Final

Roads to Rivers Assessment

Eleven Mile Canyon, Happy Meadows, and Sportsmen's Paradise Roads

Prepared For:

Coalition for the Upper South Platte
U.S. Forest Service
Colorado Department of Public Health and Environment

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Acronyms and Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
BA/BE	Biological Assessment/Biological Evaluation
BLM	U.S. Bureau of Land Management
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CNHP	Colorado Natural Heritage Program
CMP	corrugated metal pipe
CPW	Colorado Parks and Wildlife
CR	county road
CSDCM	Colorado Springs Drainage Criteria Manual
CUSP	Coalition for the Upper South Platte
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
DLEIS	Draft Legislative Environmental Impact Statement
EA	environmental assessment
FEIS	Final Environmental Impact Statement
GIS	geographical information system
HOA	homeowners' association
IPaC	Information, Planning, and Conservation
MBTA	Migratory Bird Treaty Act
mph	miles per hour
NEPA	National Environmental Policy Act
NHD	National Hydrography Dataset
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
OAHP	Office of Archaeology and Historic Preservation
OHWM	ordinary high water mark
ORV	outstandingly remarkable value
PCA	potential conservation area
PSA	potentially sensitive area
RMO	road management objective
SCPP	Sugar Creek Pilot Project

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SCS	Soil Conservation Service
SPEB	South Platte Enhancement Board
SPPP	South Platte Protection Plan
SWMP	Stormwater Management Plan
T&E	threatened and endangered
TMDL	total maximum daily load
TNW	traditionally navigable water
TRM	turf reinforcement mat
U.S.	United States
UASPP	Upper Arkansas and South Platte Project
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WQCD	Water Quality Control Division

SECTION 1

Introduction

This Roads to Rivers Assessment of Eleven Mile Canyon, Happy Meadows, and Sportsmen's Paradise Roads (Assessment) evaluates the road conditions, drainage systems, sediment concerns, traffic use, environmental conditions, and recreation management in the upper South Platte River corridor near Lake George, Colorado. The upper South Platte River is a world-class trout fishery and the river corridor provides recreational opportunities such as tubing, hiking, camping, picnicking, and rock climbing. These recreational activities have resulted in very high public use of the corridor, which has affected the river and the surrounding environment.

This Assessment reviews the existing conditions of the road and its infrastructure; identifies sediment and erosion-related areas of concern; proposes solutions to drainage problems and traffic and safety concerns; and offers recreational management options to better manage the corridor to keep users safe and minimize impacts to the river and the environment. A complimentary study is underway by the Coalition for the Upper South Platte (CUSP) to review the instream components of the corridor, including stream stability, bank erosion, fisheries habitat, water quality, and area trails. Together, this Assessment and the CUSP study will provide a comprehensive review of the corridor.

1.1 Project Stakeholders

This Assessment was completed in coordination with CUSP, the U.S. Forest Service (USFS), and other interested stakeholders, as identified in **Table 1**.

TABLE 1
Sponsors and Stakeholders

Coalition for the Upper South Platte
U.S. Forest Service
Colorado Department of Public Health and Environment
Denver Water
Park County
Trout Unlimited
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1.2 Study Area

The study area is located along the upper South Platte River within the Pike National Forest in central Colorado in Park County (**Figure 1**). The majority of the study area is located on USFS-owned land, with the remaining portions located on privately owned land, including the Sportsmen's Paradise private community. A detailed geographical information system (GIS) Map Book, as described in Section 2.1, is included in **Appendix A**.

1.2.1 Project Reaches

This Assessment focuses on three reaches along the upper South Platte River, as follows:

- **Eleven Mile Canyon Road**: Identified as County Road (CR) 96, also known as Eleven Mile Canyon road, from the Denver Water security gate below Eleven Mile Reservoir dam to the USFS fee station and entrance to the Eleven Mile Canyon Recreation Area. This reach is located on USFS-owned land and is

maintained primarily by Denver Water. A concessionaire and the USFS also support maintenance activities in the canyon.

- **Happy Meadows Road**: Identified as CR 112 from near the USFS boundary to the Sportsmen's Paradise community entrance gate. This reach is located on USFS-owned land and is maintained by Park County.
- **Sportsmen's Paradise Roads**: Identified as CR 112 from the Sportsmen's Paradise community entrance gate to the downstream end of the private property. There are two main roads adjacent to the river, plus many side roads and driveways. The roads are located on private property and are maintained by the homeowners' association (HOA).

These three road reaches are the primary study areas of this Assessment. In addition, the connecting roads, tributary streams, burn areas, and privately developed areas were considered to determine whether or not these areas are contributing to impacts to the river and provide opportunities for improvements.

1.2.2 History of the Area

Eleven Mile Canyon and the adjacent areas along the South Platte River have a rich history, and they currently offer an array of outdoor and recreational opportunities. Prior to construction of the reservoir and the dam, the canyon used to be the old Colorado Midland Railroad corridor. Incorporated in 1883, the Colorado Midland Railroad was the first standard gauge railroad built over the Continental Divide in Colorado. The Midland line ran from Colorado Springs through Leadville and Aspen to Grand Junction. Operation of the railroad ceased in 1918. In 1932, Eleven Mile Reservoir dam was completed to provide water to the city of Denver.

1.3 Key Areas of Interest

In 1998 the Colorado Department of Public Health and Environment (CDPHE) listed the upper South Platte River as an impaired water under Section 303(d) of the Clean Water Act because of excessive sediment in the river. The sediment reduces the function of the South Platte River, impairs the health of the watershed, and reduces the amount of habitat available for aquatic organisms, fish, and riparian-dependent species. The main sources of sediment were identified as erosion and runoff from burn areas from past forest fires, erosion of the granite walls of the canyon, and sediment entering the river from adjacent roads and pedestrian trails.

The USFS has identified gravel and dirt roads adjacent to rivers as key areas of concern, and the associated sediment impacts of these roads to the creeks, fisheries, and habitat have been identified as a "chronic problem" throughout the Pike National Forest. The key areas of interest in this Assessment include:

- Roadway concerns, such as traffic flow, safety, parking, and road maintenance.
- Drainage and erosion concerns, specifically related to contribution of sediment to the river.
- Recreation management, including safety, pedestrian traffic control, and maintenance of the natural character of the river system.
- Environmental concerns, including noxious weeds and riparian habitat.
- Cultural and historical findings that could impact or limit the ability to construct improvements in the study area.

A workshop was held at the start of the Assessment to bring the stakeholders together to discuss their concerns and understand the key problems along the river and to rank the problems so that the highest ranking problems could be tackled first. The discussion identified the key areas of interest, with traffic safety and management ranking as the highest area of concern, and sediment and its impacts to the river as the second highest area of concern.

1.4 Data Collection

Existing data related to the upper South Platte River and the surrounding area were collected at the start of the Assessment. The data include the following items:

- Aerial photography.
- Geographical information system (GIS) layers for streams, roads, recreational trails, and burn area limits.
- United States Geological Survey (USGS) National Hydrography Dataset (NHD) stream centerlines.
- Traffic count and accident history data.
- Road maintenance data.
- Cultural and historical records.
- Various reports and studies (see Section 1.5).

1.5 Previous Studies

Previous studies have been completed within the study area and the surrounding areas, including environmental reviews, conservation plans, habitat inventories, and restoration projects. Discussions of several of these studies follow.

1.5.1 Basinwide Stream Habitat Inventory

In 1994, USFS conducted a Basinwide Stream Habitat Inventory for the upper South Platte (United States Department of Agriculture [USDA] Forest Service, 1994). These data, along with electroshocking data collected by Colorado Parks and Wildlife (CPW), served as the basis for an environmental assessment (EA).

1.5.2 Environmental Assessment for the Eleven Mile Canyon Ecosystem Management Project

The *Environmental Assessment for the Eleven Mile Canyon Ecosystem Management Project* was prepared by the South Park Ranger District of the Pike and San Isabel National Forests and Cimarron and Comanche National Grasslands (USDA Forest Service, 1995). Several goals were identified in the EA, including the following: 1) reduction of sediment delivery into the South Platte River and improvement of channel stability, and 2) improvement of fisheries and terrestrial and aquatic habitat. The alternative selected in the decision notice involved paving parking lots, picnic areas, and 8.35 miles of road in Eleven Mile Canyon; closing the upper 3 miles of the road to motorized access; closing all campgrounds within the canyon; and building a new campground along the South Rim. The selected alternative also called for placing rocks and logs in the river to provide cover for fish and physical support for the riverbank, revegetating the disturbed portions of the bank, and hardening the access points to the river. The paving and road closure portions of the alternative were not implemented because of traffic safety concerns, lack of funding, and other administrative constraints (CPDHE, 2002). Based on discussions with USFS staff, it is believed that other actions identified in the decision notice were not implemented because of public and stakeholder opposition.

1.5.3 Total Maximum Daily Load Assessment–Upper South Platte River

Information described in the EA led the CDPHE Water Quality Control Division (WQCD) to list the South Platte River on the 1998 Section 303(d) list. It was determined that this portion of the South Platte did not support the assigned aquatic life use classification because of substrate deposition of excessive amounts of sediment (CDPHE, 2002). In 2000, macroinvertebrate population assessments were completed and substrate composition data were collected. In 2002, CDPHE completed a total maximum daily load (TMDL) assessment for the portion of the South Platte River from Eleven Mile Dam to Cheesman Reservoir (Segment 1A). CDPHE developed sediment load allocations for the reach and management recommendations for the reduction of road sediment contributions into the river (CDPHE, 2002).

Figure 1
Study Area
Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

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1.5.4 Wild and Scenic River Study Report and Final Environmental Impact Statement, North Fork of the South Platte and the South Platte Rivers

In April 1997, the study area was reviewed as part of the Wild and Scenic River Study Report and the Draft Environmental Impact Statement (DEIS) for the North Fork of the South Platte and the South Platte River, followed by the Supplemental Draft Legislative Environmental Impact Statement (DLEIS), released in March 2000. In 2004, the Final Environmental Impact Statement (FEIS) was released, outlining the Preferred Alternative (USDA Forest Service, 2004b). The result of this study determined that the study area would be sufficiently managed under a federal, state, and local government partnership, as outlined in the South Platte Protection Plan (SPPP) (SPEB, 2001). At this time, the 1984 Forest Plan was amended to include these portions of the South Platte River as "eligible" for Wild and Scenic River status, which affords protection from activities that could diminish the character of the river (USDA Forest Service, 2004a).

1.5.5 South Platte Protection Plan

As one of the stipulations of the SPPP, the South Platte Enhancement Board (SPEB), which is responsible for enactment of the SPPP, has funded 20 grant projects to date aimed at maintaining and/or enhancing the Outstandingly Remarkable Values (ORVs) within identified stream segments of the South Platte River. In addition, the Stream Flow Management Plan, a provision of the SPPP, has been implemented daily since 2006 by Denver Water, Aurora Water, and CPW to manage dam flow release operations, including water releases within the South Platte, to benefit the ORVs (SPEB, 2014).

1.5.6 Wild Connections Conservation Plan for the Pike and San Isabel National Forests

In 2006, the Upper Arkansas and South Platte Project (UASPP) released area-specific management recommendations for the South Platte Canyons Complex as part of the Wild Connections Conservation Plan for the Pike and San Isabel National Forests (UASPP, 2006). The recommendations identified Eleven Mile Canyon as an active management area for wildlife habitat.

1.5.7 Additional Studies

CUSP, formed in 1998, has been involved in numerous projects aimed at preservation and enhancement of the upper South Platte watershed. Along with various stakeholders and agencies, CUSP has provided project funding, planning, implementation, and monitoring services within the watershed.

Within the study area, a number of restoration efforts have been undertaken to improve instream habitat and water quality, reduce sedimentation, protect eroding banks, and improve geomorphology of the river. These projects include the 1996 Eleven Mile Canyon Demonstration Project (USDA Forest Service, 2007), followed by the 2004 Trees for Trout Project within Eleven Mile Canyon, and the 2009 Trees for Trout Project on Camp Alexander private land within Eleven Mile Canyon. In addition, the South Platte River Restoration Project for Happy Meadows and Sportsmen's Paradise was also completed in 2012 (CUSP, 2012) and is currently undergoing post-construction monitoring. Collectively, these efforts have made major improvements to degraded habitat conditions within the river, improving sediment load issues, and assisting in the recovery of fish populations within the reach.

Based on the assessments and recommendations from these previous studies and activities, gravel roads adjacent to the river have been identified as high-priority areas for reducing sediment loading to the South Platte River.

1.6 Similar Assessments and the Sugar Creek Pilot Project

This Assessment builds upon three similar assessments previously conducted by CH2M HILL. Similar assessments have been conducted on Pine Creek and Sugar Creek, which enter the South Platte River below Deckers, Colorado, and on Bear Creek west of Colorado Springs, Colorado. At each of these stream reaches, dirt roads immediately adjacent to the streams cause similar sediment problems. The Sugar Creek assessment led to the Sugar Creek Pilot Project (SCPP), which was completed in 2009. The SCPP designed and constructed various sediment mitigation features at four separate sites along Sugar Creek. A sediment collection feature was included at each site. The SCPP is being monitored to track the volume of sediment collected, track operations and maintenance activities, and develop lessons learned for other areas throughout Colorado. The four sites are functioning well, and Douglas County maintenance staff have requested that similar features be constructed on other dirt roads. The processes, tools, and concepts developed in the SCPP are used in this Assessment. This Assessment of the upper South Platte River may also provide opportunities to construct various improvement features; try new technologies or concepts; learn which alternatives are preferred by land owners, stakeholders, and county or Denver Water operations and maintenance staff; and provide field examples for interested parties.

SECTION 2

Site Assessments

Site assessments were conducted for each reach. Each assessment included a review of existing reach conditions and areas of concern to identify problems and develop potential solutions. The site assessments are discussed in this section and are organized by topic as follows:

- Roadway Assessment.
- Drainage and Sediment Assessment.
- Environmental and Biological Assessment.
- Recreation Assessment.
- Cultural and Historical Features Assessment.
- Data Collection and Field Assessment Summary.

2.1 GIS Map Book

A key part of this Assessment is the development of a GIS and aerial photo-based Map Book (Map Book) as presented in **Appendix A**. The Map Book highlights existing conditions, including roadway features, areas of significant erosion, sediment deposition, roadway drainage issues, narrow road-to-river buffers, and other key features identified during the site investigations. The Map Book also illustrates areas where potential solutions are recommended, such as culvert installation or repair, formalized parking areas, slope stabilization, and road widening.

The stream network shown in the Map Book is based on the U.S. Geological Survey (USGS) NHD in a high resolution scale of 1:24,000. In accordance with USGS map accuracy standards, the 1:24,000 scale displays 90 percent of features within 40 feet of their true geographic position. Some NHD steam lines do not correlate with the known topography, but they are included in the Map Book to identify tributaries and hillslope drainage patterns. The South Platte River NHD line was removed to simplify the images. The river is easily identifiable in most aerial images in the Map Book.

The following terms and symbols are used in the Map Book:

- Photo Locations: The photo location numbers on each Map Book sheet correlate with the images along the bottom of the page and are positioned at the location where the photograph was taken using a GIS-enabled digital camera.
- Perennial Stream: NHD layer indicating a stream that has continuous flow throughout the year.
- Intermittent Stream: NHD layer indicating a stream that has flow during part of the year.
- Ephemeral Stream: NHD layer indicating a stream that flows only during or immediately after precipitation or snow melt.
- Trail: Recreational hiking trail. CUSP's ongoing instream study is anticipated to identify all of the pedestrian social trails throughout the corridor.
- Ponded Water on Road: Area where roadway drainage is not sufficient and water ponds after storm or snow melt events.
- Retention Pond: Natural or manmade depression that captures and contains runoff without a formalized outlet structure. Manmade informal retention ponds are locations where the construction of the road created the pond.

- Major Roadside Erosion: Erosion adjacent to the road, either on the hillside or river side of the road that often results from limited vegetation or a steep slope.
- Pedestrian Rundown: Area where a manmade ditch, trail, or path conveys concentrated flow off the roadway towards the river.
- No Buffer between Road and River: Location with a limited distance between the road and the river or where the slope between the road and the river is steep, thereby limiting the vegetation coverage. A lack of vegetation results in limited or no ability to capture or filter sediment that is conveyed off the roadway or from roadway culverts.
- Sediment Deposition: Location where sediment deposition in the South Platte River was visible during the field assessment.
- New Sediment Trap: Locations where a sediment trap could be installed to collect sediment at a culvert crossing location.
- New Culvert for Roadside Drainage: Location of proposed new culvert where ponding in sagging roadway is visible after a precipitation or snow melt event.
- New Culvert for Drainage Basin: Location of proposed new culvert where the road crosses a tributary to the South Platte River.
- Maintenance of Existing Culvert: Existing culvert that is adequately sized but requires maintenance, primarily the removal of sediment.
- Replace Damaged Culvert: Location of a damaged culvert that needs to be replaced (culverts that are too damaged or too clogged with sediment to be maintained or repaired).
- Upsize Existing Culvert: Location of an existing culvert that needs to be replaced with a larger diameter culvert to convey the design flow rate.
- Existing Culvert: Location of an existing culvert that is adequately sized to convey the design flow event and does not require maintenance or repair.
- Culvert Outlet Protection: Area of concentrated flow, such as a culvert, that needs to be protected with soil riprap, a culvert rundown, or other means.
- Settling Pond: Location for a proposed settling pond. These are typically located along a tributary to the South Platte River and upstream of a culvert crossing to allow sediment to drop out prior to entering the South Platte River. Settling ponds are typically larger than a sediment trap and, therefore, can treat higher flow rates.
- Ditch Reconditioning: Location needing ditch re-grading or the creation of a new ditch to convey road flows to the next culvert crossing.
- Grading: Location needing road grading to reduce the opportunity for ponded water and to direct drainage to adjacent culvert crossings.
- Road Widening: Area needing potential road widening for safer traffic management.
- Stabilization: Area with existing slope erosion that could be armored using revegetation, soil riprap, turf reinforcement mat, or other means.
- Roadway Cross Slope: Direction of the roadway cross slope (roadway tilt).
- New Parking: Location of new or formalized parking area.
- Remove Parking: Area where parking should not be allowed because of safety, sight distance, narrow road width, or other related concerns.

- USFS/Private Land Ownership Boundary: Delineates private property from USFS property.

2.2 Private Land Boundaries

During review of the draft Assessment, Sportsmen's Paradise provided clarification to the private land ownership boundaries near Sportsmen's Paradise. The draft GIS figures included land ownership boundaries based on the Colorado Ownership GIS shape file obtained from the U.S. Bureau of Land Management (BLM). Notes in the GIS file metadata were found that indicate that the BLM is aware of some discrepancies. Excerpts from the shape file's metadata are listed below:

- "Data set now is a mix of scale, tolerances, and vintage, ranging from 1994 to 2006, line work ranging from GCDB to 24K to 100K map scale/land grid source."
- "Lastly while working with this data set it has come to our attention that other land types such as forest service boundaries, private land, state lands, etc. may be missing or misplaced. The BLM lands are the most accurate in this layer at this time but even those lands have some problems."

Given the information above, the private land ownership boundary approach for the area north of Highway 24 in the final Map Book herein is derived from the ParkCoParcels11MileToSportsmans.shp file provided by CUSP. To simplify the boundaries between USFS and private land, individual parcel edges have been combined/simplified where private parcels are adjacent to each other. Note that no metadata describing the source of this data was provided.

Sportsmen's Paradise has obtained the legal land description documentation for the area if further clarification of the private land ownership boundaries is needed as the project moves forward.

2.3 Roadway Assessment

The goal of the roadway assessment is to characterize the condition of the roads, identify roadway problems, and find potential solutions. The analysis and recommendations focus on minimizing the sediment contribution from the road to the river and improving traffic operation and maintenance.

This assessment focuses on Eleven Mile Canyon road. The associated side roads accessing the recreational facilities, access to the Alexander Boy Scout Camp Road, and Wagon Tongue Gulch Road were assessed near the South Platte River for major problems and areas of concern.

2.3.1 Design Criteria and Existing Conditions

Various sources of criteria for road design and evaluation are available. Based on the traffic volumes in the study area, the American Association of State Highway and Transportation Officials (AASHTO) Guidelines for Geometric Design of Very Low-Volume Local Roads was determined to be most applicable to the roadway assessment. USFS had previously recorded road features in Eleven Mile Canyon, as included in **Appendix B**. Additional data were collected as part of this Assessment.

2.3.2 Design Speed and Posted Speed

The design speed for Eleven Mile Canyon is 20 miles per hour (mph) based on the USFS Road Management Objectives (RMOs) Report. Brown signs at each end of the corridor post the recommended speed as 20 mph. Additionally, a sign before a narrow curve posts the speed as 10 mph. There are no regulatory speed limit signs.

2.3.3 Road Cross Section

The roadway cross section consists of the historic railroad bed and is surfaced with gravel. The roadway cut and fill slopes vary but are predominately steep slopes and rock cuts.

2.3.3.1 Road Width

The AASHTO Guidelines for Very Low Volume Roads specify a minimum width of 18 feet for two-way traffic. The existing roadway widths generally vary from 14 to 28 feet. In some areas, the roadway widens to accommodate parking pullouts. The narrowest sections of road are in tunnels, which were designed to meet railroad standards of 14 feet wide and 17 feet high. Several areas do not meet the 18-foot minimum width criteria because of railroad tunnels, rock cuts on one or both sides of the road, or river encroachment. Often on days with high public use, uncontrolled parking impedes the roadway width to the point where only one-way traffic is possible in those areas.

2.3.3.2 Roadway Clear Zone

The AASHTO Guidelines for Very Low Volume Roads indicate that sometimes it is not feasible to provide any clear zone on low volume roads. Most of the side slopes along Eleven Mile Canyon road are approximately 1 horizontal to 1 vertical (1H:1V), with heavy vegetation or rocks. At two locations, one just south of the Boy Scout Camp and the other just north of the dam gate, the topography is flatter and there are grassy areas between the roadway and the river. Where the roadway is constricted, it is not recommended to increase the road width or clear zone, because the corridor has a consistent context and no history of significant accidents. Furthermore, the cost to increase the road width would be significant and the disturbance caused by the construction could increase sediment into the river.

2.3.3.3 Cross Slope

Eleven Mile Canyon is narrow with steep sides. The road has steep side slopes in many areas, both on the fill slope down to the river and the cut slope up the mountain. The roadway is generally sloped away from the river, with a consistent cross slope across the entire road. Cross slope measurements were not taken during this site visit, but it appears to be close to 2 percent, with some variation. The roadway is super-elevated (such that the cross slope is greater than 2 percent) in areas with tight curves. Where the river runs on the inside of a curve, the cross slope is adversely crowned (sloped 2 percent toward the outside of the curve). The curve radius in these areas is estimated to meet the criteria even for the adverse cross slope.

2.3.4 Horizontal Geometrics

2.3.4.1 Curve Radius

The minimum radius according to the AASHTO Guidelines for Very Low Volume Roads is 65 feet (assuming the maximum super-elevation on gravel roads). AASHTO also provides a minimum radius of 200 feet assuming a normal crown (a 2 percent slope toward the inside of the curve) and 240 feet assuming adverse super (the road sloping at 2 percent toward the outside of the curve). In Eleven Mile Canyon, the roadway is sloped away from the river throughout the length of the road to manage runoff and reduce sediment transport from the road to the river. Thus, some curves have adverse cross slopes when the inside of the curve is next to the river. An estimated roadway alignment was created based on the existing road curves to determine the curve radii. All of the curves have radii estimated at 240 feet or greater; thus, all of the curves meet the radius criteria.

2.3.4.2 Sight Distance

The AASHTO Guidelines for Very Low Volume Roads include a minimum sight distance of 90 feet. Numerous areas do not meet this minimum sight distance, primarily because of rock outcroppings that result in tight radii and minimal setback from the edge of the road to the obstruction. Limited sight distances occur around three curves because of large rock outcroppings. At a few intersections where a spur road meets the main road, vegetation along the side of the road causes reduced sight distance.

2.3.4.3 Natural Speed Controls

The roadway has many curves, and it is estimated that all of the curves meet the minimum radius criteria for the design speed of 20 mph. However, limited sight distances resulting from the topography, vegetation, and narrow road widths create a traffic calming environment that naturally reduces and controls speeds. These conditions are exaggerated when visitors park along the road, making the road width seem narrower.

2.3.5 Longitudinal Grade

The roadway grades are generally flat, with long vertical curves, since the road follows the historical railroad grade. The side roads have some vertical grades that are steeper than the main road, but the grades are acceptable for the low speeds along these roads. There are no recommendations to change the roadway grades.

2.3.6 Bridge and Culvert River Crossings

There are five bridges along the road where the river crosses under the roadway. There is one additional river crossing with four large culverts near station 38+00. Bridge inspection reports from 2012 were provided by USFS. The reports address the existing bridge conditions and associated costs to address reported issues, as summarized in **Table 2**. It should be noted that the mile posts designated in the table start at the Eleven Mile Canyon fee station.

TABLE 2
Bridge Inspection Results

Mile Post	Critical Issues	Non-Critical Issues	Total Cost for Improvements ($)
3.2	Object Markers	Barrier Protection, Approach Slope, Superstructure	26,300
4.5	Object Markers	Barrier Protection, Approach Slope, Superstructure	26,300
6.2	Object Markers, Roadside Vegetation	Barrier Protection, Approach Slope, Superstructure	26,800
6.8	Object Markers, Substructure	Barrier Protection, Approach Slope, Superstructure, Surface	30,100
8.7	Object Markers	Barrier Protection, Superstructure	24,700

2.3.7 Rock Tunnels

There are three tunnels that cut through large rock outcrops, a single tunnel at station 236+00, and a double tunnel at stations 103+00 and 107+00. The tunnels were built for the historical railroad and have a narrow width of 14 feet and a height of 17 feet. These tunnels do not provide enough width for two cars to pass, but they are on straight sections of the road, so they provide adequate sight distance. On either side of the tunnels, there are pullout areas for cars to park and wait for oncoming cars to clear the tunnel.

2.3.8 Side Roads

The roads approaching the picnic areas and campgrounds are maintained by USFS. These roads have deteriorated surfaces compared with the main road. The roadway geometry is generally geared toward a lower design speed, and the widths are generally narrower and cannot accommodate two-way traffic.

2.3.9 Traffic Operations and Capacity

The field assessment was conducted over 3 weekdays in the summer of 2014. The traffic conditions and visitation vary by season as well as by day of the week. Traffic data provided by the USFS indicate the average daily traffic count from 2011 was 123 vehicles, and the peak traffic count was 519 based on the average of five peak days. The 2014 data were similar to the 2011 data, with an average daily traffic count of 138 vehicles and a peak traffic count of 540 based on the average of five peak days. The data show a 4 percent increase in the average traffic per year over 3 years, and a 1.5 percent increase in the peak traffic per year. While the field observations were conducted on week days, the analysis accounts for the trends in traffic volume throughout the week.

These traffic counts represent daily totals, so the number of vehicles in the canyon at any time depends on the duration of each stay and the time of arrival. Based on input from the stakeholders, the weekend users that are in Eleven Mile Canyon on the peak days generally stay for longer durations to rock climb, fish, picnic, tube the river, or camp.

All vehicles entering the site must pay at the fee station at the entrance of the canyon. The fee station is operated by a concessionaire.

2.3.10 Parking Areas and Associated Access Trails

The road has several designated parking areas, but the majority of the parking capacity is along the wide roadway shoulders where vehicles have historically pulled off the road and parked. Based on an analysis of the parking capacity, the following existing parking capacities were determined:

- Parking off of spur roads and in campgrounds: 50 spaces.
- Defined parking areas adjacent to the road: 35 spaces.
- Pullouts adjacent to the road: 110 spaces.

The parking off of the spur roads includes the areas for camping and picnicking, and these parking areas are generally accessed by turning off of the main road. The defined parking areas adjacent to the road include those with infrastructure in place, such as signs, wheel stops, restroom facilities, or fences designating a parking facility. The pullouts adjacent to the road are wide shoulders, flat land, or pullouts that are disturbed land where people have historically parked.

The roadside parking areas have resulted in the creation of numerous pedestrian trails between the road and the river. More formal, designated trails are located near the formalized parking areas.

The Eleven Mile Canyon has several pullouts along the road; however, a handful are hidden behind boulders or heavy vegetation, thus creating blind spots. There are also areas where vehicles park freely on busy days, even though parking is discouraged or prohibited either by sign or methods such as bordering areas with stumps or boulders.

2.3.11 Accident History

Information received during this Assessment indicates that there are a few fender-bender accidents each year. A few isolated incidents of vehicles running off the road into the river, particularly in the narrow sections, have occurred. There are also reports of a few head on collisions at the railroad tunnels where the width narrows to a single lane. Denver Water noted that one vehicular-related death occurred, but alcohol was believed to be involved.

The USFS stated that the Federal Highway Administration is performing a safety assessment on Eleven Mile Canyon. Additional information from that study can be combined with this Assessment as proposed solutions are further refined.

2.3.12 Road Maintenance

Road maintenance is required on all of the gravel roads in the corridor. The following sections describe the past and current maintenance activities based on conversations with the stakeholders.

2.3.12.1 Eleven Mile Canyon

Eleven Mile Canyon is located on USFS-owned lands but maintained primarily by Denver Water to allow safe access to Eleven Mile Canyon dam. USFS and the concessionaire also support maintenance activities. Greg East with Denver Water provided a summary of Denver Water's maintenance activities in Eleven Mile Canyon, as follows:

- Maintenance activities are conducted to remove washboarding, keep ditches clean, attempt to keep culverts clean, and keep the road safe and passable.
- The only maintenance equipment stationed on site is a road grader. Denver Water has access to a backhoe, excavator, and a dump truck. Denver Water does not have a vacuum truck.
- Road base material has been imported by Denver Water approximately four times in the last 26 years to address localized road surface issues.
- Grading activities are currently performed to keep the road base material on the road and not to create a roadside berm or cast material off of the road toward the river. Denver Water is currently working to remove roadside berms that remain. Grading typically occurs after a rain or snow melt event so the water on the road can be used to assist with compaction.
- Snow plowing operations are performed with the grader. Snow plowing operations attempt not to disturb the road base and to keep snow with high levels of sediment from entering the river. There is limited space available to store snow in the canyon.
- Ditches are cleaned by tilting the grader blade. Cleaning the culverts is difficult because of the available equipment.
- Sediment that is collected is either used onsite by Denver Water or is stockpiled temporarily near the dam and then transported off site.
- Denver Water attempts to manage the road in a way that is fiscally responsible to Denver Water's customers. Denver Water noted that funding is a constraint on the maintenance activities that can be performed.

2.3.12.2 Happy Meadows

The Happy Meadows road is located on USFS-owned land and is maintained by Park County. Maintenance activities similar to those in Eleven Mile Canyon are conducted, including road grading, ditch cleaning, and culvert cleaning. Washboarding has been identified as a major problem for user of this reach and Sportsmen's Paradise reach.

2.3.12.3 Sportsmen's Paradise

The Sportsmen's Paradise road is located on private lands and is maintained by the HOA. Maintenance activities similar to those in Eleven Mile Canyon are conducted, including road grading, ditch cleaning, and culvert cleaning. However, the available equipment and funding are limited. Sportsmen's Paradise community members noted that the equipment they have available makes it difficult to create a cross slope on the road. As a result, the road has been lowered over time because of grading activities.

2.3.13 Happy Meadows and Sportsmen's Paradise Road Assessments

This section provides additional information specific to Happy Meadows and Sportsmen's paradise roads. The design criteria for Happy Meadows and Sportsmen's Paradise roads is the same criteria used for Eleven Mile Canyon.

2.3.13.1 Happy Meadows

The Happy Meadows road is located north of U.S. Highway 24 and west of the South Platte River. This road provides access to fishing, camping, and tubing, as well as to Sportsmen's Paradise. Criteria related considerations are described below.

- Road Surface: The road is surfaced with gravel. There have been complaints of frequent washboarding of the road surface.
- Road Width: Happy Meadows road is wider than Eleven Mile, with a width ranging from 15 feet to 30 feet. There are areas where the roadway widens to accommodate parking pullouts.
- Curve Radius: Most of the curves along Happy Meadows meet the minimum curve radius of 240'. However, there are five curves with radii below the minimum criteria.
- Sight Distance: There are no rock outcroppings or vegetation near intersections that limit sight distance.
- Grade: Similar to Eleven Mile, the road is adjacent to the river along most of the route and roadway grades are generally flat.
- Utilities: There are overhead utilities located along the roadway.
- Parking: Similar to Eleven Mile Canyon, there are pullouts adjacent to the road providing access to the river. The pullouts are both on the river side and the hillslope side of the road. Some areas have boulders placed to prohibit vehicular access or parking off of the road.

2.3.13.2 Sportsmen's Paradise

The Sportsmen's Paradise community is at the end of Happy Meadows road (CR 112). The area has 160 lots and 145 homes with seasonal maintenance and no road easements. Within Sportsmen's Paradise, the community maintains the roadways. Criteria related considerations are described below.

- Speed: The roads all operate at low speeds, and there is a posted speed limit of 15 mph. Near the Sportsmen's Paradise entrance, logs are used to taper the travel lane for speed management.
- Road Width: The roadway widths in Sportsmen's Paradise vary, from wide primary roads to narrow minor roads.
- Curve Radius: The curves along the main road have radii that meet criteria.
- Sight Distance: There are no sight distance concerns in this area.

- Grade: Similar to both Eleven Mile Canyon and Happy Meadows, the road is adjacent to the river and roadway grades are generally flat.

The existing roads have roadside ditches, but the roadway cross slopes could be improved to ensure that the drainage reaches the roadside ditches. Several driveways access the main loop roads and are generally steep and carry significant drainage. The driveways could have improved roadside ditches that connect to the existing arterial ditches to ensure that the concentrated flows are conveyed without causing erosion.

Some roads in Sportsmen's Paradise are narrow and steep and could be a safety hazard. At the north end of the site on the east main road, the river is near the road and a steep eroded river bank exists. Some roadway drainage is causing erosion of the river bank.

2.4 Drainage and Sediment Assessment

This assessment investigates the existing drainage system, including culverts, rundowns, and other related features, as described below. The existing drainage system is relatively extensive, and it is apparent that drainage was considered during the construction and/or maintenance of Eleven Mile Canyon, Happy Meadows, and Sportsmen's Paradise roads over the past decades. However, much of the system is currently not functional because of accumulated sediment. The Map Book illustrates the locations of the significant drainage features.

2.4.1 Culverts, Outlets, and Rundowns

Eleven Mile Canyon, Happy Meadows, and Sportsmen's Paradise roads have numerous cross culverts that convey flow from the hillside of the road to the river side of the road. The culverts are corrugated metal pipe (CMP) and range in size from 12 to 72 inches diameter, with most pipes between 18 and 24 inches in diameter.

Many of the culverts have sediment deposition ranging from 1 inch to 9 inches deep. Some culverts are filled between 75 and 100 percent, rendering them ineffective in conveying flow. Many of the culverts transport sediment in runoff from the hillside of the road to the river side, as illustrated by large sediment deposition areas directly downstream of culverts. None of the existing culverts have sediment traps. Many of the culverts discharge to naturally vegetated swales, vegetated slopes, and natural check dams, while others discharge either directly into the river or onto unvegetated swales or slopes with limited buffer between the culvert discharge point and the river.

The existing buffer zones between the road and river allow for natural processes to remove sediment from surface runoff. Throughout Eleven Mile Canyon, Happy Meadows, and Sportsmen's Paradise, these buffer zones vary from flat, wide overbanks to steep hillslopes with or without adequate vegetation. In many areas, there is little to no buffer between the road and the river.

2.4.1.1 Buried and Damaged Culverts

During the site assessments, multiple culverts were discovered to be partially or completely filled with sediment. It is possible that some culverts were not identified or located during the site assessments because they were buried by excessive sediment deposition. Additionally, multiple culverts were found to be damaged. Because of the reduction of flow area at either the upstream or downstream end of the culvert, the original flow capacity of those culverts had been reduced. The culverts presented in **Table 3** have been identified as either buried or damaged. Existing culvert locations are shown in the Map Book in **Appendix C**.

TABLE 3
Buried and Damaged Culverts

Eleven Mile Canyon Road Station	Type	Size [inch]	Length [feet]	Condition
45+50	CMP	18	40	Damaged
53+50	CMP	18	40	Buried upstream and downstream
135+00	CMP	12	40	Buried upstream and hanging downstream
201+00	CMP	72	40	50% buried downstream
233+00	CMP	12	40	Buried upstream
248+50	CMP	18	40	Buried upstream and downstream, damaged
269+00	CMP	36	40	Buried upstream and downstream, damaged
270+50	CMP	18	40	50% buried upstream and downstream
314+00	CMP	18	40	50% buried upstream
343+00	CMP	36	60	Buried upstream and downstream
415+50	CMP	60	40	50% buried Upstream
427+00	CMP	18	40	50% buried
430+00	CMP	24	40	90% buried upstream and downstream

2.4.1.2 Culvert Hydraulics

Because of the rural location of Eleven Mile Canyon, criteria were gathered from both the Colorado Department of Transportation (CDOT) and Colorado Springs Drainage Criteria Manual (CSDCM). CDOT criteria states that for rural applications, such as the sub-watersheds contributing to culverts along the roadway, these culverts shall be designed to convey the 25-year storm. Isopluvial maps generated and maintained by the National Oceanic and Atmospheric Administration (NOAA) were used to identify contours of equal rainfall depths. Watersheds tributary to culvert locations were delineated using the USGS StreamStats tool. StreamStats provide basin characteristics, including basin area and basin slope, and calculate peak flow based on USGS regression equations. The USGS regression equations are not applicable for small watersheds, so alternative methodologies were used. The two methodologies used to determine the peak flow rate for each delineated sub-watershed were the Rational Method and the Natural Resources Conservation Service (NRCS) Soil Conservation Service (SCS) method. Because of limitations of each method, the rational method was applied to watersheds of up to 220 acres in size, while the SCS method was applied to basins exceeding 220 acres.

CulvertMaster software was used to analyze each existing and proposed culvert crossing and determine its adequacy in passing the 25-year storm flow rate. Detailed survey data were not available for the culverts. Therefore, the culvert analysis assumes the following: the inlet headwater is 1 foot above the top of the pipe as a result of backwater effects from the roadway, the tailwater elevation is at the top of the pipe on the downstream side, the pipe slope is 0.2 percent, and the minimum pipe size is 18 inches. **Appendix C** presents the culvert analysis and provides recommendations for conveyance of the 25-year design storm flow rate, per culvert sizing criteria set forth by the CSDCM.

2.4.2 Roadside Ditches

The road cross slope is typically towards the cut slope and away from the South Platte River. Drainage is conveyed via a roadside ditch and the nearest cross culvert location. The existing roadside ditch is full of

sediment in many locations, reducing the conveyance capacity of the ditch, resulting in water ponding on the road. In some locations, the roadway cross slope is either flat or towards the river, creating ponded water locations or direct discharge to the South Platte River. Formalizing and reconditioning the roadside ditch and formally grading the roadway away from the South Platte River would prevent direct discharge into the South Platte River and ponded water locations.

2.4.3 Natural and Manmade Retention Ponds

Multiple retention ponds, both natural and manmade, are located throughout the Eleven Mile Canyon reach. Natural retention ponds are localized depressions in the topography, and manmade retention ponds are locations where the road forms one edge of the retention pond. These retention ponds do not have formal outlet structures or pipes to the South Platte River. Water that enters the ponds infiltrates into the ground over time, which reduces the runoff and sediment load that directly enters the river.

No natural or manmade retention ponds are currently located in the Happy Meadows reach. Within the Sportsmen's Paradise reach, the tributaries to the South Platte River have been formalized as manmade fishing ponds.

These fishing ponds act as settling basins, allowing water to pass through them while trapping the residual sediment. Over time, these sediment deposition areas will fill up and the ponds will require maintenance to keep operating effectively. The existing retention ponds are identified in the Map Book.

2.4.4 Sediment Sources

2.4.4.1 TMDL for Sediment

According to the 2002 TMDL Assessment for Segment 1A of the Upper South Platte River, the road within Eleven Mile Canyon is a primary source of sediment within this reach (CDPHE, 2002).

The TMDL report predicted an annual sediment yield of approximately 3.5 tons for the entire 8.7-mile length of Eleven Mile Canyon road, which the report stated is somewhat lower than expected. NRCS soil loss tolerance on native soils in the South Platte corridor is 3 tons per acre per year. USFS soil scientists indicate that erosion rates as high as 5 tons per acre per year might reasonably be expected. Happy Meadows road, with an annual sediment yield of approximately 937 pounds, was significantly below NRCS acceptable soil loss tolerance levels. Sportsmen's Paradise roads were predicted to have an annual sediment yield of approximately 717 pounds, which is significantly below NRCS acceptable soil loss tolerance levels. However, these numbers were predicted prior to the Hayman fire, which directly affected the sediment load in the Sportsmen's Paradise area (CDPHE, 2002).

Table 4 provides a summary of sediment TMDL prior to the Hayman fire. Additional TMDL data have not been collected for this area since the Hayman Fire occurred. However, it is presumed that sediment levels have increased because of increased erosion that has resulted from the large-scale fire (CDPHE, 2002).

TABLE 4
WEPP Predicted Sediment Yields from Public Roads

Road	Length	Annual Sediment Yield
Eleven Mile Canyon Road	8.7 mi.	7,045 lb
Happy Meadows Road	1.5 mi.	937 lb
Sportsmen's Paradise Roads	4.5 mi.	717 lb

Source: CDPHE, 2002

2.4.4.2 Sediment Transport, Culvert Discharges, and Deposition Areas

Loose sediment from the roadway and uphill slopes is conveyed into roadside ditches and eventually into the cross culverts. The sediment is carried through the culverts to the river side of the roadway or becomes trapped and plugs the culvert. The runoff and sediment then either discharge into the river or onto the river overbank or are conveyed down a rundown or swale to the river. These rundowns are not stabilized or protected and rundown erosion is often present. The majority of the rundowns along the South Platte River within the study area have undergone significant erosion because of the lack of protective measures.

Throughout the study area, a clear correlation can be seen between sediment deposition areas and the roadway's proximity to the South Platte River. In certain sections of Eleven Mile Canyon, the difference in elevation between the roadway elevation and river exceeds 20 feet. This vertical elevation difference often results in a steep slope with limited established vegetation. The erosion and deposition areas continually add to the sediment loading in the South Platte River.

Many of the sediment deposition areas are the result of a limited vegetative buffer between the river and the road. These locations are identified in the Map Book. The limited buffer areas are typically in locations where an outside bend of the South Platte River encroaches toward Eleven Mile Canyon road or where the slope between Eleven Mile Canyon road and the South Platte River is too steep to sustain vegetation.

Sediment deposition is also seen at culvert outlet or pedestrian rundown locations. Both allow for sediment point source loading to the South Platte River.

2.4.4.3 Road Surface Material

The road surface material along all study reaches is gravel. The road surfaces exhibit washboarding along much of the corridor. After a storm, the roadside ditches were observed to carry most of the water, but pot holes collected water in some areas. Generally the road is sloped toward the cut slope, causing the drainage to collect along the base of the cut slope. The side roads had more deteriorated road surfaces compared with the main road.

2.4.4.4 Hayman Fire

In June 2002, the Hayman fire engulfed a significant portion of the tributary area that contributes flow to the South Platte River through the Sportsmen's Paradise reach. Although this assessment primarily focuses on roadways alongside the river, the tributary areas affected by the fire are contributing increased runoff and sediment load to the South Platte River. Along Vermillion Creek and Crystal Creek, manmade fishing ponds are effectively acting as retention ponds and removing sediment from runoff. However, over time, it is essential that these ponds be cleaned to maintain the pond's effectiveness in retaining sediment. In the watersheds contributing to these creeks, frequent runoff has caused a significant impact on the unprotected topography. Within the Sportsmen's Paradise reach, the Hayman fire has caused an increase in runoff and sediment load from hillslopes and drainages. Improvements to hill slopes and drainages within the Hayman fire burn area are recommended to reestablish vegetation and stabilize the existing slopes and drainages.

2.4.4.5 Hillside Erosion

As shown in the Map Book, in some locations the cut slope along the roadway has limited vegetation coverage and a high tendency to erode into the roadside ditch. In these locations, the sediment from the hillside will fill the roadside ditch, forcing ditch flow onto the road. Hillside erosion resulting in sediment on the road or in roadside ditches can be a major source of sediment reaching the South Platte River. It is known that stabilization of these steep slopes through only vegetative means can be difficult because of the soil type, lack of topsoil, and other factors.

2.4.4.6 Roadside Berms and Erosion

In some locations, roadway berms have developed on the river side of the road as a result of roadway grading operations where excess material has been pushed to that side. These berms have a tendency to fail where the roadway cross slope is toward the river and runoff concentrates alongside the berms. The failure of the roadway berms can result in erosion cutting back into the travel lane and significant sediment deposition into the South Platte River.

2.4.4.7 Pedestrian Rundowns

Numerous pedestrian rundowns are seen throughout the Eleven Mile Canyon and Happy Meadows study areas. These rundowns are caused by pedestrians moving to and from the river, creating paths with limited to no vegetation. Because of the heavy pedestrian traffic, these locations are a source of sediment to the river.

2.4.4.8 Natural Hill Slopes and Drainages

The natural hill slopes and drainages in the Eleven Mile Canyon, Happy Meadows, and Sportsmen's Paradise sections of the South Platte River corridor are a source of sediment. However, the human-caused sources of sediment are the focus of this assessment. It is assumed that the South Platte River, through natural processes of storm runoff and sediment transport, could adequately convey natural levels of sediment to sustain the natural populations of trout and other aquatic species. Therefore, although natural processes are introducing sediment into the river, the human-caused sources are increasing the sediment load on the South Platte River beyond the natural condition. The majority of the supply of sediment to the system has come from the unpaved roadways throughout the study area.

Although the area is fairly steep, the natural hill slopes have been deemed as a minor contributor to sediment supply where there is a thin duff layer of organic material acting as a filter for shallow surface runoff. Other than a few localized areas, the amount of hillslope stabilization recommended is fairly low.

2.5 Environmental and Biological Assessment

The study area is generally located within the semiarid foothills of the Rocky Mountains (USDA Forest Service, 2007). Topsoil within the study area is thin and not well developed, and ground cover is sparse, primarily as a result of the Pikes Peak decomposed granite soils found throughout the area. These erosive soils have led to the exposure of many large rock formations (UASPP, 2006). The landscape is bisected by relatively steep, narrow drainages with abundant erosional stream channels (USDA Forest Service, 2007). Average annual precipitation is 12 to 25 inches and occurs primarily during the winter months. Intense thunderstorms occur during the months of July and August (USDA Forest Service, 1995).

2.5.1 Biological Overview

2.5.1.1 Upland Areas

The majority of the upland habitat within this portion of the upper South Platte is coniferous forest. These forests are dominated by ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga menziesii*), with some smaller stands of aspen (*Populus tremuloides*), blue spruce (*Picea pungens*), and lodgepole pine (*Pinus contorta*). Shrubby cinquefoil (*Dasiphora fruticosa*) and common juniper (*Juniperus communis*) can also be found within these areas. In more moist areas, mountain mahogany (*Cercocarpus montanus*) and currant (*Ribes* spp.) can be found.

The understory within these areas is generally sparse because of the closed canopy. Within Eleven Mile Canyon and the southern portion of the Sportsmen's Paradise reach as it enters Wildcat Canyon, slopes are generally greater than 25 degrees, with a thin topsoil layer underlain by rocky decomposed granite substrate. Where the river exits Eleven Mile Canyon and enters the valley floor, which includes the Happy Meadows campground area reach, the gradient generally decreases to less than 25 degree slope. Along the majority of the study area, upland slopes appear stable, with a sufficient duff layer, and are not highly erosive, with the exception of a few areas of erosion around road cuts and drainages, primarily within Sportsmen's Paradise.

Within and outside the canyon where the slope of the river flattens out, upland areas adjacent to the river are dominated by montane grassland and short-grass prairie species such as smooth brome (*Bromus inermis*), blue grama (*Bouteloua gracilis*), needle-and-thread grass (*Hesperostipa comate*), western wheatgrass (*Pascopyrum smithii*), and crested wheatgrass (*Agropyron cristatum*). Common forbs and shrubs include Indian paintbrush (*Castilleja* sp.), copper mallow (*Sphaeralcea coccinea*), wild rose (*Rosa* sp.), common snowberry (*Symphoricarpos albus*), fringed sagewort (*Artemisia frigida*), rabbitbrush (*Ericameria nauseosa*), and snakeweed (*Gutierrezia sarothrae*).

2.5.1.2 Riparian Areas

Throughout the majority of the study area, the river flows near or adjacent to the road through the base of the canyon. This area is predominantly composed of a riparian corridor dominated by alders (*Alnus* sp.) and native willows, such as coyote willow (*Salix exigua*) and sandbar willow (*Salix interior*). Pockets of narrowleaf cottonwood (*Populus angustifolia*) exist within the corridor as well. Within the understory and in depositional and wet meadow areas where shrub cover is absent, herbaceous sedge/rush species and other species such as broad-leaf cattail (*Typha latifolia*) and reed canarygrass (*Phalaris arundinacea*) dominate.

As the river exits Eleven Mile Canyon, it is channelized around Lake George to the bridge underneath U.S. Highway 24. Downstream of the highway, the river widens and becomes shallower as it passes through private pasture lands. From this point downstream to Happy Meadows, there is little to no riparian cover. Riparian habitat characteristics improve through Happy Meadows and downstream through Sportsmen's Paradise.

2.5.2 Biological Assessment by Reach

The study area generally can be divided into three distinct sub-reaches based on geography and management. The first reach, Eleven Mile Canyon, is also identified as Segment A in the Wild and Scenic River Study Report and FEIS for the North Fork of the South Platte and the South Platte Rivers (USDA Forest Service, 2004b). The downstream reaches, Happy Meadows and Sportsmen's Paradise, are collectively identified as Segment B within the FEIS. As Sportsmen's Paradise is managed privately and is not part of USFS lands, it is described separately from Happy Meadows in this review. The following sections provide key biological findings for each reach.

2.5.2.1 Eleven Mile Canyon

Eleven Mile Canyon is an approximately 9-mile-long reach that begins just downstream of Eleven Mile Canyon dam and ends at the private land boundary upstream of Lake George. The majority of the reach lies within a rocky 400-foot-deep, V-shaped granite canyon (CPDHE, 2002).

- Upland slopes within Eleven Mile Canyon are generally stable and in good condition with little evidence of erosion or sloughing. Upland grassland areas have a good diversity of native species and sufficient ground cover.
- Weedy species are generally present along roadsides, picnic areas, campgrounds, turn-outs, and other areas of recent disturbance. Examples of noxious species observed within this reach include yellow toadflax (*Linaria vulgaris*) and musk thistle (*Carduus nutans*). No excessive weed infestations were observed.
- The riparian corridor is generally in great condition, with good willow/alder cover and sedge/rush understory. The riparian corridor narrows in areas (less than 5 feet) where the river meanders towards the road, but it is generally substantial (20 to 40-feet wide in most places).
- Exceptions to the continuous riparian border are observed in areas where steep, rocky banks along the canyon do not support vegetation, as well as at parking areas, camping areas, and river access points where pedestrian traffic has impacted the growth of woody vegetation (also noted in the EA [USDA Forest Service, 1995]).

- Within the Camp Alexander private property area, which is owned and managed by the Boy Scouts of America (approximately Station 392+00 to 415+00), riparian growth appears to be actively managed to provide easy fishing access along the reach (historically the area has been grazed by cattle). Within these areas, willow cover is sparse and banks are generally dominated by sedge and rush species. Wet meadows exist within the portion of land between the road and river in this area.

- The stream bed and banks appear, in general, to be in good condition. In 1996, CPW and USFS placed boulders and large coniferous trees within portions of the river to remedy the lack of habitat complexity (USDA Forest Service, 2007). In 2004, the Trees for Trout Program used dead ponderosa pines from the 2002 Hayman fire to increase trout habitat and support bank stabilization along Eleven Mile Canyon. Currently, CUSP is conducting an instream study along Eleven Mile Canyon to support additional future instream restoration work (CUSP, personal communication, February 5, 2015).
- Within this reach, the primary source of sediment input into the river appears to be from the main road.

- The 2002 TMDL Assessment for Segment 1A of the Upper South Platte River states that the percentage of eroding banks within this reach averages 50 percent (CDPHE, 2002). However these data are based on a habitat inventory conducted in 1994 (USFS, 1994). These rates have likely decreased as a result of subsequent restoration and revised management efforts within this reach. Banks appeared relatively stable through the majority of the reach during the site investigation.

2.5.2.2 Happy Meadows Campground Area

Happy Meadows is an approximately 2-mile-long reach that begins just downstream of the private land boundary west of Lake George, near Tappan Gulch, and ends at the private land boundary of Sportsmen's Paradise. This reach marks the start of the river's exit from the valley around U.S. Highway 24.

- Upland slopes within Happy Meadows are generally stable and in good condition, with a lower gradient than slopes found within Eleven Mile Canyon. There is little evidence of erosion or sloughing. Upland grassland areas have nice diversity of native species and sufficient ground cover.
- The presence of weedy species is much lower within the Happy Meadows reach compared with Eleven Mile Canyon, and locations are again associated with roadsides, campgrounds, and other areas of recent disturbance. Weedy species observed included thistle (*Cirsium* spp).

- Although the riparian border within the Happy Meadows reach is not continuous, it is generally in good condition. However, the width of the riparian border is thinner within this reach compared with Eleven Mile Canyon, because the road generally

runs closer to the river. The corridor again supports a good willow/alder cover and sedge/rush understory. The lack of woody vegetation along some stretches of the reach can likely be attributed to recreational access for fishing and tubing.

- The stream bed and banks appear, in general, to be in good condition and appear to be responding well to recent restoration efforts. In 2011-2012, CUSP teamed up with the Pike National Forest and Sportsmen's Paradise on a river restoration project within this area to address stream aggradation and migration that was causing stream bank erosion and sedimentation. This was accomplished by placing instream structures, removing the diversion structure and dam located within the Sportsmen's Paradise reach, and replanting sedge and willow species (CUSP, 2012).

- Within this reach, the primary source of sediment input into the river appears to be from the main road and from access points for fishing and tubing access; however, the sediment input levels from these sources appear to be significantly lower than levels within the Eleven Mile Canyon reach. This difference is likely the result of the lower grade of the reach, which reduces the velocity of flows along the road and associated sediment input from road grading activities.
- Pullout and parking locations, as well as the Happy Meadows Campground, appear to have a relatively stable vegetated border along the river.
- Sedimentation from gullies and ephemeral drainages on the east side of the river as a result of the 2002 Hayman fire are likely one cause of sedimentation (CUSP, 2012). Placement of woody debris and other techniques within these drainages took place as part of the restoration effort to reduce sediment input.

- The 2002 TMDL report noted that the percentage of eroding banks within this reach was low pre-fire and pre-restoration, at 26 percent (CDPHE, 2002; USDA Forest Service, 1994). Banks appeared relatively stable through the majority of the reach during the site investigation.

2.5.2.3 Sportsmen's Paradise

Sportsmen's Paradise is an approximately 1.5-mile-long reach within a private fishing HOA community. The reach begins just downstream of the private land boundary with Happy Meadows and ends just downstream of Beaver Creek at the private land boundary with Pike National Forest. This reach marks the start of the river's descent into Wildcat Canyon.

- Upland slopes within Sportsmen's Paradise are generally stable and in good condition. However, road cut-outs and high velocity flows resulting from the 2002 Hayman fire have caused excessive erosion in places. Upland grassland areas are a mix of landscaped and native grasses.

- As with Happy Meadows, the presence of weedy species is much lower within this reach compared with Eleven Mile Canyon and are generally isolated to areas of recent disturbance.

- The riparian border within Sportsmen's Paradise is generally in good condition with nice willow growth and herbaceous understory. Where the road generally runs directly adjacent to the river with steep slopes, woody vegetation is thin or absent. Portions of the riverbank have been landscaped with turf grass for recreational purposes.

- The stream bed and banks appear, in general, to be in good condition and appear to be responding well to recent restoration efforts. As with Happy Meadows, the Sportsmen's Paradise reach was part of the 2011-2012 river restoration project (CUSP, 2012).

- Within this reach, the primary source of sediment input into the river is excessive sedimentation from the 2002 Hayman fire, which burned nearly all the coniferous forest lands along the eastern slopes of the canyon. Loss of groundcover within this area, paired with a large network of natural drainages (Vermillion Creek, Beaver Creek, and Crystal Creek) and roads (Crystal Road, Gem Mine Road) along the eastern portion of the development, contribute to large amounts of sedimentation into the river during storm events. Responsive maintenance efforts by Sportsmen's Paradise have likely helped to reduce some of the more severe erosion impacts, but issues still remain.

2.5.3 Riparian Corridor Preservation

In general, the entire riparian corridor within the study area is in good condition and is a sensitive, high quality area. This riparian corridor provides bank stability, shade, and crucial habitat for aquatic and terrestrial species, including trout species that sustain the world-class trout fishing for which the upper South Platte River is known. The riparian corridor also serves as a natural biofilter for sediment runoff. Protection of this corridor should be of the highest priority as part of the effort to improve the road.

In general, the riparian corridor, predominantly composed of a willow/alder shrub overstory with a sedge/rush understory along its length, is fairly contiguous within the study area. Exceptions include those areas where steep, rocky banks along the canyon do not support vegetation, as well as parking, camping, and fishing and tubing access points where pedestrian traffic has impacted the growth of woody vegetation.

Two large stream segments with poor quality riparian borders are located within the private land areas in Eleven Mile Canyon (near Camp Alexander) and just upstream of Happy Meadows. Within both properties, riparian and other woody growth have been eliminated primarily as a result of cattle grazing.

Overall, the riparian corridor is functioning well to protect the stream from outside sources of sedimentation from the road. However, areas where the riparian border has been compromised serve as potential and active input areas for sedimentation from the road. Within Eleven Mile Canyon and Happy Meadows, these areas are generally located where the stream meanders directly adjacent to the road, preventing the establishment of a riparian buffer, or in areas where anglers and tubers have removed vegetation to allow

for stream access. Within Sportsmen's Paradise, areas exist where excessive sedimentation from the roads and drainages have overwhelmed riparian growth.

Although more prevalent within the Eleven Mile Canyon reach, the presence of noxious weeds and other non-native weedy species is relatively low within the study area. Where weeds are found, they are usually associated with areas of recent disturbance. Although noxious weeds were in relatively low abundance, the presence of species such as yellow toadflax and musk thistle can be cause for concern, and efforts should be taken to control the potential spread of weedy species into any disturbed areas from proposed activities.

2.5.4 Potentially Sensitive Areas

Potentially sensitive areas (PSAs) were identified as potential conservation areas (PCAs), areas that may be considered wetlands or waters of the U.S., threatened and endangered (T&E) species habitat, and/or other areas requiring special permitting for construction activities.

According to the Colorado Natural Heritage Program (CNHP), the study area supports two different PCAs associated with the South Platte River and Eleven Mile Canyon (CNHP, 2014). While no specific permitting or surveys are required for these areas, this information is provided for planning purposes. According to the U.S. Fish and Wildlife Service (USFWS), there is no critical habitat within the study area; therefore, it is anticipated that no special permitting or protocol surveys would be required for T&E species. The study area supports a fairly contiguous riparian border, as well as a number of stream and other drainage features, throughout the reach. Therefore, a formal wetlands and waters of the U.S. delineation would be required as needed in future phases of the project if any impacts to these PSAs is anticipated. It is assumed that these surveys will be conducted after stakeholder selected solutions are identified and the associated design and impact areas are better defined. During the final design, efforts should be made to protect and minimize disturbance to PSAs. If impacts will occur, mitigation will likely be required.

2.5.4.1 Potential Conservation Areas

According to the CNHP Colorado Wetlands Mapping Inventory (CNHP, 2014), the South Platte River is identified as a PCA for General Biodiversity Interest (B5), namely for its support of bald eagle populations (CNHP, 2013b). Eleven Mile Canyon is also identified specifically for High Biodiversity Significance (B3), because of its support of a globally imperiled (G2/S2) *Picea pungens / Betula occidentalis* (blue spruce/ water birch) montane riparian forest (CHNP, 2013a). PCA boundaries are intended for conservation planning purposes and have no legal status; they simply designate ecologically sensitive areas in which land managers should consider how specific land activities may impact the biological resources on which the PCA is based.

2.5.4.2 Jurisdictional Streams

The South Platte River is a perennial stream with a defined bed and bank and an Ordinary High Water Mark (OHWM), with a history of use for interstate commerce. Thus, the South Platte River is considered a Traditionally Navigable Water (TNW). TNWs are jurisdictional waters of the U.S. protected by Section 404 of the Clean Water Act, with jurisdictional authority belonging to the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency. Any impacts to the South Platte River from project activities would require a Section 404 permit for discharge of dredged or fill material into waters of the U.S.

A number of small tributaries drain into the South Platte River along the assessment reach, most of which are denoted by the blue line features mapped by the USGS, as shown in the Map Book. A number of these tributaries pass under the road through culverts into the South Platte River. Some of these tributaries, such as Vermillion Creek, Crystal Creek, and Beaver Creek, appear to have a defined bed and bank and OHWM, and their direct surface water connection to the South Platte River provides a significant nexus to consider

these features jurisdictional waters of the U.S. A formal waters of the U.S. survey would be required to determine any potential impacts to jurisdictional features, and any associated permitting requirements.

2.5.4.3 Wetlands

Riparian scrub/shrub wetlands, comprised predominantly of willows and alders, were identified along nearly the entire length of the study area. Most of the wetlands were fringe wetlands associated with the banks of the South Platte River. Additional emergent wetlands, dominated by rush/sedge species, canary reedgrass, cattails, and other herbaceous species, were identified adjacent to the river where relict oxbow channels had been isolated from the river by the road, as well as wet meadow areas within the floodplain of the river. There were also a few locations where runoff and/or groundwater seeps from the adjacent hillslopes had ponded within the roadside ditch opposite of the river, creating small pockets of emergent and scrub/shrub wetlands. Because of their location adjacent to and/or abutting the South Platte River, wetlands within the project corridor would likely be considered jurisdictional. A formal wetland survey would be required to determine any potential impacts to jurisdictional features and any associated permitting requirements.

2.5.4.4 Threatened and Endangered Habitat

According to the USFWS Information, Planning, and Conservation (IPaC) System, the study area does not support critical habitat for any federally listed species (USFWS, 2014). The elevation of the study area lies above the highest elevation where the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) is known to occur within the South Platte watershed (USFWS, 2010). In addition, critical habitat for the Pawnee mountain skipper (*Hesperia leonardus montana*) lies within a restricted range of the South Platte River upstream of Cheesman Reservoir and downstream of the study area (USFWS, 1978). Critical habitat for the Mexican spotted owl (*Strix occidentalis lucida*) within the South Platte watershed is also located downstream and northeast of the study area within the Devil's Head area (USFWS, 2004). The greenback cutthroat trout (*Oncorhynchus clarki stomias*) is native to the South Platte basin, but it is not known to exist in the study reach and is currently found only within a segment of Bear Creek (Metcalf et al., 2012).

While it is not anticipated that impacts from project activities will directly impact any federally listed species, any significant impacts from water-related activities within the South Platte may affect listed species in Nebraska, such as the least tern (*Sterna antillarum*), whooping crane (*Grus americana*), and pallid sturgeon (*Scaphirhynchus albus*), among others. Consultation with USFWS would be necessary to determine if any proposed activities would fall under these conditions.

While not federally regulated, many important big game species use the area for winter and year-round habitat, including elk, mule deer, black bear, and mountain lions. In addition, the South Platte River is home to resident populations of both native and non-native fish species, including wild brown trout (*Salmo Trutta*) and rainbow trout (*Oncorhynchus mykiss*), which maintain self-sustaining populations throughout the canyon. Snake River Cutthroat trout (*Oncorhynchus clarki behnkei*), Kokanee salmon (*Oncorhynchus nerka*), northern pike (*Esox lucius*), and yellow perch (*Perca flavescens*) are other species that can be found within the upper South Platte River (CPDHE, 2002). Care should be taken to consider any adverse impacts to these species and their habitat from project activities.

2.5.4.5 Migratory Birds

The Migratory Bird Treaty Act (MBTA) (16 USC 703–712), Executive Order 121186 for migratory bird protection, and the Bald and Golden Eagle Protection Act (16 USC 668–668d) establishes protections for migratory birds and their parts (e.g., eggs, nests, and feathers) from taking, hunting, capture, transport, sale, or purchase. Most species of birds are classified as migratory under the MBTA, except gallinaceous (upland game) birds, rock pigeons, Eurasian collared doves, European starlings, and house sparrows. Under the MBTA, taking, killing, or possessing migratory birds is unlawful.

The study area is home to a number of migratory passerine and raptor species, including bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*). In addition, other sensitive species, such as flammulated owl (*Psiloscops flammeolus*), osprey (*Pandion haliaetus*), northern goshawk (*Accipiter gentilis*), peregrine falcon (*Falco peregrinus*), pygmy nuthatch (*Sitta pygmaea*), three-toed woodpecker (*Picoides dorsalis),* and golden-crowded kinglet (*Regulus satrapa*), have been observed or have potential habitat within the area (USDA Forest Service, 1995; USDA Forest Service, 2004b). Rocky outcrops and forest nesting habitat is present along the majority of the study area, and dense willow habitat provides suitable nesting cover for a variety of passerine and waterfowl species. Therefore, the potential exists for breeding birds protected by the MBTA to occur within the study area.

The active nesting season for most migratory bird species in Colorado is generally between April 1 and August 15. To avoid potential impacts to migratory bird species, it is recommended that any ground-disturbing activities take place outside the active breeding season, to the extent practicable. For all construction activities taking place within the active nesting season, preconstruction clearance surveys must be conducted to identify any active nests. Of particular concern would be the removal of any willows or coniferous trees that may support nesting birds. If any nests are identified, agency consultation (USFWS, USFS) would need to be conducted to determine appropriate avoidance and minimization measures.

2.6 Recreation Assessment

A workshop was held with the stakeholders to discuss recreation management. The discussion concluded that for this Assessment, recreation management includes providing safe vehicular and pedestrian access, use of the various amenities and activities in the canyon, and managing the number of users as best possible through parking and road management. The stakeholders decided to identify the high use focus areas in the study area so that parking improvements and other recommendations could account for those specific areas.

In order to identify the high use focus areas, the following stakeholders were contacted and provided input:

- USFS.
- Chuck Hallam, Canyon Enterprises, Inc. (concessionaire for Eleven Mile Canyon and Happy Meadows Campground).
- Pete Gallagher, Fin-Up Habitat Consultants, Inc. (who is involved in the CUSP instream assessment).

The USFS and Fin-Up Habitat Consultants, Inc. provided information related to high use focus areas, as included in **Appendix D**. Canyon Enterprises, Inc. provided verbal information regarding high use focus areas.

The recommendations included in this Assessment account for these high use areas. It is noted that USFS is not intending to decrease the use in the canyon, but rather manage the users and impacts on the river and environment in the best way possible.

2.7 Cultural and Historical Features Assessment

2.7.1 Data Collection

An archival literature search was conducted using the records available in the COMPASS online database maintained by the Colorado Office of Archaeology and Historic Preservation. The objective of this study was to return the results of previous cultural surveys, including any determinations of National Register of Historic Places (NRHP) eligibility, to identify areas of sensitivity and develop preliminary development guidelines within of the study area. In addition, CH2M HILL also contacted Forest Service Archaeologist, Priscilla M. Riefkohl Guzmán, of the Pike National Forest and received correspondence from Joseph Saldibar, Architectural Services Manager History Colorado/Colorado Historical Society regarding previous work within the study area.

2.7.2 Data Analysis and Site Eligibility

Review of mapped data indicated that a total of 47 sites and 21 surveys were located within ¼ mile of the study area boundary. COMPASS records show that the entire study area alignment has been previously surveyed for cultural resources, with analysis and surveys conducted within the study area as recently as 2004 and 2005. The results of the research are included in **Appendix E**.

The primary resource of concern, as it relates to this Assessment, is the historic Colorado Midland Railroad and State Highway 40S/CR 96 (Site 5PA.17.6), which parallels the river and over which lies the current roadbed, accounting for approximately 8.6 miles of the study area. COMPASS records list the site as not eligible for the NRHP. The Colorado Midland was the first standard gauge railroad to penetrate the mountains of Colorado. It originated in Colorado Springs and crossed Ute Pass and Trout Creek Pass to reach Leadville. The railroad ran from the 1880s until 1918, and its associate railroad, the Midland Terminal, served Cripple Creek from 1894 until 1949. The Colorado Midland was incorporated in 1888, driven by mining at Aspen and Leadville, and was funded by Eastern and British capital. In 1886 the first tracks were laid out of Colorado Springs and were the first standard gauge tracks into the mountains of Colorado. In 1921 the line was apparently dismantled.

Additional archaeological sites, several of which are related to, and considered as contributing elements of, railroad Site 5PA.17.6 have also been recorded along the alignment. Of these, there are three tunnel segments that are listed as eligible for the NRHP. All other sites have been evaluated as not eligible according to records provided by Colorado Office of Archaeology and Historic Preservation (OAHP) or are located well outside the roadway.

The only other site of note is the Lake George Cemetery on northwest side of Tarryall Road (CR 77) at Milepost 41.5, 0.25 mile northeast of the intersection with U.S. Highway 24. Any project activities at this 9-acre fenced cemetery should be avoided.

2.7.3 Summary and Future Considerations

The entire study area has been surveyed within the last 10 years for cultural resources (Slaughter 2005; Kane 2004), and other studies are in progress (personal communication, Priscilla M. Riefkohl Guzmán Forest Service Archaeologist). Other than the three tunnel locations, no other NRHP-eligible resources have been recorded within the prism of the current roadway or within its immediate proximity; none of the previously recorded resources besides the existing roadway would be expected to be impacted from road improvements.

Mr. Joseph Saldibar, Architectural Services Manager of the History Colorado/Colorado Historical Society, confirmed that the Colorado OAHP has determined the Colorado Midland Railroad site (5PA.17.6) in Eleven Mile Canyon is not eligible for the NRHP.

The Eleven Mile Canyon area contains a moderate density of mainly historic archaeological resources, the primary resource of concern being the historic Colorado Midland Railroad alignment and its features. However, as stated previously, site 5PA.17.6 is not eligible for the NRHP, and as stated by the most recent evaluation of the entire alignment (Slaughter 2005), "The railroad grade is generally no longer intact in the canyon, and there are no structures remaining that would embody architecture typical of a type or period. The same can be said for State Highway 40S/Country Road 96 located on the original RR grade. All information that can be gleaned from State Highway 40S/County Road 96 and this segment of the Colorado Midland Railroad has been documented at this time. No further action is necessary" (Site Record 5PA.17.6).

Based on these findings, cultural resources are not considered to be an impediment to project design and are unlikely to represent a constraint to project implementation. That said, when and if a federal undertaking is identified, a thorough cultural resources study will be needed prior to project implementation in order to satisfy requirements of Section 106 of NHPA. The study would be coordinated with the USDA Forest Service, assuming they are identified as the lead federal agency.

2.8 Data Collection and Field Assessment Summary

The field assessment identified the existing conditions, key problems areas, and potential locations for improvements, as shown in the Map Book. The following items were determined to be the most significant findings in the study area:

1. The existing road widths vary from 14 feet to 28 feet and do not meet criteria in several locations. On busy days, parked cars impede the roadway width to the point that only one-way traffic is feasible.
2. All of the roadway horizontal curves along Eleven Mile Canyon and at Sportsmen's Paradise meet the minimum radius criteria. At Happy Meadows, most curves meet criteria, but five curves do not meet the minimum radius.
3. There are road areas that do not meet the minimum sight distance. This includes areas where there are rock outcroppings which result in tight radii curves and minimal setback from the edge of the road to the obstruction. There are also a few intersections where the spur roads meet the main road which have reduced sight distance due to vegetation along the side of the road. Sight distance is not an issue at Happy Meadows or Sportsmen's Paradise.
4. The estimated existing parking capacity in Eleven Mile Canyon is approximately 200 vehicles. During peak days, there is not enough parking capacity and the roadway bench is the only place to accommodate the overflow parking. There is adequate parking at Happy Meadows, however, the parking areas get muddy during thunderstorms and visitors move rocks that were placed to help define allowable parking areas.
5. The riparian corridor is generally healthy. However, in locations where the river runs adjacent to the road, the riparian buffer is either thin or absent and is unable to prevent sediment from entering the river.

6. During large storm events, high velocity sheet flows on the steeper portions of Eleven Mile Canyon road are directing sediment into the river through graded berm breaks and culverts.
7. Within Eleven Mile Canyon and Happy Meadows, pedestrian access points for fishing and tubing have compromised the riparian border and provided point source locations for sediment.
8. The extensive network of roads and drainages within Sportsmen's Paradise convey large amounts of sediment from the 2002 Hayman burn scar into the river during large storm events.
9. Despite areas of little to no vegetation where the river flows adjacent to the road, it appears stream banks overall are fairly stable, with few signs of major bank erosion. This stability is likely a result of restoration efforts along the majority of the assessment reach.
10. With the exception of a few locations along the road network within Sportsmen's Paradise, uphill slopes are stable with good ground cover.
11. Areas of significant erosion are identified on the Map Book as Major Roadside Erosion and Pedestrian Rundown.
12. Many culverts along Eleven Mile Canyon road are partially or fully blocked with sediment and debris and cannot convey tributary and roadside ditch flow to the South Platte River. In many cases, the fully blocked culverts should be replaced with larger diameter culverts based on hydrologic calculations. Additionally, the field assessment identified multiple locations where a new culvert should be placed to drain an existing tributary or located at a sag in the road where ponding occurs during precipitation or snow melt events.
13. Throughout Eleven Mile Canyon and Happy Meadows numerous pedestrian rundowns to the river occur. These rundowns are locations where pedestrians are moving to and from the river, creating linear paths with limited vegetation.
14. Multiple areas have limited vegetated buffer between the river and road. Typically, these locations are at outside bends in the river or where the elevation difference between the river and the road creates a steep slope with limited vegetation.
15. Sediment deposition is visible in multiple locations throughout Eleven Mile Canyon and Happy Meadows, either within the South Platte River or in the South Platte River overbank. Sediment deposition is caused by many factors, including a limited buffer between the river and road, culvert crossings, and pedestrian rundowns to the river. Within Sportsmen's Paradise, sediment deposition was observed along the major tributaries to the South Platte River and local roads, which often act as the main stormwater conveyance element.
16. Roadside erosion along the hillside slope in Eleven Mile Canyon, Happy Meadows, and Sportsmen's Paradise is seen in multiple locations. Erosion from the hillside enters the roadside ditch, blocking conveyance in the roadside ditch or the roadway cross culverts. Ponded water is evident in locations where the roadside ditch or cross culvert is blocked with sediment. Major erosion was also observed along the tributaries and local roads within Sportsmen's Paradise.
17. Roadside berms should be removed to prevent major roadside blowouts and to allow sheet flow to move off of the roads.
18. Within Sportsmen's Paradise, improvements already constructed include stabilization of a tributary outfall to the South Platte River and diversion berms placed within the local roads to divert flow back to the main drainage tributary. The 2002 Hayman fire resulted in increased runoff and the increased potential for sediment movement.
19. No sediment traps or settling ponds are found within the study area. Best management practices and sediment collection facilities could be implemented at many of the culverts.

SECTION 3

Conceptual Solutions

Based on the field assessments described previously, conceptual solutions have been identified and are summarized in the Conceptual Solutions table included as **Appendix F**. The conceptual solutions are designed to be a menu of options. Some of the options may not be applicable to Eleven Mile Canyon, Happy Meadows, or Sportsmen's Paradise roads but they may be beneficial to use on other roadway and stream corridors. Stakeholder input, funding availability, maintenance needs, and other factors will determine the desired and recommended improvements.

The unit costs shown in the Conceptual Solutions table are based on 2015 construction cost information obtained from the Colorado Department of Transportation, Urban Drainage and Flood Control District, CH2M HILL project libraries, and engineering judgment. The unit costs do not include contingencies or account for costs associated with administration, engineering, permitting, and other standard project components.

The qualitative Benefit to Cost Ranges in the Conceptual Solutions table are based on a basic, qualitative review of each feature and account for the feature's cost, ability to address the identified problem, ability to control sediment, longevity, stability in the environment, and anticipated success rate.

The following sections further discuss the solutions recommended for the Eleven Mile Canyon, Happy Meadows, and Sportsmen's Paradise roads, as shown in the GIS Map Book in **Appendix A**

3.1 Roadway Recommended Solutions

The primary concerns identified during the Assessment relate to roadway safety (including adherence to roadway design standards), sediment contributions from the roadway to the creek, and traffic operations (including parking capacity) during peak visitation.

3.1.1 Vehicle Safety and Road Geometrics

The roadway width is narrow in areas, and the ideal solution is to widen the roadway at the pinch points; however, expanding the road bench would involve rock cut and/or rock blasting in many areas, which would be costly. Widening the road tunnels would not be feasible because of the historic nature of the tunnels. However, there are areas, primarily on the side roads, where road width could be improved by maintaining the vegetation.

The roadside slopes are generally steep, both on the cut and fill slopes. No recommendations are proposed to change the side slopes at this time, given the narrow topography of the canyon and the difficulty in reestablishing vegetation on disturbed slopes.

The sight distance at the side road intersections can be improved with vegetation maintenance. The sight distance on the roadway could also be improved with rock blasting, but because there is limited crash history, the addition of signage is recommended to inform the users of the tight curve or limited sight distance areas. Signage at the tunnels is also recommended to inform users of the one-way traffic width segment.

The recommendations to improve roadway safety are integral for effective traffic operation through the study area by ensuring the road areas are maintained for moving vehicles.

3.1.2 Road Surface Material

Resurfacing the length of roads in this study area would be costly. The stakeholders have indicated that paving the roads is not desired due to the cost, increased vehicular speeds, safety concerns, and maintenance requirements. The placement of soil stabilizers on the gravel road could have water quality impacts that are not desired, given the high quality fishery in the South Platte River. Based on these

concerns, it is recommended that new road base material be imported in prioritized areas to allow proper road surface compaction, decrease washboarding, and decrease the frequency at which road grading is required. Additional analysis could be conducted to further investigate the short and long term benefits and costs of various road surface materials.

3.1.3 Parking and Traffic Management

Traffic and parking management recommendations are identified to improve safety, better manage the high use areas, better utilize the infrastructure, and protect the environment.

3.1.3.1 Parking Management

The existing estimated parking capacity is approximately 200 vehicles. During peak days when the traffic reaches over 500 vehicles, the roadway bench is the only place to accommodate the overflow parking. Thus, it is recommended to expand parking capacity to provide enough formal parking for the peak days and discourage the parking along the roadway where safety and environmental impacts are concerns.

Based on the traffic data provided between 2011 and 2014, the peak traffic reaches over 600 vehicles per day during summer weekends, and the 90th percentile day has approximately 285 vehicles. The proposed parking capacity strategy is based on providing capacity for the 90th percentile day. These numbers represent the daily totals, so the number of vehicles within the park at any time depends on the arrival times and the duration of each stay. For a conservative estimate, it is assumed that on peak days, people arrive in the morning and stay all day.

Proposed parking expansions were identified based on the following criteria:

- Locate parking in previously disturbed areas.
- Locate parking away from the river, or at a minimum provide buffer areas between the parking area and the river.
- Provide parking near popular destination areas identified by the stakeholders.
- Locate parking where the topography can accommodate expansion.

After reviewing potential parking expansion areas, the recommended parking capacity improvements will accommodate approximately 300 vehicles. This number includes the existing campground and spur road areas, which provide capacity for approximately 40 vehicles; parking along the roadside that is recommended to remain, where it is deemed appropriate; and new parking expansion areas. Other pullouts along the road where the roadway is less than 28 feet are recommended to be signed or otherwise designated as “No Parking Zones.” Signage is a low cost and effective tool, though too many signs along the roadway could impact the visual aesthetics of the canyon. Stakeholders prefer signage that indicates what users can do (e.g., parking allowed) as opposed to what they cannot do (e.g., no parking).

The goal of eliminating parking adjacent to the road in narrow areas is to maintain the roadway bench width to accommodate traveling cars and reduce pedestrian interactions with vehicular traffic in narrow areas. Approximately 100 spaces along the road have been identified for removal. In addition to posting signage, using boulders, wood logs, or other barrier types is recommended to discourage roadside parking. Additionally, to identify designated parking areas and direct traffic to parking, particularly where head-in parking is proposed off of the main road, the use of wood or other natural curb blocks is recommended.

Approximately 200 new or potentially expanded parking spaces have been identified to offset the reduction of the roadside parking. Additionally, stakeholders have indicated a desire to have a turnaround area at the most upstream parking lot near the Denver Water security gate. This turnaround area could be combined with a more formalized parking area.

The current parking recommendations identify previously disturbed areas and areas that could be modified through low-cost construction methods, such grading and reseeding. It is noted that the current parking

recommendations eliminate roadside parking along some relatively long reaches of road. During conceptual design, long reaches of road that do not have parking should be reviewed to determine if more costly construction methods should be used to create parking. These methods could include excavating into the cut slope of the road, rock blasting, creating driveways to areas off of the road, or other methods. Based on stakeholder input, a balance between removing parking areas while maintaining adequate access, especially at high use area, will ultimately be determined.

At Happy Meadows, there are many parking areas that are frequently used. During the thunderstorm season, some of the parking areas develop mud holes and become inaccessible. Grading the parking areas to provide proper drainage would help to alleviate this problem. Also, maintenance personnel have tried closing off parking areas using boulders, but the public has moved them and continue to drive closer to the river. For areas where the public has moved boulders for more access, post and cable fencing could be used to better delineate the parking areas and would be difficult to move.

The Map Book identifies the potential areas for parking expansion based on input from stakeholders, and **Appendix G** provides a table of existing parking, proposed parking for removal, and proposed new parking based on Map Book stationing.

3.1.3.2 Traffic Management

Several traffic management alternatives were discussed qualitatively among the stakeholders during the stakeholder workshop. These alternatives are intended to manage the traffic volumes better in Eleven Mile Canyon, increase safety, or decrease impacts on the environment. The alternatives that were reviewed and the initial conclusions of the stakeholders are described below.

Upper Road Closure

Closure of the upper section of Eleven Mile Canyon road to vehicular traffic was reviewed. Closing the road would allow users to hike or bike along the road to the upper reaches of the river. Denver Water would still need vehicular access to the dam, so maintenance of the road would have to continue. Based on the EA (USDA Forest Service, 1995), it is believed that closure of the upper reach of the road would not be acceptable to the general public. Any change to road operations on USFS land requires compliance with the NEPA process, which includes public involvement.

Shuttle Service

The parking expansion strategy could be integrated with a shuttle service on peak days to offset the difference between the demand and the available capacity. This approach would require the following:

- Tracking the number of vehicles in the canyon at the fee station.
- Closing the canyon to vehicular access after reaching the assigned capacity.
- Hiring a shuttle service and coordinating the days and times of operations to align with peak capacity periods.
- Reaching an agreement between the USFS and the concessionaire to ensure all parties have acceptable terms.
- Installing a gate at the Wagon Tongue Gulch Road entrance to the canyon if limiting access through traffic management strategies is implemented.

The lower parking lot near the fee station appears to have adequate room for expansion to accommodate carpool vehicles or a shuttle lot. The need for this additional capacity would typically be on summer weekends.

One-Way Road

A one-way road approach was reviewed, which would consist of allowing vehicles to drive upstream along the river and then exit Eleven Mile Canyon via Wagon Tongue Gulch Road. This approach would require significant improvements along Wagon Tongue Gulch Road and would eliminate the alternate entrance to, and exit from, the canyon (potential emergency access impacts). The stakeholders agreed that the needed improvements to Wagon Tongue Gulch Road to allow for passenger car usage would be too costly and this alternative was determined to not be practical.

3.1.4 Pedestrian Safety

The users along the corridor include fishermen, climbers, tubers, picnickers, campers, and sightseers. At the existing designated parking areas, there is evidence of social trails throughout the area. Along the length of the river, there is evidence of pedestrian trails from the road down to the river. While there is no way to prevent users from creating new paths, river access trails should be developed and clearly identified so that pedestrians are encouraged to follow established trails. This approach will allow vegetation to be reestablished, will decrease sediment input into the rivers, and establish safer pedestrian use areas in relation to vehicular traffic patterns. Other similar recreation areas have used boulders, logs, post and cable fencing, signs, and other means to identify old paths closed for revegetation and direct users to established trails.

Establishing formalized parking areas and formalized pedestrian trails at major destination areas is recommended to reduce the number of social trails in the corridor. These paths can be formalized with various approaches, which could include log boundaries, trails surfaced with aggregate or natural material, erosion protection components, signage, and other features.

3.1.5 Roadway Maintenance

Road maintenance should be conducted to accomplish the following:

- Provide safe access.
- Maintain adequate road cross slope so that drainage flows to the cut slope of the road and not into the river.
- Keep drainage systems clean and functional.
- Maintain the road to prevent sediment and road base material from entering the river or drainage systems.
- Minimize the impact on the environment, including protecting vegetative buffers and roadside vegetation.
- Manage washboards to allow for an adequate level of service on the roads. It is noted that the washboards help keep vehicle speeds lower than if the road is smooth.
- Bridges shall be maintained for safety, vehicle access, and conveyance of river flows.
- Appropriate road base material should be used when material is imported for road repair and maintenance.
- Roadside sediment berms should be avoided.

3.2 Drainage and Sediment Mitigation Recommended Solutions

A consistent problem throughout the corridor is sediment input into the river. Sediment is generated from many activities, including traffic impacts, pedestrian impacts, drainage off of the road and through culverts, and natural hillslope and riverine erosional processes. This section describes recommended solutions related to drainage and sediment mitigation.

3.2.1 Water Control

The following water control items are recommended.

Culvert Improvements–Recommended for all reaches within the study area, including within campgrounds and through connector roads. Culvert improvements fit into the following categories:

- New Culvert for Roadside Drainage–New culverts at locations of sags in the road where ponding is visible after a rain or snow melt event. These locations currently do not have culvert crossings.
- New Culvert for Drainage Basin–New culverts at locations where the road crosses a tributary to the South Platte River. These locations currently do not have culvert crossings.
- Maintenance of Existing Culvert–Sediment removal from existing culverts that are adequately sized to convey the design flow.
- Replace Damaged Culvert–Replacement of a culvert that is too damaged to be repaired or is completely clogged with sediment.
- Upsize Existing Culvert–Replacement of existing culvert with a larger diameter culvert to convey the design flow rate.

Culvert Outlet Protection–Recommended in locations where an existing or new culvert discharges to the South Platte River overbank with limited vegetative buffer or at existing locations where erosion is evident at the culvert outlet. Culvert outlet protection could include downspouts, soil riprap, riprap, turf reinforcement mat, and/or revegetation. Culvert outlet protection is shown in the Map Book as armoring.

Ditch Reconditioning–Modify the existing roadside ditch or create a new roadside ditch to convey flow to an existing cross culvert, proposed new culvert, existing retention pond, or proposed settling pond. In some locations, ditch reconditioning is recommended to repair major roadside erosion.

Localized Road Grading–Recommended in locations where runoff ponds along Eleven Mile Canyon and Happy Meadows roads, typically localized areas. Road grading is also recommended along campground roads, specifically the Springer Gulch campground, where rutting was observed and ponded water is visible after a rain or snow melt event.

3.2.2 Sediment Control

The following sediment control items are recommended and include options for control, capture, and removal of sediment.

Sediment Traps at Culverts–When sediment becomes mobile through various erosional processes and is being transported by the roadside ditches, sediment traps collect the sediment prior to the flow entering the road cross culvert. Sediment traps can be constructed in various ways, including depressed invert inlets, concrete basins, or other customizable features. Periodic sediment removal is required to allow the sediment traps to function appropriately. Sediment traps have been successfully installed and maintained as part of the Sugar Creek Sediment Mitigation Pilot Project. The Sugar Creek Sediment Mitigation Pilot Project has been collecting data from four sediment traps for the past 2 years. Douglas CR 67 is an existing gravel road that runs along Sugar Creek and contributes high levels of sediment to the creek, thereby impairing trout habitat. Using the data collected from the traps installed along CR 67, a predictive tool is being

developed that take into account variables such as contributing drainage area, contributing road length, road slope, drainage area aspect, and surrounding vegetation. This tool, which is based on actual field data, will allow more accurate estimates of the total volume of sediment that can be anticipated at a sediment trap location, provide the timing of sediment deposition in the traps based on typical hydrologic cycles, help optimize the placement location for future traps, estimate the size and type of trap recommended for proposed locations, and estimate sediment removal maintenance requirements.

Settling Ponds–Settling ponds are larger areas where drainage and runoff can be collected and managed to reduce sediment impacts to the river. Settling ponds are recommended at locations where Eleven Mile Canyon road crosses a significant tributary to the South Platte River. The tributary culvert crossings typically convey runoff and sediment from the tributaries and roadside ditches. Settling ponds are recommended in locations with wide overbanks and in place of sediment traps, because of the larger peak flow and total volume of flow and sediment from the tributary drainage.

Existing Fishing Ponds–Existing fishing ponds along Vermillion Creek and Crystal Creek within Sportsmen's Paradise act as detention ponds and allow for sediment to settle out before reaching the South Platte River. These fishing ponds should be maintained to prevent an overload of sediment accumulation.

Sediment Removal with a Vacuum Truck–Denver Water does not currently use a vacuum truck when cleaning culverts within Eleven Mile Canyon. A vacuum truck is also not being used for culvert maintenance within Happy Meadows or Sportsmen's Paradise. A vacuum truck could be used to remove sediment from roadway cross culverts, inlet catch basins, sediment traps, small sediment ponds, and other facilities that trap sediment. An advantage of using a vacuum truck is the truck can be operated by one person and does not require a dump truck to transport the material off site.

Excavation with Heavy Equipment–Excavation of sediment with heavy equipment is feasible if large amounts of sediment accumulate and need to be removed. Heavy equipment can also be used for sediment removal from culverts, sediment traps, and settling ponds if those facilities are design to accommodate the available maintenance equipment. Sediment removal can be accomplished with a backhoe, loader, excavator, or similar heavy equipment given adequate space to perform the maintenance activity. A downside of heavy equipment compared to a vacuum truck is the need for a dump truck and additional operators. However, larger volumes of sediment can be managed more efficiently with heavy equipment compared with a vacuum truck, which has less storage capacity.

Sediment Disposal Options–The Eleven Mile Canyon and Happy Meadows corridors are narrow, so disposal of large quantities of sediment within the corridors is unlikely. For this reason, it is anticipated that the majority of sediment collected and removed from the Eleven Mile Canyon and Happy Meadows corridors will need to be hauled off site. Sediment disposal within Sportsmen's Paradise is more feasible given the open areas farther away from the South Platte River. Denver Water currently places removed sediment at a stockpile area near the dam, then either uses the material when practical or transports the material out of the canyon.

At this time, there are no known commercial uses for the sediment. Other agencies removing sediment from the upper South Platte watershed may use the sediment for pipe trench material or other suitable purposes.

3.2.3 Slope Stabilization

These slope stabilization techniques are recommended in locations where major roadside erosion has been identified.

Hayman Fire Burn Area Slope Stabilization–Stabilization of the slopes and valleys within the Hayman fire burn area is a high priority because of increased runoff and sediment transport potential. The large sediment potential requires stabilization and sediment control within the watershed, as well as at the valley outlet to the South Platte River. Slope stabilization techniques include seed and mulch, tree felling, erosion

control products, slope interceptors, and other features. CUSP and USFA are leaders in post-fire hillslope restoration.

Pedestrian Rundown Locations–Existing pedestrian rundown locations can be hardened with soil riprap or one of the other identified slope stabilization techniques in combination with revegetation to reduce the sediment load to the South Platte River. Existing pedestrian rundown locations can also be formalized with stairs from the river and the road.

Turf Reinforcement Mat (TRM)–Similar to erosion control blanket, but more stout, TRM does not rely on the establishment of the underlying vegetation. TRM may be difficult to install in some locations because of the instability of the existing soils.

Soil Riprap and Riprap–Angular rock, with or without a soil mixture, can be used to stabilize banks, swales, and ditches. Soil riprap is often used in conjunction with an erosion control blanket or TRM and seeding/planting to reestablish vegetation. Soil riprap or riprap can also be used as culvert outlet protection.

Boulder Walls–Boulder or rock walls can be used adjacent to the road or the river to make up elevation differences, thereby creating a flatter slope for overbank areas, buffers, or areas with more established vegetation. The flatter slope behind the boulders reduces erosion potential and increases the potential for revegetation success.

Formalize Buffer–Vegetative buffers should be created in locations with limited buffer between the South Platte River and Eleven Mile Canyon road because these areas have a high potential for sediment to reach the river. This approach can be implemented by realigning the South Platte River to be farther away from Eleven Mile Canyon road or creating an overbank vegetated buffer area. In many locations, the limited buffer areas are on outside bends in the river, so realigning the river or creating the overbank buffer area may be difficult. The stakeholders understand that this type of work will require permits and has impacts to the river, but reducing sediment into the river is a primary concern and development of new buffer areas is a practical solution.

3.3 Environmental and Biological Recommended Solutions

3.3.1 Formalize Buffers

This symbol is used in locations where there is limited buffer between the road and the South Platte River. Formalizing a buffer includes either realigning the South Platte River to be farther away from the road or creating an overbank buffer area.

3.3.2 Weed Management

Weeds were found within the project area. Weeds should be managed to prevent the spread to other areas. Also, USFS weed management procedures should be followed for any heavy construction equipment that enters the site for construction to limit the spread of weeds and weed seed.

3.3.3 Flow Management

Denver Water, CPW, and others are currently managing flow releases from Eleven Mile Canyon Reservoir dam to better mimic the natural hydrologic cycle of spring runoff. By managing the flow releases, the fish reproduction and survival rates are increased. This cooperative approach should continue so that the fishery, aquatic habitat, and recreational opportunities are maximized.

3.3.4 Upland Restoration of Hayman Fire Hillslopes

The watershed areas that were burned by the Hayman fire remain unstable. Upland restoration should be considered to reestablish vegetation, stabilize soils, decrease runoff, and decrease impacts to the downstream valleys and the South Platte River.

3.4 Other Considerations

3.4.1 Trails and River Access

Formalizing trails within Eleven Mile Canyon and Happy Meadows adjacent to the South Platte River would provide river access at designated locations and discourage access at other locations. The trails could be created in conjunction with a formalized buffer or overbank adjacent to the river.

Trails adjacent to the river provide multiple benefits, such as reducing pedestrian traffic on Eleven Mile Canyon road, protecting existing vegetation by defining pedestrian access points to the river, and reducing the sediment load on the river from pedestrians accessing the river at non-designated locations. Hardened stairs should also be considered to allow safer and less erosive means for visitors to get to and from the river.

Existing pedestrian rundowns are locations where pedestrians are currently accessing the river and should be considered, in conjunction with parking, safety, and other factors, as locations for pedestrian stairs from the road to the river. The types of stairs to be considered include rock or boulder steps, metal steps, concrete interlocking blocks, soil cement, plastic steps, and others.

3.4.2 Pedestrian Bridges

Pedestrian bridges across the South Platte River in the study area have been discussed by the stakeholders. The only pedestrian bridge in the corridor is located at Station 268+00 in the Map Book. Additional pedestrian bridges could be installed to allow access to both sides of the river. However, impacts to the environment would need to be considered.

3.4.3 Dam Removal

The existing diversion dam at Station 469+00 in the Map Book is owned by Colorado Springs Utilities. The stakeholders have discussed the value in removing the dam to allow for fisheries connectivity. Removal of the dam could also allow for increased tubing areas. The ability to remove the dam is currently being investigated by Colorado Springs Utilities.

3.4.4 Upper Parking Area Stability

The uppermost parking area at Station 23+00 in the Map Book has had settlement issues, which results in potholes, mud, and sediment concern. It is unknown at this time whether the settlement is the result of poor soils, groundwater, or other factors, but it could be investigated and solutions could be determined to resolve the problems. If this parking area is converted into a turnaround and formalized parking area, this issue should be addressed during the design of those features.

3.4.5 Campground Relocation

The relocation of campgrounds was discussed by the stakeholders. The purpose of relocating campgrounds would be to decrease the impact on the river related to erosion, sediment input, and water quality impacts and to increase the usability and experience for fishing and other purposes along the river. Initial stakeholder feedback indicated that campground relocations have been considered but that adequate area and topography away from the river are very limited.

3.4.6 Eleven Mile Entrance Station

An improved entrance station is being planned and designed by the USFS. The improved station will allow for safer vehicle management at and near the entrance stations. It is anticipated that the station will be located between the inbound and outbound road lanes.

SECTION 4

Stakeholder Input

During review of the draft Assessment, stakeholders provided input on focus areas and items to consider as solutions to the problems are investigated further. Input was provided by the following:

- Denny Bohon, USFS
- Don Logelin, Cheyenne Mountain Chapter of Trout Unlimited
- David Leinweber, Angler's Covey

Appendix H contains the input provided by the stakeholders. Due to project funding and schedule constraints, stakeholder comments are to be reviewed with the stakeholders and addressed during the next phase of the project. The following section describes the potential next steps for the project.

SECTION 5

Next Steps

The following sections discuss the next steps for implementing the priority improvements.

5.1 Project Implementation

The following approaches are available for implementing the selected solutions:

- Convene the stakeholders to review the focus areas, discuss stakeholder comments, and select the preferred solutions.
- Further clarify the private land ownership boundaries near the Sportsmen's Paradise area, if needed.
- The USFS stated that the Federal Highway Administration is performing a safety assessment on Eleven Mile Canyon. Additional information from that study can be combined with this Assessment as proposed solutions are further refined.
- The USFS has indicated that it is interested in conducting a pilot project in the canyon, which could implement some of the selected solutions to develop lessons learned during design, permitting, construction, and monitoring that could be applied to a larger-scale project in the future.
- Use the Pilot Project to refine the proposed solutions and develop cost estimates for larger-scale improvements.
- Design and construction of larger-scale improvements to address the problems identified in this Assessment.

With each approach above, data collection, design, permitting, and other steps are needed. Design is needed for permitting, estimating the construction costs, and constructing the improvements. The level of detail for each design could be tailored to the construction approach, which may vary from the use of Denver Water, USFS, or county staff to an open public bid and contractor selection process. The level of design will also determine the types of data needed.

The design process will include detailed cost estimates for each project. Operations and maintenance costs can be estimated, once the project details are known. The cost estimates performed during design can build upon the unit costs in the Conceptual Solutions table and can include costs for mobilization, surveying, water control, and other construction components.

5.2 Anticipated Permitting Requirements

Based on the PSAs identified, it is expected that the following permits may be required for construction:

- National Environmental Policy Act (NEPA) analysis
- Biological Assessment/Biological Evaluation (BA/BE) as part of Section 7 consultation with USFWS
- Clean Water Act (CWA) Section 404 permit from the United States Army Corps of Engineers (USACE)
- Concurrence and permits from other agencies if the riparian vegetation is impacted
- Colorado Department of Public Health and Environment Stormwater Permit, Stormwater Management Plan (SWMP), and Groundwater Discharges permit
- Colorado Department of Public Health and Environment Air and Dust Control Permit if the disturbance area is large
- Other permits as determined to be needed during design

5.3 Future Data Needs

The following items are anticipated to be needed for design and/or permitting:

- 1-foot design topography
- Infrastructure information
- Utility locates
- Wetland and waters of the U.S. surveys for impacted areas to support Section 404 permitting
- Threatened and endangered species surveys
- Cultural and historic surveys
- Sediment production estimates, if needed, in order to set expectations related to sediment collection, removal, and maintenance activities

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Appendix A
GIS Map Book

105°28'35"W 105°28'30"W 105°28'25"W 105°28'20"W 105°28'15"W 105°28'10"W

38°54'25"N

38°54'20"N

38°54'15"N

Spillway Campground

South Platte River

Co Rd 358

Turn-around and Parking

Limit of Study Area

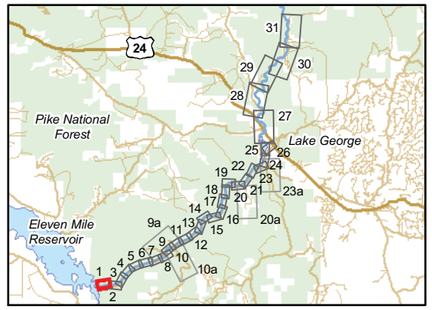
Security Gate

11 Mile Dam

10-00 15-00 20-00 25-00 30-00

105°28'35"W 105°28'30"W 105°28'25"W 105°28'20"W 105°28'15"W 105°28'10"W 105°28'5"W

Vicinity Map and Page Index



LEGEND

- Photo Locations
- Perennial Stream (NHD)
- Intermittent Stream (NHD)
- Ephemeral Stream (NHD)
- Trail
- Ponded Water On Road
- Retention Pond
- Major Roadside Erosion
- Pedestrian Rundown
- No Buffer Between Road and River
- Sediment Deposition
- New Sediment Trap
- New Culvert for Roadside Drainage
- New Culvert for Drainage Basin
- Maintenance of Existing Culvert
- Replace Damaged Culvert
- Upsize Existing Culvert
- Existing Culvert
- Culvert Outlet Protection
- Settling Pond
- Ditch Reconditioning
- Grading
- Road Widening
- Stabilization
- Roadway Cross Slope
- New Parking
- Remove Parking
- USFS/Private Ownership Boundary

0 100 200
Feet

N W E S

Photo 1
Start of Eleven Mile Road

Photo 2
Pedestrian Trail

Photo 3
Pedestrian Rundown to River

Photo 4
Limited Buffer Next to River

Photo 5
Wetland - Old Oxbow

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

Page 1

CH2MHILL

105°28'5"W 105°28'0"W 105°27'55"W 105°27'50"W 105°27'45"W 105°27'40"W

38°54'25"N

38°54'20"N

38°54'15"N

Co Rd 358

Idlewild Picnic Site

Bridge #1

South Platte River

30-00

35-00

40-00

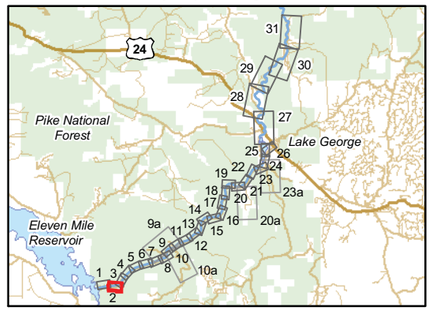
45-00

50-00

1 2 3 4 5

105°28'10"W 105°28'5"W 105°28'0"W 105°27'55"W 105°27'50"W 105°27'45"W 105°27'40"W

Vicinity Map and Page Index



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- Ephemeral Stream (NHD)
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- Road Widening
- Stabilization
- Roadway Cross Slope
- New Parking
- Remove Parking
- USFS/Private Ownership Boundary

0 100 200
Feet

N W E S

Photo 1
Approach to Bridge #1

Photo 2
Typical Roadway Section

Photo 3
Pedestrian Rundown to River

Photo 4
Intersection Approach

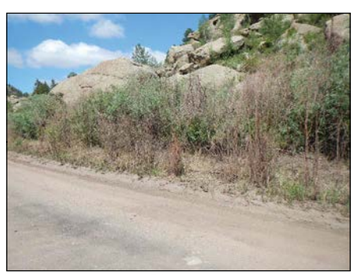

Photo 5
Willows - Upland Side of Road

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

38°54'25"N 105°27'50"W 38°54'30"N 105°27'45"W 38°54'40"N 105°27'40"W 38°54'45"N

Idlewild Picnic Site

Cove Campground

Co Rd 387

South Platte River

Bridge #2

50-00

55-00

60-00

65-00

70-00

17' approximate roadway width

1 2 3 4 5

105°27'50"W 38°54'20"N 105°27'45"W 105°27'40"W 38°54'25"N 105°27'35"W 38°54'30"N 105°27'30"W 38°54'35"N 105°27'25"W 38°54'40"N 105°27'35"W 38°54'45"N 105°27'30"W

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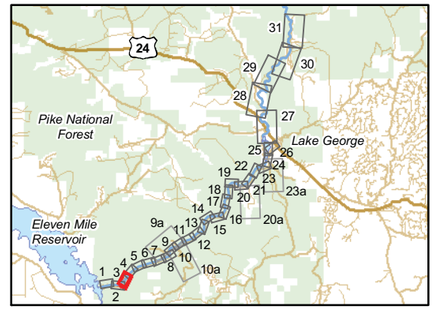

LEGEND

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Feet

N E S W

Photo 1
Intersection Signage

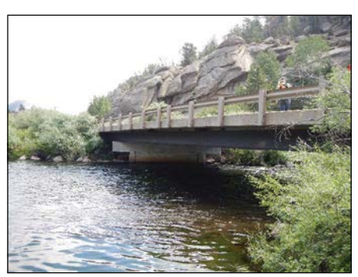


Photo 2
Bridge #2

Photo 3
Typical Pullout Area

Photo 4
Thin but Stable Riparian Edge

Photo 5
Sediment Deposition Location

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

105°27'40"W 38°54'45"N 105°27'35"W 38°54'50"N 105°27'30"W 105°27'25"W 105°27'20"W

38°54'40"N 105°27'35"W 38°54'35"N 105°27'30"W

105°27'15"W 38°54'55"N 105°27'10"W 38°54'50"N

17' approximate roadway width

17' approximate roadway width

Poor sight distance around curve

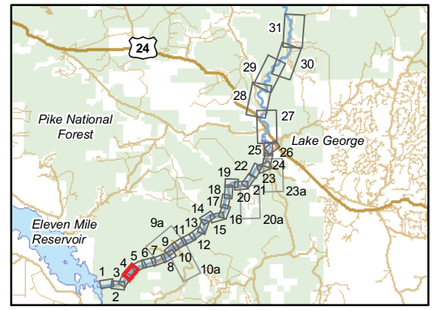
South Platte River

75-00 70-00 80-00 85-00 90-00

1 2 3 4 5

105°27'25"W 38°54'35"N 105°27'20"W 38°54'40"N 105°27'15"W 38°54'45"N 105°27'10"W

Vicinity Map and Page Index



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- Remove Parking
- USFS/Private Ownership Boundary

0 100 200
Feet

N E S W

Photo 1
Typical Pullout Area

Photo 2
Hillside Erosion

Photo 3
Steep Slope to River

Photo 4
Narrow Rock Cut Section

Photo 5
Old Rock Wall - Cultural Resource

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

105°27'20"W 38°55'0"N 105°27'15"W 105°27'10"W 105°27'5"W 38°55'5"N 105°27'0"W 105°26'55"W

38°54'55"N 38°54'50"N 105°27'15"W 38°54'45"N 105°27'10"W 105°27'5"W 105°27'0"W 38°54'50"N 105°26'55"W 105°26'50"W 105°26'45"W 38°55'5"N 38°55'0"N 105°26'45"W

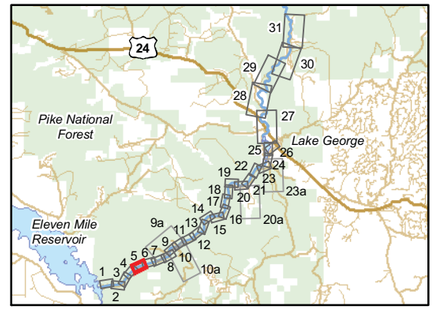
South Platte River

90-00 95-00 100-00 105-00 110-00

14' wide x 17' tall tunnel

14' wide x 17' tall tunnel

Vicinity Map and Page Index



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- Road Widening
- Stabilization
- Roadway Cross Slope
- New Parking
- Remove Parking
- USFS/Private Ownership Boundary

0 100 200 Feet

N W E S

Photo 1
Well Vegetated Along River Terrace

Photo 2
Culvert Outlet

Photo 3
Approach to Tunnel, Pullout

Photo 4
Existing Retention Pond

Photo 5
Steep Slope to River

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

105°26'55"W 105°26'50"W 105°26'45"W 105°26'40"W 105°26'35"W 105°26'30"W

38°55'5"N 105°26'25"W 38°55'10"N 38°55'0"N 105°26'55"W 38°55'15"N 38°54'55"N 38°55'0"N

105°26'50"W 105°26'45"W 105°26'40"W 38°54'55"N 105°26'35"W 105°26'30"W 105°26'25"W

South Platte River

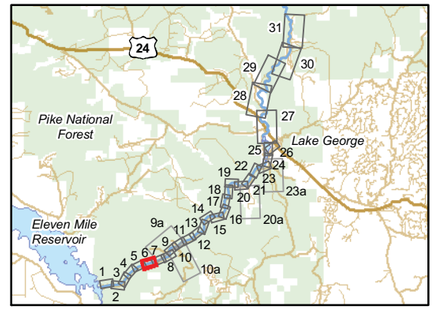
1 2 3 4 5

110-00 115-00 120-00 125-00 130-00

14' approximate roadway width

14' wide x 17' tall tunnel

Vicinity Map and Page Index



LEGEND

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- Perennial Stream (NHD)
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- Ephemeral Stream (NHD)
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- Retention Pond
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- Sediment Deposition
- New Sediment Trap
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- New Culvert for Drainage Basin
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- Existing Culvert
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- Roadway Cross Slope
- New Parking
- Remove Parking
- USFS/Private Ownership Boundary

0 100 200
Feet

N W E S

Photo 1
Car Parking in Pullout

Photo 2
Hillside Erosion

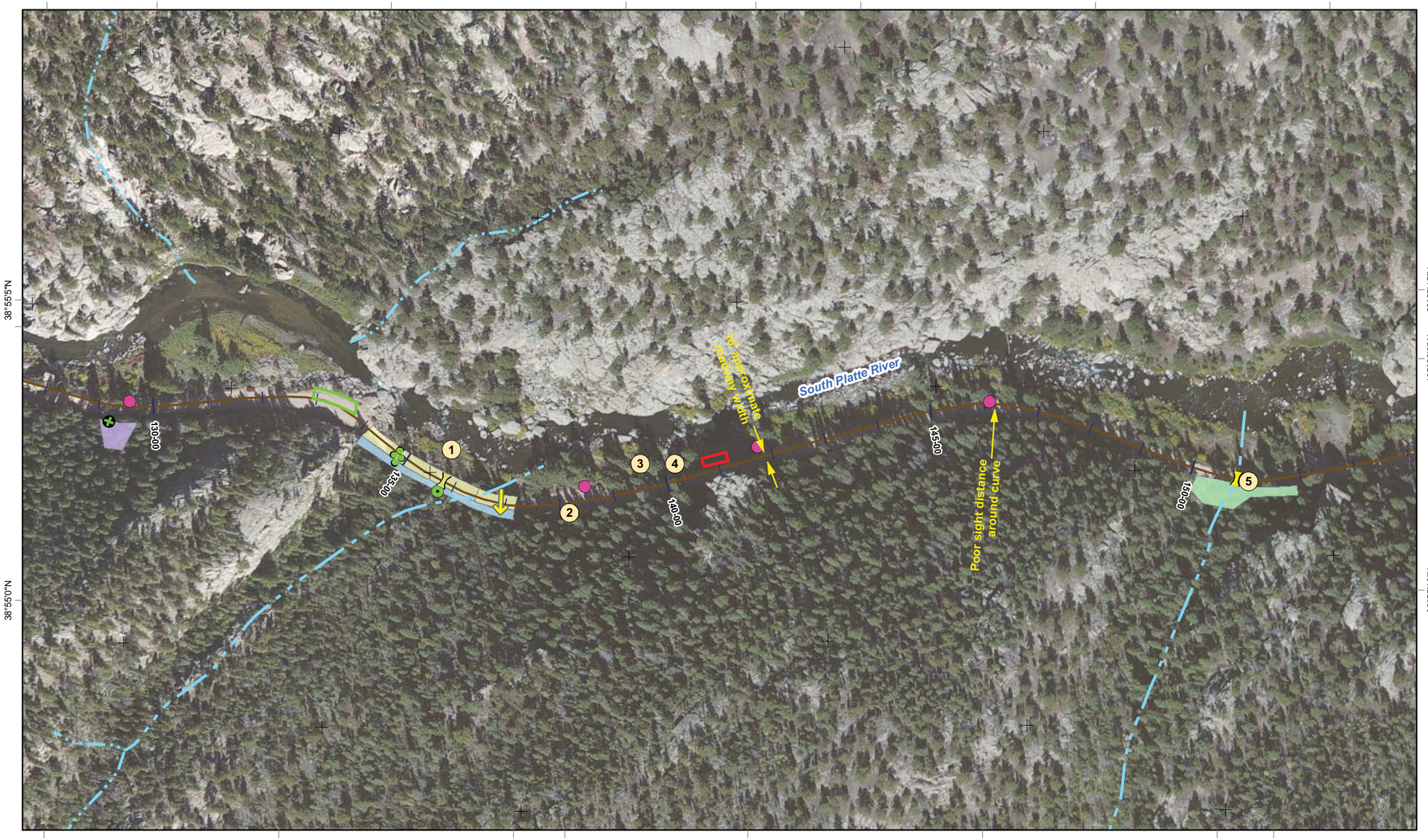
Photo 3
Rock Cut

Photo 4
Steep Slope to River

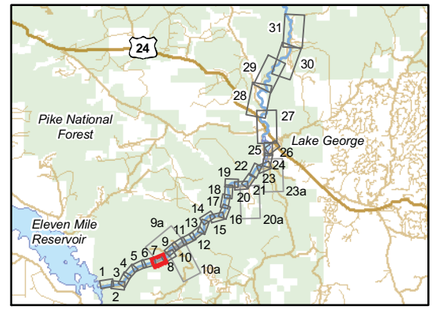
Photo 5
Wide Vegetated Buffer at Meander

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL



Vicinity Map and Page Index



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0 100 200
Feet

N W E S

Photo 1
Culvert Outlet

Photo 2
Wider Roadway Section

Photo 3
Representative Upland Hillslope

Photo 4
Limited Vegetation on Slope

Photo 5
Drainage Rundown

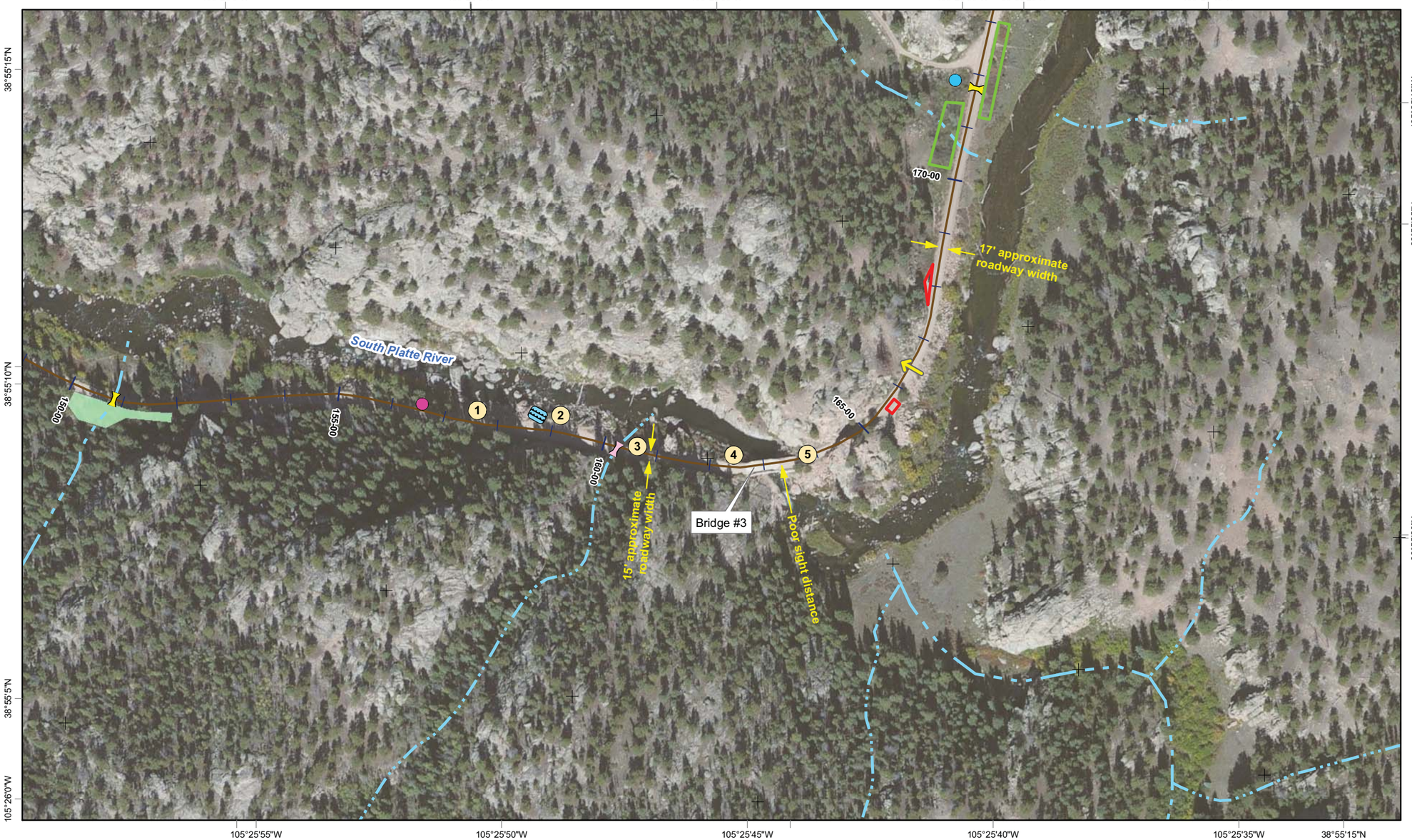
Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

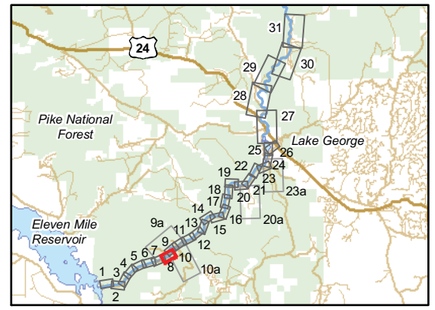
105°26'5"W 105°26'0"W 105°25'55"W 105°25'50"W 38°55'25"N 105°25'45"W

38°55'15"N 38°55'10"N 105°26'0"W 38°55'5"N 105°25'40"W 38°55'25"N 38°55'20"N

105°25'55"W 105°25'50"W 105°25'45"W 105°25'40"W 105°25'35"W 38°55'15"N



Vicinity Map and Page Index



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0 100 200
Feet

N W E S

Photo 1
Popular Mountain Climbing Location

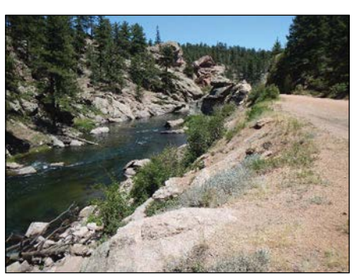


Photo 2
Sparsely Vegetated Buffer

Photo 3
Smaller Rock Cut Section

Photo 4
Bridge #3

Photo 5
Large Rock Cut near Curve

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

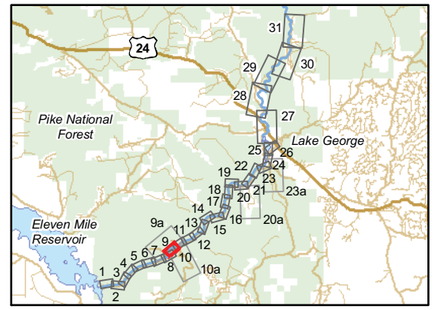
CH2MHILL

105°26'0"W 105°25'55"W 105°25'50"W 38°55'35"N 105°25'45"W 105°25'40"W

38°55'25"N 38°55'20"N 38°55'15"N 105°25'35"W 105°25'30"W 105°25'25"W

Co Rd 364
Co Rd 366
South Platte River
U.S. Forest Service
Private
Bridge #4
180-00
185-00
190-00
195-00
175-00
170-00
165-00
17' approximate roadway width

Vicinity Map and Page Index



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- Roadway Cross Slope
- New Parking
- Remove Parking
- USFS/Private Ownership Boundary

0 100 200
Feet

N W E S

Photo 1
Typical Side Road

Photo 2
Culvert Outlet

Photo 3
Roadway Drainage

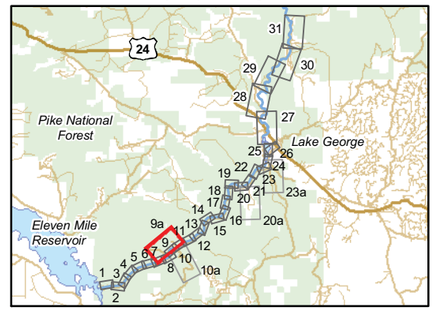
Photo 4
Nice Backwater Habitat

Photo 5
Approach to Road Intersection

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

Vicinity Map and Page Index



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- New Parking
- Remove Parking
- USFS/Private Ownership Boundary

0 100200 400 600
Feet

N W E S

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

Page 9a

CH2MHILL

105°25'40"W 105°25'35"W 105°25'30"W 105°25'25"W 105°25'20"W

38°55'35"N 38°55'30"N 105°25'35"W

105°25'15"W 38°55'50"N 38°55'45"N 38°55'40"N

Co Rd 366

U.S. Forest Service

Private

South Platte River

Bridge #4

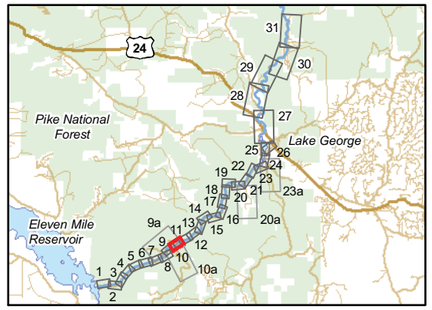
Co Rd 393

205-00 210-00 215-00 195-00

1 2 3 4 5

105°25'30"W 105°25'25"W 105°25'20"W 105°25'15"W 105°25'10"W

Vicinity Map and Page Index



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- Stabilization
- Roadway Cross Slope
- New Parking
- Remove Parking
- USFS/Private Ownership Boundary

0 100 200
Feet

N W E S

Photo 1
Bridge #4

Photo 2
Potential Water of the U.S.

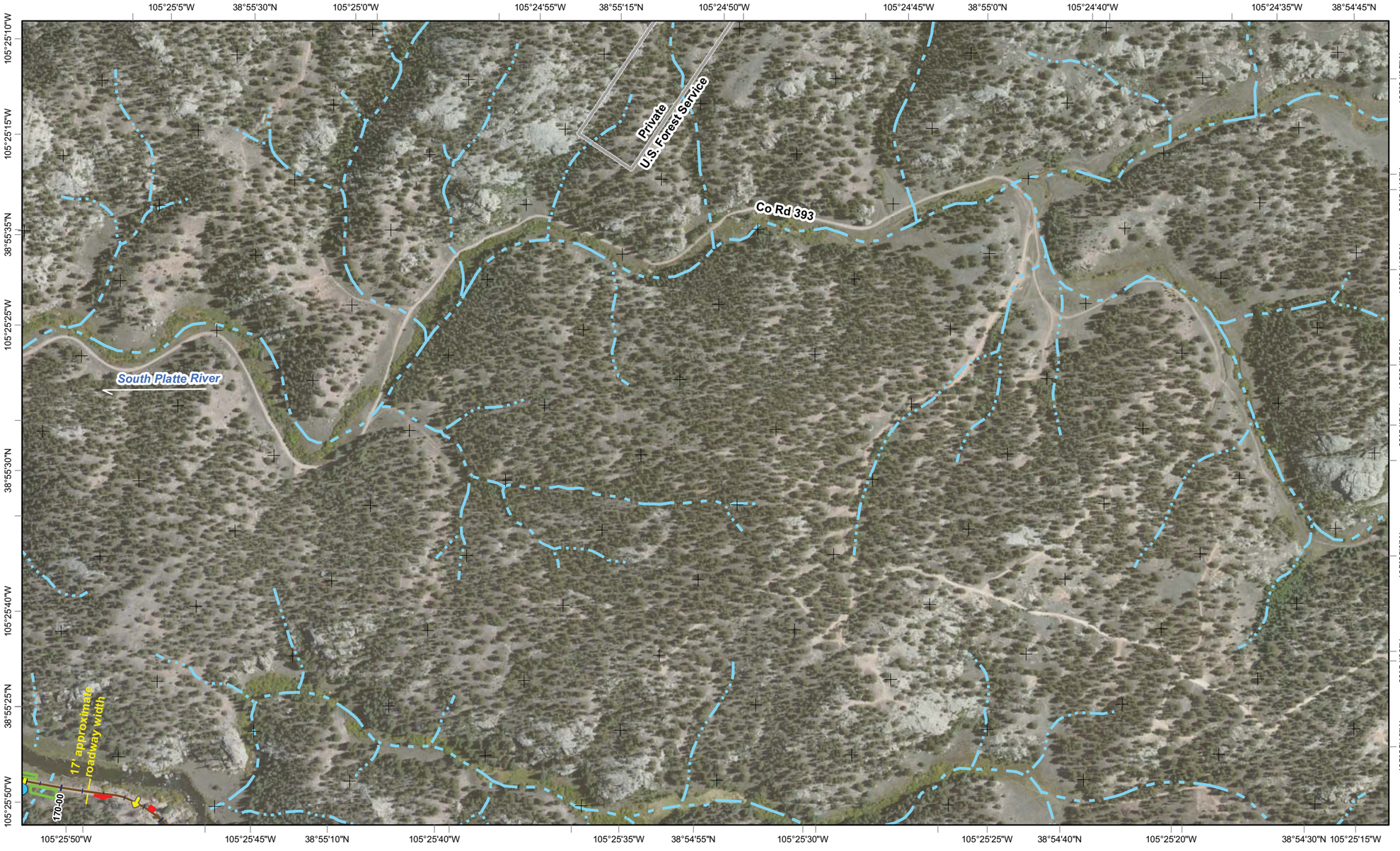
Photo 3
Wagon Tongue Gulch Road

Photo 4
Rundown Location

Photo 5
Pedestrian Rundown to River

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL



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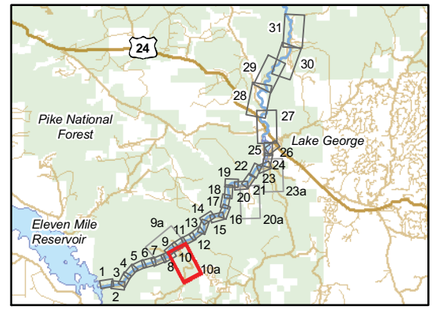

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0 100200 400 600
Feet

N E S W

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

Page 10a

CH2MHILL

105°25'20"W 38°55'50"N 105°25'15"W 105°25'10"W 105°25'5"W 105°25'0"W 105°24'55"W 38°56'0"N

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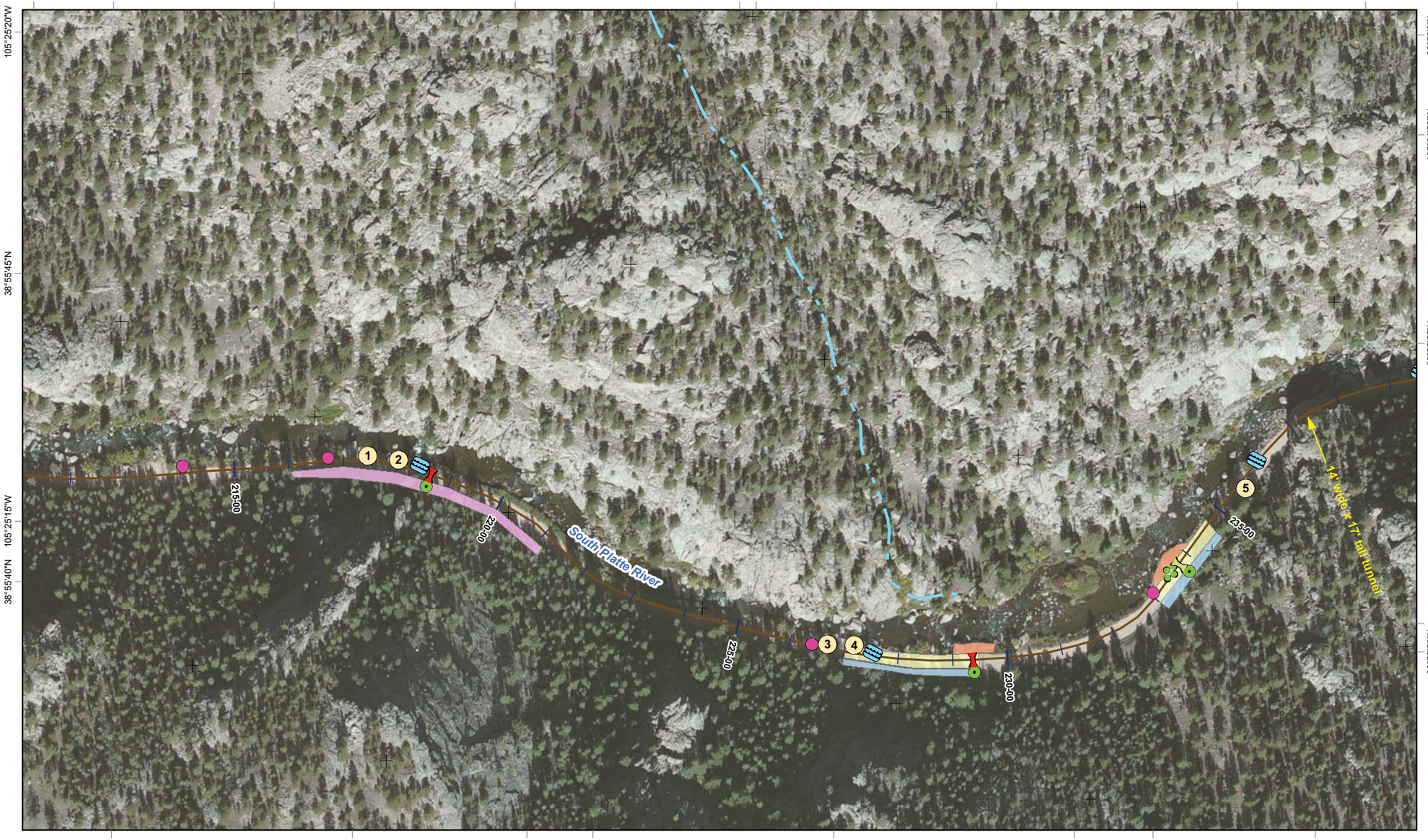

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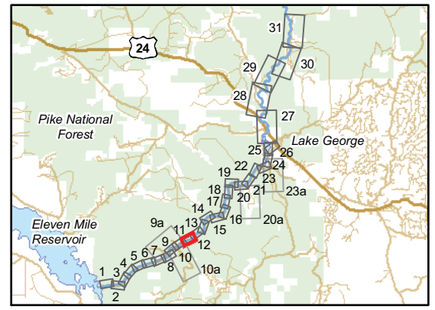
Vicinity Map and Page Index



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0 100 200
Feet

N W E S

Photo 1
Limited Buffer Next to River

Photo 2
Nice Willow/Alder Riparian Border

Photo 3
Limited Buffer Next to River

Photo 4
Typical Roadway Section

Photo 5
Typical Wider Roadway Section

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

105°25'0"W
105°24'55"W
105°24'50"W
38°56'5"N
105°24'45"W
105°24'40"W
38°56'10"N
105°24'35"W
38°55'55"N
105°24'30"W
38°55'50"N
105°24'25"W
38°56'0"N
105°24'45"W
38°55'50"N
105°24'40"W
105°24'35"W
38°55'55"N
105°24'30"W

South Platte River

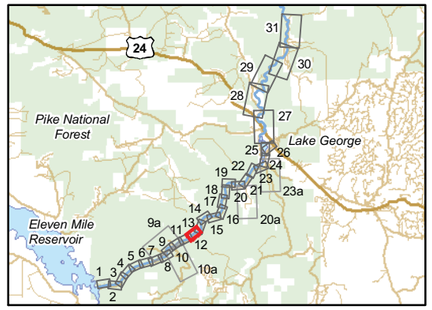
Messenger Gulch
Picnic Site

270-00
245-00
250-00
235-00
225-00

14' wide x 17' tall tunnel

1
2
3
4
5

Vicinity Map and Page Index



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0 100 200
Feet

N
E
S
W

Photo 1
Culvert Blocked with Sediment

Photo 2
Narrow Tunnel

Photo 3
Pullout Intersection

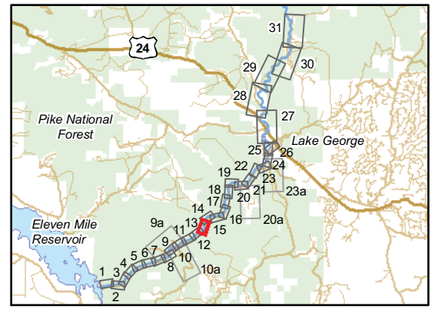
Photo 4
Trees Within Clear Zone

Photo 5
Hillside Erosion

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

Vicinity Map and Page Index



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0 100 200
Feet

N
S
E

Photo 1
Noxious Weeds - Toadflax/Thistle

Photo 2
Pedestrian Rundown to River

Photo 3
Typical Washboard Surface

Photo 4
Pedestrian Bridge Parking

Photo 5
Culvert Blocked with Sediment

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

105°24'30"W 105°24'25"W 105°24'20"W 105°24'15"W 105°24'10"W

38°56'25"N 38°56'40"N

105°24'30"W 105°24'45"W

38°56'20"N 38°56'35"N

105°24'25"W 105°24'40"W

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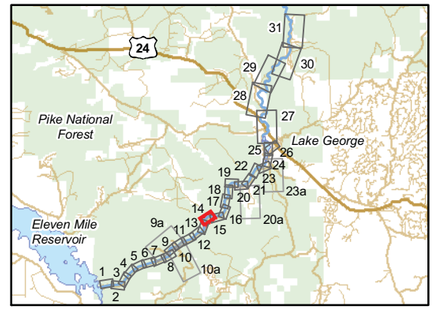
105°24'20"W 105°24'15"W 105°24'10"W 105°24'5"W 105°24'0"W

Vicinity Map and Page Index



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0 100 200
Feet

N W E S

Photo 1
Typical Cut Slope Near Curve

Photo 2
Banks Too Steep to Support Vegetation

Photo 3
Bridge #5

Photo 4
Limited Vegetation on Slope

Photo 5
Pullout Near Narrow Rock Cut

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

105°24'5"W 105°24'0"W 105°23'55"W 105°23'50"W 105°23'45"W 105°23'40"W

38°56'30"N 38°56'25"N 38°56'20"N

300-00 305-00 310-00 315-00 320-00

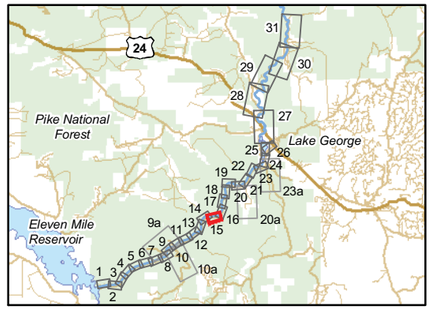
South Platte River

1 2 3 4 5

38°56'35"N 38°56'30"N

105°24'0"W 105°23'55"W 105°23'50"W 105°23'45"W 105°23'40"W 105°23'35"W

Vicinity Map and Page Index



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0 100 200
Feet

N W E S

Photo 1
Typical Washboard Surface

Photo 2
Culvert Outlet to River

Photo 3
Pedestrian Rundown to River

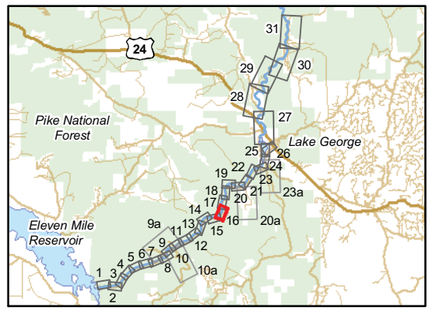
Photo 4
Willow Growth in Armored Bank

Photo 5
Typical Rock Cut Near Curve

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

Vicinity Map and Page Index



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0 100 200
Feet

N E S

Photo 1
Culvert Blocked with Sediment

Photo 2
Typical Washboard Surface

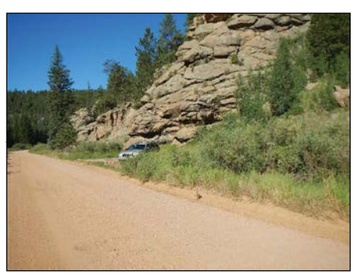


Photo 3
Vegetation Near Pulloffs

Photo 4
Wetland - Old Oxbow

Photo 5
Pedestrian Rundown to River

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

38°56'50"N 38°56'55"N 38°57'0"N 38°57'5"N 38°57'10"N

105°23'40"W 105°23'35"W 105°23'30"W 105°23'25"W 105°23'20"W

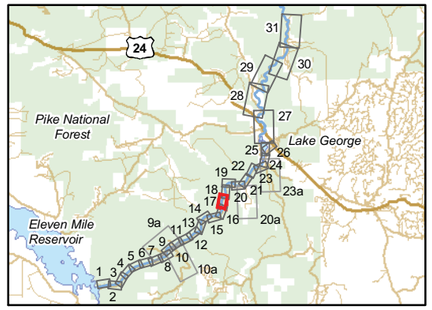
340-00 345-00 350-00 355-00 360-00

South Platte River

Bridge #6

1 2 3 4 5

Vicinity Map and Page Index



LEGEND

- Photo Locations
- Perennial Stream (NHD)
- Intermittent Stream (NHD)
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- Retention Pond
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- Settling Pond
- Ditch Reconditioning
- Grading
- Road Widening
- Stabilization
- Roadway Cross Slope
- New Parking
- Remove Parking
- USFS/Private Ownership Boundary

0 100 200
Feet

N S E

Photo 1
Roadside Buffer

Photo 2
Roadway Drainage

Photo 3
Rundown Location

Photo 4
Typical Loose Cut Slope

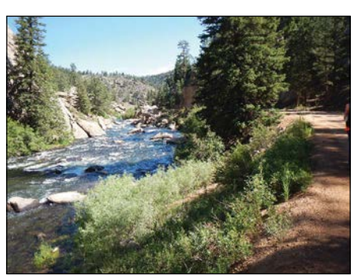

Photo 5
New Willow Growth in Depositional Area

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

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105°23'30"W 105°23'25"W 105°23'20"W 105°23'15"W

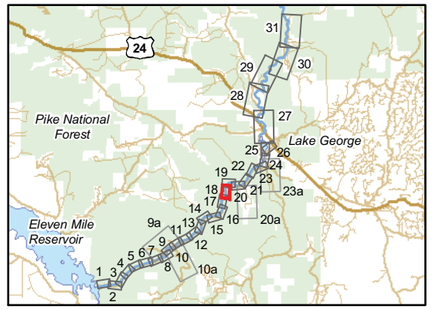
South Platte River

O'Brien Gulch Picnic Site

390-00 365-00 370-00 375-00 380-00 385-00

1 2 3 4

Vicinity Map and Page Index



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- Remove Parking
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0 100 200
Feet

W N S E

Photo 1
Pedestrian Access Location

Photo 2
Typical Road Shoulder Drop

Photo 3
Typical Road Shoulder Drop

Photo 4
Pedestrian Access Vegetation Impacts

Photo 5
Roadway Drainage

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

105°23'30"W 105°23'25"W 105°23'20"W 105°23'15"W 105°23'10"W 105°23'5"W 105°23'0"W

38°57'40"N

38°57'35"N

38°57'30"N

U.S. Forest Service

Private

South Platte River

O'Brien Gulch
Picnic Site

395-00

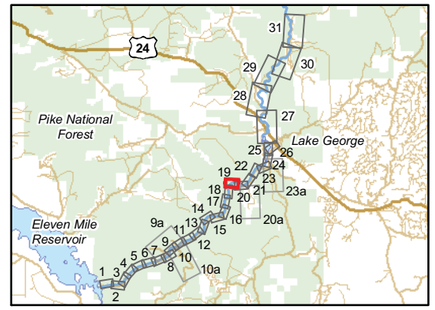
395-00

395-00

400-00

1 2 3 4 5

Vicinity Map and Page Index



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- Remove Parking
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0 100 200
Feet

N W E S

Photo 1
Washboarded Surface

Photo 2
Wetland Meadow

Photo 3
Fenceline Adjacent to Roadway

Photo 4
Buffer Between River and Road

Photo 5
Roadway Drainage

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

Page 19

105°23'5"W
105°23'0"W
105°22'55"W
105°22'50"W
105°22'45"W
105°22'40"W
38°57'35"N
38°57'30"N
38°57'25"N

U.S. Forest Service
Private
South Platte River
Private
U.S. Forest Service
Road to Camp Alexander
395-00
400-00
410-00
415-00
420-00
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2
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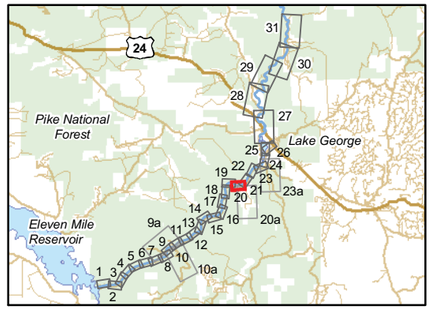
4
5

Vicinity Map and Page Index



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0 100 200
Feet

N
W E
S

Photo 1
Typical Cut Slope

Photo 2
Wetland - Old Oxbow

Photo 3
Culvert Outlet to River

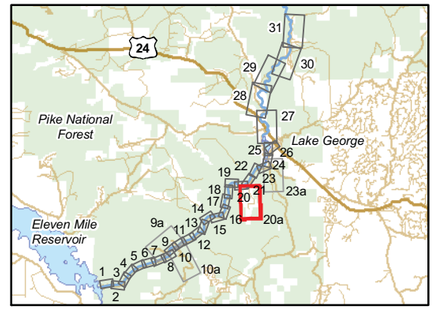
Photo 4
Potential Water of the U.S.

Photo 5
Boy Scout Intersection

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

Vicinity Map and Page Index



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0 100200 400 600
Feet

W S N E

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

Page 20a

CH2MHILL

105°22'50"W 105°22'45"W 38°57'45"N 105°22'40"W 38°57'50"N 105°22'35"W

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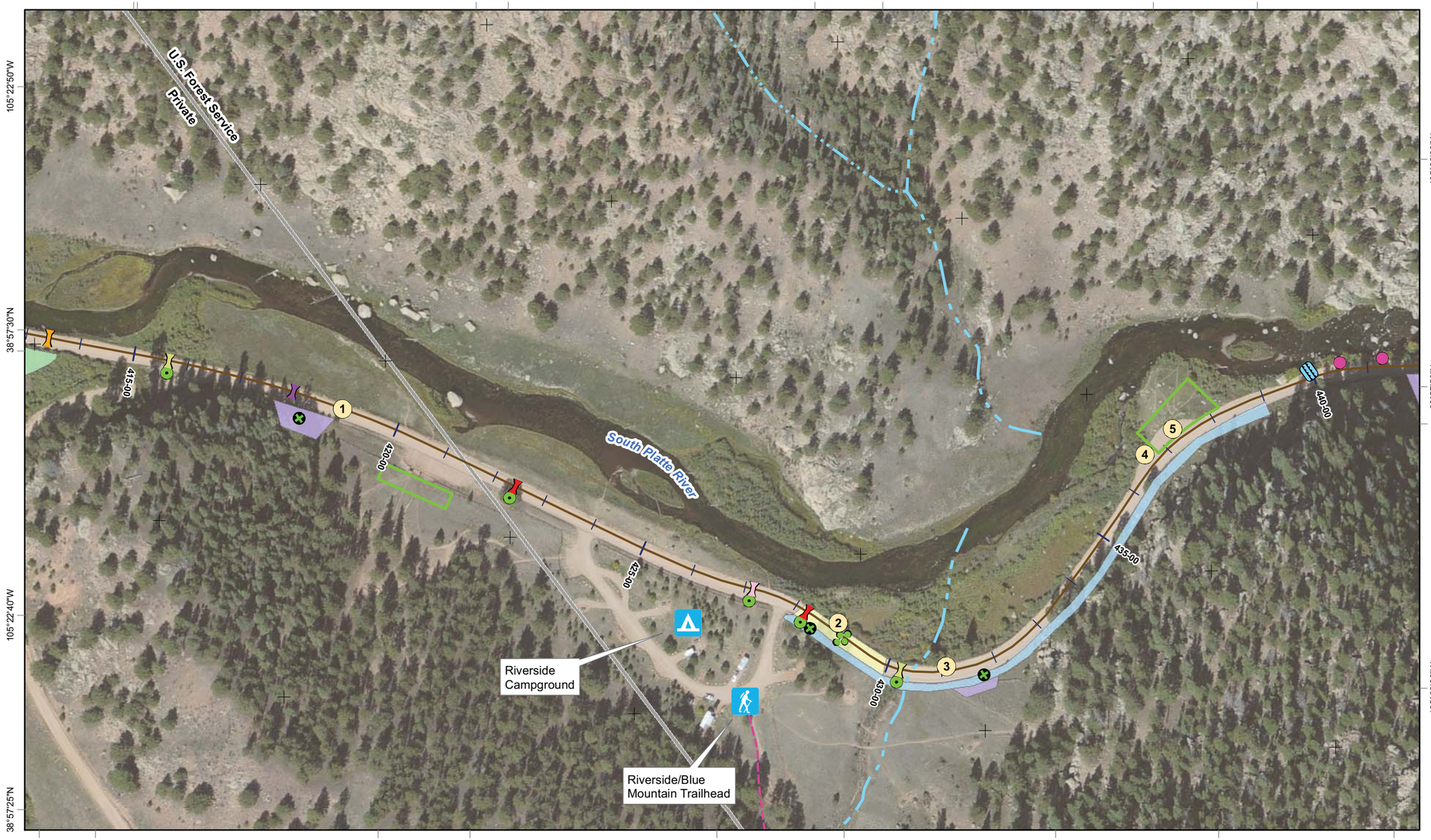

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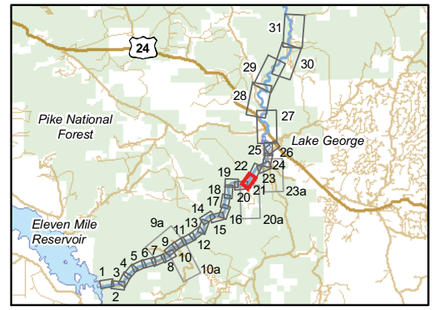
Vicinity Map and Page Index



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0 100 200
Feet

N W E S

Photo 1
Shoulder with Loose Sediment

Photo 2
Roadway Drainage

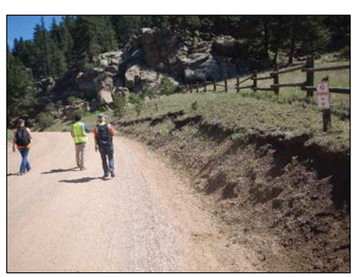


Photo 3
Cut Slope Near Campground

Photo 4
Boulders Used as Parking Limit

Photo 5
Typical Pullout Area

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

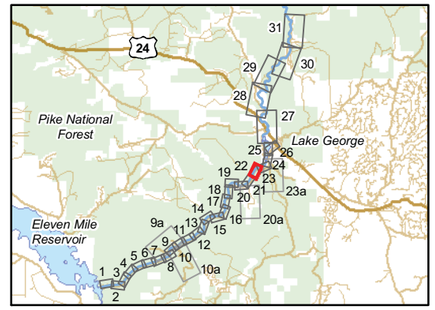
105°22'30"W
38°58'0"N
105°22'25"W
38°58'5"N
38°58'10"N
105°22'20"W
38°57'50"N
105°22'30"W
105°22'25"W
38°57'45"N
105°22'15"W
38°57'50"N
105°22'10"W
38°57'55"N
38°58'0"N
105°22'5"W
38°58'5"N
105°22'15"W
38°58'10"N
105°22'10"W
105°22'5"W

South Platte River

440-00
445-00
450-00
455-00
460-00
465-00

1
2
3
4
5

Vicinity Map and Page Index



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0 100 200
Feet

N E S W

Photo 1
Old Rock Wall - Cultural Resource

Photo 2
No Buffer Next to River

Photo 3
Limited Vegetation on Slope

Photo 4
Steep Slope to River

Photo 5
Curve with Vegetated Slope

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

105°22'10"W 105°22'5"W 105°22'0"W 105°21'55"W 105°21'50"W 105°21'45"W

38°58'5"N 38°58'0"N 105°22'10"W 38°57'55"N

38°58'15"N 38°58'10"N 105°21'40"W 38°58'5"N

Private

U.S. Forest Service

South Platte River

Eleven Mile Canyon Rd

Co Rd 423

Diversion Dam

Potential Parking Lot and Shuttle Location

Eleven Mile Canyon Fee Station

Limit of Study Area

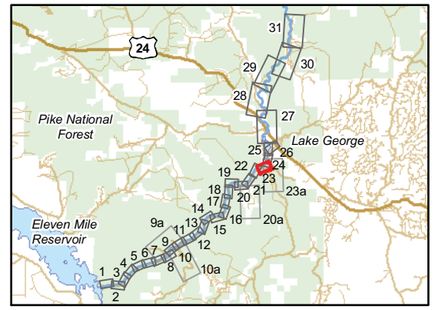
Blue Mountain Rd

460-00 465-00 470-00 475-00 480-00 485-00 490-00

1 2 3 4 5

105°22'5"W 38°57'55"N 105°22'0"W 105°21'55"W 105°21'50"W 38°58'0"N 105°21'45"W 105°21'40"W

Vicinity Map and Page Index



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0 100 200
Feet

N W E S

Photo 1
Banks Too Steep to Support Vegetation

Photo 2
Hillside Erosion

Photo 3
Diversion Dam

Photo 4
Large PEM Wetland Complex

Photo 5
Entrance Gate Fee Station

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

38°58'10"N 38°58'15"N 38°58'20"N 38°58'25"N 38°58'30"N

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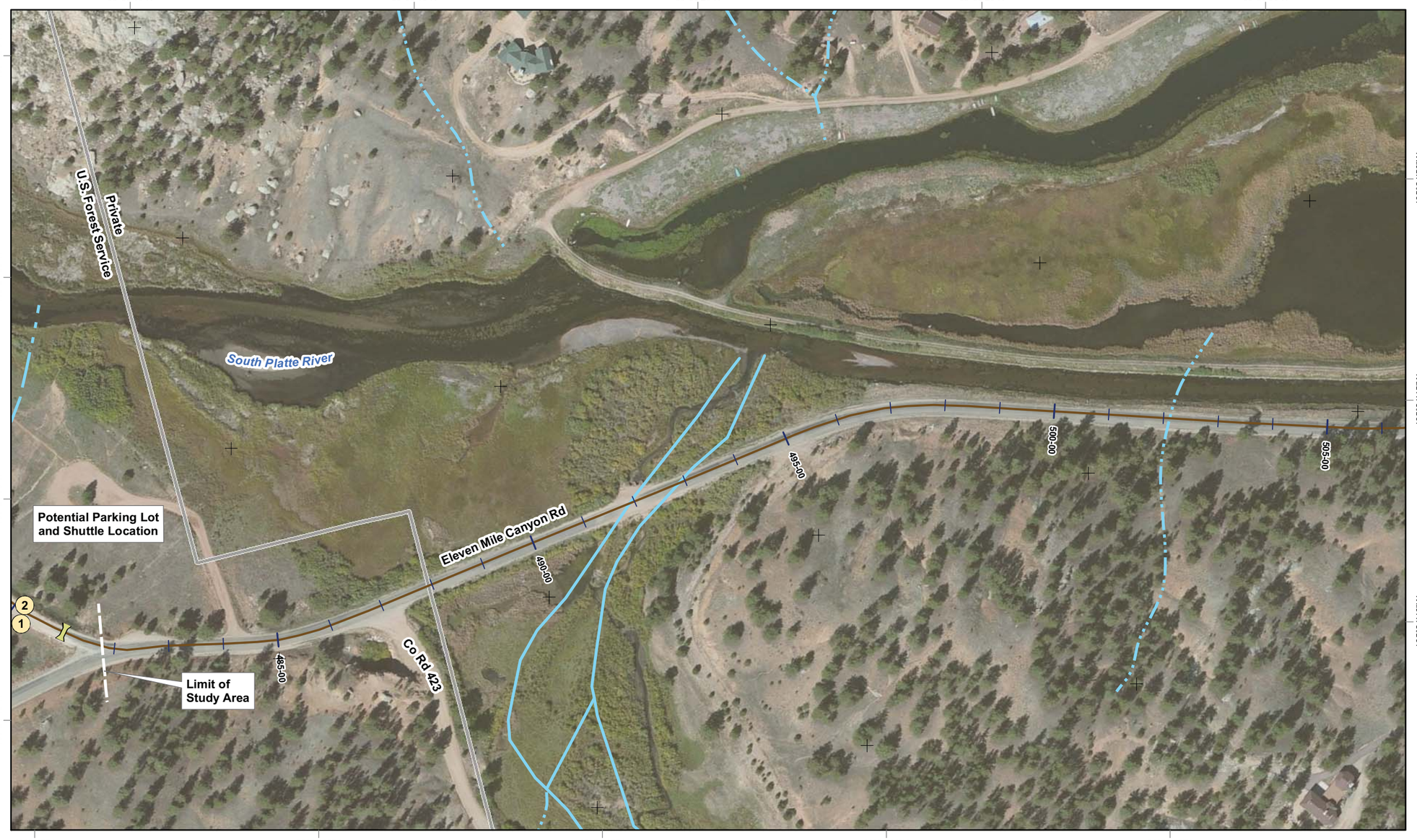
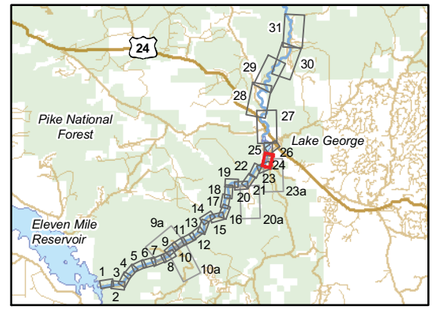


38°58'5"N 38°58'10"N 38°58'15"N 38°58'20"N 38°58'25"N

Vicinity Map and Page Index



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0 100 200
Feet

N W E S

Photo 1
Culvert Rundown

Photo 2
Culvert Rundown

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

W:\483467 CUSP 11 Mile Assessment\GIS\MapFiles\Photos_Map_MapBook_picTest2.mxd lheyerda 2/27/2015

CH2MHILL

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105°21'55"W 105°21'50"W 105°21'45"W 105°21'40"W 105°21'35"W 105°21'30"W 105°21'25"W 105°21'20"W 105°21'15"W 105°21'10"W

Hard Rock Interpretive & Blue Mountain Riverside Trailhead

Blue Mountain Campground

Blue Mountain Rd

Eleven Mile Canyon Fee Station

South Platte River

Eleven Mile Canyon Rd

475-00

480-00

485-00

490-00

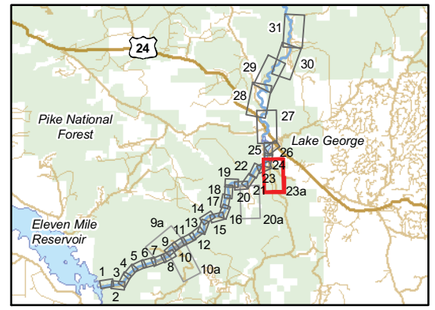
495-00

U.S. Forest Service

Private

Co Rd 423

Vicinity Map and Page Index



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0 100200 400 600
Feet

W S N E

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

Page 24a

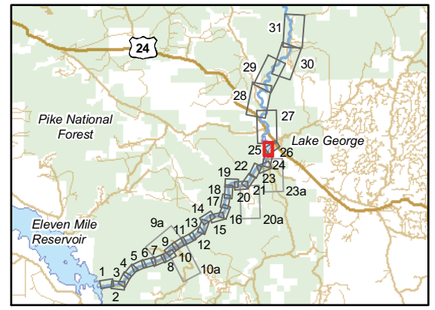
38°58'30"N 38°58'35"N 38°58'40"N 38°58'45"N 38°58'50"N

105°21'55"W 105°21'50"W 105°21'45"W 105°21'40"W

Lake George

505-00 510-00 515-00

Vicinity Map and Page Index



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0 100 200
Feet

W S N E

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

Page 25

105°21'50"W 38°58'45"N 105°21'45"W 105°21'40"W 105°21'35"W 105°21'30"W

38°58'40"N
105°21'50"W
38°58'35"N
105°21'45"W
38°58'30"N

38°58'55"N
105°21'25"W
38°58'50"N
105°21'20"W
38°58'45"N

Lake George

24

515-00
520-00
525-00
530-00
535-00

38°58'30"N 105°21'40"W 105°21'35"W 38°58'35"N 105°21'30"W 105°21'25"W 105°21'20"W

Vicinity Map and Page Index

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0 100 200
Feet

N W E S

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

Page 26

38°58'55"N 38°59'0"N 38°59'5"N 38°59'10"N 38°59'15"N 38°59'20"N 38°59'25"N 38°59'30"N 38°59'35"N 38°59'40"N 38°59'45"N 38°59'50"N

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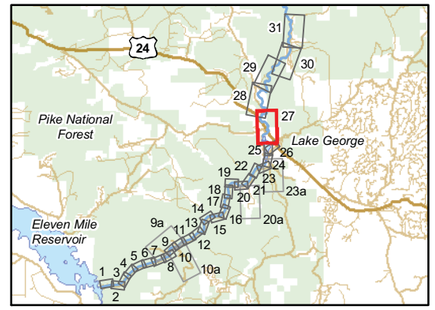
Vicinity Map and Page Index



LEGEND

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- New Culvert for Drainage Basin
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- Replace Damaged Culvert
- Upsize Existing Culvert
- Existing Culvert
- Culvert Outlet Protection
- Settling Pond
- Ditch Reconditioning
- Grading
- Road Widening
- Stabilization
- Roadway Cross Slope
- New Parking
- Remove Parking
- USFS/Private Ownership Boundary

0 100200 400 600
Feet

W S N E

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

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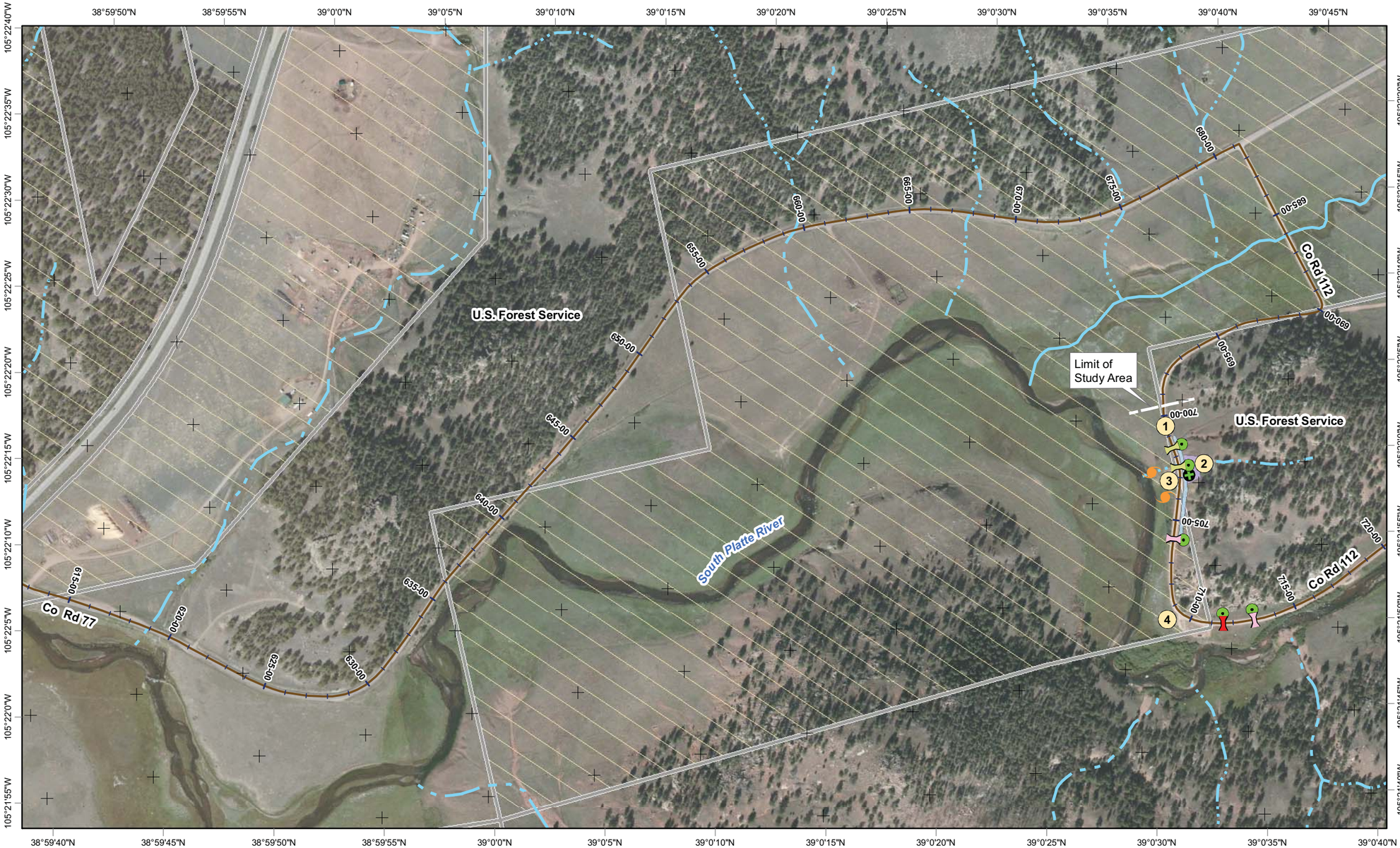
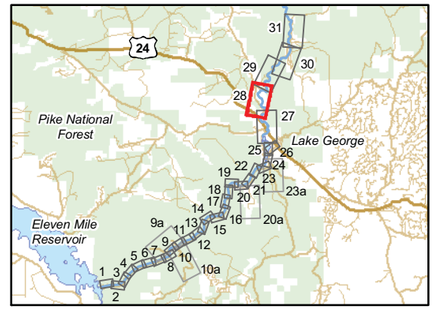


Vicinity Map and Page Index



LEGEND

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Feet

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Photo 1
Woody Vegetation Returns at Boundary

Photo 2
Hillside Drainage Erosion

Photo 3
Sediment Deposition

Photo 4
Information Sign

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

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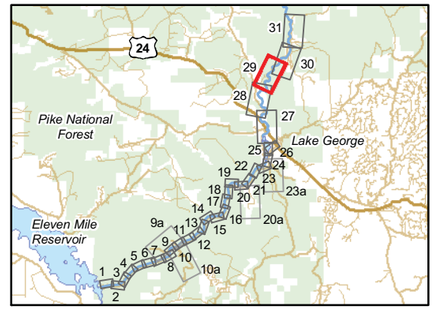
Vicinity Map and Page Index



LEGEND

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0 100200 400 600
Feet

N NE E S

Photo 1
Lack of Woody Riparian Buffer

Photo 2
Typical Road Section

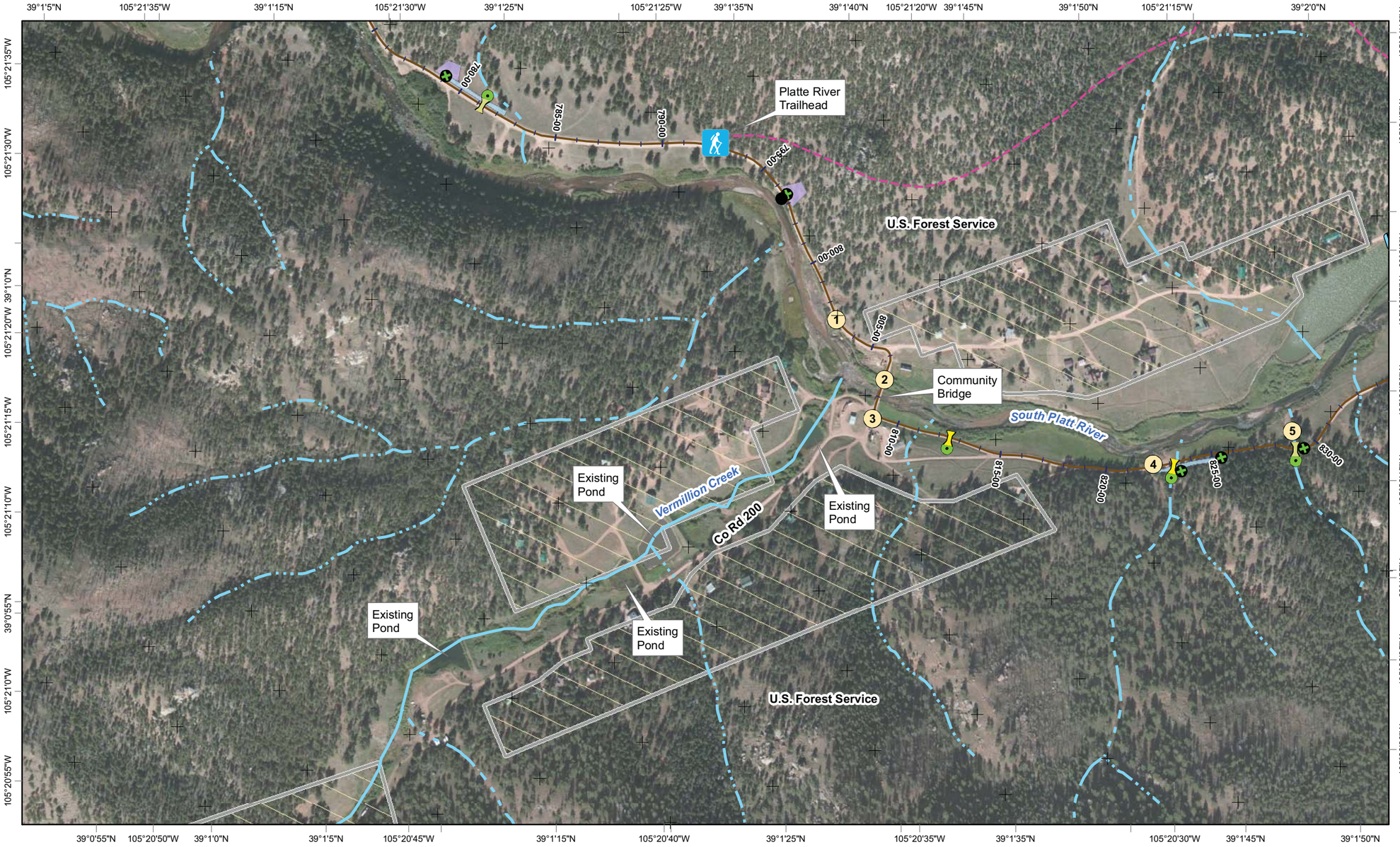
Photo 3
Culvert Outlet to River

Photo 4
Campground Signage

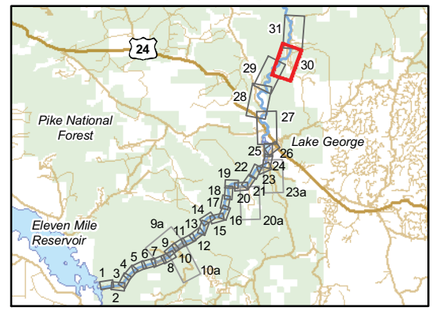
Photo 5
Hillside Erosion

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL



Vicinity Map and Page Index



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- New Parking
- Remove Parking
- USFS/Private (hatched) Ownership Boundary

0 100200 400 600
Feet

N E S W

Photo 1
Instream Woody Structures

Photo 2
Happy Meadows Community Bridge

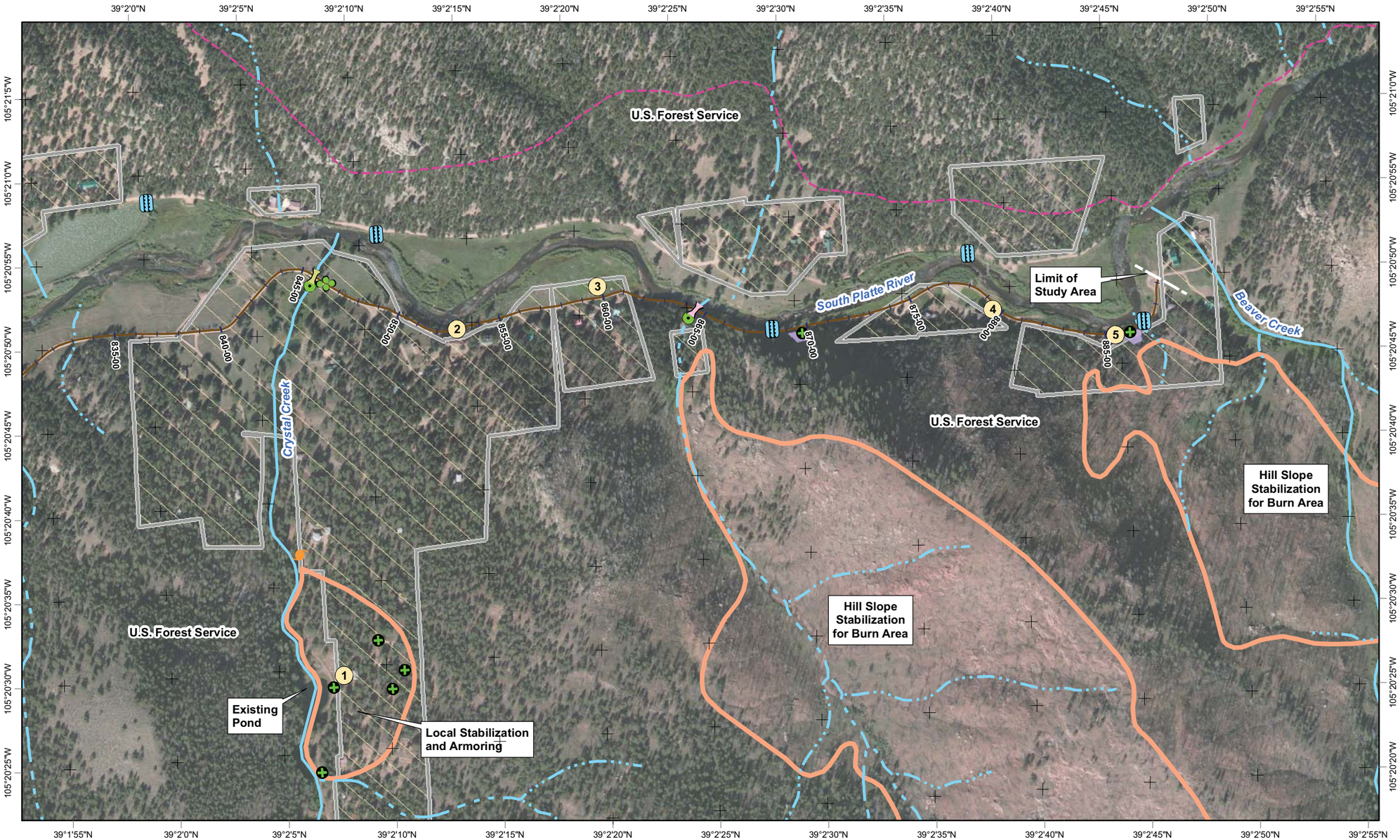
Photo 3
Manicured Lawn

Photo 4
Hillside Drainage

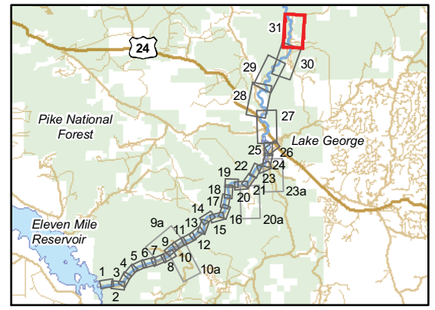
Photo 5
Drainage with Erosion

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL



Vicinity Map and Page Index



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0 100200 400 600
Feet

W E S N

Photo 1
Typical Narrow Roadway Section

Photo 2
Roadside Erosion Protection

Photo 3
Typical Cut Slope

Photo 4
Roadway Drainage

Photo 5
Typical Driveway Intersection

Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

Appendix B
USFS Roadway Data

DL Road Feature Log

ID: 96 **Name:** ELEVENMILE CANYON **BMP:** 0 **EMP:** 9.5

BMP	EMP	Feature Type - Category (material)	Size	Status	Location	Admin Org	Remarks
0.8		Sign - Guide (hdo plywood)		Existing - Active	Left	021210	Directional sign "Riverside C.G., Springer Gulch C. G., Camp Alexander BSA" - Left
0.8		Sign - Regulatory (aluminum)		Existing - Active	Left	021210	stop sign - left
0.83		Culvert - Round Pipe (plastic/rubber)	18x12	Existing - Active	Right	021210	18"x 12' plastic pipe to right of road as Lead-off w/ concrete headwall
0.85		Culvert - Elliptical Pipe (cmp - galvanized steel)	4x6x60	Existing - Active	Under	021210	4' x6' x 60' squash cmp - install reflectors
0.85		Sign - Warning (aluminum)		Existing - Active	Right	021210	"Stop Ahead" warning sign
1.02		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Install Reflectors
1.32		Sign - Warning (aluminum)		Existing - Active	Right	021210	"Narrow Rough Road" waring sign - right
1.55	1.56	Barrier - Rock - Rock Berm (rock)		Existing - Active	Right	021210	Rock Wall - Erosion Contol - to right of road
1.57		Sign - Warning (aluminum)		Existing - Active	Right	021210	Winding Road Warning sign - right
1.68		Culvert - Round Pipe (cmp - galvanized steel)	24x40	Existing - Active	Under	021210	24"x40' cmp - Install Reflectors
1.8		Sign - Warning (aluminum)		Existing - Active	Left	021210	Winding Road Warning sign - Left
1.82		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Install Reflectors
1.9		Sign - Guide (hdo plywood)		Existing - Active	Right	021210	Directional sign "Cove C.G, Spillway C.G., End of Road" - Right
2		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Install Reflectors
2		Sign - Warning (aluminum)		Existing - Active	Right	021210	Side Road Left warning sign - Right
2.03		Sign - Visitor Information (hdo plywood)		Existing - Active	Right	021210	Visitor Info sign "Respect Private Land Stay on Main Road Next 0.5 miles" - Right
2.04		Culvert - Elliptical Pipe (cmp - galvanized steel)	4x6x60	Existing - Active	Under	021210	3'x5'x40' squash cmp - w/ 2 reflectors
2.1		Culvert - Round Pipe (cmp - galvanized steel)	24x40	Existing - Active	Under	021210	24"x40' cmp - Repair inlet - Install Reflectors
2.12		Culvert - Round Pipe (cmp - galvanized steel)	24x40	Existing - Active	Under	021210	24"x40' cmp - Repair inlet - w/ Reflectors
2.13		Sign - Warning (aluminum)		Existing - Active	Left	021210	Side Road Right warning sign - Left
2.37		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Repair inlet - w/ Reflectors
2.62		Sign - Visitor Information (hdo plywood)		Existing - Active	Left	021210	Visitor Info sign "Respect Private Land Stay on Main Road Next 0.5 miles" - Left
3.2		Bridge	88	Existing - Active		021210	2004 insp by Lonco, Inc. thru the State.
3.34		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Install Reflectors
3.95		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - w/ 2 Reflectors
4.22		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Replace 2 Reflectors
4.32		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Replace 2 Reflectors

DL Road Feature Log

ID: 96 **Name:** ELEVENMILE CANYON **BMP:** 0 **EMP:** 9.5

BMP	EMP	Feature Type - Category (material)	Size	Status	Location	Admin Org	Remarks
4.5		Bridge	88	Existing - Active		021210	2004 insp by Lonco, Inc. thru the State.
4.76		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Repair inlet - Replace 2 Reflectors
5.19		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - w/ 2 Reflectors
5.3		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp -plugged
5.35		Sign - Warning (aluminum)		Existing - Active	Right	021210	"Narrow Road" Warning sign - Right
5.4		Tunnel (rock)	24156.1 cu ft	Existing - Active	On	021210	
5.47		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - w/ 2 Reflectors
5.47		Sign - Warning (aluminum)		Existing - Active	Left	021210	"Narrow Road" Warning sign - Left
5.5		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Replace 2 Reflectors
5.97		Sign - Warning (aluminum)		Existing - Active	Right	021210	Side Road Left warning sign - Right
6.05		Sign - Guide (hdo plywood)		Existing - Active	Left	021210	Directional sign "Wagon Tongue Gulch Road, CR 98" - Left
6.12		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Install 2 Reflectors
6.12		Sign - Warning (aluminum)		Existing - Active	Left	021210	Side Road Right warning sign - Left
6.2		Bridge	88	Existing - Active		021210	
6.47		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Install 2 Reflectors
6.52		Culvert - Round Pipe (cmp - galvanized steel)	24x40	Existing - Active	Under	021210	24"x40' cmp - Install 2 Reflectors
6.62		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Install 2 Reflectors
6.64		Sign - Warning (aluminum)		Existing - Active	Right	021210	"Road Narrows" - warning sign - right
6.8		Bridge	66	Existing - Active		021210	
6.92		Sign - Warning (aluminum)		Existing - Active	Left	021210	"Road Narrows" - warning sign - Left
7.31		Culvert - Round Pipe (cmp - galvanized steel)	12x40	Existing - Active	Under	021210	12"x40' cmp - Replace 2 Reflectors
7.78		Sign - Warning (aluminum)		Existing - Active	Right	021210	"Road Narrows" - warning sign - right
7.8		Tunnel (rock)	14217.6 cu ft	Existing - Active	On	021210	
7.85		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp
7.9		Tunnel (rock)	24675 cu ft	Existing - Active	On	021210	
8		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp
8		Sign - Warning (aluminum)		Existing - Active	Left	021210	"Road Narrows" - warning sign - Left

DL Road Feature Log

ID: 96 **Name:** ELEVENMILE CANYON **BMP:** 0 **EMP:** 9.5

BMP	EMP	Feature Type - Category (material)	Size	Status	Location	Admin Org	Remarks
8.1		Culvert - Round Or Elongated Pipe (corrugated steel)				021210	
8.1		Culvert - Round Or Elongated Pipe (corrugated steel)				021210	
8.1		Culvert - Round Or Elongated Pipe (corrugated steel)				021210	
8.1		Culvert - Round Or Elongated Pipe (corrugated steel)				021210	
8.1		Culvert - Round Or Elongated Pipe (corrugated steel)				021210	
8.1		Culvert_Installation		Existing - Active		021210	
8.55		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Replace 2 Reflectors
8.65		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Repair inlet - Replace Reflectors
8.7		Bridge	88	Existing - Active		021210	
8.89		Culvert - Round Pipe (cmp - galvanized steel)	18x40	Existing - Active	Under	021210	18"x40' cmp - Replace 2 Reflectors
8.9		Sign - Warning (aluminum)		Existing - Active	Left	021210	Side Road Left warning sign - Left
8.91		Sign - Warning (aluminum)		Existing - Active	Right	021210	Side Road Right warning sign - Right
9.13		Sign - Warning (aluminum)		Existing - Active	Left	021210	Side Road Left warning sign - Left
9.15		Sign - Warning (aluminum)		Existing - Active	Right	021210	Side Road Right warning sign - Right
9.25		Sign - Warning (aluminum)		Existing - Active	Left	021210	Side Road Left warning sign - Left
9.4		Sign - Warning (aluminum)		Existing - Active	Right	021210	"Road Ends 500 Ft" Warning Sign - Right

DL Road Feature Log

Report Summary

Report Title:	DL Road Feature Log
Report Name:	RD_DL03
Run By:	CCUDDIHY

Filter By

Security ID:	%0212
Admin Org:	%
Route ID:	%96
Route Name:	%
Feature Type:	%
Feature Category:	%
Feature Status:	EX%

Sort By

Security ID, RTE_ID, FEA_BMP, FEA_EMP, FEA_OBJ_NAME, FEA_SUB_TYPE

Notes

A listing of features along a route.
Tables used: RTE_BASICS, II_FEATURES

Appendix C
Culvert Summary

APPENDIX C

Culvert Summary

Road Station	Diameter (inches)	Type	Capacity (cfs)	25-YR Flow Rate at Culvert	Capacity (% of 25-YR Flow)	Recommended Size and Type	Condition
Eleven Mile Canyon Reach							
31+00	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
45+50	18	CMP	10	--	--	18 [in] CMP	Replace Damaged Culvert
49+50	--	CMP	--	--	--	18 [in] CMP	Existing Culvert
53+00	18	CMP	10	--	--	18 [in] CMP	Maintenance of Existing Culvert
56+50	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
69+00	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
72+50	21	CMP	10	56	17%	42[in] CMP	Upsize Existing Culvert
99+50	18	CMP	10	--	--	18 [in] CMP	New Culvert for Roadside Drainage
105+50	12	CMP	4	--	--	18 [in] CMP	New Culvert for Roadside Drainage
110+00	--	--	--	59	--	42[in] CMP	New Culvert for Drainage Basin
135+50	12	CMP	4	37	10%	36[in] CMP	Upsize Existing Culvert
151+00	--	--	--	19	--	27[in] CMP	New Culvert for Drainage Basin
172+00	--	--	--	73	--	48[in] CMP	New Culvert for Drainage Basin
177+00	24	CMP	19	48	39%	42[in] CMP	Upsize Existing Culvert
179+00	--	CMP	--	--	--	18 [in] CMP	Maintenance of Existing Culvert
184+50	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
187+50	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
199+00	72	CMP	198	1759	11%	Double 12'x10' RCBC	Upsize Existing Culvert

APPENDIX C

Culvert Summary

Road Station	Diameter (inches)	Type	Capacity (cfs)	25-YR Flow Rate at Culvert	Capacity (% of 25-YR Flow)	Recommended Size and Type	Condition
203+00	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
218+50	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
229+50	--	--	--	72	--	48[in] CMP	New Culvert for Roadside Drainage
233+50	12	CMP	4	--	--	18 [in] CMP	Upsize Existing Culvert
241+50	--	---	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
248+00	18	CMP	10	70	14%	48[in] CMP	Upsize Existing Culvert
264+50	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
269+00	36	CMP	43	--	--	36 [in] CMP	Replace Damaged Culvert
270+50	18	CMP	10	--	--	18 [in] CMP	Maintenance of Existing Culvert
276+00	36	CMP	43	--	--	36 [in] CMP	Maintenance of Existing Culvert
288+00	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
295+00	36	CMP	43	305	14%	Double 8'x6' RCBC	Upsize Existing Culvert
297+00	36	CMP	43	30	144%	30[in] CMP	Maintenance of Existing Culvert
311+50	36	CMP	43	--	--	36 [in] CMP	Existing Culvert
314+00	18	CMP	10	--	--	18 [in] CMP	Maintenance of Existing Culvert
322+00	--	--	--	34	--	33[in] CMP	New Culvert for Drainage Basin
331+00	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
335+00	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
342+50	36	CMP	43	24	181%	27[in] CMP	Maintenance of Existing Culvert
344+00	--	--	--	--	--	18 [in] CMP	Maintenance of Existing Culvert

APPENDIX C

Culvert Summary

Road Station	Diameter (inches)	Type	Capacity (cfs)	25-YR Flow Rate at Culvert	Capacity (% of 25-YR Flow)	Recommended Size and Type	Condition
347+50	18	CMP	10	24	41%	27[in] CMP	Upsize Existing Culvert
353+00	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
363+50	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
373+50	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
381+50	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
392+00	--	--	--	24	--	27[in] CMP	New Culvert for Drainage Basin
398+00	--	--	--	56	--	42[in] CMP	New Culvert for Drainage Basin
412+00	24	CMP	19	22	86%	27[in] CMP	Maintenance of Existing Culvert
413+00	24	CMP	19	--	--	24 [in] CMP	Maintenance of Existing Culvert
415+50	60	CMP	131	625	3%	Double 8'x6' RCBC	Upsize Existing Culvert
418+00	18	CMP	10	--	--	18 [in] CMP	Replace Damaged Culvert
422+50	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
427+00	18	CMP	10	--	--	18 [in] CMP	Existing Culvert
428+50	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
430+00	24	CMP	19	84	22%	54[in] CMP	Upsize Existing Culvert
449+00	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
459+00	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
470+00	24	CMP	19	--	--	24 [in] CMP	Existing Culvert
479+00	48x78	CMP	151	246	61%	Double 8'x6' RCBC	Upsize Existing Culvert
481+00	18	CMP	10	246	4%	Double 8'x6' RCBC	Upsize Existing Culvert

APPENDIX C

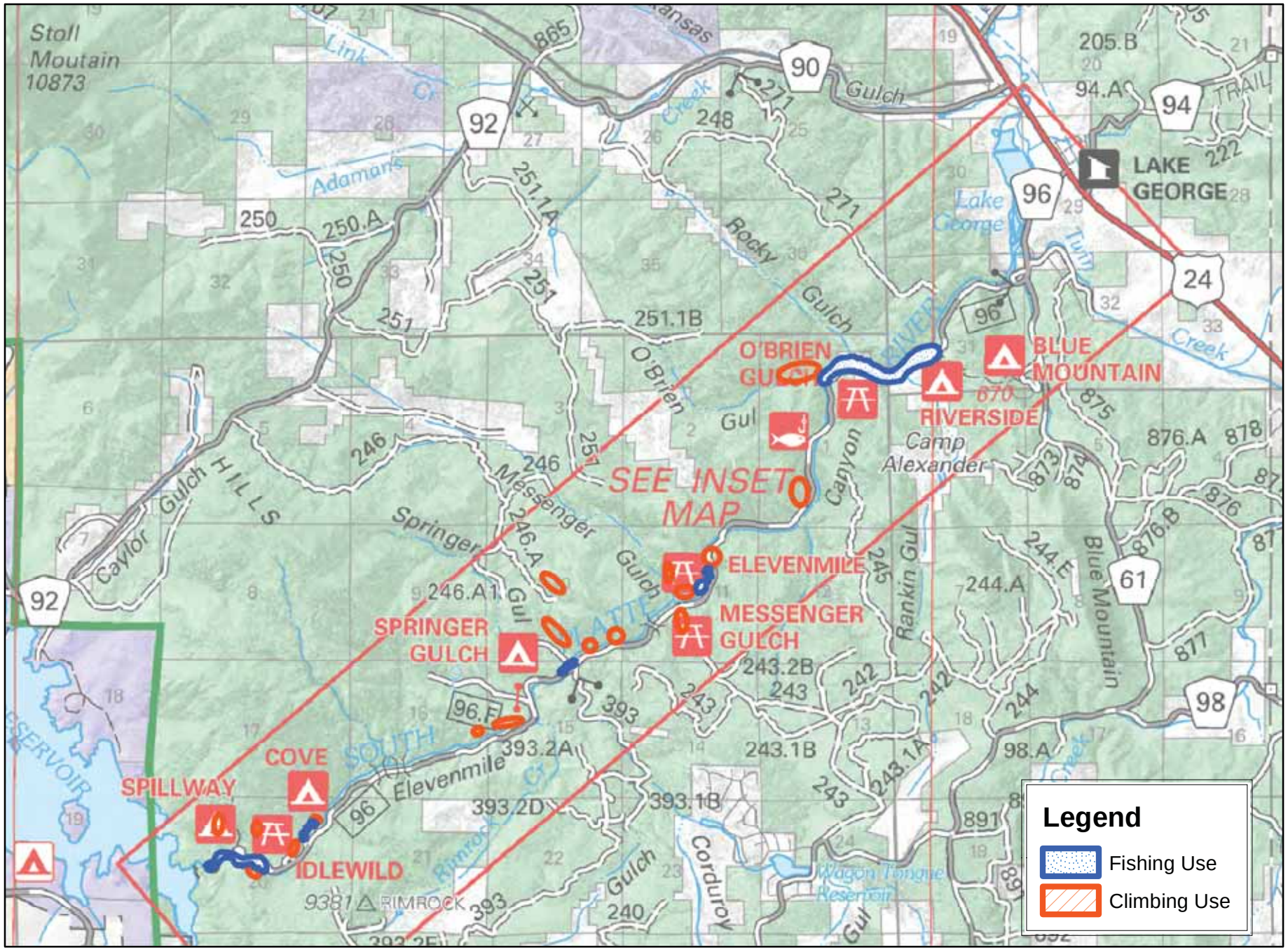
Culvert Summary

Road Station	Diameter (inches)	Type	Capacity (cfs)	25-YR Flow Rate at Culvert	Capacity (% of 25-YR Flow)	Recommended Size and Type	Condition
Happy Meadows Reach							
701+50	12	CMP	4	--	--	18 [in] CMP	Upsize Existing Culvert
703+00	18	CMP	10	--	--	18 [in] CMP	Existing Culvert
706+00	18	CMP	10	--	--	18 [in] CMP	Existing Culvert
711+50	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
713+00	18	CMP	10	--	--	18 [in] CMP	Existing Culvert
728+00	12	CMP	4	--	--	18 [in] CMP	Upsize Existing Culvert
739+00	18	CMP	10	--	--	18 [in] CMP	Existing Culvert
748+50	--	--	--	--	--	18 [in] CMP	New Culvert for Roadside Drainage
760+00	18	CMP	10	--	--	18 [in] CMP	Existing Culvert
781+00	18	CMP	10	63	15%	48[in] CMP	Upsize Existing Culvert
Sportsmen's Paradise Reach							
812+50	--	--	--	18	--	24[in] CMP	New Culvert for Drainage Basin
823+00	--	--	--	72	--	48[in] CMP	New Culvert for Drainage Basin
829+00	24	PVC	19	56	33%	42[in] CMP	Upsize Existing Culvert
842+00	x2 48"	PVC	160	905	18%	Double 12'x6' RCBC	Upsize Existing Culvert
845+50	12	PVC	4	13	27%	21[in] CMP	Upsize Existing Culvert

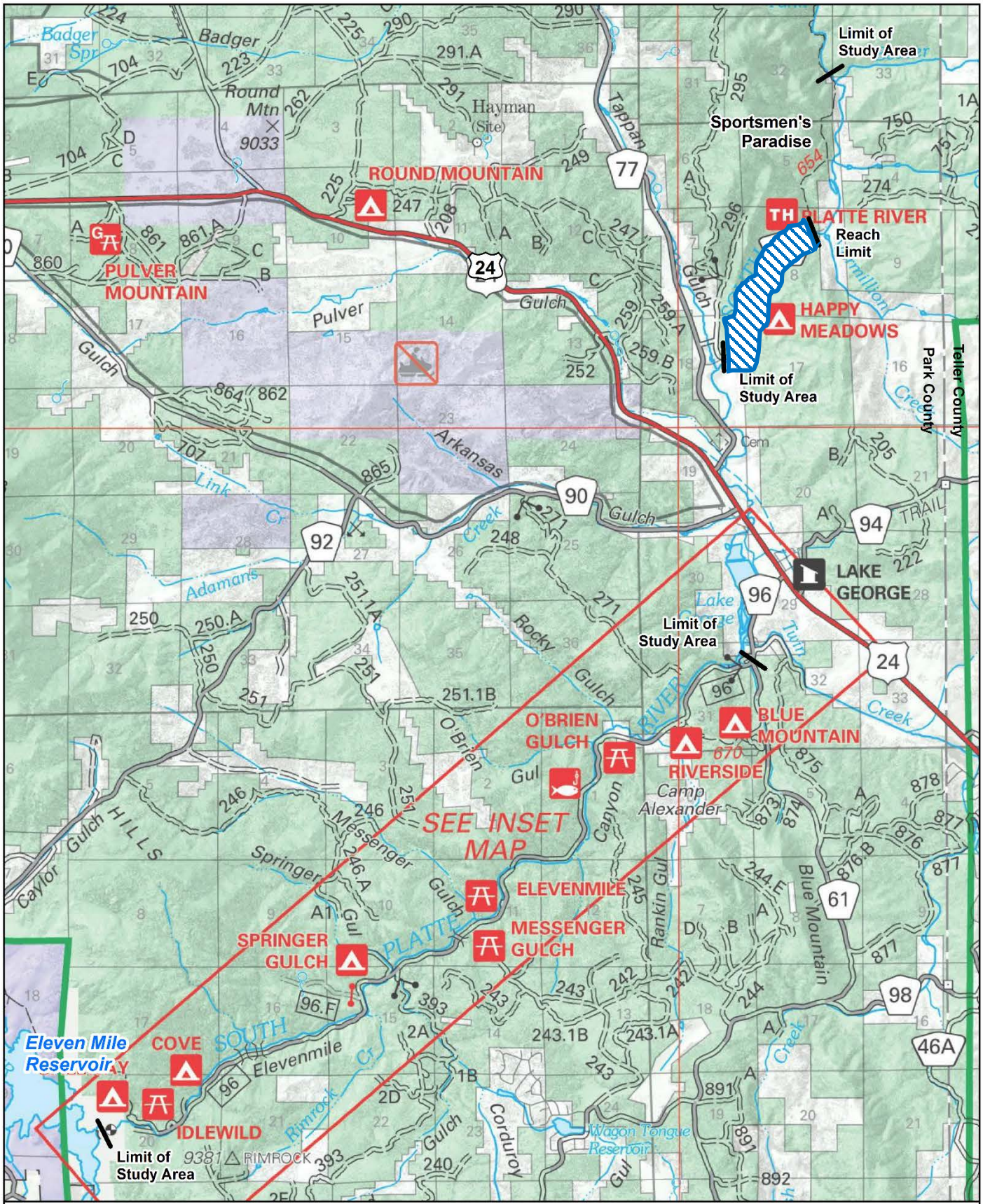
* RCBC: Reinforced Concrete Box Culvert

Appendix D
Recreational Focus Areas

Recreational Focus Areas - Eleven Mile Canyon



Provided by USFS, 2015



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LEGEND

Tubing Use

Background Source: Pike National Forest Visitor Map 2010

Recreation Focus Areas – Happy Meadows
Tubing Use
Roads to Rivers Assessment for Eleven Mile, Happy Meadows and Sportsmen's Roads

CH2MHILL

South Platte River Recreation "Hotspots"

Eleven Mile Canyon

From a fishing perspective, the entire canyon can be considered a hotspot. Of course, the Catch & Release segment from Road Station 00-00 to 195-00 probably receives the most use and is most in need of some additional management. Downstream of the Catch & Release segment, areas where the Canyon bottlenecks, such as around the first tunnel and near the entrance regularly become congested on crowded weekends. The most problematic areas for parking in the canyon are the areas where multiple recreation opportunities exist in the immediate vicinity. For the purpose of this exercise, I will identify the areas I am familiar with where these multiple uses are currently occurring. I will also identify existing areas that are contributing sediment to the river and degrading the quality of the habitat.

Road Station 24-00 This is the primary parking area at the upstream end of the canyon. The GIS map book identifies pooling water and proposes grading along the west side of the parking area. The northern loop of this parking area is immediately adjacent to the river, and may be contributing sediment. I would prefer to see this part of the parking area closed and rehabilitated to create an adequate buffer between the parking area and the stream.

Road Station 40-00 This is the turn-off to Spillway Campground. This is a popular parking area not only for fisherman accessing the river upstream and downstream of the culvert bridge, but also for hikers and rock climbers to access Baboon Rock via the National Forest System Trail to the north. This is also where the CPW sets up for its periodic monitoring of the upper electrofishing station in the canyon.

Road Station 50-00 to 55-00 Pine Cone Dome is immediately north of the road through this segment. This is frequently a congested area due to good fishing in the river and a very popular rock climbing crag close to the road. There is no real parking here, and people typically straddle the inboard ditch to park in this segment.

Road Station 60-00 Small pull-out next to the bridge. This spot is popular for fishermen and for climber access to Ice Box Wall on the south side of the river upstream of the bridge.

Road Station 75-00 to 130-00 This is the segment that starts at the top of the Cascades. There are one or two very poor parking pull-outs along this segment, which is adjacent to some of the very best pocket-water fishing in the canyon. There are numerous social trails leading down the road fill slope to the river, and most of these are unstable and contributing sediment. There are also several small crags popular with the climbing community on the north side of the river through this segment. Ideally, parking could be eliminated through this segment, and adequate parking and a decent access trail constructed on either end to provide recreation access.

Road Station 135-00 to 165-00 Similar to the segment described above, but less severe. The river segment here also contains some excellent pocket-water. Numerous social trails lead directly to the river and are likely contributing sediment to the system. In addition to outstanding fishing, there is a popular rock climbing area along the north side of the river immediately upstream of the Steel Bridge. This segment is also very popular with kayakers when flows allow.

Road Station 192-00 This is the turn-off to Springer Gulch campground, and is also the downstream boundary of the Catch & Release special regulations segment. In addition to heavy fisherman use, this area is also popular for rock climbers accessing Springer Gulch Domes (above the CG), Teale Tower (211-00), and Sport Crag (222-00) on the north side of the river.

Road Station 270-00 Eleven Mile Picnic Ground. Highest use area for fishermen, tubers, rock climbers, and all other general recreation users. There are numerous social trails on either side of the river. Two of the most

popular climbing areas in the canyon, Arch Rock and Turret Dome, are within easy walking distance of the parking lot. This area is overrun by tubers in the summer time, so some consideration for hardened access trails to and from the river upstream and downstream of the picnic ground should be considered. It would be really nice to see the CRX toilet relocated outside of the water influence zone.

Road Station 331-00 Eleven Mile Dome. This is probably the second most popular climbing area in the canyon, and is frequently subject to over-crowding and parking problems. The river restoration effort in this segment has worked well and now attracts a fair number of fishermen as well.

Road Station 355-00 This is a small pull-out on the north, upstream side of the bridge. This is a popular parking area for both fishermen and rock climbers. A trail leads from here to Spray Wall (363-00) and Knome Dome (365-00). The 120^{o} overhanging Spray Wall hosts some of the most difficult rock climbs in the canyon, and has become very popular with sport climbers in recent years.

Road Station 365-00 to 380-00 This area has really limited parking and numerous very unstable social trails leading down to the river.

Happy Meadows

Road Station 710-00 Parking Area at the top of the Happy Meadows Reach. This area is frequently congested by hordes of tubers putting into the river in the summer months. This parking area also frequently develops a large mud hole during the thunderstorm season.

Road Station 715-00 to 722-00 We tried to close these parking areas during the river restoration project, but the public has re-opened them. A permanent closure and obliteration would be nice.

Road Station 740-00 This parking area is in a good central location, but frequently develops a huge mud-hole in the center. Once the mud-hole forms, the parking area becomes mostly inaccessible.

Road Station 745-00 to 755-00 There are several pedestrian run downs along this segment that could be closed or hardened.

Road Station 755-00 This is probably the best quality segment for fishing in the Happy Meadows reach.

Road Station 761-00 This is a good parking spot that accesses a lot of good quality water. You might consider enlarging it while closing some of the other less desirable pull-outs in the area. Numerous social trails crossing the meadow from this parking area could be consolidated and rehabilitated.

Road Station 779-00 I'm not certain, but this may be where the CPW sets up for the Happy Meadows electrofishing site. If not, it really isn't necessary, and could be obliterated.

Road Station 784-00 Large Parking Area and loop near the downstream boundary of the Happy Meadows reach. This is the take-out area for tubers floating the reach, as well as a popular fishing and picnicking spot. We attempted to limit vehicles to the parking area utilizing left over boulders from the habitat project, but the public continues to move the boulders and drive vehicles down to the water's edge. This area could use steel post and cable fencing to define the parking area.

Prepared by:
Pete Gallagher
Fin-Up Habitat Consultants, Inc.
February 13, 2015

Appendix E
Cultural and Historical Literature Search Results

APPENDIX E

Cultural and Historical Literature Search Results

Site ID	Site Name	Resource Type	NRHP Status
5PA.1002		Archaeological	Field not eligible
5PA.1003		Archaeological	Officially needs data>Field needs data
5PA.1004		Archaeological	Officially needs data>Field needs data
5PA.136		Archaeological	No assessment given on form
5PA.137		Archaeological	
5PA.1377		Historical Archaeology	Officially not eligible>Officially not eligible>Field not eligible>Field not eligible
5PA.138		Archaeological	
5PA.17	Colorado Midland Railroad, Eleven Mile Canyon	Historic	Field not eligible
5PA.17.10	Colorado Midland Railroad Tunnel (Segment)	Historic/Historical Archaeology	106 - Officially eligible>Field eligible
5PA.17.2	Colorado Midland Railroad (Segment)	Historical Archaeology/ Historic	Contrib. to Officially elig. dist.>Noncontrib. to Officially elig. dist.>Field not eligible>Field not eligible
5PA.17.6	Colorado Midland Railroad Grade – Segment	Historical Archaeology/ Historic	106 - Officially not eligible>Field not eligible>Officially not eligible
5PA.17.8	Colorado Midland Railroad Tunnel (Segment)	Historic/Historical Archaeology	106 - Officially eligible>Field eligible
5PA.17.9	Colorado Midland Railroad Tunnel (Segment)	Historic/Historical Archaeology	106 - Officially eligible>Field eligible
5PA.2004.1	US Highway 24 – Segment	Historical Archaeology/ Historic	Field eligible
5PA.2433		Archaeological/Historical Archaeology	Officially not eligible>Officially not eligible>Field not eligible
5PA.2667		Historical Archaeology	106 - Officially eligible>Field eligible
5PA.2668		Historical Archaeology	106 - Officially eligible>Field not eligible
5PA.304	Lake George Depot	Historic	
5PA.3131	Idlewood Park and Location Of the Platte Canyon Eating House	Historical Archaeology	106 - Officially eligible>Field eligible
5PA.3132		Historical Archaeology	Officially not eligible>Field not eligible
5PA.3133	South Platte Bridge, Bridge Over South Platt River at County Road 96	Historical Archaeology/ Historic	106 - Officially eligible>Field eligible
5PA.3134		Historical Archaeology	Officially not eligible>Field not eligible
5PA.3135		Historical Archaeology	Officially not eligible>Field not eligible
5PA.3136		Historical Archaeology	Officially not eligible>Field not eligible

APPENDIX E

Cultural and Historical Literature Search Results

Site ID	Site Name	Resource Type	NRHP Status
5PA.3137		Historical Archaeology	Officially not eligible>Field not eligible
5PA.3138		Historical Archaeology	Officially not eligible>Field not eligible
5PA.360	Lake George	Historic	
5PA.361	Lake George Ice House	Historic	Field not eligible
5PA.382	Lake George Cemetery	Historical Archaeology	Staff - Officially Eligible>Contrib. to Officially elig. dist.>Contrib. to Officially elig. dist.>Officially not eligible>Field eligible>Field not eligible>Field not eligible
5PA.3823	Sleeping Tom Summer Home Group Lot F	Historic	Officially needs data>Field eligible
5PA.3905		Archaeological	Officially needs data>Field needs data
5PA.3906		Archaeological/Historical Archaeology	Officially not eligible>Field not eligible
5PA.3907		Archaeological	106 - Officially eligible>Field eligible
5PA.3908		Archaeological	Officially not eligible>Field not eligible
5PA.3909		Historical Archaeology	Field not eligible
5PA.3910		Historical Archaeology	Field not eligible
5PA.3911		Historical Archaeology	Field not eligible
5PA.3912		Archaeological	Field not eligible
5PA.4256		Archaeological	Field not eligible
5PA.4260	Spillway Campground/Reservoir Campground	Historical Archaeology	Officially not eligible>Field not eligible
5PA.44		Archaeological	
5PA.4466	Snair Ranch, Abell Ranch, Etheridge-Abell Property	Historical Archaeology	Staff - Officially Eligible>Officially Eligible for the State Register>Contrib. to Officially elig. dist.>Field needs data
5PA.4470	Golding Homestead, Abell Ranch, Etheridge/Abell Property	Historical Archaeology	Staff - Officially Eligible>Officially Eligible for the State Register>Contrib. to Officially elig. dist.>Field needs data
5PA.4519	Red House	Historic	Officially not eligible>Field not eligible
5PA.532	Lake George Ranger Station	Historic	106 - Officially eligible>Field eligible
5PA.6	Eleven Mile Canyon Dam And Reservoir	Historical Archaeology/ Historic	106 - Officially eligible>Field eligible>No assessment given on form
5PA.865		Historical Archaeology	Officially not eligible>Field not eligible

Source: COMPASS Online Database, Colorado Office of Archaeology and Historic Preservation (OAHP), 2015

Appendix F
Conceptual Solutions Table

APPENDIX F
Conceptual Solutions, Approximate Unit Costs, and Qualitative Benefit to Cost Range
Roads to Rivers Assessment for Eleven Mile Canyon, Happy Meadows, and Sportsmen's Roads

Treatment	Description	Considerations	Representative Item	Unit	Unit Cost	Benefit to Cost Range
Roadway Improvements - Surface Material						
Asphalt Paving	Reconstruct the roadway with a pavement section consisting of base course and asphalt (or full depth asphalt) to eliminate surface sediment.	This option will eliminate surface sediment and provide a more durable surface. Paving a roadway tends to encourage a higher speed of travel, which for safety, may lead to upgrading the roadway geometrics. Estimated costs are around $5 million just for the pavement, and additional infrastructure and maintenance costs would be incurred. Paving was not considered a viable option in the 1995 EA for the area.	Pave with Asphalt	Mile	$ 600,000	Low
Concrete Paving	Reconstruct the roadway with concrete to eliminate surface sediment.	This option will eliminate surface sediment and provide a more durable surface similar to asphalt paving. Paving a roadway tends to encourage a higher speed of travel, which for safety, may lead to upgrading the roadway geometrics. Paving was not considered a viable option in the 1995 EA for the area.	Pave with Concrete	Mile	$ 700,000	Low
Chip Seal	Chip seal a base course surface with three layers to stabilize and improve durability.	The USFS indicates this is a preferred option. Washington County in Oregon uses this technique on many of its gravel roadways with very good results, and some of their roads receive plowing in the winter. This does wear differently in different areas, so it may create additional maintenance concerns.	Pave with Chip Seal	Mile	$ 200,000	Low
Cementious Additive	Scarify the surface and mix in additives, such as Portland cement, fly ash, or lime.	This treatment stabilizes the roadway, but may have water quality impact concerns. Environmentally sensitive projects should considered impacts to the environment and water quality.	Treat with Cement	SY	$ 20	Moderate
Magnesium Chloride	Treat the roadway periodically with magnesium chloride to reduce surface erosion.	Magnesium chloride is used by other counties in Colorado to control dust and stabilize/harden the road surface. A potential concern with the chemical is its impact on the environment. Douglas County, Colorado currently uses a magnesium chloride and lignin mixture to treat many of their gravel roads.	Treat with Stabilizer (Magnesium Chloride)	Ton	$ 200	Moderate
Road Stabilizers	Treat the roadway periodically with commercially available road stabilizer.	This treatment stabilizes the roadway with commercially available products, and some brands are environmentally safe. Products include Gorilla Snot, Road Oyl, Soiltac, and others. Some products have been approved by the Federal Government.	Treat with Polymer Stabilizer (Soiltac)	Ton	$ 200	Moderate
New Road Base	Bring in new material to create a new gravel surface.	Sedimentation may increase or decrease depending on the material selected. New road base allows for more cohesive aggregate that can be compacted and is less prone to wash boarding.	Aggregate Base	Mile	$ 200,000	Moderate
Roadway Improvements - Geometrics						
Major Realignment	Major realignment includes changing the vertical or horizontal alignment of the roadway.	Due to the narrow road and stream corridor, any major realignment would be costly. Moderate realignment, in order to increase the buffer distance between the road and stream, would also be costly. The impact to the environment during construction would likely outweigh the benefit of an increased buffer.	Varies by location.	--	--	Low
Reverse Roadway Cross Slope	Change the roadway cross slope so that the road drains away from the river.	Changing the cross slope will allow flow and sediment to be directed to a roadway ditch instead of the river. Generally, the roadways in this study area are already sloped away from the river, so this improvement would only be at spot locations.	Reverse Roadway Cross Slope (assumes only road base modifications required, does not include additional culverts if needed)	Mile	$ 20,000	Moderate
Increase Roadway Cross Slope	Adjust roadway cross slope to ensure the road is draining into the proper ditch.	There are areas where the existing road cross slope is flatter than the recommended 2% as a result of maintenance activities. A steeper cross slope, at least to 2%, will better control runoff and decrease erosion potential.	Roadway Reconditioning	Mile	$ 20,000	Moderate
Flatten Roadway Cut Slope (hill slope)	Cut the slope back to reduce sediment sloughing into the ditch.	The hill slope would need to be flattened significantly for the sediment sloughing to stop. This would be a very large project with potentially significant impacts. The flattened slope may still be erosive due to the geology and vegetation coverage in the area. Shotcrete may be used to mitigate low vegetation and geology where the hill slope was flattened. Retaining walls could also be used to stabilize hill slopes. The costs for this treatment and hauling off excavated material can be significant.	Varies by location.	--	--	Low
Rolling Dips	Provide subtle rolling dips along the roadway to shorten the length of road that collects subarea runoff.	Rolling dips may be feasible in some locations. The low points of the dips will need to be stabilized to convey runoff from the road down the embankment. Additional speed control signing may be required.	Varies by location and depends on the type of earthwork involved.	Each	$ 600	Moderate
Intersection Geometrics	Ensure all intersections are as close to a 90 degree angle as possible.	Improve the intersection approach roads to reduce the skew angles and improve sight distance. This would also define the road edge to reduce the disturbance at the existing skewed intersections where the roadway is not defined and cars also park.	Roadway Obliteration	SY	$ 10	Moderate
Visual Barrier Removal	Improve sight distance around curves and at intersections	Rock blasting would improve sight distance at rock outcroppings. Vegetation maintenance would improve intersection sight distance. Blasting may be limited by cultural/historical aspects within the project area.	Rock Excavation and Clearing	CY	$200 for rock, $6 for vegetation	Low for Rock, High for Vegetation
Roadway Maintenance and Operational Changes						
Road Grading and Snow Plow Operations	Omit roadside gravel berms, grade away from the river, and minimize removal of road base.	In order to not push sediment and contaminants into the river, operational crews should manage equipment in a way to push road material (and snow where feasible) away from the stream. It is understood that this may be more time consuming, but is a very cost effective solution. Removal of the roadside berms removes the likelihood of road material being pushed over the edge of the road and allows less erosive sheet flow to run off the road. Increasing the road cross slope will also lessen the runoff on the river side of the road. Due to the lack of storage space for snow, it is realized that snow plowing may need to include plowing towards the river. Care should be taken to not remove road base material when plowing. Douglas County has adopted these methods on several dirt roads and they are very pleased with the results.	Roadway Reconditioning	Mile	$ 20,000	Moderate
Culvert Cleaning	Remove and dispose of sediment from culverts.	Keeping culverts clean is needed to ensure the drainage system functions properly in order to correctly convey flow, reduce erosion, and prevent water ponding and ice buildup. As culverts are cleaned by jetting water and using a vacuum truck, additional sediment control measures should be considered to minimize the loss of sediment. BMPs consisting of coconut logs, filter socks, or geotubes (dewatering tubes) could be used to trap sediment at the end of pipe. A geotube could be temporarily attached to the end of the culvert prior to flushing, to ensure all sediment is captured. An excavator bucket can also be used to capture water and sediment exiting the pipe.	12" Erosion Log	FT	$ 8	Moderate

APPENDIX F
Conceptual Solutions, Approximate Unit Costs, and Qualitative Benefit to Cost Range
Roads to Rivers Assessment for Eleven Mile Canyon, Happy Meadows, and Sportsmen's Roads

Treatment	Description	Considerations	Representative Item	Unit	Unit Cost	Benefit to Cost Range
Roadside Stream Protection Barriers						
Curbing	Use curb and gutter to control and convey flow to a stabilized location.	The concept here is to provide a curb and gutter solution for a gravel road. This feature would contain flow and sediment on the roadway, and prevent it from being pushed down the slope and into the river. A hardened gutter would likely be needed at the base of the curbing (riprap, concrete, other). The curbing could consist of a small structural trench wall, a row of grouted boulders, sheet pile with a concrete cap, or a buried CDOT Jersey Barrier. The features need to be stout to withstand potential impact by grading and snow plow equipment. It is recognized that this would create a hazard for plows. It is unknown if this concept has been used elsewhere, so its performance is unknown. However, this is a more durable option than the existing dirt berm, and could be a candidate for a pilot project. The impact to the roadway width would need to be considered. The same concept can be applied to the uphill side of the road to trap sediment from crossing the road. This application of curbing would require regular maintenance to ensure that the capacity is maintained.	8" Curb and Gutter	FT	$ 40	Low
			Half Buried Type 7 Concrete Barrier	FT	$ 50	Low
			18" Wide Concrete Swale	FT	$ 15	Low
			2' Diameter Boulders keyed in 6"	Each	$ 175	Low
Guard Rail with Curb or Running Board	Use a roadway guard rail and running board to control sediment.	In environmentally sensitive areas, guard rails can include a running board consisting of a 6" to 12" tall barrier placed on the guard rail support posts to control sediment. A sample of this is on Highway 24 west of Colorado Springs, CO. With this solution, the curb or running board would be protected from grading or snow plow equipment by the guard rail. However, the cost and roadway width needed to construct this feature may not be feasible for this project. Also, scour can occur under the running board, which can allow erosion to occur and sediment to be conveyed past the running board.	Guard Rail with Running Board	FT	$ 30	Low
Roadside Infiltration	Place a device along the stream side of the road to allow runoff infiltration.	The devices used here could be a vegetative strip, a rock trench, soil wraps, of other components that would capture runoff and let it infiltrate, as opposed to allowing the flow to run down the roadway side slope. Plugging and maintenance needs of these devices would need to be considered.	Rock Trench	FT	$ 30	Moderate
Vehicular Traffic Flow and Safety Management						
Improved Entrance Station	Construct an improved entrance station.	An improved entrance station with a center station (between the inbound and outbound lanes) would allow the attendee to coordinate with traffic entering and leaving the canyon in a safe manner.	Kiosk	LS	$ 2,000	Moderate
Limit Entrance Capacity	A limited amount of vehicles would be allowed into the area at one time, to be monitored through the entrance gate.	Managing the number of vehicles allowed into the canyon could be considered, as is done in many popular recreation areas. Improvements to the entrance gate may be required, and a gate on Wagon Tongue Gulch Road may be required. Pedestrian and bicycle traffic would be accommodated.	Enforcement	-	--	High
Reduce On-street Parking in Narrow Areas	Reduce parking where there is poor sight distance and the road is narrow.	This would prevent parking from occurring in dangerous areas. Signage and enforcement would be needed.	Roadway Obliteration	SY	$ 10	Moderate
Transit	Shuttle visitors into the areas from a lower carpool / gathering area.	This would allow for additional recreational visitors to the area while reducing individual vehicle travel on the roads. Annual maintenance and operations costs for the shuttle service would need to be considered.	Transit	LS	$ 500,000	Low
Partial Closure to Vehicular Traffic	Limit vehicular traffic to only certain areas.	Limiting vehicular traffic has been considered in the past, but was determined to not be desired.	Gate	Each	$ 1,000	Moderate
One-Way Traffic Only	Manage the road to be one-way only.	Creating a one-way road in the canyon would require Wagon Tongue Road to be improved for safe travel of vehicles. The stakeholders determined that costs associated with improving the road make this option impractical.	Signage and Enforcement	-	--	Low
Parking Management						
Congestion Charging	Implement parking fees. Increase rate as demand increases.	This approach would attempt to level the usage in the area by having a scaled fee structure. This approach may not meet USFS regulations.	Fee Collection System	LS	$ 2,000	Low
Designate Formal Parking and No-Parking Zones	Identify acceptable areas for parking.	Parking signs are a low cost and practical method for controlling parking. More advanced management systems, such as assigning specific parking spots, is being done in the South Platte basin and could be considered. Signage and enforcement would be needed.	Signage and Enforcement	Each	$ 30	High
Additional Formal Parking	Add parking spaces where there is room to increase capacity for peak use periods to accommodate demand.	Increased parking may not align with stakeholder goals for all areas. Added parking will accommodate peak capacity days and will designate areas with erosion protection and drainage.	Aggregate Base	SY	$ 15	High
Pedestrian Traffic Control						
Designated Pedestrian Pathways	Clear indication of authorized trails.	Vegetation clearing and stabilization of approved trails and paths. Strategic placement of logs or boulders could discourage pedestrians from creating additional pathways, particularly near the river, as well as reduce the potential for erosion.	Aggregate Paths	SY	$ 15	Moderate to High
Signage	Signage to inform pedestrians.	Place signs to direct pedestrians to safe road crossings, trailheads, and stabilized areas to get from the road to the river.	Signage	Each	$ 30	High
Steep Slope Trails / Stairways	Switchback trails or stairways to control pedestrian traffic in a safe and non-erosive manner.	Creation of switchback trails or stairways from the road elevation to the river elevation would provide safe and less erosive pathways for pedestrians. Trails and stairways could be constructed with logs, boulders, and other materials. Drainage would need to be managed to not create erosion.	Boulders	SY	$ 120	Moderate to High
River-Side Trail	Create a trail on the river's overbank where feasible.	Creation of a trail along the river, where feasible, would decrease pedestrian traffic along the roadway. If pedestrian bridges are constructed, or if safe river crossing areas are feasible, the trail could be on both sides of the river.	Earthwork/Grading, Aggregate Trail	SY	$ 40	Low

APPENDIX F
Conceptual Solutions, Approximate Unit Costs, and Qualitative Benefit to Cost Range
Roads to Rivers Assessment for Eleven Mile Canyon, Happy Meadows, and Sportsmen's Roads

Treatment	Description	Considerations	Representative Item	Unit	Unit Cost	Benefit to Cost Range
Water Control						
Swales and Ditches	Water conveyance elements that route flow to cross culverts or to rundowns.	Roadside ditches exist along Eleven Mile Canyon road, and are typically V-shaped ditches cut into the natural ground material. The ditches at the time of the site assessment appear to be stable and not actively eroding, except at localized locations. The swales are transporting sediment from the roadway and natural slopes to culverts and/or rundowns.	Construct Roadside Swale (assumes dirt grading, on hill slope side of road)	FT	$ 1	Moderate to High
Inlets	A concrete structure that connects a ditch, swale, or gutter to a pipe.	There are currently no inlets along Eleven Mile Canyon road. Inlets and pipe could be added at rundown locations to convey flow from the road surface elevation to the overbank elevation. Mountain roads often use simple inlets (or even flared pipe end sections) and flexible pipe for these purposes. Asphalt, rock, or other hardened materials are often used at the inlet or pipe entrance to control erosion. A sample of this is just east of Eisenhower Tunnel on I-70.	Inlet, CDOT Type C	FT	$ 6,500	Low
Curb and Gutter	Water conveyance elements that route flow to cross culverts or to rundowns.	These roadside elements have a hardened bottom and side walls to increase the conveyance capacity and provide a road barrier. Curbs and gutters are not typically placed on gravel roads. In order to consider the curb and gutter function for a gravel road, see the Roadside Stream Protection Barriers section.	8" Curb and Gutter	FT	$ 40	Low
			Half Buried Type 7 Concrete Barrier	FT	$ 50	
			18" Wide Concrete Swale	FT	$ 15	
			2' Diameter Boulders keyed in 6"	FT	$ 175	
Cross Culvert	Flow conveyance elements to route flow under the road.	Includes new larger culverts to convey the design runoff event, replacement of existing culverts in kind due to structural damage or excessive sediment deposition, and maintenance of existing culverts. Cross culverts can be used in combination with a sediment trap or settling pond on the upstream side of the road and culvert outlet protection or a stabilized rundown on the downstream side of the road.	Cross Culvert, 24" CMP	FT	$ 65	Moderate to High
Pipes / Downspouts	Flow conveyance elements.	Pipes are used to convey flow and can be concrete, metal, or plastic. They could be used to replace the existing rundowns. The stability of pipes on the steep roadway slopes would need to be considered. Constructability would also need to be addressed in the very loose decomposed granite. The USFS prefers the use of corrugated metal pipes to help decrease velocities. Downspouts can be connected to pipes to convey flow down the road embankment.	Cross Culvert, 24" CMP	FT	$ 65	Moderate to High
Stabilized Rundown	Use stabilized rundowns to convey flow from the road elevation to the overbank elevation. This applies to roadside ditches and culvert discharges.	Rundown lining includes grass, soil riprap, riprap, concrete, brush/slash lined, and others. In addition to lining, small check dams built of rock or bioengineered products can be used to trap sediment and slow velocities. However, these check dams will fill with sediment quickly and may become maintenance intensive. There are also rundown stabilization products which may be applicable to this area, such as the "SmartDitch". Major erosion is occurring from flow conveyance from the road to the river. Stabilized rundowns are a practical, feasible solution for Eleven Mile Canyon road.	Concrete Rundown	CY	$ 400	High
			Soil Riprap	CY	$ 125	High
			Straw Bales	FT	$ 10	Moderate to Low
Culvert Outlet Protection	Erosion control located at the end of a pipe.	Soil riprap, riprap, and other hard materials are the most common types of outlet protection. Vegetation, turf reinforcement mat, or other materials may be feasible.	Soil Riprap	CY	$ 125	High
Sediment Control						
Silt Fence / Sediment Barriers	Sediment barrier attached to wooden posts and keyed into the ground.	Silt fence is a very good product for trapping sediment, but it is typically not a long term solution. The sediment will need to be removed, and the fabric and posts have a relatively short life span. Silt fence is a great product to use during construction to limit sediment dispersion. Live vegetative barriers, brush fences, and other features work similar to silt fences.	Silt Fence	FT	$ 5	Moderate
Check Dams	Small dams used to slow down velocities and trap sediment.	Small dams could be placed in swales or in gullies to slow velocities and trap sediment. The most common material used is riprap, but logs, coconut logs, willow bundles, brush, and other materials can be used as long as they can withstand the hydraulic forces in the stream or gully.	Riprap Check Dam	CY	$ 125	Moderate
Sediment Trap at Culvert Entrance / Exit	Use an inlet to trap sediment from the roadside ditch before it enters cross culverts.	Inlets can be constructed with depressed inverts, such that sediment is captured inside the inlet. The depression can be 2' to 5'. Once sediment fills the depressed area, sediment would then have the potential to be conveyed through the pipe. The inlet grates could be hinged, and a vacuum truck could be used to remove the sediment. A sediment trap could also be placed at the downstream end of the culvert to increase the trapping capacity, and keep the sediment close to the road and accessible by a vacuum truck. Alternatively, small rock walls could be constructed at culvert entrances to provide the same effect, but would be less stable than using a concrete inlet, and may not be able to have the same depression height. A geotube could also potentially be used to trap sediment exiting a pipe, while allowing water to continue downstream. The maintenance effort and associated costs for this treatment should be considered.	Depressed Inlet Box	Each	$ 8,000	High
Proprietary Water Quality Devices	Sediment traps and water quality devices.	There are many proprietary sediment trap and water quality devices on the market today. However, they often have a small flow rate capacity, can be expensive, and their function is often questioned. It is recommended that depressed inlets, settling ponds, and other proven features be used on this project. Proprietary devices have not been considered at this time.	N/A	N/A	N/A	Low
Settling Ponds	Surface ponds that allow for sediment trapping.	These ponds could be placed upstream of the road or in wider overbank areas, and receive flow from the road ditches, rundowns, or small streams. The ponds could be lined with rock to allow for excavation, and have perimeter vegetation installed to visually hide the ponds. A vacuum truck or long reach excavator could be used to dredge the ponds. An overflow area should be provided and stabilized to prevent erosion in large storms.	Settling pond costs will vary by site, access to the pond, pond depth, and erosion control required.	Each	$3,000-$20,000	High
Filter Strips	Control sediment on flatter slopes using vegetation or bioengineered products.	Where flatter slopes exist and sediment needs to be controlled, filter strips can be used to trap the sediment. Filter strips can consist of vegetative strips (willows, etc.), strategically placed logs, coconut logs, or other products. These products must be installed to create a "sheet flow" effect over them to minimize flow concentration and erosion on the downhill side of the feature. As sediment builds up, additional features can be added on top of the collected sediment. However, improper installation can lead to concentrated flows and erosion.	12" Erosion Log	FT	$ 7	Moderate

APPENDIX F
Conceptual Solutions, Approximate Unit Costs, and Qualitative Benefit to Cost Range
Roads to Rivers Assessment for Eleven Mile Canyon, Happy Meadows, and Sportsmen's Roads

Treatment	Description	Considerations	Representative Item	Unit	Unit Cost	Benefit to Cost Range
Slope Stabilization - Roadway and Natural Slopes						
Seeding, Plantings	Plant native, noxious weed-free seed to establish vegetation for erosion protection.	Due to the lack of topsoil, the erosive nature of the geology in the area, and steep slopes, seed establishment will be difficult. Import of noxious weed-free topsoil would be needed, but even with that, seeding success rates may be low. Seeding of flatter slopes, the river overbanks, and the riparian corridor would have higher success rates. Additional riparian vegetation would trap additional sediment and increase water quality, even for relatively narrow buffer areas.	Upland Seeding	Acre	$ 6,000	Low
			Riparian Seeding	Acre	$ 8,500	Moderate
			Willow Staking	Each	$ 7	Low
			Wetland Plugs	Each	$ 4	Moderate
Mulch	Weed-free straw mulch scattered or crimped into the ground.	Mulch is typically used in combination with seeding to establish vegetation and prevent erosion until the seed is established. The existing loose granite slopes will be a challenge to support vegetation, and the mulch may not be stable. Crimping the mulch into the soils in this area is likely not practical. Unless importing topsoil is an option, this is not recommended for further consideration. Mulch can also consist of bark, shredded wood, or other materials.	Mulch, Crimped Straw	Acre	$ 1,850	Low
Erosion Control Blanket	Use erosion control blanket and seeding to reduce sediment from the slope.	Erosion control blanket is used to temporarily stabilize an area until the underlying seed is established. Blankets must be placed on smooth ground, keyed in, and have staking and check slots appropriate for the ground conditions. Incorrect installation can lead to erosion under the blanket. The existing loose granite slopes will be a challenge to support vegetation, and the blanket could be a hazard to animals. Unless importing topsoil is an option, this is not recommended for further consideration.	Erosion Control Blanket	SY	$ 8	Low
Turf Reinforcement Mat (TRM)	Similar to erosion control blanket, but TRM is more stout, may have a significant thickness, and has a longer life span.	TRM must be installed similar to erosion control blanket, but is more resistant to flow, is more sturdy, and does not rely on the underlying vegetation to establish. TRM can be a reasonable replacement for soil riprap or riprap. TRM can be used for outlet protection, lining gullies, and other uses. However, the unstable soils in this project area may make TRM impractical.	Turf Reinforcement Mat	SF	$ 3,650	Low
Hydroseed / Hydromulch	Spraying seed or mulch from a nozzle for large area applications.	These products are common, but result in mixed opinions. Many of the products do not work well on loose soils, on steep slopes, or where concentrated flow will occur. Also, many metro Denver agencies do not allow their use. It is assumed that due to the conditions in the area, these products would not have the anticipated success rates needed for implementation.	Native Seeding with Hydromulch	SY	$ 10	Moderate
Soil Riprap and Riprap	Angular rock used to stabilize swales, ditches, and streams.	Riprap is angular rock categorized by its D50 particle size. Riprap is often placed on a layer of more finely graded angular rock (filter material) or on geotextile, to prevent piping of smaller particles through the riprap. Soil riprap is riprap that has all of its void spaces filled with the native soil. Soil riprap is compacted, and typically has an additional layer of soil placed on top, then seeded with noxious weed-free seed. After the seed has established, the soil riprap is no longer visible and the area mimics the natural vegetated surroundings. These features can be used for slope stabilization, toe scour protection, creating small drop structures in streams, and are applicable to this project.	Soil Riprap	CY	$ 125	Moderate
Boulder Wall / Stream Protection	Stack tiers of boulders to prevent erosion of the slope, or to allow a flatter slope between the road and the stream.	With this feature, boulders are placed at the edge of the stream, stacked to the height needed, and then backfilled from the top of boulder back to the tie in grade. This is a method often used to provide both stream stabilization at the toe of a slope, while also creating a flatter slope to the top of the boulders. Grout or concrete can be used to make the boulders much more sturdy, and prevent piping of soil from behind the boulders. When grout is used, the grout is typically kept to 1/2 the boulder height, so that the grout is not seen. Other features such as soil wraps, gabion walls, crib walls, live retaining walls, brush layers, and sheet pile can be used to create walls or steep slopes. These features could be applied where the river and the road are adjacent to each other.	2' diameter boulders, single row, ungrouted	FT	$ 175	Moderate
Soil Stabilizers, Tackifiers	Treat the slope periodically with a polymer-based product to reduce slope erosion.	These products stabilize the slope, and some brands are environmentally safe. Due to the erosive nature of the geology in the area, the success rates for these products could be low.	Soil Binder	AC	$ 800	Low
Slope Interceptors	Barriers or ditches placed on long slopes to intercept flow and direct it off the slope in a controlled manner.	These features may consist of bio-logs, natural logs, and ditches. Ditches are often placed at a slope to direct slope runoff to one side of the slope to a stabilized location. Due to the erosive nature of the soils in the area, the applicability of these features is limited.	12" Erosion Log	FT	$ 8	Low
Stream Improvements						
Channel Realignment / Buffer Width	Move the stream to increase the buffer between the road and the stream.	The costs associated with channel realignment or increasing the buffer width will vary depending on the site.	Varies by location.	--	--	--
Bank Stabilization / Toe Protection	Stabilize the toe of the bank to control stream bank erosion.	Bank stabilization typically consists of laying back an eroded slope and using stabilization such as vegetation, erosion control blanket, turf reinforcement mat, soil riprap, or riprap. Access to erosive bank locations can be difficult. If only hand work can be conducted, it is recommended that TRM and vegetation controls are used. These materials can be hand carried to the site, are cost effective, and will not damage the surrounding area. Willow staking and riparian seed at the water's edge would provide additional bank stability.	Soil Riprap	CY	$ 125	High
In-Stream Improvements	Fish habitat, grade control, bank stabilization, etc.	Instream improvements are not included in this assessment. CUSP is conducting a separate instream assessment.	N/A	--	--	--
Remove Small Dam	Remove the small diversion dam at the lower end of Eleven Mile Canyon	Removal of the existing dam would remove a fisheries barrier that would allow stream connectivity. This in turn could increase the fishery downstream of Eleven Mile and help to lessen the pressure and recreation use in the canyon.	N/A	--	--	--

APPENDIX F
Conceptual Solutions, Approximate Unit Costs, and Qualitative Benefit to Cost Range
Roads to Rivers Assessment for Eleven Mile Canyon, Happy Meadows, and Sportsmen's Roads

Treatment	Description	Considerations	Representative Item	Unit	Unit Cost	Benefit to Cost Range
Vegetation Management						
Vegetate with Seeding and Plantings	Planting of native plants to increase diversity, create wildlife habitat, and reduce erosion and sedimentation.	Planting of noxious weed-free seed mix, seedlings, stakes, or plugs in areas where vegetation has been removed or excluded, or areas where additional vegetation would prove beneficial. Due to the lack of topsoil, erosive nature of the geology in the area, and steep slopes, seed establishment may be difficult. See the Slope Stabilization treatment options for more information.	Varies by location.	--	--	--
Revegetate Disturbed Areas	Revegetate areas disturbed by recreation, fire, or project activities.	Native, noxious weed-free seed mixes would be used. Seedlings or other plantings would also be considered based on location and habitat. Topsoil and erosion control blankets would also be considered. See the Slope Stabilization treatment options for more information.	Varies by location.	--	--	--
Weed Control	Treatment and prevention of noxious weeds.	Any seed mixes used during or after the project will be weed-free, native mixes. Current areas of infestation should be treated, and preventative measures should be in place for areas disturbed by the project. A noxious weed management plan is recommended.	Varies by location.	--	--	--
Recreation Management						
High Use Corridor Management	Maximize the user experience while maintaining a safe and manageable corridor.	Balance the needs for safe vehicle and pedestrian use while allowing for the multiple uses in the corridor and minimizing impacts to the environment and river.	See related solutions in this table.	--	--	--
Limited Permitting for Recreational Activities and Access	Provide permits to allow a specific number of visitors. Increase the fee as demand increases.	Permitting could be used for various recreational activities (fishing, camping, rock climbing, etc.), but it is realized that this could be controversial and may not meet USFS regulations. For example, there is a new fishing area in South Park where there are four parking spaces, with a user system that states that only four cars are allowed. This controls the number of users in the area.	N/A	--	--	--

NOTES:
1. Costs are for planning purposes only, and do not include engineering, permitting, mobilization, water control, contingencies, or adjustments for current economic conditions.
2. Costs (2015 dollars) are based on CDOT, Urban Drainage and Flood Control District (UDFCD), and Engineering Judgment. Costs were increased to account for increased costs associated with the site conditions and location.
3. Benefit to Cost Ranges are based on a basic, qualitative review of each feature for the site conditions, and account for the feature's cost, ability to control sediment, longevity, stability in the site conditions, and anticipated success rate.

Appendix G
Parking Summary

APPENDIX G

Eleven Mile Parking Capacity

Location	Destination	Parking Off of Spur Roads	Defined Parking Areas Parallel to Road	Pullouts Adjacent to Main Road	Total Spaces - Currently	Spaces To Be Removed	Total Remaining Spaces	New Parking Spaces	Total Spaces Proposed
Parking Near Dam	Fishing near dam	20			20		20		20
Spillway Campground	Camping	13			13		13		13
35+00	Fishing near culvert bridge			12	12	2	10		10
40+00	Parking near culvert bridge for hikers and climbers			3	3		3	20	23
Idlewild Picnic Site	Picnic and climbing, parking near restroom for fishers	5			5		5	8	13
Cove Campground	Camping and climbing	6			6		6		6
60+00	Fishing and climbing just north of bridge			0	0		0	10	10
65+00	Fishing access			3	3		3	9	12
70+00	Roadside parking to be removed			3	3	3	0		0
74+00	Roadside parking to be removed			8	8	8	0		0
77+00	Roadside parking to be removed			5	5	5	0		0
82+00	Roadside parking to be removed			3	3	3	0		0
87+00	Roadside parking to be removed			10	10	10	0		0
93+00	Roadside parking to be removed			2	2	2	0		0
106+00	Roadside parking to be removed near tunnels			2	2	2	0		0
110+00	Roadside parking to be removed near tunnels			2	2	2	0		0
133+00	Expand pulloff parking outside of curve near Rock Outcrop			4	4		4	5	9
141+00	Roadside parking to be removed			2	2	2	0		0

APPENDIX G

Eleven Mile Parking Capacity

Location	Destination	Parking Off of Spur Roads	Defined Parking Areas Parallel to Road	Pullouts Adjacent to Main Road	Total Spaces - Currently	Spaces To Be Removed	Total Remaining Spaces	New Parking Spaces	Total Spaces Proposed
165+00	Roadside parking to be removed near tight curve with poor sight distance			1	1	1	0		0
168+00	Roadside parking to be removed			3	3	3	0		0
Gated Access	Expand parking off of gated access to provide river and rock access	2			2		2	12	14
172+00	Expand parking to provide river access				0		0	20	20
175+00	Expand parking to provide river access for fishing			3	3		3		3
186+00	Expand parking near river, but away from marsh			4	4		4	3	7
Springer Gulch Road	Fishing and rock climbing, improve intersection and provide side road access to parking	2			2	2	0	20	20
Wagon Tongue Gulch Road	Head in parking to access river, minimal parking south of here	2			2	2	0	10	10
209+00	Roadside parking to be removed			1	1	1	0		0
Messenger Gulch Picnic Site	Expand road to provide head in parking to allow for camping, fishing	2			2	2	0	18	18
265+00	Excess parking for picnic site		15		15	15	0	30	30
Eleven Mile Picnic Site	Maintain existing head in parking		12		12	0	12		12
276+00	Roadside parking to be removed			1	1	1	0		0
280+00	Roadside parking to be removed			1	1	1	0		0
295+00	Roadside parking to be removed			1	1	1	0		0
301+00	Roadside parking to be removed			2	2	2	0		0

APPENDIX G

Eleven Mile Parking Capacity

Location	Destination	Parking Off of Spur Roads	Defined Parking Areas Parallel to Road	Pullouts Adjacent to Main Road	Total Spaces - Currently	Spaces To Be Removed	Total Remaining Spaces	New Parking Spaces	Total Spaces Proposed
308+00	Roadside parking to be removed			2	2	2	0		0
313+00	Roadside parking to be removed			1	1	1	0		0
319+00	Roadside parking to be removed			3	3	3	0		0
322+00	Access to river			3	3	0	3	2	5
328+00	Access to adjacent climbing near curve			0	0	0	0	12	12
331+00	Roadside parking to be removed			6	6	6	0		0
351+00	Parking for fishing and climbing			3	3	0	3	7	10
355+00	Roadside parking to be removed			2	2	2	0		0
376+00	Roadside parking to be removed			3	3	3	0		0
380+00	Roadside parking to be removed			8	8	8	0		0
385+00	Roadside parking to be removed for sight distance			3	3	0	3		3
O'Brien Gulch Picnic Site	Picnic and river access	5			5	0	5	12	17
421+00	No change, on private property			15	15	0	15	0	15
Riverside Campground	No change to campground	12			12	0	12		12
437+00	Expand pullout with access to river for fishermen and tubers			8	8	0	8	7	15
Total =		**36**	**27**	**133**	**196**	**95**	**101**	**205**	**306**
Outside of Fee Station									
Fee Station			8		8	0	8	8	16
Restroom Lower Lot		10			10	0	10	20	30

Appendix H
Stakeholder Input

Appendix H
Stakeholder Input - Roads to Rivers Assessment
Eleven Mile Canyon, Happy Meadows, and Sportsmen's Paradise Roads

Note: The stakeholder input provided below is as-provided by the stakeholder, with minor editorial changes for readability. Due to funding and schedule constraints, stakeholder comments are to be reviewed with the stakeholders and addressed during the next phase of the project.

Denny Bohon, USFS

General comment: It's not clear to me if the added parking lots represent an estimated area of disturbance, or are just serving as place holders. It would be most helpful if the polygons represent the actual area needed, with the understanding that the overall area would change somewhat, but not dramatically during design. Some polygons are immediately adjacent to the road edge, others are offset; some are narrow, some are wider, others are abstract polygons. Also, with each roadside parking lot closure we have to anticipate having more people walking the road, and the safety issues that that brings. Need to decide what the desired number of cars in the canyon is at one time.

Page	Station	Comment
1	23+00	As drawn, the new parking area's western edge is too close to the river. Does this polygon represent the area needed for 40+ vehicles? How do we keep this from becoming a large mud hole? Are there standard parking designs that maximize the number of sites in a minimum area of disturbance? What maximum size vehicle are we accommodating?
		Settling ponds; are these constructed, or just holes in the ground? Do they need to be cleaned out?
		Will each new culvert have outlet protection to minimize new erosion and sediment sources?
	27+00	Hard to tell if this purple is widening or stability
3	65+00	Can this lot be made larger to accommodate closures downstream?
4		Can any of the red lots be left open?
		What actions will be used for stabilization, is the intent to fix major roadside erosion?
7		Ditch reconditioning may become parking
8		River side trail feasible in this section? from page 3 to 8
14	265+00	Parking lot with culvert under it? Is the intent to have the sediment trap capture all flow coming from the drainage, as shown?
15	317+00	Parking area is too close to the river, can it be made narrower, or placed on other side of road?
16	322+00	Not sure if blue line drainage is correct, but if so, does the drainage conflict with the parking area?
	328+00	Parking area in wetland?
17	355+00	Is the red parking area safe to leave?
18	380+00	Safe to leave red parking area? Adjust shape?

	383+00	Change parking area shape to retain vegetation between road and parking.
20	411+00	Private. Can road at 411+00 be closed and rehabilitated?
20	420+00	Parking on private. Is it an issue to be so close to fee area? Why is new design so far from road edge? High number of social trails from this site, not certain of attraction. Restroom?
23		Great shuttle site. Move restroom closer. If intent is to provide shuttle service on capacity days, need more space here.
	476+00	Purpose of larger parking area here? Especially if have the shuttle space.
	710+00	Parking area on private?
	739+00	Stabilize sediment in drainage on south side
	780+00	To 785+00. Need a good parking area design here, post and cable and close other roads in this area.

Phone Conversation Record - Denny Bohon/USFS and Kyle Hamilton/CH2M HILL

1. Parking Areas: Design parking areas to be defined (e.g. use boulders), pull them away from the river where possible, place in upland grass areas if possible (not riparian areas), and use post and cable fencing if needed to control use.
2. Stairs for Pedestrian Access: Denny said USFS hasn't found a great solution to this. We discussed several options, ideas, and lessons learned:
    a. Rock steps: These don't work well, anglers walk around them, and rocks can be slippery with the decomposed granite pebbles.
    b. Metal steps: Don't look good, but function and last.
    c. Concrete interlocking blocks: USFS has used for OHV trails, these could be tried.
    d. ADA compliance: Coordinate with USFS in the next project phase to determine if ADA compliance would apply to any improvements.
    e. Grouted rock or boulders: These can work, and have been used elsewhere.
    f. Soil cement using native material: These could be costly and difficult to construct.
    g. Logs or railroad tie steps: USFS has found they degrade and don't last.
    h. Plastic Steps: An HDPE ditch liner is being used on the Sugar Creek Pilot Project. This material could be tried in a pilot project for use as steps.
3. Downspouts at the end of culverts: We know there are challenges, but may be worth a pilot project.
4. Turn around area at the upstream parking lot: Clearly define a turn-around road, and where people should park to not conflict with turning vehicles.
5. Add restrooms where needed.
6. Consider if the road can be narrowed to allow the creation of a buffer between the road and river.
7. Operations: USFS and Denver Water need to coordinate on best practices, placement of gravel, grading, snow storage, removal of berms, not casting material into the river, etc.
8. Need to identify proposed solutions for a pilot project.

Don Logelin, Cheyenne Mountain Chapter of Trout Unlimited

Road Improvements

I like the recommendations for road safety and maintenance. I think that we need to take another look at getting a harder road surface, since this is probably the only way to mitigate road sediment entering the stream in areas where there is little or no buffer between the stream and the road.

Parking Management

Overall I like the plan for adding and improving existing parking. Also closing some parking in areas where there is a safety issue. However, I do agree with Dave that some of the proposed parking closures are not warranted and that we should look closer at the > 1 mile stretch where it is proposed to close all parking.

Traffic Management

I believe that addressing the parking issue will address most of the concerns with traffic volume. Since there have not been many accidents in this section I do not believe that there is a significant safety issue.

Upper Road Closure: I am not sure what issue this is trying to address and therefore I would have a hard time defending this action.

Shuttle Service: I do not think that this is a viable option. I estimate it would take a shuttle an hour to do a round trip in the canyon. Therefore it would probably be necessary to have at least two working and one spare shuttle. I think it would be difficult for fisherman to get all of their gear on and off the shuttle. There will be peak times (afternoon thunderstorms) when everyone will want to get a ride out and the shuttle will be full. This means that a number of people will need to wait out the hail/lightning somewhere. If someone misses the last shuttle it is a long walk out. In general having to take a shuttle would take away from much of what people enjoy about going to the canyon.

Capacity Limit: I would support limiting the number of vehicles in the canyon if it was shown to have a significant improvement on illegal parking/parking safety.

Pedestrian Safety

I support closing run-downs and having off road trails that are sustainable and contribute less sediment to the stream. Due to the topography there are limits to what can be done in this area. Also having longer stretches of road without approved parking will force more people to walk the road.

Water Control

I agree with the drainage and mitigation measures outlined but they do not address sediment from the road in area that do not have a buffer. I believe that a large amount of sediment is due to the road surface and can only be mitigated by hardening the road surface.

Dam Removal

I would like to see a reconnection of the Platte from Happy Meadows to Eleven Mile Canyon to improve the fishery and get more recruitment. This would involve removing the diversion structure at the lower end of Eleven Mile Canyon and also providing for fish passage around the structure on private property adjacent to Lake George lake.

David Leinweber/Angler's Covey

Road Station 75-00 to 130-00
This is the segment that starts at the top of the Cascades. There are one or two very poor parking pull-outs along this segment, which is adjacent to some of the very best pocket-water fishing in the canyon. There are numerous social trails leading down the road fill slope to the river, and most of these are unstable and contributing sediment. There are also several small crags popular with the climbing community on the north side of the river through this segment. Ideally, parking could be eliminated through this segment, and adequate parking and a decent access trail constructed on either end to provide recreation access.

Pedestrian Rundowns are a major issue within the framework of this project and the development of a clearly marked and maintained anglers trail would be a great contribution, but closing parking should be carefully consider. Reducing access will be heavily resisted by the angling community and the current proposal to close parking for a mile section with Eleven Mile Canyon with be strongly opposed.

73 Parking Closure - This is a good parking area. It is on an inside corner, but the traffic coming upstream around the corner is on the opposite side of the road. It is clearly seen from downstream traffic. With simple signage you could raise the safety of this area. This area could be adjusted and entry placed farther from corner for sight issues.

110 Parking Closure - This is a great parking area and holds two cars very adequately. With some fill it could be expanded to hold up to 6-8 cars. Signs could be used to direct anglers slightly down stream where access to a river trail could be done easily. This parking area would be ideal because it is half way within the mile closure currently proposed.

River Trail Proposal - Within the current proposal, parking will be closed for a mile and inadequate parking in place on both ends of this closure. The idea of an angling trail is going to be challenging in this section because of the amount of rock protrusions. Each bank has several sections where a trail location is impossible. The addition of pedestrian bridges is impractical and costly and would greatly detract from the beauty of this section.

With that said, there are sections that could hold an angling trail that could also be used for casual hiking, but river crossing will be an issue. Angler's Covey strongly supports the closures of angling rundowns and sediment control is vital to the improved health of the canyon.