases, particularly on trails open to motorized uses.

Figure 3–9. Cut logs help to keep the trail in place and the proper width. Refer to the TMO for trail design specifications, including appropriate trail width. Tongass National Forest, Alaska. USDA photo by Laurent Deviche.

Logging out a trail is also where you can use your creativity and refine your craft. Rub the fresh cut ends of trailside logs or stumps with soil to reduce their brightness. Cut stumps flush with the ground and cover them with soil, pine needles, or moss. Depending upon the situation, different cuts may be used for the safety of the sawyer, to prevent damage to the saw, and for efficient clearing (fig. 3–10). Compound cuts may be used so that the bucked section

will roll away once cuts are completed without having to lift or move bucked logs more than necessary. Seek training and become certified for crosscut and chainsaw use on national forests and grasslands.

Use personal protective equipment, determine forces on the log, and plan the cut.

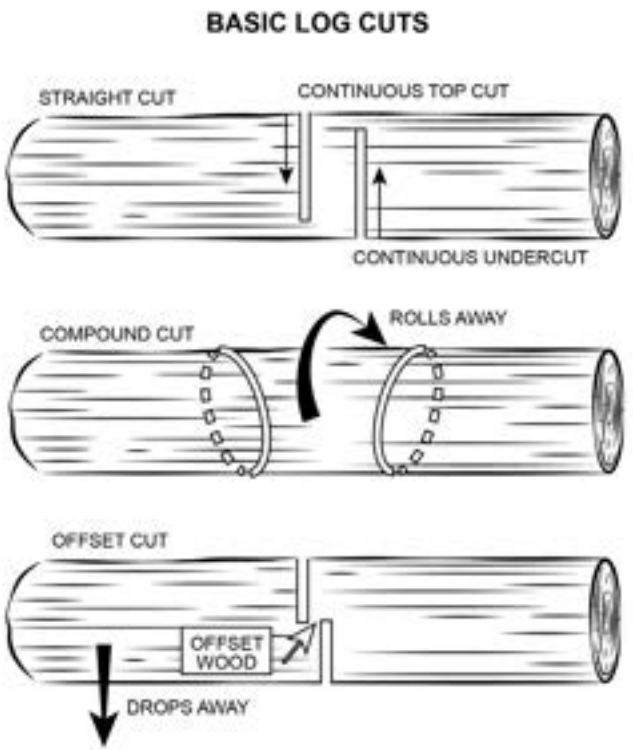

Figure 3–10. Basic log cuts for bucking logs.

Maintenance tips

- Consider using the log as an opportunity to create and stabilize a forced uphill undulation.
- On moderate to steep hillsides, cut logs on the uphill side further back to reduce potential for the log to slide into the trail or if the trail is open to motorized uses (fig. 3–11).
- Roll the log pieces off the trail and outside the clearing limits on the downhill side.
- Place cut logs on the outside of the tread on the downhill side (without creating a dam) to encourage users down the center of the trail.

Common mistakes

- Cutting above your skill level and abilities.
- Blocking drainage outflows by placing logs across or in them.
- Leaving logs perpendicular to the trail on the uphill side—these might roll or slide down onto the trail.

Figure 3–11. When logging out a trail on a hillside, make sure to clear the uphill side far enough off the trail in case the log slides down over time. San Juan National Forest, Colorado. USDA photos by Chris Bouton.

Tree Felling

A hazard tree is a standing tree that presents a visible hazard to people or property due to conditions such as deterioration of or damage to the root system, trunk, stem, or limbs or the direction or lean of the tree. Trail users assume inherent risks associated with outdoor environments. Not every hazard tree along a trail needs to be removed. Hazard tree mitigation should go up as the trail development scale goes up.

Leaners and hung-up trees presenting a hazard should be assessed for removal as skill level, time, and resources allow. If a tree hanging over the trail will be cut down, ensure the bucked section meets the minimum width for the trail type and development scale.

Once you've decided that a tree should be removed, the location of the trail can determine whether a chainsaw, crosscut saw, bow saw, or ax is a more appropriate tool. Using an ax to cut standing or fallen trees poses similar hazards to cutting with a chainsaw or crosscut saw. Gas- or electric-powered chainsaws, as well as other mechanized tools and equipment, are restricted in designated wilderness areas, as outlined in the Forest Service Manual (FSM) 2326. Learn more about traditional tools for working in designated wilderness areas in the Wilderness Connect website.

Regardless of the tool you use, remove root balls completely from felled trees within the tread width.

In certain circumstances, hazard trees that are hung-up or complicated can be removed with explosives to reduce risk and increase efficiency. Check with a trained and certified Forest Service blaster to learn where blasting is feasible. Refer to the Danger Tree Mitigation Guidelines for Managers publication for more strategies to remove hazard trees.

Figure 3–12. Walk away if you are not confident in your ability to safely cut a tree because of the hazards or your level of experience. Flathead National Forest, Montana. USDA photo by Michele Kiefer.

Tread Maintenance

Reestablishing a solid, outsloped trail surface is the main objective of maintaining the tread. Outsloping may not be needed in all situations—check the TMO to determine if it is appropriate for the trail type and development scale. Trail maintenance can be as simple as removing the sticks and stones that have fallen on the tread or started to poke up above the tread as the surrounding soil is removed by use or erosion. It can also be more involved and include repairing or reconstructing trail sections damaged by landslides, uprooted fallen trees, washouts, ruts, or boggy conditions.

Reestablish Tread and Stop Creep

Slough (pronounced "sluff"), berms, and tread creep are common tread maintenance issues that need to be addressed over time. Slough composed of soil, rock, and debris is moved downhill by water and gravity and deposited to the inside of the tread, narrowing the tread.

Excessive slough is often a symptom of an overly steep backslope. Restoring or improving the backslope angle will often fix the problem (fig. 3–14).

Berms are mounds of dirt that typically occur on the outside edge of the tread as water and the feet, hooves, or tires of trail users displace the soil (fig. 3–13). Berms can also be unintentionally created during construction if the trail tread isn't properly compacted. Remove or break up continuous berms that trap water to allow water to flow across the trail (sheet flow) and not down the trail.

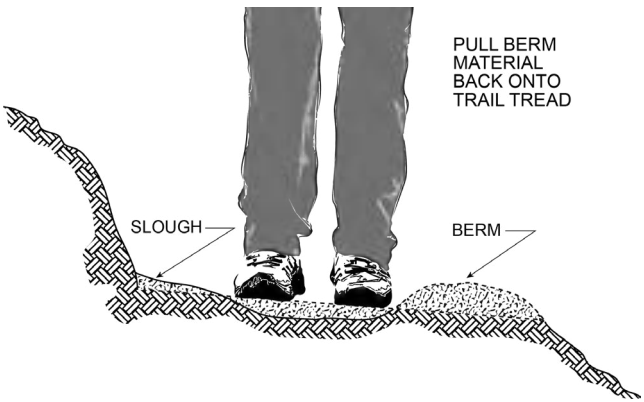

Figure 3–13. Remove the slough and berm, leaving the trail outsloped so water will run off.

Tread creep is often created by trail users or wildlife using the outside edge of a trail on a hillside. The outside edge of the tread will break down when users are forced to the outside by brush, slough, rocks, logs, excessive outslope, and other obstacles on the hillside adjacent to the trail. Pack animals typically travel on the outside regardless of how wide a trail is. This use pattern on the outside edge of the trail tread will slowly move the tread downslope as it becomes the flattest part of the tread, until the tread narrows and eventually fails.

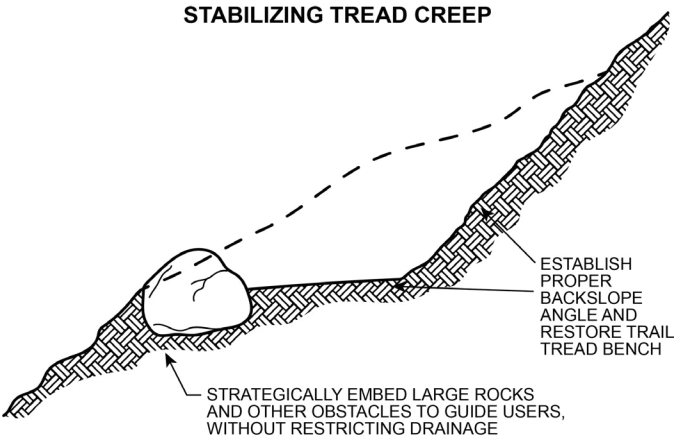

Figure 3–14. A properly installed guide rock or log end can help prevent tread creep. Do not create a continuous barrier that impedes water drainage.

Maintenance tips

- Pull berm material back on the trail and use slough from the backslope to reestablish the original location of the trail tread and tread width.
- Compact the critical (or downhill) edge of the tread to promote drainage and reestablish tread width.
- Place boulders or other objects along the outside edge in irregular locations to keep stock to the center of the tread. Ensure that these objects—also called gargoyles—don't block drainage (fig. 3–14).
- If berms persist, inspect drainage or consider reroutes that increase undulation.

Common mistakes

- Not removing slough during routine maintenance.
- Adopting the new location of the trail that has moved downhill from tread creep (although in some situations this can create a beneficial grade reversal that naturally sheds water off the trail).

Reestablish Outsloping

The outsloped tread on a trail on a hillside is lower on the outside or downhill side than on the inside or bankside. Outsloping allows water flowing down the hillside to sheet across the trail instead of being captured and focused to run down the trail. The technique allows the trail to be "hydrologically invisible," meaning it allows water to follow natural drainage patterns. Outsloping is often

accomplished during berm removal. Reestablish the outslope to approximately 5 percent (fig. 3–15).

Maintenance tips

- Shape and compact all tread and sections of backslope that were reworked.
- If the excavated soil in the berm is good for compacting as tread material (not too much clay, not too much rock, no organics, and just the right amount of moisture) then compact the material back onto the tread and shape rolling grade dips.
- If it is not reasonable to remove the entire berm, remove sections at intervals that prevent water from causing tread erosion. Remove sections at least 10 ft (3 m) in length.
- Addressing loss of outslope is a common maintenance problem. Installing knicks in the trail can facilitate drainage without removing the entire berm and reestablishing the outslope. The "Draining Water" section in chapter 4 includes techniques for draining water off existing trails.

Common mistakes

- Using organic material mixed with mineral soil for the tread material.
- Not compacting the tread material well enough.
- Building rolling grade dips with soil that is dry and impossible to properly compact.

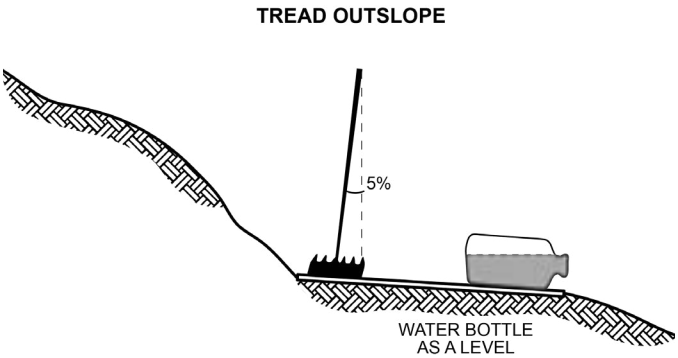

Figure 3–15. Maintain an outslope of 5 percent.

Maintain Drainage

Sediment and buildup of other debris frequently cause failed drainage features. If the drain clogs, the water either continues eroding its way down the tread or forms puddles that can create mudholes. The best drainage structures direct the flow of water at the appropriate velocity to wash sediment out of the drain, keeping it clear and requiring less frequent maintenance.

Maintenance tips

- Reestablish the outslope and width of the outlet to prevent clogging.
- Maintain a smooth transition into the outlet so water flows out of the drain fast enough to keep sediment suspended and slow enough to prevent headward erosion (a.k.a. a headcut) from forming (fig. 3–16).

- Remove the sediment buildup from the outlet and use it for reconstructing the crest or filling ruts above the drainage structure. Never help gravity and always move dirt uphill.
- Mulch the outlet to prevent users from mistaking it as part of the trail, although use care to not clog the outlet with too much.

Common mistakes

- Digging too deep into compacted native soil during maintenance in a way that promotes erosion.
- Making the initial sag and crest too small to accommodate the volume of water and use.
- Excavating outlets and drains too flat, allowing them to get clogged with sediment.

Figure 3–16. Headcut starting from water leaving the trail at too high of a velocity and creating a waterfall effect. Los Padres National Forest, California. USDA photo by Scott Johnson.

Walking in the Rain

A lot of learning takes place when you slosh over a wet trail in a downpour and during spring snow melt. Watch what the water is doing and how your drains and structures are holding up. If you notice a large volume of water flowing across the trail, follow it uphill to figure out where the water is coming from and assess where new trail drainage is needed to prevent erosion. Think about soil type, hillside slope, trail grade, distance of flow, and volume of water before establishing priority trail maintenance projects for the year.

Address Trail Widening

Trail widening commonly occurs in flat and muddy areas and on fall line trails. A small puddle can grow into a large mudhole as the traffic skirts the edge and breaks it down (fig. 3–17). In areas of open and moderate terrain with scarce natural barriers, users tend to travel side by side or pass others and cause tread widening.

Excessively widened or braided sections of trail may need to be rerouted; however, in cases where reroute is not approved or possible, install barriers to define the tread width. Use care when placing barriers to avoid pointed ends facing upward. Take care to bury logs and rocks to the widest diameter so that the barriers remain in place, appear natural, and don't block drainage.

Figure 3–17. Trail users avoid puddles and widen the trail. Drain water before it finds the low spot of the trail. Chequamegon-Nicolet National Forest, Wisconsin. USDA photo by Kristen Thrall.

Maintenance tips

- Take advantage of large stationary objects (called guide structures) to prevent animals and people from travelling side by side and widening a singletrack to a doubletrack.
- Buck trees that have fallen across the trail to the desired trail width.
- Place the ends of logs, rocks, and stumps close to the downhill edge of the trail to keep users closer to the middle.
- In cases where curves are being straightened, partially bury a short section of log or rock on the inside of the curve to prevent straightening of the trail.

- Where users are circumventing a mud hole, consider rerouting around the low spot or elevate the tread with borrow material or a causeway.
- Repair braided trails by installing a causeway and positioning logs, rocks, and other natural barriers in the braided sections (refer to the "Causeways" section in chapter 4 for more information).

Common mistakes

- Blocking drainage or creating a berm.
- Decommissioning areas using branches, rocks, and other material that is too small and poorly secured.
- Removing intentional passing lanes.
- Leaving new barriers on top of the soil instead of partially burying them.

Other Maintenance Solutions

Trail sections with chronic issues require a lot of attention and resources. Try to determine how and why a trail segment is failing in the first place. This is critical to develop strategies for repair. Sometimes the problem can be resolved by addressing a drainage issue farther up the trail—evaluate the bigger picture before applying a temporary fix. Consider rerouting segments of trail that continue to have chronic issues. Better yet, design and build trails that follow more sustainable alignments to avoid this headache altogether (for tips, refer to the "Sustainability" section in chapter 2). It is paramount to build the best trail for the location, not the trail that is easiest to build.

The root cause of tread failure is commonly linked to a few situations:

- Fall line trail alignment
- Located in flat areas or ridge tops that capture runoff
- Located in areas prone to flooding
- Overly steep trail grades
- Lack of or infrequent grade reversals
- Lack of maintenance

Treat the problem, not the symptom!

Eroded Tread on a Steep Trail

Issue. Steep trails with failed or missing drainage features are often channelized.

Potential solution. Reroute the trail to a lesser grade. If rerouting isn't possible, stabilize the tread by removing the outside berm of the trail and reusing the material to create rolling grade dips. Install as many rolling grade dips as necessary to drain water and prevent it from running down the trail and channelizing the tread (refer to the "Rolling Grade Dips" section in chapter 4 for details). Unfortunately, this technique doesn't stop tread loss from overuse. In these cases, consider armoring the grade dips with rock in heavily eroded sections to create a durable drain and a stable tread surface. Refer to the discussion of draining water off existing trails in chapter 4 for more information

about armoring techniques. In some cases, especially in very steep or loose soils that don't hold rolling dips well, drainage features with an anchor, such as a waterbar, may be necessary.

Wide, Braided, or Deeply Rutted Trail Going Straight Down the Hillside

Issue. A fall line trail that is wide, braided, or deeply rutted and going straight up or down a slope.

Potential solution. Reroute the trail to a lesser grade. A short section of fall line trail may not be a major problem, particularly if the surface has stabilized and new erosion is minimal, as some users appreciate these challenging sections. Refer to the TMO to verify if the section of trail is within the design specifications. If it isn't, reroute the segment.

Maintenance tips if rerouting isn't possible

- Minimize the length of the fall line section as much as possible.
- Construct drains sufficiently large enough above and below the fall line section to prevent erosion.
- Install barriers to prevent off-trail travel. Remember, users will find another way if the trail isn't the easiest path.
- Install surface armoring with riprap (small stones) or stone pitching (arranging vertical flat or angular stones) or install steps.

Muddy or Boggy Trail

Issue. Channelized flat section of trail that consistently holds water and creates mudholes. Users skirt the edges of the mudhole causing trail widening.

Potential solution. Install rolling grade dips or change the alignment to force the tread uphill briefly (called a forced uphill undulation) by realigning that section of trail uphill to allow the water to drain. If moving the trail isn't possible, constructing a causeway is another solution. A causeway (or turnpike without ditches) is an earthen structure that elevates the tread above the saturated area. Refer to the discussion of draining water off existing trails in chapter 4 for more information about causeways.

Stream Diversion

Issue. Trails that approach a stream crossing from below will divert streamflow in a high-water event, causing a stream diversion that channels water down the trail. This situation can cause extensive damage both on and off the trail in a single storm event.

Potential solution. Plan stream crossings carefully. Reroute the portion of the trail that intersects the stream at a place with an approach above the high-water mark. The approaches should descend to the stream instead of entering at an even grade.

Figure 3–18. Stream at flood stage diverting down a trail that is approaching from a lower angle. Inyo National Forest, California. USDA photo by Jennie Leonard.

Washed-Out Tread

Issue. Trail section in a valley bottom prone to episodic flooding.

Potential solution. Relocate the section. If you can't relocate the trail out of the valley bottom, then consider installing extra drainage features, armoring stream banks, and installing rock tread. In some cases, with the right construction and the right amount of maintenance, a trail can still perform even when flooding occurs if it is constructed to withstand the erosional forces of a stream for short periods of time.

Objects in the Trail Corridor

Refer to the trail design specifications for the use type and development scale before removing boulders, rockslides, large roots, stumps, and other obstacles. Is it a minimally developed (class 1) trail in a wilderness area or a wide, flat, fully developed (class 5) trail near a campground? The trail type and development scale will help you know what obstacles to remove and what should remain to challenge users. Large objects can sometimes be moved more easily with rigging. Rigging is a system of specialized ropes, cables, and hoists that makes moving heavy objects safer and easier. Safe use of rigging techniques requires training and experience. "Rigging for Trail Work: Principles, Techniques, and Lessons from the Backcountry" provides a thorough review of when and how to use rigging.

Rock Removal

Rocks may need to be removed when they fall onto the trail or when the tread is compacted causing rocks to protrude. Depending on the trail development scale, obstacles and protrusions in the tread may be acceptable. In some cases, they add character to the trail. Discuss with trail managers the acceptable protrusions and tread width for the trail.

Removing large rocks safely takes experience, especially where there is the possibility of dislodged rock rolling downhill. Trail managers use several techniques to remove or reduce the size of large rocks, or shape rocks for retaining walls or other guide structures (figs. 3–19 and 3–20).

Receive training and any necessary certifications on these techniques before trying them on your own.

Common methods and tools include:

- Rock bars and fulcrums
- Specially designed drills and wedges that can split a rock
- Lever chain hoists (Griphoist is a popular brand)
- Chemical expansion agents
- Motorized equipment with splitting or grinding heads
- Specialty tools (popular brands include Boulder Buster and BMS Micro-Blaster)
- Blasting with explosives by a trained and certified Forest Service blaster

Figure 3–19. Rock bar and fulcrum used to move a large rock. Cibola National Forest, New Mexico. USDA photo by Kerry Wood.

Figure 3–20. A boulder being split with plugs (wedges) and feathers. Coconino National Forest, Arizona. USDA photo by Kevin Kuhl.

Maintenance tips

- If you decide to manually remove the embedded rock, remove it to meet the trail standards to accommodate the use type and development scale.
- Prepare a location for the rock to be moved to and anticipate how it might roll before it is moved.
- Communicate with all crewmembers about how the task is progressing. Make sure crews are rotating among tasks to prevent overexertion and possible injury.
- Build a barrier to prevent any loose rocks from gaining momentum if people, trails, or other facilities are located below.

- Save rock that is removed or blown up to be used in wire baskets (called gabion baskets) or as fill material.
- Once a dislodged rock is moving—intentionally or by mistake—do not try to stop it! Yell "ROCK!" to warn anyone below.

Common mistakes

- Simply knocking off the top of a rock flush with the existing tread, which may leave another obstacle in the future after soil has eroded around the rock. (Remove the whole thing.)
- Not adequately repairing the tread after a rock or stump has been removed.
- Letting rocks roll down a slope regardless of size.

Be patient—when rocks are moved in a hurry they almost always end up in the wrong place.

The two most common injuries in rock work are pinched (or smashed) fingers and tweaked (or blown out) backs. Both sets of injuries result from using muscles first and brains last. High-quality rock work is almost always a methodical, even tedious task. Safe work is ALWAYS faster than taking time out for a trip to the hospital. Slow is smooth, smooth is fast!

Root and Stump Removal

Removing roots and stumps is hard work. Explosives and equipment are good alternatives to manually removing stumps.

Maintenance tips

- Leave stumps tall to create a lever for removal. Use machines to push over smaller trees (instead of cutting) to avoid the need for stump removal.
- Use a sharpened pick mattock or Pulaski to chop away at the roots.
- Remove roots and stumps from the tread on developed to fully developed (class 3–5) trails.
- Before you remove a stump, consider whether other crews before you might have left it to keep the trail from creeping downhill or for a challenging feature (depending on the trail type and development scale).
- Remove roots that are parallel with the tread because they often funnel water down the trail and also create slipping hazards.
- Remove roots perpendicular to the trail when the root is fully exposed.

Common mistakes

- Removing large roots or too many roots and impacting the health of the tree.
- Not removing roots and stumps during trail construction. A new trail tread will compact and stumps, stobs, and roots that are simply cut at the surface will grow over time, causing hazards for users and maintenance issues the first season after the trail is constructed.

4

STRUCTURES

4. STRUCTURES

Trail structures are constructed features that support the trail. They can be earthen structures like rolling grade dips that shed water off the trail or rock walls that support the tread on a steep hillside. Constructed features require some degree of maintenance, so think about them critically before installing. Forest Service engineer-approved standard drawings for common trail structures are available on the Plans for Trail and Trail Bridge Structure web page.

Draining Water

Telltale signs of poorly designed trail segments with drainage issues are channelized, incised, rutted, or gullied tread. Erosion issues are caused by inadequate drainage uphill of the issue. Designing and locating trails that allow for shedding water off the trail at regular intervals protects the tread from this type of erosion. Your goal should be to treat the problem and not the symptoms. A well-designed trail takes drainage into consideration before construction by incorporating grade reversals in the alignment. Refer to the "Grade Reversals" section in chapter 6 for more information.

The trail and support structures are threatened by erosion when water is allowed to flow down or pool on the trail. Standing water often occurs in flat areas with poorly draining soils, where displacement or compaction has reshaped the trail causing water to be trapped and

pooled. Mudholes often develop around pooled water in most soils (fig. 4–1). And as users avoid the muddy area, the mudhole grows.

Solutions for Draining Water Off Existing Trails

- Remove any berms that have formed.
- Outslope the tread or restore the outslope to 5–8 percent.
- Regularly maintain drainage features.
- Install new drainage features where they are lacking.
- Reroute the saturated segment of the trail uphill or downhill.
- Armor tread where soils are susceptible to rutting.

Before maintaining drainage features along a trail, take time to observe if the drainage features are well-located, self-cleaning, and optimally functioning. They should shed water off the trail at regular intervals and require only light maintenance to remove seasonally accumulating organics. If there is not adequate drainage, adding new ones or modifying existing drainages may resolve erosion and puddling issues.

Figure 4–1. Water pools in ruts created when the trail is saturated. Solutions for this include more effectively removing water from the trail, installing a forced uphill undulation, or hardening sections where rerouting isn't possible and draining is not effective. USDA photo.

Rolling Grade Dips

A rolling grade dip is a drainage feature that reverses the trail grade for a short distance so water sheds off the trail instead of flowing down the trail (fig. 4–2). A well-constructed rolling grade dip blends into the existing trail without abrupt turns or elevation changes and requires minimal maintenance. It will have little effect on the trail users' experience. Each rolling grade dip has a

crest, a sag (also called a dip), and an outlet. The size and frequency of the crest, sag, and outlet will depend on the user type, trail grade, soil condition, hillside slope, and typical rainfall patterns.

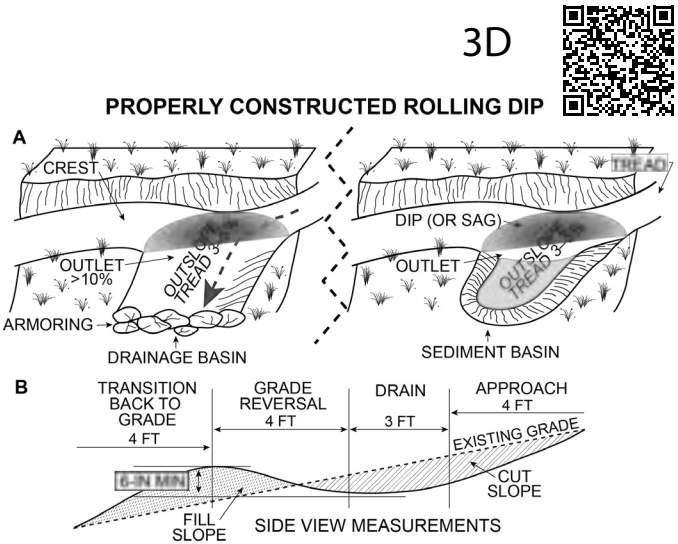

Figure 4–2. A properly constructed rolling dip can be a sustainable solution for a poorly designed or constructed trail. The side view measurements in the lower diagram are estimates from a hand-built hiking trail. Dimensions will change depending on user type, trail grade, soil condition, prevailing hillside slope, and typical rainfall patterns. Diagrams based on Forest Service standard trail drawings STD 927–01 and 927–02.

Construction tips

- Space rolling grade dips close enough to prevent water from building volume and velocity, which will transport soil downhill and wear the tread surface away. There isn't a formula to calculate the distance between drainage features; they can be as close as every 50 ft (15 m), or more typically every 200 ft (61 m). Observe other trails in the area and measure drainage spacing along stable sections of tread.
- Locate a rolling grade dip where surface water is being channeled into the trail. Below the top of the hill summit, within the midslope, and above the toe (or bottom) of the hillside are ideal locations. Installing a rolling grade dip above the toe of the hillside helps to mitigate muddy or loose conditions when the trail reaches the bottom.
- Reinforce the crest with material and construct it tall enough to divert anticipated water flows off the trail (without creating a jump).
- Outslope the tread in the sag 3–5 percent to drain water into the outlet. Extend outlets into a drainage or sediment basin.
- Ensure the outlet of the drain is shallow and wider and more sloped than the trail tread. The spoon or lens shape of the drain and outlet directs water off the trail in a thin sheet to prevent sediment deposition and avoid erosional rills or gullies from forming.
- Determine whether a sediment basin is needed to prevent sediment from directly entering a stream or

if soils in the outlet are easily eroded. The captured sediment can be used for maintenance of the structure or tread (fig. 4–3). Sediment basins require regular maintenance, or they will fail.

- If necessary, armor the area where the water leaves the drainage basin to help prevent headcutting.

Common mistakes

- Using rolling grade dips on steep sections of trail (greater than 15 percent grade).
- Locating the dip on the outside of a turn.
- Directing sediment into rivers, streams, and creeks.

Figure 4–3. A sediment basin connected to a rolling grade dip catches eroded material that can be reused in routine trail maintenance. Consider increasing the number of rolling dips if the sediment basin fills in less than 3 years. Daniel Boone National Forest, Kentucky. USDA photo by Matt Able.

Use Topography To Force Uphill Undulation

Creating a grade reversal by moving a small segment of trail upslope or downslope can be a feasible solution to drain water from an existing trail (fig. 4–4). The upslope and then downslope pattern are referred to as undulation. This method may require additional environmental evaluation as the short reroute could be outside of the existing trail corridor (fig. 4–5).

Construction tips

- Layout the relocated segment either above or below the existing trail, with sufficient grade to force water off the trail. The length of the relocation will depend on the surrounding terrain.
- Smooth the grade transitions from the old tread to the new alignment with no abrupt turns, rises, or dips.
- Naturalize the old trail tread with rocks, debris, and plantings to discourage use.

Figure 4–4. On the right, a minor realignment uphill of an existing trail to create a grade reversal, also referred to as a forced uphill undulation. Cibola National Forest, New Mexico. USDA photo by Kerry Wood.

Figure 4–5. The old trail (solid line) was realigned uphill (dotted line) to create a grade reversal. Tennessee. USDA photo by Scott Johnson.

Knicks

Knicks are semicircular drains constructed to shed water off existing trails on hillsides (fig. 4–6). They are installed more quickly than a rolling grade dip and are essentially the sag portion of a rolling grade dip without the crest. They can be a viable choice when soil moisture is not adequate to compact the crest of a rolling grade dip. They perform best when installed to the inside of turns, where they can drain downhill.

Knicks are inserted into an existing trail by removing a thin amount of material in a 10–ft (3–m) semicircle and outsloping it up to 15 percent. When located thoughtfully, knicks can function for many years with little maintenance. However, most are not constructed carefully and generally require annual maintenance to reestablish and remove any collected sediment.

Figure 4–6. Installing knicks into existing trails will drain puddles from flat areas. This knick will require frequent maintenance because it's draining to the outside of a curve in the trail. Fishlake National Forest, Utah. USDA photos by Nathan Conder.

Waterbars

Waterbars are linear features made from embedded rock or wood used to direct water off the trail. They should only be used on less-developed hiking or equestrian trails. Waterbars are not favored on motorized trails and trails open to bicycles. They also require routine maintenance to remove trapped sediment from the drain and outlet. If neglected, the sediment accumulates, and water will overtop the waterbar or erode the sides (fig. 4–7). Although no longer favored by most, waterbars are still found on many trails. Consider installing a rolling grade dip, forced uphill undulation, knick, or a grade reversal with a short reroute instead of continuing to maintain a waterbar.

Construction tips

- Set the waterbar at a 45– to 60–degree angle across the tread and anchor it either into the backslope (if made of a log) or deep into the soil (if made of rocks). This will prevent the waterbar from being undermined and failing.
- Construct and maintain the outlet of the drain to be shallow, outsloped, and at least three shovel-widths across. The length and shape of the drain should slow the water down and direct it off the trail without letting the water ever reach the bar.

- Shape the drain at least as wide and steep as the outlet where the water drains off the trail to prevent sediment depositing and clogging the waterbar.
- Compact or reinforce the tread downslope of the waterbar to withstand concentrated foot traffic.

Dips Are In, Bars Are Out

In place of waterbars, install rolling grade dips and knicks to fix drainage issues where possible. Users commonly step or roll around waterbars, causing trail widening. To function properly, waterbars also require heavy recurring maintenance to reestablish the drain and outlet. You can build a good rolling grade dip or knick quicker than you can install a waterbar, and in most cases a rolling grade dip works better at shedding water from the trail and preserving soil. If you do install waterbars, limit their use to trails predominately designed for hikers and equestrian riders. They may be appropriate in a few situations, for example on trails with limited or shallow soils and in very rocky areas where other options are limited.

Figure 4–7. Waterbars fail for a variety of reasons and are not a preferred way to drain water off the tread. Water and sediment load have overwhelmed this waterbar and users have begun skirting around it. Carson National Forest, New Mexico. USDA photo by Kerry Wood.

Areas With Saturated Soil

Some trails in areas with consistently saturated soil require unique design, construction, and maintenance techniques to raise the trail surface above the surrounding grade to improve drainage and help to keep the tread dry and firm. Characteristics of seasonally and perennially saturated areas in the United States vary widely, depending on soil types, topography, and rainfall patterns. Misusing materials

or misapplying these techniques can lead to more frequent maintenance needs and may negatively impact sensitive aquatic environments. Most techniques for fixing trails in saturated areas also require more crew time, materials, and other resources and need to be repeated frequently. Consider locating new trails away from saturated areas or relocating problem sections of trail.

This section covers simple mitigation measures to elevate or stabilize the tread for short segments of trails. Simple structures may be necessary to elevate the tread over an area of consistently saturated soil, move water from one side of the trail to the other in a culvert, or to span a small creek or riparian area with a trail bridge.

Trail building techniques on longer segments of saturated ground may require installing more complex structures that lower the surrounding water table, like turnpikes, or are built over the saturated area, like a boardwalk (fig. 4–8). Techniques for building structures over longer distances are covered in the "Trail Structures for Wet, Unstable, and Sensitive Areas" publication available on the Forest Service national publications page.

Figure 4–8. Standing water results in soft, boggy tread. Water is pooling in this flat trail segment. Ideally, the trail would be relocated onto the slope uphill. However, if relocation is not possible, the trail manager could install a drainage structure. Baltimore, Maryland. Maryland Department of Transportation photo by Cheryl Ladota.

Rock Underdrains

Rock underdrains (often called French drains) are a fairly complex rock and earthen structure that allows water from small springs or seeps to flow under the tread surface. Successful construction requires access to varying material sizes and an understanding of local soils, precipitation, and conditions. Large rocks with progressively smaller rocks on top are placed in a trench perpendicular to the trail, with

the trail tread laid over top. Water percolates between the spaces in the large rock, while the smaller rock holds everything in place and provides a firm surface for the tread (fig. 4–9).

In many cases, trail managers pursue other solutions that are easier to construct and maintain, like open surface drains and drain dips or armored drainage dips. Refer to the sections on culverts and armoring the tread (below) for more information about these techniques.

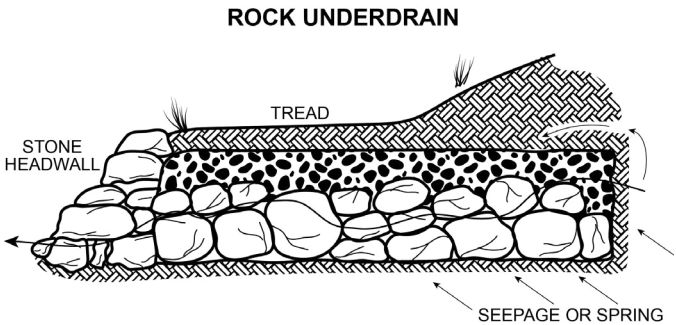

Figure 4–9. Rock underdrains allow water from low-flow springs and seeps to drain under the trail tread. Diagram based on Forest Service standard trail drawing STD 924–10–01.

Construction and maintenance tips

- Observe the greatest extent of the saturated area during the wet season. The width of the structure should capture the entirety of the wet area to be effective.
- Dig a trench perpendicular to the trail tread with a flat bottom and compact the bottom of the trench.

- If installing on a hillside, use large rocks or boulders to create a stone headwall along the outside edge.
- In the trench, create a solid base course of interlocking rocks with the largest rocks (greater than 8 in [20.3 cm]) placed along the bottom. The purpose is to create small voids between the larger rocks to allow for slow water flow. If erosion is a concern, establish a second course of tightly laid rocks with larger spaces to accommodate higher water flows.
- Layer smaller rock and gravel to establish an even surface.
- Place at least 6 in (15 cm) of suitable tread material to cap the rock underdrain.
- Maintain the tread to prevent surface erosion by restoring outslope and surface drains.

Causeways

A causeway is a turnpike without ditches. It is an earthen structure that elevates the trail tread in seasonally wet areas. It is not typically used where year-round groundwater saturation is a problem. Causeways can also be used to restore multiple parallel paths by replacing them with a single pathway (fig. 4–10). Constructing a causeway can be a moderate to big project, depending on the size. Even a small causeway will require staging of several tons of rock and soil. Consider the alignment, rock and soil source, and size of the disturbed area before beginning the project.

Causeways are not recommended in consistently saturated soils because the foundation can sink into the ground. This is particularly problematic in clay soils. Constructing a turnpike with lead-off ditches is better in that situation. Refer to the "Trail Structures for Wet and Sensitive Areas" publication available on the national publications page for information about building traditional turnpikes.

Figure 4–10. A suitable place for a causeway to raise the trail and drain the tread. Lake Tahoe Basin Management Unit. USDA photo by Garrett Villanueva.

CAUSEWAY WITH GRAVEL BASE

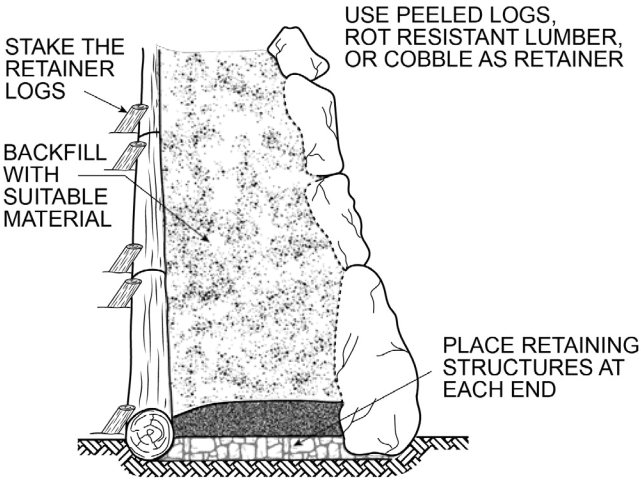

Figure 4–11. Causeways are turnpikes without ditches. They create an elevated, hardened tread and are best used across seasonally wet areas or to cover and replace multiple parallel paths. Diagram based on Forest Service standard trail drawing STD 932–20–01.

Construction tips for causeway foundation

- Dig down in the trail tread to stable mineral soil.
- Create a solid base course with the largest angular rock, 3–8 in (8–13 cm), placed along the bottom.
- Use smaller rocks to fill voids in the base layer and place another course of smaller rocks on top of that. Place fill material at the top to create a level foundation for the trail tread.

- Line the causeway with large rocks, timber, or log retainers. Large rocks (greater than 80 lb. [36 kg]) are preferable if available near the work site. Partially bury the retainer rocks two-thirds deep to anchor them so they don't move. Lay retaining timbers or logs in continuous rows along both edges of the trail tread. Logs should be peeled and at least 6 in (15 cm) in diameter. Use wood stakes or sapling stakes to hold the log retainers in place.
- "Broadcast" (or evenly distribute) woody material, partially bury rocks, and replant the disturbed areas along the sides of the causeway to discourage users from using old routes.

Construction tips for causeway trail tread

- Layer gravel or other well-draining soil on top of the fill to elevate the tread above seasonal water levels, which provides a stable trail tread and prevents trail braiding and muddy areas.
- Install a crown (or mound) in the center of the tread a minimum of 2 in (5 cm) above the side retainers or at a minimum of 2–percent grade so water will drain off the tread in either direction.
- Install armored dips, open rock drains, and other drainage features as necessary to prevent damming surface water.

Maintenance tips

- Recrown the tread where the soil has settled.
- Reestablish drainage features.

- Service retainer materials (e.g., rebury or replace logs, rocks).

Crossing Streams and Rivers

Stream and river crossings can range from a shallow stream ford to a trail bridge. The type of crossing depends on the trail type and development scale. For example, steppingstones are an appropriate water crossing on a minimally developed (class 1) hiking trail and a trail suspension bridge is appropriate for a fully developed (class 5) route designed for people using mobility devices.

Working in or near streams requires special consideration to not damage natural and potential cultural resources in the riparian area, including banks and flood plains. Permitting and coordination with environmental specialists is required. The U.S. Army Corps of Engineers evaluates applications and issues permits for all construction activities that occur in, under, over, or near all waters in the United States, including wetlands. An agency engineer or hydrologist can help evaluate if a permit is necessary.

Shallow Stream Fords

Shallow stream fords provide users with solid, level footing or driving surface at a consistent depth from one bank to the other without blocking passage for fish and other aquatic organisms (fig. 4–12). Most are designed to be used during low to moderate flows.

Install fords in wider, shallower portions of the stream, avoiding bends where water will undercut approaches on the outside of a turn. Well-constructed and well-located shallow stream fords require minimal maintenance.

Figure 4–12. Fords should be established in wider, shallower portions of a stream. Place steppingstones for hikers. Approaches should climb a short distance above the high-water line. Lake Tahoe Basin Management Unit, California. USDA photo by Garrett Villanueva.

The key is to maintain the hydrologic characteristics of the stream channel and bank in the ford. Changing these characteristics could change the channel volume during flood stage and lead to scour (or erosion caused by flowing water). The trail adjacent to either bank should immediately climb above the high-water line to prevent the

streamflow from diverting onto the trail (fig. 4–13). Installing grade reversals on approaches above the high-water line minimizes sedimentation into the stream (fig. 4–14).

Figure 4–13. Bank armoring in the approach to a shallow stream ford. Lake Tahoe Basin Management Unit, California. USDA photo by Garrett Villanueva.

If appropriate, a shallow stream ford may be constructed to include well-spaced steppingstones. The steppingstones or other obstructions should be placed close enough together to be useful and far enough apart to prevent debris from getting trapped and altering water flow characteristics (figs. 4–12 to 4–14).

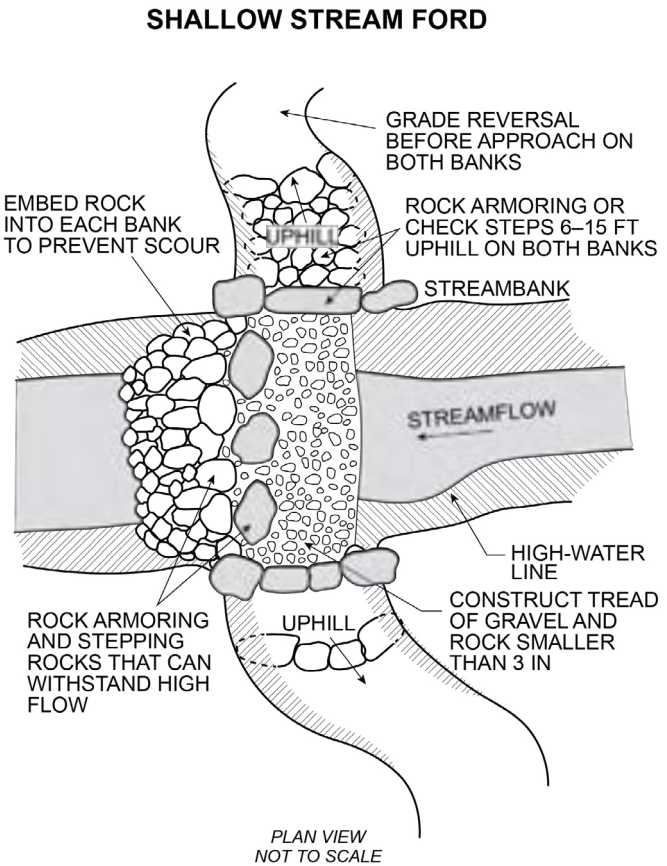

Figure 4–14. Shallow stream form. Diagram based on Forest Service standard trail drawing STD 917–20–01.

Construction tips

- Armor the banks and tread with steps or surface riprap to prevent stream bank scour and failure.
- Construct fords for hikers and pack stock, such as llamas and pack goats, no deeper than 16–24 in (41–61 cm), or about knee high during most of the use season.
- Place steppingstones or large rocks downstream from the tread. Rocks that are large enough to withstand flood flows and be embedded in the channel are generally larger than you think they should be. Interlock bedded rocks with steppingstones to withstand scour and movement of the steppingstones.
- Use care to minimize any construction that narrows or constricts the channel, causing higher water velocity and scour potential. Space the rocks far enough apart to prevent debris from becoming stuck, but close enough to step across.
- Work to retain or restore an even, shallow flow and solid footing.

Culverts

Culverts are structures placed in the ground that allow low to moderate flows under the trail. They can be made of metal, plastic, wood, or rock. Building culverts out of native materials is preferred and may be required in some areas (fig. 4–15). The size of the culvert depends on the maximum amount of storm runoff. An undersized culvert can easily clog with debris during large rain events, causing water to

go around the culvert or increase the velocity at the outlet and erode the trail tread.

Figure 4–15. Rock culvert on the Lake Tahoe Basin Management Unit, California. USDA photo by Garrett Villanueva.

Traditional culverts are appropriate for higher flows and provide a stable tread surface over the ditch. In fire-prone areas, metal and rock culverts are preferred over plastic, as plastic culverts can burn or melt. Bottomless arch culverts require less vertical space and have a natural streambed bottom that is preferred for aquatic organism passage (fig. 4–16). All arches and round culverts require a level outlet.

Elevated outlets create a waterfall that may scour and headcut the channel. Work with hydrologists to determine the best type and size of culvert to fit your needs.

Figure 4–16. Arch culverts are a good option for moving water under a trail while keeping a natural stream bottom. Boise National Forest, Idaho. USDA photo by Scott Johnson.

Water flowing toward a culvert often carries a lot of silt and debris. Installing settling basins on the upstream side helps prevent culverts from clogging with silt and debris (fig. 4–17). Also, consider how water in the channel might overtop the trail during high-water flows when developing the finish tread and slope armoring. Trail segments should

be shaped above the culvert so water that overtops the trail flows back into the channel. The goal is to keep the stream and any flow that overtops the trail in the channel and not down the trail. Culverts often plug during storm events because debris is swept into the stream. Consider where the water will go when the culvert plugs to prevent the stream from diverting onto the trail and causing a new channel to form.

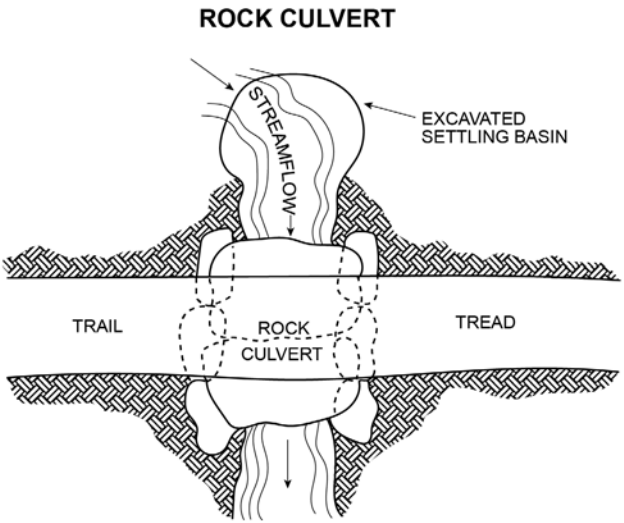

Figure 4–17. Settling basin on the upstream side of the culvert to prevent the culvert from clogging with silt and debris. Diagram based on Forest Service standard trail drawing STD 921–30–01.

A properly constructed open-top drain (fig. 4–18) is one of the easiest drains to maintain and can sustain moderate flows without eroding the surrounding area. The open top should be wide enough to accommodate the water flow and narrow enough for someone to step over.

Construction tips for open-top drains made from rock (fig. 4–18)

- Dig a ditch across the trail that is wide and deep enough to accommodate the rock base and sides, and with an opening large enough for the highest predicted flow.
- For the base, embed large, smooth rocks (greater than 80 lb. [36 kg]) two-thirds into the ground with a 3–percent slope to the downstream side of the trail.
- For the sides, embed large rocks two-thirds into the bottom and sidewalls of the drain, while providing a flat surface for the trail tread.

Figure 4–18. Open-top drains can be made of rock or wood. Pike-San Isabel National Forests, Colorado. USDA photo by Adam Carroll.

Construction tips for rock culverts (see fig. 4–15)

- Follow the same tips as for open-top drains made from rock.
- Lay large, thick, flat stones slightly below the trail tread that are long enough to span the opening.
- Interlock the top tread rock with boulders at corners.
- Take time to prepare the channel and supporting rocks before placing the spanning rock.

Construction tips for metal or synthetic round or bottomless culverts (see fig. 4–16)

- Measure the channel width and depth and choose a culvert diameter that provides at least 100 percent volume of existing channel.
- The culvert length should be the width of the trail, shoulders, and any armoring.
- The ditch width should be the culvert diameter and enough space on either side of the culvert for tool compaction, about 8–12 in (20–30 cm) on either side.
- Embed the culverts below the channel grade approximately one-third the culvert height—this allows for the culvert to pass the stream bedload (streambed material) through the culvert and prevent damming at the culvert inlet.
- Place fill material over the bedded culvert in lifts (or multiple layers) and compact each layer.
- Place a minimum depth of 12 in (30 cm) of tread material above the culvert.
- Stack rocks around the inlet and outlet to protect or armor the fill of the culvert from washing out. Creating a rock funnel into the culvert inlet will increase the volume of water the culvert can carry.
- In locations with higher flows, install a rock-reinforced spillway on the downhill side of the culvert to reduce headcutting and washouts.

Common mistakes

- Constructing the end of a perched or "shotgunned" culvert projecting from the face of the fill or embankment, which creates a waterfall out of the culvert, destabilizes the natural stream channel, and can cause headcutting.
- Failing to bed and compact the culvert tightly to prevent water from eroding around the culvert (a.k.a. piping).

Trail Bridges

A trail bridge is a structure erected over a depression or obstruction such as a body of water, a road, a trail, or a railroad that provides a continuous pathway and that has a deck for carrying traffic or other loads. They range from a simple foot bridge to multi-span, suspended, and truss structures. Appropriateness of bridge types and materials vary depending on the trail type, development class, and the relative recreation opportunity spectrum (ROS) class. The information in this section is a simple overview of trail bridge terms. Forest Service Handbook 7709.56b, Chapter 100 has more information, as well as the Forest Service's "Sustainable Trail Bridge Design" publication. Contact a Forest Service engineer if you think a trail bridge is a needed solution.

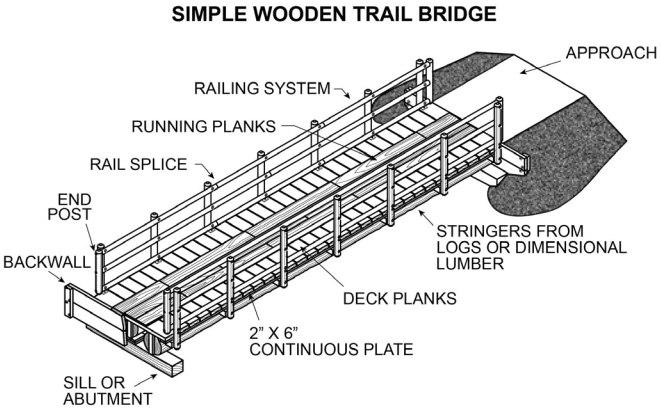

Figure 4–19. Basic trail bridge anatomy. Diagram based on Forest Service standard trail drawing STD 961–20–01.

Installation of new trail bridges, even simple log bridges, on National Forest System trails requires site-specific design approval from a designated engineer before construction. The Forest Service has standardized and approved trail bridge plans in AutoCAD and PDF preview files on the Plans for Trail and Trail Bridge Structures web page. The standard plans can't be modified without approval from the regional engineer.

The Forest Service categorizes trail bridges as minor, major, and complex depending on their length, construction material, and complexity (figs. 4–20 to 4–22).

Figure 4–20. Minor bridge:

- Requires training, but no certification to inspect
- Made of timber
- A single span less than 20 ft (6 m)
- Inspected every 5 years
- Appropriate for minimally to moderately developed trails (class 1–3)

Pike-San Isabel National Forests, Colorado. USDA photo by Adam Carroll.

Figure 4–21. Major bridge:

- Requires certification to inspect
- Made of timber
- Single span of more than 20 ft (6 m)
- Inspected every 5 years
- Appropriate for developed to fully developed trails (class 3–5)

Huron-Manistee National Forests, Michigan. USDA photo.

Figure 4–22. Complex bridge:

- Requires in-depth certification to inspect
- Truss, suspension, multi-span, and nontimber bridges
- Inspected every 5 years
- Appropriate for fully developed trails (class 5)

Bridger-Teton National Forest, Wyoming. USDA photo by Jay Sammer.

Common trail bridge material

- Pressure-treated wood
- Wood laminates
- Metal
- Concrete
- Fiber-reinforced polymers (FRP)

Approaches

The sections of trail on either end of a trail structure are referred to as "approaches" (fig. 4–23). The length of the approaches to a trail bridge or other structure depends on the difference in deck elevation and trail elevation.

Approaches should rise to meet the decking, and either be a ramp with grades from 2 to 8 percent or be a step(s) that climbs to the level of the decking. This creates drainage to prevent water from flowing and depositing soil and debris onto the bridge. When possible, construct straight approaches to funnel users onto the bridge without the need to turn and risk sliding.

Figure 4–23. Trail bridge approaches should climb at a 2– to 8–percent grade or be a step(s) that climbs to the level of the bridge deck. Carson National Forest, New Mexico. USDA photo by Kerry Wood.

Use compacted gravel, pavers, poured cement, or other durable material to transition smoothly from the trail to the bridge. Pavers are not recommended on trails used by equestrian riders. Buried concrete pavers are a good option where they can be transported to the site (fig. 4–24). Install the pavers at a downward angle so no edge appears as the tread wears down (fig. 4–25). The angle also locks the pavers in place. Take your time to align each paver so they create a uniform flat surface without rocking.

Figure 4–24. Concrete pavers are good for hardening trail structure approaches on trails designed for motorized use. The voids need to be filled with gravel, sand, or native soil and compacted. Sam Houston National Forest, Texas. USDA photo.

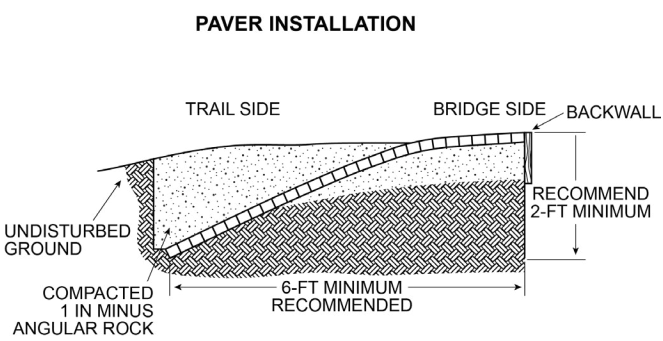

Figure 4–25. Angle the first course of pavers adjacent to the structure slightly downward. Place additional interlocking courses at a downslope and bury them to hold the first courses in place.

Handrails and curbs

User barriers on trail bridges can be curbs, railing systems, or a combination of the two. They are required on trail bridges, except foot logs and other minor trail bridges where user barriers are impractical or unnecessary. The amount of use and distance from population centers determines the type of railing. Curbs are appropriate in some cases if the potential hazards along the trail are the same or greater than the hazards of a bridge without a railing (fig. 4–26). Install a scupper block under the bullrail to create at least 4 in (10 cm) of clearance under the curb to let water drain and make removing leaves, sticks, and other debris easier.

Figure 4–26. Example of curbing made of dimensional lumber with bull rail and scupper blocks. Greenbrier State Park, Maryland. Maryland Department of Transportation photo by Cheryl Ladota.

Railings in urban and high-risk areas require a top rail and balusters less than 4 in (10 cm) apart. Railings in rural and moderate-risk areas require a top rail and balusters less than 6 in (15 cm) apart. Railings in remote and low-risk areas require a top and intermediate rail (fig. 4–27). Work with the local Forest Service bridge engineer to determine if handrails or curb railing are appropriate based on potential hazards, and the trail type, uses, and development scale (FSH 7709.56b section 82.4).

Figure 4–27. Trail bridge railing system with posts and top and intermediate rails. Huron-Manistee National Forests, Michigan. USDA photo.

Basic bridge maintenance and inspections

Following construction, all trail bridges require regular inspection by a qualified inspector every 5 years. Employees, partners, and volunteers can receive training to inspect minor and major trail bridges; only employees can be certified to inspect complex bridges. Trail managers can start an "adopt-a-trail-bridge" program and invite partners and volunteers to tighten bolts, clean between deck boards, sweep off debris, and conduct other routine maintenance.

Report issues to a qualified bridge inspector who can determine whether the bridge should remain open. Common things to pay attention to include:

- Rotting or insect-damaged wood
- Bent, broken, or disconnected components
- Large cracks, splits, or crushed components
- Exposed rebar or broken concrete with cracks wider than 1/16 in (1.5 mm)
- Erosion around abutments

Refer to FSH 7709.56b, Transportation Structures Handbook, chapter 100—Trail Bridge Operation for more information about trail bridge management.

Steep Trail Grades and Hillside Slopes

In some cases, steep trail grades or loose or unstable soils are unavoidable. Installing structures built with natural or imported materials may be necessary in areas with less-than-ideal conditions. Locate structures and anchor points carefully during layout to develop sustainable trail grades between them. Build structures with sustainable principles in mind and limit the number of structures that will have to be maintained in the future.

Turns in Steep Terrain

Climbing turns and switchbacks reverse the direction of travel on a hillside to gain elevation while still maintaining sustainable trail grades (fig. 4–28). Different types of

turns are used depending on the user type and how much space is available for the turn. The main difference between switchbacks and climbing turns is a switchback has a flat landing at the turn. Most trail managers prefer to construct and maintain climbing turns, although both styles are difficult to design and labor-intensive to construct correctly. The Forest Service standard drawings provide detailed plans for climbing turns and two switchback styles.

The best way to learn how to build turns in steep terrain is to seek out an experienced trail builder with a reputation for designing and building well-designed climbing turns, switchbacks, or retaining walls. Invite experienced builders to work with your crew, or volunteer to work with the experienced builder and their crew and add to your trail-building skills.

It is a better practice to reduce the need for climbing turns and switchbacks by avoiding the routing of trails on steep slopes. Fewer turns means less maintenance. If difficult terrain is impossible to avoid, contour the trail along the midslope and minimize the number of switchbacks or climbing turns. Installing grade reversals before and after each turn is essential to shed water prior to the turn. Also, avoid stacking turns above each other, as the water draining off the turn above will erode the turn below. Staggering the lengths of the legs of your turn will improve drainage and provide a better experience for the user.

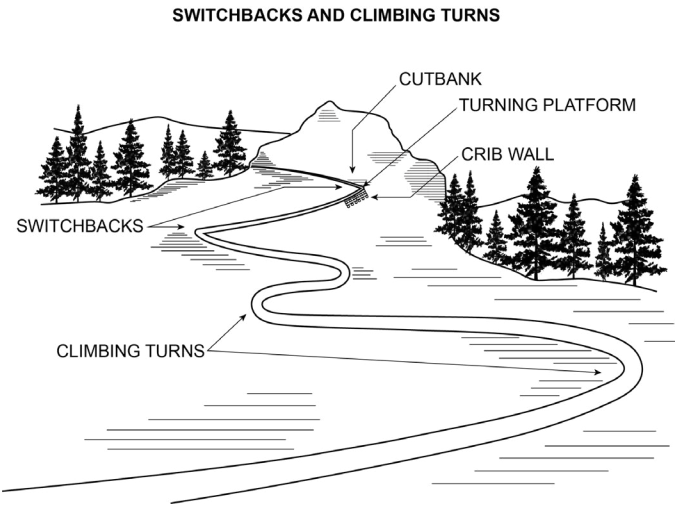

Figure 4–28. Climbing turns should be built on moderate slopes (less than 25 percent), whereas switchbacks can be constructed on steeper grades. Switchbacks require more technical construction techniques, such as installing crib walls.

Climbing Turns

Climbing turns are built on minimal to moderate hillside slopes when a change in direction is needed (fig. 4–29). The trail "climbs" through the turn at the same rate as the slope itself, as opposed to turning on a relatively flat surface or landing, as in a switchback or a modified climbing turn. Pack stock have an easier time negotiating a climbing turn than a switchback. Most trail managers also prefer constructing climbing turns over switchbacks because they require less maintenance and material to construct.

Build a climbing turn on hillsides of 25 percent or less or when a radius of 13–20 ft (4–6 m) is possible from the center of the turn.

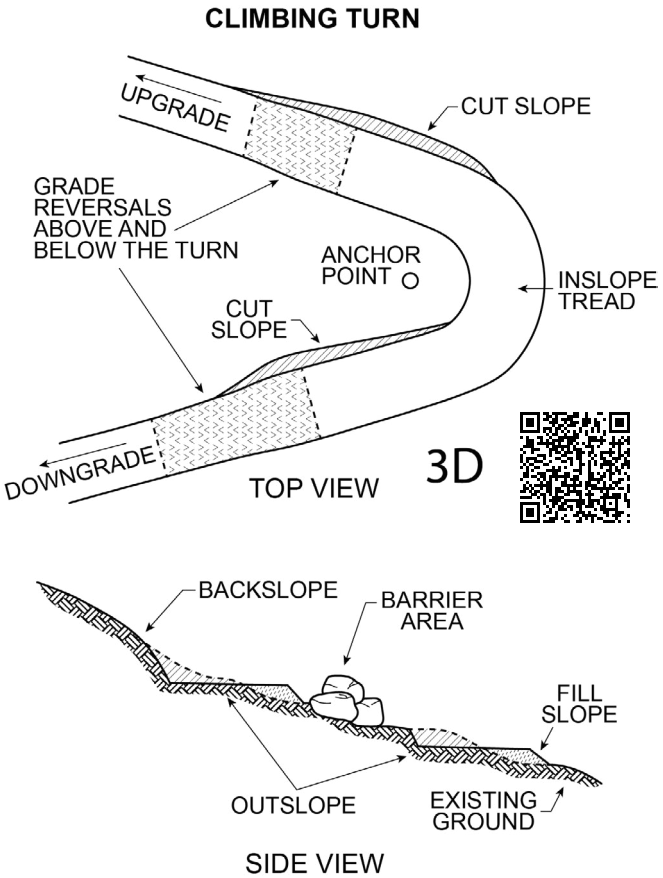

Figure 4–29. Climbing turn. Diagram based on Forest Service standard trail drawing STD 914–01.

Construction tips

- Lay out the turn so it wraps around a natural obstacle (anchor point) or place guide structures along the inside edge of the turn to prevent shortcutting (fig. 4–30).
- Use pin flags to designate the desired turn radius length and at various points along the turn to maintain a smooth radius.
- Always design grade reversals in both approaches to drain water before and after the turn. The reversal on the lower leg should capture flow from the upper leg.
- As the turn reaches the fall line, less material will be excavated.
- Inslope the turn toward the anchor point to contain users and stabilize the tread.
- Construct full benches at each end of the turn.

Common mistakes

- Constructing on a hillside slope that is too steep.
- Making the turn radius too tight or making the radius decrease through the turn (creating a "J" shape). The tight turn interrupts the forward motion of wheeled traffic through the turn and can cause riders to spin their tires.
- Providing inadequate grade reversals on the upper leg, causing the upper leg to drain onto the lower leg.
- Leaving rocks and roots in the trail tread.
- Positioning the upper and lower legs too close together, causing flat approaches to the turn, inviting shortcutting, and creating unnecessarily long approaches.

Figure 4–30. Use natural obstacles, like the tree at the top of this photo, as guide structures to prevent shortcutting. Wayne National Forest, Ohio. USDA photo by Scott Johnson.

Switchbacks

A switchback is typically constructed on steep hillside slopes (over 25 percent) when a change in direction is needed and the turning area is limited. The trail switches direction back and forth across the hillside in a zigzag pattern (fig. 4–31) to gain elevation in a short distance. Switchbacks are usually limited to nonmotorized trails, as motorized users will have a tough time with the small turning radius.

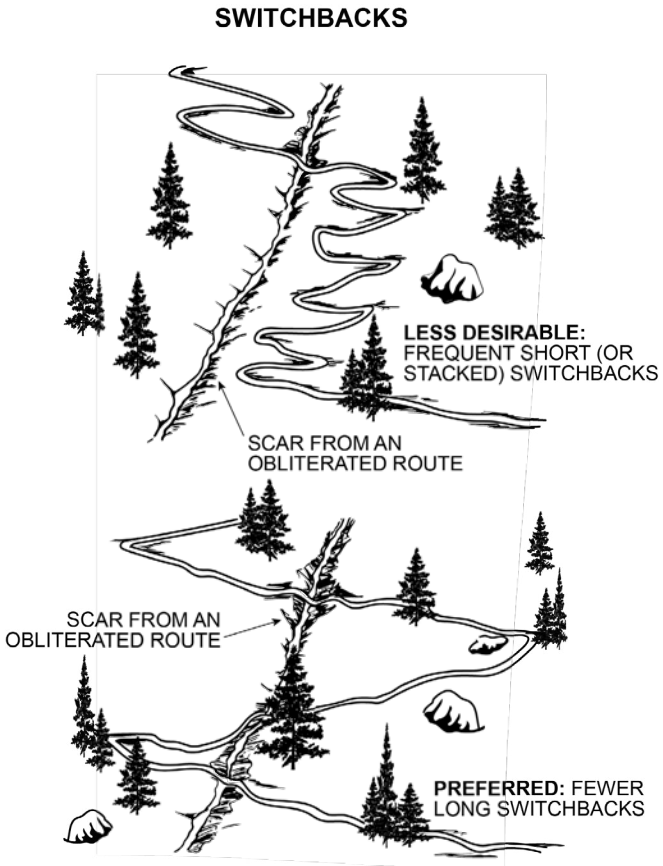

Figure 4–31. Long sections of trail between switchbacks are better than short sections that require more switchbacks with more opportunities to shortcut. Fewer switchbacks also means less construction and maintenance.

Trail managers use several different techniques to build switchbacks, mostly depending on the user type, topography, and obstacles. The circular landing style takes up the least space (fig. 4–32). The radius landing style is preferred for trails open to mountain bikes, where riders can flow through the turn without heavy braking. Rectangular landings are often used on trails that comply with accessibility guidelines.

In either style, drain features are installed above and below the turn. The upper leg is insloped to drain water away from the turn. Crib walls and other retaining structures are often necessary on switchbacks with steep hillsides in poor soil types.

Build a switchback when the hillside slope is greater than 25 percent with limited area for turn radius and the trail is open to nonmotorized users or built to meet accessibility guidelines.

Construction tips

- Avoid stacking turns (called corkscrews) that can increase the likelihood of water draining off upper trail sections onto lower trail sections (see fig. 4–31).
- Attempt to locate the turn on a relatively flat area or natural bench on the slope.
- Install grade reversals to drain water on the upper and lower legs before and after the turn.

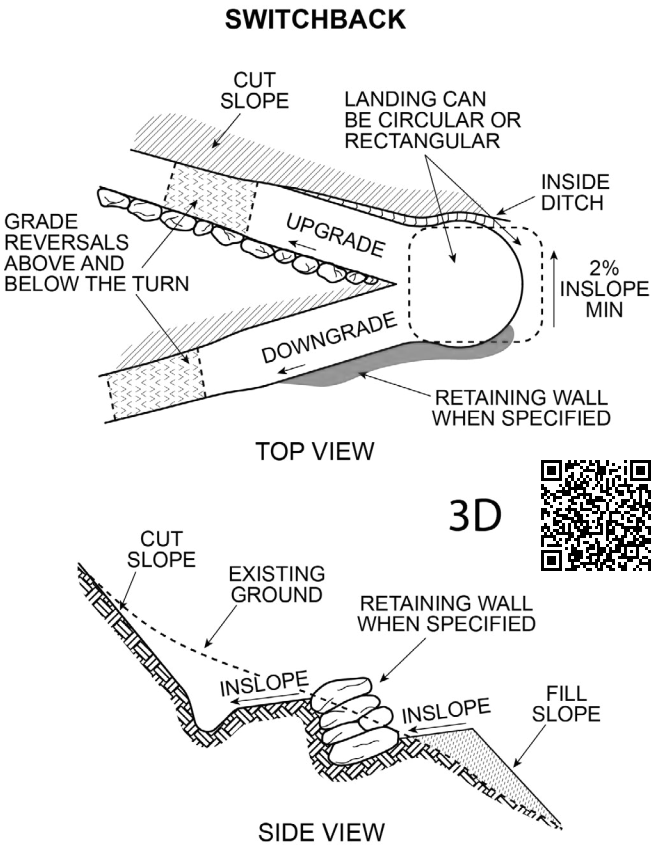

Figure 4–32. Switchback with a circular or rectangular landing. Diagram based on Forest Service standard trail drawings STD 931–20–01 and 931–30–01.

- Drain the landing or turning platform by insloping or outsloping the area 2–5 percent.
- Install an inside ditch if insloping the platform.
- Reserve excavated material from the upper leg to use as fill on the lower leg.
- Build retaining or crib walls to support either leg.
- Create barriers to discourage users from crosscutting between legs (fig. 4–33).

Common mistakes

- Not designing approaches and turns to accommodate the allowed uses.
- Creating a turn steeper than the desired level of difficulty.
- Having a disjointed or rough grade transition leading to the landing.
- Positioning the upper and lower trail legs too close together.
- Constructing the upper leg with inadequate insloping and not having a self-cleaning drain.

Figure 4–33. Rocks on the inside of the turn help prevent crosscutting the switchback. Rocks in the tread provide inside drainage before the turn. Pike-San Isabel National Forests, Colorado. USDA photo by Adam Carroll.

Radius Switchback

A radius switchback, also called a modified climbing turn, is like a climbing turn constructed on hillside slopes steeper than 25 percent. The turning area is "flattened" in a modified climbing turn so the steepest trail grade through the turn is approximately 20 percent. Flattening the turn is accomplished by building up the lower leg and cutting down the upper leg to reduce the grade on the turn. The

turning radius ranges from 5 to 10 ft (1.5 to 3 m) wide—on the wider side if the trail is open to wheeled traffic or used by long pack stock strings (fig. 4–34).

Just as in a traditional climbing turn, grade reversals before and after the turn are essential. The grade reversals on the lower leg should capture flow from the upper leg.

Figure 4–34. Pack stock navigate around a guide structure on a modified climbing turn. Nez Perce-Clearwater National Forests, Idaho. USDA photo by Ella Bradley.

Characteristics of a good radius switchback

- Turn is insloped toward the radius anchor point to contain users and stabilize the tread.

- Natural anchor points create barriers between the upper and lower legs to discourage crosscutting.
- Grade reversals shed water before and after turns where the grade reversal on the lower leg captures flow from the upper leg.

Figure 4–35. Modified climbing turn with rock retaining walls on the upper and lower legs. Inyo National Forest, California. USDA photo by Jess May.

Retaining Structures

Ideally, trails are located and constructed in suitable soils and on gentle slopes. Unfortunately, that's not the reality in many locations. When the slope gets steep or the

tread material is not ideal, trail workers construct crib and retaining walls, steps, and armoring to keep soil in place. Many of these projects require a heavy investment in time and resources to construct and maintain. Weigh whether the work is necessary to stabilize a trail and prevent erosion and consider if an alternative route would provide the solution without a heavy investment in building retaining structures.

Retaining structures hold back material or create a solid foundation. They are useful for keeping loose rock on scree slopes from sliding down and obliterating the tread, for keeping streams from eroding abutments, and for holding trail tread in place on steep hillsides (fig. 4–36). Any retaining structures over 6 ft (2 m) tall require engineering approval.

Rock Retaining Walls

Well-constructed rock retaining walls (also called dry masonry walls because no mortar is used between the rocks) can last for centuries. Rock is more durable than wood and recommended for most applications if there is an adequate supply near the project area.

Figure 4–36. A rock retaining wall can be used to support the trail tread or hold back the backslope. Inyo National Forest, California. USDA photo by Jess May.

Selecting the rocks. The key to a good retaining wall is a solid foundation and correct placement of rocks of acceptable size and shape. Before getting started, ensure an adequate supply of rocks to construct the retaining wall. The best rocks are rectangular with flat surfaces on most of the sides and 100 lb. (45 kg) or heavier—the bigger and heavier, the better (fig. 4–37). Quarrying, cutting, or shaping may be required to generate suitable material (fig. 4–38).

Figure 4–37. Rock wall foundation using quarried and cut rock. Lake Tahoe Basin Management Unit, California. USDA photo by Garrett Villanueva.

Figure 4–38. Shaping rock with rock chisels. Coconino National Forest, Arizona. USDA photo by Kevin Kuhl.

Plan your wall. Properly constructed retaining walls start out with a plan that includes location of the base, the height of the wall, and the angle of the wall face or "batter" (fig. 4–39). Aim for the angle of the batter (the amount that the wall leans into the hillside) to be at least 1:0.5, which means a 1–ft (30–cm) rise in height for every 0.5 ft (15 cm) of inward tilt. The batter should never be less than 1:0.25 without the use of cement, internal anchors, or both.

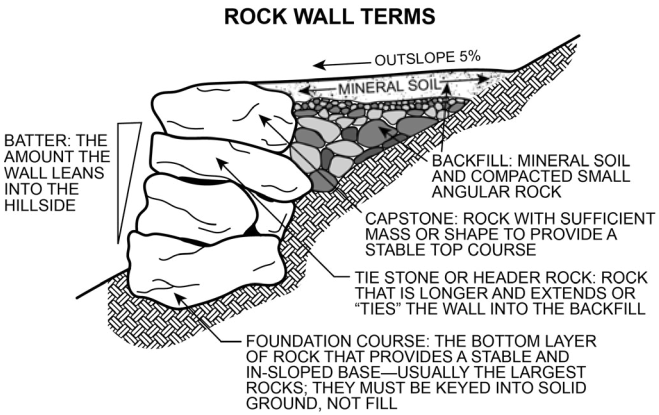

Figure 4–39. Terms used to describe rock retaining walls. Diagram based on Forest Service standard trail drawing STD 935–20–01.

Laying the foundation

- Excavate the wall footing to firm, stable soil or solid rock, preferably 6 in (15 cm) below grade.
- Tilt or inslope the excavated foundation into the hillside so the wall will lean inward to create a wall batter.
- Lay foundational or keystone rocks (often the largest rocks in the wall).
- Place and fit each rock to eliminate gaps and wobble or movement.
- Install rocks with many contact points along the outside of the wall. Mid and inside contact points will cause rocks to move by creating a fulcrum point.
- Compact behind each layer of rock with crushed gravel to tighten the wall layer by layer (fig. 4–40).

Figure 4-40. Use smaller rock to backfill and compact behind the larger rocks to stabilize the rock wall. Pike-San Isabel National Forests, Colorado. USDA photo by Adam Carroll.

Building the wall

- Once the foundation layer or course is completed, set successive courses:
- Use adequately sized and shaped rocks. Don't skimp by using inadequate material.
- Break joints by overlapping the seams between rocks in each course so the seams or joints don't line up in the courses above or below.

- Set each rock so it has a minimum of three points of contact set in a triangle, with two points toward the front edge of the stone.
- Shape the stones to improve fit on the front. Use smaller stones or shims to improve contact or fill gaps on the backside and negative space, as necessary. Never use shims on the face of the wall that can be worked out over time.
- As each course is completed, place and compact backfill in the remaining space with crushed rock (0.5–1 in [1–2.5 cm]), keeping organic material out.
- Place each course slightly farther into the hill to create the desired batter.
- Place tie stones and header rocks or long rocks perpendicular so that they extend deep into the hillside in each course. Using header rocks is particularly important if the wall's cross section widens as the wall gets higher.
- Use large, flat rocks as capstones for the top course of the wall. The heavier the better. Ensure capstones are shaped and placed to prevent trail users from loosening them.
- Backfill the capstone course with gravel and crushed stone a few inches below grade, then cap backfill with a minimum of 6 in (15 cm) of mineral soil.

Log Crib Walls

Log walls, called crib walls, are mostly used to support trails on steep hillsides, to hold back steep backslopes, in areas with loose or poor soils, or where adequate rock is not available. Wooden crib walls made of strong and naturally rot-resistant wood may work better for longer spans and in areas where rock cannot be anchored (fig. 4–41).

Figure 4–41. Where no large rocks are available, log crib walls may be a viable solution. Columbia River Gorge, Oregon. USDA photo by Nathaniel Brodie.

Selecting and preparing logs

- Use rot-resistant logs from native tree species (typically hardwoods) if available and permissible. Species vary depending on location. Avoid aspen, cottonwood, true fir, spruce, birch, and other soft and rot-prone wood species.

- Logs should be straight and consistent in overall shape and diameter.
- Peel logs past the cambium layer (the layer between the bark and the sapwood) to prevent premature rotting.

Notching the log. The purpose of a notch is to add stability and strength to a wall. The notch holds the upper log to the lower log and prevents horizontal rotation. The notch is cut into the bottom side of the upper log to reduce the water absorption into the cut area. Anywhere end grain of wood is exposed, water is wicked into the wood and the moisture promotes rot. "Lightly on the Land: The SCA Trail Building and Maintenance Manual" is a good resource for information about different notching methods. The notch type depends on the crew skill, tools, and time. There are three common notch types (fig. 4–42):

- A saddle notch, the preferred type, requires specialty scribing tools that refine the notch and a higher degree of patience and skill. Saddle cuts are accomplished by scribing the shape of the log below, making vertical cuts perpendicular to the scribed line, knocking out the cut blocks, and then using a single-bit ax or chisel for final shaping.
- A V-notch is not optimal but may suffice in low-consequence situations. This notch may be simply cut with a saw or an ax. It is just as the name implies: the cuts intersect at a single point at no more than one-third deep into the log. This notch may also be partially rounded to create a more secure connection.

- A square notch can be accomplished more quickly than a saddle notch by creating two vertical cuts and then chopping out the middle to create a flat bottom. In this notching style, both the top and bottom log are notched to create a flat mating surface. However, because the notched top of the lower log creates a surface, the logs will rot more quickly (fig. 4–43).

Construction tips

- Excavate the wall footing to firm, stable soil, or solid rock where possible. If establishing a solid footing is not possible, anchor or pin the sill and the first course face logs with deeply buried posts or 0.5–in (13–mm) or greater rebar driven a minimum of 24 in (61 cm) into the ground.
- Lay sill logs perpendicular to the direction of travel and alternate tiers of face logs and header logs (also called deadmen) (fig. 4–44). The purpose of the deadmen is to anchor and hold the wall to the slope.
- Interlock face and header logs with well-scribed and fitted notches on the bottom of the logs (see fig. 4–42). Pin logs at junctions with 3/8–in (10–mm) rebar or larger.

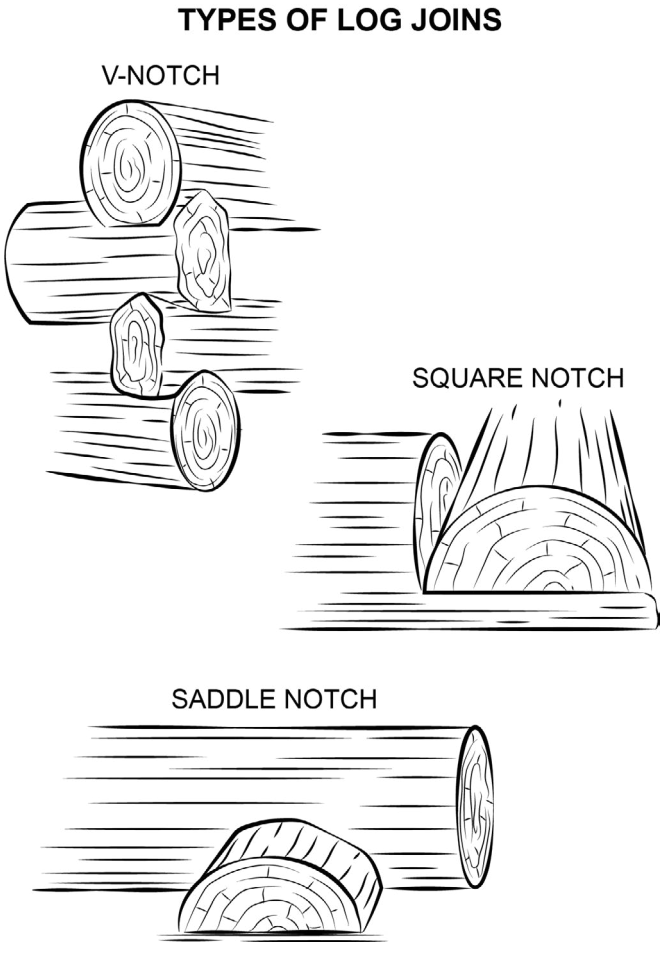

Figure 4–42. Types of log joinery.

Figure 4–43. An example of a square notch on timber steps. Inyo National Forest, California. USDA photo by Jess May.

- Pin the interior end of the header logs or deadmen to provide added anchoring and resistance to downward and outward forces.
- Place filler logs between the face logs or wedge larger rocks from inside the structure to plug the spaces between the face logs and retain the backfill.
- Like retaining walls built with rock, backfill log walls with gravel or crushed stone and avoid using organic materials. Backfill after each successive tier or after the wall is completed.

- Set each successive tier at enough of a batter angle to resist creep pressure from the slope and to reduce pressure on the face logs from the backfill.
- Cap the backfill with mineral soil (minimum of 6 in [15 cm]) to prevent dislodging or displacing and to provide a smooth tread.

Construction tips common to retaining and crib walls

- Outslope the tread to keep water from saturating the fill and excavation. Water should not cascade off the wall, as it will erode and undermine the structure. Drain water away from wall sections.
- Place riprap or other material at the wall base to prevent the foundation from being scoured.
- Embed large boulders or logs or other guide structures randomly along the outside edge to keep traffic off the edge of the tread—without creating a dam. Dig these into the tread so they don't get kicked off.

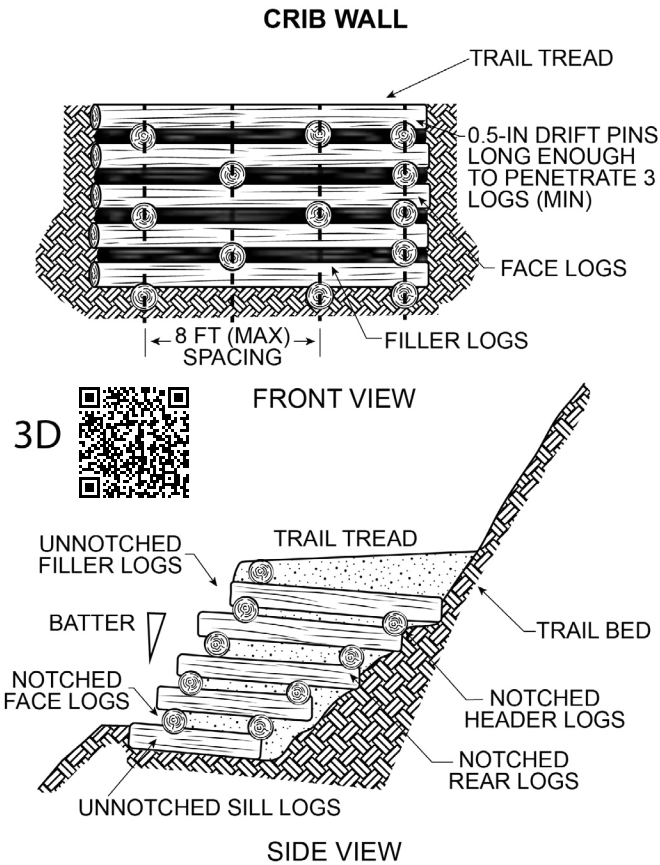

Figure 4-44. The characteristics of a log crib wall. Rot-resistant logs are recommended. Diagram based on Forest Service standard trail drawing STD 935-10-01.

Wire Basket Retaining Walls

Often called gabions (derived from an Italian word meaning "big cage"), wire baskets offer an alternative to rock or crib walls and other built structures in areas with shallow bedrock or where there is an insufficient supply of large rock or logs, but smaller rock is plentiful. The wire baskets are wired or welded together and filled with well-placed smaller rocks at a sufficient batter (fig. 4–45). Gabions are prone to fail if not constructed properly—particularly gabions made from twisted wire (fig. 4–46). Depending on the type of wire used and the climate, even well-constructed gabion walls may not last as long as a traditional rock wall. Some trail managers and users feel that gabions appear more artificial than a rock wall. Get help from someone with experience building long-lasting gabions if you use this type of structure.

Figure 4–45. Gabion retaining structure. Ashley National Forest, Utah. USDA photo by Nathan Emer.

Figure 4–46. Place rock tightly to avoid failure. This failing gabion was constructed with inadequately sized material and without sufficient batter. Shasta-Trinity National Forest, California. USDA photo.

Steps

Steps are used to gain a lot of elevation in a short distance. Rock steps are preferrable, but they can be made from wood depending on the availability of material. Steps are commonly found on legacy hiking trails where rerouting, paving, or other alternative stabilization means are not feasible due to terrain, need for elevation gain, and other factors. They are generally avoided on trails designed for equestrian riders and wheeled uses.

Figure 4–47. Installing overlapping rock steps with side retainer rocks. Lake Tahoe Basin Management Unit, California. USDA photo by Garrett Villanueva.

Constructing quality, durable steps requires a high degree of skill and experience, particularly if rock needs to be shaped (figs. 4–48 and 4–49). Steps can be constructed individually or grouped and in different styles depending on the location, alignment, trail grade, and available building materials. The width of trail structures, including steps, changes depending on the trail type and development class. Consult the trail management objective for the particular trail for a list of minimum structure widths.

Figure 4–48. Splitting rock with a stone sledge. Coconino National Forest, Arizona. USDA photo by Kevin Kuhl.

Figure 4–49. Cutting rock with a gas-powered rock saw. Coconino National Forest, Arizona. USDA photo by Kevin Kuhl.

Common step types

- **Overlapping steps** are constructed with timber or stones large enough to make up the needed rise and run proportions and placed on top of each other in a stairway (fig. 4–52).
- **Individual steps** can also be constructed with large stones as a single step or in a series where the bottom of each step lays underneath the top of the step below it, often with fill material separating them (fig. 4–51).

- **Check steps** are used when tread is rutted, and the step material is embedded in the tread and both banks to elevate the tread and retain fill.
- **Boxed steps** have a riser with an associated retaining wall on one or both sides to hold fill.
- **Riprap steps** will always include multiple steps and are installed so that each riser rock touches the back of the run rock below (which may be the same as the riser rock) instead of overlapping it on top like an overlapping step.

Components of a step

- "Rise" is the height of the face of each step.
- "Run" is the distance from the edge of one step to the base of the face of the next step (also referred to as the step tread).
- Retainers are side rocks (also called edge stones, gargoyles, or corrals) that hold the fill in place, increase contact between step rocks, and prevent erosion around the sides of the structure.

Steps on highly developed trails (class 4+) typically have a rise of 6–10 in (15–20 cm), minimum run of 14 in (35.5 cm), and do not vary more than 1 in (2.5 cm) in any direction between steps (fig. 4–50).

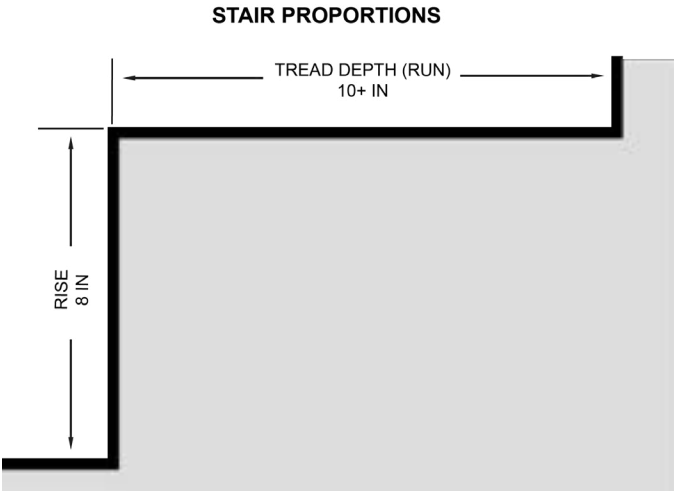

Figure 4–50. Risers range 6–10 in (15–25 cm) and treads are a minimum of 10 inches (25 cm) depending on the trail type and development scale.

Construction tips

- Gather material that matches the desired dimensions of the step for the trail type and development scale. Rocks should be larger than the desired dimensions to account for some of the rock being set into the ground.
- Start with constructing the bottom step "at grade" (i.e., the bottom of the incline) on a solid, excavated footing.
- Install a drainage feature above the top of the staircase to keep water from flowing down the steps.
- Incorporate drainage in the stairway—to keep water from pooling in landings—by making a longer run and building a waterbar into the stairway.

- Avoid using shims or small rocks to set or level steps, especially on the front end or above grade, as these will move over time. Shimming from the backside is strongest if the backfilled material is very well compacted to continuously push the shim into place.
- All steps should be level, solidly positioned, and free of wobbles or rocking.
- Backfill individual steps with crushed rock that is fist-sized or smaller, and cap with at least 2 in (5 cm) of compacted mineral soil.
- Place large, irregular stones or other material adjacent to the steps to discourage users from going around.
- Bury the bottom rock or timber step at least 1/3 of the object height (2/3 is preferred). Rocks and timbers in steps should also be well-anchored (fig. 4–52).
- For overlapping timber steps, use heavy timbers with at least a 6–in (15–cm) diameter for an overlapping stairway (fig. 4–53).
- For crib steps, use minimum 3 x 12 in (7 x 30 cm) lumber or 12–in (30–cm) diameter timber for the riser and embed the first step at least 6 in (15 cm) (fig. 4–54).

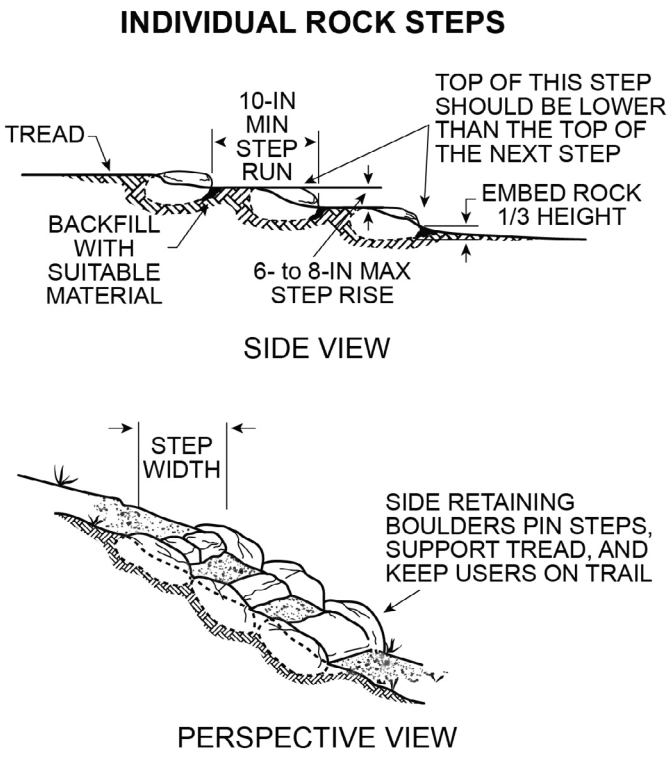

Figure 4–51. Side and perspective view of individual rock steps. Diagram based on Forest Service standard trail drawing STD 936–10–02.

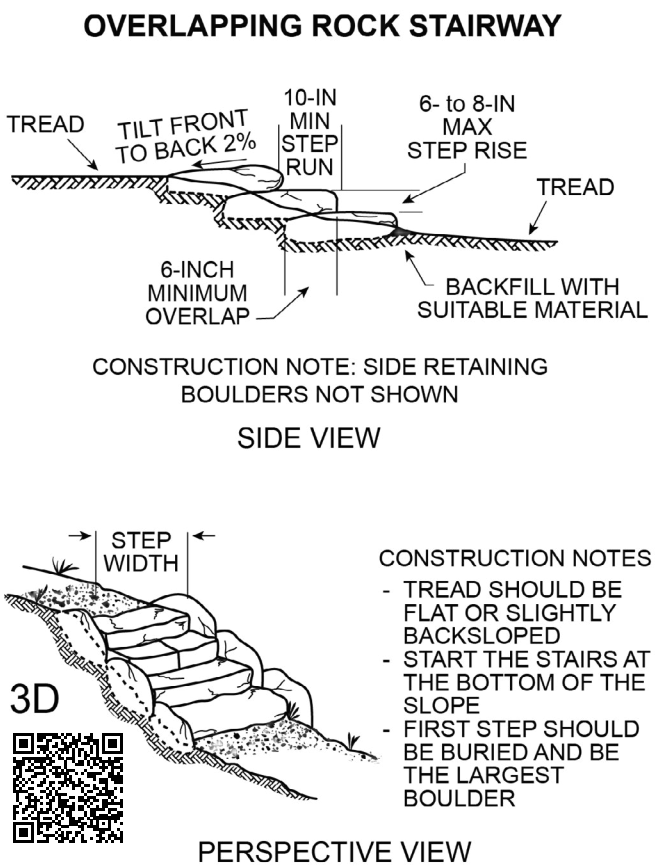

Figure 4–52. Side and perspective view of overlapping rock stairway. Diagram based on Forest Service standard trail drawing STD 936–20–01.

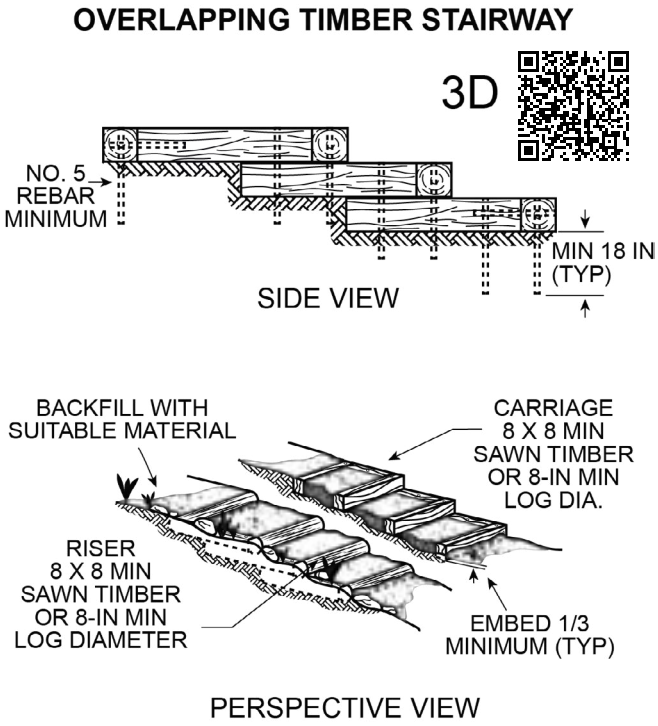

Figure 4–53. Side and perspective view of overlapping timber stairway. Diagram based on Forest Service standard trail drawing STD 936–20–02.

Figure 4–54. Overlapping timber steps being constructed on a hiking trail. The steps will be filled with crushed rock and overlain with fill material. Willamette National Forest, Oregon. USDA photo by Christopher Beitner.

Armoring the Tread

In limited cases, a segment of trail can require an exceptionally durable tread. Trail armoring creates a hardened segment of tread that resists erosion, compaction, and displacement. This labor-intensive approach requires a high degree of expertise and an adequate source of rock that may have to be split or shaped onsite.

Do not apply this technique as a bandage if the real problem is poor design, layout, or construction. In those cases, consider options to mitigate the problem or move the trail segment. Also, consider that armoring will fail if not routinely maintained and if users consistently disturb and erode the soil around it. Because users will follow the path of least resistance, ensure the armoring is as pleasing to the user as possible and install scree rocks or transplant vegetation to prevent people from avoiding the armored area.

Typically, armoring can be done in two ways depending on the size and shape of the available material. Pavestone or paving uses large, heavy rock with big faces, where each rock is buried so only the upper face is visible (fig. 4–55). Stone pitching is often used when rocks are not heavy enough to withstand use forces if laid flat. Instead, each rock is "pitched" or stood on the long axis and buried deeply to provide greater anchoring and strength (fig. 4–56). Either technique requires starting at grade and anchoring with the largest stones. When complete, all stones should be stable with no wobbling.

Figure 4–55. Rocks can be used to armor sections of heavily used trail. Coconino National Forest, Arizona. USDA photo by Kevin Kuhl.

Figure 4–56. Rock pitching used to protect a steep section of trail. Grand Canyon National Park, Arizona. USDA photo by Kerry Wood.

5 SIGNS

5. SIGNS

Trail signs provide essential information about trails for the safety, enjoyment, and convenience of national forest and grassland visitors, and Forest Service volunteers, partners, and employees. The Forest Service standards for trail sign design, construction, placement, and installation (including requirements for signs in designated wilderness) are described in the engineering manual "Sign and Poster Guidelines for the Forest Service." Nonstandard signs should be consistent with the Forest Service "Built Environment Image Guide" and should be approved by the regional forester. Before purchasing signs from a manufacturer or making them yourself, consult any local sign plan and the local trail manager for the correct sign type and design.

Signs are primarily installed at trailheads and at trail and road junctions. Wilderness boundaries, trail termini, popular features, and interpretive opportunities may call for special sign types and installation. Trail and trailhead signs and kiosks can also be translated into multiple languages where appropriate. Contact the Forest Service's limited English proficiency program staff in the Office of Civil Rights for more information about translation services.

Trail signs can display the route name, number, distance, allowed or prohibited uses, national scenic and historic trail markers, and a self-locator map. The amount of information

depends on the trail type and development scale. If a destination is identified on a guide sign, the destination should also be identified on all subsequent guide signs until the destination is reached. Don't include mileage on signs in designated wilderness.

Mount signs on posts or trees so that the bottom of the trail sign is a minimum of 5 ft (1.5 m) above the trail tread.

Figure 5–1. An example of a guide sign on a nonmotorized trail. Cibola National Forest, New Mexico. USDA photo by Kerry Wood.

The typical speed of users and whether the trail is used at night also influences the size of a sign. Signs can't alert visitors to every inherent risk associated with the area, but warning signs may be used to make people aware of

known hazards that, relative to the recreation opportunity spectrum (ROS) setting, are unusual, unexpected, or not readily apparent.

Signs are made of wood, metal, plastic, and other materials, depending on the ROS setting class, nonmotorized or motorized status, use type, and development scale. Think about environmental conditions when choosing your sign material. Consider using fire-resistant material for signs in areas prone to wildfire. Signs designed to fit on a single post are less likely to sustain damage from wildlife and snow loads.

Figure 5–2. Signs in remote areas are made of wood (or material appearing like wood), similar to the image on the left. Huron-Manistee National Forests, Michigan. (USDA photo.) Signs on routes designated for motor vehicles are retroreflective as shown in the image on the right. Custer Gallatin National Forest, Montana and South Dakota. (USDA photo by Charity Parks).

Placement

At the trailhead or junction, set the signpost back from the trail entrance by a few feet (approximately 1 m) to clearly mark the intended trail(s). Place signs at the right edge of the trail tread, perpendicular to the trail entrance. Install additional signs along the trail perpendicular to the tread (fig. 5–3). Different trail types require signs to be set back at varying distances from the tread. On hiking trails, leave at least 3 ft (1 m) of space between the tread edge and the nearest sign edge. Consider additional clearance for trails used by pack stock.

Trail or road junctions. Install signs where trails cross each other or roads. Consider the route type, sight distance, stopping speed of the typical user type, and applicable State laws when placing. Also, set signs far enough back to avoid snow berms when roads or trails are plowed. At trail junctions on moderately to highly developed (class 2–4) trails, place self-locator map signs or a map clearly displaying the trail system and the sign location.

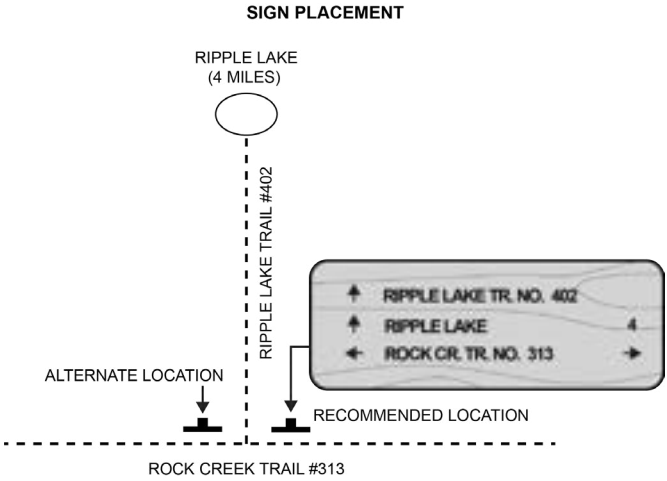

Figure 5–3. Sign placement example on a trail not designated for motor vehicle use.

Posts

Signposts are most often made of wood, steel pipe, or U-channel. Select the best post material for local conditions. Wooden posts of onsite (native) material are usually less expensive and appear less artificial, especially in a primitive setting, but they may have a shorter useful life. Purchased posts should be pressure-treated, as their longer lifespan will offset the higher initial investment. Round posts appear less artificial than square posts and provide more options for custom alignment of signs at trail junctions. Round posts should be at least 6 in (15 cm) in diameter.

Installation tips (fig. 5-4)

- Dig a hole at least 20-24 in (50-61 cm) deep and 6 in (15 cm) wider than the post.
- Fill the bottom of the hole with small rock to prevent pooled water from damaging the base of the post.
- Place spikes or lag screws at the base of the post to improve anchoring and prevent theft .
- Seat the post in the hole and keep it vertical while dropping rocks into the hole to secure it.
- Tamp these rocks with a rock bar or tool handle to jam them into place. Continue to place rocks and soil in the hole, tamping as you go.
- Top off the hole with mounded soil to account for settling and to prevent water from puddling around the post.

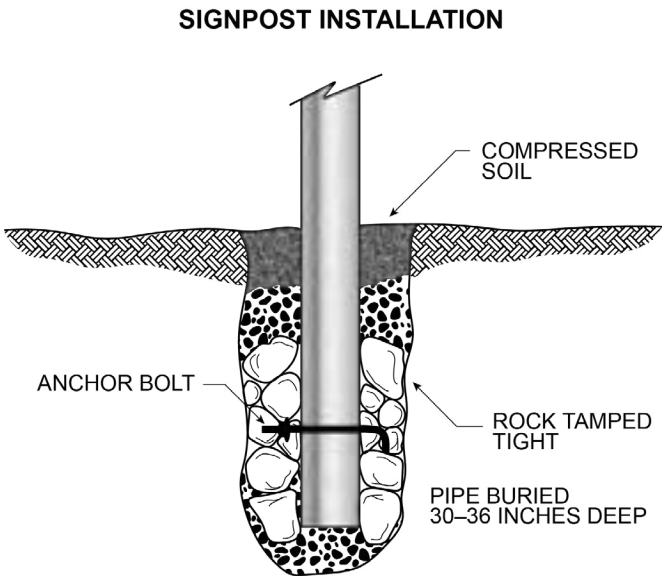

Figure 5–4. The key to placing solid signposts is to tamp the rock and soil with a rock bar as you fill the hole. Diagram based on Forest Service standard trail drawing STD 951–02.

In rocky areas or very soft soils, signposts can be supported with a rock cairn (see the route identification section below) or a gabion basket (fig. 5–5). Place horizontal spikes or lag screws at the base of these posts as well. Refer to the "Anchoring Trail Markers and Signs in Rocky Areas" publication for tips on installing signposts without using heavy tools and equipment.

Figure 5–5. Gabion foundation for a signpost. Coconino National Forest, Arizona. USDA photo by Kerry Wood.

Affixing the sign to the post. Affix the sign so the bottom edge is 5 ft (1.5 m) from the ground, high-water line, or average snow height. Purchased signs typically have predrilled holes. Level each sign and secure it with galvanized washers and lag screws or through-bolts that have a bolt head and washer on one side and a washer and nut on the other. Galvanized hardware, washers, and fasteners reduce rust stains on the sign.

Tip: Apply wood preservatives before installing sign hardware. Some preservatives, like alkaline copper

quaternary (ACQ) compound, are highly corrosive to aluminum and carbon steel. The brushed-on preservative may discolor or corrode metal signs and fasteners, making it difficult to remove fasteners for sign repairs.

Designed for Accessibility

Trails that comply with trail accessibility guidelines require special signage. In addition to the standard trail signpost with the trail identity and destinations at the beginning of the trail, these signs should include:

- Typical and maximum trail grade
- Typical and maximum tread cross slope
- Minimum clear tread width
- Tread surface type and firmness
- Any major height obstacles (as appropriate)

Forest Service accessibility guidelines, including the Forest Service Trails Accessibility Guidelines (FSTAG) and the Forest Service Outdoor Recreation Accessibility Guidelines (FSORAG) contain more information about signing on trails designed for accessibility.

Reassurance Markers

Trail managers use different types of reassurance markers to reconfirm the route when the tread is indistinct, often across meadows and scree fields, where the ground is covered with snow or commonly obscured by fog and heavy rain, or when the route is confused by multiple

trails. Depending on the trail development class, space the markers closely enough that the next marker is visible in either direction from any given marker. Position the markers on small rises, not in swales. The best time to decide where to place a marker is during a day with poor visibility.

Reassurance markers can be made from metal, plastic, or wood, or cairns made from rock. Trail managers prefer metal or natural materials, particularly in fire-prone environments, as plastic melts and can introduce microplastics into the environment over time. Some are made from blazes cut into trees, although this method risks opening the tree to disease. Check with your local trail manager to learn what's appropriate

Blazes

The Forest Service uses colored blazes to mark the trail and indicate the type of trail (table 5–1). Blazes can include an arrow that indicates the trail direction. They are typically plastic or metal triangular-shaped tags, although they can be painted, branded, or routed, and mounted on posts or trees at least 3 ft (1 m) above the ground, high-water line, or average snow depth. If mounting on trees, use aluminum nails and allow 0.5 in (1 cm) or so behind the tag for additional tree growth (fig. 5–6). Some trail managers use painted blazes carefully created with a template of the correct size and color.

Table 5–1. Approved reassurance marker colors and sizes for common trail types

Trail type	Color and reflectivity finish	Minimum size
Hiker, pedestrian, and pack and saddle	Gray, white, natural	5 x 7 in (13 x 18 cm)
Cross-country ski (urban setting or night skiing)	Blue (retroreflective)	5 x 7 in (13 x 18 cm)
Cross-country ski	Blue	5 x 7 in (13 x 18 cm)
Bicycle	White on brown background (retroreflective)	6 x 6 in (15 x 15 cm)
Water	White on brown background	3 x 3 in (7 x 7 cm)
ATV and motorcycle	White on brown background (retroreflective)	3 x 3 in (7 x 7 cm)
Snowmobile	Orange (retroreflective)	5 x 7 in (13 x 18 cm)

ATV = all-terrain vehicle

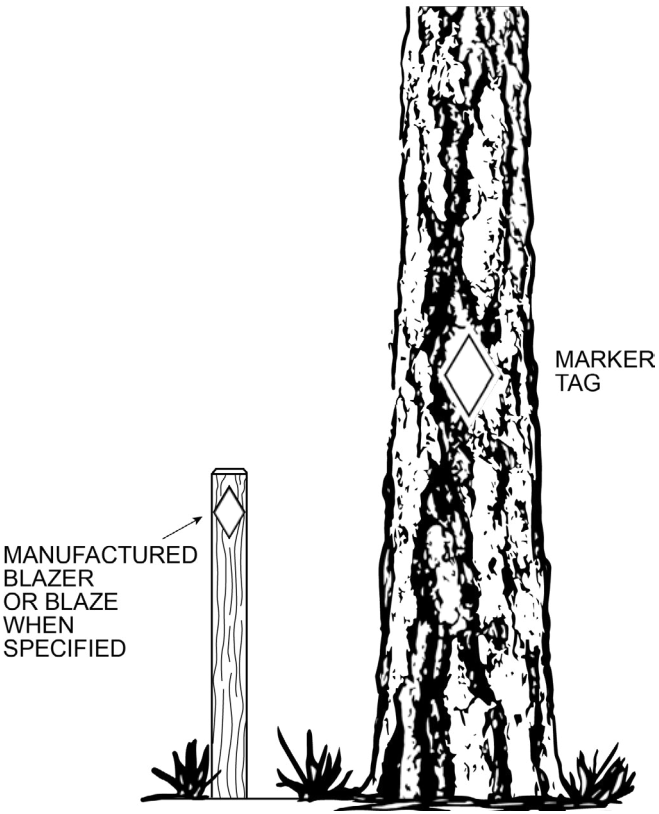

Figure 5–6. Most trail managers use reassurance markers nailed to posts or trees. Blazes are no longer cut into trees in many parts of the country. If it is still a practice in your area, blaze the tree on both sides. Cut the blaze no deeper than needed for clear visibility. Diagram based on Forest Service standard trail drawing STD 953–01.

Flexible Fiberglass Markers

Many trail managers use signs and markers made of flexible fiberglass, also referred to by the brand name Carsonite (fig. 5–7). The lower cost, slimmer size, and damage-resistant material make them a great option where local conditions warrant. Their slimmer size allows the flexible signs to be located closer to the trail tread and not constrict the trail. Installation requires specialty pilot hole and post drivers.

Figure 5–7. Flexible fiberglass trail reassurance marker. Manti-La Sal National Forest, Utah. USDA photo by Charity Parks.

Cairns

A cairn is a stack of rocks that can mark less-developed trails in open areas where low visibility or snow cover makes it difficult to follow the tread or where the tread is rocky and indistinct. Cairns are not a few stones piled one on top of the other (sometimes called a rock duck), which can easily be kicked over. Properly constructed cairns are similar in construction to rock walls and consist of circular tiers of stones (fig. 5–8). Check with an experienced trail manager in your area to determine the appropriate style of cairn.

Make the base of the cairn wide enough for each subsequent tier to be narrower than the one below it. In deep snow country or if building in areas with loose, angular rock (called talus), use a 6.5–ft (2–m) guide pole in the center to distinguish the cairn from other piles of rock or snow-covered mounds. A pipe built into the center of the cairn allows the guide pole to be removed and reinstalled with the seasons.

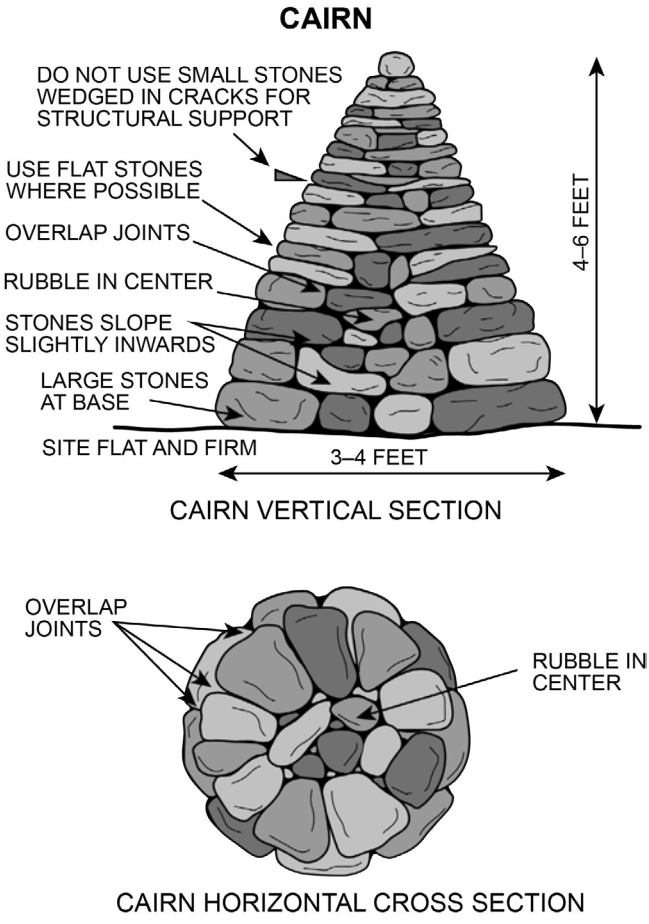

Figure 5–8. A cairn is constructed of circular tiers of stones. Illustration adapted with permission by the Appalachian Mountain Club's Trail Adopter Handbook. Diagram based on Forest Service standard trail drawing STD 955–01.

National Trails

Specially designed triangle markers indicate national scenic, national historic, and national recreation trails. Each national trail is managed by either the Forest Service, National Park Service, or the Bureau of Land Management (fig. 5–9). The designated national trail marker should appear below the trail sign at the trailhead, at road crossings, and on guide signs and reassurance markers. Visit the Forest Service's America's National Trails website for more information about national scenic and national historic trails administered by the Forest Service. The American Trails nonprofit supports management of national recreation trails (fig. 5–10).

Figure 5–9. Individually designed trail markers for the Nez Perce National Historic Trail and the Florida National Scenic Trail.

Fig. 5–10. Special marker for national recreation trails.

6

CONSTRUCTION AND DECOMMISSIONING

6. CONSTRUCTION AND DECOMMISSIONING

Trails are costly to construct and maintain. Trail managers think strategically before constructing a new trail, adopting a user-created route, or accepting a proposal for a new trail from a partner or community. A trail manager may choose to construct a new segment of trail to relocate a physically unsustainable portion or construct an entirely new trail within the trail system in response to an unmet public need. Many managers use a screening process to evaluate the new trail proposal. The PACE It! tool is a good example (available on the Forest Service's National Trail Program SharePoint (internal site). The tool quantifies how the proposed trail aligns with the desired outcomes for sustainable recreation on the local unit.

An abundance of user-created routes could be a symptom of a lack of trail maintenance, inadequate signing, or an unmet public need for new or different trails. Trail enthusiasts often create their own route when the official trail system doesn't suit their need or offer convenient access to a desirable area. Official trails should be more obvious, easier to access, and more enjoyable than the alternatives.

Relocation

Repeatedly "fixing" short sections of poorly located trail consumes valuable time and resources. A crew can spend an entire season reinforcing trail tread on a short section of physically unsustainable trail, only to come back every few years and do it again. Or they can spend a season or two decommissioning the trouble spot and rerouting it to a new sustainable trail that requires little maintenance for a decade or more. Before beginning the relocation, review the requirements for appropriate authorization outlined in chapter 1.

A trail relocation may involve a short segment to improve undulation or even an entire trail realignment of where the trail has become wholly unmaintainable, causes substantial environmental impacts, or requires major yearly investments in time and resources to fix. Trail sections following the fall line are examples of unsustainable and unmaintainable situations where relocation may constitute the preferred long-term solution. Reducing trail grade and incorporating grade reversals and other sustainable elements creates longer trail segments than the segments they replace (fig. 6–1).

As you consider rerouting the trail, pay close attention to the conditions that caused the maintenance issue in the first place. Don't repeat the same mistakes in the new trail alignment. If the new alignment options won't resolve the underlying issues, then don't reroute. Spend your time and resources to repair the existing trail.

If relocation is the chosen option, invest time in scouting for suitable places to relocate and work with specialists to review maps and data on soils, hydrology, and environmentally and culturally sensitive areas. The relocated trail or trail segment should have the same character and be designed for the same uses and development scale as the rest of the trail. Relocated segments should connect to the original trail with smooth transitions and no abrupt turns.

Develop a construction plan for the reroute that incorporates all the elements of a rolling contour trail discussed in chapter 2. Follow the steps to close and rehabilitate the old trail tread, as discussed below, to prevent further erosion and use.

Some short sections of eroded trails may not be a major problem and are appropriate for minimally to moderately developed trails. If the trail surface is rocky—and water, use, and slopes are moderate—the section could stabilize itself. These segments provide challenging elements sought by some users. A short section of eroded but stable trail may cause less environmental damage than constructing a longer rerouted section. Weigh your options wisely.

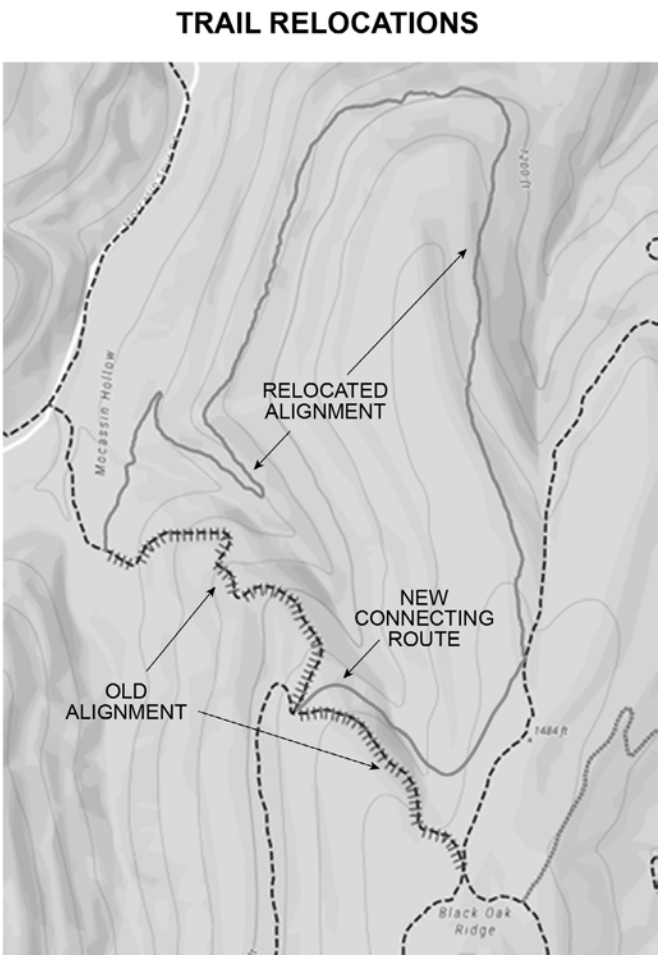

Figure 6–1. Trail relocations are often double (or more) than the length of the segment of trail they are replacing to allow for lower average grade, sufficient grade reversals, and other physically sustainable design elements.

Preparing for Construction

The preparatory work to construct a new trail or trail segment ensures the project will succeed and the trail will be sustainably built. The focus in this step is to work with others to determine the best type of trail and trail location to fulfill the management objectives. During this step, trail managers communicate the need for a new trail or trail segment and gain the support of the line officer. They also work with Forest Service specialists to determine the most sustainable route that minimizes negative impacts to environmental and cultural resources. Drafting a trail management objective (TMO) for the proposed trail is a good way to share information about the proposed trail.

New Trail Planning

A good trail may appear completely natural, but that appearance belies an incredible amount of work in planning, scouting, design, layout, construction, and maintenance (fig. 6–2). There is an art to the way a trail interacts, respects, celebrates, and acknowledges the landscape and the user.

Planning considers why the new trail or trail section is needed and informs the trail design. Most trail managers document the design in a trail construction plan.

A trail that is well-designed but poorly built can be saved, but a trail that is poorly designed and well-built is destined for failure.

Considerations for successful planning and design of a new trail:

- **Describe the project purpose, need, and feasibility,** including the local conditions and how the trail fits into existing trail system opportunities.
- **Ensure the project aligns** with the land use plan.
- **Engage the line officer** and ensure they support prioritizing specialists' time to conduct environmental analysis.
- **Identify correct trail design specifications** for the user type and development scale, such as the target trail grade, width, surfacing, corridor, and presence of obstacles. This information will be documented in the TMO.
- **Share a conceptual map and description** of the trail with stakeholders and specialists.
- **Incorporate stakeholder and resource specialist input** into the design (often part of National Environmental Policy Act [NEPA] or another formal environmental review process).

- **Estimate project costs,** including how long-term maintenance will be accomplished.
- **Share the final proposed trail alignment with the resource specialists.**
- **Document environmental decisions and permits.**
- **Layout the approved route in the field** and identify locations of planned trail structures and equipment staging areas. Most trail managers use stakes to identify these areas.
- **Develop the construction plan** that describes needed materials, tools, equipment, workforce (including staff, contractors, partners, and volunteers), and the project timeframe.
- **Secure funding** from prioritized appropriated funding, grants, or other sources. Note that large projects may span multiple seasons and fiscal years.
- **Notify the public of trail access impacts,** if necessary.
- **Prepare the route for work to begin,** including finalizing route flagging (and/or staking) in the field, digging test pits, marking specific obstacles to be left or removed, and marking the location of new structures and features on the ground.

Figure 6–2. Design and construct your trail to be a part of the landscape. Flathead National Forest, Montana. USDA photo by Cassidy Bender.

Plotting the Proposed Trail on a Map

Being a "trail artist" requires the highest quality craftsmanship to design, scout, lay out, and build a trail that ties into the landscape. The process starts with thinking about what the user will enjoy most from your trail—features such as beautiful vistas, giant rock formations, and water views—while still adhering to physical sustainability principles.

Incorporating these features into your trail integrates spatial and field-collected data. Digital maps allow you to overlay multiple data layers to help inform where the trail should and should not go. Geographic information systems like Google Earth or ArcGIS offer good options for displaying aerial, satellite, and lidar imagery. Using digital maps allows you to overlay the area with topography, water bodies, watershed boundaries, roads, other trails, recreation infrastructure, and other features to start planning the trail alignment. Digital maps also help you communicate with resource specialists and the public about the proposed route.

Anchor points (also called positive control points) are places where the trail should go (e.g., trailheads, desirable destinations, scenic overlooks or other points of interest, water crossings, and other natural features). Anchor points help you narrow down the possible routes and make sure you don't miss anything important or exciting in a project area.

Avoidance areas (also called negative control points) include, but are not limited to, noxious weed infestations, threatened and endangered species, critical wildlife habitat, cultural sites, safety hazards, and property boundaries. Forest Service specialists can help you identify these areas. Avoid or minimize segments in poor soils, flat areas, steep hillsides, ridgelines, the bottom of slopes, and other areas that are difficult to drain. Trails through wetlands and bogs require special permitting. Routing trails through

avoidance areas requires advanced planning and design and is more costly to construct and maintain.

Target trail grade represents the grade percentage appropriate for the desired trail type and development scale. A good guideline is to plot on a map a trail grade 2–3 percent less than the target trail grade to allow flexibility in maintaining a sustainable grade during field layout. Staying within the technical guidelines for trail type and development scale isn't always possible. You'll likely have short segments with steep grades (called maximum short pitches) to avoid obstacles like rock outcroppings, while the remaining trail segments meet the target grade.

Steps to plan the route on the map

- Plot any known anchor points and avoidance areas.
- Connect the anchor points with a draft line, skirting avoidance areas and following contour lines that keep the route at the desired grade and outside the fall line.
- Consider drawing multiple draft alignments so you have options when scouting the route in the field.
- Use the digital files to gather feedback from resource specialists and the public about the proposed route.
- Bring the map with you into the field, either on a device or in printed form.

Using a Clinometer

A clinometer (or "clino") is a handheld device that you can use to measure the grade (percent) or angle (degree) of a trail segment or hillside (fig. 6–3). Clinometer apps for smart devices are also available. Grade and degree values are on either side of the viewfinder. Always double check which scale you're using. The units tend to be printed on the bottom of the scales. Most trail managers use the percent side. The lingo can be tricky—trail managers say "percent slope" when referring to the incline or decline of the natural terrain, and "percent grade" when referring to the incline or decline of the constructed trail. (Refer to the "Trail Grade" section in chapter 2 for additional information.) Both measurements use the percent value from the same side of the clinometer. Refer to the table of grade and degree conversions in the "Resources" chapter.

Never lay out a trail without a traditional or digital clinometer.

Finding a grade with a clinometer is called "shooting a grade." Always use a clinometer to find grade; never eyeball it. Assuming or guessing the grade will cause problems from the start of your new trail or trail assessment. A trail professional always has a clinometer when they go to the field.

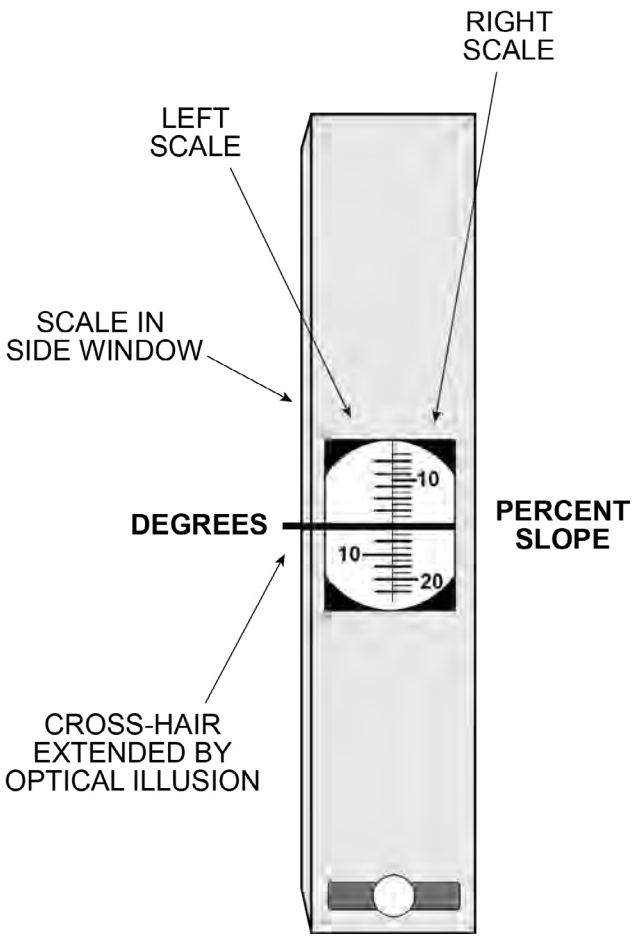

Figure 6–3. Diagram of a clinometer.

How to use a clinometer (fig. 6–4)

Step 1. Hold the clinometer sight hole to your dominant eye. Keep both eyes open. Look through the viewfinder and find the percentage scale. Use the horizontal line in the center of the viewfinder to measure the percent grade.

Step 2. Work with a partner to determine a "zero" grade. Working with someone of similar height is easier. Stand toe-to-toe on level ground. Keep your head level and look straight ahead. Hold the clinometer to your dominant eye, keeping both eyes open. Notice where the horizontal line crosses your partner's face or body. This will be your reference spot when shooting a grade. Some trail managers also use a surveyor's pole, short avalanche probe, or stick with a flagged mark at zero grade. This allows your partner to move the aim point up and down the hill with ease and the color mark is easier to spot in thick vegetation.

Step 3. Practice by facing your partner on uneven ground at least 15 ft (4.5 m) apart. Hold the clinometer to your dominant eye, keeping both eyes open. Look at the same reference spot on your partner's face or body (or flagged pole) and record the percent grade. Uneven terrain, thick vegetation, and different people shooting the grade affect the accuracy of the reading. Consistently having the same person shoot the grade will increase accuracy. It is also common to average the readings of two people.

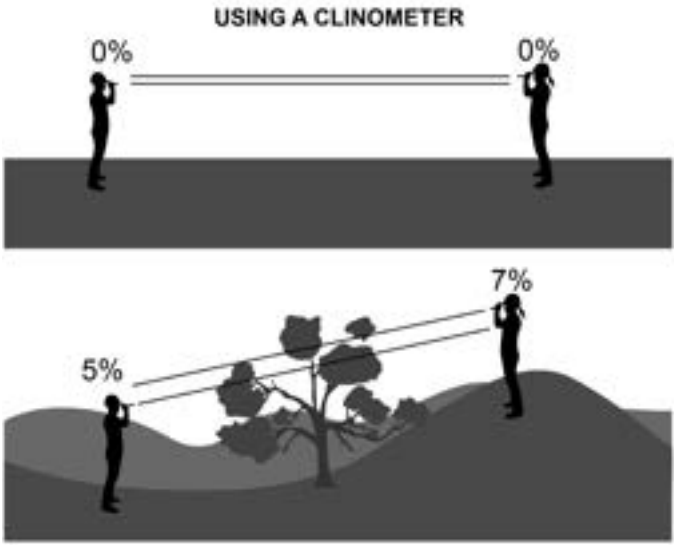

Figure 6–4. The easiest way to use a clinometer is with a partner. Use the steps above to determine the percent of the grade.

Scouting the Route

The goal of scouting and layout for a new trail or trail segment is to refine the route and flag the final corridor for review by specialists. Field scouting requires solid knowledge of navigating and interpreting the map you made in the office. Start the layout process by bringing your draft corridor map or device into the field and scout the area where the proposed trail will go. A GPS-enabled tablet loaded with the conceptual routes, anchor points, and avoidance areas saves time. Keep detailed field notes of potential routes, control points, and avoidance areas. Field

scouting is an iterative process and trail standards may be modified based on field conditions

Some specialists may prefer you flag the corridor for their review while you are scouting the route; others prefer you flag it during field layout. Check with the specialists for their preferences, then adjust accordingly and flag the final route.

A variety of useful apps for trail scouting and layout are available on smartphones and tablets, including social network trail apps, digital notepads, clinometers, and apps for measuring and leveling.

Objectives for scouting the route

- Verify that the route can be constructed within the design specifications for the use type and development scale and within the guidelines of a physically sustainable trail.
- Locate known anchor points and avoidance areas and identify additional points and areas.
- Modify the office-based draft corridor to create the best alignment.
- Establish a flag route or routes on the ground and update digital files for specialist review (flagging techniques are described below).
- Identify areas that will need trail structures to support the tread or create drainage.

Steps for scouting the proposed route

- Use the map or track feature on a GPS unit to follow the route you developed in the office.
- Validate the hillside slopes.
- Take detailed and organized notes of the information you collect during scouting and refine the route location.
- Measure segments of the proposed trail grade with a clinometer (see above for the steps to use a clinometer).
- Try different routes until you find the best continuous route between control points, considering the positive and negative control points on the ground.
    - Consider the smaller features along the desired corridor, such as an interesting tree or root ball that subtly enhances the user experience and can increase the physical sustainability of the trail.
    - As much as possible, avoid switchbacks, water crossings, and routes that intersect flat terrain, ridgelines, and the bottoms of slopes that are difficult to drain. Don't flag the route adjacent to large trees to avoid damaging the root ball.
- Identify breaks in grade and locations for drainage features.
- Walk the route at least three times and in both directions to refine and adjust the flag line using a clinometer.
- Record the GPS coordinates of these locations in a field notebook or mapping app:
    - Riparian vegetation, seeps or soggy ground, and other indicators of high ground water

    - Patches of sparse vegetation that could indicate shallow bedrock
    - Draws and natural drainage to construct grade reversals
    - Where a maximum short pitch grade will exceed the target grade
- Update your digital files with the scouted corridors and any new anchor points and avoidance areas.

Tools for scouting the route and laying out the trail (fig. 6–5)

- Clinometer
- Compass and altimeter
- GPS or smartphone
- Diameter tape (also called forester or logging tape)
- Multiple colors of flagging
- Wire pin flags
- Roll-up pocket surveyor's pole
- Permanent marker to write notes on the flagging or stakes
- Notebook
- Probe to check soil depth to bedrock
- Maps

Figure 6–5. A few essential tools for scouting and laying out a trail: clinometer, flagging, diameter tape (also called forester tape), pocketknife, and folding handsaw. Tongass National Forest, Alaska. USDA photo by Laurent Deviche.

Layout

Once you have the draft alignment identified in the field, mark the center of the trail corridor using flagging tape. This represents the alignment that specialists will analyze. Most trail managers request that specialists review at least 25–30 ft (7.5–9 m) on either side of the flagging line to allow for minor adjustments to the alignment during construction.

Objectives of field layout

- Identify the center line of the final trail corridor for environmental evaluation.
- Hang enough flagging so the resource specialist can follow the flagging when they conduct their analysis.

- Identify and adjust the route accordingly when you find impassable terrain, additional control points, guide structures, and obstacles that weren't discovered during scouting.

Flagging

Trail managers use flagging for a variety of purposes—identifying trail alignments, drawing attention to anchor points and avoidance areas, and indicating areas to stage supplies. Most trail managers also use stakes if they plan to contract the work. Different colors, or a combination of colors, is helpful to communicate different things. Make sure the color or colors you're using are not already used locally for some other purpose and that they stand out from the vegetation and surrounding landscape.

How to flag a route

- Always use a clinometer to measure grades.
- Record your field alignment with a GPS unit.
- Establish the preliminary line (P-line) by tying flagging to the branches of live trees or bushes at eye level about every 30 ft (9 m). At least two flags should be visible in either direction.
- Tie knots with a girth hitch or one-sided bow that can be easily untied because you will likely adjust the flag line.
- Use pin flags instead of flagging if you are working in an open area without trees or shrubs.
- Update your digital files with the flagged center line.

Two or more people flagging

- Standing on the P-line, direct your partner ahead about 30 ft (9 m).
- Shoot a grade with your clinometer and have your partner adjust their location higher or lower on the hillside to meet your desired grade.
- Determine the desired alignment and have your partner adjust the P-line flagging or tie a new piece of flagging on live vegetation, then you both move ahead.
- Stand at the newly placed flagging and shoot another grade.
- The process repeats to refine the P-line to be at the desired grade.
- A third person can be scouting ahead for obstacles and control points.

One-person flagging

- Stand on the P-line and tie flagging at eye level.
- Move ahead 25–75 ft (8–23 m) and shoot a grade back to the flag you just tied.
- Move up or down the slope to meet your desired grade.
- Tie another piece of flagging at eye level.
- Leave larger spaces between flags, as you'll likely have to adjust the flag line on your second pass.
- Fill in the gaps with more flagging and make minor adjustments as you go.

Don't scrimp. Flagging is cheap compared to the time spent locating the route. Flagging that is close together helps trail workers visualize the flow of the trail. The technique also accounts for animals carrying off flags or the wind blowing them down.

Marking the final alignment. Pin flags work well to mark the exact location of the trail tread and direct novice trail builders where to dig (fig. 6–6).

- Place pin flags on the trail's centerline or on its uphill or downhill side. Opinions vary on which is the best; just make sure the crew knows where the trail will be relative to the pin flags.
- Place pin flags every 10 ft (3 m) or so. More is better. Remember to collect all the material from the pin flags after construction.

Figure 6–6. Pin flags mark the exact location of the trail tread and give you a good feel for the flow of the trail. Cibola National Forest, New Mexico. Courtesy photo by Jenny Blackmore.

After flagging, run, walk, or ride the proposed route and imagine how the intended user will feel on it. This will give you a good feel for the flow of the trail. Adjust by moving flags if a turn feels too sharp or a section has too much straightaway.

Tread Construction

This section assumes completed environmental studies and that all parts of the project have been approved and permitted. The section applies to trails built by hand or by mechanized trail-building equipment.

Optimally, trails and trail features are designed with physical sustainability principles in mind. A trail built with a full bench, low slope ratio, and rolling contours is the most physically sustainable trail that requires the least amount of maintenance. Remember, every constructed feature you build will require maintenance. Weigh your options carefully.

Trails are constructed with these common attributes:

- **Trailway.** The area that contains the trail tread, excavation, and embankment.
- **Tread.** The surface that traffic moves on (including water and snow). It can be made of native or imported material depending on the trail type and development class.
- **Crest.** A short portion of trail elevated above a dip (or sag) on either side.
- **Dip (or sag).** A short portion of trail that dips or sags down below a crest on either side.
- **Backslope.** The area uphill from the tread that is typically steeper than the prevailing hillside.
- **Clearing.** The horizontal and vertical area that is cleared of vegetation.

- **Constructed features.** A range of structures, such as a causeway or steps, made of native or imported material that support the trail.

The features, tread, and clearing widths depend on the trail type and development scale. The specifications are described in the TMO for each trail. An overview of these concepts is in chapter 2, "Basic Trail Concepts." Visit the Forest Service Trail Management Basics web page for a full list of trail design specifications and clearing limits for different use types and development scales.

Sample Preconstruction Checklist

These steps are strongly encouraged before cutting any vegetation or removing any soil (local conditions may warrant additional steps).

All projects:

☐ Resource specialists have documented their review of impacts to natural and cultural resources and the project conforms to a forest land and resource plan.

☐ The authorized officer has approved the project (district ranger or forest or grassland supervisor).

☐ Trail crew members are trained, have the skills, tools, and personal protective equipment necessary to do the job safely, and the proposed work is documented in a project risk assessment.

☐ A crew member is assigned to take photos of the work and record and report accomplishments.

Construction projects. Planned trail alignments are physically sustainable and match the technical guidelines for the intended trail type and development scale.

Maintenance projects. Maintenance activities are intended to bring the trail back within the technical guidelines for the intended trail type and development scale.

Best Practices for Construction

There are a few basic things to consider before implementing any trail construction project.

Construction plan

The trail construction plan will guide the trail development process. Discuss the plan with the crew before starting work. Minimum information should include:

- Trail location and proposed structures
- Appropriate trail design specifications for the user type and development scale (as documented in the TMO)
- Locations of staging and work areas
- Drawings of planned structures and features
- Proposed timeline for the project
- Mitigation measures and other considerations from the NEPA decision document or supporting materials
- Needed workforce and materials
- Safety plan for trail workers and the public, including considerations for public and construction access during the project

Clear the corridor

Clearing the corridor opens the footprint of the trail in preparation for the excavation phase of the project.

- Following the approved corridor (commonly a flag line), start by removing standing trees, brush, and duff (leaves, sticks, and other organic material above the mineral soil layer) to a width and height per the target trail design specifications.
- Mitigate hazard trees, loose rock, holes, and safety issues as soon as possible for worker safety.
- Remove boulders that could protrude above the tread as appropriate for the trail type and development scale. Obstacles and obstructions are appropriate on less-developed trails and add to the challenge and desired user experience.
- Only cut trees if the environmental evaluation allows it. Generally, avoid cutting larger live trees greater than 4 in (10 cm) diameter at breast height (DBH) when possible, especially in areas where shade is important.
- Leave high stumps on felled trees within the tread. This will make stump removal easier when you dig them out later—roots and all. Do not "low stump" trees within the tread, as they will eventually stick up after the tread compacts. Cut stumps outside the tread flush with the ground so no one gets hurt if they fall.
- Place all debris far away from the corridor with cut ends facing away from the trail. Scatter the debris evenly downhill to prevent material from rolling onto the trail.

- Preserve organic material to naturalize disturbed areas and to prevent erosion. For example, save leaf litter, pine needles, mulch, and woody debris to naturalize the impacted area adjacent to the work site. Preserve the roots of plants for replanting in disturbed areas.
- Refine the alignment and finalize construction needs once the initial vegetation clearing is completed.

Borrow pits

Consult with specialists to identify appropriate places to dig borrow pits as needed for fill, gravel, and other material. Fewer large borrow pits are better than multiple smaller borrow pits. Rehabilitate the borrow pits. Fill deep pits with unused soil or material unsuitable for trail construction that is mixed with organics. Restore a natural contour to the pit and cover the disturbed area with topsoil and debris. Partially bury logs and rocks on top to appear natural and protect germinating seeds. Finish by spreading needles, leaves, other woody debris, and smaller rocks over the disturbed area.

Imported materials

Favor using native material wherever possible, although imported material may be necessary if native material isn't available or suitable. Local line officers should approve the use of imported material in advance of work. Soil, gravel, rock, and other material from borrow sites or quarries should be prescreened by a qualified botanist for invasive weeds before the material is purchased or transported.

Invasive weeds are extremely difficult to eradicate and can permanently alter the local ecosystem.

Pressure-treated wood designed for use in wet environments needs to be cleaned. The chemicals bond with lignin within the wood, but the carrier oil has to be removed to prevent toxins from entering surface or groundwater.

Grade reversals

Grade reversals are areas along a trail where the trail grade reverses or changes in the opposite direction—up or down. Trail managers use grade reversals combined with outsloping tread to keep water moving across the trail instead of down it, not disturbing the natural flow of water down slope and making the trail "hydrologically invisible." The reversal or rise (crest) and fall (dip) of the trail are repeated as it traverses the hillside (fig. 6–7). The crest must be tall enough to divert anticipated water flows off the trail while not creating a trail jump. Grade reversals are also called by various names—grade dips, terrain dips, break in grade, undulations, or swales.

Figure 6–7. Grade reversals are much more effective than constructed drainage features. Grade reversals in this image are where the trail rises and falls. Water from the slope above will run off the trail in these areas instead of down the trail. Cibola National Forest, New Mexico. USDA photo by Kerry Wood.

The beauty of grade reversals compared to constructed drainage features is they require little maintenance and can complement the terrain and go unnoticed by the user. Trails sustainably designed with low slope ratios and multiple grade reversals are called rolling contour trails. Review the "Rolling Contour Trails" section in chapter 2 for more information.

Hillside slope, trail grade, soil type, and trail development scale affect where and how often grade reversals should be incorporated into the trail. More frequent grade reversals are needed on trails with less-cohesive soils and steeper grades. Less frequent grade reversals are needed on trails with good soil cohesion or lower grades. Study the average distance between grade reversals on physically sustainable segments of nearby trails with similar grades.

Where available, use natural dips in the terrain to help you add reversals. Otherwise, grade reversals can be designed in the layout. Reverse the trail grade for about 10–15 ft (3–5 m), then "roll" back or resume the trail grade (fig. 6–7). Grade reversals enhance the trail user's experience by providing an up-and-down motion, curving the trail up and around the high side of large trees (fig. 6–8) or winding it around boulders.

Figure 6–8. Enhance the user's experience and improve drainage using grade reversals by going above trees and rocks. Cibola National Forest, New Mexico. Courtesy photo by Jenny Blackmore.

Compaction

Compaction is crucial in trail maintenance and construction to ensure durability and stability. It is particularly important on high-traffic sections and in areas prone to erosion. The process involves compressing the trail surface, often using tools like tampers or rollers, to reduce soil porosity and increase load-bearing capacity. This helps prevent the trail from becoming uneven or developing ruts and reduces maintenance frequency. By creating a firm, stable surface, compaction enhances user safety and preserves the trail's integrity against weather and wear when combined with good drainage and appropriate trail grades.

Full-Bench Construction

Most trails constructed on hillsides (or "sidehill trails") use full-bench construction. They are constructed by cutting the full width of the tread into the exposed mineral soil on the hillside (fig. 6–9). Full-bench construction is more durable and requires less maintenance, although it requires more excavation and leaves a larger backslope than partial-bench construction. Use full-bench construction whenever possible.

Construction tips

- Excavate the full width of the trail from the hillside.
- Evenly distribute the excavated material on the downhill side or use it for nearby features during construction. Always distribute and stockpile soil away from water bodies.

- Consider constructing a wider bench for passing before difficult sections.
- Ensure tread is not being supported by excavated material.
- Construct the backslope angle to match the prevailing hillside slope as much as possible to prevent slough.
- Compact tread and backslope, removing loose materials that may roll onto tread.
- Anticipate settling after compaction that might expose obstructions or affect the outslope and drainage of the trail.

Common mistakes

- Not sticking to the flag line, referring to the design standards, or consulting the trail designers.
- Leaving obstacles in the cutslope that push users to the critical (or outside) edge, causing failure.
- Piling excavated material next to the tread or negatively impacting nearby resources like waterways or vegetation.
- Leaving roots and other obstacles just under the tread surface so that they emerge and become obstructions as the tread continues to compact.
- Building the easiest trail and not the right trail.

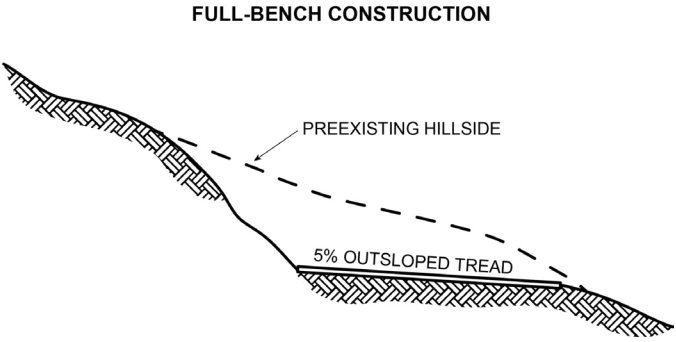

Figure 6–9. Construct a full-bench trail by cutting the full width of the tread into the hillside. Outslope the tread 3–8 percent (or maximum 5 percent on trails designed for accessibility). Diagram based on Forest Service standard trail drawing STD 911–01 (A section).

The design width of a single-lane developed (class 3) hiking trail outside of designated wilderness is 18–36 in (46–91 cm). The length of the handle of a typical pick mattock or similar tool is 36 in (91 cm).

Partial-Bench Construction

Partial-bench construction is another method to cut in a trail (fig. 6–10). This technique isn't recommended for hand-constructed trails: It is difficult to compact the soil enough without the right equipment and often requires building additional retainment structures.

Construction tips

- Once the vegetation is removed, material is excavated from the hillside to construct part of the bench. The excavated material is then used to create the remaining portion of the tread to the desired width. This portion is called the fillslope. Water and compact the fillslope material to improve the soil strength.
- If you can't water and compact the fillslope sufficiently, consider constructing a retaining or crib wall to reinforce the trail tread, for example when constructing a trail around an outcropping vertical rock escarpment.

Common mistakes

- Not compacting the fillslope well enough, resulting in failure of the shoulders of a partial bench trail, potentially within the first season. When the fillslope fails, the trail tread is lost and may require an expensive, intrusive, and complex retaining wall.
- Constructing a partial bench with poor soil where retaining the soil isn't possible.

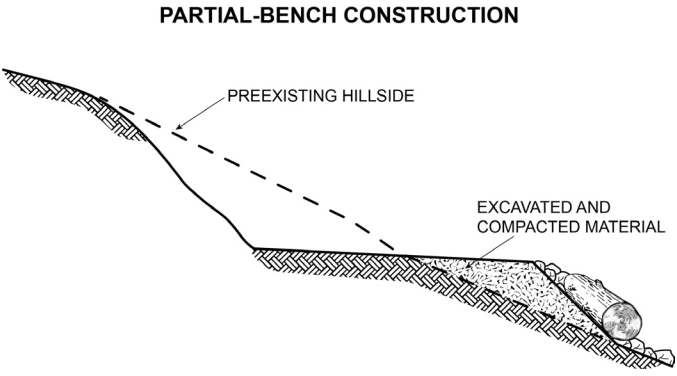

Figure 6–10. The tread on a partial-bench trail is part hillside and part fill material and is outsloped at least 5 percent. This technique is less desirable than the full-bench construction technique, as uncompacted fill will more easily erode and cause the trail to narrow over time. Diagram based on Forest Service standard trail drawing STD 911–01 (B section).

Backslope

The backslope is the excavated, exposed area above the tread surface of trails constructed on hillsides. Excavate and compact enough of the backslope to prevent the slope failing and sloughing onto the tread. Well-excavated and stable backslopes encourage users onto the center of the tread, whereas steep, unstable slopes often push users onto the weaker outside edge.

The backslope should match the angle of repose of the parent material. The "angle of repose" refers to the steepest angle at which the material stabilizes on its own.

You may come across trail specifications calling for 1:1 backslope (fig. 6–11). This means the hillside slope has a ratio of 1 unit of vertical rise to 1 unit of horizontal run. A trail that has a completely vertical backslope is unfinished and a sign of poor craftsmanship.

Most soils are stable in a 1:1 backslope. Solid rock can have a steeper 1:0.5 backslope, while less-cohesive soils may need a longer, 1:2 backslope. When the hillside slope is steeper than 1:1, the backslope will be overly steep and you'll likely have to frequently remove slough to keep the trail open.

Examine slopes in the surrounding landscape and identify areas with stable soil. Create a somewhat gentler backslope than you think is necessary. Initially exposing more raw soil is worth keeping the backslope stable so it can start revegetating. Angle the backslope until loose material stops falling onto the trail tread. Stabilize the entire backslope by compacting it with the back of a McLeod tool (also called a rake hoe). Chapter 7, "Tools and Equipment," lists common trail tools.

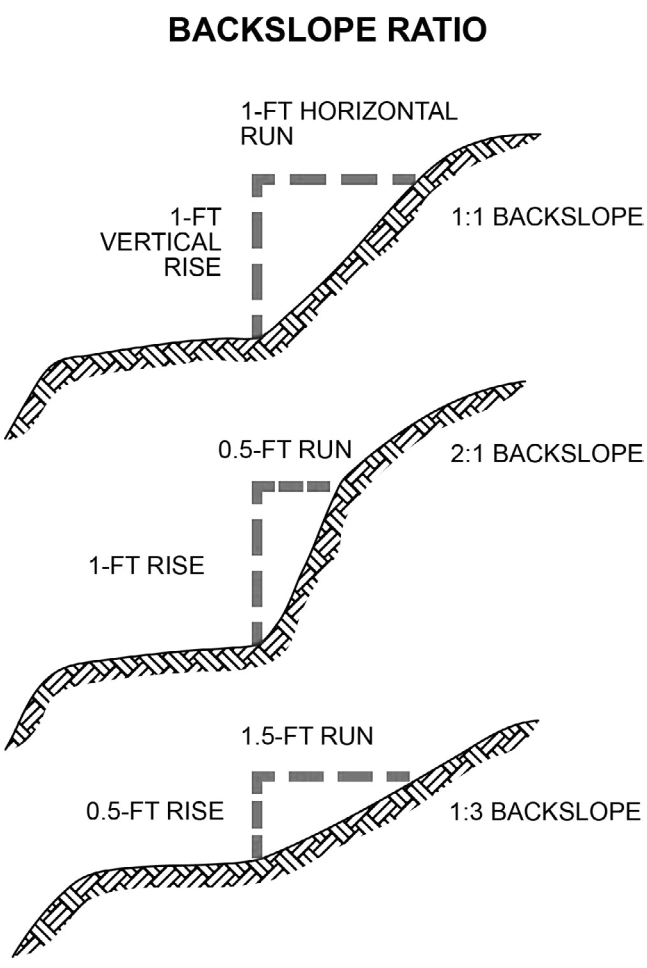

Figure 6–11. Backslopes are described by the ratio of vertical rise to horizontal distance or "rise to run."

Figure 6–12. A sidehill trail that is being made more physically sustainable by excavating the backslope. Note the bushes encroaching on the trail in the background. Boise National Forest, Idaho. USDA photo by Scott Johnson.

An alternative to huge backslope excavations is constructing a retaining wall. Retaining walls reduce sloughing when you are constrained to steep backslopes. Cutting a trail into a slope already at the angle of repose will cause slough to fall onto the tread. Retaining walls on the uphill slope may be helpful to reduce long-term maintenance needs for slough removal (refer to the "Retaining Structures" section in chapter 4 for more information).

Hand-Built

Suggested steps for constructing trails by hand (fig. 6–13).

1. Lay out the route and excavate the bench.

- Follow the preconstruction steps and best practices for construction described above.
- Place pin flags to keep the trail workers on course and ensure the crew knows where the trail should be in relationship to the flag line (above, below, or in the center).
- Excavate the trail tread to the specified width while following the pin flags. Broadcast excavated materials evenly downhill.

2. Excavate backslope, including loose material.

- Excavate backslope out of the cutbank behind the tread, including removal of loose materials that may roll onto the tread later. The backslope should blend with the general slope of the hill. A properly cut backslope won't disrupt the natural water flow.
- Broadcast excavated materials evenly downhill or save the material for revegetating and naturalizing borrow pits.

3. Refine the backslope and outslope the tread.

- Round the backslope by smoothing the hard edge where the backslope joins the hillside, and outslope the tread grade by 3–8 percent.
- Rake excavated materials off the tread and broadcast evenly below the trail evenly, ensuring no berms or piles remain.

- Compact tread and backslope to help keep soil in place.
- Redistribute organic material over the broadcasted material downslope to encourage revegetation and reduce the potential for erosion. Use caution to not create berms or piles. A light sprinkling of leaf litter may be applied to the fresh treadway to reduce splash erosion.

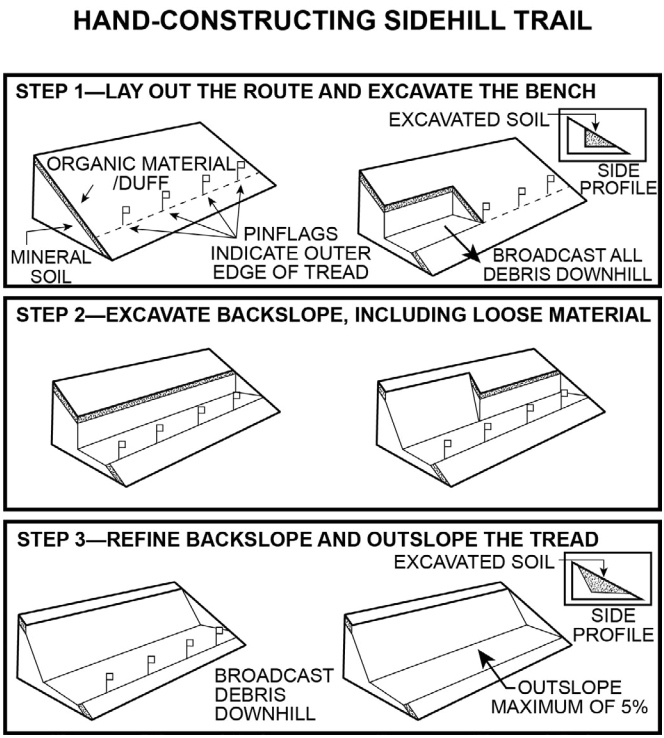

Figure 6-13. Steps to construct a sidehill trail by hand. Adapted from a drawing by the Appalachian Trail Conservancy.

Outsloping

The recommended outslope for most contouring sidehill trails is 3–8 percent grade to encourage proper sheet flow, with a goal of about 5 percent. An outslope of 5 percent is barely perceptible to most users and to most new trail builders, who tend to exaggerate the outslope beyond 5 percent. A 5-percent outslope is often accomplished simply by pulling excavated material to the outside of the tread on a newly constructed bench. Another tip is to work parallel to the trail rather than perpendicular when refining the tread to improve your vantage point. A bottle of water or a McLeod are also helpful for judging the outslope (fig. 6–14).

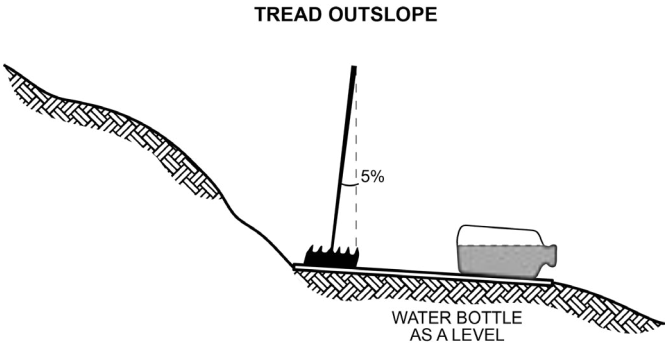

Figure 6–14. The outslope of 3–8 percent should be barely detectable to the eye. A partially filled water bottle makes a good level, or you can stand a McLeod on the trail tread—the handle should lean downhill.

Machine-Built

Trail dozers, mini excavators, and other specifically designed trail building equipment can save you time and energy where they are allowed. However, trail construction with equipment creates more disturbance and requires more cleanup and finish work. Furthermore, building trails using machines isn't appropriate in all settings, such as in designated wilderness areas or areas where the design calls for a light footprint.

The work of machines can be combined with hand construction to remove rocks and refine the tread and backslope. The work follows the same basic steps discussed above for building a trail completely by hand. Using equipment for trail work requires training (typically a certification) and experience. Partners and volunteers can also receive training to work with Forest Service equipment. Work with well-trained operators or professional trail builders—inexperienced operators can cause a lot of damage very quickly. Discuss the training requirements and availability in your area with the agency trail manager.

Best practices for trail building with machines

- Be certain the corridor is wide enough to accommodate machinery. Assess any snags that have the potential to fall on the machine and the operator.
- Follow the flag line and know what the flag line means (above, below, or in the center of the trail).

- Depending on the soil type and rock content, use a trail dozer, mini excavator, or other mechanized equipment to establish the bench; always keep the machine on a stable surface.
- If needed, drive or "track" the machinery around areas where hand construction has been identified as the appropriate method.
- Track over the bench cut multiple times and use the weight of the machine to compact the soil and create the desired outslope.
- Use a mini excavator to lay back the cut bank to the appropriate backslope and remove debris from the fill slope.
- Refine the tread by hand or with a drag pulled behind an all-terrain vehicle (ATV) to remove rocks and debris.

Decommissioning

The goal of decommissioning or obliterating a trail is to return the area to as natural a state as possible, reduce further impacts, and prevent further use.

Know the lingo: National Forest System trails are "decommissioned." User-created routes are "obliterated." You can't decommission something that wasn't approved in the first place.

Planning for Success

Reclaiming a trail is hard work. Machines make the work easier and get better results, but even that doesn't guarantee long-term success. A well-thought-out plan is essential to effectively close and rehabilitate an unwanted trail, trail segment, or user-created route—and keep it closed. Start with considering why the trail needs to be decommissioned and weigh the environmental, social, and managerial factors before committing resources. Plan to eliminate completely all abandoned segments that are visible from trails that remain open. Monitor the area and continue work as needed until evidence of the old trail is gone.

Environmental. Evaluate each site for its potential to regrow and heal. Simple decommissioning may consist of blocking entry and exit points and allowing the vegetation to recover on its own. This works best on sites that are moist and relatively flat. More common complex restoration in other areas can include obliterating the tread, obscuring the unwanted route, recontouring the slope, and planting native species. Dry, steep sites take a lot of work to decommission successfully.

Social. Weigh the users' needs with the resource damage that may be occurring. Decommissioning projects are more likely to succeed when the trail users have a better alternative that meets the trail standards, provides a higher quality opportunity, and the new trail has less resource

impact than the original trail. Obliterating a user-created route without addressing the potential unmet need can be a recipe for failure.

Managerial. Decommissioning an existing National Forest System trail or obliterating a user-created route requires input from a Forest Service line officer. The local trail data manager will also need to change the trail status to "decommissioned" in the Forest Service trail data system. Trails marked as decommissioned won't show up on the Interactive Visitor Use Map and invite unintended use. Data managers should attach the signed environmental decision document authorizing the project to the trail database record. Trail managers should also work with public affairs officers to communicate changes in trail opportunities, including updating agency web pages.

Refer to the Decommissioning Trails web page (on the Trail Skills Project website) for more resources or refer to the "Wilderness and Backcountry Site Restoration Guide" available from the Forest Service.

Steps To Decommission or Obliterate a Trail

Project preparation

- Evaluate the likelihood of successfully decommissioning or obliterating:
  - Evaluate how effectively you can "naturalize" an area.
  - Consider why the route was created and if the need can be met elsewhere. Provide an alternative route before decommissioning work starts.

- Ensure you have authorization to proceed and adhere to any mitigation measures.
- Disguise or install signs closing both ends of the trail to avoid user and worker conflicts.

Naturalize the old trail

- Restore the natural contour of the slope, if necessary, by pulling fillslope material back into the cut.
- Loosen soil 8–10 in (20–30 cm) to promote seed germination, increase water filtration, and reduce the likelihood of erosion.
- Install log or rock check dams where trails are gullied. Steeper grades require more check dams. The top of one check dam should be level with the bottom of the next if installed on a slope (refer to the "Check Dams" section below).
- Partially bury logs and rocks, particularly at trail junctions, to create a natural-appearing barrier.
- Cover the disturbed area with native mulch and organic debris from the surrounding area to retain moisture, protect soils, and promote seed germination. In dry areas with slow vegetation growth, consider transplanting resilient species from the local area into the disturbed area (commonly known as vertical mulching) if allowed by planning documents.
- Use branches, rocks, and other native materials to further camouflage and discourage use of the former trail.

- Leave the hinge connected on trees that have been felled across the trail.

Revegetate the corridor

- Consult trail managers in your area to understand which native plant species have the best transplant survival rate.
  - Use grass pelts, brush, and even small trees to jumpstart revegetation.
  - Replanting just before or during the wet season is helpful.
  - Watering may be necessary for successful reestablishment, especially in arid regions.
- Fill in the visual or vertical opening of the corridor by planting shrubs and trees, even dead ones (fig. 6–16).

Keep it closed

- Keeping closure signs up after the restoration is complete may be helpful, although it can also draw attention for users seeking for the old route.
- Monitor the area and adjust if needed to repair damage.

Figure 6–15. A candidate trail for a causeway structure or decommissioning and rerouting. Flathead National Forest, Montana. USDA photo by Jess May.

Figure 6–16. Completely block off abandoned trails. Plant native grasses and shrubs or place deadfall and other large debris to fill the opening left by the abandoned trail. Pike-San Isabel National Forests, Colorado. USDA photo by Scott Johnson.

Check Dams

Check dams are constructed features of earth, log, or rock that hold surface water long enough for the water to percolate into the soil and deposit the sediment it is carrying (fig. 6–17). They are commonly used in a series to stop erosion and hold material in place during restoration of abandoned and trenched tread. The sediment fills in the trench over time. On a trail with 25 percent grade, check dams placed every 65 ft (20 m) is typically sufficient. Install

more dams closer together on steeper grades. Check dams can be used as a last resort with existing rutted tread and to slow or prevent additional soil loss.

Installation tips

- Install a drainage feature at the top of the slope leading to the trenched tread to drain water away from the trail and reduce erosion.
- Install check dams with a level top or a low point in the middle to prevent erosion around the low sides.
- Embed at least one-third of the diameter of the log or timber into an excavated footing that extends into the sides of the gully.
- Backfill each check dam with tamped gravel or rock to aid drainage and support the structure.
- Construct the top of the check dam to be above the bottom of the next check dam uphill.

Common mistakes

- Not monitoring the site to catch and repair "blow outs" early.
- Not burying or anchoring the sides deep enough into native soil. Water will undermine or bypass check dams not sufficiently embedded into native soil.
- Leaving the old trail visible.
- Not accounting for the decomposition of broadcasted vegetation originally used to obscure the old tread. It takes a long time for a trail to revegetate, and you may need to block the old tread if the vegetation used decomposes too quickly.

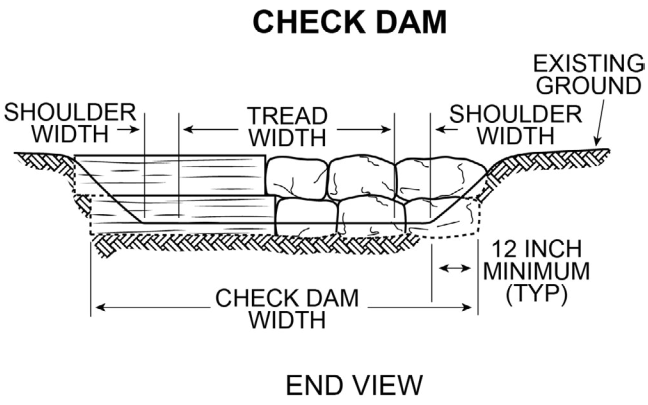

Figure 6–17. End view of a check dam that allows soil to rebuild on eroded trails. Diagram based on Forest Service standard trail drawing STD 928–10–1.

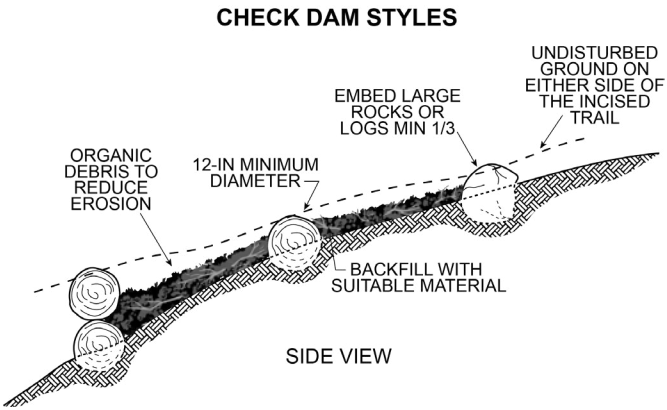

Figure 6–18. Side view of a series of check dams. The bottom of each dam should be level with the top of the next lower dam. Check dams aren't suitable on grades steeper than 40 percent. Diagram based on Forest Service standard trail drawing STD 928–10–1.

7

TOOLS AND EQUIPMENT

7. TOOLS AND EQUIPMENT

This chapter describes common tools and mechanized equipment for trail work. For additional publications and websites about trail tools, refer to the "Tools" section in chapter 8.

Mechanized Tools

The term "mechanized" refers to any machine that uses mechanical advantage (or has gears) or is powered by gas or electricity. Mechanized tools, equipment, and transportation are restricted in designated wilderness areas. The prohibitions include wheelbarrows, mountain bikes, motorized equipment, and electric hand tools. The integrity of designated wilderness areas is being preserved through the use of traditional skills. Learn more about motorized equipment or mechanical transport in designated wilderness areas in Forest Service Manual (FSM) 2326 and the Wilderness Connect website.

Digital tools

One tool that most people carry daily is a smartphone. There are a variety of digital apps that make trail planning easier, including apps for mapping, trail locating, GPS tracking, measuring, notetaking, and taking pictures. Avoid using a personal device for work, as they could be subject to Freedom of Information Act (FOIA) requests.

Tool Safety

Choosing the right tool

- Your most important tool is your brain—use it.
- Choose the least complex tool for the job.
- Make sure you know how to use the tool properly and you are using it for its intended purpose.

Carrying and storing tools

- Carry tools on your downhill side. Grasp the handle at the balance point with the sharpened blade forward and down. Throw the tool clear if you fall.
- Cover the blade of any cutting tool with a sheath when carrying, loading, or storing it. Fasten down or secure tools carried in vehicles.
- Keep cutting tools sharp. A dull tool makes your work harder and more dangerous.
- At the worksite, lay tools on the uphill side of the trail with the business end farthest uphill. Place the handles far enough off the edge of the trail so they are not a tripping hazard. Never sink double-bit axes, Pulaskis, mattocks, or similar tools into tree trunks, stumps, or the ground where the exposed portion of the tool will present a hazard.

Using tools safely

- Always use proper hardhats, gloves, safety glasses, and other personal protective equipment (PPE). Refer to the "Safety" section in chapter 1 for a list of common PPE.

- Follow the risk assessment or similar approved safety plan.
- Carefully inspect each tool. Make sure the handles are solid, smooth, and straight and that the heads are tight.
- Survey the site before you start working. Think about the potential hazards. Observe crew member spacing. Consider if people are using the right tool for the job.
- Clear away any brush or limbs before you start swinging a tool.
- Posture is important. Stand comfortably. Adjust your stance and tool grip continually to prevent slipping and to avoid glancing blows. Be especially careful when working in wet, slippery conditions.
- Think about the consequences of every move, especially when working with a rock or log. Think ahead so you aren't standing in the wrong place when it moves. Be ready to toss your tool aside and jump free. Avoid cutting toward any part of your body and watch out for your coworkers. Use skill, not brute force.
- Maintain at least 10 ft (3 m) between workers when using individual chopping and cutting tools.
- Pace yourself. Take rest breaks, drink plenty of water, and keep your mind on your work. Trade off on work tasks occasionally for relief from repetitive stresses.

Brushing

Lopping shears and pruning shears. Lopping and pruning shears (fig. 7–1) are similar in design and use. Lopping shears have long handles and may have gears to increase leverage to cut thicker stems. Pruning shears are small enough to be carried in one hand and are designed to cut small stems and branches. Cutting edges vary, but generally one blade binds and cuts a stem against an anvil or beveled hook. The hook and blade shear for overhead cuts is recommended because the curved blades transfer the weight of the shears to the limb. Lopping and pruning shears do a better job than hand saws or axes of making a nice clean cut.

Figure 7–1. Lopping shears. USDA photo by Matt Able.

Power weed cutter. Motorized weed cutters, also referred to as brush cutters or weed whackers, use rotating plastic line or metal blades to cut weeds. These can be a good option for mowing grass and encroaching weeds.

Chopping

Common ax types are double-bit (fig. 7–2) and single-bit (fig. 7–3).

Double-bit axes have two symmetrically opposed cutting edges. One edge is maintained at razor sharpness. The other edge is usually duller and used to chop around rocks or in soil. Mark the duller edge with a spot of paint.

Figure 7–2. A double-bit ax. USDA photo by Laurent Deviche.

Figure 7–3. A single-bit ax. USDA photo by Matt Able.

Before chopping with an ax, check for adequate clearance for your swing. Remove any underbrush and overhanging branches that might interfere. Be sure your footing is stable and secure. Chop only when you are clear of other workers.

Using an ax proficiently requires practice. Inexperienced users and dull axes can cause serious accidents. In general, placing the ax accurately is more important than the force of the swing. Always chop away from your body. Stand where a glancing blow will not strike you. If the situation makes you cut toward yourself, "choke up" on the handle with both hands and use short swings for more control.

The Forest Service offers ax training as part of its national crosscut and chainsaw program. Also refer to the publication "One Moving Part: The Forest Service Ax Manual."

Digging and Tamping

Digging and tamping bar. A digging and tamping bar (fig. 7–4) is about the same length as a rock bar, but much lighter. It is designed with a chisel tip for loosening soil or rocks and a flattened end for tamping. These bars are not prying tools.

Figure 7–4. Digging and tamping bar. USDA photo by Matt Able.

Shovel. Shovels are available in various blade shapes and handle lengths (fig. 7–5). The common or round-point shovel weighs 5–6 lb. (2.5–2.7 kg). The head measures about 8 x 12 in (20 x 30 cm). If a shovel feels too heavy or large, choose a smaller version—remember, you have to lift everything the head holds.

The square shovel is a flat-bottomed model intended for shoveling loose materials, not digging.

Figure 7–5. Square and round-point shovel heads. USDA photo by Matt Able.

When scooping materials, lift with your legs and glutes while holding your core tight in a neutral position. Push the end of the shovel handle with your thigh. This makes the handle an efficient lever and saves your energy and your back. Don't use the shovel to pry objects out of the trail—that's a job for a pick and a pry bar.

Grubbing

Hoes. Use a grub hoe or hazel hoe (fig. 7–6) to break up sod clumps during new trail construction or when leveling an existing trail tread. These hoes are also useful in heavy duff. They generally work better than a Pulaski.

Figure 7–6. Grubbing hoe. USDA photo by Laurent Deviche.

Mattock (pick or cutter). The pick mattock (fig. 7–7) is often the standard tool for trail work for many applications. Its pointed tip is used for breaking up hard soil and digging up rocks, while the grubbing blade works on softer materials, making the tool more versatile than a Pulaski. Use the grubbing blade to cut roots or remove small stumps. Tamp soil and loose rocks or smooth new tread with the edge of the tool.

Pry rocks with a pick mattock without fear of breaking the handle. Two people working with pick mattocks may not need to carry rock bars.

Figure 7–7. Pick mattock and cutter mattock heads. USDA photo by Matt Able.

Maintain good cutting edges on mattocks. Sharpen grubbing blades to maintain a 45–degree edge bevel on the underside. Sharpen pick ends as you would a pick and maintain factory bevels on cutter blades.

McLeod. The McLeod (fig. 7–8) combines a heavy-duty rake with a large, sturdy hoe. It works well for constructing trails through light soils and vegetation or for reestablishing tread when material from the backslope sloughs onto the trail. A McLeod is essential for compacting tread and is helpful for checking outslope. To avoid the bolt impression left in your freshly compacted tread, remove the bolt that secures the toolhead and weld the head to the mounting plate. McLeods are inefficient in rocky or heavy brushed areas.

Figure 7–8. McLeod. USDA photo by Matt Able.

Pulaski. The Pulaski (fig. 7–9) combines an ax and a grub hoe into a multipurpose tool. It is a popular trail tool, mostly because it is widely available and easier to carry than several single-purpose tools. It isn't as good as a hoe or mattock for grubbing, nor is it as good as an ax for chopping. It also isn't meant to be used as a prying tool because of how the head is hung on the handle.

When using the hoe end of a Pulaski, stand bent at the waist with your back straight and parallel to the ground, knees flexed, and one foot slightly forward. Hold the handle with both hands so the head is at an angle to your body, and use short, smooth, shallow swings. Let the hoe hit the ground on its corner. Use the ax end to chop large roots after the soil has been cleared by the hoe.

Figure 7–9. Pulaski. USDA photo by Matt Able.

Carry the Pulaski at your side. Grip the handle firmly near the head and point the ax end away from your body and down.

Sharpen the cutting edge of the Pulaski's ax as you would any other ax. When sharpening the Pulaski's hoe end, maintain the existing inside-edge bevel. Never sharpen the top of the hoe.

Lifting and Hauling

Canvas bag. Heavy-duty canvas bags (fig. 7–10) are great for soil, small rocks, and mulch. They are more durable than similarly styled shopping bags.

Figure 7–10. Heavy-duty canvas bag. USDA photo by Matt Able.

Hoist. Hand-operated cable hoists (fig. 7–11) make moving large boulders and logs possible with mechanical advantage. They come in different styles, sizes, and capacities.

Figure 7–11. Hoist. USDA photo by Matt Able.

Motorized carrier. Consider a motorized carrier (fig.7–12) to efficiently carry heavy materials. They come in a variety of sizes and capabilities and typically feature a dump body. A trailer pulled behind an all-terrain vehicle may be an alternative to a motorized carrier.

Figure 7–12. Motorized carrier being used to transport rocks. Tongass National Forest, Alaska. USDA photo by Laurent Deviche.

Measuring

Tips for measuring

- Mark off commonly used measurements on your tool handles.
- Know the length of your feet, arms, fingers, and other rulers that are handy on the trail.
- Know the length of your pace so you can easily estimate longer distances.

Clinometer. A clinometer (fig. 7–13), called a "clino" by trail workers, is a simple instrument for measuring grades. Digital clinometer apps are available. Verify their accuracy before depending on them. Most clinometers have two scales, one with percent of slope, the other with degrees. Don't confuse the readings (it is easy to do). Percent slope is the most-used measure, and the values are on the right side of the scale on most standard clinometers. Percent slope is derived from the relationship of rise or drop in grade over a horizontal distance. You can derive your own slope value with this equation:

$$\text{Percent of slope} = \frac{\text{Amount of rise}}{\text{Amount of run (horizontal distance)}} \times 100$$

For example, a section of trail 100 ft (30 m) long with 10 ft (3 m) of difference in elevation would be a 10 percent grade ([10/100]x100=10). A 100 percent grade is equal to 45 degrees.

Figure 7–13. Standard clinometer. USDA photo by Kerry Wood.

Global Positioning System (GPS) unit. Most trail managers use GPS units to receive a signal from GPS satellites for accurate trail location, inventory, and contract preparation. Accuracy depends on a clear view of the sky. The reading can be off under a heavy canopy.

Tape measures. Standard tape measures are handy for measuring lumber and logs. A forestry tape (also called diameter tape) is better for measuring longer distances. One side of the tape also has marks to measure the diameter at breast height (DBH) of a tree. (DBH is measured about 4.5 ft [1.4 m] above the ground).

Mechanized Trail Building Equipment

Excavator. A mini excavator (fig. 7–14) can excavate the bench, shape the tread and backslope, and move building material, debris, and rocks from place to place. This flexibility makes the mini excavator particularly popular for trail work.

Figure 7–14. A mini excavator. Weber Basin Job Corps, Utah. USDA photo by Scott Johnson.

Dozer. Dozers come in a broad range of sizes, including trail-sized dozers (fig. 7–15). The trail dozer is commonly used to cut in full-bench trails, during heavy maintenance to repair trail tread and reconstruct rolling dips, and during decommissioning to reshape and naturalize the old trail tread.

Figure 7–15. A trail-size dozer. Boise National Forest, Idaho. USDA photo by Scott Johnson.

Stand-on skid steer. The small skid steer (fig. 7–16) comes with a variety of attachments for pushing, shaping, and lifting. The narrow tracks and weight are well-suited for building and maintaining narrow trails. The versatility makes the skid steer the "Swiss Army knife" of mechanized trail equipment. It is also lighter than other pieces of trail equipment and towing doesn't require a commercial driver's license.

Figure 7–16. Stand-on skid steers being used on the George Washington and Jefferson National Forests, Virginia. USDA photo by Scott Johnson.

Peeling and Shaping

Drawknife. A drawknife (fig. 7–17) works best to peel dry logs. Position the log about waist high. Grasp both handles so the beveled edge of the blade faces the log. Begin each stroke with arms extended and pull the tool toward you while keeping even pressure on the blade. Keep your fingers clear of the blade's corners.

Figure 7–17. Drawknife. USDA photo by Matt Able.

Chainsaw debarking attachment. This attachment (fig. 7–18) fits onto a chainsaw for debarking, planing, jointing, and notching logs.

Figure 7–18. Chainsaw debarking attachment. USDA photo by Tim Farris.

Pounding and Hammering

Sledgehammer (single or double). A sledgehammer (fig. 7–19) has a head forged from heat-treated, high-carbon steel weighing 2–5 lb. (0.9–2.3 kg) for single and 8–20 lb. (3.6–9 kg) for double. Heat treating, also known as hardening, makes the metal more resistant to deformation but more brittle. For more information on hand drilling, refer to "Hand Drilling and Breaking Rock for Wilderness Trail Maintenance."

Figure 7–19. Single jack hand-drilling hammer and double jack hand-drilling hammer. USDA photo by Matt Able.

Rock Work

Rock bar. Use a rock bar (also called a pry bar) for lifting, flipping, or sliding large, heavy objects (figs. 7–20 and 7–21). These bars are heavy duty. They have a chisel tip on one end. The other end can be rounded or pointed.

Figure 7–20. Rock bar. USDA Matt Able.

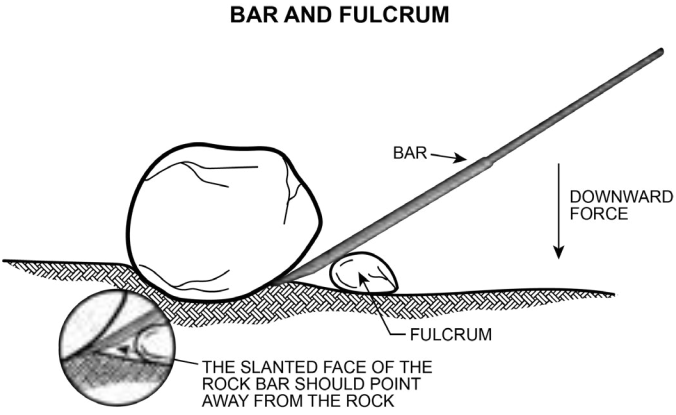

Figure 7–21. Rock bar and fulcrum used to move a large rock.

Place the tip of the chisel under the object to be moved with the slanted face pointing away from the rock. Wedge a log or rock between the bar and the ground to act as a fulcrum. Press the handle down with your weight over your palms. Never pry with the bar between your legs or near your collar bone. When the object raises as much as the bite allows, place blocks under it and use a larger fulcrum or shorter bite on the same fulcrum to raise the object farther. This kind of maneuver requires a tool with high tensile strength—use a high-quality rock bar and don't settle for a cheap digging bar.

The rounded end of a rock bar is great for compacting material into rock cracks when armoring the trail. You can also use the pointed end to break large rocks by jabbing the point into a crack and twisting.

Other tools for rock work

- Pick mattock
- Gravel box, rock bag, rucksack, rock litter—all useful for carrying rocks of various sizes
- Winch and cable systems, such as grip hoists or come-alongs
    - Some rocks can be dragged or lifted into place—this work requires special training; check with your local trail manager to determine the skills required
- Motorized equipment, including rock drills and rock breakers
- Hammers (fig. 7–22) and chisels (for shaping)
- Stone feathers and wedges (for splitting)

Figure 7–22. Heads of common hammers for rock work (left to right): engineer's hammer, cross peen (a.k.a. blacksmith hammer), and mason's hammer. The mason's hammer is made of soft metal designed to be hit with a sledge for rock shaping. USDA photo by Jess May.

Sharpening

Inspect all tools before use. Sharpening makes tools last longer. A small scratch that is ignored could lead to a serious crack or nick in the blade. Wear gloves when sharpening cutting edges.

Use a file or grindstone to remove metal from a dull edge. A touchup with a whetstone will restore the edge bevel if there are no visible nicks. Whetting the edge removes very small bits of metal from the blade and causes the remaining metal to burr slightly on the cutting edge. This burr is called a feather or wire edge. Remove this weak strip by honing the edge on the other side. A correctly honed edge is sharp, does not have a wire edge, and does not reflect light or show a sharpening line.

Restoring the blade bevel (fig. 7–23) requires coarser grinding tools to reshape worn cutting blades. Reshape blades with a hand file, sandstone wheel, or electric grinder. Remove visible nicks by grinding the metal back on the blade. Remember that a correct blade bevel requires maintenance. If using an electric grinder to reestablish edges, be mindful of overheating the metal and losing the temper. If the shape can't be maintained, either discard the blade or have a blacksmith recondition the toolhead.

A hand-tool sharpening gauge (or bevel angle gauge) that provides the correct angles is helpful.

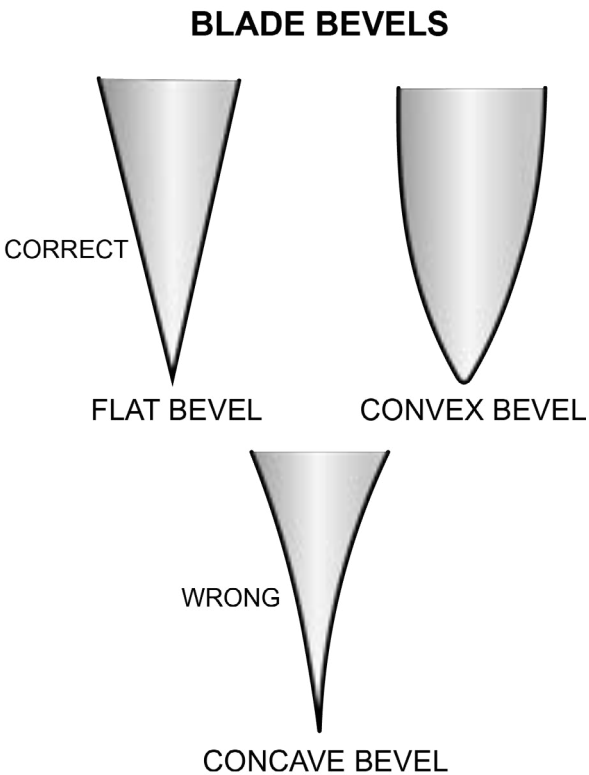

Figure 7–23. Illustration of correct and incorrect blade bevels.

If a cutting edge is nicked by a rock, it may be "work hardened." A file will skip over these spots and create an uneven edge. Use a whetstone or the edge of a bastard file to reduce the work-hardened area, then resume filing. Alternate using a whetstone and the file until the file cuts smoothly over the entire length of the edge.

Files. Files come in single or double, curved or rasp cuts. Single-cut files have one series of parallel teeth angled 60 to 80 degrees from the edge; they are used for finishing work. Double-cut files have two series of parallel teeth set at a 45–degree angle to each other; they are used for restoring shape. Curved files are used for shaping soft metals. Rasp-cut files are used for wood.

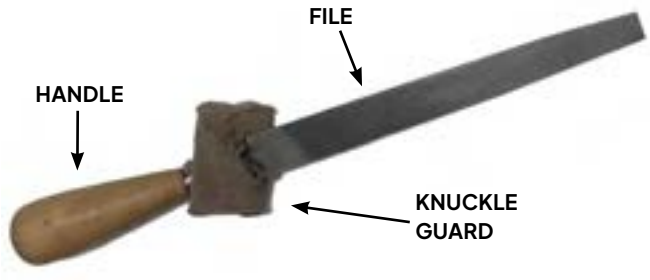

Figure 7–24. A hand file with a handle and a knuckle guard made from an old fire hose. USDA photo by Kerry Wood.

Files are measured from the point to the heel, excluding the tang (the tip used to attach a handle). File coarseness is termed "bastard," "second cut," or "smooth." The bastard is the coarsest file available for files of the same length. A 10–in (25–cm) mill bastard file is good for all-around tool sharpening.

Before filing, fit the file with a handle and knuckle guard (fig. 7–24). Always wear gloves on both hands. Secure the tool so both hands are free for filing. Use the largest file you can. Remember that files are designed to cut in one direction

only. Apply even pressure on the push stroke, then lift the file up and off the tool while returning for another pass.

Store or transport files so they are not thrown together. Protect them from other tools as well. An old piece of fire hose sewn shut on one end makes a great holder for several files, a guard, and a handle.

Sawing

Chainsaw. A chainsaw (fig. 7–25) can make short work of your cutting tasks. Stay within your training and certification limits when operating. Both gas- and battery-powered chainsaws are available in a variety of bar sizes, powerhead sizes, and chain types for different applications. Using a sharp chain is essential for safe and efficient cutting; know how to sharpen chains in the shop and in the field.

Figure 7–25. A gas-powered chainsaw. USDA photo by Matt Able.

Crosscut saw. Symmetric crosscut saws that are designed for a sawyer to hold at either end come in two basic patterns (figs. 7–26 to 7–28). Felling crosscuts are 4–12 ft (1.2–3.6 m) long, light, and flexible, with concave backs that conform easily to the arc of the cut and the sawyer's arm. The narrowed distance between the teeth and back leaves room for sawyers to get wedges into the cut quickly. Stay within your training and certification limits when operating.

Bucking crosscuts have straight backs and are heavier and stiffer than felling saws. They are recommended for most trail work because they are more versatile. Bucking saws come with short blades (3–4.5 ft [1–1.4 m]) and a single handle so they can be used solo. The blade is asymmetrical with a D-shaped handle on one end. Holes at the point (tip) allow for attaching a supplemental handle.

Figure 7–26. One-person crosscut saw. USDA photo by Matt Able.

A sharp crosscut saw is a pleasure to operate, but a dull or incorrectly filed saw is a source of endless frustration and is known as a "misery whip" for good reason. Never sharpen a saw without a saw vise and the knowledge to use it. Field sharpening ruins crosscut saws.

Figure 7–27. Ribbon-style felling crosscut saw with handles. USDA photo by Kerry Wood.

Figure 7–28. Blades of bucking (top) and felling (bottom) crosscut saws. USDA photo by Matt Able.

Pruning saw. A pruning saw (fig. 7–29) is useful for limbing, some brushing, and removing small downfall, especially where space is limited, and cutting is difficult. A folding pruning saw can easily be carried in a pack. Some pruning saws cut only on the pull stroke.

Figure 7–29. Folding pruning saws come in many sizes. USDA photo by Jess May.

Pole saw. A pole saw (fig. 7–30) can be used to prune back high branches from the trail corridor. Manual, electric, and gas-powered versions are available.

Figure 7–30. Manual pruning saw (top) and electric pruning saw (bottom). USDA photo by Scott Johnson.

8 RESOURCES

Forest Service Trail and Trail Bridge Policy

The Forest Service is required to provide an adequate system of trails to meet recreation demands and promote a wide variety of trail opportunities and experiences for people of all ages and abilities (16 USC §532 and the Architectural Barriers Act of 1968). There are National Forest System trails on nearly every forest and grassland unit in the United States, including Puerto Rico. These include thousands of miles of congressionally designated national scenic and national historic trails, administratively designated national recreation trails, and trails through congressionally designated wilderness. Visit the National Forest System Trails website to learn more about trail management and maintenance in the Forest Service.

Forest Service trail-related policy

- Trails Management Handbook (FSH 2309.18)
- Trail, River, and Similar Recreation Opportunities Manual (FSM 2350)
- National Scenic, Historic, and Recreational Trail Management (FSM 2353.3)
- Forest Service Standard Specifications for Construction and Maintenance of Trails (EM-7720-103)

- Sign and Poster Guidelines for the Forest Service (EM-7100–15)
- Recreation Opportunity Spectrum (ROS) (FSM 2300, chapter 10)
- Forest Service Health and Safety Code Handbook (FSH 6709.11)
- Travel Planning (FSM 7700, chapter 10)
- Bridges and Structures (FSM 7722 and FSM 7736)

Websites and Publications

Accessibility

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Forest Service Interactive Visitor Use Map. www.fs.usda.gov/ivm/index.html.

Forest Service Trail Accessibility Guidelines (FSTAG). www.fs.usda.gov/sites/default/files/FSTAG-2013-Update.pdf. A "pocket version" can be found at www.fs.usda.gov/t-d/products.php.

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Endangered Species Act, particularly Section 7—project actions don't result in jeopardy to the continued existence of an endangered or threatened species: www.fws.gov/media/endangered-species-act

National Environmental Policy Act (NEPA) Compliance, Code of Federal Regulations (CFR) 36 CFR Part 220: www.ecfr.gov/current/title-36/chapter-II/part-220?toc=1.

National Historic Preservation Act, particularly Section 106—preservation of historic properties: www.achp.gov/.

National Trail System Act, particularly section 4 —extends workers' compensation, tort, and personal property damage or loss coverage to include qualifying cooperators' volunteers: www.fs.usda.gov/managing-land/trails/trails-stewardship-act.

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This notebook describes techniques used to construct and maintain trails. It is written for trail crew workers and is intended to be taken along on work projects. Numerous illustrations help explain the main points. The notebook was printed in 1996 and has been revised during four reprintings. This edition has restructured information and expanded trail sustainability concepts. Trail construction techniques and references have also been updated.

Keywords: sustainable trails, accessibility, climbing turns, drainage, fords, grade reversals, puncheon, reclamation, resilience, signs, switchbacks, trail construction, trail crews, trail maintenance, training, turnpikes

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Common Conversions and Comparisons

Table 8.1. Angle (degrees) to grade (percent) conversions

Angle (degrees)	Grade (percent)	Angle (degrees)	Grade (percent)
1	1.75	27	51
3	5.2	30	57.7
6	10.5	33	64.9
9	15.8	36	72.7
12	21.3	39	81
18	32.5	42	90
21	38.4	45	100
24	44.5		

Common Metric Conversions

0.04 inch = 1 millimeter
1 inch = 2.5 centimeters
1 foot = 0.3 meters
1 yard = 0.9 meters
1 mile = 1.6 kilometers
1 ounce = 28.3 grams
1 pound = 0.5 kilograms
1 quart = 0.9 liter
1 gallon = 3.8 liters

1 inch^2 = 6.5 centimeters^2
1 foot^2 = 9.3 decimeters^2
1 acre = 0.4 hectare
0 °Fahrenheit = -17.8 °Celsius
32 °Fahrenheit = 0 °Celsius
100 °Fahrenheit = 37.8 °Celsius

Common Length Comparisons

- A **millimeter** is about the **thickness of a dime**.
- **6 inches** (152.2 cm) is the **length of a dollar bill**.
- **36 inches** (1 m) is the **length of a typical Pulaski tool handle**.

This notebook is 7.5 in (19 cm) long and 4 in (10 cm) wide.

Sample Day Pack List

- ☐ First aid kit
- ☐ Radio, cell phone or smartphone, or personal locating beacon (or all three)
- ☐ Map and compass or GPS unit (or both)
- ☐ Personal protective equipment (will change depending on the type of trail work)
- ☐ Tools (will change depending on the type of trail work)
- ☐ Foul-weather gear
- ☐ Hat/sun protection
- ☐ Headlamp or flashlight and extra batteries
- ☐ Personal items (including gloves, water, and food)
- ☐ Clinometer
- ☐ Tape flagging and pin flags
- ☐ Notepad, pen, permanent marker
- ☐ Your copy of the "Trail Maintenance and Construction Notebook"

Sample Medical Incident Report

Some trail managers use the "8–Line" medical incident report in the National Wildfire Coordinating Group's Incident Response Pocket Guide (PMS 461) to train their crew about the process they should follow in a medical emergency. Contact a Forest Service trail manager familiar with the form or fire personnel if the terms or acronyms are unfamiliar.

Remember, when using a radio, speak calmly and clearly. Think about what you need to say before speaking and hold the "talk" button for 1–2 seconds before you begin talking (to avoid initial transmission cutoff).

For a nonemergency incident, work through your chain of command to report and transport injured personnel as necessary.

For a medical emergency: identify on-scene incident commander by name and position and announce, "**medical emergency,**" to initiate response from dispatch.

Use the following items to communicate the situation to dispatch.

1. **Contact dispatch.** (Verify correct frequency prior to starting report.) E.g., *"dispatch, [state name, call sign, and/or work unit]. Stand-by for emergency traffic."*

2. **Incident status.** Provide incident summary, including location and number of patients. E.g., *"Dispatch, I have a red-priority patient, unconscious, struck by a falling tree. Requesting air ambulance to Forest Road 1 at [lat./long.]. EMT Smith is providing medical care."*

Severity of emergency/ transport priority

Red/Priority 1—Life or limb threatening injury or illness. Evacuation need is **immediate**, e.g., unconscious, difficulty breathing, bleeding severely, 2nd–3rd degree burns more than 4 palm sizes, heat stroke, disoriented.

Yellow/Priority 2—Serious injury or illness. Evacuation may be DELAYED if necessary, e.g., significant trauma, unable to walk, 2nd–3rd degree burns not more than 1–3 palm sizes.

Green/Priority 3—Minor injury or illness. Nonemergency transport, e.g., sprains, strains, minor heat-related illness.

Nature of injury or illness and mechanism of injury *Brief summary of injury or illness (e.g., unconscious, struck by falling tree)*
Evacuation request *Air ambulance, short-haul, hoist, ground ambulance, etc.*
Patient location *Descriptive location, lat./long. (WGS84)*
Incident name *Geographic Location Name + Medical (e.g., Trout Meadow Medical)*
On-scene incident commander *Name of on-scene supervisor or medical provider*
Patient care *Name of medical provider (e.g., EMT Smith)*

3. **Initial patient assessment.** Complete this section for each patient (start with the most severe patient).

Patient Assessment: See IRPG page 118
Treatment:

4. **Evacuation plan**

Evacuation location, if different than current (descriptive location [drop point, intersection, etc.] or lat./long.). Patient's ETA to evacuation location:
Helispot/extraction site size and hazards:

5. **Additional resources or equipment needs**

Example: Paramedic/EMT, crews, immobilization devices, AED, oxygen, trauma bag, IV/fluid(s), splints, rope rescue, wheeled litter, HAZMAT, extrication

6. **Communications.** Identify State air/ground EMS frequencies and hospital contacts as applicable.

Function	Channel Name/#	Receive (RX)	Tone/ NAC	Transmit (TX)	Tone/ NAC
Command					
Air-to-ground					
Tactical					

7. **Contingency.** If primary options fail, what actions can be implemented in conjunction with primary evacuation method? Think ahead.

8. **Additional information.** Updates, changes, etc.

Remember:

- Confirm ETAs of resources ordered.
- Act according to your level of training.
- Be alert. Keep calm. Think clearly. Act decisively.

Tailgate Safety Session

Overview

- **Project location and goals,** including type of work and transportation to and from worksite
- **Introductions** (welcome new people, medical conditions, experience level, first aid training)

Safety

- **Tasks, potential associated hazards, and mitigation measures**
- **Personal protective equipment** needed for the project
- **Anticipated environmental conditions** (weather, terrain, vegetation, wildlife, disaster potential)
- **Locate first aid kits**
- **Tools** and safety practices (carrying, using, storing)
- **Communication** (check-in/check-out, passing on the trail, loose or rolling rock, overhead swing, when to stop work and warn others, giving positive feedback)
- **Emergency evacuation plan** (identify the nearest road/trail head, communications, when to evacuate, contingency plan)
- **Questions, clarifications, or concerns?**

The tailgate safety session is based on information in the project risk assessment. The discussion should be documented on an official FSM 6719.8 – Exhibit 06 form.

After-Action Review

Tips for a helpful after-action review (AAR)

- Perform the AAR as soon as possible after the event.
- Take a few deep breaths.
- Don't make it personal and don't take it personal.
- Supervisors model open and honest discussion about what happened. Respectful disagreement is okay.
- Everyone participates.
- Leave with a strong desire to improve proficiency.
- End the AAR on a positive note.

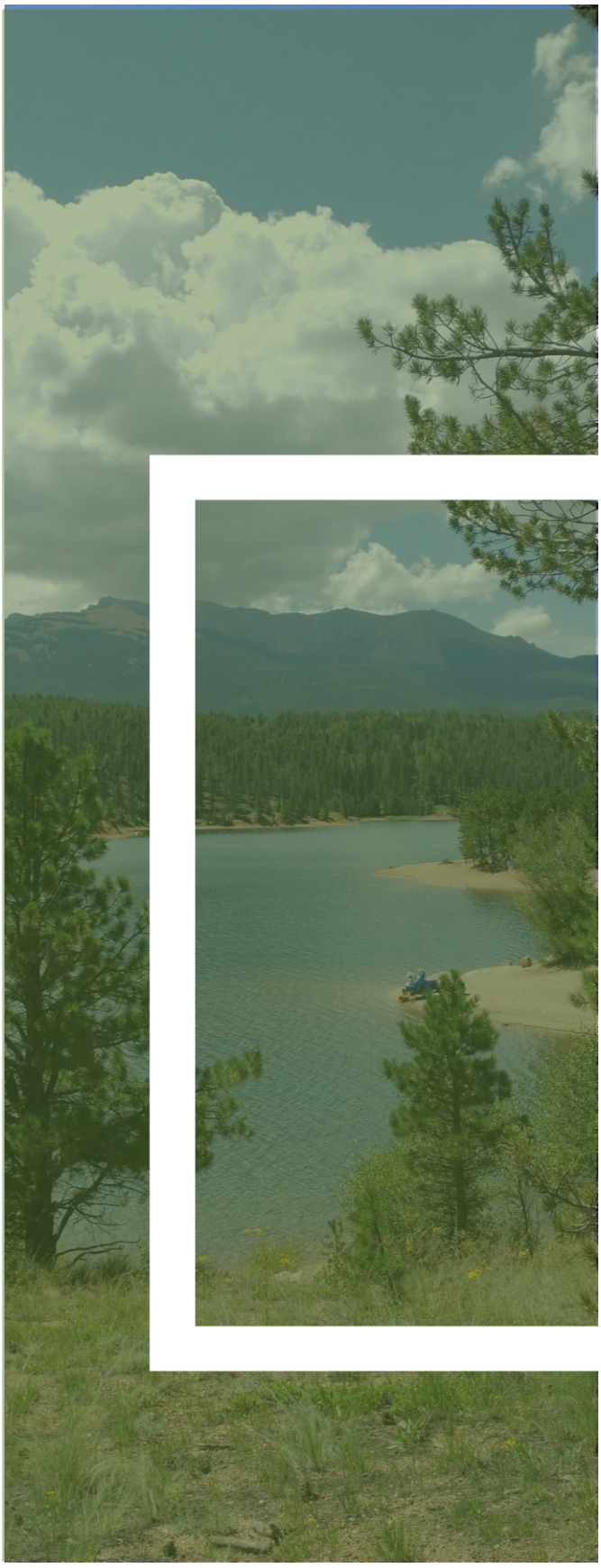
Questions during an AAR

- What was planned?
- What actually happened?
- Why did it happen?
- What can we do next time?

A trail crew on the Inyo National Forest, California. USDA photo by Keith Dawley.

NSRA Field Work Criteria 7/30 - 8/1/2025

Overall Project Considerations & Priorities *(ref. Draft Evaluation Criteria & Priorities - April 28th tech mtg, slide 11)*
(Yes, Some, NA)
(Yes, Some, NA)
(Yes, Some, NA)
(Yes, Some, NA)
(Yes, Some, NA)
(Yes, Some, NA)
($,$$,$$$)
Trail Considerations
(Good, Ok, Poor)
(Good, Ok, Poor)
(Number required, 0-3 Good, 3-5 Ok, >5 Poor)
(Number required, 0-3 Good, 3-5 Ok, >5 Poor)
(Distance from Structure)
(Number, 0-3 Good, 3-5 Ok, >5 Poor)
(Number, 0-3 Good, 3-5 Ok, >5 Poor)
(Yes, No)
Trailhead Considerations
(Yes, No, Notes)
(Yes, No, Notes)
(Yes, No, Notes)
(Yes, No, Notes)
(Yes, No, Notes)



North Slope Recreation Area: Commercial Guided Activities Review

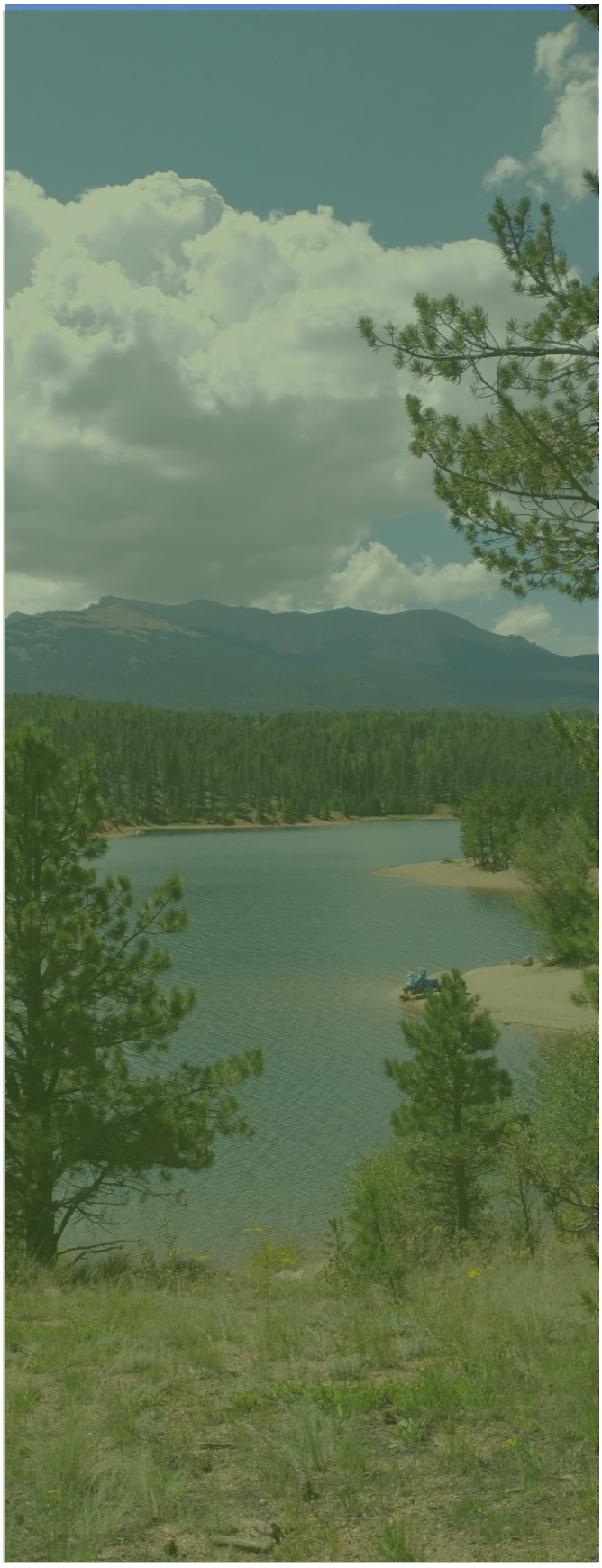
Colorado Springs Utilities

It's how we're all connected

Final Draft

31 JULY 2023

TAPS
associates



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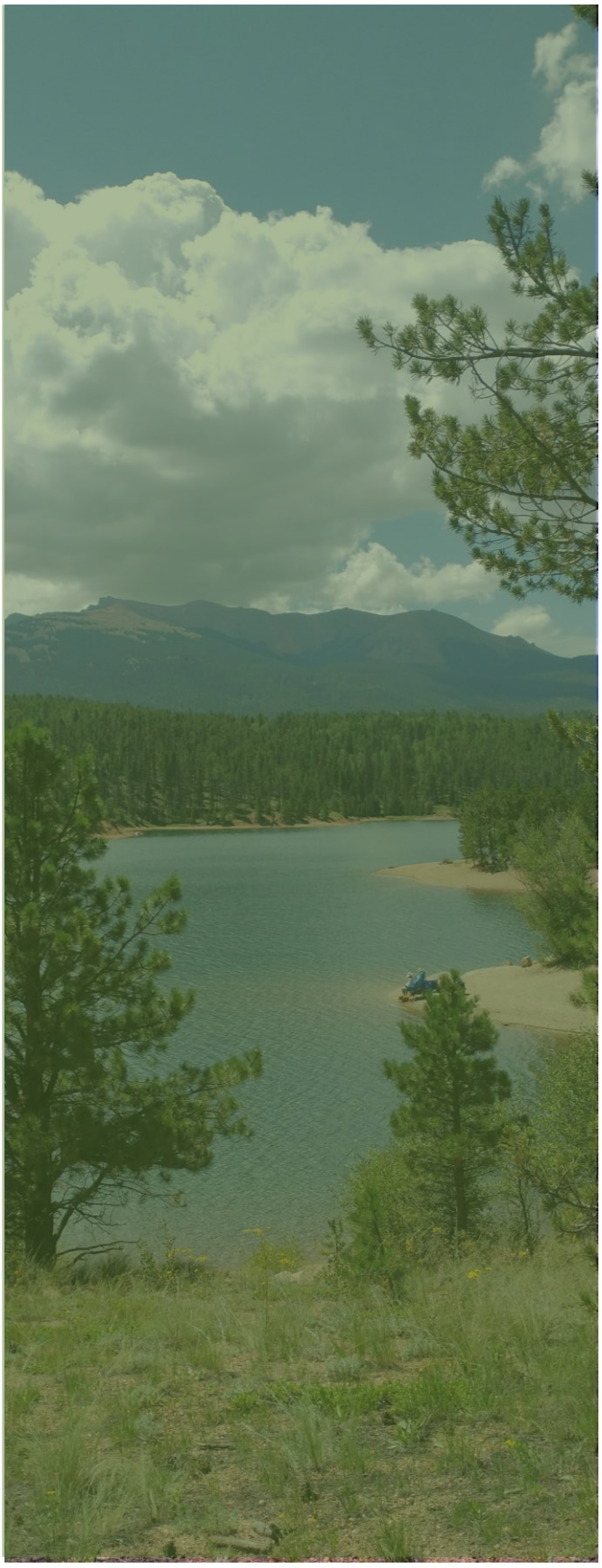


Introduction

Colorado Springs Utilities
It's how we're all connected

NSRA: Commercial Guided Activities Review

Introduction

Introduction

Overview

Project Description and Purpose

In fall 2022, Colorado Springs Utilities (Utilities) undertook an evaluation of potential water operations impacts, watershed impacts, recreational user impacts, community benefits, and best management practices for any current and future commercial recreational activities (guided tours) on the three reservoirs located in the North Slope Recreational Area (NSRA) – see text box *Purpose of the Review*. This evaluation was in partnership with Pikes Peak - America's Mountain (PPAM) as the current recreational managing partner at the NSRA.

The Review focused on water-based commercial guided recreation on North Catamount, South Catamount and Crystal reservoirs in the NSRA. Crystal and South Catamount reservoirs partially reside on US National Forest Service land and are operated under a special use permit– see *Map on page 3*. Non-negotiable "givens" established at the initiation of the review kept discussions focused - see text box *Givens on page 4*. Throughout the process considerations for land-based recreation and other Utilities' watershed lands and reservoirs were discussed. The findings contained in this review reflect these conversations.

A thorough review of relevant studies, policies, and plans initiated the process – see Appendix G. As part of the review process, recreational area users, commercial outfitters, adjacent landowners, and Utilities customers participated in discussions and surveys to provide valuable input to guide future decision making. In collaboration with Utilities, TAPIS Associates facilitated the review.

Project Background

Public recreation on the North Slope began in the early 1990s, following the formal City Charter authorization in 1967 and development of the recreation management plan. In more recent years, local outfitters began conducting commercial guided activities for fishing and boating on North and South Catamount reservoirs. In 2018, Pikes Peak America's Mountain (PPAM) took over management of recreation on the North Slope from City of Colorado Spring Parks and began issuing annual concession agreement to the outfitters for existing commercial guided recreation activities including fishing, kayaking, and stand-up paddleboard tours. Existing Utilities' policy does not explicitly authorize commercial guided activities, so Utilities began working with PPAM to develop an assessment of existing commercial guided recreation activities on the watershed. Potential policy changes would be presented to Utilities Board for consideration and the final approval would be by City Council.

PURPOSE OF THE REVIEW

Colorado Springs Utilities is examining the community benefits, water operations, watershed impacts, recreational user impacts, and best management practices along with financial sustainability to inform existing Utilities' policies regarding current and future commercial for-profit recreation on the three reservoirs in the North Slope Recreation Area.

Utilities values of Responsibility, Collaboration, People, Trust, Continuous Improvement, and Safety will be honored in the review. This review will not result in policy decisions or changes on the North Slope Recreation Area: rather it is a tool to inform future decision making.

NSRA: Commercial Guided Activities Review

Introduction

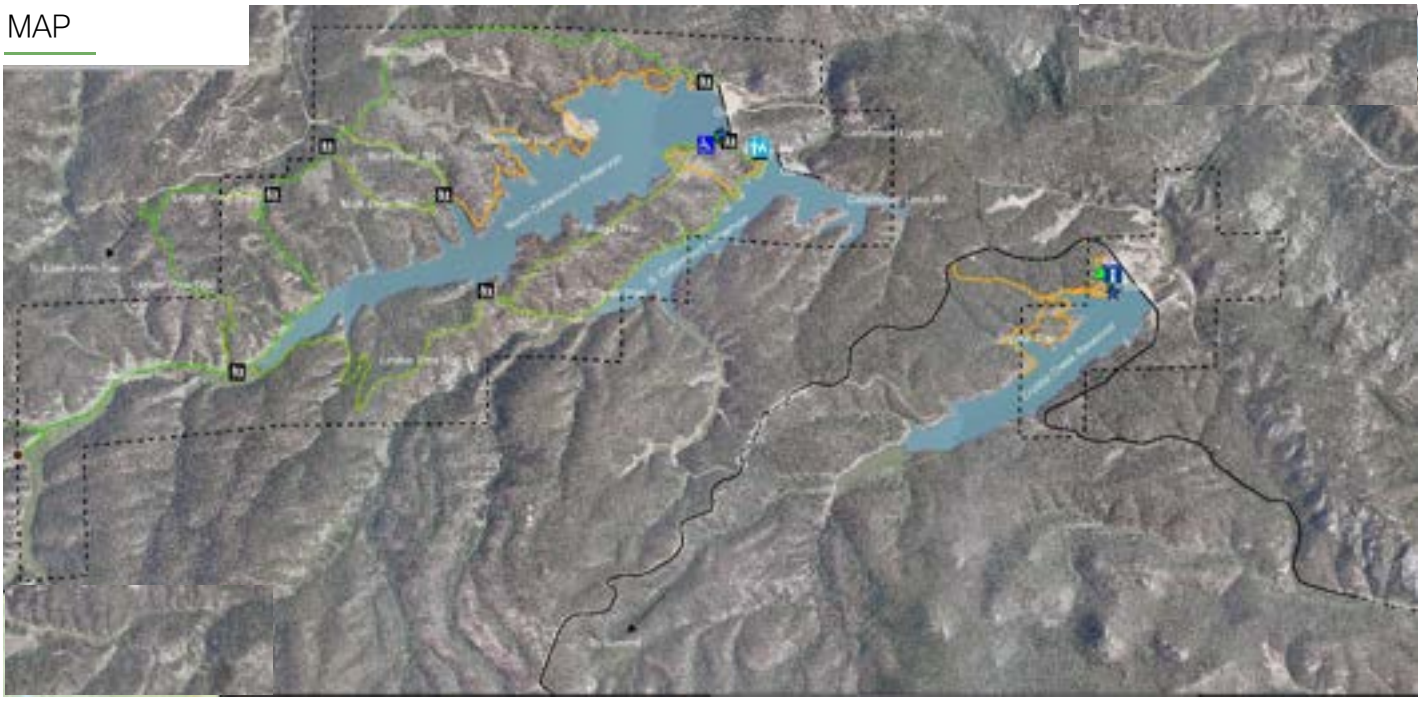
Review Description

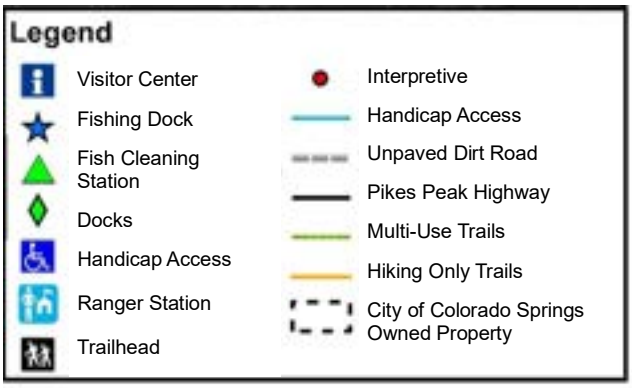
This review is formatted to inform Utilities' future policies for commercial guided recreational use of the reservoirs to best align community benefits, water operations, watershed protection, financial sustainability, and commercial recreation opportunities. There are five sections of this review. The first section, Introduction, includes a description of the review purpose. Process, the second section, includes, the supporting stakeholder engagement process and potential scenarios for future commercial guided recreation at NSRA. The third section takes a wider view of all Utilities' managed watershed lands and contains the Best Management Practices (BMPs) *if* commercial guided activities are authorized on Utilities watershed lands. Future Recreation Considerations is the fourth section, and the fifth section is the Appendices.

NSRA: Commercial Guided Activities Review

Introduction

MAP





Source: City Parks, Recreation and Cultural Services

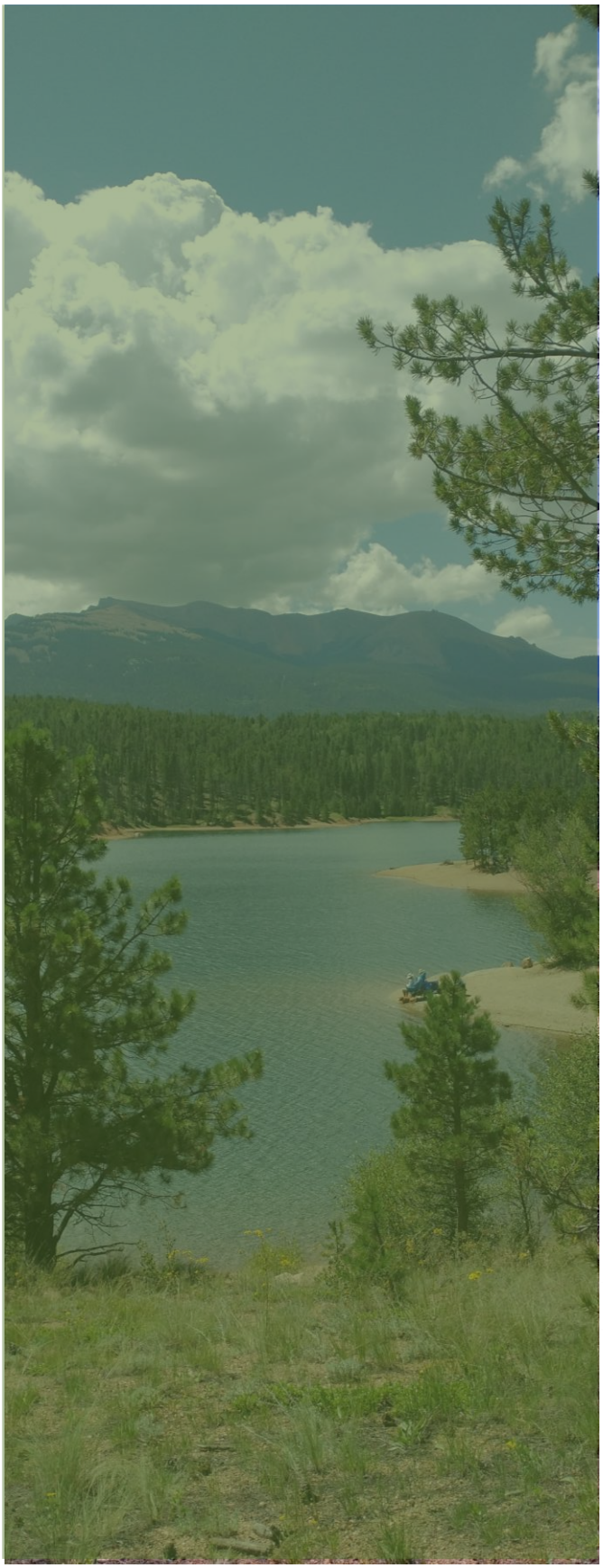
NSRA: Commercial Guided Activities Review

Introduction

GIVENS

Colorado Springs Utilities (Utilities) is examining the community benefits, watershed impacts, recreational user impacts, and best management practices along with financial sustainability to inform existing Utilities' policies regarding current and potential future commercial for-profit recreation on the three reservoirs in the North Slope Recreation Area (NSRA). Utilities' values of Responsibility, Collaboration, People, Trust, Continuous Improvement, and Safety will be honored in the review. The following givens support Utilities' values during the NSRA: Commercial Guided Activities Review.

- Utilities is legally responsible to provide a high-quality, reliable source of drinking water.
    - Any deterioration of source water quality can have a long-lasting operational and financial impact on our customers. Therefore, any adverse impacts from proposed recreational activities to utility infrastructure, operations, and maintenance responsibilities must be avoided, minimized, and mitigated.
    - It would be irresponsible for Utilities to approve a recreational activity and/or infrastructure that could cause a decrease in water yield or that would have an adverse effect on water rights. This is because any decrease in water yield has a direct, tangible, and financial effect on our customers.
    - Fire poses tremendous risk to the safe and effective delivery of high-quality drinking water to our customers. Wildland fire risk on City-owned watersheds and adjacent public or private lands must not significantly increase as a result of direct or indirect effects from recreational activities.
- Utilities must not cause or contribute to a violation of local, state, or federal, rules or regulations, as a result of direct or indirect effects from recreational activities. Acts or activities that may increase the regulatory burden on Utilities or the City of Colorado Springs must be evaluated on a case-by-case basis.
- Utilities is committed to being a steward of the environment. Therefore, any adverse impact on natural or cultural resources, as a result of direct or indirect effects from recreational activities, must be avoided, minimized, and mitigated.
- All recreational activities must be compatible and consistent with Utilities' Excellence in Governance Policy Manual. (https://www.csu.org/Documents/BoardPolicies.pdf)
- Utilities will not make unilateral decisions that will have an impact on other landowners or partner agencies without receiving buy-in from affected parties.
- Utilities has not yet conducted a thorough analysis and may not have all the data necessary to currently identify all givens for the NSRA.
- Utilities currently does not have a mechanism for funding recreation that applies to all City-owned properties. Therefore, creation and maintenance of recreational infrastructure will require a funding mechanism and strategy that are sustainable over the long term.



Process

NSRA: Commercial Guided Activities Review

Process

Process

Engagement Process

The multi-faceted engagement process included multiple stakeholder groups, NSRA visitors, multiple Utilities departments, and similar land managing entities. The engagement methodologies targeted diverse inputs from those familiar with NSRA. Survey opportunities reached a broad audience lending a community-wide perspective.

The Engagement Process Goals were two-fold:

- To identify the range of expectations, desired experiences, and conflicts when individuals, friends and families recreate at the NSRA.
- To identify the range of expectations, desired experiences, and conflicts when commercial outfitters host client activities at the NSRA.

The following paragraphs describe the engagement methodologies and key findings from each. Detailed information and verbatim responses are provided in the appendices.

Utilities staff work sessions and discussions

Aug 2022 -July 2023

Colorado Springs Utilities representative work sessions were conducted throughout the process to ensure all alternatives aligned with Utilities operations, security, and communications protocols. The Kick-off on 16 August 2022 confirmed the project purpose and givens. In addition, discussion of opportunities and concerns formed the initial Opportunities/Areas of Concerns List that was shared and added to during the Stakeholder and Commercial Outfitter Discussion Groups in September 2022.

The Utilities project manager communicated frequently with the department representatives, sharing discussion group information, benchmark data, and PPAM data as it became available. Lively dialog on 10 January 2023 provided a thorough review of the draft best management practices (BMPs).

At the 06 April 2023 public Presentation of Findings, Utilities staff shared an overview of the review's findings and BMPs, provided updates on the dam rehabilitation projects at Crystal and South Catamount reservoirs, and shared the anticipated planning process for NSRA through 2026. PPAM also shared key commercial activity BMPs that will be implemented for the 2023-2024 season.

Stakeholder and Commercial Outfitters Discussion Groups

September 2022

Two discussion groups provided input in September. The invited participants included 1) Organizations representing User Groups and 2) Commercial Outfitters and Organizations representing Commercial Outfitters – see text boxes *Invited Stakeholders* and *Invited Commercial Outfitters*. Short surveys sent to invitees prior to discussion group meetings ensured the in-person sessions focused information and discussions on the participants' interests.

On 20 September 2022, both discussion groups met (one in the morning and one in the afternoon) to

NSRA: Commercial Guided Activities Review

Process

gather input and discuss how this input will be integrated into the process. Discussion included past feedback, future expectations, opportunities and concerns, and observations of their constituents and/or clients. The group's discussions added a community NSRA user perspective to the opportunities/ concerns list - see text box *Issues and Concerns* and *Opportunities*. Following each group meeting, a survey link was sent so that participants could distribute a Utilities-hosted online survey to their constituents and/or clients via their e-networks.

The Stakeholder Discussion Group's consistent themes included concerns of increased use and crowding, commercial outfitters profiting from public lands/not paying "their fair share," and overflow onto adjacent USFS lands. Opportunities identified included consideration of a shoulder season, teaching new recreators proper etiquette and behaviors in the outdoors, and potential revenue to reinvest in NSRA. The Commercial Outfitter Discussion Group's consistent themes included desire for consistent and required compliance with licensing, liability, fees, and safety standards for all outfitters. Allocating spaces to minimize conflicts between general recreation and commercial guests, teaching and instructing proper outdoor etiquette, requiring "community benefit" component of all permittees, protocol for reporting "bad actors," and a willingness to work within framework established at NSRA were opportunities discussed by the Commercial Outfitter Discussion Group - See Appendix A for detailed discussion group notes.

INVITED STAKEHOLDERS

- US Forest Service (USFS)
- Colorado Parks and Wildlife (CPW)
- El Paso County
- Teller County
- City of Colorado Springs Parks
- Trails and Open Space Collation (TOSC)
- Medicine Wheel (MWTA)
- Friends of the Peak (FOTP)
- Rocky Mountain Field Institute (RMFI)
- Trout Unlimited Pikes Peak Chapter
- Chipeta Trout Club
- Silver Lakes Trout Club

INVITED COMMERCIAL OUTFITTERS

included outfitters currently holding permits and those that have requested permits in the past 5 years.

- Angler's Covey - current permit
  - Pikes Peak Outfitter
- Dragonfly Paddle Yoga – current permit
- Denver Outdoor Adventure Company – current permit
- Aspire Tours – current permit
- Broadmoor Outfitters – interested in permit
- Broadmoor – interested in permit
- REI – interested in permit
- South Platte Fly Shop – interested in permit
- Pikes Peak Outdoor Recreation Alliance, (PPORA, outdoor recreation advocacy non-profit)

NSRA: Commercial Guided Activities Review

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ISSUES and CONCERNS

- NSRA receives the highest concentration of recreators of all Utilities properties
  - Located in the Front Range and easy access.
  - Pandemic visitation surge is over, seeing return to pre-pandemic visitation.
  - Do commercial outfitters bring too many additional people into the NSRA?
- Water Quality and Natural Resource Concerns
  - Loving everything to death seen by multiple public landowners
  - 'Carrying Capacity' may need to be determined and understood for NSRA.
  - Natural Resources impact.
    - Does incidental water contact (i.e., paddleboarder or angler entering to release) impact water quality? Consider collecting data to support this for discussions with the public.
- Operations Concerns – Utilities and PPAM partner operations
  - Highest visitation days on the weekends.
    - Crystal Reservoir closure has concentrated and changed use patterns.
    - South Catamount dam work – try to better anticipate use redistribution.
    - Consider suggesting other similar locations for water-based recreation to visitors.
  - Roadways and Parking
    - Visitors to NSRA (and needed parking) cannot be fully managed at the gate (summit ticket holders can access NSRA & other guests).
    - Staffing and expenses are/may not be sustainable.
  - Utilities Operations
    - Pressure on Utilities' Caretakers.
    - 15 miles of trails and development of rogue trails.
    - Trash overflows containers on weekends (e.g., big pile at South Catamount).
    - Operational function and travel to needed areas is reduced by numbers of people and vehicles on the NSRA roads.
    - Road maintenance and costs are increasing due to increase in use by recreationists. Consider collecting data to support this for discussions with the public.
  - Funding and Personnel Resources
    - No capital designated to improve facilities, parking, trails, signage, roads.
    - Access Fee/Outfitter Permit Fee split – reconsider monetary distribution to include Utilities and PPAM current partnership responsibilities.
    - Staffing and expenses are/may not be sustainable.
    - Additional resources needed to manage recreation.
- Outfitter Specific Concerns
  - It is only fair or responsible for commercial businesses to profit from public lands if they pay monies to benefit the resource and recreation visitor services.
  - General Liability as people recreate – ensure outfitter agreements address each Partner's liability needs.
  - Equity and Accessibility Concerns.
    - Costs of tours (financial accessible).
  - Consequences for differences between outfitters (good vs bad performers).
  - Impact to 'experience' of general recreators.
    - Public Access for recreation is allowed per 1967 City Charter - Commercial Outfitter use is not mandated by the City Charter for NSRA.
  - The optimal number of agreements and arrangements needs to be determined – more or less than current.
    - What is the permit management capacity of the partners?
    - Which of the Partners is best equipped to be the Permit grantor?
    - If expanded – It will be (politically) difficult to go back.
    - Also need to establish equitable criteria for Partners to determine which companies receive the limited number of NSRA permits.
    - Access Fee/Outfitter Permit split – reconsider monetary distribution to include Utilities and PPAM current partnership responsibilities.
- Enforcement Concerns
  - Keeping people in the authorized areas (i.e., out of spillways and dam areas).
  - Rangers have no ticketing/enforcement – rely on part-time County Sheriff to enforce defacing property, parking violations, and pets not on-leash.
  - Safety – PFDs on and around the water.

Not all items relate exclusively to commercial guided activities, although commercial activities may exacerbate these issues and concerns.

NSRA: Commercial Guided Activities Review

Process

OPPORTUNITIES

- General Public Recreation
  - Supports Utilities mission areas of Community Building and Economic Development.
    - Utilities wants to support their recreation /management partners.
  - This area has resources that are unique for location to provide recreation opportunities,
  - 15 miles of trails in the area,
  - Parking is our current control for capacity,
    - Parking needs could be reduced with guide provided van transport or shuttle system,
    - Example of Summit reservation system to manage the people.
- Funding:
  - Consider higher fees for out of state visitors.
  - Can NSRA operate as a City Enterprise? Is this an operational/management/funding benefit for Utilities and PPAM?
- Outfitter Specific Opportunities
  - Guides could counter with a solution to most of the issues.
    - Adopt a shoreline, parking areas.
  - Outfitters are generally accountable and follow the rules.
    - Outfitters can be held accountable with their group.
  - Experienced recreator, education, and safety.
    - Having a guide with a recreator (teach them).
    - Get outfitters involved with messaging/outreach/service days/Leave No Trace principles.
  - Oversight with agreements and insurance requirements.
    - Could require equity and access to target different customers.
    - Opportunity to consider a sustainable arrangement and program (make it look the way we want).
    - Require licensing, safety, and liability standard compliance.
    - Need method to identify permitted outfitter vehicles.
    - Agreements.
      - Consider maximum group size.
      - Reporting of "bad actors" process.
      - Institute Benefit to Community (youth, underserved, military, volunteerism, or in-kind projects) component.
  - Funding / revenue generation from commercial.
    - Need a discussion around financial sustainability – bringing some permits on Utilities properties in house.
  - Expansion to land-based commercial outfitters.
    - Will have different resource, ranger, surveillance, and maintenance impacts than water-based commercial use.
  - Shoulder season commercial guided use could be considered.

Not all items relate exclusively to commercial guided activities, but rather to general recreation as a whole.

NSRA: Commercial Guided Activities Review

Process

Surveys

mid-August 2022 – January 2023

Three surveys hosted throughout the process engaged 627 interested citizens to share their preferences for general recreation and commercial outfitter considerations at the NSRA. All the surveys were developed in close coordination with Utilities Public Affairs staff.

Recreation Experience Survey

The first survey, the Recreation Experience Survey, was available from mid-August through the close of the NSRA season on 16 October 2022. This short survey asked about what visitors do and why they choose NSRA as well as their experiences with commercial outfitters. Recreators could also provide contact info to facilitate invitation to additional NSRA Review informational events. While the survey was available to anyone visiting the Utilities website, direct invitations increased participation. The direct invitation responses were tracked so results could be categorized. The three direct invitation groups included:

1. Intercept Survey invitation distributed to NSRA Recreators at the PPAM gate. NSRA Recreators received a card at the PPAM Entry Gate through the end of the 2022 season. Of the 1,000 cards distributed, 130 NSRA recreators responded.
2. Online survey link to the Utilities website, distribution by Commercial Guide focus group participants to their constituents. While we do not know the distribution rate, one guest responded.
3. Online survey link to the Utilities website, distributed by General Stakeholder focus group participants to their constituents. While we do not know the distribution rate, 39 recreators responded from 13 different organizations.

The themes in the Recreation Experience Survey were unique between PPAM gate responses and the General Stakeholder constituent responses. The responses, organized on the right, highlight each groups' unique experience.

PPAM gate responses

- Most visit NSRA 1-2 times per month in a single occupancy vehicle.
- 33% utilize the parking reservation website.
- Less than 25% are willing to pay for parking.
- 60% prefer to visit North Catamount Reservoir for its fishing and beauty.
- Fishing, boating, and hiking were the main activities.
- The experience of "being in nature by the water" ranked highest.
- **3/4 did not know if commercial outfitters were present during their visits. If they were aware, shore fishing and paddleboarding were most observed.**
- **77% indicated the commercial use had no impact or somewhat diminished impact on their experience.**
- **14% agree that commercial guided activities should be allowed at the NSRA, 29% are neutral and 57% disagree with commercial guided activities.**

General Stakeholder and constituent responses

- Most visit NSRA 1-3 times per year in a single occupancy vehicle.
- 43% utilize the parking reservation website.
- Less than 7% are willing to pay for parking.
- 75% prefer to visit North Catamount Reservoir for its mountain views, size, and access to trails.
- Participation in on-land activities (hiking, biking, picnicking) was higher than on-water activities.
- The experience of "being in nature by the water" ranked highest.
- **50% did not know if commercial outfitters were present during their visits. If they were aware, kayaking and paddleboarding were most observed.**
- **100% indicated the commercial use had no impact or somewhat diminished impact on their experience.**
- **39% agree that commercial guided activities should be allowed at the NSRA, 23% are neutral and 38% disagree with commercial activities at the NSRA.**

The full surveys and results can be found in Appendix B.

NSRA: Commercial Guided Activities Review

Process

Discussion Group Participant Surveys

The second surveys, as mentioned above, were short surveys sent to discussion group invitees, to ensure the in-person sessions targeted information and discussions on the participants' interests. Eight invitees responded.

The third survey, the Utilities Customer Counts Panel Survey, was distributed and recorded in January 2023. More than 440 Utilities customers responded to the online survey. Background information was shared to ensure respondents understood the purpose and focus of the NSRA Review. Respondent demographics reflected age, income, education level, and gender diversity. Three-quarters of the respondents recreate on public lands.

Key Findings

- In response to the effect of commercially guided tours on the general recreation experience at NSRA, 39% believe commercially guided tours affect the general recreational experience, 29% believe there is no effect and 32% felt they needed more information to respond.
- Most responding Utilities customers believe it is important for commercial entities to compensate Utilities for the time and effort to manage the activity.
- Most responding Utilities customers believe commercial entities should contribute to responsible recreation, educate on Leave No Trace principles, and sponsor community activities for disadvantaged populations.
- In statistical analysis, the respondents who recreate “often” on public lands (69 of the 449), shifted the aggregate responses to many questions towards more negative perceptions of commercial guided activities and towards limiting commercial access on Utilities properties.
- All respondents recognized community and resource benefits of commercial guided activities.

The full surveys and results can be found in Appendix C.

NSRA: Commercial Guided Activities Review

Process

Benchmark Agency Programs *September-November 2022*

As a part of the North Slope Recreation Area – Recreation Review project objectives, additional information was gathered about commercial recreation programs that are implemented on public lands owned by federal, state, and utilities public entities. Utilities' staff identified three agencies with existing commercial recreation uses that are in proximity to Colorado Springs or have a similar structure with landownership to Colorado Springs Utilities. The agencies included U.S. Forest Service, Pike-San Isabel National Forests & Cimarron and Comanche National Grasslands, Colorado Parks and Wildlife, Arkansas Headwaters Recreation Area, and water provider Denver Water.

Interviews were arranged with each agency and the staff who work directly with commercial recreation to gather information on the following topics:

- Program creation and management
- Authorization and policy development for implementing commercial recreation
- Program funding arrangements and fee collection
- Evaluation and enforcement requirements
- Best management practices for program sustainability

These interviews were phone discussions with agency staff about the general operations and considerations with commercial operations. Components of each agency's operations were integrated into the BMPs developed as part of this review.

The full report can be found in Appendix D.

2022 PPAM Pilot Project Data *November 2022*

PPAM provided several past years and current year data for use in this NSRA Review. Data has been collected since 2017. For all years, the NSRA open season is May 1 through the third Sunday in October with consistent hours of operation. NSRA admission fees also remained the same at $5 per adult, a 30-punch pass for $100, no fees for children under 16, and no additional fees for commercial outfitters and guests.

Consistent with all years, the most visits occur in July with June and August visitation both about 80% of July visitation. Highest visitation days occurred on the holiday weekends associated with Memorial Day, Fourth of July, and Labor Day. The data provided to date has revealed that NSRA total visitors increased significantly during the first year of the COVID pandemic in 2020 but have returned to pre-pandemic visitation in the 2 years following 2020.

NSRA VISITATION	
2017	32,409
2018	34,505
2019	30,134
2020	43,316
2021	26,859
2022	26,260

Pikes Peak - America's Mountain visitation is consistently between 500,000 and 600,000 people each year. Highway visitors are able to visit all stops along the highway including NSRA. It is unknown how many of these visitors stop at NSRA.

NSRA: Commercial Guided Activities Review

Process

PPAM Rangers record their contacts with all recreators. Rangers answer visitors' questions and provide aid for minor accidents. Rangers do not have ticketing power; however, they do interact with recreators to remind them of rules regarding bait fishing in North Catamount Reservoir, body contact with the water, dogs off leash, parking in prohibited areas, and life jacket requirements. Life jacket violations are the most frequent PPAM ranger interactions. El Paso County and Teller County sheriff's offices provide ticketing and enforcement services. USFS rangers provide ticketing and enforcement on surrounding USFS lands.

Since the initiation of the free online parking reservation system in 2020, it has been used by approximately 14% of NSRA visitors. Limited data is available for 2022 Commercial Outfitter guided visits.

Commercial Outfitter data for 2022 was limited. Revenue data for 2022 is available for two permit holders; the two commercial companies represent significantly varied size and gross revenue totals. The data does provide an example for possible future commercial outfitter reporting requirements.

The full PowerPoint presentation and accompanying data can be found in Appendix E.

NSRA: Commercial Guided Activities Review

Process

Presentation of Findings *06 April 2023*

The Presentation of Findings, hosted at the Leon Young Service Center from 4:00-5:15 pm was well attended by 28 participants and 9 staff members. In addition to posting on the project website, direct email invitations were sent to all survey respondents and all individuals invited to the September discussion groups. Groups represented included several commercial outfitters, Trails and Open Space Coalition, Rocky Mountain Field Institute, Medicine Wheel Trail Advocates, Pikes Peak State College, USFS, El Paso County, City of Colorado Springs Parks, hiking advocates, and interested citizens.

The presentation purpose was to share progress and next steps. It provided interested partners and participants with the opportunity to hear how their thoughtful input may be incorporated in the future considerations for possible commercially guided activities at the North Slope Recreation Area. The presentation started with a welcome and an overview of the project followed by the engagement and survey findings. After each BMP was presented, PPAM shared key BMPs that will be implemented in the 2023 NSRA season. Utilities concluded the presentation by outlining the Crystal and South Catamount dam projects along with the NSRA planning taking place through 2026. Utilities and PPAM staff responded to participant questions until the meeting closed.

Participants expressed gratitude for a well thought out process. They expressed interest in:

- maintaining both commercial and public access during restoration of the South Catamount dam,
- designating an alternative on-water recreation location during construction,
- considering non-water commercial guided activities,
- improving parking,
- enhancing trail system and connectivity,
- establishing carrying capacity protocols & standards, and
- enhancing enforcement.

The full PowerPoint presentation and accompanying response forms can be found in Appendix F.

Process to develop Best Management Practices - BMPs *Oct 2022 - April 2023*

The Best Management Practices (BMPs) are based on the data collected throughout the planning process. The first version was drafted following the September discussion groups and completion of the Benchmark Agency interviews. Throughout the next months, the draft BMPs were reviewed and finessed in Utilities departmental worksessions.

The BMPs are organized into six sections. Each BMP is supported by several implementation strategies. Establishing a priority level and a responsible agency was discussed but not assigned for the BMPs.

1. Commercial Permit Administration
2. Commercial Outfitter Permits
3. Outfitter Responsibilities
4. Outfitter Management
5. Monitoring Commercial Use Impacts - Adaptive Management
6. Monetizing Commercial Use

The BMPs can be found starting on page 16.

NSRA: Commercial Guided Activities Review

Process

Alternative Scenarios Considered

Throughout the NSRA Review process, discussions included proposals for a range of options, to address the current and potential future guided commercial activities. This led to the Best Management Practices (BMPs) in the following section, addressing general Utilities watershed lands and reservoir areas. The Alternative Scenarios described below are specific to the North Slope Recreation Area.

At the start of the review, it was imagined there may be several alternatives concerning commercial guided activities considered – from full approval to formal prohibition - and that one would be approved by Utilities Board/City Council. This process has revealed the need for a more fluid approach – to review existing policy, and consider BMPs that could be applied, not just to the NSRA, but potentially to other watershed lands and reservoir areas. Utilizing the BMPs, this approach can be considered, tested, evaluated, and tweaked as conditions/use/resources change over time. Any BMPs will be reviewed and agreed upon by Utilities and the watershed's managing partner and adjusted as needed. The commercial guide permit holder would agree to and implement required actions according to their permit.

Three Alternative Scenarios that may occur at the NSRA were identified and include:

1. Maintain the "status quo" with no changes.
2. Eliminate Commercial Guided Activities.
3. Authorize Commercial Guided Activities with adaptive management strategies – BMPs and monitoring

If commercial guided activities are authorized, then Utilities and PPAM may employ an Adaptive Management approach following the BMPs in the following section. Adaptive Management is a structured approach to decision making that:

1. Provides the ability to adjust to changing circumstances over time,
2. Creates formal monitoring networks and processes, and
3. Maximizes opportunities to learn from experience.

NSRA: Commercial Guided Activities Review

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The Alternative Scenarios will continue to be considered on the following criteria: Ease to implement, Coincide with PPAM and Utilities coordination, Minimize impacts to Utilities and NSRA operations, Limit impact on general recreational users, Opportunity for community support, Opportunity for visitors to learn new skills, Opportunity for rule and stewardship education, Opportunity for oversight and enforcement support, Opportunity for new commercial permitees, and Opportunity for NSRA revenue.

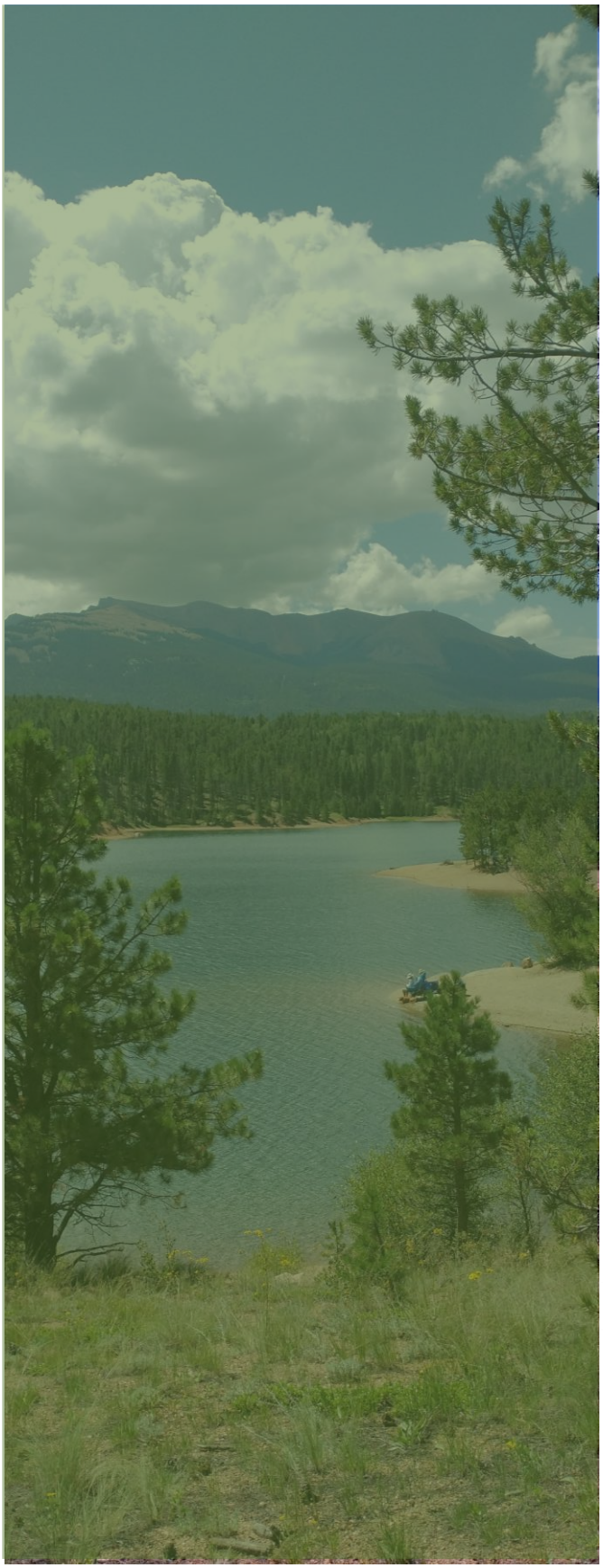
The alternative scenarios were evaluated against the current outfitter condition – 1. Maintain the "Status Quo."

If a scenario was determined to be the same as the status quo it is marked ⊙

If a scenario is determined to provide more work or less benefit it is marked ○

If a scenario is determined to provide more benefit and more management it is marked ●.

Commercial Outfitter Scenarios	Ease to Implement	Coincide with PPAM & Utilities Coordination	Minimize impacts to Utilities NSRA operations	Limit impact on General Recreational Users	Opportunity for community support	Opportunity for visitors learn new skills	Opportunity for rule & stewardship education	Opportunity for oversight & enforcement support	Opportunity for new commercial permitees	Opportunity for NSRA revenue
1. Maintain Status Quo	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	○	○
2. Eliminate commercial activities	○	⊙	●	●	○	○	○	○	○	○
3. Authorize commercial activities with adaptive management	○	○	○	●	●	⊙	●	●	●	●



Best Management Practices

NSRA: Commercial Guided Activities Review

Draft - Commercial Outfitter Best Management Practices – BMPs for On-Water Activities

This review and these BMPs, will not result in policy decisions or changes on the North Slope Recreation Area rather it is a tool to inform future decision making. The BMPs are for consideration only if commercial guided activities are approved. Throughout this section Colorado Springs Utilities is referred to as "Utilities," and Pikes Peak - America's Mountain is referred to as "PPAM."

I. Commercial Permit Administration

BMP	Strategies
a- Establish commercial permit **administrative responsibilities** for Utilities and, if applicable, the Utilities' management partner for watershed lands and reservoirs.	1. Establish regular meetings between Utilities (Operations staff, Business Communications, Security) and Managing Partner for first year of partnership. Adjust meetings as needed for following years. 2. Determine responsibility for promulgating rules and policies, permit requirements, permit qualifications criteria, and permit issuance, communication, and others. a. When needed, coordinate with multiple land and water owners. 3. If needed, determine and integrate unique attributes for each watershed lands and reservoirs area, as considered. 4. Establish a Utilities Watershed Lands and Reservoirs Commercial Permit document. a. Develop a NSRA specific commercial Permit document. 5. Establish an executive agreement or revocable permit agreement between Utilities and the Utilities' management partner for each watershed lands and reservoirs area. e.g., PPAM and Utilities will require an Executive Agreement with an Operations Plan.
b. Ensure appropriate **staff and resources** to manage and monitor Utilities' Watershed Lands and Reservoirs Commercial Permits.	1. Identify and assess current staff and resource allocations. a. Establish baseline of time dedicated to commercial outfitter management for Utilities and Partner. 2. Monitor the need for additional staff and resources to implement adjusted Utilities' Watershed Lands and Reservoirs Commercial Permit policies. a. Monitor staff and resources needs as number of Utilities' Watershed Lands and Reservoirs Commercial Permits increase or decrease

II. Commercial Outfitter Permits

BMP	Strategies
a- Establish **Goals for commercial outfitter participation** on Utilities' Watershed Lands and Reservoirs.	1. Establish Community Support and Establish Equitable Access goals. a. Goals may include underserved population participation, youth participation, watershed stewardship, and others. 2. If needed, determine and integrate unique attributes for each watershed lands and reservoirs area, as considered. a. When needed, coordinate with multiple land and water owners 3. Establish goal for commercial outfitter permit holders to comply with the **Outfitter Requirements** set forth in the Utilities *Watershed Lands and Reservoirs Rules and Regulations, Commercial Outfitter Specific Requirements*, and *Community Support Requirements.*
b- Designate and or promulgate **Watershed Lands and Reservoirs Rules and Regulations** applicable to Commercial Outfitter participation in Utilities' Watershed Lands and Reservoirs.	1. Establish Watershed Lands and Reservoirs Rules and Regulations. a. Watershed Protection ordinance 12.4.801-806 (no bodily contact). b. If needed, determine and integrate unique attributes for each watershed lands and reservoirs area, as considered. a. Review and adjust for unique NSRA attributes. b. NSRA Open Season (review annually based on annual weather and changing climate). c. NSRA closed dates to commercial outfitters: e.g., existing closure Pikes Peak International Hill Climb. d. NSRA access is currently limited by parking reservations. Gates may be useful for other high use times.

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c. Define the **Commercial Permit Application and Distribution System**	1. Utilize and /or establish the Utilities Watershed Lands and Reservoirs Commercial Permit documents. a. Establish NSRA specific Commercial Permit and application documents. b. Establish customer satisfaction survey for use by all commercial outfitters. 2. Determine the types of commercial permits to allocate on Utilities' Watershed Lands and Reservoirs. a. Water-based – consider if permit allocations should be based on the type of water-based activity. b. Land-based – consider if permit allocations should be based on the type of land-based activity. c. Long term* d. Seasonal** e. Determine if some or all permit types will or will not be transferable. 3. Determine the total number of Commercial Permits for each activity type that will be annually allotted based on the Adaptive Management Approach findings for each watershed lands and reservoirs area. *** a. Consider initial year permit numbers at the NSRA based on experiences with current permit holders. 4. Commercial Permit Distribution - Determine how limited permits will be distributed. a. The potential for more qualified applicants than available commercial permits is high. The selection process should be fair and equitable. i. The recommended process is to issue a competitive RFP & bid and to follow City and Utilities contracting rules. • Annual permit with option to renew for 4 additional years. After 5 total years, a competitive RFP & bid is required. ii. Other selection methodologies discussed and dismissed included lottery, seniority, and potential revenue generation.

continued on next page

d. **Commercial Outfitter Specific Requirements**	1. Complete, fulfill, and agree to uphold all requirements of the Utilities Watershed Lands and Reservoirs Commercial Permit Application. 2. License, Certification, and Insurance. State and CPW requirements vary by Commercial outfitter activity. Utilities and the Utilities' management partner for each watershed should verify and stipulate the requirements for each use in each area. a. Department of Regulatory Agencies - DORA b. CPW Requirements (input and support for requirements) (boating safety) c. Liability insurance d. First Aid Certification e. Guide Certification – Wilderness first aid?, EMT?, satellite phone?, peer-organization certifications? Lifeguard? 3. Mandatory attendance at both Preseason and Postseason Commercial Outfitter Meeting. 4. Visitation Limits and Rationing – Consider if controls on commercial outfitter guided group size or visitation frequency optimize Utilities and the Utilities' management partner goals for each watershed. Controls may include: *** a. Maximum Group size b. Guide/guest ratio – this could be a recommendation or requirement based on type of use c. Maximum number of visits / season d. Rationing of visits or timing of visits on peak days/weekends 5. Education Requirements – Commercial outfitters will be required to present their protocols for guest education including: a. Utilities Watershed and Lands Rules and Regulations b. Leave No Trace ethic and adherence c. Community and Watershed History 6. Community Support and Equitable Access Requirements a. Establish the Community Support Requirements to achieve the goals set forth in II.a.1 of this section. b. Consider allowing each commercial permit holder to suggest their own approach for Community Support and Equitable Access. i. How would you accomplish equitable access? c. Share criteria to determine if commercial outfitter proposed approach meets the goals set in II.a of this section. d. Determine what, if any, role the Utilities' management partner takes in connecting community groups with commercial outfitters. i. For NSRA, the outfitter will identify, contact, and coordinate with groups per their RFP proposal. e. Determine consequences for commercial permit holders for not meeting their community support program.

	7. Reporting a. Submit End-of-Season CPA certified report to Managing Partner to include attendance, entry fees, and revenue by month. b. Submit customer satisfaction surveys from all guests with End-of-Season submission. c. Report all accidents and incidents in compliance with Utilities requirements. 8. Review and modify as appropriate per the Adaptive Management Approach in section 5.
e. Adjust BMPs for Outfitter Responsibilities and Outfitter Management to **support decisions and adjustments of this section**.	1. See section below for Outfitter Responsibilities BMPs. 2. See section below for Outfitter Management BMPs.

* While the USFS awards 10-year commercial outfitter permits, PPAM currently issues 1 year permits with optional renewable eligible for up to 4 years.

** The USFS has a category to "try out" new outfitters and provide some opportunities for new outfitters.

*** USFS Permits are not transferable. New permits are issued per the USFS rationing table. CPW limits permits by parking availability and by Boat/per/river mile standards.

III. Outfitter Responsibilities

BMP	Strategies
a. Adhere to **Outfitter Requirements** stipulated in the Utilities Watershed Lands and Reservoirs Commercial Permit Compliance with Watershed Lands Rules and Regulations, Compliance Outfitter Specific Regulations, and Community Support Requirements	1. Determine outfitter reporting protocol and report submission process to either Utilities or Utilities' management partner for each watershed lands and reservoirs area. Refer to section 2.d above
b. Implement, record and report completion of **Community Support** activities as agreed to in each outfitter's Utilities Watershed Lands and Reservoirs Commercial Permit.	1. Determine outfitter reporting protocol and report submission process to either Utilities or Utilities' management partner for each watershed lands and reservoirs area.
c. **Protect the Watershed** by: i. Educating and managing your guests. ii. Each guide should be prepared to document (via license plate or name) and report other outfitter bad behavior" or unauthorized use/activities by other commercial outfitters/guides (poaching). iii. Document and report general recreators not complying with the Rules and Regulations of the property.	1. Determine outfitter reporting protocol and report submission via email to either Utilities or Utilities' management partner for each watershed lands and reservoirs area. 2. Outfitters shall contact Utilities Managing Partner to engage/ educate the user.

IV. Outfitter Management

BMP	Strategies
a- **Monitor compliance** with all requirements and stipulations of the Utilities Watershed Lands and Reservoirs Commercial Permit	1. Determine whether Utilities or Utilities' management partner will be responsible for monitoring compliance implementation for each watershed lands and reservoirs area. 2. Implement framework for Drop-in audits.
b- Implement a method to **verify vehicles** belonging to Utilities' Watershed Lands and Reservoirs Commercial Permit holders.	1. Determine responsibility for verification strategy development and implementation to either Utilities or Utilities' management partner for each watershed lands and reservoirs area. 2. Discuss with management partner and outfitters to determine the best option for each watershed lands and reservoirs area. 3. Consider vehicle stickers, hang tags with id number, or company id to show at gate.
c- Establish **enforcement strategies, procedures and penalties** for commercial outfitters.	1. Implement a procedure for current Utilities' Watershed Lands and Reservoirs Commercial Permit holders to report "bad behavior" or unauthorized use/activities by other commercial outfitters/guides (poaching) as well as general recreational users.* 2. Implement a procedure for Rangers to report "bad behavior" or unauthorized use/activities by commercial outfitters/guides (poaching) as well as general recreational users. 3. Implement a recording/monitoring protocol and penalties procedure to follow-up on the reported information. ** a. There is zero-tolerance for aggression/ abuse towards rangers or other users. b. Establish warning and due process procedures.

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NSRA: Commercial Guided Activities Review

Draft - Commercial Outfitter Best Management Practices – BMPs for On-Water Activities

* Information from Benchmark Agency Study

1. Colorado Springs Utilities has a provision in its charter to have ticketing authority on the watershed.
2. Denver Water funds USFS rangers at Dillion Reservoir for ticketing enforcement as members of the Summit County recreation district.
3. Denver Water funds USFS rangers for enforcement and ticketing in Waterton Canyon.

** Ideas collected during 20 Sept 2022 Stakeholder Work Sessions include:

1. Consider a watch list at entry gates and for watershed ranger use as well.
2. Revoke commercial permits or bar access to specific license plates.
3. Consider when infractions warrant Colorado Parks and Wildlife (CPW), USFS, or El Paso County Sheriff intervention/enforcement.

V. Monitoring Commercial Use Impacts – Adaptive Management

BMP	Strategies
a- Establish an **Adaptive Management Approach** to measure and respond to resource, recreational, and community impacts from Utilities Watershed Lands and Reservoirs Commercial Permit holders' activities.	1. Determine whether Utilities or Utilities' management partner is responsible for establishing the Adaptive Management Approach for each watershed lands and reservoirs area. 2. Determine responsibility for implementing the Adaptive Management Approach (AMA) to either Utilities or Utilities' management partner for each watershed lands and reservoirs area. 3. If needed, determine and integrate the unique attributes for each watershed lands and reservoirs area, as considered. All AMA's may include: a. Items/Categories to measure, such as water quality, recreationists' experience impacts, outfitter experience impacts, resource sustainability, maintenance/operational sustainability, financial sustainability, community benefit*. b. Methods to solicit recreationists and outfitter input** c. Methods to collect empirical data. d. Frequency and Timeframe of AMA monitoring. e. Steps to make appropriate adjustments. 4. Establish a watershed (NSRA) specific Adaptive Management Approach document. ***
b- **Implement the Adaptive Management Approach**.	1. Determine when to start Adaptive Management Approach. 2. Determine the optimal time of year to initiate and implement the Adaptive Management Approach. 3. Implement Adaptive Management Approach. 4. Complete report/memo of findings.
c- Make **Appropriate Adjustments**.	1. Recommend appropriate adjustments to address needs or shortcomings. 2. Assign responsibility, resources, and schedule to implement the adjustments. 3. Schedule or identify the next Adaptive Management Approach implementation.

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NSRA: Commercial Guided Activities Review

Draft - Commercial Outfitter Best Management Practices – BMPs for On-Water Activities

* See Appendix A: 22.09.20_Meeting Notes from the 20th. pdf. Page 2 Potential community benefits from guided outdoor recreation.

** See Appendix D: Benchmark Agency Programs Report / Benchmark Common Themes – CPW, "Staffing and Resources" for CPW's AHRA input framework.

For example- This is what you will find in the appendix

AHRA has input from their staff and advisory committees, plus the Citizen Task Force.

*** See Appendix D: Benchmark Agency Programs Report / Benchmark Common Themes – CPW, "Additional Response information – CPW" for CPW's 4 step adaptive management approach.

For example- This is what you will find in the appendix

Additional Response information - CPW - If resource damage exceeds a Standard for Healthy Public Lands, managers would implement strategies to address resource impacts. Under both alternatives, the four steps in this adaptive management approach include:

a. Process: If resource impact symptoms are present, communicate with appropriate partners. Increase inventories and monitoring to verify trends, if needed. Share interagency monitoring results with appropriate partners annually.

b. Standards: Confirm whether the condition trend exceeds or will exceed established thresholds.

c. Compliance and Notification: If standards are not met, initiate formal project planning and associated compliance (NEPA, Section106) with appropriate partners (CPW, BLM, U.S. Forest Service, State Historic Preservation Officer - SHPO).

d. Take Action: Implement corrective actions including but not limited to designating campsites, facility hardening, restoration, site-specific education, and regulatory actions (e.g., reservation systems, reducing capacities, seasons, operating windows/timeframes).

VI. Monetizing Commercial Use

BMP	Strategies
a. Understand the **current and ongoing operational and management cost** to manage recreation for both PPAM and Utilities	1. Tracking the current and ongoing operational and management cost to facilitate the Utilities Watershed Lands and Reservoirs Commercial Permit holders' activities by Utilities and PPAM to allow for meaningful decisions regarding commercial permit fees and requirements. 2. Tracking the current and ongoing operational and management cost to facilitate the general recreation activities on Utilities Watershed Lands and Reservoirs by Utilities and PPAM to allow for more meaningful decisions regarding both general recreationist fees and commercial permit fees and requirements.
b. Consider what **is fair, equitable, and consistent.**	1. Any commercial permitting and fee system should be fair and equitable for all outfitters. a. Review and adhere to all applicable DEI principles, goals and mandates established by the City of Colorado Springs and Utilities. b. While long-term permits are important for businesses to plan, lack of new or "permit turnover" can bar new businesses legal access to Utilities' watershed lands and reservoirs. c. Flexible and systematic turnover of commercial permits may minimize poaching – unauthorized use - by unpermitted outfitters. 2. Any commercial permitting and fee system should consider consistency with adjoining land manager systems. The potential Commercial Fee Permit and Fee System for Utilities' Watershed Lands and Reservoirs may include: a. Permit Application Fee.* b. Entrance Fee per guest.** c. Seasonal Fee/permit holder d. Percentage of Gross Income with commercial outfitter reporting requirements.***

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NSRA: Commercial Guided Activities Review

Draft - Commercial Outfitter Best Management Practices – BMPs for On-Water Activities

c. Consider **how commercial fees will be allocated.**	1. Consider what is legal/possible as stipulated within City Code and within existing PPAM and Utilities Enterprise agreements for the collection of various fee systems. 2. Determine how the fees will be collected. 3. Determine where the fees will be deposited and distributed annually, if not the City General Fund. 4. Determine how commercial permit fees should be allocated. Options could include: a. Ranger salaries b. Improvements - general recreation c. Improvements - commercial outfitter facilities d. Maintenance – PPAM e. Maintenance – Utilities f. Signage g. Education h. Others
d. Consider **City Enterprise** options	1. Consider benefits and drawbacks to establishing NSRA and SSRA as a joint City Enterprise or sub-enterprise to PPAM. 2. Consider if this approach is applicable to other Utilities' watershed lands and reservoirs. 3. Consider the executive agreement requirements needed between Utilities and PPAM. 4. Implement if the City Enterprise structure optimizes outcomes for Utilities, PPAM, recreational users and the general community.

* See Appendix D: Benchmark Agency Programs Report / Benchmark Common Themes –CPW and USFS.

For example- This is what you will find in the appendix

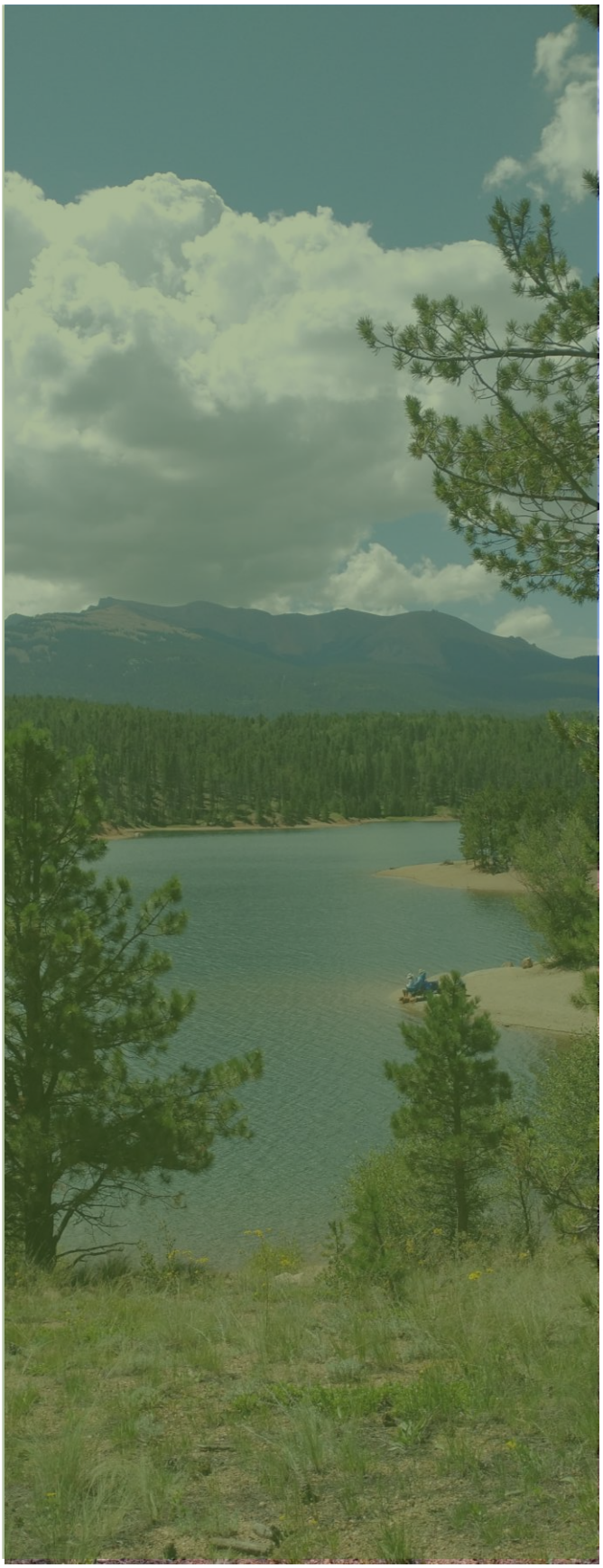
(Forest service 5% gross) (CPW $250-400 application fee plus 5% of all revenue to general fund) (Denver Water 3-5% gross rev)

** Current commercial outfitter fee system for the NSRA charges each commercial outfitter guest the current $5 daily fee – this is the same for all recreationist to the NSRA.

*** See Appendix D: Benchmark Agency Programs Report / Benchmark Common Themes – USFS, for current USFS commercial outfitter fee system.

For example- This is what you will find in the appendix

Monthly (FS 5% of gross income) City has the right to audit commercial establishments, but does it want to for the NSRA?



Future Recreation Considerations

Future Recreation Considerations

Throughout the NSRA Review process, discussions ranged beyond the Review's scope. The following is a list of those ideas and concepts that Utilities and PPAM may want to consider following this review.

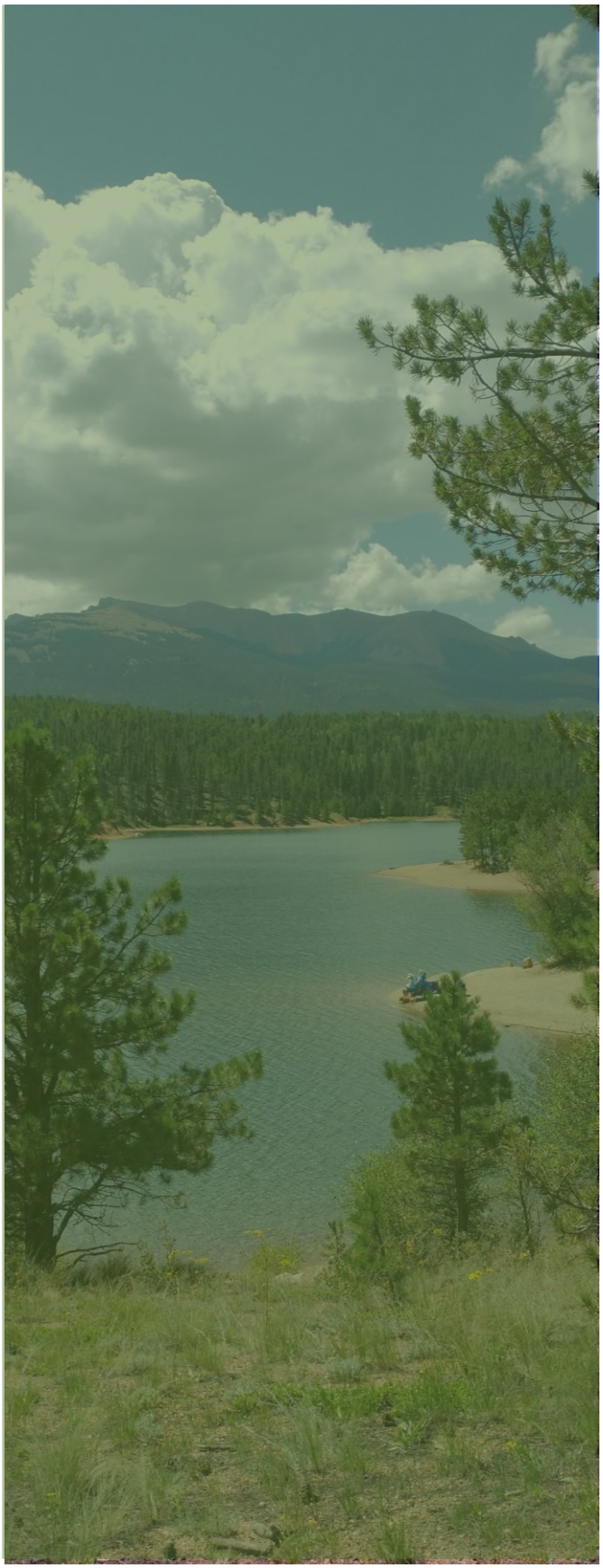
Management Goals

Establish management goals to include in the PPAM and Utilities agreement.

Possible Future Watershed and Recreation Management Plan for the NSRA

Consider developing a Watershed and Recreation Management Plan for the NSRA. Within the planning process, consider and explore:

- Future operational uses and security infrastructure protections
- Enforcement of security and infrastructure protections
- Rerouting publicly used vehicle routes away from secure Utilities operations and facilities
- Rerouting trails and foot access away from operations and facilities
- Land- and water-based uses
- Land-based commercial permits
- Minimizing potential conflict by moving land-based parking away from water's edge
- Establishing and monitoring carrying capacity at the NSRA
- Length of season for water-based and land-based recreation
- Off-season access for outfitter guided groups. e.g., Crystal Reservoir is open as long as PPAM is open



Appendix

Appendix

The Appendices are provided in electronic form and include the following documents.

Appendix A Stakeholder Discussion Groups 20 September 2022

22.09.13_Agendas for the 20th
22.09.13_SURVEY for Outfitter guests
22.09.13_SURVEY for Recreation organizations
22.09.14_outfitter mtg.pptx
22.09.14_rec organization.pptx
22.09.20_Meeting Notes from the 20th

Appendix B Recreation Experience Survey & Results

General Recreation Experience at NSRA (1-39)
General Recreation Verbatims (1-39)
Guided Recreation Experience at NSRA (1-1)
Guided Recreation Verbatims (1-1)
Intercept Postcard Recreational Experience at NSRA Survey
Recreation Experience at NSRA (1-130 gate)
Recreation Verbatims (1-130 gate)

Appendix C Utilities Customer Account Panel Survey Results

Customer Account Panel Verbatims
North Slope Recreation Area Survey Presentation

Appendix D Benchmark Agency Programs Report

23.06.08_CSU Benchmark Agency Programs Report
ArkRivMgmtPlan83

Appendix E PPAM Pilot Project Data

22.11.10_PPAM North Slope Presentation
2017-2020_PPAM Visitation NSRA
2021_PPAM Gate NSRA
2021_PPAM Visitation NSRA
2022_PPAM NSRA sales Fish NSRA
2022_PPAM outfitter visits by date NSRA
2022_PPAM Ranger Contacts NSRA

NSRA: Commercial Guided Activities Review

Appendix

Appendix F Presentation of Findings 06 April 2023

23.04.06_Presentation of Findings
23.04.06_participant comments_Presentation of Findings

Appendix G Existing Baseline Studies Available at Project Start

1995_USFS-PPISC Recreational Capacity Analysis Summary – folder
2009_NS appendices – folder
1937_Pamphlet with map too large to copy.pdf
1992_North Slope Watershed Recreation Plan.pdf
1993_North Slope Watershed Recreation Progress Report.pdf
2008_Catamount Landscape Assessment PSICC 2008.pdf
2009_Final SU NRA 23 January 2009.pdf
2010_Plan for Recreational Uses on Watershed Lands – Final 8-6-10.pdf
2010_Red Impact BMPs for S Slope 2010.pdf
2010_Util.watershed Red Guiding Statements from S SLOPE report 2010.pdf
2011_RMFI_Severy_Creek_Basin_Analysis.pdf
2013_NothSlope_WSD_MP_2013-2017.pdf
2013_Trail_Census_NorthSlopeMonitoring.pdf
2014_SouthSlope_WSD_MP_2014_2018.pdf
2019_Water Longitudinal Study Presentation.pdf
2022_BoardPolicies.pdf
2022_Forest Management Completed Treatments

NSRA: Commercial Guided Activities Review

Appendix

Appendix – internal for Utilities

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Intercept Postcard Recreational Experience at NSRA Survey.pdf
Recreation Experience at NSRA (1-130 gate) pdf and xlsx
Survey_Recreation Experience at Colorado Springs North Slope Recreation Area

Appendix C Utilities Customer Account Panel Survey Results

2023 North Slope Recreation Area Survey Verbatims.xlsx
North Slope Recreation Area Survey Presentaiton.pptx

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2021_PPAM Visitation NSRA.xlxs
2022_PPAM NSRA sales Fish NSRA.xlxs
2022_PPAM Sample permit agreement NSRA_Anglers Covey NS executed.pdf
2022_PPAM Dragonfly Paddleboard season summary.msg
2022_PPAM outfitter visits by date NSRA.xlsx
2022_PPAM Ranger Contacts NSRA.xlsx

NSRA: Commercial Guided Activities Review

Appendix

Appendix F Presentation of Findings 06 April 2023

23.04.06_Presentation of Findings.pptx
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Present of FINDINGS attendee Sign-in and comments 4.6.23.pdf

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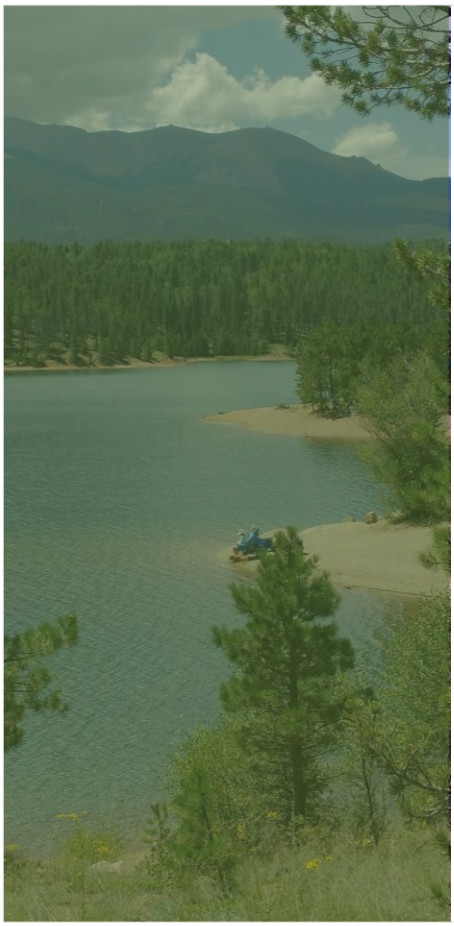

TAPS associates

Site Implementation	Unit	Unit Cost
Total trail miles with contingency. Sustainable trail construction ranges $10,000 to $60,000 per mile.		
Assume higher end of per mile cost due to erodibility of soils	Mile	$45,000
Seasonal Trail Closure Infrastructure	Each	$20,000
Trail Drainage Features/Switchbacks/Culverts	Each	$4,000
Native and Imported Stone Steps on Hiking Only Trail	Each	$400
Weed Management	Acre	$1,200
Benches	Each	$2,500
Picnic Tables	Each	$4,000
Signage - Wayfinding and kiosks at trailheads	Each	$50,000
Fencing	LF	$45
Enhanced Drainage Crossings bridge	SF	$350 - $400
Parking*		
Gravel	Stall	$8,000
Asphalt	Stall	$12,000
Concrete ADA	Stall	$15,000
**General costs for light to moderate grading for the stall and associated drive aisle. Additional costs needed for stormwater manageent, striping, signage, fencing, big retaining walls and curb and gutter.*		

Other:
Estimated Design Fees: 15% of construction budget
CONTINGENCY: (Class 5 Cost Estimate Contingency of 30%)