2020

Old Yellowstone Trail South Corridor Study

Park County Montana

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Definitions

ADA	Americans with Disabilities Act
BLM	Bureau of Land Management
FHWA	Federal Highway Administration
FLAP	Federal Lands Access Program
FLMA	Federal Land Management Agency
MP	Milepost
NPS	National Park Service
OYTS	Old Yellowstone Trail South
ROW	Right of Way
USFS	United States Department of Agriculture Forest Service
USMP	Unstable Slopes Management Plan
WFL	Western Federal Lands Highway Division
YELL	Yellowstone National Park

Executive Summary

Introduction

At the request of Park County Montana, Western Federal Lands Highway Division (WFL) conducted a study of the Old Yellowstone Trail South (OYTS) road alignment for potential improvements to the corridor. Sitting 60- to 90- minutes from Bozeman and less than an hour from Livingston, the county seat of Park County, Old Yellowstone Trail South has the potential to be a major recreational destination.

The objective of the study is evaluation of the corridor which includes a road and trail of the same name, Old Yellowstone Trail South. The two intertwine one another for 21+ miles and provide access to homes, recreation, farming, and a place of worship. This study, referred to as the *Old Yellowstone Trail South Corridor Study*, is a planning level review of safety; operational and geometric conditions; and environmental resources within the corridor to identify needs and constraints. This study is not intended to be a decision document. This effort strives to identify feasible improvements within the study area based on needs identified by the public, the study partners, and resource agencies. It will serve as a pre-NEPA evaluation to identify reasonable options for the 21-mile corridor.

A section of the road was blocked by a rockslide in 2014, and has remained unpassable up to the writing of this document. Removing the rockslide, restoring the roadway and reestablishing emergency access is the primary objective of Park County officials. Additionally the question was raised of whether the corridor is suitable as a recreational corridor. There is anticipation that opening the roadway will encourage additional activity. Considering additional activity in the corridor raised further questions: Should the road be reopened to the public? Should it provide only emergency access? Should it provide recreational access? Should there be a plan for more people? Should there be consideration for additional activities?

A major consideration for this corridor is the proximity to Yellowstone National Park and inclusion within Custer Gallatin National Forest. Maintenance, improvements and decisions regarding management of the corridor must be a collaborative effort and consider the resources and mission of each of the agencies involved.

Study Area

OYTS is a roadway and trail of the same name located in Park County, Montana. The study area is a 21.1-mile-long corridor starting at the Roosevelt Arch Monument in Gardiner, meeting US Highway 89 just beyond the landform referred to as Point of Rocks. The corridor is bounded on the east by the Yellowstone River and on the west by the Gallatin Range.

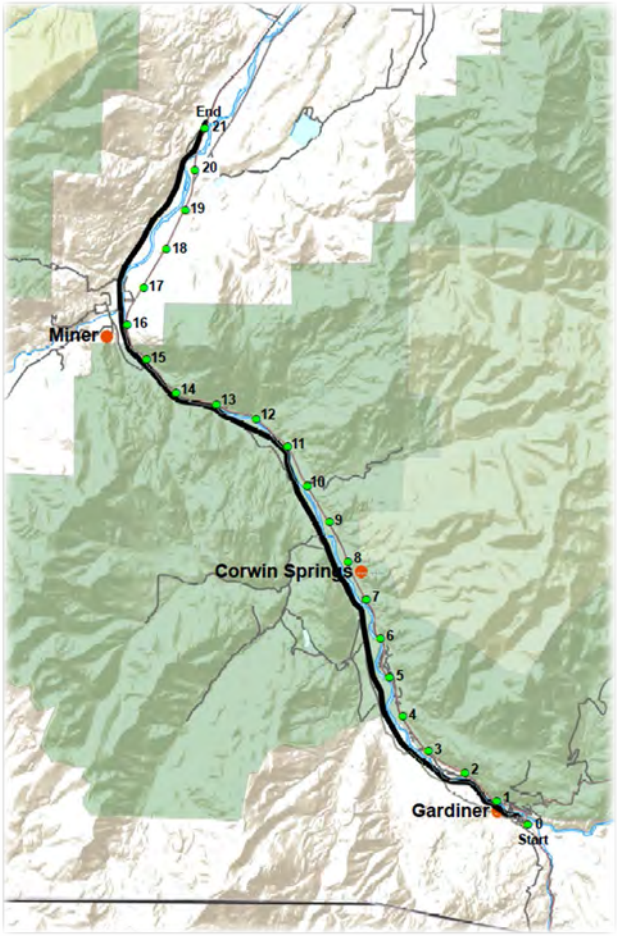


Figure ES- 1 Park County, Montana geographical area with study area identified in the lower left corner. Source: Google Earth

Figure ES- 2 Old Yellowstone Trail South Corridor Study Area. Source: WFLHD GIS

Focus Areas

Three main focus areas emerged from discussions with Park County, Land Management Agencies, and the public:

- ***Focus Area 1 – Safety:*** *Provide safer and more adequate transportation access to and through CGNF and YNP for residents, recreationists, visitors and resource users.*
- ***Focus Area 2 – Condition:*** *Ensure the future use of the corridor is not inhibited by degradation of travel surfaces.*
- ***Focus Area 3 – Planning for Growth:*** *Establish a balance in developing recreational opportunities, while also preserving the existing character of the area. Ensure that increased use does not elicit an increase in unwelcome behaviors.*

Existing Conditions

The OYTS road is used to access recreation and private property within the study area. Recreation in the study area includes camping, cycling, hiking, fishing, rafting and boating. Wildlife in the area include bison, grizzly and black bear, wolves, big horn sheep, pronghorn antelope, elk, and numerous species of birds and fish.

Roadway

The existing roadway is gravel of varying width and condition. Park County performs regular maintenance, and deploys a grader at least annually to correct surface irregularities and restore the crown of the road. Many large vehicles use the roadway to support ranching and farming operations. The National Park Service (NPS) uses the roadway for transport of semi-trailers full of horses and bison and access to their bison operations.

Safety is a concern in the corridor, due to unstable slopes, wildlife interactions, and roadway geometry and condition. Geotechnical concerns such as unstable slopes and lack of catchment ditches contribute to the degradation of the road and pose risks to existing users. The road corridor has been closed to through traffic since 2014 due to slides at milepost (MP) 14.1 and 14.2. Additional safety concerns include limited sight distance, lack of guardrails, narrow sections of road and portions where high speeds could produce significant consequences.

Drainage issues at many points along the roadway cause roadway flooding, washboarding, potholes and rutting. In addition, runoff has washed away the surface aggregate in places, allowing the remaining roadbed to become muddy or impassable.

Railbed

The rail line has long been removed, and the land beneath it has been returned to property owners. An informal trail has developed on many segments of the original rail alignment. On the ground, navigating the trail is quite simple for the first half of the corridor but becomes progressively more difficult as the condition deteriorates and the ownership converts to a higher percentage of private property. A couple property owners have visible segments of former railbed on their property, while others have obscured the original sections through farming or construction of buildings.

The condition of the trail is deemed good in segments near the start of the study area, and has become overgrown or nonexistent in other segments. Current irregularities in the surface of the former railbed prevent designation of the alignment as a proper trail.

Public and Stakeholder Participation

WFL met with project partners, the public and other local stakeholders to gather information and comments. Attendees of the public meeting were largely interested in the impact the development would have on their property and what could be expected from the process. Largely, residents were worried about maintaining the nature of the corridor, and were in support of keeping improvements as minimal as possible.

The main message from public agencies is the interest in improving, enhancing and protecting public health and safety; emergency access; recreational opportunities; and environmental and cultural resources. There is anticipation that this corridor will have growth in population and recreational users. A plan is requested that will provide a basis for future decisions regarding investment in recreational opportunities and ensure safety of the users. There is concern about condition of the road.

Agencies that also responded to the request for comment include: Montana Fish, Wildlife and Parks; Yellowstone Gateway Museum; Royal Teton Ranch; Rails to Trails Conservancy; and archeologists from USDA Forest Service.

Problem Statement, Goals, and Objectives

Evaluation of the corridor, discussions with public officials and inputs from stakeholders generated a significant list of concerns, suggestions, and needs within the corridor. Based on the results of those inputs, we have identified 8 problem areas:

1. **Secondary emergency access**
2. **Roadway condition**
3. **Impact to wildlife**
4. **Destruction of archaeological assets**
5. **Environmental degradation**
6. **Impact to property owners**
7. **Corridor encroachment**
8. **Visitor experience**

Through this study, the following Goals and Objectives were determined. These Goals and Objectives will help to guide future construction improvements and/or can be used in the NEPA process.

Goal #1

Improve the corridor to establish a throughway for vehicle and recreational use.

Objectives

- Provide secondary emergency access through the full corridor.
- Improve roadway elements to better road condition and increase user safety.
- Establish a multi-use trail separated from the roadway where possible.

Goal # 2

Protect cultural and natural resources that make the corridor unique.

Objectives

- Minimize impacts to wildlife and the landscape from corridor usage.
- Minimize impacts to archaeological resources.
- Highlight original transportation connections along the trail.

Goal #3

Balance visitor experience with landowner property rights.

Objectives

- Involve property owners in the planning process.
- Provide a positive and coherent visitor experience.

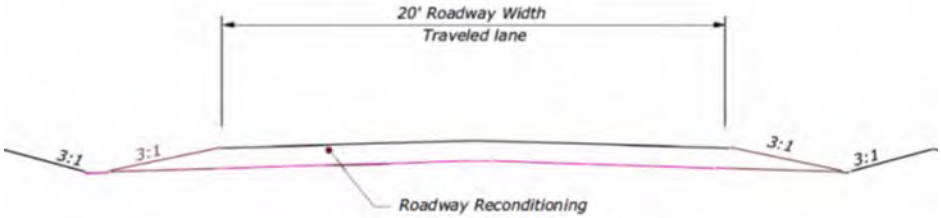
Possible Improvements

Corridor-wide Improvements

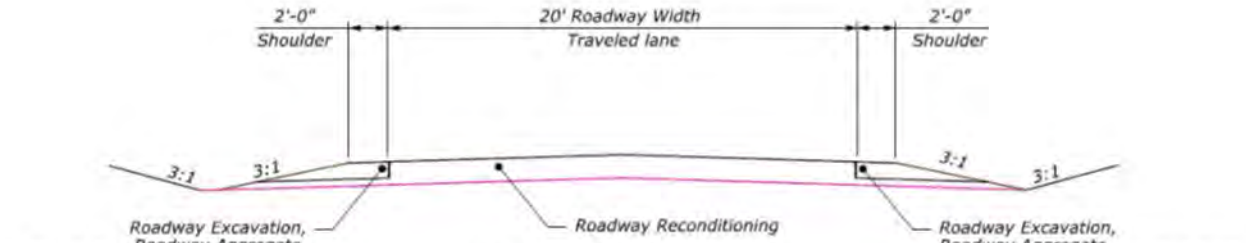
This section summarizes general geometric and surface condition improvements throughout the corridor. The general recommendations are referenced or described in more detail for each segment in the sections below.

Road

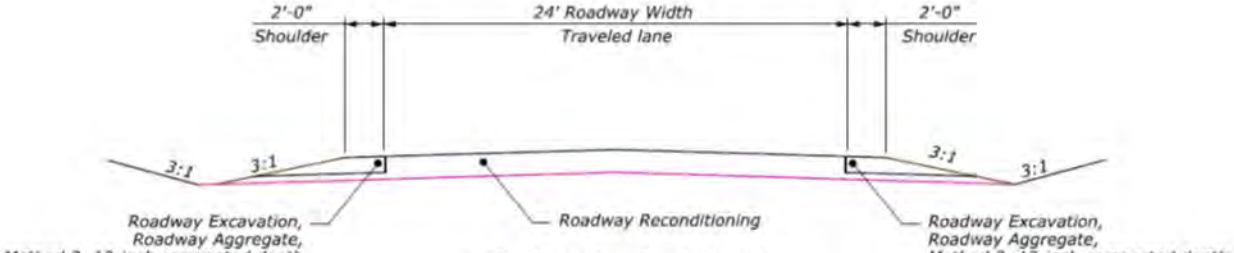
- Improve roadway to consistent width (20 foot, 24 foot or 28 foot). The width of the existing roadway varies throughout the corridor. See Figure 1 for roadway typical cross-section options.
- Elevate finish grade in low areas to prevent ponding of water on road surface
- Recondition gravel surface to eliminate formation of muddy sections and reduce washboarding
- Improve drainage in problem areas:
    - Install, replace, repair, or clean culverts where necessary.
    - Construct drainage ditches. Where drainage ditches are already present, clear them of any debris or overgrowth.
    - Establish crown on roadway
- Apply dust-free surface applications when multi-use trail shares right-of-way. Consider use of a sealant or other treatment that will secure the surface and prevent erosion.
- Continue regular maintenance
- Clear debris and vegetation from road edge
- Install clear wayfinding signs



20-ft Typical Section



24-foot Typical Section



28-foot Typical Section

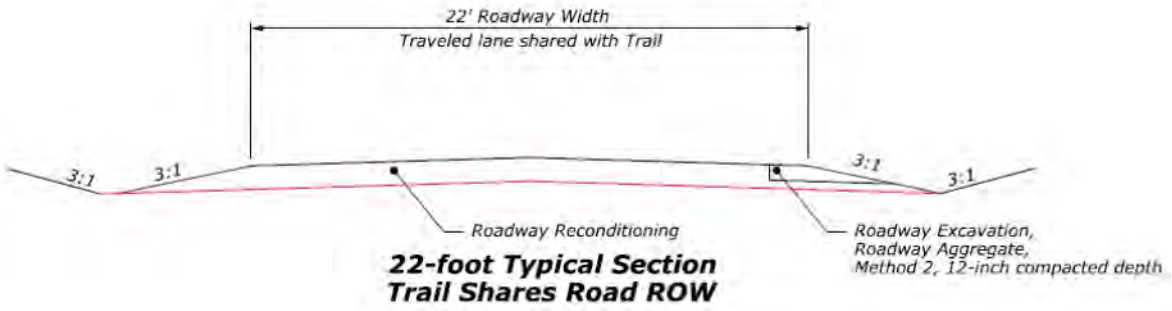
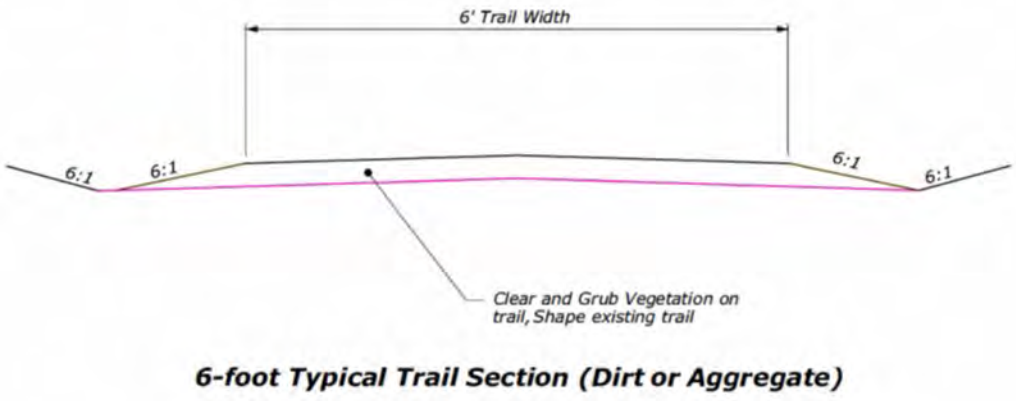


Figure ES- 3 Road Typical Cross Section

Trail

- Improve trail to consistent width (6 to 10 foot) where it is separated from the road. The width of the trail varies throughout the corridor. See Figure 2 for trail typical cross-section options.
    - The 6-foot wide cross-section could keep the trail surfacing as dirt, or add aggregate
    - The 10-foot wide cross-section assumes adding aggregate
- Grubbing and clearing of overgrowth
- Remove large rocks from trail
- Fill potholes, sinkholes, and ruts
- Establish standards for surface preparation, treatment and maintenance
- Install clear wayfinding signs



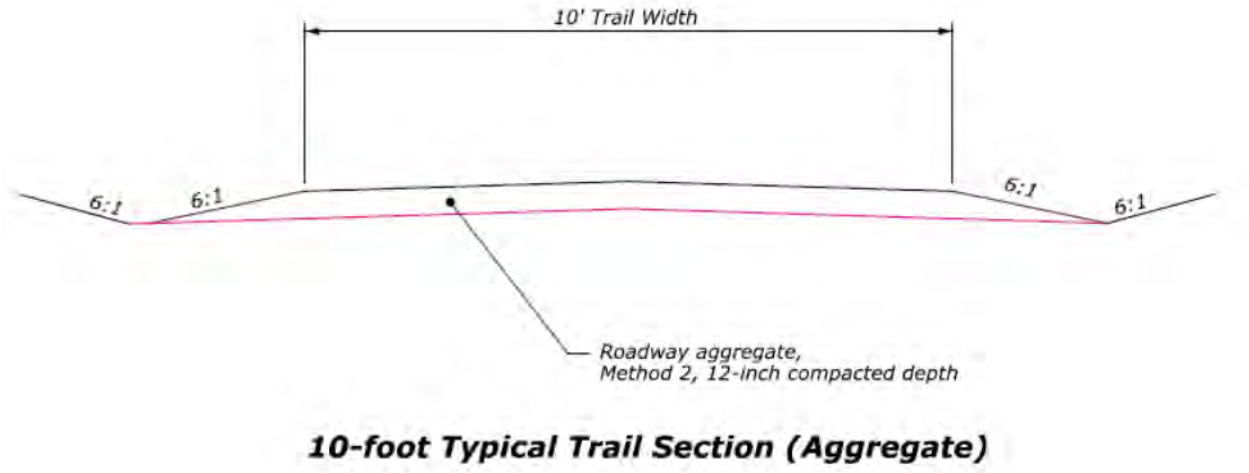


Figure ES- 4 Trail Typical Cross Section

Range of Improvement Options

Possible improvements are grouped together below in three options for the entire corridor. It is worth noting that the improvement options are packaged together for ease of comparison, but project partners may choose to "mix and match" segment options in myriad combinations. The estimated construction cost is based on planning-level cost estimates described in Appendix A.

- ***Option 1: 20-Foot Road with Minimum Improvements (est. construction cost $2.0 million)***
  - **Road:**
    - Clear the blockages on the roadway at MP 14.1 and 14.2
    - Undertake low-cost slope stabilization measures
    - Establish consistent 20-foot road width; except keep one-lane width in Yankee Jim Canyon with intervisible turnouts for passing
    - Recondition road with aggregate
    - Improve drainage:
      - Install, replace, repair, or clean culverts where necessary.
      - Construct or clear drainage ditches.
      - Establish crown on roadway
    - Install clear wayfinding signs
  - **Trail:**
    - Formalize existing trailhead
    - Remove rocks and clear and grub vegetation from trail
    - Establish or maintain 6-foot dirt trail where trail is separated from road

- Separate trail from roadway where feasible, but do not acquire easements where trail is on private property
    - Trail on existing, separated alignment in Segments 1, 3, and most of 5
    - Trail on shared ROW with road in Segments 2, 4, portion of 5, and 6, 7, 8
- Install clear wayfinding signs

- ***Option 2: 24-Foot Road with Moderate Improvements (est. construction cost $5.3-6.4 million)***
    - **Road:**
        - Clear the blockages on the roadway at MP 14.1 and 14.2
        - Undertake mid-range slope stabilization measures
        - Widen to consistent 24-foot road width; except keep one-lane width in Yankee Jim Canyon with intervisible turnouts for passing
        - Recondition road with aggregate
        - Improve drainage:
            - Install, replace, repair, or clean culverts where necessary.
            - Construct or clear drainage ditches.
            - Establish crown on roadway
        - Install clear wayfinding signs

    - **Trail:**
        - Build a trail from the Gateway Arch to the existing trailhead.
        - Remove rocks and clear and grub vegetation from trail
        - Improve to 6-foot aggregate trail where trail is separated from road
        - Separate trail from roadway where feasible, but do not acquire easements where trail is on private property
            - Trail on existing, separated alignment in Segments 1, 3, and most of 5
            - Trail on shared ROW with road in Segments 2, 4, portion of 5, and 6, 7, 8
        - Install clear wayfinding signs

- ***Option 3: 28-Foot Road with High Improvements (est. construction cost $8.9-$15.1 million.[1])***
    - **Road:**
        - Clear the blockages on the roadway at MP 14.1 and 14.2
        - Undertake extensive slope stabilization measures
        - Widen to consistent 28-foot road width; except keep one-lane width in Yankee Jim Canyon with intervisible turnouts for passing
        - Recondition road with aggregate
        - Improve drainage:
            - Install, replace, repair, or clean culverts where necessary.
            - Construct or clear drainage ditches.

[1] ***The $15.1 million includes a pedestrian bridge over the Yellowstone River at an estimated cost of $4-5 million***

- Establish crown on roadway
- Install clear wayfinding signs

- **Trail:**
  - Build a trail from the Gateway Arch to the existing trailhead or build a pedestrian bridge over the Yellowstone River.
  - Remove rocks and clear and grub vegetation from trail
  - Widen to 10-foot aggregate trail
  - Maximize trail separation from road, including negotiating with property owners to try to acquire easements where trail is on private property
    - Trail on existing, separated alignment in Segments 1, 3, and most of 5
    - Work with landowners to acquire easements for trail in Segments 2, 4, portion of 5, 7, and 8
    - Trail on shared ROW with road in Segment 6
  - Install clear wayfinding signs

Conclusions

This study set out to look at the existing conditions of the corridor and develop an evaluation of the future possibilities. Over the course of the development of this report, the opinion has existed that Old Yellowstone Trail South is a viable alignment for a mixed-use recreation corridor. It is clear that it already is being used as such, and there is no evidence that suggests changing the existing use.

The authors of the report recommend that at a minimum, the rockslide and landslide in Yankee Jim Canyon be removed and reinforced to allow the roadway to be reopened. The lack of a secondary emergency access presents an unnecessary risk for the residents and visitors of the Gardiner Basin. In addition to removing the rockslide, the roadway approaching the rockslide from the south is in need of repair and maintenance to improve the existing condition. There must be a commitment to ensure the roadway is passable at all times of the year.

Once access is restored, it is advisable to perform a baseline visitor use survey. Having a baseline survey will give decisionmakers the information they need to ensure that the demand on the corridor does not exceed the capacity. The options presented in the report allow the owners of the roadway to pick and choose which improvements to implement. Possible projects provide flexibility to proactively address increased demand and remain agile to changing usage patterns. No major projects are currently recommended in the corridor. It does not appear that current demand justifies major expenditures. It is possible that major improvements may never be necessary.

The primary objective based on feedback from stakeholders and residents is to retain the current character of the corridor and to ensure the condition of the roadway and trail do not deteriorate. It is recommended that the corridor be monitored closely, especially in response to the reopening of the access through Yankee Jim Canyon.

Chapter 1. Introduction

At the request of Park County Montana (COUNTY), Western Federal Lands Highway Division (WFL) conducted a study of the Old Yellowstone Trail South (OYTS) alignment for potential improvements to the corridor. The study, referred to as the *Old Yellowstone Trail South Corridor Study*, is a planning level review of safety; operational and geometric conditions; and environmental resources within a defined corridor to identify needs and constraints. This effort strives to identify feasible improvements within the study area based on needs identified by the public, the study partners, and resource agencies. Park County Commissioners submitted an application in March 2016 to request Federal Lands Access Program (FLAP) funding for a planning feasibility study in the Gardiner Basin. In November 2016, the study was selected by the Programming Decisions Committee (PDC), which consists of representation by WFL, Montana Department of Transportation (MDT), and Montana Association of Counties (MACo).

OYTS currently provides the only secondary access option between Tom Miner and Gardiner as an alternative to US Highway 89. As of the time of this writing, the roadway is unusable for anything more than a walking and cycling path. In 2014, OYTS was rendered impassable by a rockslide covering a section of the road, and then a landslide on the cut side of the slope above the river washed out a section of the road. OYTS was investigated for the possibility to provide secondary emergency access, as well as potentially improving the recreational options along the corridor. This was a collaborative process including WFLHD, Park County, the unincorporated Town of Gardiner, the United States Forest Service (USFS), National Park Service (NPS) and Bureau of Land Management (BLM).

Background

Old Yellowstone Trail South holds historical significance for its role in facilitating travel to Yellowstone National Park[2]. Yellowstone National Park was established in 1872 by President Ulysses S. Grant. Around the same time the first road was under construction to provide formal access for visitors. The original road may have been a mining road and served mostly stagecoaches and movement of livestock. One account states that the road was built by a miner from Cooke City[3]. Roads of the time were not always well maintained, and often farmers didn't see the need to improve their roadways for the access of outside "tourists". Government money was not often allocated for their construction or maintenance either. After the road was built, one man living in the area claimed ownership of a narrow section of the road and established a toll collection, though it is unlikely he did much to maintain it. Stories abound about the man Yankee Jim George, who operated the toll road named in his honor. It is also said he may have built the toll road, but accounts are inconsistent. In 1883, in response to the demand to visit the park, the Northern Pacific Railroad extended a line to Cinnabar, making the toll road somewhat obsolete[4]. In the process, some of the roadway alignment was acquired for the construction of the railroad, and new roadways had to be constructed over more difficult terrain.

[2] Letter from Gateway Museum
[3] Paradise Valley Corridor Planning Study
[4] (https://www.nps.gov/yell/learn/historyculture/park-history.htm)

In 1903, the arch at the north entrance of Yellowstone National Park was dedicated by Theodore Roosevelt. The same year, the railroad was also extended from Cinnabar to Gardiner[5]. Not long after the railroad was completed automobile ownership started becoming more common. There was soon demand for an improved roadway leading to Yellowstone. A plan by some businessmen in South Dakota to construct a roadway from Chicago to Gardiner started to gain momentum and soon the federal government was in support of getting the roadway built. The original idea for a road to connect Ipswich, MA to Aberdeen, SD grew into a plan for a transcontinental route to 'get folks to Yellowstone' in just a few weeks. The route was known as the Yellowstone Trail and was one of a handful of transcontinental roadways being planned and constructed in the United States to satisfy the growing demand from influential automobile owners[6]. The Yellowstone Trail would eventually extend from Providence, Rhode Island to Seattle, Washington with a tagline that read "A good road from Plymouth Rock to Puget Sound." In 1912, Park County used the impetus of the Yellowstone Trail to start construction of a Park to Park Highway between Glacier National Park and Yellowstone National Park[7]. The counties actions in improving the road through Yankee Jim Canyon in 1912 facilitated the designation of this route as the only spur line off the entire Yellowstone Trail between Plymouth Rock to Puget Sound[8]. Late in the summer of 1915, cars arrived at the north entrance of Yellowstone for the first time by way of the Old Yellowstone Trail. The continued operation and protection of Yellowstone was secured in 1916 under the newly created National Park Service. Rail service continued to Gardiner until 1948.

As the demand for automobile access increased, the number of rail passengers declined and the railroad discontinued service. Construction of US Highway 89 replaced the Yellowstone Trail and the historic alignment of the Yellowstone Trail was abandoned and returned to private property owners. What is now called Old Yellowstone Trail South was the western tip of the original Yellowstone Trail and is one of the few preserved lengths of the corridor that still exists.

Study Area

Old Yellowstone Trail South is a roadway and trail of the same name located in Park County, Montana. The study area is a 21.1-mile-long corridor starting at the Roosevelt Arch Monument in Gardiner, extending generally northwest to Carbella Bridge (Miner) for 17 miles and then shifting direction northeast for the remaining 4.1 miles, meeting US Highway 89 just beyond the landform referred to as Point of Rocks. The corridor is bounded on the east by the Yellowstone River, and to the west the boundary is framed by either the former railbed, or the Old Yellowstone Trail Road, altering, as the road and the railbed frequently cross one another. The study area is shown in Figure 1.

[5] https://www.visitgardinermt.com/about/history
[6] https://en.wikipedia.org/wiki/Yellowstone_Trail
[7] Allen, Lerick Dean; Convicts, Boosters and Farmers.
[8] Letter from Yellowstone Gateway Museum

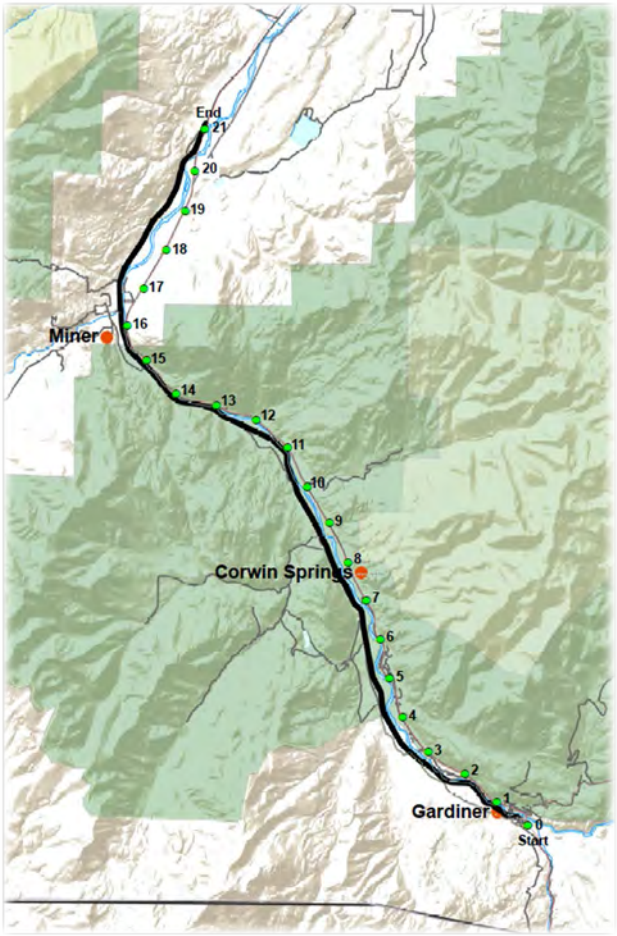


Figure 5 Park County, Montana geographical area with study area identified in the lower left corner. Source: Google Earth
Figure 6 Old Yellowstone Trail South Corridor Study Area. Green dots indicate mileposts. Source: WFLHD GIS

Problem Definition

The issues that this study seeks to address are 1) lack of consistent secondary emergency access between Livingston and Gardiner, 2) drainage and road condition issues on the Old Yellowstone Trail South Road corridor, and 3) the need and desire to plan for anticipated growth and recreation use within the corridor.

Park County is faced with a dilemma of interrupted secondary emergency access on portions of Highway 89 between Livingston and Gardiner. Alternate roadways are available for sections of the 51 mile corridor, but there are impassible segments between mileposts 7.5 and 16.5. Slightly north of milepost 20, East River Road connects to Highway 89 and extends parallel to Highway 89 on the east side of the Yellowstone River and reconnects to Highway 89 approximately 2 miles south of Livingston. On the west side of Highway 89, North Old Yellowstone Trail connects in Emigrant and connects to Highway 89 approximately 2.5 miles south of Livingston. Both roads offer an alternate emergency access in the event of a disaster or accident blocking Highway 89. South of milepost 16.5, in the study area of this project, such an event on Highway 89 would make Gardiner unreachable by emergency services.

Park County has repaired rockslides in the corridor previously, but the current situation is far more severe and requires additional engineering to remove the current cause of a roadblock and repair the road for access. In addition to repairing the road, Park County has an opportunity to establish a comprehensive vision for managing growth in the corridor. It is expected that the number of annual visitors will continue to increase in the corridor, though there are no projections for growth, and no plan should that occur. Park County is taking action to prepare a long-range plan for management of the corridor. Similar locales in neighboring states have experienced rapid growth without a plan and have allowed that growth to occur unchecked. In most cases, communities are left reacting to the problem and never quite catching up. There is potential that one day Gardiner Valley will be a major recreation destination in addition to a visit to Yellowstone National Park. The challenge being addressed in this effort is the management of the corridor in the future in anticipation of a rise in use. Resources to improve the corridor are limited, and should be spent towards a unified vision of what the corridor should become.

The existing corridor is not currently strained by the amount of visitation. In fact, visitors to the area lucky enough to venture across the Yellowstone River will be amazed at the wilderness available to them. Herds of bison, elk, deer and antelope are frequently roaming on or near the roadway. In most cases, only a handful of vehicles will pass through the corridor daily, and aside from a few short stretches connecting residents to one of two bridge crossings of the river, there are very few man-made structures. No, the problem is not excessive traffic or recreationists. The challenge of managing such a beautiful wilderness area is that eventually what was once a lesser-known destination rockets in popularity, and planners are left managing the problem in a reactionary vs. proactive method. Popular recreation areas across the country have experienced rapid growth in use that threatens to overwhelm available resources and create a challenge for management staff. The FLAP application requested assistance in studying the long-range feasibility of improving the corridor and generating a list of recommended planning actions. Park County will not await the fate of comparable locales.

Focus Areas

Three main focus areas emerged from discussions with Park County, Land Management Agencies, and the public. Those themes are the result of hundreds of considerations for what is important in developing the corridor, many of which will be discussed in this section. Planning efforts are often initiated in response to a major problem, such as overcrowding, congestion, or ecological impacts. Park County elected to plan for future possible outcomes that have been witnessed in similar recreation areas in the western United States and have overwhelmed visitor capacity (i.e. Slickrock, Bryce Canyon, Zion National Park). Taking action to develop a plan now has the potential to mitigate impacts from growth in recreation and visitation.

Focus Area 1 – Safety: *Provide safer travel and a secondary emergency access to and through CGNF and YNP for residents, recreationists, visitors and resource users*

First and foremost, improvements in the corridor must generate a measurable improvement to emergency vehicle access, safety of the users, and safety of wildlife. US89 is a single point of entry for emergency responders, creating concerns about the ability to appropriately respond to a significant event in or around Gardiner. In the event of an incident that requires outside assistance it would likely

need to be requested from Mammoth or West Yellowstone and would require significant response time. Secondary emergency vehicle access is a key objective to improving transportation options in the corridor. Correcting the existing Tom Miner Canyon rock slide and preventing future degradation of the roadway is important to ensure a reliable access is available in an emergency event.

Objectives for Safety include:

- Provide Secondary Emergency Access
- Mitigate Rockslides/landslides
- Meet current roadway and trail design standards
- Reduce conflict of animal/human interactions
- Provide emergency response capability
- Ensure stability of significant slopes/grades

Focus Area 2 – Condition: *Ensure the future use of the corridor is not inhibited by degradation of travel surfaces.*

Another matter at hand is the overall condition of the roadway, trails and recreation amenities. Park County Public Works Department establishes a roadway designation for each of the roadways in the County road network which determines the level of maintenance a roadway receives. Due to the existing rockslides, and the low volume of use, some sections of the roadway in the study corridor receive reduced levels of maintenance. Reinstituting access for emergency vehicles is the first step in a commitment to improving roadway conditions. Once travel is open, maintaining a positive surface is vital to ensure continued availability of the road.

Objectives for Condition include:

- Maintain roadway to established standards
- Improve drainage to prevent future roadway damage
- Improve rail bed trail surface
- Prolong deterioration from increased use

Focus Area 3 – Planning for growth: *Establish a balance in developing recreational opportunities, while also preserving the existing character of the area. Ensure that increased use does not elicit an increase in unwelcome behaviors.*

Federal Land Management Agencies (FLMA) have a mission to serve the public and facilitate access to federal lands for the enjoyment of all. Each agency has a slightly different mission and list of objectives, and must balance visitation with preservation. That same mission can often present a challenge. Encouraging access can invite unwanted activities, increase maintenance costs, impact wildlife and residents, and diminish the visitor experience. On the upside, increased use of the area offers opportunities for self-policing, development of adventure tourism, and collaboration with friends groups. Providing options for recreation and creating a network for access along the corridor will ideally guide visitors to where they are wanted and not where they aren't. While often access is something to be regulated, shaping access is an opportunity.

Objectives for Planning for growth include:

- Define additional recreation opportunities
- Manage increased usage
- Protect natural/historic assets
- Maintain current level of service and access to public lands

Key Considerations

Development in National Parks and National Forests presents challenges not found in private lands. Public lands are declared national assets by the Federal Government and preserved in accordance with their natural characteristics for future generations. The preservation framework that has been put in place requires that each decision is analyzed for adverse impact to protected populations, nature, and historic integrity. A determination for any action must assess whether that action will have an adverse impact either on its own or when considered in combination with any previous action. NEPA requires that evaluation of impact analyze cumulative impacts.

Through discussions with FLMA, property owners, and other stakeholders, a list of topics emerged which warrant consideration for any future actions. This document does not set out to define future actions, nor is the intent to fulfill NEPA. Keeping in mind the major project focus areas, each of the key areas listed here may be impacted.

Wildlife

- Animal habitat is defined differently for each of the species in the study area and any decisions on increased recreation must consider year round habitat and breeding grounds.
- Hunting is seasonal and is interrelated with migration and breeding and is subject to state regulations. Hunting is also tied to tribal traditions and subsistence.
- Migration corridors cross throughout the corridor and are a concern expressed by the Montana Department of Fish, Wildlife and Parks
- Protected Species have been identified in the study area and should be a consideration when making future planning decisions.
- Human interaction with wildlife is a reason visitors come to the area in and around Yellowstone National Park, but those interactions have an impact on animal movement and behavior. Agencies aim to promote interactions that are safe for people and wildlife. In rare instances, those interactions have negative consequences.
- The overall safety of people and animals throughout the corridor is a primary consideration for any future actions
- Noise created by visitors has the potential to impact animals as well as existing residents. Any such impacts should be reviewed and analyzed.

Wetlands Rivers and Watersheds

- Additional pollution caused by an increase in users has a potential negative impact on the Yellowstone River.
- Commercial outfitter use of Yellowstone River is on the rise, and much of the river is not regulated. It seems that use can continue to rise unchecked.

- Yellowstone River is not currently designated as a Wild and Scenic River, though there are various sources indicating it is eligible, and a designation would have definite implications for management of the corridor.
- US Army Corps of Engineers has developed the Upper Yellowstone River Special Area Management Plan, which addresses existing river impacts in detail and speaks to the threats posed by future modifications, and estimates risks for decomposition in the future.
- Capacity tends to be a concern in all categories. It is likely that the river has a carrying capacity that once reached will have a detrimental effect on the quality of the waterway.

Cultural and Archaeological Sites

- Stage Coach Routes once persisted between Livingston and Gardiner and the evidence is still visible in the form of signage and wheel ruts in the rocks.
- Historical Advertisements once painted on rocks to attract travelers are still visible today.
- Protection of special sites is a priority of archaeologists with the United States Forest Service, and land management agencies in general (including NPS). The challenge of protection comes from the fact that identification of the sites may draw unwanted attention, but currently vandalism is already occurring.
- Town of Electric was the site of the coke ovens for the Montana Coke and Coal Company. The town was originally known as Horr. It was in existence from 1888 to 1910. The town had mine adits, a power plant, coke ovens, a railyard, a flume, a general store, warehouses, a saloon, a jail, a post office, worker cottages, and various other buildings.

Historical Significance

- Cultural resources cover a long time span from the precontact period through the historic period. The precontact occupation covers the Middle Plains Archaic period (begins 3500 BC) to the Late Prehistoric periods (ends AD 1800) with a focus of occupation during the Late Plains Archaic period (1000 BC - AD 500). The historic period is also well represented with transportation and town sites.
- There are at least 15 recorded precontact campsites or stone tool production locations along the west side of the Yellowstone River between Point of Rocks and Gardiner. Some rockshelters also were used during the precontact period. The historic period sites include the Old Yellowstone Trail, the Northern Pacific Railroad, the Yellowstone River Bridge at Corwin Springs, a train crash location, and the townsite of Electric.

Geological

- Landslides are a possibility and there is evidence that the current landscape was largely shaped by landslides of a significant nature. The soil conditions are unstable and are described in the geotechnical appendix.
- Rockslides present a clear danger to those riding bicycles, hiking or engaging in other activities.
- Fault lines directly under the area are likely responsible for triggering the landslides that have shaped the area.
- Groundwater wells risk contamination.

Recreation

- White water rafting[9] is a popular activity, but as the use grows, there is a related impact.
- Bicycling is seeing growth in gravel and mountain bike venues. Catering to that growth may draw considerable visitors to the area.
- Fishing is already a popular activity in the Yellowstone River. Boating and fishing are ultimately limited by the capacity of the river.
- Walking and hiking are ideally low-impact activities, but if not planned for, may produce overcrowding of trails, trailheads, and parking areas.
- Camping is often associated with the other recreational activities listed here. As growth happens in related activities, camping may grow in demand. Additionally, smaller camp vehicles and off-grid travelers are changing the duration and range for campers.
- Hunting as a recreational activity is linked to conservation and continued use of adjacent private lands. Numerous land trusts, conservation groups and special interest groups that support hunting have a mission to see public lands protected.
- Animal watching likely extends into all the activities above. In some cases a standalone activity, such as in birdwatching, but in others, a factor for attracting runners, cyclists, hikers, etc.

[9] http://www.montanahikes.com/Yankee-Jim-Canyon.php

Chapter 2. Existing Conditions

Geographical Area

The study area resides within the geographical defined areas of Gardiner Basin and Paradise Valley. Gardiner Basin contains the town of the same name and extends in a mostly north-south manner bounded by the Absaroka Range to the east and the Gallatin Range to the west. Gardiner Basin extends from a point just south of Gardiner to Yankee Jim Canyon. Paradise Valley continues north from Yankee Jim Canyon and extends to Livingston. As defined in the introduction, the study area encompasses roughly 22 square miles, however, the greater geographical area accessible from the study area potentially includes hundreds of square miles of national forest, national park, private lands, gravel roads, and wilderness.

Population

Gardiner, at MP 0 at the southern end of the corridor, is home to almost 900 residents based on 2016 population estimates[10]. Emigrant is not an incorporated town, nor is it within the study area, but as the next closest census area is home to about 300 additional residents. While there may be additional residents not captured in either of these census areas, it likely does not amount to more than a few dozen individuals. Overall, the study corridor encompasses roughly 22 square miles, and less than 1200 residents. Population density works out to 55 residents per square mile, indicating that this is a low-density rural area, and inflections of visitors are certainly recognized for their impact to congestion, recreation, and the environment.

Annual Visitors and Tourism

It was not possible to acquire data for the number of visitors to Paradise Valley, or even Gardiner. However, the National Park Service collects data at each of their entry gates, and data for the north gate can potentially be used as a proxy for the number of visitors. Knowing the number of visitors to Yellowstone will provide the number of people passing through Gardiner. Yellowstone receives about 4 million visits a year. Approximately 22% of all annual traffic passes through the north gate of Yellowstone, and thereby passes through Gardiner and Paradise Valley. The north entrance is the only year-round automobile access to Yellowstone. Winter visitors enter other entrances on over snow vehicles via roads that are groomed, but not plowed, suggesting that all visitors to the park by car in the winter will arrive through Gardiner. In 2017-18, 163,000 visitors were counted from November to April.

In total, around 880,000 people drive through Gardiner each year, to stop for recreation prior to arriving in Yellowstone, the increased use would have a significant impact on the area. It is uncertain if there will in fact be a significant shift to visit areas outside of Yellowstone in the future, and the 1% number cited above is merely to demonstrate the magnitude of the number of visitors to Yellowstone. Such behavior has in fact been observed in other national parks in the country.

[10] https://www.visitgardinermt.com/about/about-gardiner-montana

Recreation

Recreation in the corridor can be rugged and remote. There are few amenities, no stores, no public utilities and very little wayfinding or information about the area. It is likely to encounter wild animals. In the event of injury, it may be difficult to contact medical assistance, and depending on the location it may be difficult to render assistance once requested. Limited mobile phone service is available in the valley making online navigation or contact difficult. Many visitors may not be prepared for the lack of connectivity, and those relying on online maps are surprised and dismayed to find their maps unavailable.

It is not possible to establish estimates for activities as a whole, and it would be helpful to have an understanding of the current demand paired with future projections to determine timing on recommended actions resulting from the study. The corridor under consideration provides numerous opportunities for relaxation, leisure or physical activity. While there are some developed trails and formalized recreation areas, there are vast sections of the National Forest that are uncharted and open for exploration.

Camping

Camping is a common activity and Forest Service personnel have reported an increase in use of improved sites as well as signs of growing numbers of new dispersed sites appearing. There are 2 camping areas in the vicinity of the study area. One small dispersed camping area exists at milepost 12.8, with the opportunity for another one at milepost 12.4. The Canyon Campground is a Forest Service operated campground located to the east of the Yellowstone River near Emigrant. It is not directly within the study area, and it offers 17 semi-improved sites with firepits and picnic tables and serves as a starting point for people sleeping and recreating in the area.

Cycling

Mountain biking is currently not a featured activity in the area. There has been some effort by BLM to incorporate trail planning in nearby regions of the state, and they have brought on a specific person to manage the task of developing a network of mountain bike trails. Bozeman has a couple of notable custom bike builders, and the number of bike shops has actually risen in the past 10 years, while the number of shops across the country has declined by 18%[11]. There is potential for mountain bike development in the region. Gravel biking is a sport growing in popularity, and is the only form of cycling actually experiencing growth while the rest of the market is in a decline[12]. Gravel riding is defined by bicycles normally ridden on paved roads, slightly modified with wider, better traction tires, disc brakes, and clearance for fenders. It is an appealing activity for adventurers that are no longer interested in the more extreme sport of mountain biking or have grown tired of the risks associated with road cycling. An abundance of gravel roads in Gardiner Basin, particularly spreading out from Cinnabar have potential to draw increased numbers of locals and travelers.

[11] https://streets.mn/2015/07/29/why-are-bicycle-sales-declining-for-the-14th-year/
[12] https://www.outsideonline.com/2332511/gravel-bike-road-cycling-gear

Hiking

While surveying the corridor, there were few indications of formal hiking trails. In total there are 5 trailheads in the area. Three of them are located to the east of the river, but Beattie Gulch and Sphinx Creek are within the study corridor. Beattie Gulch exists at milepost 4.4 and is identified by the parking area and Forest Service signage. The trailhead provides access to 5.5 miles of Forest Service hiking trails, and eventually connects to the Yellowstone National Park trail system. The Sphinx Creek trailhead is in the corridor at milepost 14 closer to Yankee Jim Canyon and provides access to technical trails. There are also less active recreational offerings. Two day-use sites with picnic tables and interpretive signage are available in the area. The LaDuke picnic area sits to the east of the Yellowstone River, and Sphinx Creek offers picnic tables, a restroom, and a paved Americans with Disability Act (ADA) accessible trail.

Information on hiking in the area is difficult to find on the internet. Forest Service personnel in Gardiner can provide detailed information about hiking, but the information is not readily available on the USFS website. Maps of the Gallatin Range online show a series of hiking trails originating from the south or the west, but do not include hikes starting from the east.

Hunting

Park County offers abundant hunting options. It is possible to hunt for Antelope, Bighorn Sheep, Black Bear, Deer, Elk, Moose, Mountain Goats, Wolf and a variety of birds. More notably, there is the possibility to hunt bison. The Gardiner Basin provides a unique hunting experience not found elsewhere in the state and in just a few locations around the country. Annually, bison migrate from higher elevations in Yellowstone National Park to lower elevations in the surrounding basins when winter sets in. Seven tribes from across MT, WY, ID, WA, and OR, along with Montana Fish, Wildlife, & Parks (MFW&P) participate in traditional hunting as bison leave YNP and enter National Forest System (NFS) and private lands. The majority of this hunting occurs along the Old Yellowstone Trail corridor at Beattie Gulch, Cinnibar, and Cutler Meadows on public lands.

Management of the bison hunt poses various challenges. There are potential safety issues brought about by the number of hunters congregated in a small hunting area. The animals themselves are unpredictable and their behavior is modified by the existence of the hunters. Bison hunts are coordinated each morning based on the number of hunters and animals. USFS and MFW&P monitor the hunts to ensure safety. Cars are parked along the roadway near the hunting site leading to congestion and possibly erosion. Traffic flow is impeded by the number of vehicles. Once hunting is over, the animal remains are sometimes left on the hunting grounds.

Waterways

Yellowstone River is the primary water recreation amenity in the corridor. There are 8 named tributaries to Yellowstone but none of them provide recreational opportunities. The Yellowstone River is not dammed at any point along its 670 mile length[13] making it the last great free flowing river in the lower

[13] https://www.visitmt.com/listings/general/river/yellowstone-river.html

48 United States[14][15]. There is desire by some members of the community to seek designation of Yellowstone River as a Wild and Scenic River. Such a designation may place additional requirements on future development. Depending on perspective, this may be interpreted as a protection or limitation. The state of Montana does not impose a daily capacity limit for use of the river. In some cases, the daily use has the potential to overwhelm the capacity of the river, but an official threshold has never been established. Primary river use starts in April and extends until October with peak usage in July and August.

Fishing

Perhaps the most popular, or most notable activity is fly-fishing. World class fly-fishing is a term oft used by tourism websites and sportsmen who write about the activity online. As the longest uninterrupted river in the United States, providing unhindered habitat for trout, fly-fishing is a regular activity in the river. The Salmon Fly hatch occurs in early summer and is a big draw for fly fisherman.

Montana Fish, Wildlife and Parks has 5 fishing access sites along the Yellowstone River. Bureau of Land Management also has a site at Carbella Bridge. All but one are located on the east side of the river out of the study corridor, but access to the river is pertinent to the discussion. Fishermen accessing the Yellowstone River from the east are still impacting the same recreation corridor and count towards the overall users.

Boating

In addition to fly-fishing, rafting or floating down the river are popular activities, and the segment north of Gardiner offers some of the best whitewater rafting in the state. Access permits are at maximum capacity for the 2 landings controlled by USFS. Rafters are also known to enter the river in spots not controlled by the Forest Service. Some outfitters access from private property and some users access illegally. In addition to rafts, kayaks and canoes, fishing boats also use the river. There are 3 Forest Service boat launches within the corridor and one BLM boat launch. McConnell and Cinnabar launch each have capacity for 10 single vehicles, or 5 trucks and trailers. Yankee Jim launch is good for 15 single vehicles or 10 trucks and trailers. Each location has overflow parking.

Wildlife

Animals migrate annually between the higher elevations in Yellowstone Park and the lower elevations of the Gardiner Basin. The area is home to many large wildlife species. Populations of bison, bear and wolves are increasing annually, and there is a permanent population of grizzlies near Cinnabar. Bison move in herds, are generally not greatly impacted by presence of humans, and are not allowed to travel throughout the entire extent of the corridor. Their territory is limited by physical intervention that keeps them from passing through Yankee Jim Canyon. After the winter, the cows and their calves are herded back into the park by the Montana Department of Livestock. The bison bull is allowed to remain. There is some contention over the number of animals that should remain in the herd each year. Yellowstone National Park has been appointed to keep the number from growing, but environmental groups and

[14] https://www.visitmt.com/listings/general/river/yellowstone-river.html
[15] https://www.americanrivers.org/river/yellowstone-river/

hunters are encouraging population growth. As the numbers rise, that means more animals ending up in Gardiner Basin, and increased opportunity for interaction with them. It also means more opportunity for conflict. As buffalo populations increase, predators are likely to be drawn in. Wolves are commonly seen within the corridor, and may be attracted to the area with a higher buffalo population.

Bighorn sheep, pronghorn antelope, elk, and black bears are also frequently seen in the valley. The existence of wildlife is one of the most commonly cited aspects why residents enjoy living in the area. It is also listed as a concern by residents and wildlife agencies for encouraging activity along the corridor.

Roadway

Many large vehicles use the roadway to support ranching and farming operations. The National Park Service uses the roadway for access to their bison operations and hauls semi-trailers full of horses and bison. While this also contributes to road degradation, the NPS is a victim of the poor roadway condition. The existing roadway is a bumpy gravel road[16]. Drainage issues at many points along the roadway cause roadway flooding, washboarding, potholes and rutting. In addition, runoff has washed away the surface aggregate in places, allowing the remaining roadbed to become muddy and rutted. Utility installation has led to erosion and is suspected as a contributing factor in the rockslide within the Yankee Jim Canyon.

Figure 7 Mile 5.4 looking north.

Park County performs regular maintenance, and deploys a grader at least annually to correct surface irregularities and restore the crown of the road. Annual maintenance records indicate the highest maintenance cost comes from a commitment to grading. The second highest maintenance cost is plowing snow. Unfortunately, it is likely that clearing snow in the winter contributes to the need to grade in the spring and summer as well as replace lost gravel.

[16] https://www.eenews.net/stories/1060100069

Railbed

The rail line has long been removed, and the land beneath it has been returned to property owners. Easements on the property were originally granted for railroad use, and were void once the rail was removed. On the ground, navigating the trail is quite simple for the first half of the corridor but becomes progressively more difficult as the condition deteriorates and the ownership becomes a higher percentage of private property. A couple of large property owners have visible segments of the railbed on their property, and others have made the original sections obsolete through farming or construction of buildings. An informal trail has developed on many segments of the original rail alignment. There are no official counts but estimates for use are extremely low. Footprints and bike tracks left in the mud or dust provide evidence of prior usage, but without the ability to quantify the frequency. The condition of the surface varies, but from aerial imagery, much of the original alignment is still visible.

Segment Summary

Along the 22-mile corridor, condition of the roadway, geology, and traffic intensity varies considerably. Traffic data was not collected prior to the rockslide, therefore we may not say definitively that traffic has subsided. Based on anecdotal information from residents and staff of partner agencies, it is clear that the roadway served as a throughway. Throughout the corridor, the current roadway and the historic rail alignment carry the same name of Old Yellowstone Trail South, making it challenging to distinguish between the two in the body of this report and online maps. This effort evaluates the corridor for emergency access as well as recreation, which make it necessary to review the roadway and the standalone trail when they exist. It was decided to divide the corridor into segments to evaluate the type and volume of use, and summarize potential improvements and limitations within each segment.

It is the intent of this study to evaluate options and feasibility of a multi-use trail along the extent of the corridor. The alignment of such a trail may at times utilize the old rail bed, and at other times may merge and share right-of-way with the road. In areas where the trail is likely to share the roadway, improvements must take into consideration the potential for shared-use, and plan accordingly. Ideally, the trail will follow the rail alignment whenever possible, which will provide safe and comfortable separation from vehicle traffic; gentle grades the length of the corridor; and a connection to the historic alignment that shuttled the first visitors to Yellowstone. An existing conditions analysis is meant to summarize the condition of each alignment and report on where it may be feasible to stay true to this ideal. Where it is not possible to physically separate the two forms of transport, every effort should be incorporated to provide a safe and identifiable visual or aesthetic separation of vehicle and pedestrian traffic.

Old Yellowstone Trail South Segment Map

Figure 8 Segment summary for extent of study corridor. Pins mark the end of each segment, with the first segment beginning in Gardiner.

Following is a summary of the segments in the corridor. Based on a segment/node analysis of the corridor, the 22 miles was divided into 8 unequal segments and are identified by milepost. Nodes were established at property lines, intersections, and changes in maintenance category. Descriptions of the corridor start with milepost 0 in Gardiner at the Roosevelt Arch and generally trend north to the intersection with US-89 at milepost 22. Contained within this section is a broad overview of the surface condition, geotechnical assessment, environmental considerations, and safety concerns. Geotechnical information is summarized for each segment based on information contained from a geotechnical assessment. Slopes along the corridor were input into a Federal Highways Administration (FHWA) database named the Unstable Slopes Management Plan (USMP). The USMP provides a risk score based on inputs from the geotechnical expert performing the survey. A detailed report on the rockfall and landslide hazards, how the score is determined, and what the score means is included in this report as Appendix A. A FHWA environmental specialist performed an introductory environmental analysis which is included as Appendix B.

Segment 1: Gardiner to NPS Boundary, MP 0 - 4.4

Figure 9 Segment 1 begins at the Roosevelt Arch and continues to the creek crossing at milepost 4.4, which coincides with the end of NPS property.

The first 4.4 miles of the corridor reside on National Park Service land, but are outside of the fee area of Yellowstone National Park. Many visitors to this area are likely unaware they are in the park boundary since they have not entered the gate. It is a potential advantage to have the segment of trail adjacent to the population center located on federal land. Future improvements will not require acquisition of easements and the mission of the Park Service is to protect park resources and provide opportunities for recreation and visitor use.

Road: OYTS road is of substantial width throughout this entire stretch, and is in fair to good condition. Park County classifies the section of road as a Class 2 – high priority road and performs regular maintenance, typically deploying a grader 3 times annually to correct surface irregularities

and restore the crown of the road. The most recent concurrent average daily traffic count data (est. 2012) for this section of roadway at Gardiner was 194 and at the Yellowstone National Park Boundary was 60. Emergency vehicle access is sufficient. Some wash boarding occurs in the steeper areas, which makes it more difficult to ride a bicycle. It is anticipated that improvements are needed for drainage but not to accommodate cyclists. Some changes in elevation, including steep grades, result in rather strenuous climbs for less experienced cyclists and is not the preferred option for the

Figure 4 Mile 0.2. The trail has no clearly distinguished starting point. Much of the trail is devoid of any signage. A young elk is pictured in the left of the picture. It is common to see wildlife at many points along the trail.

Figure 5 Mile 0.5. The trail is well established, but foliage is starting to grow over the path.

first stretch of riding that will likely also be the most used. Drainage for the adjacent roadway is an overall concern in this area, as significant rutting and erosion occurs due to winter rains and snow melt. Maintenance crews have expressed a desire to have drainage improved in known problem areas. The road starts near Roosevelt Arch, skirts around the community park and then passes the school. The road is narrow in this section, with a retaining wall to one side and the community park on the other. Beyond the school and the Yellowstone Heritage and Research Center there is a small parking spot with a narrow footpath leading to the railbed. This is the only indication that a trail exists.

Trail: The trail consists of a gravel base with a width between 6-10 feet. The entirety of this first segment of railbed is largely intact and well defined. The stretch along the river is beautiful and flat and provides a great opportunity to serve a greater population. In places, the gravel aggregate has been washed away, and animal tracks and tire ruts formed during the rainy season make for a bumpy surface when the ground dries up. Sections of the trail have suffered from washout and erosion from uncontrolled drainage. Sinkholes have appeared in one location from erosion beneath

the surface, but current impact is minimal. It is likely that an existing culvert has experienced damage and needs replacement.

Judging by tracks in the dirt and the lack of vegetation, it appears this segment currently experiences significant use by recreationists. It is not well understood how the trail is primarily accessed. The trail does not make a clear connection back to the town. An informal trail connects through the community park and the shoulder is wider near the running track and sports field, but no official pedestrian connection exists. It is also possible to connect to the trail from 4th Street behind the school, but the school has indicated a preference not to have the path connect behind the school in the future.

Geotech: Much of the trail in this area is cut into ancient earthflows, landslides and glacial deposits. Unstable slopes assessed in this section are either local cut-slopes or eroding fill-slopes along the corridor and not considered unstable due to being a part of the large earth flows. Although there are mostly no catchment ditches along most of this section, the trail width is wide enough to provide some catchment for rockfall along the old railroad grade. Potential avenues for mitigating rockfall in this section could be selective rock scaling, lessening cut slope angles, improving the catchment ditch, or various trail-side barrier types. Erosion closer to the riverbank is also leading to destabilization of the slope below the old railroad grade.

Figure 10 Mile 0.75. Falling rocks have blocked sections of the trail.

Figure 7 Mile 0.75. Erosion on the fill side above the Yellowstone River.

Environment: It is not uncommon to find herds of bison, elk, antelope and sheep in this area. During winter months, many animals come out of the mountains of northern Yellowstone and into the lower areas of Gardiner Basin. This provides a great opportunity for animal viewing, but also increases the possibility of negative interactions either for the animals or for corridor users.

Safety: There are certainly safety concerns for interaction with automobiles, hunters and single person mishaps, but the greatest threat is likely that of wildlife interactions. Not only is there a possible threat to humans, but there is the risk of safety to the wildlife as well. Increased numbers of people using the corridor may cause changes in animal behavior, and travelers unfamiliar with wild animals may not possess an appreciation for the unpredictability and protectionist tendencies of animal mothers.

Figure 11 Mile 1.4 facing north.

Figure 9 Mile 1.4 facing cut slope to the east (left) of the trail.

Segment 2: NPS Boundary to Corwin Springs Bridge, MP 4.4 - 7.7

Figure 10 Segment 2 extends from NPS property line to Corwin Springs Bridge.

National Park Service property abuts a small section of Forest Service land which covers only a short distance before the former rail corridor continues on private property. Along this segment and the next, significant sections of private property reside under the old rail alignment. There has been no discussion with property owners about the possibility of utilizing this historic alignment. In the next phase of development, the NEPA process will evaluate the possibility of easements or land swaps. The likelihood certainly exists that bicycles, hikers and other users of the corridor will share right of way with the road if property owners are not supportive of using the alignment. Final alignment will depend on factors of safety, environment and ownership.

The original extent of the railbed is visible throughout, but passes through private property, and in some cases crosses active agricultural fields. Close proximity to the road allows for relatively easy access to the railbed, and it appears that hikers and bikers are using it currently. An elevated length of trail extending from approximately MP 6.8 to MP 8.3 shows signs of use, but is becoming overgrown with brush. Signage in the area is not clear on whether this is usable by the general public or if it is private land.

Road: Roadway condition is good as well. Aggregate base layers appear to be solid, though the surface suffers from some wash board ripples. Dry summer and fall conditions make this stretch extremely dusty with even a single vehicle pass. Fine dust particles coupled with dry conditions can cause difficulty breathing for anyone exercising or with respiratory issues. Park County classifies the section of road as a Class 2 – high priority road and performs regular maintenance, typically deploying a grader 3 times annually to correct surface irregularities and restore the crown of the road.

Figure 121 Mile 5 standing on OYTS Road looking north.

Trail: Overall condition on this section of railbed is quite good. The base layer of aggregate is solid and shows little to no sign of major degradation. Vegetation has started to obscure the original surface though, and eventually will begin to greatly degrade the integrity. Lack of major gradients limits the amount of erosion caused from water. The biggest concern for cyclists within this stretch, and along the entire corridor for that matter, is the proliferation of vegetation with thorns.

Figure 132 Mile 7. Overgrowth obscures the trail.

Geotech: No significant areas of concern

Environment: Wildlife is present in significant numbers within this section of the corridor. The natural landforms create a natural funnel thereby reducing the distance between the base of the mountains and the river. This natural reduction likely results in a closer proximity between wildlife and people. Future planning should devote special attention to wildlife corridors in this area.

Historic artifacts have long been discovered on or near the railbed. Coke ovens can be seen from the Old Yellowstone Trail - where the community of Electric once stood. The foundations, and in some cases the structure of those ovens still stand. Access to these sites is not readily available, and some consideration should be given to the protection, preservation and prominence of these buildings in the interpretive story of Old Yellowstone Trail.

Figure 153 Mile 7.6 standing on the rail bed looking north.

Figure 154 Mile 7.6 standing on the rail bed looking south.

Safety: There are certainly safety concerns for interaction with automobiles, hunters and single person mishaps, but the greatest threat is likely that of wildlife interactions. Not only is it a threat to humans, but there is the risk of safety to wildlife. Increased numbers of people using the corridor may cause changes in animal behavior.

Segment 3: Corwin Springs Bridge to Cinnabar Basin Road, MP 7.7 - 8.3

Figure 165 Segment 3 extends from Corwin Springs bridge to Cinnabar Basin Road.

Though this segment is short in length, it has been identified as a standalone segment for its role in providing access to Royal Teton Ranch and the associated traffic volume. The ranch periodically applies dust control between the bridge and the ranch entrance. It is likely the most heavily utilized segment in the corridor, but this assumption will need to be verified with future traffic counts. Royal Teton Ranch generates the majority of the traffic demand, with Cinnabar Basin Road residents producing the remaining demand. There is limited public access off Cinnabar Basin Road. Most of the land ownership is private. There are likely some hunters, hikers and OHV users looking for access or entering areas illegally because there is evidence of these activities in the form of tire tracks and bullet casings.

At approximately MP 8.3 the original railroad alignment serves as the access road for Royal Teton Ranch (Figure 16). Cinnabar Basin Road intersects Old Yellowstone Trail South Road where most of the traffic is diverted.

Figure 176 Mile 8.3. Intersection of Old Yellowstone Trail South, Cinnabar Basin Road and Royal Teton Ranch Road. Photo credit: Google Earth

Road – The condition of road in this section is greatly deteriorated. There is evidence of excessive rutting, and pictures provided by Royal Teton Ranch show that the road gets very muddy when it rains. Trail activity is harder to distinguish in this area, and it is unclear whether the trail is on private property or is accessible for potential users.

Trail - Similar to the section of previous railbed, the condition is quite good, but there is little remaining of the aggregate base course. As the distance from town increases there is less evidence of trail use. Vegetation overgrowth has become more significant and the surface condition is much rougher from rocks and dead plants. Permission to access the path is unclear. Signage is badly damaged.

Figure 187 (L) Mile 8.3 looking south on OYTS Road. Drainage is inadequate to handle heavy rains. Photo credit: Alan Shaw; Figure 198 (R) Mile 8.3 Looking south on old railbed.

Geotech - No significant areas of concern.

Environmental – No significant areas of concern.

Safety - The intersection of the railbed and Cinnabar Basin Road where it meets Old Yellowstone Trail South Road poses nominal safety concerns. Average daily traffic is very low and does not pose significant risk for vehicle collisions. A greater risk arises from the deteriorated road condition causing rutting and uneven surfaces. In the wet season, the muddy conditions can make roads difficult for bicycles, especially at intersections, where tire tracks worn into the mud cross one another. In the dry season, the ruts can turn into lips and edges that can catch a bike tire, or roll an ankle.

Segment 4: Cinnabar Basin Road to Cutler Lake, MP 8.3 - 10.6

Figure 209 Segment 4 extends from Cinnabar Basin Road to Cutler Lake.

Shortly beyond Cinnabar Basin Road, the roadway and the railbed encounter a chokepoint as they come together to cross Mulherin Creek Bridge. There was once a railroad bridge in this location that is no longer here. The existing roadway bridge should be evaluated, improved or replaced to facilitate access for multi-modal users. North of the bridge, as the segment continues, the classification of the road changes from Class 2 to Class 4 in the Park County roadway classification system, signifying seasonal use as opposed to high priority use[17]. The reduced level of maintenance is reflective of lack of users in the area. What was once the railroad is now essentially non-accessible. A private fence separates the former rail alignment with the roadway, and no trespassing signs communicate the desire to keep recreational users off what was perhaps once a trail.

As mentioned, traffic beyond this point is limited. There are no additional roadway outlets beyond this point due to the rockslide in Yankee Jim Canyon. Any vehicle traveling north will be turned back by the barriers at MP 13.6.

[17] http://parkcounty.maps.arcgis.com/apps/webappviewer/index.html?id=876e7852b92f48ceb2cc0671a69e92b9

Road - Road condition deteriorates somewhat as the road extends north, but has not declined to a point to be considered in poor condition. In light of the reduced maintenance standards, this segment remains in remarkably good condition.

Trail - Trail access is not permitted, and therefore unable to be evaluated. Aerial photographs reveal a largely intact alignment of the former railbed, and from the road, it appears that the property owners have developed the alignment into a gravel farm road for accessing their fields.

Figure 20 Mile 9.7. Trail access is plausible, but requires coordination with current land owner.

Geotech - No areas of significant concern

Environment – No areas of significant concern

Safety - Immediately north of Mulherin Creek, the road bends uphill into an S-curve. There is loose gravel, poor visibility, and a short, steep slope. High speed or inexperience on the part of a cyclist could result in tires sliding out from under the bike. The bridge crossing itself is a narrow vehicle bridge with minimal fall protection. Probability of a mishap is very low, but the consequences rate moderate. Due to the low volume usage, potential conflicts with vehicles is expected to be lower proportional to the distance from Cinnabar Basin Road.

Segment 5: Cutler Lake to Yankee Jim Canyon, MP 10.6 - 13.6

Figure 21 Segment 5 extends from Culter Lake to Yankee Jim Canyon.

MP 10.6 indicates a significant departure of the railbed from the road. The railbed continues at grade along the river, whereas the road rises up to the crest of Cutler Hill. It likely took a blasting effort in the 1890s to create the original rail line and evidence suggests that rock stabilization was not incorporated into the construction. The integrity of the area has suffered as a result and today this site suffers from rockfall activity and alluvial sediment deposits.

Figure 22 Mile 10.2. Loose Rock.

Figure 213 Mile 10.6. Errosion and resulting sediment deposits.

At the top of the climb is Cutler Lake with access for hiking, camping and mountain biking nearby. Just north of the hill is a rental home, which is the only residential property in this segment. Towards the end of the segment, the road and the railroad alignment merge to be one in the same, and remain together for much of the remainder of the corridor.

Avid cyclists will likely welcome the challenge of navigating this section of roadway, but beginner cyclists may find it difficult in either direction. While traveling north, the road rises an average of 7.7 percent for

just over a mile, with a maximum slope over 21 percent. Traveling south, those numbers are 8.3 and 29.7 percent. Add to this the difficulty of breathing while exercising at an elevation above 5,000 feet, and this may be a discouraging ride for cyclists of all but the most high level. Depending on the direction of travel, both sides of the hill have drawbacks and safety concerns, and regardless of the direction, a climb and descent are necessary. The viability of the corridor as a recreational mixed-use corridor is highly dependent on this segment. This is the most challenging segment both from the standpoint of physical ability and dependence on generosity of private property owners.

Figure 234 Mile 10.7. Path becomes overgrown.

Road - Once again, the maintenance classification of the roadway drops, this time from class 3 to class 4, and because there are no additional residences beyond this point, roadway users tend to be Forest Service personnel, outdoorsmen utilizing the Sphinx Creek TH, or the occasional visitor who may have just stumbled upon the corridor. The road varies greatly in condition, especially with the season. Large rocks, rutting, and lose surface describe the southern approach to the summit. The northern extent is well compacted gravel and shows very little sign of deterioration.

Trail – The section of trail that was accessible looks to be in good condition. Vegetation has overgrown the path, and overgrowth loaded with thorns threatens to flatten bicycle tires at any moment.

Geotech- Both the river and the railbed are cut into an ancient, inactive landslide that includes the Cutler Lake feature. It is not anticipated that the larger feature is a threat, but slopes cut into the feature currently exceed what is expected stability for similar soils. Composition of the soil consists of large chunks of rock suspended in a mix of sand and gravel. Railroad construction likely oversteepened the slopes. Water and debris moving downslope create erosion channels on the slopes and deposit debris across the trail up to 2 feet deep in some locations. Water flowing over the trail erodes the fill side (river side) of the railroad grade and causes some slumping of fill into the river. Erosion at the toe of the slope is not a significant concern in this segment.

Environment - The FS has active rangeland restoration ongoing in Cutler Meadows. The railbed alignment cuts through the middle of the restoration area and then merges with the road. The alignment is not visible from ground level and does not appear to be evidence of an impact from

human use. Aerial photos provide some indication of the historic alignment. Use of the alignment may hinder restoration efforts.

Safety - Loose gravel, large rocks and inconsistencies in surface make the traction on the southern side of the hill somewhat poor. Some of the turns are also sharp, with sightline limitations, and significant exposure. The surface on the north side of the hill is more solidly compacted, but the grade is much steeper, raising concerns for unchecked high-speed descents.

Segment 6: Yankee Jim Canyon, MP 13.6 - 15.6

Figure 245 Segment 6 extends from Cutler Meadow to Yankee Jim Canyon

Known trouble areas within the Yankee Jim Canyon segment of the corridor present the greatest challenge for generating a secondary emergency access. A landslide washed out a section of road at

Figure 256 Rockslide at milepost 14.1 looking northwest.

Figure 267 Landslide at milepost 14.2 looking north.

milepost 14.2 in 2011 and a rockslide covered a nearby section of road at milepost 14.1 in 2014. Park County has been unable to restore safe access and has endured the road closure since 2014, a significant obstacle in the desire to establish an alternative emergency access route. There is evidence of off-road vehicles bypassing the road barriers and driving around the landslide, but the rockslide is currently impassible. Alternate routes are possible for bicycle and pedestrian access, but both are also able to navigate around the slides as they exist.

For the length of the segment, the established roadway is completely within the original railbed. Yankee Jim is the most narrow section of the corridor, and with widths ranging from 8 to 12 feet, it is a challenging section to develop if the stated objective is to provide separation between the road and the trail. There is little opportunity to separate the two, unless the trail is established off to the side of the roadway or follows another alignment. A small road branches off the main road and climbs the slopes above the old railroad grade. This roadway could provide opportunity for an optional route, though in its current condition it likely can only serve as a mountain bike trail (figure 25). Before the train line was constructed, it was the only passage through the area. It is tough to imagine that wooden wheeled wagons pulled by a team of horses once passed over this terrain, as it presents a challenge for a knobby-tired mountain bike equipped with suspension.

Figure 278 The orange line highlights the alternate path able to be used by bicycles and pedestrians. Off-road vehicles may be able to navigate this route as well, but it has not been designated as an OHV trail.

Land ownership reverts to USFS for the length of this segment. There have been efforts to add interpretive signage, and in 2002 the Forest Service constructed a parking area with toilets and an ADA accessible trail. Prior to the unexpected closure of the road, the Forest Service reported regular use of the area. Roadway condition has deteriorated slightly, and absence of thru-access has likely inhibited visitation. A future development opportunity is certainly possible to highlight historical sites of significance, geological features, and recreational opportunities in this dynamic segment of the corridor.

Road - Maintenance in this area ranks as a low priority, and large sections of the road suffer from significant rutting. Road classification remains class 4 the length of the segment at MP 15.6. Heavy rain leads to deep mud sections where travelers have a difficult time getting through. Due to the rock fall and landslide the road closure extends from MP 13.9 to MP 15.1, and the condition is classified as impassible. Road width for the railbed is very narrow and prior to the slide events was only able to accommodate one-way traffic. Upon repair, two-way travel is unlikely.

Trail - The historic toll road today is between 3-5 feet wide, with very uneven terrain and large rocks that have either been exposed through erosion or deposited by rockfall. The northern section of former toll road bypasses the rockslide area, but the condition of the road is only suitable for off-road vehicles. Emergency vehicles and bicycles would find it difficult to navigate without significant improvements.

Geotech - Yankee Jim Canyon is confined on either side by very old granitic sourced garnet gneiss to migmatite. The rock is considerably stronger and resistant than previous areas discussed, which constricts the Yellowstone River into a canyon with steep walls. A toll road was constructed through this pinch point.

A covering of glacially deposited material and colluvial soils is over the resistant gneiss bedrock in this section as well. These geological materials combined provide conditions for the highest ranked sites in the investigation, US103 with a total USMP score of 488 and US16, with a total USMP score of 433.

The slopes measured along the unstable slopes ranged from 25 feet to 92 feet with inclinations ranging from 42 degrees to 70 degrees. Some of the slopes were overhanging. There is minimal catchment ditch availability along both the road and trail.

Landslide slopes in this section are attributed to erosional cutting at the toe of the slope by the Yellowstone River. Both of these sites incorporate a longer area than is directly affecting the road because they appear to be at risk of future slope toe erosion and upslope failure of the road. Soils in these areas appear to be fluvial (river) or glacial deposits with boulders and cobbles being supported by an unconsolidated silty sand and gravel matrix. Vegetation was sparse on most of the slopes and in the failing areas exposed soils were observed. Fill slopes are generally inclined approximately 38 to 43 degrees and the axial length of the failures were measured 30 feet to 85 feet, top to bottom. Site US106 is a failure affecting half of the roadway.

Environment - Historically, there have been various wagon roads and trails developed, and some artifacts of the first wagon road into the park are still remaining. A rock painted with an advertisement for souvenirs served as a makeshift billboard in the early 1900's. The toll roads themselves are considered a cultural resource. They are constructed with hand laid dry stone masonry retaining walls.

Safety - Repair of the road is essential if it is to be reopened, especially if recreational use is to be encouraged. Existing conditions demonstrate the risk and the possibilities. Where the road has slid away is a drop of 60-70 feet to the river. If something similar were to occur in the future, the consequences could be significant. Additionally, the road is quite narrow, which presents potential conflict for multiple users at one time.

Segment 7: Yankee Jim Canyon to Carbella Bridge, MP 15.6 - 17.5

Figure 289 Segment 7 extends from Yankee Jim Canyon to Carbella Bridge

As the road reaches milepost 15.6, the road and the railbed divert from one another. The probability of utilizing the former railbed is assumed to be very low. The old rail alignment continues parallel to the river and serves as a driveway to access a private farm, and is no longer accessible as a public trail. Further north, it skirts a field, ends at a stream where a bridge once stood, continues on the other side, traverses another private property and reconnects into Tom Miner Creek Road at milepost 17.5.

Road - Roadway condition is good to excellent in this area. Due to the relatively high number of residences, and the proximity to active farming and recreation, Park County classifies the section of road as a Class 2 – high priority road. Regular grading and maintenance have kept the road in good repair. There are no significant signs of damage to the roadway. The intersection with Tom Miner Creek Road at milepost 17.5 suffers some rutting and dispersion of surface material, but it is anticipated this will be corrected with normal maintenance. During rain events, however, this area becomes muddy and may benefit with rebuilding the roadway subgrade and improving existing drainage.

Figure 30 Mile 14.7 Looking North.

Trail - Condition is not assessed within this segment, because there is no standalone trail. The desired alignment is clearly marked with private property signage.

Geotech - No significant areas of concern

Environment - No significant areas of concern

Safety - No significant areas of concern

Segment 8: Carbella Bridge to US 89, MP 17.5 - 21.1

Figure 291 Segment 7 extends from Carbella Bridge to US 89.

The former railbed tracks immediately adjacent to the roadway for almost the entire length of the segment, apart from Point of Rocks where the road grade rises up and over this formation, the rail alignment stays tight to the river. Private property constitutes the entire length of the segment save for a parcel owned by Montana Fish, Wildlife and Parks at MP 20.9, the site of the boat launch.

Evaluation from the proximity allowed suggests that the alignment is being used by the ranch owner for access to their fields and pastures. Due to the retained use of the alignment as a road, conversion to a trail would be possible with modest improvements, if the property owners are willing to consider an easement.

Old Yellowstone Trail South Road terminates at MP 21.1 where it meets US89. Near this point, there is evidence of the rail bed continuing on an alignment closely parallel to US 89. Park County and MDOT have long term plans to connect Livingston and Gardiner with a multi-use path and are likely to use the railroad alignment whenever possible.

Road - The roadway is smooth and appears to be well graded, but the gravel surface is thin, and patches of soil have started to show through. Tire tracks are visible on the roadway. The short section at Point of Rocks had some rippling, an early sign of future washboard surface. As the grade increases, the surface deteriorates and becomes muddy and rippled. Washboard surface develops as the surface dries up and tires spin on the steepness of the slope.

Trail - The majority of the rail alignment was not accessible for evaluation during the site survey, as it is contained completely within private property, and is within a private fenceline. As most of the trail was not accessible, it was difficult to assess the condition. It appeared to be well utilized by the property owner as an access road. A limited section that was accessible on foot has been overgrown by grass and shows little to no sign of use.

Figure 312 Mile 16.7. Looking North

Figure 313 Mile 18. Looking South on OYTS Road.

Much like the Cutler Lake segment, beginner cyclists may find the Point of Rocks surface to be loose and bumpy. The steepness of the road, loose gravel, and weather conditions have created a washboard surface that is uncomfortable to drive on, and likely uncomfortable for anything other than a full suspension mountain bike.

Figure 334 Mile 18.6. Looking North on OYTS Road.

Figure 335 Mile 18.9. Looking North on OYTS Road.

Geotech - Point of Rocks is a mix of large rocks and boulders sitting atop a mix of finer grained material. The larger, visible formations on the top with the vertical cliffs are strong and resistant to weathering, but with some weathering taking effect on the finer deposits. Rockfall is possible and already occurring from erosion. Catchment ditches are possible along the road and trail, and are

better than the rest of the areas assessed along the corridor. Rockfall mitigation measures are possible.

The greatest threat for landslide activity is seen to the fill side of the trail adjacent to the river. Erosion activity from the river current has washed out exposed soils where not armored with bedrock. High water has likely caused the existing soil to be evacuated. Vegetation is sparse on the slope and there is no root system to provide support for the soils. The riverbank consists of material cast aside during construction of the railroad, and is a mix of silty, sand and gravel.

Environment - No significant areas of concern

Safety - Loose gravel and inconsistencies in surface make the traction on the southern side of the pass somewhat poor. Some of the turns are also sharp, with sightline limitations, and significant exposure. The surface on the north side of the pass is more solidly compacted, but the grade is much steeper, raising concerns for unchecked high-speed descents

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Chapter 3: Stakeholder Involvement

Planning Process

A corridor study is initiated to evaluate the overall impacts, capacity, safety or constraints on a transportation system within a defined geographical area. Often the system has not been completely defined, and the study considers various alternatives within that corridor for possible implementation. The study will look at environmental impacts, cost implications, and safety factors as considerations for future actions. Throughout the process citizens in the community, stakeholder groups, and neighboring property owners are engaged to provide feedback to the alternatives. In the case of this project, that feedback was solicited through a series of public meetings, site visits and public hearings.

Western Federal Lands staff performed site visits to evaluate the corridor and develop a set of potential alternatives. The alternatives were presented to members of the project team and briefed to the public. Alternatives were assigned a set of pros and cons and a input was solicited from the public as to the long-term viability of the various options. Throughout the evaluation process, planning staff engaged with the public to solicit inputs regarding the alternatives, and encouraged early communication with interested parties.

An initial site visit and scoping meeting was conducted in May 2017 by WFL and Park County Community Development staff. Meeting participants discussed the project timeline, and the desire to have a completed planning study prior to the 2019 FLAP project data call. A second site visit was conducted in October 2017 to evaluate and document the corridor. Park County, United States Forest Service and National Park Service staff convened at Carbella Bridge with WFL and toured the corridor. Staff provided confirmation of project objectives and highlighted in detail the concerns to be addressed. A Statement of Work proposal was drafted by WFL and circulated to FLMA partners.

WFL staff worked hand in hand with members of the project team to identify factors early on that are important to a successful corridor. Frequent calls between the project team ensured that the project was on track to produce a usable and relevant final product.

Public Participation Procedures

It is important to engage the public, stakeholders, and other interested parties throughout a planning study to ensure there is a process in place that invites participation. During this study, communication with the public occurred infrequently due to the long duration of the study. During all phases of the planning process opportunities were provided for FLMA and Park County staff to review and comment on draft and final documents. It was emphasized during the October 2017 site visit that stakeholder participation would be important for the study, and a plan was developed to meet with stakeholders in the spring of 2018.

A series of meetings was held to allow the public to provide input to the process. First, meetings were held with various government groups to better understand the considerations and sensitivities of the area. Over the course of April 4-5 there were three meetings held with each of the major project participants to discuss what was discovered during the site visits and create a list of problem

statements. Individual meetings were scheduled for Park County, USFS and NPS. Staff new to the process attended the meetings and were provided an overview of the project objectives. Concerns reflected in the small group discussions included emergency response, animal migration, river use, and remediation of drainage concerns to reduce roadway damage.

Second, an open house was held in Gardiner at the community center on May 31, 2018. This open house was arranged to allow the public to discuss concerns with planning staff. A notification was placed in the Livingston Enterprise to make residents aware of the opportunity. A total of 11 members of the public attended the meeting, and engaged in discussion with County, FLMA and WFL representatives. A one-page handout was provided to attendees. Five tables were set up with aerial photographs of segments along the corridor and each table was manned by staff from USFS, NPS, Park County and WFL. Two Park County Commissioners also attended the meeting to make themselves available for questions and listen to feedback from the community. Attendees of the public meeting were interested in the impact the development would have on their property and what could be expected from the process. Residents were worried about maintaining the existing character of the corridor. No written comments were provided during the meeting. Attendees confirmed preliminary staff concerns and were curious to follow the progress in the future. It was explained that no construction would result as a direct outcome of this effort. Following the meeting, WFL staff received comments in writing from interested stakeholders. One resident supplied comments via email.

Emails requesting written comments were sent to stakeholders who were not able to attend the public meeting, largely because they were government agencies or private organizations. Many agencies provided comments through email, and many vouched support for a future corridor plan. Agencies who responded to the request for comment include Montana Fish, Wildlife and Parks; Yellowstone Gateway Museum; Royal Teton Ranch; Rails to Trails Conservancy; and archeologists from USFS. A summary of comments is included in the following section.

Summary Of Public Outreach

In initial meetings Park County discussed concerns such as the landslide and rockslide activity that has made the current road impassible and the impact it has had on the community. Emergency services personnel addressed the lack of an alternate route. USFS staff identified capacity issues with the river. Boat launch sites are limited and the restroom facilities are inadequate to support additional growth. The following is a summary of comments from those meetings and written comments received from various public and private agencies:

Park County meeting, Livingston – April 4, 2018

The main message from the staff of Park County is the interest in improving, enhancing and protecting public health and safety; emergency access; recreational opportunities; and historic and prehistoric resources. There is anticipation that this corridor will experience growth in population and recreational users. A plan is requested that will provide a basis for future decisions regarding investment in recreational opportunities and ensure safety of the users.

It is said that the corridor is underutilized and there is a lot of recreational and historical value. Great opportunity exists for collaboration among all agencies located in the corridor. There is currently a good working relationship with Park County, USFS, NPS and BLM. It is expected the tribes will also be interested in being involved with the corridor development. Tribes may be interested in helping tell their story with interpretive signage. Coordination will certainly occur prior to any project development within the corridor.

Roadway condition is one of the major categories of discussion. Along the corridor various sections require maintenance or rehabilitation if the roadway is going to be opened up again as an access road. Yankee Jim Canyon is a very specific area of focus. Emergency access on OYTS has been blocked since 2014 as a result of a section of roadway washing out.

A summary of additional stakeholder comments is presented below:

- There is a desire to use the old rail bed for recreation, and if possible complete the connection with the old town site. A major area of concern is the road condition and associated drainage issues with the uphill section traveling in the direction of Gardiner after Stephen's creek.
- There has been previous discussion of establishing a trailhead near Cutler Lake. There was a loop trail approved in the 2007 travel plan that has not been executed. It has possibly been reconsidered because there is a high likelihood for bears in this area.
- Widening near Beattie Gulch for safety possible? Does this raise concerns from residents? Beattie Gulch doesn't have any major improvements that are being asked for, but as usership increases, it may result in conflicts with other users (i.e. tribal hunts). Maybe widen out road at Beattie Gulch?
- Park County public works would encourage emphasis on improving the Cinnibar Road access. Road work is needed in this area, including an area near the Church Universal and Triumphant that has been washed out and may need attention possibly as a result of a drop inlet by Church Universal and Triumphant property.
- Outfitter camps utilize Corwin Springs bridge to get to Cinnibar Basin. There are safety concerns at the intersection of Cinnibar Road.
- Another vehicle crossing may be required at some point between Corwin and Gardiner.
- Park County ownership of Aldridge Road will likely be an issue that will come up with the public; The roadway is a county road that provides right-of-way through private property. The public is able to use the road for access to Aldridge Lake, but cannot get off the road until on USFS land at the top near the lake. May need to be more well marked as private property.
- Restoring access is a priority for emergency responders. Emergency vehicles will be expected to provide response to recreationists in the corridor. If there is going to be year round access; there will be additional demands on emergency response and roadway maintenance.
- The roadway will need to be identifiable (signage for emergency vehicles and rescues). Many of the roads and trails do not contain identifying signage which is confusing for recreationists and first responders not familiar with the area. This is all part of the bigger concern for wildland and urban interface planning.
- Access to powerlines is a priority for emergency response.
- Changes to recreation in the corridor must take into account impacts to emergency access.

- One suggestion was that access be limited to only non-motorized activities and emergency response.
    - It is not clear if the roadway can be designed to accommodate emergency vehicles without permanently opening the road to traffic. There are likely restrictions on using public funding to improve roadways that are not open to the public.
- Multiple types of emergency vehicles need access to the corridor:
    - Landing zones for Life Flight helicopters (not necessarily creating them, but knowing where they are).
    - Ambulances
    - Type 6 USFS fire engine
    - Structural fire engines
    - Sheriff's office Search and Rescue
    - Tow truck access

Federal Land Management Agency meeting, Gardiner – April 4, 2018

Land management agencies were concerned with the condition of the roadway. Many of the attendees suggest improving the roadway condition with drainage improvements. Improving drainage will reduce roadway erosion and reduce maintenance costs. Improving the strength of the road for large vehicle operations will help with bison management. NPS may need to increase operations at Stephens Creek.

The USFS wants to see responsible development of the area. There is concern that encouraging additional visitors will place an extra burden on the corridor. Permitting for river access is at maximum capacity, and management of facilities to service recreationists places a costly burden on the USFS budget. New dispersed campsites are potentially damaging to the landscape and are very disruptive to natural animal corridors.

A summary of stakeholder comments is presented below:

- There are known drainage deficiencies and cross-slope issues along the road
    - A previous installation of fiber optic may have led to current roadway degradation.
- USFS agrees that we should plan for increased recreation and use in the corridor, but also expressed reservation about making significant investment in improvements until there is evidence that the demand makes it necessary. There is an ADA accessible trail in the canyon previously developed by the USFS that is underutilized.
- Activities that utilize river access permits are at maximum capacity. An additional river access site may be beneficial if there is another vault toilet, but may also add to the river congestion. Rafters who use the landings outside of USFS sites have large impact on the area. Vault toilet pumping is already an issue that could impact budgets. Seasonal use starts as early as April, but typically extends from early May to October 1. Peak visitation normally occurs in July and August. Salmon Fly hatch is "insane" and people are parked along the highway.
- There is no river management plan in this area:
    - USFS working on a multi-agency river management plan. Initiation efforts are underway.
    - State does not limit access on this river
    - USFS does not regulate along the entire river, only on USFS land

- 2 companies have USFS permits to use USFS access
- Other companies use private land, Brogans Landing or alternate locations
- Various stakeholders are interested in pursuing a Wild and Scenic Rivers designation for the Yellowstone River. Such a designation has implications for the use of the river. Coordination through the development of a river management plan is encouraged and will likely be required.

- Ensure that any focus on developing the corridor does not overlook the high value of preserving and planning for wildlife.
  - Recreation will have an impact on the wildlife in the corridor.
  - Grizzly bear conservation efforts have successfully increased the population and there is a healthy population that has established a territory.
  - Wildlife migration corridors are well established and should not be cutoff.
  - Avoid improvements or activities that limit free movement of animals and avoid funneling animals into choke points if possible.
- Currently there is no cell service or very limited signal in the canyon, and more recreationists could lead to more emergency calls. Education of the public on emergency resources will be a challenge.
- The following list of data points were provided throughout the discussion and are seen as the minimum components to be addressed in the study:
  - Multi-hazard mitigation plan
  - Geotechnical unstable slopes management plan (USMP), likely 3 key areas
    - Gardiner to Stevens Creek
    - Church Universal and Triumphant property to Cutler Hill
    - Tom Miner Canyon
  - Study and understand sensitive wildlife corridors
    - It would be nice to have information regarding movement of wildlife, but the length of this study may not lend itself to that. May need to include a recommendation for a follow-on study.
    - Evaluate the possibility of a wildlife overpass
  - Bison Operations
  - Draft forest plan
    - USFS draft plan is in development as of the date of the public meeting. Components of that plan should align with the recommendations of this study.
  - Quantifying use
    - Counting of traffic
    - Trail counters
    - Rec use counts
    - Boaters
    - Residential development
    - Sensitive Wildlife habitat
    - Formal access points
    - Informal access points
    - Toilet use
    - Informal campsite count

Gardiner Partners meeting, Gardiner – April 5, 2018

The meeting kicked off with a presentation from the NPS regarding the north entrance improvement project. Following on the heels of the Gardiner Gateway project, the entrance project is another opportunity to improve the connection between Gardiner and Yellowstone National Park. One of the important aspects of this project is the separation of bicycle, pedestrian and vehicle traffic.

After the NPS project discussion, Quinn Newton and Michael Inman presented the concept for the Old Yellowstone Trail South Corridor Study. Many of the same concepts from previous meetings were shared by the NPS attendees. A summary of unique stakeholder comments is presented below:

- Two water/sewer lines extend under Yellowstone River that are likely to fail at some point. These lines are old, and shifting of the river bottom threatens to break them at any time. A new bridge constructed to carry pedestrians and emergency vehicles could also carry utility lines over the river.
- It would be very naïve not to plan for increasing the future input and usage. The Gardiner Chamber of Commerce is often asked where the good bike trails are located.
- Eagle Creek and Bear Creek campgrounds are often full during peak season. They are located off the study corridor but push campers to find new sites.
- Park County was awarded a Tiger Grant for Highway 89 corridor mixed-use path south of Livingston. Similar federal programs may be an opportunity for future construction funding.
- Rails to Trails Conservancy is interested in seeing the completion of a trail from Livingston to Gardiner. The corridor stretches 55 miles, and there is desire to see a non-motorized option for connecting to Yellowstone National Park through Paradise Valley. Ideally, a linkage will be created with similar efforts at the West Yellowstone entrance, thereby creating a regional connection.

Public Town Hall, Gardiner – May 31, 2018

An open house was held at the community center to give residents an opportunity to learn about the planning effort and provide comments to the planning team. Residents were mostly curious about changes that would have a potential impact on the current lifestyle enjoyed in the corridor. The resounding comment was that people living along OYTS enjoy the quiet, rugged nature of the area, and did not wish to see improvements that would change the character. Paved roads and trails is not a desirable outcome of this study.

A summary of stakeholder comments is presented below:

- Annual tribal hunting of bison in National Forest is sometimes contentious between different user groups. Proximity of hunting to residents is sometimes concerning, and more oversight of the hunt is desired.
- Increased access in an area that is historically significant/sensitive can be good or bad.
- Increased usage is not seen as a bad thing, but needs to be managed responsibly.
- Topography along the corridor will present some challenges.

- Project area includes 148 residences and 4 local businesses. They should all be contacted about any future project work.
- Former Custer Gallatin National Forest Gardiner District Ranger Walt Allen says there are no special management considerations for water quality, wildlife security, or connectivity at this time.
- General support was expressed from the local community, land agencies, and recreational land users
- Low water conditions on area rivers has resulted in an increase in commercial outfitters using Yellowstone River
- Landowners, travelers and outfitters have expressed an increased interest in RV campground development based on the increasing market demand

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Chapter 4. Problem Statement, Goals, and Objectives

Transportation improvements within the corridor must accommodate competing factors which make implementation of a comprehensive strategy challenging. The length of the road corridor, topography, and recreation opportunities generate varied types and levels of use. Execution of future improvements will be impacted by the lead agency, roadway type, adjacent landowners, and environmental, cultural, and historical considerations. The challenge lies in balancing these objectives and the goal of this report is to identify the actions that need to occur from a planning standpoint. Some of the actions identified may require additional coordination, study, and a determination of whether they are appropriate.

Evaluation of the corridor, discussions with public officials and inputs from stakeholders generated a significant list of concerns, suggestions, and needs within the corridor. Based on the results of those inputs, we have identified 8 problem areas, each of which have measurable and attainable targets. Some problems are meant to be addressed immediately. Others may not need focus until the intensity of use increases in the corridor, and in some cases may never be necessary if the indicators aren't reached.

Problem statements:

1. **Secondary emergency access** is not available due to current roadway conditions. Emergency access is a primary motivation for the FLAP request, and should be the initial focus of any investment in the corridor.

2. **Roadway condition** has degraded along many sections of Old Yellowstone Trail South, aside from strictly Yankee Jim Canyon. Most notably, drainage is a consistent issue that has resulted in longitudinal and transverse rutting of gravel roadways; long stretches of muddy or potholed roadway; and washboarding of gravel surface.

3. **Impact to wildlife** from increased recreation activity in the valley is a concern shared by all stakeholders. Migrating animals utilize established corridors that potentially conflict with current and future recreation corridors.

4. **Destruction of archaeological assets** in the corridor is a known issue. Theft and vandalism are problems and additional usage has the potential to increase these issues. However, more people on the corridor could act as a deterrent to thieves and vandals.

5. **Environmental degradation** from unchecked increase in use threatens this unique environment. It is not currently known how users of the corridor will impact the environment

6. **Impact to property owners** by unwanted development of a trail in the corridor. Not each resident will be supportive of increased recreation in the corridor. Some residents we heard from shared concerns about improvements affecting their properties, and impacting the wildlife.

7. **Corridor encroachment** resulting in the loss of a significant historical connection is a lesser known threat. Old Yellowstone Trail South once stretched from Plymouth to Seattle, but now, there are sections remaining in only Montana, Wisconsin and Washington[18]. The section between Livingston and Gardiner is possibly one of the longest contiguous sections of the original road still remaining. As growth, or opposition to growth, affects the corridor, it is possible that the visual history of the trail in the region will be lost completely.

8. **Visitor experience** goals must be aligned with a comprehensive plan for the corridor. Travelers and residents partake in many outdoor activities and there is potential to expand the available options. There is an opportunity for Park County to develop a management plan to guide recreation in the region.

Through this study, the following Goals and Objectives were determined. These Goals and Objectives will help to guide future construction improvements and/or can be used in NEPA documentation.

Goal #1

Improve the corridor to establish a throughway for vehicle and recreational use.

Objectives

- Provide secondary emergency access through the full corridor.
- Improve roadway elements to better road condition and increase user safety.
- Establish a multi-use trail separated from the roadway where possible.

Goal # 2

Protect cultural and natural resources that make the corridor unique.

Objectives

- Minimize impacts to wildlife and the landscape from corridor usage.
- Minimize impacts to archaeological resources.
- Highlight original transportation connections along the trail.

[18] http://www.yellowstonetrail.org/page141.html

Goal #3

Balance visitor experience with landowner property rights.

Objectives

- Involve property owners in the planning process.
- Provide a positive and coherent visitor experience.

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Chapter 5. Action Plan

This chapter describes potential improvement options for the corridor. The problem statements and associated general actions are summarized below, followed by possible geometric and surface condition improvements, and the chapter ends with additional recommendations.

1. **Secondary emergency access**. First and foremost, the existing landslide in Yankee Jim Canyon must be cleared and corrected. The slide occurred on the cut and fill slopes of the roadway, and will need reinforcement and rockfall protection to mitigate the risk of a recurring event. Once the landslide has been corrected, access will be restored between Miner and Cinnabar Basin. A risk assessment should be performed to determine if the access is safe for general access or if access should be restricted to recreation and emergency response. Part of the risk assessment should evaluate the addition of intervisible turnouts to allow two-way traffic, or consider implementation of one-way travel. Emergency response is vital to the corridor as recreation grows. In addition to restoring emergency vehicle access, the Park County Emergency Response Chief recommended establishing helicopter landing sites and identifying tow truck access to retrieve a vehicle from the river. The risk assessment exercise would be useful for identifying probable (high-risk) locations.

2. **Roadway condition.** Roadway maintenance must be performed at regular intervals with consistency applied the entire extent of the corridor. All roadways should be shaped and graded to maintain a crown to promote proper drainage. Where needed raise roadway grade, replace culverts, widen ditches to handle flows, improve roadway surface by adding gravel or compacting, widen roadway, correct rutting and correct the source of the problem. In extreme cases, a full depth roadway repair may be needed to correct damage to the subbase and basecourse layers of the road section.

3. **Impact to wildlife.** Recommendations for new recreation should take wildlife into account. Critical locations should be studied, identified and compensation measures formulated to mitigate impacts. One possibility is to limit access to residents and emergency vehicles only. Such restrictions may not be necessary year-round, but may correspond with key migration seasons, breeding times, or when an abnormally large population of animals is present. Grizzly bear populations in Cinnabar Basin have been reported to be growing, and could potentially create conflict with recreators. Based on what is known about existing animal populations, it is recommended to define key recreation nodes, and focus development of new recreation opportunities in these areas. Trailheads should be established to coincide with desired recreation nodes, and in essence encourage activity where it is desired.

4. **Destruction of archaeological assets**. The first step in protecting and mitigating impacts to historic resources is to identify critical protection zones. This is not a document that should be circulated to the public, but should be part of a management strategy for the property owners. Visitors should be encouraged to visit these sites, and the public

should be educated on the importance of preservation. Preservation presents a key opportunity for interpretation and encourages the community to take an active role in monitoring the site. Known historic sites should also be part of the monitoring plan for the land owners. Law enforcement needs to be part of the discussion of managing protected assets.

5. **Environmental degradation**. It is recommended a study be completed that focuses on carrying capacity and establishes upper limits for users in the corridor. It is likely that the current amount of use requires very little change to the corridor, but higher user thresholds may trigger corridor improvements. This document lays out actions that should be taken to manage the corridor. From the recommendations in the document, land owners should develop a long-range investment plan and continue to make improvements as prioritized in that plan. A strategy for encouraging and managing corridor use is to provide developed infrastructure in desired locations, and formalize opportunities for off-trail exploration in previously disturbed sites. Lack of formalized recreation sites will encourage dispersed uses and accelerate degradation.

6. **Property owners impacts.** For any changes that are proposed, it is essential to make contact with each property owner along the corridor and provide an opportunity to comment. After meeting with property owners, document their interest in accessing or providing access to a trail on or near their property. Ensure that property owners who are in favor of the trail have an opportunity to understand the impacts. For property owners that are not supportive of the trail, mitigate impacts to the maximum extent possible. To be prepared for future protests or complaints, ensure that all options are evaluated and well documented.

7. **Corridor encroachment.** The Old Yellowstone Trail South corridor seems largely unchanged from how it likely appeared at the turn of the 19th century, and visitors are treated to the same sights and sounds as the very first explorers that identified the significance and value of preserving what would come to be called Yellowstone Park for generations to come. Interpretive signage could be used to highlight original transportation connections along the trail, explain the evolution of the corridor over the previous century and provide education on how prison labor was used to construct the roadway itself. Not much has been done to preserve the history of the once substantial roadway, and only a few segments exist. This roadway is seen by some as a national treasure[19]. Preservation and maintenance of the roadway and railbed will enable potential efforts to pursue a national historic trail designation.

[19] http://www.yellowstonetrail.org/page141.html

8. **Visitor experience.** There is an opportunity to develop a guided plan that public and private investors alike can rally behind. Independent efforts can be inefficient and misguided. Some ideas for collaboration include interpretive signage, shared or consistent mapping, wayfinding and identification of neighboring amenities. Trailheads should include comprehensive information about the area and identify connections with nearby amenities and additional recreational opportunities. There is an opportunity for Park County to establish more opportunities for year-round activities for locals and visitors along this iconic corridor. As visitation has grown in Yellowstone Park so has demand for outdoor activities in less congested venues nearby. Park County offers year-round activities like hiking, rock climbing, fly fishing, camping, skiing, snowmobiling, and hunting.

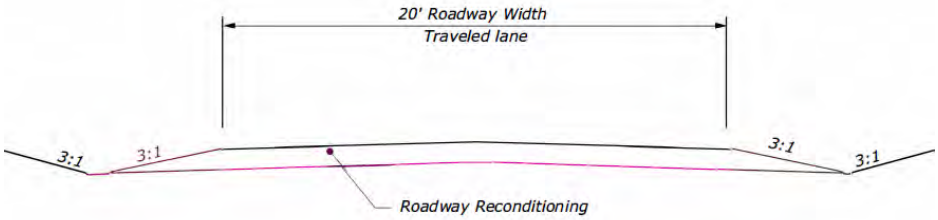
Geometric and Surface Condition Improvements

Corridor-wide Improvements

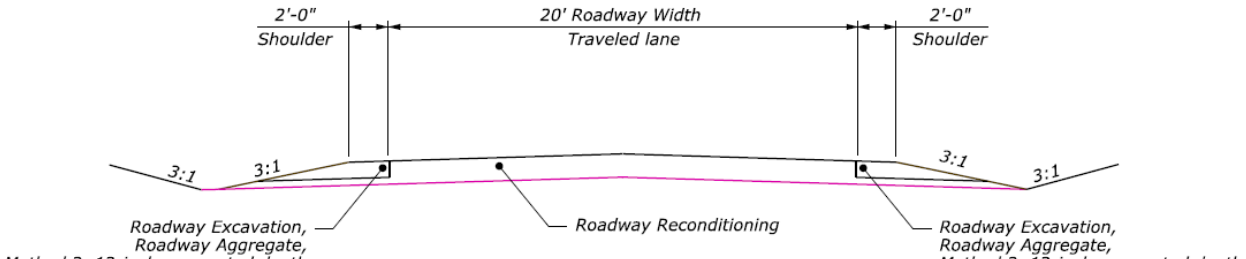
This section summarizes general geometric and surface condition improvements throughout the corridor. The general recommendations are referenced or described in more detail for each segment in the sections below.

Road

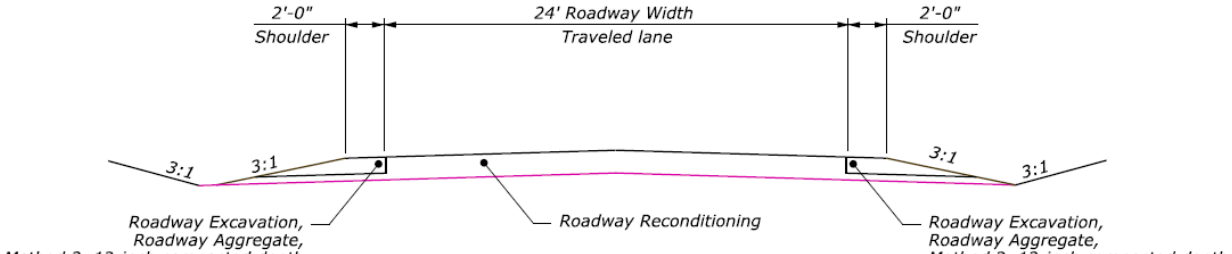
- Improve roadway to consistent width (20 foot, 24 foot or 28 foot). The width of the existing roadway varies throughout the corridor. See Figure 1 for roadway typical cross-section options.
- Elevate finish grade in low areas to prevent ponding of water on road surface
- Recondition gravel surface to eliminate formation of muddy sections and reduce washboarding
- Improve drainage in problem areas:
    - Install, replace, repair, or clean culverts where necessary.
    - Construct drainage ditches. Where drainage ditches are already present, clear them of any debris or overgrowth.
    - Establish crown on roadway
- Apply dust-free surface applications when multi-use trail shares right-of-way. Consider use of a sealant or other treatment that will secure the surface and prevent erosion.
- Continue regular maintenance
- Clear debris and vegetation from road edge
- Install clear wayfinding signs



20-ft Typical Section



24-foot Typical Section



28-foot Typical Section

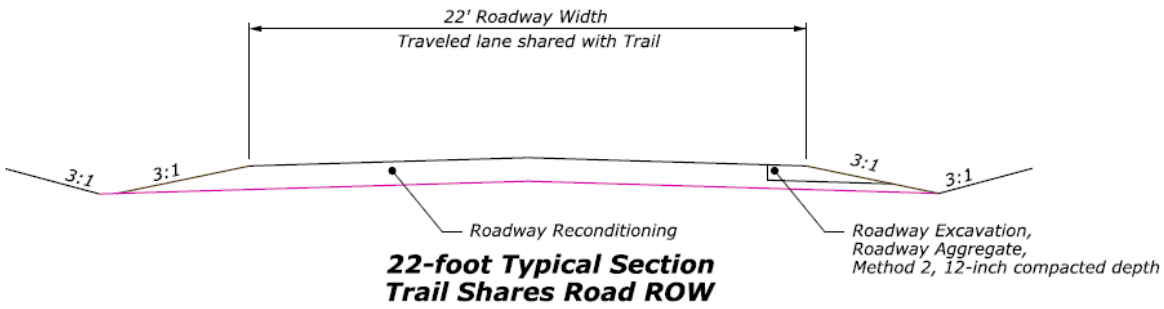
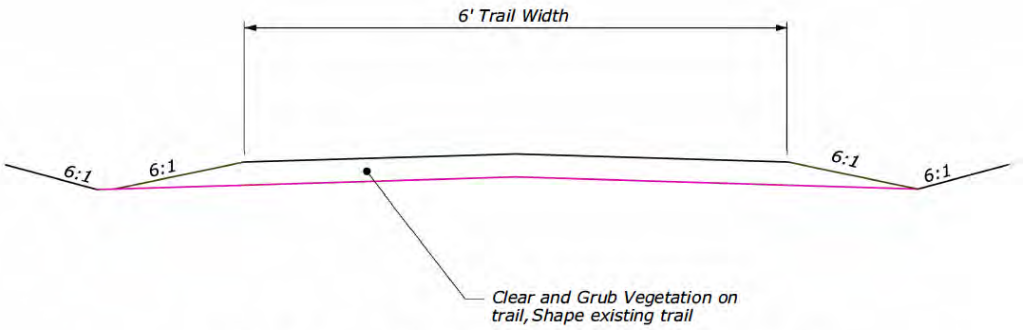


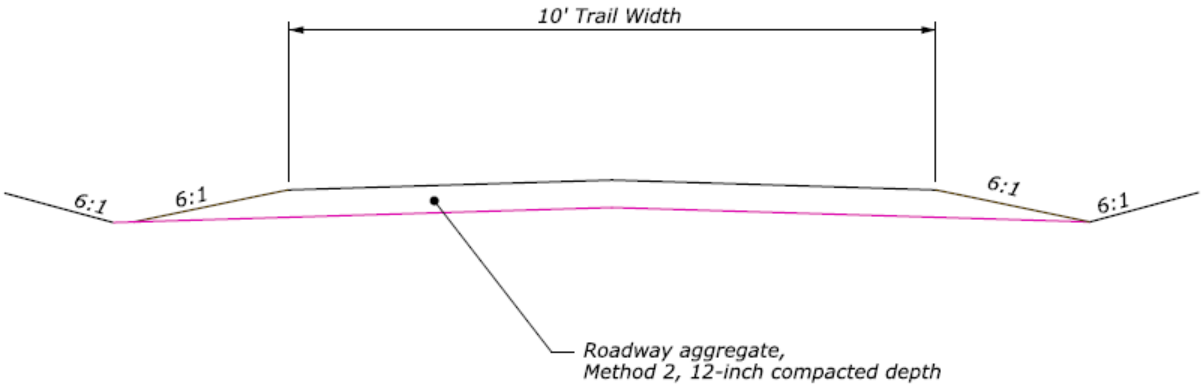
Figure 34 Road Typical Cross-Sections

Trail

- Improve trail to consistent width (6 to 10 foot) where it is separated from the road. The width of the trail varies throughout the corridor. See Figure 2 for trail typical cross-section options.
    - The 6-foot wide cross-section could keep the trail surfacing as dirt, or add aggregate
    - The 10-foot wide cross-section assumes adding aggregate
- Grubbing and clearing of overgrowth
- Remove large rocks from trail
- Fill potholes, sinkholes, and ruts
- Establish standards for surface preparation, treatment and maintenance
- Install clear wayfinding signs



6-foot Typical Trail Section (Dirt or Aggregate)



10-foot Typical Trail Section (Aggregate)

Figure 35 Trail Typical Cross-Sections

Range of Improvement Options

Possible improvements are grouped together below in three options for the entire corridor. The improvements are described in more detail by corridor segment later in this chapter. It is worth noting that the improvement options are packaged together for ease of comparison, but project partners may choose to "mix and match" segment options in myriad combinations (for example, do minimal improvements to the corridor, but build a pedestrian bridge to the trailhead). The estimated construction cost is based on planning-level cost estimates described in Appendix A.

- ***Option 1: 20-Foot Road with Minimum Improvements (est. construction cost $2.0 million)***
  - **Road:**
    - Clear the blockages on the roadway at MP 14.1 and 14.2
    - Undertake low-cost slope stabilization measures
    - Establish consistent 20-foot road width; except keep one-lane width in Yankee Jim Canyon with intervisible turnouts for passing
    - Recondition road with aggregate
    - Improve drainage:
      - Install, replace, repair, or clean culverts where necessary.
      - Construct or clear drainage ditches.
      - Establish crown on roadway
    - Install clear wayfinding signs
  - **Trail:**
    - Formalize existing trailhead
    - Remove rocks and clear and grub vegetation from trail
    - Establish or maintain 6-foot dirt trail where trail is separated from road
    - Separate trail from roadway where feasible, but do not acquire easements where trail is on private property
      - Trail on existing, separated alignment in Segments 1, 3, and most of 5
      - Trail on shared ROW with road in Segments 2, 4, portion of 5, and 6, 7, 8
    - Install clear wayfinding signs

- ***Option 2: 24-Foot Road with Moderate Improvements (est. construction cost $5.3-6.4 million)***
  - **Road:**
    - Clear the blockages on the roadway at MP 14.1 and 14.2
    - Undertake mid-range slope stabilization measures
    - Widen to consistent 24-foot road width; except keep one-lane width in Yankee Jim Canyon with intervisible turnouts for passing
    - Recondition road with aggregate
    - Improve drainage:
      - Install, replace, repair, or clean culverts where necessary.
      - Construct or clear drainage ditches.
      - Establish crown on roadway

- Install clear wayfinding signs

- **Trail:**
  - Build a trail from the Gateway Arch to the existing trailhead.
  - Remove rocks and clear and grub vegetation from trail
  - Improve to 6-foot aggregate trail where trail is separated from road
  - Separate trail from roadway where feasible, but do not acquire easements where trail is on private property
    - Trail on existing, separated alignment in Segments 1, 3, and most of 5
    - Trail on shared ROW with road in Segments 2, 4, portion of 5, and 6, 7, 8
  - Install clear wayfinding signs

- ***Option 3: 28-Foot Road with High Improvements (est. construction cost $8.9-$15.1 million.[20])***
  - **Road:**
    - Clear the blockages on the roadway at MP 14.1 and 14.2
    - Undertake extensive slope stabilization measures
    - Widen to consistent 28-foot road width; except keep one-lane width in Yankee Jim Canyon with intervisible turnouts for passing
    - Recondition road with aggregate
    - Improve drainage:
      - Install, replace, repair, or clean culverts where necessary.
      - Construct or clear drainage ditches.
      - Establish crown on roadway
    - Install clear wayfinding signs
  - **Trail:**
    - Build a trail from the Gateway Arch to the existing trailhead or build a pedestrian bridge over the Yellowstone River.
    - Remove rocks and clear and grub vegetation from trail
    - Widen to 10-foot aggregate trail
    - Maximize trail separation from road, including negotiating with property owners to try to acquire easements where trail is on private property
      - Trail on existing, separated alignment in Segments 1, 3, and most of 5
      - Work with landowners to acquire easements for trail in Segments 2, 4, portion of 5, 7, and 8
      - Trail on shared ROW with road in Segment 6
    - Install clear wayfinding signs

All options meet the project goals described in Chapter 5:

[20] The $15.1 million upper limit includes a pedestrian bridge over the Yellowstone River at an estimated cost of $4-5 million.

- *Goal #1: Improve the corridor to establish a throughway for vehicle and bike use.*
- *Goal #2: Protect cultural and natural resources that make the corridor unique.*
- *Goal #3: Balance visitor experience with landowner property rights.*

Segment Specific Improvements

Improvements specific to each segment of the corridor are described in more detail below.

Segment 1: MP 0-4.4

Road

OYTS road is of substantial width throughout this entire stretch, and is in fair to good condition. Emergency vehicle access is sufficient.

Road Condition Improvements

Establishing a 20-foot road width would likely only require reconditioning of the existing roadway. Building a 24-foot or 28-foot wide road would require excavation and addition of aggregate. To improve drainage with any of the roadway widths, establish ditches and install, replace, or repair culverts every 500 feet or as needed.

Trail

Segments closest to Gardiner will likely receive the most traffic, because of the proximity to population. It is potentially convenient that the first 4.4 miles of trail is located on Park Service property, and is already a largely intact section of trail. It is convenient because use of public lands is typically favorable. Many segments of the 22-mile trail will have significant difficulties as compared to the initial extent.

Trail Alignment

Continue to use the trail on the existing alignment, which is separated from the OYTS road.

Formalize Main Trailhead

A key to the success of the multi-use corridor is formalized access from Gardiner to the OYTS trail. There is currently no official start to the trail nor a connection to the trail from town. Standing at the Gateway Arch, there is no accommodation for bicycles or pedestrians to access the trail. A trail exists behind the Yellowstone Heritage Center, but it is not visible from the road and there is no signage or map to provide confirmation.

Option A

Formalize the trailhead at the location of the existing pullout at approximately MP 0.4 on the OYTS road. To access the trailhead from the Gateway Arch, users will need to walk on the roadway of OYTS. Add signage near the Arch to provide directions to the trailhead.

Option B

Build a trail within the ROW of the OYTS road, either separated from the road or on the shoulder, from the Gateway Arch to the existing trailhead. The new segment of trail will create a clear and intentional connection from the Gateway Arch and Town of Gardiner, and encourage

people not to use the connection behind the high school. Add signage near the Arch to indicate the start of the trail.

Option C

Build a pedestrian bridge over the Yellowstone River, to facilitate access from uptown businesses. The majority of lodging is located along Scott Street and visitors staying in this area will likely drive to the start of the trail without a shorter connection. With the introduction of a bridge, residents and visitors can access the trail more directly and will likely leave their vehicles behind. An added benefit of constructing a bridge is the ability to include replacement of water and sewer lines above the river. Current utility lines are buried under the river and pose a risk of breaking and contaminating the river, as well as greatly impacting utility operations in Gardiner. It is standard practice to hang utility lines under bridges to cross waterways.

Unstable Slopes Mitigation

Two rockfall slopes (US06 - score 327; US07 – score 292) have moderately high scores. Potential avenues for mitigating rockfall in this section could be selective rock scaling, lessening cut slope angles, improving the catchment ditch, or various trail-side barrier types. Additional geotechnical recommendations are included in the geotechnical report, Appendix C.

Trail Condition Improvements

The trail is highly used and in fairly good condition through this segment. Keeping the trail as dirt, clearing and grubbing vegetation, and spot improvements as necessary would be the low-cost option. The trail could also be widened and surfaced with aggregate.

Figure 36 Segment 1 (Map 1 of 2)

Figure 37 Segment 1 (map 2 of 2)

Segment 2: MP 4.4-7.7

Road

OYTS road is of substantial width throughout this entire stretch, and is in fair to good condition. Emergency vehicle access is sufficient.

Road Condition Improvements

Establishing a 20-foot road width would likely only require reconditioning of the existing roadway. Building a 24-foot or 28-foot wide road would require excavation and addition of aggregate. To improve drainage with any of the roadway widths, establish ditches and install, replace, or repair culverts every 500 feet or as needed. Depending on the placement of the trail, one or both shoulders of the road could be widened to give bicyclists and pedestrians more separation from vehicle traffic.

Trail

Trail Alignment

The railroad bed is on private property for the majority of this segment (MP 4.4-7.0). There are two sections where it passes through agricultural fields. Depending on property owners willingness to provide an easement for a trail on all or part of their property the trail may need to share road ROW for a large portion of this segment. Those sections of private property are described below.

MP 4.4 Stream Crossing

At the beginning of the segment, the trail intersects with a stream and there is no crossing. Two options for a crossing are described below. The stream delineates between NPS property to the south and private property to the north.

Option A

Build a crossing on the existing alignment. Options include pre-fabricated steel bridge, a wooden bridge or a box culvert. The crossing is estimated at 10-feet wide and 15-feet long.

Option B

Shift the trail alignment to cross at the road bridge about 600 feet away.

Trail Private Property Crossing MP 4.4-7.0

The railroad bed passes through properties of a number of private owners before reaching USFS property around MP 7.0.

Option A

Use the road ROW. The trail could share the road or could be built alongside the road but separated from the roadway.

Option B

Acquire easements from the private property owners to use the railroad bed. This option is the straightest, but passes through agricultural fields and near ranch buildings at MP 4.6-5.4 and MP 5.8-6.3.

Option C

Use the railroad bed, but shift the alignment to run beside the river at MP 4.6-5.4 and MP 5.8-6.3, where the railroad bed passes through agricultural fields. This option would probably also need easements from private property owner, but would skirt the fields and avoid the ranch buildings.

Figure 38 Segment 2

Segment 3: MP 7.7-8.3

Road

The condition of road in this section is greatly deteriorated with excessive rutting, and the road gets very muddy when it rains.

Road Condition Improvements

Establishing a 20-foot road width would require significant reconditioning of the existing roadway. Building a 24-foot or 28-foot wide road would require excavation and addition of aggregate. To improve drainage with any of the roadway widths, establish ditches and install, replace, or repair culverts every 500 feet or as needed.

Trail

Trail Alignment

The trail is to the west of the road and it appears to be on USFS land.

Trail improvements

Vegetation overgrowth has become more significant and the surface condition is much rougher from rocks and dead plants. Reconditioning the trail and keeping it as dirt, while clearing the vegetation, would be the low-cost option. The trail could also be widened and surfaced with aggregate.

Figure 39 Segment 3

Segment 4: MP 8.3-10.6

Road

The condition of road in this section is fair with some rutting.

Road Condition Improvements

Establishing a 20-foot road width would likely only require reconditioning of the existing roadway. Building a 24-foot or 28-foot wide road would require excavation and addition of aggregate. To improve drainage with any of the roadway widths, establish ditches and install, replace, or repair culverts every 500 feet or as needed. Depending on the placement of the trail, one or both shoulders of the road could be widened to give bicyclists and pedestrians more separation from vehicle traffic.

Trail

Trail Alignment

The railroad bed is on private property for the entirety of this segment.

Trail improvements

Option A

Use the road ROW. Depending on how wide the ROW is, the trail could share the roadbed or could be separated from the roadway.

Option B

Coordinate with private property owners to obtain easements to use the railroad bed.

Figure 40 Segment 4

Segment 5: MP 10.6-13.6

Road

The condition of road in this section varies. Large rocks, rutting, and loose surface describe the southern section. The northern extent is well compacted gravel and shows very little sign of deterioration.

Road Condition Improvements

Establishing a 20-foot road width would likely only require reconditioning of the existing roadway. Building a 24-foot or 28-foot wide road would require excavation and addition of aggregate. To improve drainage with any of the roadway widths, establish ditches and install, replace, or repair culverts every 500 feet or as needed.

Trail

Trail Alignment

The railroad bed is on private property for approximately the first 0.25 miles of this segment, then continues on USFS property.

Trail improvements

For the majority of this segment, the trail can be on the railroad bed. The path will need to be cleared of vegetation. The trail could remain as a dirt trail or improved to aggregate.

For the portion of the trail on private property, there are two options:

Option A

Use the road ROW for the portion on private property (MP 10.6-10.85). Depending on feasibility and how wide the ROW is, the trail could share the roadbed or could be separated from the roadway.

Option B

Coordinate with private property owners to obtain easements to use the railroad bed.

Figure 41 Segment 5 (Map 1 of 2)

Figure 42 Segment 5 (Map 2 of 2)

Segment 6: MP 13.6-15.6

Road

Known trouble areas within the Yankee Jim Canyon segment of the corridor present the greatest challenge for generating a secondary emergency access. A rockslide covers a section of road at milepost 14.1 and a landslide washed out a section at milepost 14.2. The rockslide at MP 14.1 is the highest scoring unstable slope (US 103 - score 488). The landslide at MP 14.2 scores high in the unstable slope assessment (site US 106 – score 303).

Unstable Slopes Mitigation Options at MP 14.1 (rockslide) and MP 14.2 (landslide)

- Clear existing rocks and aggregate material from the roadway
- Reduce cut slope angles
- Reinforce the fill slope between the roadway and the river
    - Construct retaining walls
    - Install boulders for stabilization
    - Provide additional fill material
- Construct rockfall mitigation on the cut slope above the roadway/trail
    - Establish rockfall clear zones
    - Build gabion walls
    - Mount rock netting
    - Perform rock scaling
    - Establish catchment ditches
    - Install trail side barriers

Road Condition Improvements

Large sections of the road suffer from significant rutting. The road is narrow through Yankee Jim Canyon and even getting 20-foot width in that section could be impractical. It is possible to keep the section through Yankee Jim Canyon as one-lane and add turnouts as necessary or allow one-way travel for the public. The remainder of the segment could be 20, 24, or 28 feet, as feasible. Add aggregate, establish a crown and install, replace or repair culverts to address drainage.

Trail

Trail Alignment

The trail is and will probably need to be the same as the road for the entirety of this segment. The shared ROW is on the railroad bed on USFS property. Continue to utilize the road, since the corridor is narrow and would be difficult to separate a trail. There are two sections where a mountain bike trail could veer from the road, but not for the full length of the segment. The second highest scoring unstable slope is above the potential mountain bike trail at approximately MP 13.9 (US 16 - score 433).

Figure 43 Segment 6

Segment 7: MP 15.6-17.5

Road

Roadway condition is good in this area.

Road Condition Improvements

Establishing a 20-foot road width would likely only require reconditioning of the existing roadway. Building a 24-foot or 28-foot wide road would require excavation and addition of aggregate. To improve drainage with any of the roadway widths, establish ditches and install, replace, or repair culverts every 500 feet or as needed. Depending on feasibility and how wide the ROW is, the trail could share the roadbed or could be separated from the roadway.

Trail

Trail Alignment

The railroad bed travels through private property, clearly marked with signs, and serves as access to a farm. The trail would likely share the road ROW.

Figure 44 Segment 7

Segment 8: MP 17.5-21.1

Road

Old Yellowstone Trail South Road terminates at MP 21.1 where it meets US89. The roadway is smooth and appears to be well graded, but the gravel surface is thin, and patches of the softer subgrade have started to show through.

Road Condition Improvements

Similar to Segment 7, Establishing a 20-foot road width would likely only require reconditioning of the existing roadway. Building a 24-foot or 28-foot wide road would require excavation and addition of aggregate. To improve drainage with any of the roadway widths, establish ditches and install, replace, or repair culverts every 500 feet or as needed. Depending on feasibility and how wide the ROW is, the trail could share the roadbed or could be separated from the roadway.

Trail

Trail Alignment

The railroad bed travels through private property. The trail would likely share the road ROW.

Figure 45 Segment 8 (Map 1 of 2)

Figure 46 Segment 8 (Map 2 of 2)

Additional Recommendations

Corridor Management

- Establish a working group that would continue momentum and help to facilitate improvements in the corridor.
- Consider establishing maintenance agreements with National Park Service, Forest Service, Bureau of Land Management, Montana Fish and Game, and Park County for collaborative approach to corridor maintenance.

Develop a comprehensive signage plan

- Replace existing signage that is no longer current.
- Remove illegal signage
- Review private property posting and ensure that no public lands are posted by mistake
- Identify sites for interpretation. There are former settlements, wagon train routes, and the alignment of the former rail line that are prime educational opportunities.
- Another interpretation opportunity exists for sharing stories of tribal hunting and how native tribes subsisted on the land for generations.
- Once a final alignment is decided, create and install very clear directional signage.
- Clearly identify property lines. Additional signage for NPS and USFS property.

Figure 47 Sample trail directional signage

Recreation Marketing

- Visitors to the area will benefit from a consolidated mapping system that provides the location of trailheads, amenities and camping in one easy to use system.
- Include nearby amenities and trail connections on BLM maps.
- Create marketing plan for trail system
- Distribute maps for corridor trail system
- Coordinate with the Adventure Cycling Association
- Network with Montana state tourism office and adventure tour operators to have OYTS included in itineraries
- Facilitate public private partnerships to help improve sections of the trail and attract bicycle tourism

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Appendix A: Geotechnical Report No. 17-18

Provided as separate attachment.

Geotechnical Report No. 17-18

Old Yellowstone Trail South Trail Unstable Slope Assessment

UNSTABLE SLOPE CORRIDOR ASSESSMENT REPORT

MT PARK 2016(10)
Park County, Montana
June, 2018

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

WESTERN FEDERAL LANDS HIGHWAY DIVISION
VANCOUVER, WASHINGTON

Geotechnical Services

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APPENDICES

1 INTRODUCTION

The following summarizes results of Western Federal Lands Highway Division's (WFLHD) assessment of unstable slopes along Old Yellowstone Trail South trail and road in southern Park County, Montana (Appendix A-1). The unstable slope management program for federal land management agencies (USMP) was utilized for this assessment. The assessment was completed to prepare a relative unstable slope hazard and risk rating priority list and to identify highly rated unstable slopes for planning purposes associated with planning of the Old Yellowstone Trail South Montana Federal Lands Access Program (FLAP) project.

It is our understanding that this report will be used by Park County, Montana to demonstrate positive decision making with a risk based assessment of the unstable slopes along Old Yellowstone Trail South trail and road to aid in planning the FLAP project. Rehabilitation of this road will provide improved access to nearby federal lands and be an alternative transportation route from Highway 89 which extends between the communities of Livingston and Gardiner, Montana (Appendix A-1). This alternative corridor will also provide resiliency to impacts from closure along portions of Highway 89.

1.1 SCOPE

This investigation was scoped to assess unstable slopes along the proposed, approximately 21-mile, Old Yellowstone Trail South trail corridor. The trail alignment mostly follows an historic railroad grade along the west side of the Yellowstone River. The majority of the corridor is on publicly managed lands with portions traversing private property. The trail proposal begins in Gardiner, Montana within Yellowstone National Park (YNP) and goes north through Custer Gallatin National Forest (USFS) managed lands and privately owned property, ending near Point of Rocks fishing access on the Yellowstone River. Access to private property was not obtained for the field investigation so these areas were assessed from the road easement when possible.

It is our understanding that there are sections of the proposed trail that may be immediately adjacent to, or shared use with, the Old Yellowstone Trail South roadway. While the focus of this study was assessing unstable slopes along the proposed trail alignment, some areas along the Old Yellowstone Trail South roadway were assessed and are included in this report as an added benefit to Park County. Significant lengths of the proposed trail (and roadway) are relativity flat terrain and have low risk for unstable slope hazards.

This report presents a detailed overview of the geological hazards and relative risk to users from the geologic hazards. Different types of risk reduction and mitigation techniques are provided as options, but this report does not provide specific risk reduction plans or cost estimates for improvement of the trail or road. However, Park County can use information provided in this report to direct potential risk reduction work needed for unstable slopes. The priority array for the unstable slopes should be considered a decision support tool to help formulate and plan for potential proactive funding requests, environmental analyses and permitting, and construction contracts for needed trail safety improvements along the Old Yellowstone Trail South road and proposed trail.

No conceptual, qualitative or quantitative landslide or rockfall mitigation design work was part of the scope of this project.

2 GEOTECHNICAL ASSESSMENT

Unstable slopes along Old Yellowstone Trail South were evaluated using the USMP[1]. The USMP is a performance-based geotechnical asset evaluation tool for unstable slopes along roads and trails. It is designed to give land and transportation facility managers a decision support tool that increases their understanding of the performance of their slope assets, helps them to proactively plan preventative maintenance and funding requests, and provides support for responding to litigation or claims related to unstable slopes. It evaluates unstable slopes based on a variety of factors, including roadway and trail characteristics, slope failure type and severity, maintenance frequency and complexity, and risk factors associated with human exposure, maintenance costs, and right-of-way, environmental, and cultural impacts. The USMP assigns a total score to an unstable slope based on these hazard and risk-related factors. A high total score typically indicates a slope that poses a relatively higher unstable slope hazard and risk to the users of the transportation facility than a lower rating does.

Field investigations were conducted by Orion George (WFLHD Engineering Geologist) and Nathan Jenks (WFLHD Geotechnical Engineer) on the following dates: May 7 to May 9 and May 21, 2018. We evaluated a total of 33 unstable slopes using the USMP (Appendix B). Twenty-two unstable slopes, designated as US01 to US22, along the Old Yellowstone Trail South proposed trail and an additional 11 unstable slopes, designated US101 to US111, on the existing roadway. Maps of the sites can be observed in Appendix A.

During the unstable slope evaluation of Old Yellowstone Trail South, WFLHD met with Park County personnel responsible for oversight of Old Yellowstone Trail South. Information regarding unstable slope history, frequency, and size of unstable slope events was gathered during this meeting. These data informed and influenced subsequent USMP ratings for unstable slopes along the proposed trail and road.

2.1 GEOLOGY

Numerous geologic deposits and bedrock units are mapped along the roughly 21-mile long corridor investigated for this report. Notable geologic units along the Old Yellowstone Trail South alignment associated with assessed unstable slopes are mapped as modern and older alluvial deposits, undivided glacial deposits, landslide deposits, gneiss, and Hyalite Peak volcanics[2]. Pertinent geologic materials are described in greater depth with site conditions below.

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[1] Unstable Slope Management Program (2017), *Geotechnical Asset Management – Unstable Slope Rating Category Descriptions for Federal Land Management Agencies:* http://usmp.info/RatingManual.pdf, accessed Oct 4, 2017.

[2] Berg, R.B., J.D. Lonn, and W.W. Locke, 1999, Geologic map of the Gardiner 30' x 60' Quadrangle, South Central Montana, Montana Bureau of Mines and Geology Open File Report MBMG 387.

2.2 SITE CONDITIONS AND ASSOCIATED GEOLOGIC HAZARDS

Rockfall and landslide hazards are common along the Old Yellowstone Trail South, and are caused by many different processes. We evaluated a total of 33 unstable slope lengths and have grouped them in four separate sections based on proximity and similarity of geologic material (Appendix A-1):

- Yellowstone National Park section, map in Appendix A-2
- Cutler Lake Landslide section, map in Appendix A-3
- Yankee Jim Canyon section, map in Appendix A-4
    - Yankee Jim Toll Road South
    - Yankee Jim Toll Road North
- Point of Rocks section, map in Appendix A-5

The geologic hazards along the corridor are grouped by rockfall and landslide hazards and generally discussed in their distinct sections. Site specific observations are described and displayed in figures to produce a general understanding of the geologic hazards in the separate sections. Individual site descriptions and ranking forms are in Appendix B and can be accessed via the USMP website[3]. Unstable slope descriptions along the proposed trail alignment are given first; followed by possible mitigation techniques that were briefly discussed in the field. A summary of the USMP ratings including a list of all sites rated is provided in Section 3 of this report.

These section and hazard descriptions are provided as if encountered while traveling along the corridor from south to north. Project stationing was not available. Locations of unstable slopes are reported using the beginning and ending WGS84 latitude and longitude coordinates as obtained from a recreational grade GPS.

2.2.1 YELLOWSTONE NATIONAL PARK SECTION; US01 – US07

This section is at the beginning of the proposed trail alignment and within the boundaries of Yellowstone National Park (Appendices A-1 and A-2). It is our understanding that the proposed trail alignment in this section follows the historic roadway grade adjacent to the Yellowstone River. The Old Yellowstone Trail South Road is upslope and to the west of the trail alignment. The roadway is maintained by Park County, Montana.

Slopes in this section are located in a portion of the trail that is directly across the Yellowstone River from Gardiner, Montana. The old railroad grade is mostly cut into landslides, ancient earthflows, and glacial deposits (Appendix A-2). The ancient earthflows were sourced from Sepulcher Mountain to the southwest[4] and onsite observations suggest the features are relict, meaning they are immobile. Unstable slopes assessed in this section are either local cut-slopes or eroding fill-slopes along the corridor and not considered unstable due to being a part of the large earth flows.

[3] Unstable Slope Management Program website: http://usmp.info/client/login.php
[4] Waldrop, H.A. and H.J. Hyden, 1962, Landslides near Gardiner, Montana, *in* Geological Survey Research 1962, Geological Survey Professional Paper 450-E, article 182, p. E11-E14.

As the trail follows the old railroad grade through this section the trail is largely straight with site distances 250 feet or longer, trail width ranging from 9 feet to mostly 10 feet wide, a largely flat gradient, and always below 5 degrees. Although there are mostly no catchment ditches along most of this section, the trail width is wide enough to provide some catchment for rockfall along the old railroad grade (Figures 1 and 2).

Rockfall slopes in this section (US01, US06, and US07) appears to be due to oversteepened slopes that are sourced in either unconsolidated landslide or glacial outwash deposits (Figure 1). Modes of rockfall failure were via undermining/raveling and differential erosion. Assessed slopes inclination range from 36 to 38 degrees. Generally, slopes of similar soils are expected to be at their angle of repose at about 34 degrees. Overall slopes are less than 60 feet high.

Potential avenues for mitigating rockfall in this section could be selective rock scaling, lessening cut slope angles, improving the catchment ditch, or various trail-side barrier types.

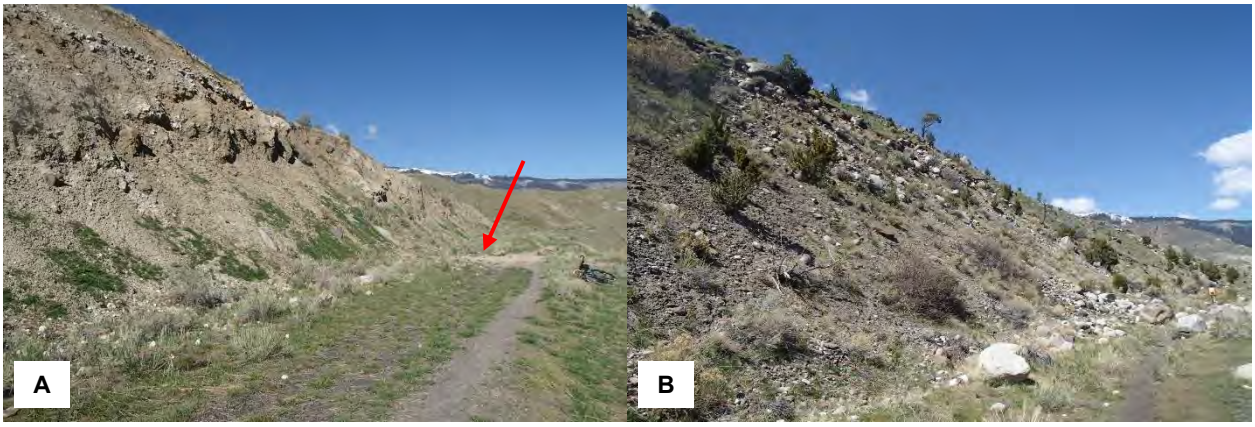


Figure 1 Representative rockfall slopes in the Yellowstone National Park section (Appendix A-2). **A)** Site US02, red arrow denotes a small alluvial fan of sediment overlying trail approximately 1 foot thick. **B)** Site US06, displaying boulders and cobbles differentially eroding out of an oversteepened cut slope of unconsolidated glacial outwash deposits. Plentiful rockfall is observed on the trail.

Landslide slopes in this section (US02 – US05) are in reference to the local landslides in the fill side below the old railroad grade and above the Yellowstone River. Failures appear to be due to seasonal or sporadic, uncontrolled surface water flow from above that transports sediment, which is accompanied by erosion action of water moving downslope over unconsolidated soils. Piping erosion is suspected as well below the old railroad grade and was evidenced by sinkholes in the grade (Figure 2). Piping appears to be associated with damaged culverts. Fill slopes are generally steeper than the cut slopes and range 35 to 60 degrees and have an axial length of up to 90 feet from top to bottom (Figure 2). Erosion at the toe of the slope by the Yellowstone River was observed in this section and is also leading to localized destabilization of the slope below the old railroad grade.

Mitigation techniques that could with the landslide areas assessed along this section would be surface and subsurface drainage improvements such as establishing or reestablishing drainage ditches and culverts, redirecting surface water to those drainage structures, installing underdrains

in select locations, rock embankment fills, and constructing keyed retaining walls to reduce erosion and evacuation of fill slope materials.

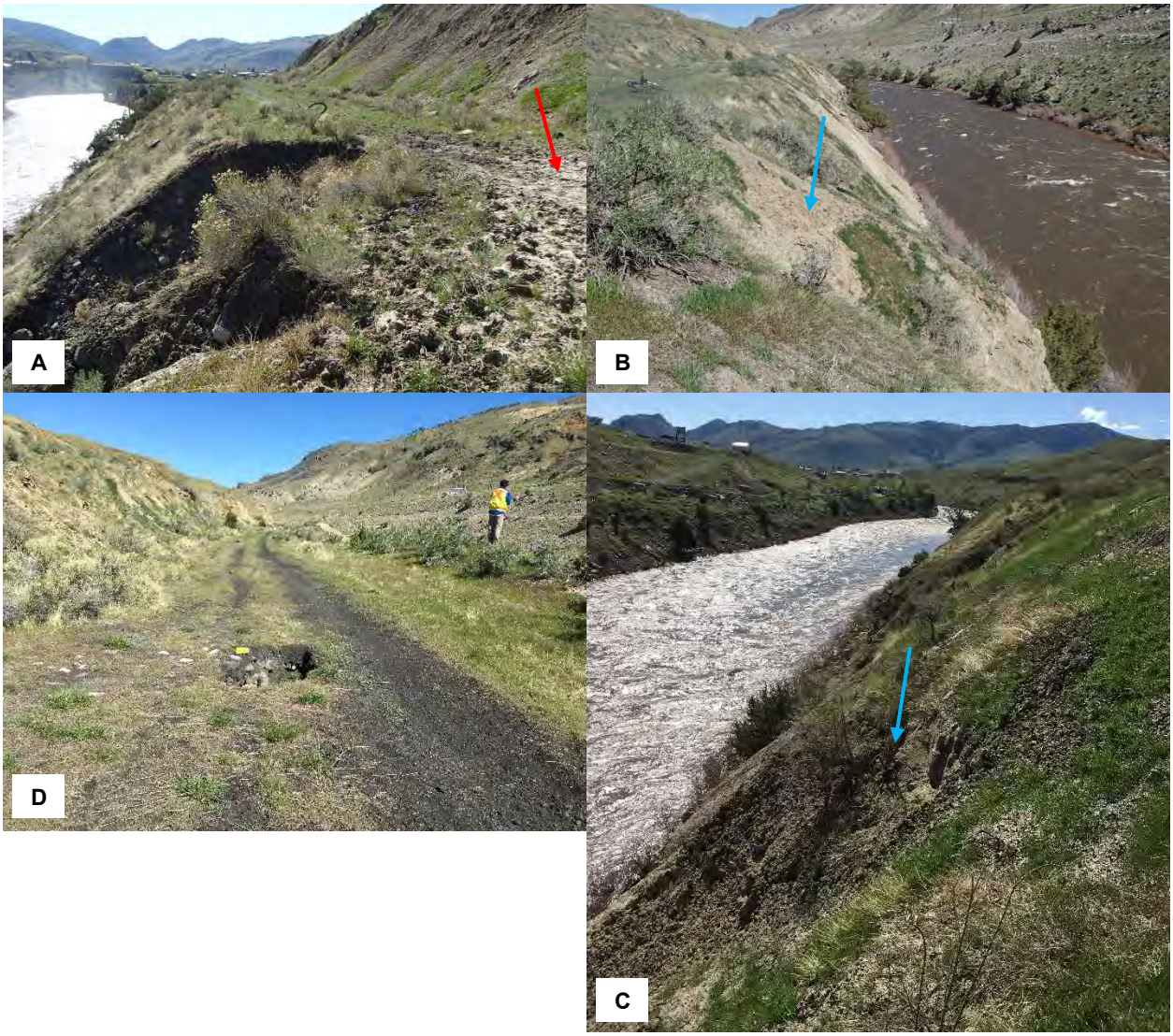


Figure 2 Representative landslides in the Yellowstone National Park section (Appendix A-2). **A)** Site US03 looking upstream, fill side failure with head cutting into proposed trail corridor. Red arrow denotes a shallow alluvial fan, approximately 1 foot thick, over the trail. This is the same source of surface water that initiated the shallow slump. **B)** Site US04 looking downstream and **C)** looking upstream, showing steep slopes on the fill side of the old railroad grade leading down to the Yellowstone River. Blue arrows denote shallow slumps from oversteepened slopes, surface water erosion, and cut bank erosion from the Yellowstone River. **D)** Site US04 looking downstream, sinkhole observed from piping associated with a damaged culvert.

2.2.2 CUTLER LAKE LANDSLIDE SECTION; US08 – US15

This section is at the toe of a large mapped landslide complex[2] that has been eroded into by the Yellowstone River since its failure. I termed it the Cutler Lake landslide because Cutler Lake is located on the feature and is likely a sag pond of the ancient landslide (Appendices A-1 and A-3). Like earthflows in the Yellowstone National Park section, this landslide had little evidence of mobility and is considered a relict landform that is immobile. The Cutler Lake landslide is sourced in andesitic and dacitic volcanic bedrock and was at least partially overridden by the latest

glaciation[2]. Unstable slopes assessed on this landform are considered surficial and independent of the larger feature. The southern portion of this section is on private property and was assessed at a distance from the roadway and adjacent northern USFS managed land (Appendices A-1 and A-3).

The old railroad grade is mostly cut into the toe of the ancient landslide. The cut slopes expose mostly a diamict (jumbled material) of highly fractured, likely displaced, andesitic bedrock along with areas of rounded river or glacially transported deposits, boulders and cobbles supported by unconsolidated silty sand and gravel.

Of the eight slopes assessed in this section all of them are on the proposed trail alignment. The existing grade is approximately 12 feet wide ~~though~~ this section with some areas that are wider.

Rockfall slopes in this section (US08, US09, US11, and US15) appear to be due to oversteepened slopes that are sourced in either unconsolidated landslide, river, or glacial outwash deposits. The landslide deposit has large chunks of bedrock that are often highly fractured and supported in a diamicton (an unsorted mixture of clay to boulder sized material; Figure 3). Thus, the modes of failure observed were undermining/raveling and differential erosion. Assessed slopes inclination range from 40 degrees to 60 degrees. Generally, slopes of similar soils would be expected to safely stand at about 34 degrees. The slopes were both likely oversteepened from railroad construction and past river incision in the valley. The rockfall slopes ranged in height from 35 feet to 160 feet

Potential avenues for mitigating rockfall in this section could be selective rock scaling, developing a catchment ditch or trail side barrier, or lessening cut slope angles.

Landslide slopes in this section (US10 and US12 – US14) are in reference to the local landslides in the fill side below the old railroad grade and debris flows sourced from above the grade. Failures appear to be due to seasonal or sporadic, uncontrolled surface water flow from above that transports sediment, which is accompanied by erosion action of water moving downslope over unconsolidated soils. Steeper, higher slopes in this section facilitate more erosion of the water flowing downward. As such, channels have been incised up to 5 feet into the slopes, which confines water and increases erosion potential as well (Figure 4). As water and debris exit the confinement of the incised debris shoots, encountering the relatively flat railroad grade, debris is deposited on the trail covering it up to 2 feet in locations. Locally water is also flowing over the fill side of the grade causing shallow slumping of fill into the Yellowstone River (Figure 4).

Landslide slopes are generally less steep than the cut slopes and range 32 to 38 degrees with an axial length of up to 90 feet from top to bottom. The debris shoots were measured to have an axial length of up to 120 feet uphill from the proposed corridor. Erosion at the toe of the slope by the Yellowstone River was observed in this section, but was interpreted to be a minor factor in the landsliding within the section.

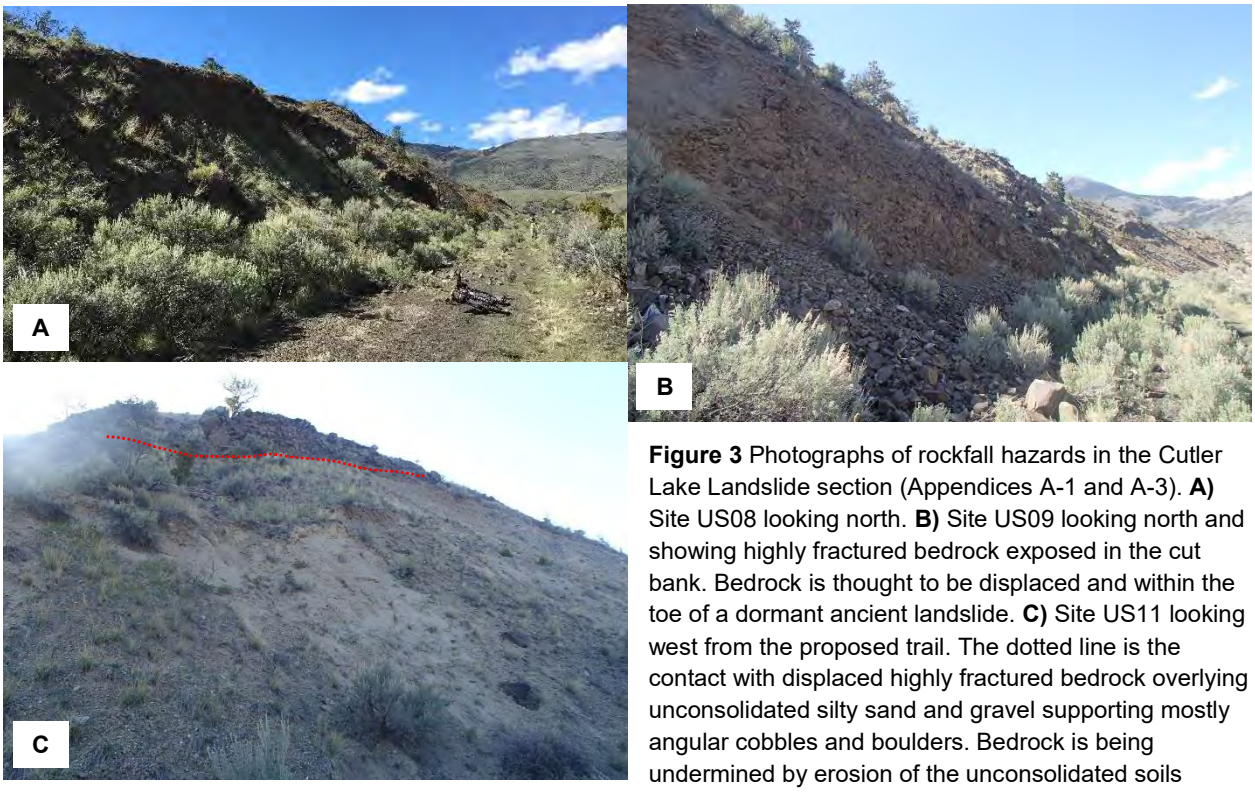


Figure 3 Photographs of rockfall hazards in the Cutler Lake Landslide section (Appendices A-1 and A-3). **A)** Site US08 looking north. **B)** Site US09 looking north and showing highly fractured bedrock exposed in the cut bank. Bedrock is thought to be displaced and within the toe of a dormant ancient landslide. **C)** Site US11 looking west from the proposed trail. The dotted line is the contact with displaced highly fractured bedrock overlying unconsolidated silty sand and gravel supporting mostly angular cobbles and boulders. Bedrock is being undermined by erosion of the unconsolidated soils bringing rockfall down to the proposed trail.

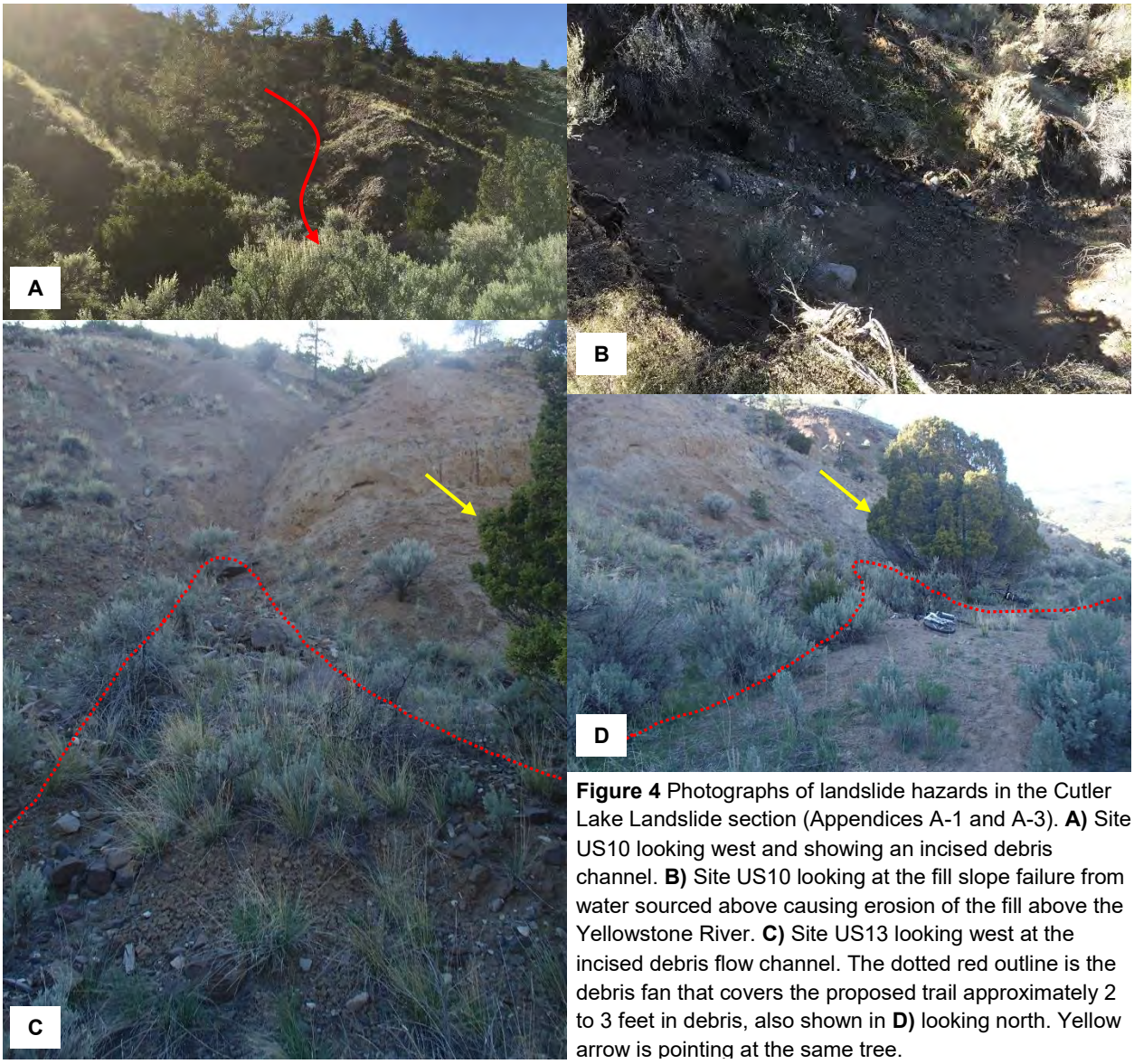


Figure 4 Photographs of landslide hazards in the Cutler Lake Landslide section (Appendices A-1 and A-3). **A)** Site US10 looking west and showing an incised debris channel. **B)** Site US10 looking at the fill slope failure from water sourced above causing erosion of the fill above the Yellowstone River. **C)** Site US13 looking west at the incised debris flow channel. The dotted red outline is the debris fan that covers the proposed trail approximately 2 to 3 feet in debris, also shown in **D)** looking north. Yellow arrow is pointing at the same tree.

Mitigation techniques that could help with the landslide areas assessed along this section would be surface and subsurface drainage improvements such as establishing or reestablishing drainage ditches and culverts, redirecting surface water to those drainage structures, constructing debris collection ditches, and constructing keyed retaining walls to reduce erosion and evacuation of fill slope materials.

2.2.3 YANKEE JIM CANYON; US16 – US18, US101 – US109

The proposed trail alignment leaves the roadway in the Yankee Jim Canyon section in two locations as it follows the historic Yankee Jim Toll Road; the section can be thought of as two separate sub-sections: Yankee Jim Toll Road South and Yankee Jim Toll Road North (Appendices A-1 and A-4). Both of these sub-sections were assessed for unstable slopes along the proposed trail alignment, which climbs the slopes above the old railroad grade and along the established roadway, which is on the old railroad grade. Most of the sites are on the roadway (US101 – US109) while the proposed trail only has three sites (US16 – US18; Appendix A-4).

Yankee Jim Canyon is a canyon confined on either side by very old (pre-Cambrian) granitic sourced garnet gneiss to migmatite, meaning the rock is beautifully folded with light and dark bands with reddish garnet minerals[2]. The rock is considerably stronger and resistant than previous areas discussed, which constricts the Yellowstone valley into a canyon with steep walls. This constriction and steepness made a pinch point in the canyon that a toll road was constructed to allow passage for a price to the Yellowstone country. Yankee Jim took control of the toll road in 1873 before establishment of the railroad grade and US Highway 89 on the opposite side of the canyon.

The toll roads themselves are considered a cultural resource. The toll roads have historic hand laid dry stone masonry retaining walls and advertisements painted on adjacent rocks that are wonderful aspects of the proposal through this section (Figure 5). The USFS has placed numerous informational signs along the toll roads explaining the history and ecology of the area.

A covering of glacially deposited material and colluvial soils is over the resistant gneiss bedrock in this section as well. These geological materials combined provide conditions for the highest ranked sites in the investigation, US103 with a total USMP score of 488 and US16, with a total USMP score of 433 (Table 1; Appendix B).

The roadway width ranged from 8 feet to 12 feet wide in this section whereas the trail along the old toll road ranged 3 to 5 feet wide. The speed limit used in the USMP rating calculations for this roadway section was 25 mph unless it was a considerably straighter and smoother section of road upon which 35 mph was utilized (site US102). The trail speed limit was considered 2 mph.

Rockfall slopes comprise most of the unstable slopes assessed in this section (US101 – US104, US106 – US108, and US16 – US18). The bedrock has numerous adversely oriented joint sets and foliation planes that allow for planar, wedge, and toppling modes of failure (Figure 5). Combined with the covering of glacial and colluvial deposits in locations, undermining/raveling and differential erosion are also modes of rockfall failure observed.

The slopes measured along the unstable slopes ranged from 25 feet to 92 feet with inclinations ranging from 42 degrees to 70 degrees. Locally some of the slopes were overhanging. There is minimal catchment ditch availability along both the road and trail. The trail along the old toll road also has a fill side that is being retained by historic dry stone wall in many locations with some of the sites exhibiting damage to the wall from rockfall. The walls appeared to otherwise be in good condition without any obvious bulging, sagging, cracking, or other signs of deformation.

Large boulders, up to 10 feet in dimension were observed at some of the sites, but in general the average boulder size was approximately 2 feet to 3 feet in dimension (Figure 5).

Possible rockfall mitigation in this section could be selective rock scaling, developing a catchment ditch or trailside barrier, and rock reinforcement such as rock bolts or rock dowels; in some locations lessening cut slope angles could also be an option.

Figure 5 Photographs of rockfall hazards in the Yankee Jim Canyon section (Appendices A-1 and A-4). **A)** Site US16 looking east (towards Gardiner). The site is along the Yankee Jim Toll Road south sub-section and has historic hand laid drystone rockery wall (yellow arrow). The site has numerous adverse oriented joint sets that allow planar, wedge, and toppling failures. **B)** Site US17 at the western end, looking east. An historic advertisement painted on a boulder is visible (yellow circle). The slope has unconsolidated silty sand and gravel supporting cobble and boulders. **C)** Through cut along the road, sites US103 (left) and US104 (right) looking northwest and **D)** looking southeast. Large rockfall was observed coming off of site US103. Numerous adverse oriented joint sets that allow planar, wedge, and toppling failures.

Landslide slopes in this section (US105 and US109) are attributed to erosional cutting at the toe of the slope by the Yellowstone River. Both of these sites incorporate a longer area than is directly affecting the road because they appear to be at risk of future slope toe erosion and upslope failure of the road. Soils in these areas appear to be fluvial (river) or glacial deposits with boulders and cobbles being supported by an unconsolidated silty sand and gravel matrix. Vegetation was sparse on most of the slopes and in the failing areas exposed soils were observed. Fill slopes are generally inclined approximately 38 to 43 degrees and the axial length of the failures were measured 30 feet to 85 feet, top to bottom.

Site US106 is a failure affecting half of the roadway (the old railroad grade; Figure 6). Within the exposed headscarp utility conduit was exposed. We were uncertain of the nature of the conduit however. This failure has caused the County to close the road and from our understanding was initiated about 2 years ago, during high flows along the Yellowstone River.

Mitigation efforts for the landslide slopes could entail keyed in retaining walls, or cutting further into the cut slope to extend the distance the roadway has ~~form~~ the Yellowstone River's erosional banks. Surface and subsurface drainage improvements could also provide some reprieve from these hazards as well.

Figure 6 Site US106 along the roadway. **A)** Looking northwest, the roadway has been undermined from erosion at the base of the slope by the Yellowstone River. Continued headward erosion is expected. This failure has caused Park County to close the roadway as well. **B)** Looking south, black conduit is exposed. We are uncertain what is carried in this conduit.

2.2.4 POINT OF ROCKS SECTION; US19 – US22 AND US110 – US111

The proposed trail alignment and roadway are separate in the Point of Rocks section as well. In this section the roadway is the upper corridor and is separate from the old railroad grade whereas the proposed trail alignment is on the railroad grade and along the banks of the Yellowstone River (Appendices A-1 and A-5). This section was named after the Point of Rocks fishing access.

The geology of Point of Rocks is marked by the Hyalite Volcanics Formation[2]. This Formation is an epiclastic volcanic deposit meaning it is volcanic rock that has been reworked and redeposited. In this case, it is a conglomerate, a rock with large rounded cobble to boulder sized material being supported by a lithified matrix of finer grained material. The rock is strong enough and resistant enough to maintain near vertical cliffs, however the matrix is also weak to moderately strong and is weathering and spalling in areas. Again, there are zones of unconsolidated, poorly sorted colluvial (more angular clasts) and glacial deposits (rounded material) covering the bedrock along the upper roadway and above the lower proposed trail.

The roadway width ranged from 21 feet to 26 feet wide in this section whereas the trail ranged 4 to 12 feet wide. The speed limit used in the USMP score calculations for this roadway section was 35 mph. The trail speed limit was 2 mph.

Rockfall slopes comprise most of the unstable slopes assessed in this section (US19, US21, US110, and US111; Appendix A-5). The bedrock is weathering and spalling with discontinuous fractures resulting in rockfall through raveling and general erosion, but some adverse joint sets are allowing for planar and wedge modes of failure (Figures 7 and 8). Combined with the covering of glacial and colluvial deposits in locations, undermining/raveling and differential erosion are also modes of rockfall observed (Figures 7 and 8).

The slopes in this area ranged from 23 feet to 85 feet tall with inclinations ranging from 43 degrees to 60 degrees. There is some catchment ditch availability along both the road and trail and is considered better than the rest of the areas assessed. Boulders up to 2 feet in dimension were observed at some of the sites.

Possible rockfall mitigation in this section could be selective rock scaling and developing a catchment ditch or barrier; in some locations lessening cut slope angles could also be an option.

Landslide slopes in this section are attributed to erosional cutting of the old railroad grade by the Yellowstone River (site US20) and a debris shoot channeling debris flows (site US22; Figures 7 and 8).

Site US20 will likely grow over time from active erosion by the Yellowstone River. The base of the fill has been armored with native bedrock, but zones had been evacuated as the river is actively eroding exposed soils. Soils along the fill appear to be local material that was sidecast during construction of the railroad grade, angular cobble and boulder up to 3 feet to 4 feet supported by a clayey, silty, sand and gravel matrix. Cutoff posts were observed along this section as well and were thought to be some kind of past utility that ran alongside the railroad. Vegetation was sparse on most of the slopes and in the failing areas exposed soils were observed (Figure 8).

Figure 7 Photographs of rockfall hazards in the Point of Rocks section (Appendices A-1 and A-5). **A)** Site US19 looking north, with the Yellowstone River on the right. Differential erosion rockfall hazard with a limited ditch catchment along the old rail road grade. **B)** Site US19 looking south. **C)** Site US21 looking north. Joint sets are observed in the bedrock (yellow dashed lines) that facilitate planar, wedge, and indeterminate failures off of the 85-foot high bedrock outcrop. A debris flow is observed covering the proposed trail (outlined in dashed red) up to 3 feet deep. The trail curves around the outside edge of the debris fan. Dashed yellow lines highlight joint surfaces, some of which are adverse and consistent with others being indeterminate, or inconsistent. **D)** Site US110 looking north. Similar Hyalite volcanics as at site US21 (photograph **C**).

Site US22 is an incised channel in the bedrock that is funneling water and debris from seasonal and storm events onto the proposed trail (Figures 7 and 8). A debris cone up to 3 feet deep, about 36 feet long (along the trail) and sloping up at 26 degrees to the apex is currently covering the proposed trail in a through cut of the old railroad grade (Figures 7 and 8). Boulders up to 3 feet in dimension were observed on the trail.

Mitigation efforts for US20 could entail armoring of the fill, a barbed retaining wall, or some other type of engineered hydrologic structure to retain soil and dissipate the Yellowstone River's energy and flow along the embankment. Site US22 mitigation efforts could entail constructing a diversion structure or trail side barrier.

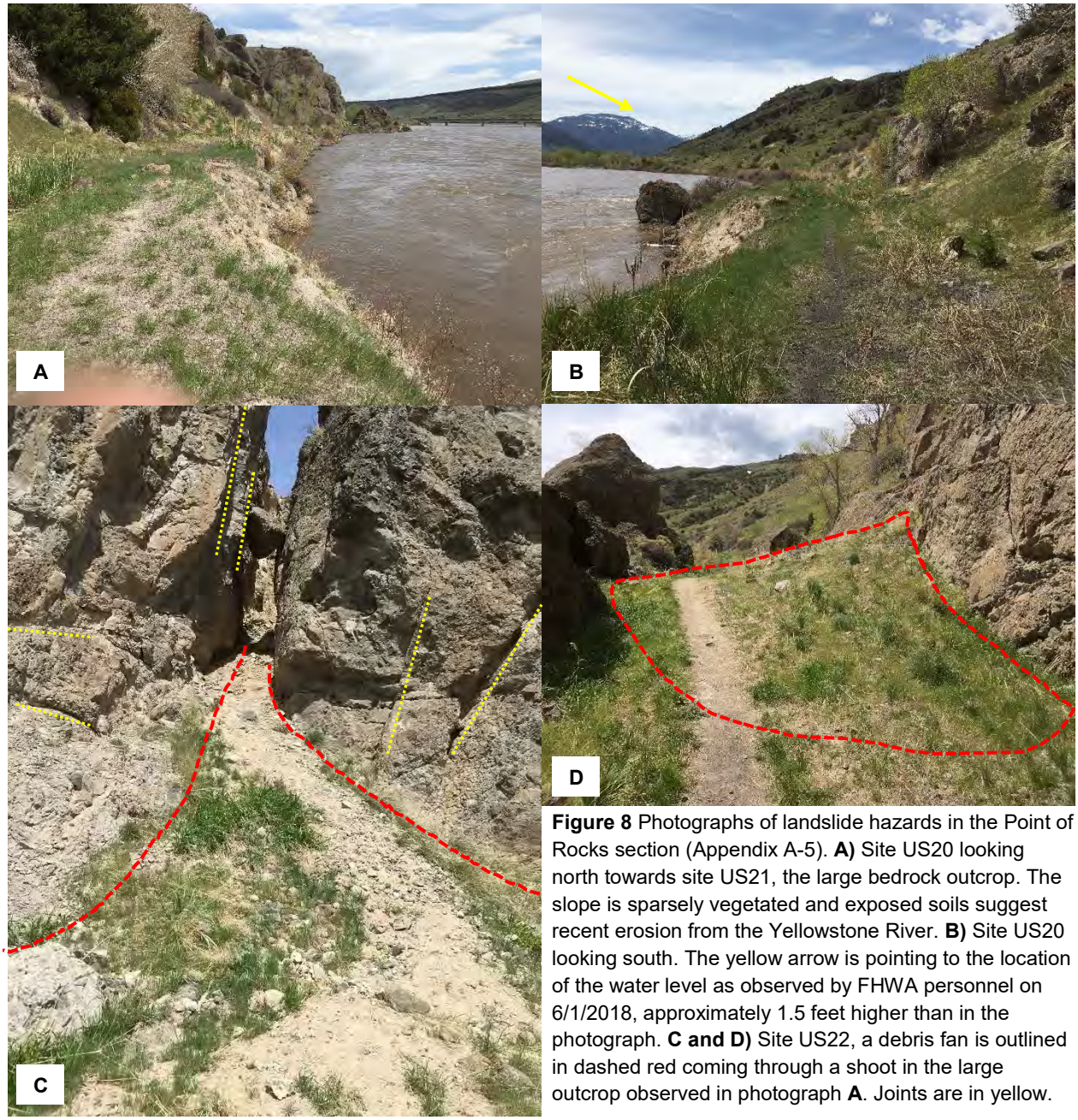


Figure 8 Photographs of landslide hazards in the Point of Rocks section (Appendix A-5). **A)** Site US20 looking north towards site US21, the large bedrock outcrop. The slope is sparsely vegetated and exposed soils suggest recent erosion from the Yellowstone River. **B)** Site US20 looking south. The yellow arrow is pointing to the location of the water level as observed by FHWA personnel on 6/1/2018, approximately 1.5 feet higher than in the photograph. **C and D)** Site US22, a debris fan is outlined in dashed red coming through a shoot in the large outcrop observed in photograph **A**. Joints are in yellow.

2.2.5 LARGE BOULDER FIELDS

Two areas were identified where large boulders were observed on the terrain near the proposed trail alignment and roadway, to the east and below Cinnabar Mountain and south of and through the Point of Rocks section (Appendix A-1). It is interpreted that these boulders result from rockfall originating hundreds to thousands of feet upslope of the proposed trail and roadway location. Due

to the expected infrequency of these events, and the location of the source area, these sites were not included in the USMP assessment. However, these locations do present some level of risk and hazard and could be considered in future development of the trail.

3 UNSTABLE SLOPE MANAGEMENT PROGRAM ASSESSMENT DISCUSSION AND RESULTS

Based on discussions with Park County personnel, Parks Frady, Director of Public Works, and Mike Inman, we were able to ascertain general tail use characteristics, but unable to obtain an annual average daily traffic (AADT). Also, the roadway is currently closed at the north end of Yankee Jim Canyon. However, for purposes of determining rating scores within the USMP system we estimated the average annual daily traffic (AADT) for the three sections based on anticipated and observed use:

- Yellowstone National Park section AADT – Occasionally used, score = 200
- Cutler Lake Landslide and Yankee Jim Canyon sections AADT – Rarely used, score = 50
- Point of Rocks section AADT – Occasionally used, score = 200

The southern section of the corridor was observed to have use while in the field and is expected to have a higher usage after construction because of the proximity to Gardiner, Yellowstone National Park, and private property concentrations. We observed recreational use along the middle section as well, but due to less access options and less private property proximity we gave it a lower AADT. The northern section has a larger concentration of private property and a popular fishing access site and as such was given the same AADT as the southern section.

Along the proposed trail alignment the speed limit was limited to an average hiking speed of 2 miles per hour (mph). This is considered conservative as it raises the overall exposure time of users to potential geologic hazards along the corridor, which in turn raises the overall risk and total USMP score. The road sections that were rated were given speed limits of 25 to 35 mph based on the road conditions at the site.

Most of the 33 slopes do not have any type of catchment ditch. No catchment results in a rating of 81 for USMP Category D – Rockfall – Ditch Effectiveness. However, the old railroad grade is wide enough in most locations that it provides some catchment. To account for this, several slopes were assigned a lower rating for Category D of 9 or 27 based on the width of the corridor.

Unstable slopes US103 and US16, both with Yankee Jim Canyon, are the two highest rated slopes from the assessment. The slopes have a significantly higher total USMP score, 488 for US103 and 433 for US16. As such it would be our recommendation that these slopes be given attention if any future unstable slope mitigation work is undertaken, particularly US103 as this slope is along the roadway whereas US16 is on the proposed trail. Additionally, site US106 has resulted in loss of a portion of the existing roadway resulting in closure and should be considered for repair and mitigation work depending on the goals for the corridor.

A final determination on which sites are selected for further assessment and/or receive funding for mitigation is based on many factors. From experience, sites with scores above 400 are typically

identified for further assessment and potential mitigation and sites above 300 are often considered for further assessment and possible mitigation.

3.1 UNSTABLE SLOPES MANAGEMENT PROGRAM

Table 1 presents the USMP rating for unstable slopes along the Old Yellowstone Trail South roadway (US101 – US111) and proposed trail along the old railroad grade (US01 – US22). They are ranked from highest to lowest total USMP score. The details of the slope ratings and slope locations can be found in Appendix B and the USMP website[3].

4 CONCLUSION

It is our understanding that the USMP will be used by Park County, Montana to demonstrate positive decision making, secure funding for risk reduction work, and to facilitate environmental analyses and permitting.

Once Park County has determined what the scope of the trail and roadway work will be, WFLHD can provide conceptual design and cost estimates of potential mitigation techniques. We believe using this transparent, standardized, and systematic asset management process to locate, assess the condition of, and prioritize unstable slopes is a helpful tool to support decision making for any future unstable slope work along the proposed trail and current roadway.

5 LIMITATIONS

This report has been prepared to assist Park County, Montana with their planning for the Old Yellowstone Trail South project. It should not be used, in part or in whole for other purposes without contacting the WFLHD Geotechnical Section for a review of the applicability of such reuse. These data are not to be used for other purposes.

The conclusions and recommendations contained in this report are based on WFLHD's Geotechnical Section's understanding of the project at the time that the report was written and on site conditions that existed at time of the field observations. If significant changes to the nature, configuration, or scope of the project occur during the environmental, design, or construction phases of the work, the Geotechnical Section should be consulted to determine the impact of such changes on the USMP results for the Old Yellowstone Trail South presented in this report.

Questions regarding this final geotechnical report should be addressed to Orion George, WFLHD Engineering Geologist, at (360) 619-7634, or electronically sent to Orion.George@dot.gov

Table 1 Unstable Slope Management Program slope assessment scores in order of highest to lowest Total Scores.

Unstable Slope ID	Section[1]	Hazard Type	Affected Length	Preliminary Total[2]	Hazard Total[2]	Risk Total[2]	TOTAL SCORE[2]
US103	YJC-N	Rockfall - Planar, Wedge, Toppling, Diff. Erosion	440	292	276	134	**488**
US16	YJC-S	Rockfall - Planar, Wedge, Toppling, Diff. Erosion	340	198	264	151	**433**
US20	POR	Landslide - Erosional Failure	287	167	187	180	**349**
US06	YNP	Rockfall - Diff. Erosion	225	99	281	46	**327**
US15	CLLS	Rockfall - Diff. Erosion	200	129	292	27	**319**
US110	POR	Rockfall - Indeterminate, Diff. Erosion	260	135	148	197	**315**
US104	YJC-N	Rockfall - Planar, Wedge	130	120	171	45	**314**
US22	POR	Landslide - Debris Flow	54	107	249	76	**307**
US106	YJC-N	Landslide - Shallow Slump	35	112	163	101	**303**
US108	YJC-N	Rockfall - Diff. Erosion	1230	105	139	24	**295**
US07	YNP	Rockfall - Diff. Erosion	185	82	258	34	**292**
US111	POR	Rockfall - Indeterminate, Diff. Erosion	207	104	146	143	**289**
US11	CLLS	Rockfall - Diff. Erosion	440	23	264	24	**288**
US101	YJC-S	Rockfall - Diff. Erosion	296	51	132	100	**274**
US10	CLLS	Landslide - Debris Flow, Shallow Slump	90	104	318	42	**270**
US102	YJC-S	Rockfall - Diff. Erosion	251	93	140	124	**264**
US14	CLLS	Landslide - Debris Flow	120	107	327	24	**261**
US13	CLLS	Landslide - Debris Flow	70	99	322	21	**253**
US107	YJC-N	Rockfall - Diff. Erosion	100	105	132	24	**251**
US21	POR	Rockfall - Planar, Wedge, Indeterminate	70	57	138	82	**244**
US12	CLLS	Landslide - Debris Flow	65	102	322	5	**237**
US109	YJC-N	Landslide - Shallow Slump	60	29	57	74	**214**
US03	YNP	Landslide - Shallow Slump	40	31	121	82	**203**
US17	YJC-N	Rockfall - Diff. Erosion	425	51	117	79	**196**
US04	YNP	Landslide - Debris Flow, Erosional Failure	275	51	114	78	**192**
US19	POR	Rockfall - Raveling/Undermining., Indeterminate, Diff. Erosion	277	57	103	96	**163**
US05	YNP	Rockfall - Diff. Erosion, Erosional Failure	125	57	122	37	**159**
US18	YJC-N	Rockfall - Diff. Erosion	775	51	120	79	**145**
US01	YNP	Rockfall - Diff. Erosion	500	57	102	34	**136**
US09	CLLS	Rockfall - Raveling/Undermining, Diff. Erosion	500	75	143	42	**131**
US02	YNP	Landslide - Shallow Slump	575	21	---	---	**21**
US08	CLLS	Rockfall - Raveling/Undermining, Diff. Erosion	175	21	---	---	**21**
US105	YJC-N	Landslide - Shallow Slump	50	14	---	---	**14**

Notes:

1) YNP = Yellowstone National Park section (Appendix A-2), CLLS = Cutler Lake Landslide section (Appendix A-3), YJC-S = Yankee Jim Canyon south section, YJC-N = Yankee Jim Canyon north section (Appendix A-4), POR = Point of Rocks section (Appendix A-5).

2) With a preliminary score of 21 or less USMP protocol calls to stop the assessment.

GEOTECHNICAL REPORT NO. 17-18
UNSTABLE SLOPE CORRIDOR ASSESSMENT REPORT

Old Yellowstone Trail South Project
MT PARK 2016(10)
Park County, Montana

June 2018

Prepared by: _____
Orion George, Engineering Geologist

Reviewed and Approved by: _____
Nathan Jenks, Supervisory Geotechnical Engineer

APPENDIX A

Maps

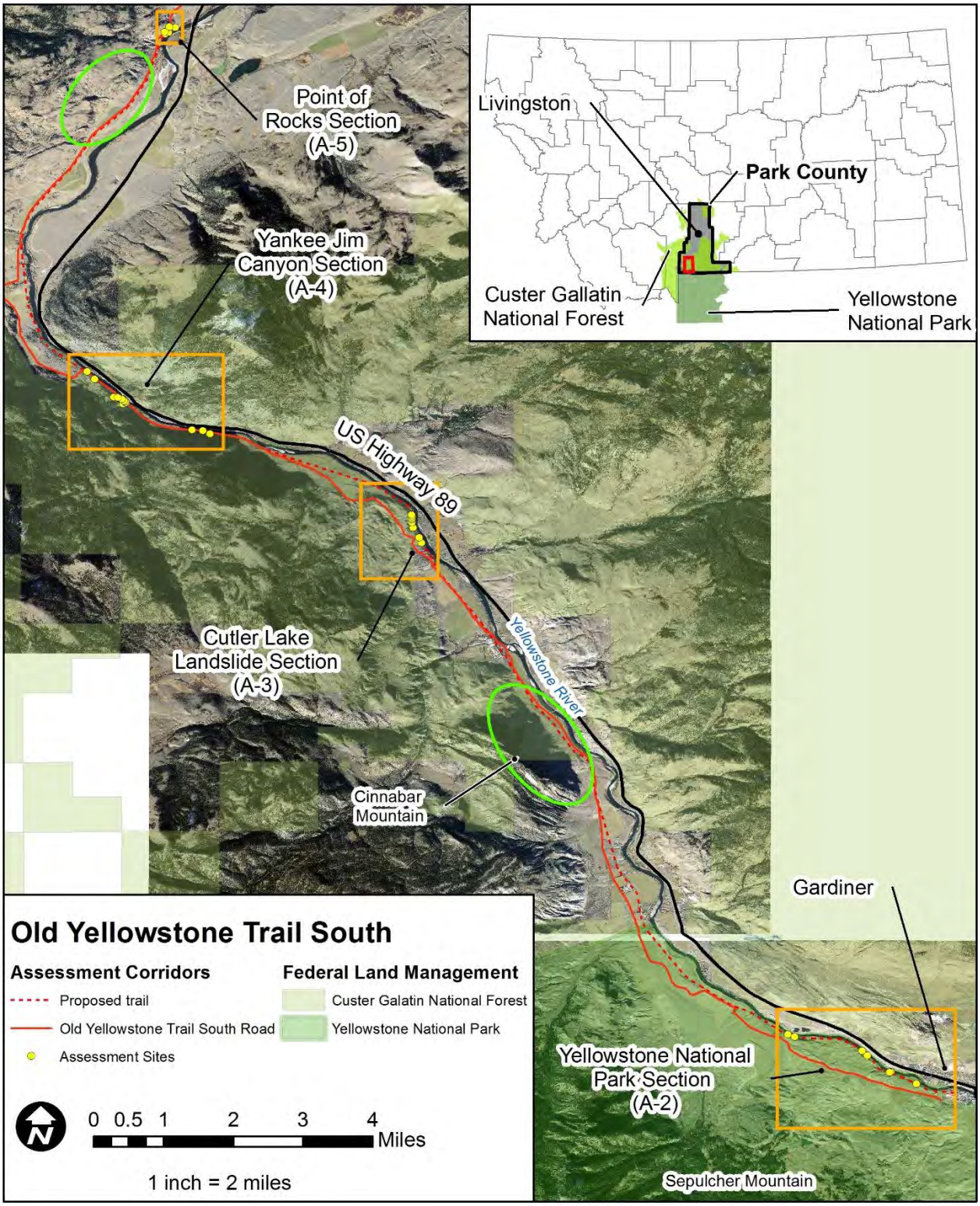
A-1: Overview Map

A-2: Map of the Yellowstone National Park Section

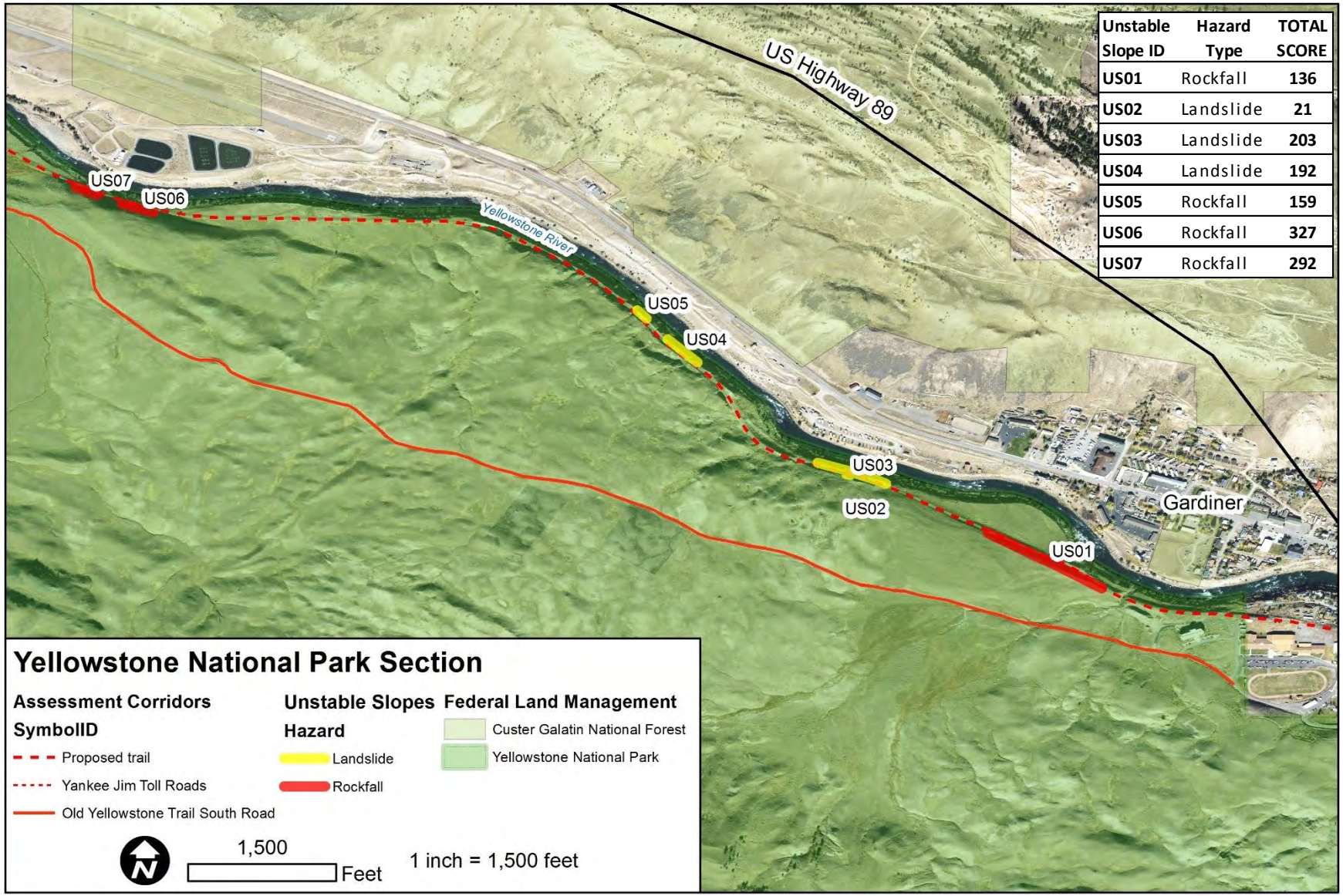
A-3: Map of the Cutler Lake Landslide Section

A-4: Map of the Yankee Jim Canyon Section

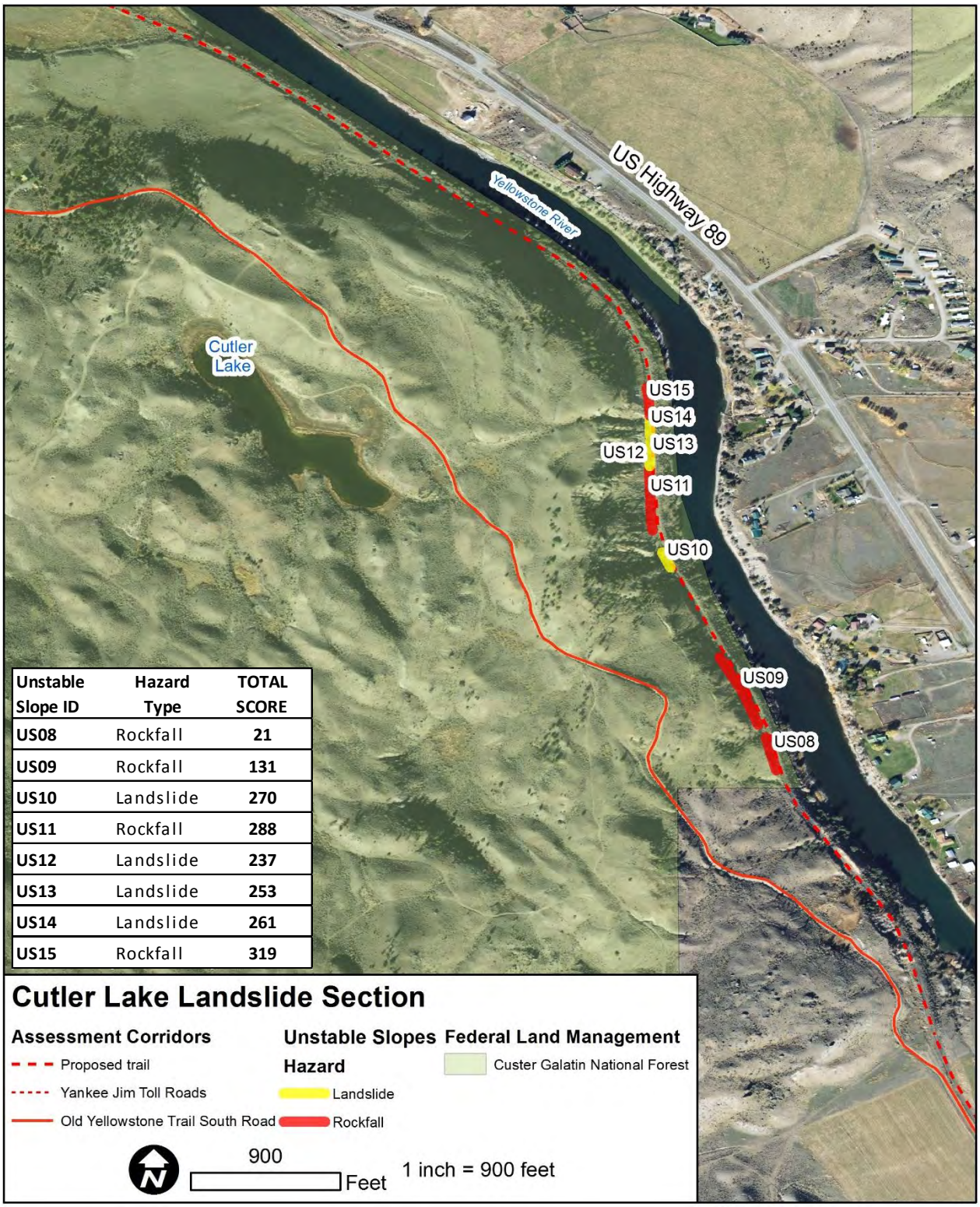
A-5: Map of the Point of Rocks Section



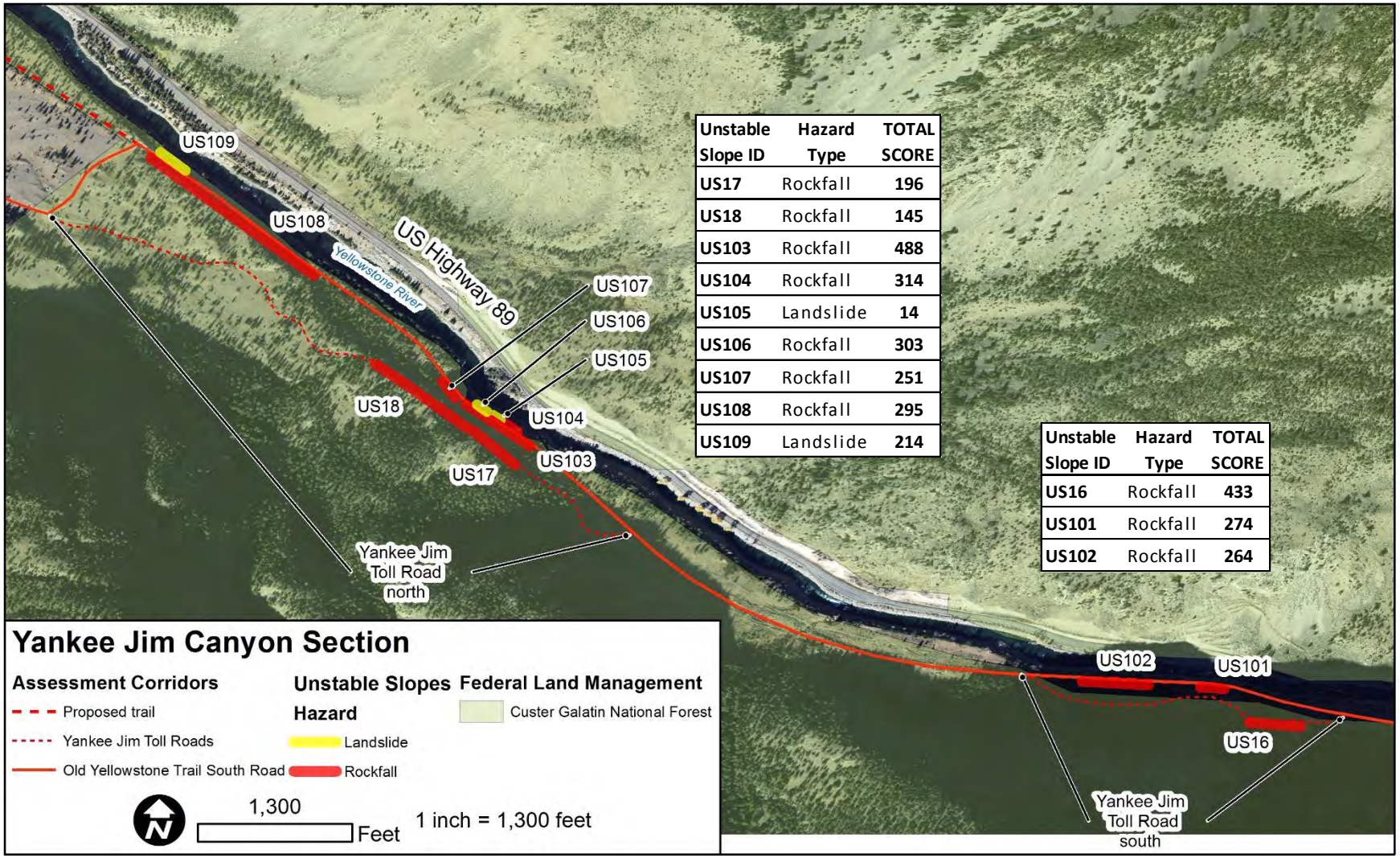
A-1) Overview map of the Old Yellowstone Trail South project area. Gardiner is in the southeast corner with US highway 89 extending north towards Livingston, Montana. Four sections have their individual map's extent highlighted with orange rectangles with the Appendix page in parentheses extending from south to north, the same direction as the unstable slope sites are numbered. For descriptions of unstable slopes assessed in the sections see individual sections within the report and Appendix B. Green ovals denote areas where we observed large boulders sourced from ridgelines above.



A-2) Map of the Yellowstone National Park section of the unstable slope assessment. The hummocky textured area to the southwest of the proposed trail and road corridors is an ancient landslide that is sourced from Sepulcher Mountain to the southwest.



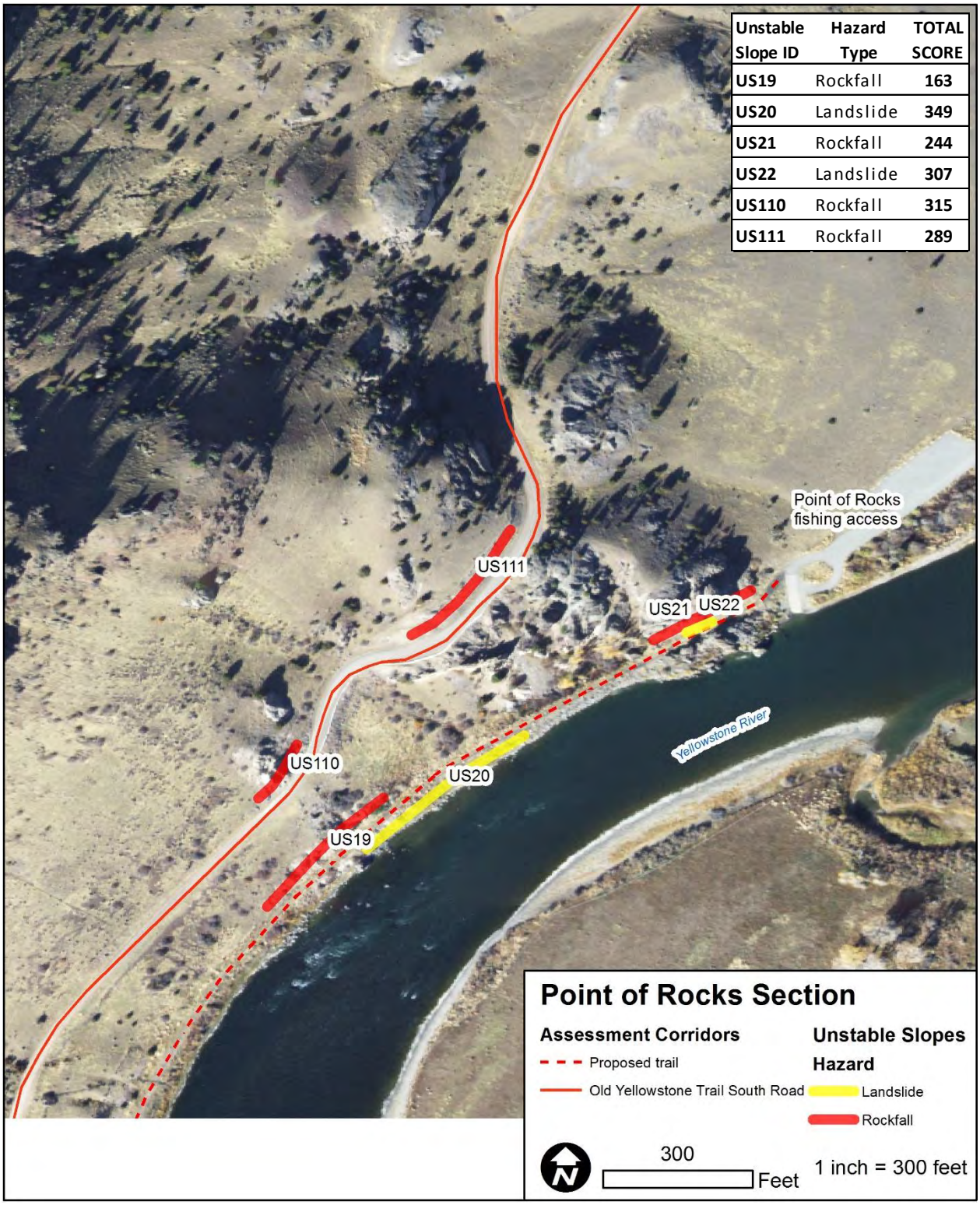
A-3) Map of the Cutler Lake Landslide section. The southern portion of the proposed trail is on private property and was not walked by us, however a decent view of that area was given from the roadway. Unstable slopes are not anticipated along that section of proposed trail. The hummocky area surrounding Cutler Lake down to the Yellowstone River is considered an ancient, dormant landslide sourced from the mountains southwest of the area.



Unstable Slope ID	Hazard Type	TOTAL SCORE
US17	Rockfall	196
US18	Rockfall	145
US103	Rockfall	488
US104	Rockfall	314
US105	Landslide	14
US106	Rockfall	303
US107	Rockfall	251
US108	Rockfall	295
US109	Landslide	214

Unstable Slope ID	Hazard Type	TOTAL SCORE
US16	Rockfall	433
US101	Rockfall	274
US102	Rockfall	264

A-4) Map of the Yankee Jim Canyon section. This section is broken into two sub-sections, the Yankee Jim Toll Road south and north sub-sections. Sites US103 and US16 were the two highest rated unstable slopes assessed for this investigation. Total USMP scores were: US103 (rated at 488) and US16 (rated at 433).



A-5) Map of the Point of Rocks section. The proposed trail is on the old railroad grade in this section, which is along a cutbank of the Yellowstone River that was being actively eroded during the field visit (5/7/2018).

APPENDIX B

Unstable Slope Management Program Forms

Sites US01 thru US111

(in numerical order by site number)

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:14:41 Last edit: 2018-05-18 11:13:20	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS US01	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NE - IF ROAD DIRE	Weather: Clear
Begin Coord. Lat/Long: Lat (##.#####): 45.03345 Long (-###.#####): -110.71622	End Coord. Lat/Long: Lat (##.#####): 45.03433 Long (-###.#####): -110.71788	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 500	Slope Height (rock)/Axial Length (slide) (ft): 40		Slope Angle (°): 38
Sight Distance (ft): 250	Usable Roadway/Trail Width (ft): 10		Speed Limit (mph): 2
Ditch Width Range (ft): 3 - 5	Ditch Depth Range (ft): 1 - 1.5	Ditch Slope Range (H:V): 1 :1 - 1 :1	Block Size (ft): 3 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen
Comments: US09, Old rr grade with cut in fluvial deposits, Boulder and cobble up to 5' supported by fine sand to coarse gravel some silt, clasts rd to sub rd. Minimal vegetation and upper lip becoming undermined (~top 2 '). Ditch catching most material, but numerous large boulders up to 3.5' on outside edge of trail. National Park section.			
Alternate database Name:		Alternate database ID:	
Alternate database Description:			

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	9

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	27
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 9
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					57
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					57

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	6
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	27

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	9
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								102
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		9
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								34
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								136

Feedback & Support

Slope Rating Form - Site Information (Landslide)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:15:50 Last edit: 2018-05-18 11:13:08	○ Rockfall ◉ Landslide	Hazard Type: Press (ctrl+click) to select more than one Rotational Debris Flow Shallow Slump Erosional Failure
Road/Trail No: OYTS US02	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NE - IF ROAD DIRE	Weather: Clear
Begin Coord. Lat/Long: Lat (##.#####): 45.03624 Long (-###.#####): -110.72222	End Coord. Lat/Long: Lat (##.#####): 45.0368 Long (-###.#####): -110.72418	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 575	Slope Height (rock)/Axial Length (slide) (ft): 40		Slope Angle (°): 47
Sight Distance (ft): 350	Usable Roadway/Trail Width (ft): 10		Speed Limit (mph): 2
Ditch Width Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 0 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Cobble up two feet supported by silty gravlley, coarse sandy fine to medium sand, moisture is held on alignment when wet, recommend better drainage, water ponded in ditch at beginning. Clasts angular and mostly sedimentary. Is in the toe of a larger ancient? Earthflow/landslide. National Park section. [originally designated site US10]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	3
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	3
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	3
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	0

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	0
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	0
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 9
Preliminary Rating Landslide T otal (A+B+C+G+H):					21
Preliminary Rating Rockfall T otal (D+E+F+G+H):					
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					21

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	9
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	6
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								33
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								0
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		9
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		0
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		4
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		0
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		0
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		0
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		0
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								104
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								137

Feedback & Support

Slope Rating Form - Site Information (Landslide)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:16:16 Last edit: 2018-05-18 11:13:03	○ Rockfall ◉ Landslide	Hazard Type: Press (ctrl+click) to select more than one Translational Rotational Debris Flow Shallow Slump
Road/Trail No: OYTS US03	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NE - IF ROAD DIRE	Weather: Unknown
Begin Coord. Lat/Long: Lat (##.#####): 45.03657 Long (-###.#####): -110.72315	End Coord. Lat/Long: Lat (##.#####): 45.03662 Long (-###.#####): -110.72322	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 40	Slope Height (rock)/Axial Length (slide) (ft): 90		Slope Angle (°): 35
Sight Distance (ft): 350	Usable Roadway/Trail Width (ft): 10		Speed Limit (mph): 2
Ditch Width Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 0 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen
Comments: National Park section. [originally designated site US11]			
Alternate database Name:		Alternate database ID:	
Alternate database Description:			

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	3
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	9
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	7
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	0

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	0
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	0
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 9
Preliminary Rating Landslide T otal (A+B+C+G+H):					31
Preliminary Rating Rockfall T otal (D+E+F+G+H):					
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					31

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	20
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	52
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	3
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	9
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	9
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								121
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								0
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		9
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		27
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		27
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								82
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								203

Feedback & Support

Slope Rating Form - Site Information (Landslide)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:16:47 Last edit: 2018-05-18 11:12:56	○ Rockfall ◉ Landslide	Hazard Type: Press (ctrl+click) to select more than one Rotational Debris Flow Shallow Slump Erosional Failure
Road/Trail No: OYTS US04	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NE - IF ROAD DIRE	Weather: Clear
Begin Coord. Lat/Long: Lat (##.#####): 45.03955 Long (-###.#####): -110.72753	End Coord. Lat/Long: Lat (##.#####): 45.04013 Long (-###.#####): -110.72823	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 275	Slope Height (rock)/Axial Length (slide) (ft): 85		Slope Angle (°): 49
Sight Distance (ft): 250	Usable Roadway/Trail Width (ft): 12		Speed Limit (mph): 2
Ditch Width Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 0 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Fill side of grade is being undermined by river. Piping observed at culvert location and in middle of slope in middle of trail. Shallow slump, colluvial hollow like, failures are exhibiting and slowly eroding headward towards grade. Trail could be moved slopeward and cut laid back to avoid. National Park section. [originally designated site US12]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	3
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	9
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	27
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	0

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	0
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	0
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 9
Preliminary Rating Landslide T otal (A+B+C+G+H):					51
Preliminary Rating Rockfall T otal (D+E+F+G+H):					
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					51

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	9
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	42
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	3
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	9
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	3
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								114
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								0
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		5
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		27
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		27
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								78
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								192

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:17:17 Last edit: 2018-05-18 11:12:49	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Rotational Debris Flow Shallow Slump Erosional Failure
Road/Trail No: OYTS US05	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NE - IF ROAD DIRE	Weather: Clear
Begin Coord. Lat/Long: Lat (##.#####): 45.04076 Long (-###.#####): -110.72892	End Coord. Lat/Long: Lat (##.#####): 45.04105 Long (-###.#####): -110.72913	Datum: WGS 84	AADT: 0
Length of Affected Road/T rail (ft): 125	Slope Height (rock)/Axial Length (slide) (ft): 20		Slope Angle (°): 60
Sight Distance (ft): 350	Usable Roadway/T rail W idth (ft): 9		Speed Limit (mph): 2
Ditch W idth Range (ft): 2 - 4	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 2 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen
Comments: slope has rockfall hazard associated with steep slope and differential erosion rates, trail constricted. National Park section. [originally designated site US13]			
Alternate database Name:		Alternate database ID:	
Alternate database Description:			

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway W idth Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	27

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	9
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 9
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					57
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					57

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	9
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	2
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	27

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	27
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								122
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		12
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								37
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								159

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:17:47 Last edit: 2018-05-18 11:12:37	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS US06	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NE - IF ROAD DIRE	Weather: Mostly Cloudy and B
Begin Coord. Lat/Long: Lat (##.#####): 45.04386 Long (-###.#####): -110.7425	End Coord. Lat/Long: Lat (##.#####): 45.0441 Long (-###.#####): -110.74339	Datum: WGS 84	AADT: 0
Length of Affected Road/T rail (ft): 225	Slope Height (rock)/Axial Length (slide) (ft): 65		Slope Angle (°): 38
Sight Distance (ft): 350	Usable Roadway/T rail W idth (ft): 10		Speed Limit (mph): 2
Ditch W idth Range (ft): 0 - 4	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 3 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Trail covered in rxfall with boulder up to 3', slope oversteepened with sand and gravel with some silt supporting cobble and boulder up to 5'. National Park section. [originally designated site US14]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway W idth Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	27

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	27
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	27
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	9
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 9
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					99
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					99

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	17
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	9
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	81

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	81
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								281
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		9
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		9
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								46
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								327

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-06-05 15:44:18 Last edit: 2018-05-18 11:12:32	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Planar Wedge Toppling Raveling/Undermining
Road/Trail No: OYTS US07	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NE - IF ROAD DIRE	Weather: Unknown
Begin Coord. Lat/Long: Lat (##.#####): 45.04439 Long (-###.#####): -110.74407	End Coord. Lat/Long: Lat (##.#####): 45.0446 Long (-###.#####): -110.74467	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 185	Slope Height (rock)/Axial Length (slide) (ft): 55		Slope Angle (°): 36
Sight Distance (ft): 250	Usable Roadway/Trail Width (ft): 10		Speed Limit (mph): 2
Ditch Width Range (ft): 1 - 4	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 2.5 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Oversteepened soil slope with fluvial or alluvial ,arterial, cobble and boulders up to 5' supported by sand and gravel with some silt, rxfall over trail. National Park section. [originally designated site US15]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	27

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	27
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	16
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 9
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					82
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					82

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	11
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	81

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	81
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								258
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		9
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								34
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								292

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:18:44 Last edit: 2018-05-18 11:10:34	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS US08	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: E - IF ROAD DIREC	Weather: A Few Clouds
Begin Coord. Lat/Long: Lat (##.#####): 45.1462 Long (-###.#####): -110.82026	End Coord. Lat/Long: Lat (##.#####): 45.14671 Long (-###.#####): -110.8204	Datum: WGS 84	AADT: 0
Length of Affected Road/T rail (ft): 175	Slope Height (rock)/Axial Length (slide) (ft): 35		Slope Angle (°): 45
Sight Distance (ft): 300	Usable Roadway/T rail W idth (ft): 12		Speed Limit (mph): 2
Ditch W idth Range (ft): 2 - 4	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 1 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Rock mass is basalt or rhyolite highly fractured with loose rock, differential erosion area with minor rock fall. Cutler Lake Landslide section. [originally designated as site US18]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway W idth Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	9

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	3
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	3
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					21
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					21

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	0
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	5
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								29
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		5
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		0
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		0
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		0
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		0
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								101
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								130

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:19:05 Last edit: 2018-05-18 11:10:27	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS US09	Road/Trail: T	Road/Trail Class: Proposedp	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: E - IF ROAD DIREC	Weather: A Few Clouds
Begin Coord. Lat/Long: Lat (##.#####): 45.14697 Long (-###.#####): -110.82052	End Coord. Lat/Long: Lat (##.#####): 45.14813 Long (-###.#####): -110.82114	Datum: WGS 84	AADT: 0
Length of Affected Road/T rail (ft): 500	Slope Height (rock)/Axial Length (slide) (ft): 60		Slope Angle (°): 60
Sight Distance (ft): 300	Usable Roadway/T rail W idth (ft): 12		Speed Limit (mph): 2
Ditch W idth Range (ft): 4 - 6	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 :0 - 0 :0	Block Size (ft): 0 Volume (cy): 9
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Soil slope with Fx rhyolite/basalt cropping out, few localized locations with greater volume in events, overall slope has smaller rock fall on trail about 1.5'. Cutler Lake Landslide section. [originally designated as site US19]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway W idth Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	9

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	27
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	27
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	9
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					75
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					75

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	14
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								89
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		5
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		9
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		9
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								42
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								131

Feedback & Support

Slope Rating Form - Site Information (Landslide)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:19:22 Last edit: 2018-05-18 10:40:36	○ Rockfall ◉ Landslide	Hazard Type: Press (ctrl+click) to select more than one Translational Rotational Debris Flow Shallow Slump
Road/Trail No: OYTS US10	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: L - FOR USE WITH	Weather: A Few Clouds
Begin Coord. Lat/Long: Lat (##.#####): 45.14954 Long (-###.#####): -110.82222	End Coord. Lat/Long: Lat (##.#####): 45.14981 Long (-###.#####): -110.82215	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 90	Slope Height (rock)/Axial Length (slide) (ft): 450		Slope Angle (°): 38
Sight Distance (ft): 500	Usable Roadway/Trail Width (ft): 12		Speed Limit (mph): 2
Ditch Width Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 0 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: On both sides of road. Trail has small debris fan with debris sourced from above and water then causing shallow slumping (colluvial hollow like) failures in fill side at corridor edge. Boulders up and to3.5' deposited at base of cut slope. [originally designated as site US20]

Alternate database Name:

Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	81
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	3
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	8
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	0

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	0
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	0
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	9
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					104
Preliminary Rating Rockfall T otal (D+E+F+G+H):					
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					104

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	27
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	100
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								228
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								0
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		5
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		9
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		9
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								42
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								270

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:19:54 Last edit: 2018-05-18 11:10:11	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS US11	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: E - IF ROAD DIREC	Weather: A Few Clouds
Begin Coord. Lat/Long: Lat (##.#####): 45.15003 Long (-###.#####): -110.82222	End Coord. Lat/Long: Lat (##.#####): 45.15044 Long (-###.#####): -110.82228	Datum: WGS 84	AADT: 0
Length of Affected Road/T rail (ft): 440	Slope Height (rock)/Axial Length (slide) (ft): 160		Slope Angle (°): 40
Sight Distance (ft): 350	Usable Roadway/T rail W idth (ft): 12		Speed Limit (mph): 2
Ditch W idth Range (ft): 15 - 20	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 1.5 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Tall slope with debris raveling and eroding off, ,outlying being caught by trees and sage brush, but covering the trail in numerous locations. Locally slope is rilling with fans below on the trail. Cutler Lake Landslide section. [originally designated as site US21]

Alternate database Name:

Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway W idth Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	3

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	5
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					23
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					23

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	27
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	100
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	81

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	27
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								264
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		5
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								24
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								288

Feedback & Support

Slope Rating Form - Site Information (Landslide)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:20:15 Last edit: 2018-05-18 10:40:45	○ Rockfall ◉ Landslide	Hazard Type: Press (ctrl+click) to select more than one Diff. Erosion Translational Rotational Debris Flow
Road/Trail No: OYTS US12	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: E - IF ROAD DIREC	Weather: A Few Clouds
Begin Coord. Lat/Long: Lat (##.#####): 45.15124 Long (-###.#####): -110.82233	End Coord. Lat/Long: Lat (##.#####): 45.15141 Long (-###.#####): -110.82235	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 65	Slope Height (rock)/Axial Length (slide) (ft): 300		Slope Angle (°): 37
Sight Distance (ft): 550	Usable Roadway/Trail Width (ft): 12		Speed Limit (mph): 2
Ditch Width Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 0 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Localized debris flow shoot incised into slope, ~2' debris on trail. Cutler Lake Landslide section. [originally designated as site US22]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	81
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	9
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	6
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	0

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	0
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	0
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					102
Preliminary Rating Rockfall T otal (D+E+F+G+H):					
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					102

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	27
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	100
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								232
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								0
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		5
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		0
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		0
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		0
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		0
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								5
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								237

Feedback & Support

Feedback & Support

Slope Rating Form - Site Information (Landslide)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:20:35 Last edit: 2018-05-18 11:09:58	○ Rockfall ◉ Landslide	Hazard Type: Press (ctrl+click) to select more than one Diff. Erosion Translational Rotational Debris Flow
Road/Trail No: OYTS US13	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: E - IF ROAD DIREC	Weather: A Few Clouds
Begin Coord. Lat/Long: Lat (##.#####): 45.15159 Long (-###.#####): -110.82251	End Coord. Lat/Long: Lat (##.#####): 45.15155 Long (-###.#####): -110.82219	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 70	Slope Height (rock)/Axial Length (slide) (ft): 450		Slope Angle (°): 36
Sight Distance (ft): 400	Usable Roadway/Trail Width (ft): 12		Speed Limit (mph): 2
Ditch Width Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 0 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Localized debris flow shoot incised into slope, ~2' debris on trail. Cutler Lake Landslide section. [originally designated as site US23]

Alternate database Name:

Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	81
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	9
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	6
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	0

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	0
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	0
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	0
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					99
Preliminary Rating Rockfall T otal (D+E+F+G+H):					
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					99

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	27
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	100
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								232
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								0
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		5
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								21
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								253

Feedback & Support

Slope Rating Form - Site Information (Landslide)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:20:53 Last edit: 2018-05-18 11:09:16	○ Rockfall ◉ Landslide	Hazard Type: Press (ctrl+click) to select more than one Diff. Erosion Translational Rotational Debris Flow
Road/Trail No: OYTS US14	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: E - IF ROAD DIREC	Weather: A Few Clouds
Begin Coord. Lat/Long: Lat (##.#####): 45.15166 Long (-###.#####): -110.82226	End Coord. Lat/Long: Lat (##.#####): 45.1519 Long (-###.#####): -110.82253	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 120	Slope Height (rock)/Axial Length (slide) (ft): 450		Slope Angle (°): 32
Sight Distance (ft): 350	Usable Roadway/Trail Width (ft): 12		Speed Limit (mph): 2
Ditch Width Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 0 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: This site covers two debris flow channels incised on the slope with fans covering the trail (close together). Cutler Lake Landslide section. [originally designated as site US24]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	81
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	9
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	11
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	0

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	0
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	0
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					107
Preliminary Rating Rockfall T otal (D+E+F+G+H):					
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					107

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	27
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	100
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								237
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								0
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		5
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								24
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								261

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:21:19 Last edit: 2018-05-18 11:07:48	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS US15	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: E - IF ROAD DIREC	Weather: A Few Clouds
Begin Coord. Lat/Long: Lat (##.#####): 45.15207 Long (-###.#####): -110.82235	End Coord. Lat/Long: Lat (##.#####): 45.15254 Long (-###.#####): -110.82237	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 200	Slope Height (rock)/Axial Length (slide) (ft): 90		Slope Angle (°): 42
Sight Distance (ft): 200	Usable Roadway/Trail Width (ft): 12		Speed Limit (mph): 2
Ditch Width Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 2 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Slope with fractured rhyolite being undermined by raveling of colluvial slopes, debris covering trail. Cutler Lake Landslide section. [originally designated as site US25]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	81

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	27
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	9
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	9
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					129
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					129

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	52
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	81

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	27
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								292
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		5
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		0
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								27
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								319

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:21:43 Last edit: 2018-05-18 11:30:33	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS US16	Road/Trail: T	Road/Trail Class: Proposed	Rater: Og Nj
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NW - IF ROAD DIRE	Weather: Partly Cloudy
Begin Coord. Lat/Long: Lat (##.#####): 45.16918 Long (-###.#####): -110.86408	End Coord. Lat/Long: Lat (##.#####): 45.16909 Long (-###.#####): -110.86289	Datum: WGS 84	AADT: 50
Length of Affected Road/Trail (ft): 340	Slope Height (rock)/Axial Length (slide) (ft): 85		Slope Angle (°): 70
Sight Distance (ft): 84	Usable Roadway/Trail Width (ft): 3		Speed Limit (mph): 2
Ditch Width Range (ft): 1 - 2	Ditch Depth Range (ft): 0.1 - 0.2	Ditch Slope Range (H:V): 1 : 1 - 1 : 1	Block Size (ft): 10 Volume (cy): 1
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen
Comments: US01, on yankee Jim toll road section, multiple sections of dry stone retaining wall holding alignment with some potential damage from rockfall, but overall good condition without bulging , cracking, or clear signs of deformation. Zones of differential erosion from cut in between rock faces. Bdrx gneiss with adverse foliation and			
Alternate database Name:	Alternate database ID:		
Alternate database Description:			

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	81

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	81
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	27
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☐ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					201
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					198

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	42
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	27
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	9
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	9

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	9
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								282
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		62
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		2
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		9
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		27
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		9
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		9
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								151
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								433

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:22:48 Last edit: 2018-05-18 11:34:55	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS US17	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NE - IF ROAD DIRE	Weather: A Few Clouds
Begin Coord. Lat/Long: Lat (##.#####): 45.17498 Long (-###.#####): -110.88188	End Coord. Lat/Long: Lat (##.#####): 45.17586 Long (-###.#####): -110.88278	Datum: WGS 84	AADT: 0
Length of Affected Road/T rail (ft): 425	Slope Height (rock)/Axial Length (slide) (ft): 25		Slope Angle (°): 45
Sight Distance (ft): 60	Usable Roadway/T rail W idth (ft): 5		Speed Limit (mph): 2
Ditch W idth Range (ft): 0 - 2	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 2 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Cut slope oversteepened with loose rock on slope above but much less. Boulders up to 4' observed on trail, but avg 1-2', historic dry stone wall on fill side trail in good condition. Historic sign painted on rock in slope near End. Yankee Jim Toll Road 2 section. [originally designated site US16]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway W idth Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	27

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	9
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					51
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					51

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	3
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	27

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	27
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								117
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		36
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		27
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								79
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								196

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:23:49 Last edit: 2018-05-18 11:35:18	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS US18	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NE - IF ROAD DIRE	Weather: A Few Clouds
Begin Coord. Lat/Long: Lat (##.#####): 45.17591 Long (-###.#####): -110.8828	End Coord. Lat/Long: Lat (##.#####): 45.17733 Long (-###.#####): -110.88508	Datum: WGS 84	AADT: 0
Length of Affected Road/T rail (ft): 775	Slope Height (rock)/Axial Length (slide) (ft): 25		Slope Angle (°): 45
Sight Distance (ft): 75	Usable Roadway/T rail W idth (ft): 5		Speed Limit (mph): 2
Ditch W idth Range (ft): 0 - 2	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 2 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Slope begins in foliated and folded garnet schist gneiss with copious biotite, but little perceived risk, risk most hazardous portion appears in differentially eroding portion. clasts rounded to angular, up to 3', supported by silty sand and gravel. Historic dry stone wall on fill side. Yankee Jim Toll Road 2 section. [originally designated site

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway W idth Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	27

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	9
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					51
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					51

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	9
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	3
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								66
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		36
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		27
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								79
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								145

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:26:09 Last edit: 2018-05-18 12:01:19	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one: Raveling/Undermining; Rock Avalanche; Indeterminate Rock Failures; Diff. Erosion
Road/Trail No: OYTS US19	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NE - IF ROAD DIRE	Weather: A Few Clouds and B
Begin Coord. Lat/Long: Lat (##.#####): 45.25113 Long (-###.#####): -110.87351	End Coord. Lat/Long: Lat (##.#####): 45.25231 Long (-###.#####): -110.8732	Datum: WGS 84	AADT: 0
Length of Affected Road/T rail (ft): 277	Slope Height (rock)/Axial Length (slide) (ft): 33		Slope Angle (°): 53
Sight Distance (ft): 620	Usable Roadway/T rail W idth (ft): 4		Speed Limit (mph): 2
Ditch W idth Range (ft): 0 - 4	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 2 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Volcanic breccia? Or glacial Till? Light gray weak to moderately strong bedrock with gravel to boulders up to 3' supported by weakly cemented matrix (fine grained material to coarse sand) angular to rounded. Trail on a fill and well armored against cutting by Yellowstone River, in a cut bank, however at end of section bank is eroding

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway W idth Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	27

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	9
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 9
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					57
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					57

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	9
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	4
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								67
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		47
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		27
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								96
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								163

Feedback & Support

Slope Rating Form - Site Information (Landslide)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:26:27 Last edit: 2018-05-18 12:01:24	○ Rockfall ◉ Landslide	Hazard Type: Press (ctrl+click) to select more than one Rotational Debris Flow Shallow Slump Erosional Failure
Road/Trail No: OYTS US20	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: SW - IF ROAD DIRE	Weather: Mostly Cloudy and B
Begin Coord. Lat/Long: Lat (##.#####): 45.25221 Long (-###.#####): -110.87343	End Coord. Lat/Long: Lat (##.#####): 45.25279 Long (-###.#####): -110.87264	Datum: WGS 84	AADT: 0
Length of Affected Road/T rail (ft): 287	Slope Height (rock)/Axial Length (slide) (ft): 19		Slope Angle (°): 40
Sight Distance (ft): 230	Usable Roadway/T rail W idth (ft): 12		Speed Limit (mph): 2
Ditch W idth Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 0 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen
Comments: Cut bank of Yellowstone actively eroding into embankment. No armor if present, besides apparent native boulders sporadically located. Wooden pier present, unknown origin. Buried fiber at middle of site under Trail. Bank material lt gray, loose supporting boulders up to 3,5 ft observed. Trail eroded to about 4' in locations. Mid			
Alternate database Name:		Alternate database ID:	
Alternate database Description:			

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway W idth Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	81
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	9
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	41
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	0

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	0
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	0
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	27
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 9
Preliminary Rating Landslide T otal (A+B+C+G+H):					167
Preliminary Rating Rockfall T otal (D+E+F+G+H):					
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					167

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	27
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	2
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								169
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								0
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		5
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		81
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		27
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		27
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								180
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								349

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:26:49 Last edit: 2018-05-18 12:01:33	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Toppling Raveling/Undermining Rock Avalanche Indeterminate Rock Failures
Road/Trail No: OYTS US21	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NW - IF ROAD DIRE	Weather: A Few Clouds and B
Begin Coord. Lat/Long: Lat (##.#####): 45.25325 Long (-###.#####): -110.87178	End Coord. Lat/Long: Lat (##.#####): 45.25344 Long (-###.#####): -110.87121	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 70	Slope Height (rock)/Axial Length (slide) (ft): 85		Slope Angle (°): 60
Sight Distance (ft): 150	Usable Roadway/Trail Width (ft): 6		Speed Limit (mph): 2
Ditch Width Range (ft): 0 - 4	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 2 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen
Comments: Tall bedrock cut on NE side and smaller cut on SW Side. Alluvial fan with ~2.5 ' of material on trail mid-site from debris chute. Boulders up to 3' on either side of trail. Point of Rocks section. [originally designated site US28]			
Alternate database Name:		Alternate database ID:	
Alternate database Description:			

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	27

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	9
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 9
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					57
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					57

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	9
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	42
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	27
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	3
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								162
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		27
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		27
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		9
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								82
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								244

Feedback & Support

Feedback & Support

Slope Rating Form - Site Information (Landslide)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:27:06 Last edit: 2018-05-18 12:01:36	○ Rockfall ◉ Landslide	Hazard Type: Press (ctrl+click) to select more than one Diff. Erosion Translational Rotational Debris Flow
Road/Trail No: OYTS US22	Road/Trail: T	Road/Trail Class: Proposed	Rater: OG
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NW - IF ROAD DIRE	Weather: A Few Clouds and B
Begin Coord. Lat/Long: Lat (##.#####): 45.25331 Long (-###.#####): -110.87161	End Coord. Lat/Long: Lat (##.#####): 45.25349 Long (-###.#####): -110.87145	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 54	Slope Height (rock)/Axial Length (slide) (ft): 150		Slope Angle (°): 37
Sight Distance (ft): 500	Usable Roadway/Trail Width (ft): 6		Speed Limit (mph): 2
Ditch Width Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 0 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Debris fan over trail ~2-3' debris current apex ~36' Slope distance from trail at about 26 degrees. Clasts up to 2-3' observed in fan. Point of Rocks section. [originally designated site US29]

Alternate database Name:

Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	81
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	9
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	5
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	0

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	0
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	0
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 9
Preliminary Rating Landslide T otal (A+B+C+G+H):					107
Preliminary Rating Rockfall T otal (D+E+F+G+H):					
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					107

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	27
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	100
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								231
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								0
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		27
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		27
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								76
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								307

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-06-07 14:25:35 Last edit: 2018-05-18 13:46:21	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS US101	Road/Trail: R	Road/Trail Class: Proposed	Rater: OG
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NW - IF ROAD DIRE	Weather: Unknown
Begin Coord. Lat/Long: Lat (##.#####): 45.16971 Long (-###.#####): -110.8649	End Coord. Lat/Long: Lat (##.#####): 45.17015 Long (-###.#####): -110.86613	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 296	Slope Height (rock)/Axial Length (slide) (ft): 92		Slope Angle (°): 52
Sight Distance (ft): 171	Usable Roadway/Trail Width (ft): 12		Speed Limit (mph): 25
Ditch Width Range (ft): 1 - 2	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 2 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: On road below yankee Jim toll rd 1. Differential erosion rockfall slope with zones of high and no veg. Rock king outside edge of road up to 2.5' on avg smaller in ditch. Yankee Jim Toll Road 1 section. [originally designated site US30 rd]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	27

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	9
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					51
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					51

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	57
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								114
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		81
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		60
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								160
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								274

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-05-18 12:22:21 Last edit: 2018-05-18 11:25:18	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one: Raveling/Undermining; Rock Avalanche; Indeterminate Rock Failures; Diff. Erosion
Road/Trail No: OYTS US102	Road/Trail: R	Road/Trail Class: Road	Rater: OG
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NW - IF ROAD DIRE	Weather: Mostly Cloudy
Begin Coord. Lat/Long: Lat (##.#####): 45.16973 Long (-###.#####): -110.86688	End Coord. Lat/Long: Lat (##.#####): 45.16938 Long (-###.#####): -110.86779	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 251	Slope Height (rock)/Axial Length (slide) (ft): 48		Slope Angle (°): 57
Sight Distance (ft): 700	Usable Roadway/Trail Width (ft): 12		Speed Limit (mph): 35
Ditch Width Range (ft): 1 - 1.5	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 :0 - 0 :0	Block Size (ft): 3 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: On road below yankee Jim toll rd 1. Oversteepened Cut in soils supporting angular gneissic colluvial boulders up to 10’ in size. Apparent large failures have been repaired, large boulders on the outside edge avg ~2.5’ to 3’. Yankee Jim Toll Road 1 section. [originally designated site US31 rd]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	27

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	27
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	27
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					93
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					93

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	8
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	27

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	27
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								140
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		81
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		0
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								124
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								264

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-06-07 13:59:00 Last edit: 2018-05-18 13:53:37	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS US103	Road/Trail: R	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: SE - IF ROAD DIRE	Weather: Partly Cloudy and Br
Begin Coord. Lat/Long: Lat (##.#####): 45.17617 Long (-###.#####): -110.88262	End Coord. Lat/Long: Lat (##.#####): 45.17635 Long (-###.#####): -110.88296	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 440	Slope Height (rock)/Axial Length (slide) (ft): 65		Slope Angle (°): 70
Sight Distance (ft): 350	Usable Roadway/Trail Width (ft): 12		Speed Limit (mph): 25
Ditch Width Range (ft): 1 - 2	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 4 Volume (cy): 15
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: US02, large wedge features contributing bulk of material, large zones of weak biotite in gneiss. Yankee Jim Toll Road 2 section. [originally designated site US02]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	81

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	27
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	100
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	81
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					292
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					292

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	17
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	27
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	9
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	27

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	9
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								276
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		81
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		4
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		27
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		9
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								212
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								488

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-06-07 13:58:09 Last edit: 2018-05-18 13:51:00	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one: Planar, Wedge, Toppling, Raveling/Undermining
Road/Trail No: OYTS US104	Road/Trail: R	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NW - IF ROAD DIRE	Weather: Mostly Cloudy and B
Begin Coord. Lat/Long: Lat (##.#####): 45.17603 Long (-###.#####): -110.88201	End Coord. Lat/Long: Lat (##.#####): 45.17603 Long (-###.#####): -110.88201	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 130	Slope Height (rock)/Axial Length (slide) (ft): 25		Slope Angle (°): 65
Sight Distance (ft): 350	Usable Roadway/Trail Width (ft): 12		Speed Limit (mph): 25
Ditch Width Range (ft): 0 - 1	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 3 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: US03, in through cut with US02, same structures different aspect and smaller cut, less adversity in discontinuities. Yankee Jim Toll Road 2 section. [originally designated site US03]

Alternate database Name:

Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	81

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	27
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 0
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					120
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					120

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	3
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	27
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	9
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	9

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	3
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								189
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		81
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		4
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		27
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								125
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								314

Feedback & Support

Slope Rating Form - Site Information (Landslide)

Management Area: OTHER / Montana / Park County	Date: 2018-06-07 14:02:36 Last edit: 2018-05-18 13:50:14	○ Rockfall ◉ Landslide	Hazard Type: Press (ctrl+click) to select more than one Translational Rotational Debris Flow Shallow Slump
Road/Trail No: OYTS US105	Road/Trail: R	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NW - IF ROAD DIRE	Weather: Mostly Cloudy and B
Begin Coord. Lat/Long: Lat (##.#####): 45.17582 Long (-###.#####): -110.8823	End Coord. Lat/Long: Lat (##.#####): 45.17615 Long (-###.#####): -110.88244	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 50	Slope Height (rock)/Axial Length (slide) (ft): 85		Slope Angle (°): 43
Sight Distance (ft): 350	Usable Roadway/Trail Width (ft): 11		Speed Limit (mph): 25
Ditch Width Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 0 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Two smaller sections of land sliding in a 350' section that is at risk. Yankee Jim Toll Road 2 section. [originally designated site US04]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	3
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	3
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	5
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	0

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	0
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	0
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					17
Preliminary Rating Rockfall T otal (D+E+F+G+H):					
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					14

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	0
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	42
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								62
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								0
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		93
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		4
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		0
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		0
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		0
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		0
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								104
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								166

Feedback & Support

Slope Rating Form - Site Information (Landslide)

Management Area: OTHER / Montana / Park County	Date: 2018-06-07 14:00:05 Last edit: 2018-05-18 14:18:59	○ Rockfall ◉ Landslide	Hazard Type: Press (ctrl+click) to select more than one Translational Rotational Debris Flow Shallow Slump
Road/Trail No: OYTS US106	Road/Trail: R	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NW - IF ROAD DIRE	Weather: Unknown
Begin Coord. Lat/Long: Lat (##.#####): 45.17595 Long (-###.#####): -110.88251	End Coord. Lat/Long: Lat (##.#####): 45.17595 Long (-###.#####): -110.88251	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 35	Slope Height (rock)/Axial Length (slide) (ft): 85		Slope Angle (°): 42
Sight Distance (ft): 200	Usable Roadway/Trail Width (ft): 8		Speed Limit (mph): 25
Ditch Width Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 0 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen
Comments: Yankee Jim Toll Road 2 section. [originally designated site US05]			
Alternate database Name:		Alternate database ID:	
Alternate database Description:			

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	27
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	81
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	4
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	0

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	0
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	0
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	0
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 0
Preliminary Rating Landslide T otal (A+B+C+G+H):					112
Preliminary Rating Rockfall T otal (D+E+F+G+H):					
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					112

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	0
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	42
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								163
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								0
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		100
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		39
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		0
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		0
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		0
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		0
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								140
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								303

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-06-07 14:01:39 Last edit: 2018-05-18 13:43:11	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS US107	Road/Trail: R	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NW - IF ROAD DIRE	Weather: Partly Cloudy
Begin Coord. Lat/Long: Lat (##.#####): 45.17657 Long (-###.#####): -110.88315	End Coord. Lat/Long: Lat (##.#####): 45.17679 Long (-###.#####): -110.88338	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 100	Slope Height (rock)/Axial Length (slide) (ft): 40		Slope Angle (°): 46
Sight Distance (ft): 250	Usable Roadway/Trail Width (ft): 12		Speed Limit (mph): 25
Ditch Width Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 2 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: Yes	Mitigation Present: YES	Photos/Documents(up to 10MB): Choose Files No file chosen
Comments: Old rail grade below old yankee Jim toll road 2, colluvial slope with rounded to angular material, over-steepened. Yankee Jim Toll Road 2 section. [originally designated site US06]			
Alternate database Name:		Alternate database ID:	
Alternate database Description:			

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	81

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	9
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					105
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					105

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	6
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	9

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	3
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								132
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		81
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		19
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								119
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								251

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-06-07 13:57:05 Last edit: 2018-05-18 14:16:44	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS US108	Road/Trail: R	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NW - IF ROAD DIRE	Weather: Mostly Cloudy and B
Begin Coord. Lat/Long: Lat (##.#####): 45.17964 Long (-###.#####): -110.88678	End Coord. Lat/Long: Lat (##.#####): 45.18207 Long (-###.#####): -110.89017	Datum: WGS 84	AADT: 0
Length of Affected Road/T rail (ft): 1230	Slope Height (rock)/Axial Length (slide) (ft): 45		Slope Angle (°): 50
Sight Distance (ft): 175	Usable Roadway/T rail W idth (ft): 12		Speed Limit (mph): 25
Ditch W idth Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 2 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen
Comments: Yankee Jim Toll Road 2 section. [originally designated site US07]			
Alternate database Name:		Alternate database ID:	
Alternate database Description:			

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway W idth Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	81

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	9
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					105
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					105

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	9
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	7
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	9

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	3
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								139
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		81
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		56
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								156
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								295

Feedback & Support

Slope Rating Form - Site Information (Landslide)

Management Area: OTHER / Montana / Park County	Date: 2018-06-07 13:55:42 Last edit: 2018-05-18 14:15:32	○ Rockfall ◉ Landslide	Hazard Type: Press (ctrl+click) to select more than one Translational Rotational Debris Flow Shallow Slump
Road/Trail No: OYTS US109	Road/Trail: R	Road/Trail Class: Proposed	Rater: OG NJ
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: NW - IF ROAD DIRE	Weather: Unknown
Begin Coord. Lat/Long: Lat (##.#####): 45.18173 Long (-###.#####): -110.8897	End Coord. Lat/Long: Lat (##.#####): 45.18207 Long (-###.#####): -110.89015	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 60	Slope Height (rock)/Axial Length (slide) (ft): 30		Slope Angle (°): 38
Sight Distance (ft): 300	Usable Roadway/Trail Width (ft): 11		Speed Limit (mph): 25
Ditch Width Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 0 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Shallow slump ends mid slope, Erosional rills at head, cracking at edge of corridor. Yankee Jim Toll Road 2 section. [originally designated site US08]

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	9
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	9
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	5
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	0

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	0
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	0
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 3
Preliminary Rating Landslide T otal (A+B+C+G+H):					29
Preliminary Rating Rockfall T otal (D+E+F+G+H):					
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					29

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	9
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	4
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								45
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								0
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		93
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		9
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		3
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		27
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		27
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								169
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								214

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-06-04 13:03:26 Last edit: 2018-06-01 15:38:19	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Raveling/Undermining Rock Avalanche Indeterminate Rock Failures Diff. Erosion
Road/Trail No: OYTS rd US110	Road/Trail: R	Road/Trail Class: County unpaved	Rater: OG
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: W - IF ROAD DIREC	Weather: Overcast and Breezy
Begin Coord. Lat/Long: Lat (##.#####): 45.25234 Long (-###.#####): -110.87405	End Coord. Lat/Long: Lat (##.#####): 45.25299 Long (-###.#####): -110.87361	Datum: WGS 84	AADT: 0
Length of Affected Road/Trail (ft): 260	Slope Height (rock)/Axial Length (slide) (ft): 45		Slope Angle (°): 60
Sight Distance (ft): 65	Usable Roadway/Trail Width (ft): 21		Speed Limit (mph): 35
Ditch Width Range (ft): 0 - 2	Ditch Depth Range (ft): 0 - 0.5	Ditch Slope Range (H:V): 0 : 0 - 2 : 0	Block Size (ft): 2 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen

Comments: Volcanic bx/congl with clasts up to5' observed. Discontinuous dilated fox present, adverse, moderately hard with areas of weak rx, overhanging rock outcrop upslope ~520' out of easement. Originally named US32

Alternate database Name:	Alternate database ID:

Alternate database Description:

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway Width Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	81

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	9
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	27
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 9
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					135
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					135

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	7
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	0
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	0
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	0
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	0

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	0
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								118
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		24
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		100
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		27
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								197
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								315

Feedback & Support

Slope Rating Form - Site Information (Rockfall)

Management Area: OTHER / Montana / Park County	Date: 2018-06-04 15:32:55 Last edit: 2018-06-01 15:45:39	(•) Rockfall ( ) Landslide	Hazard Type: Press (ctrl+click) to select more than one Planar Wedge Toppling Raveling/Undermining
Road/Trail No: Oyst rd US111	Road/Trail: R	Road/Trail Class: County unpaved	Rater: OG
Beginning Mile Marker: 0	Ending Mile Marker: 0	Side: W - IF ROAD DIREC	Weather: Unknown
Begin Coord. Lat/Long: Lat (##.#####): 45.25325 Long (-###.#####): -110.87311	End Coord. Lat/Long: Lat (##.#####): 45.25402 Long (-###.#####): -110.8725	Datum: WGS 84	AADT: 0
Length of Affected Road/T rail (ft): 207	Slope Height (rock)/Axial Length (slide) (ft): 23		Slope Angle (°): 43
Sight Distance (ft): 75	Usable Roadway/T rail W idth (ft): 26		Speed Limit (mph): 35
Ditch W idth Range (ft): 0 - 0	Ditch Depth Range (ft): 0 - 0	Ditch Slope Range (H:V): 0 : 0 - 0 : 0	Block Size (ft): 0.5 Volume (cy): 0
Annual Rainfall Range (in): 10 - 20	Sole Access Route: No	Mitigation Present: NO	Photos/Documents(up to 10MB): Choose Files No file chosen
Comments: Soil Cut with rock outcrop, discontinuously fx, glacial outwash seeds likely stratified Sand with gravel and cobble up to 1' observed, oversteepened brow. previously named US33			
Alternate database Name:		Alternate database ID:	
Alternate database Description:			

Preliminary Ratings

Category Rating:	3	9	27	81	Score:
A. Landslide - Roadway W idth Affected:	0-5 percent	6-25 percent	26-50 percent	51-100 percent	0
B. Landslide - Slide/Erosion Effects:	Visible crack or slight deposit of material / minor erosion	1 inch offset, or 6-inch deposit of material / major erosion will affect travel in < 5 years	2-inch offset or 12-inch deposity / mod. erosion impacting travel annually	4-inch offset or 24-inch deposity / severe erosion impacting travel consistently	0
C. Landslide - Roadway Length Affected:	25 ft	100 ft	225 ft	400 ft	0
D. Rockfall - Ditch Effectiveness: (consider launch features)	Good	Moderate	Limited	No Catchment	81

Feedback & Support

E. Rockfall - Rockfall History:	Few Falls	Occasional Falls	Many Falls	Constant Falls	9
F. Rockfall - Block Size or V olume per Event:	1ft or 3yd^3	2ft or 6yd^3	3ft or 9yd^3	4ft or 12yd^3	2
G. All - Impact on Use:	Full use continues with minor delay	Partial use remains Use modification required, short (3mi / 30min.) detour available	Use is blocked - long (>30min.) detour available or less than 1 day closure	Use is blocked - no detour available or closure longer than 1 week	3
H. All - AADT/Usage/Economic or Recreational Importance (highest rating applies):	50 Rarely Used Insignificant economic / rec. importance	200 Occasionally used Minor economic / rec. importance	450 Frequently used Moderate economic / rec. importance	800 Constantly used Significant economic / rec. importance	Use AADT in calculation: ☑ 9
Preliminary Rating Landslide T otal (A+B+C+G+H):					
Preliminary Rating Rockfall T otal (D+E+F+G+H):					104
Preliminary Rating Good (15-21 pts) | Fair (22-161 pts) | Poor (>161 pts)					104

Slope Hazard Ratings

Category Rating:			3	9	27	81	Score:
I. All - Slope Drainage:			Slope appears dry or well drained; surface runoff well controlled	Intermittent water on slope; mod. not well drained; or surface runoff moderately controlled	Water usually on slope; poorly drained; or surface runoff poorly controlled	Water always on slope; very poorly drained; or surface water runoff control not present	3
J. All - Annual Rainfall:			0-10"	10-30"	30-60"	60"+	9
K. All - Slope Height (Rockfall) / Axial Length of slide (Landslide):			25ft	50ft	75ft	100ft	3
Select One Unstable Slope Type	Landslides / Erosion	L. Thaw Stability:	Unfrozen / Thaw Stable	Slightly Thaw Unstable	Moderately Thaw Unstable	Highly Thaw Unstable	0
		M. Instability - Related Maint. Frequency:	Every 10 years	Every 5 years	Every 2 years	Every year	0
		N. Movement History:	Minor movement or sporadic creep	Up to 1 inch annually or steady annual creep	Up to 3 inches per event, one event per year	>3" per event, >6" annually, more than 1 event per year (includes all debris flows)	0
	Rockfalls	O. Rockfall-Related Maint. Frequency:	Normal, scheduled maintenance	Patrols after every storm event	Routine seasonal patrols	Year round patrols	3
		Geological Character Case 1 — P. Structural Condition:	favorable	random	Discontinuous adverse	Continuous adverse	9
		Geological Character Case 1 — Q. Rock Friction:	Rough / Irregular	Undulating	Planar	Clay infilled / Slickensided	3
		Geological Character Case 2 — R. Structural Condition:	Few differential erosion features	Occasional differential erosion features	Many differential erosion features	Major differential erosion features	9

Feedback & Support

			S. Diff. in Erosion Rates:	Small difference	Moderate difference	Large difference	Extreme difference	27
T. LANDSLIDE HAZARD T OTAL (A+B+C+I+J+K+L+M+N):								0
U. ROCKFALL HAZARD T OTAL (D+E+F+I+J+K+O+(greater of P+Q or R+S)):								146
Risk Ratings								
V. Route W idth or T rail W idth:			36ft 14ft	28ft 10ft	20ft 6ft	12ft 2ft		12
W. Human Exposure Factor:			12.5% of the time	25% of the time	37.5% of the time	50% of the time		1
X. % of Decision Sight Distance (Judge avoidance ability on trails):			Adequate, 100% of the low design value	Moderate, 80% of the low design value	Limited, 60% of the low design value	Very limited, 40% of the low design value		100
Y. Right of W ay (R/W) Impacts (If Left Unattended):			No R/W implications	Minor effects beyond R/W	Private property, no structures affected	Structures, roads, RR, utilities, or Parks affected		9
Z. Environmental/Cultural Impacts if Left Unattended:			None/No Potential to Cause Effects	Likely to Effect/No Hist. Prop. Affected	Likely to adversely Affect/Finding of No Adverse Effect	Current adverse effects/Adverse Effect		3
AA. Maintenance Complexity:			Routine Effort / In-House	In-House maint. / special project	Specialized equip. / contract	Complex / dangerous effort / location / contract		3
BB. Event Cost:			$0-2k	$2-25k	$25-100k	>$100k		3
CC. Risk Totals (G+H+V+W+X+Y+Z+AA+BB):								143
TOTAL USMP SCORE: LANDSLIDES (T+CC) OR ROCKF ALL (U+CC): Good (<200 pts) | Fair (200-400 pts) | Poor (>400 pts)								289

Feedback & Support

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Appendix B: Introductory Environmental Assessment

Environmental Overview Memo
Old Yellowstone Trail South Corridor Study

9/5/19

The purpose of this memo is to present a preliminary environmental overview for the Old Yellowstone Trail South (OYTS) Corridor Study project – MT PARK 2016(10). The study area begins near Gardiner, Montana and extends approximately 21.1miles mostly towards the northwest, paralleling the west bank of the Yellowstone River. The proposed project currently has three main objectives:

1. Provide safer and more adequate transportation access through the corridor for emergency vehicles as well as residents, recreationists, visitors and resource users
2. Ensure the future use of the corridor is not inhibited by degradation of travel surfaces
3. Establish a balance in developing recreational opportunities, while also preserving the existing character of the area

Below is a summary of relevant environmental categories related to the project:

1.0 National Environmental Policy Act

The National Environmental Policy Act (NEPA) is required when a Federal action is taken that may have impacts on the human and natural environment. Federal actions are those that require Federal funding, permits, policy decisions, facilities, equipment, or employees. NEPA analysis and documentation depends on the scope, funding source, and lead federal agency of potential project activities. It is likely that the NEPA document for proposed project activities would be a Categorical Exclusion or Environmental Assessment, which have shorter timelines than Environmental Impact Statements. Since project activities would likely occur at least partially on National Park Service (NPS) and USDA Forest Service (USFS) lands, they would determine which type of NEPA document would meet their needs. The project activities could potentially fall under the Federal Highway Administration (FHWA) categorical exclusions described in 23.CFR.771.117. The NPS and USFS would need to determine if they could use FHWA's categorical exclusion to satisfy their NEPA requirements.

It is not anticipated that a Montana Environmental Policy Act (MEPA) review would be required as part of proposed project activities. However, an environmental review under NEPA may be legally sufficient to cover MEPA, if MEPA becomes required.

1.1 Federal Land Management Agency Consistency Determination

Since portions of the OYTS corridor are on NPS and USFS lands, each agency will need to provide a determination that the project is consistent with its policies and plans. The determination may be in the form of a NEPA document, or it could be a separate document.

2.0 Land Use

Land use within the OYTS corridor is a mixture of public and privately-owned land. Public land includes areas within the corridor that are managed by the NPS and USFS. Park County has coordinated project development with the NPS and USFS and both the NPS and USFS support the project.

Depending on the outcome of the study, right-of-way (ROW) acquisition may be required through private lands, including the Church Universal and Triumphant (Royal Teton Ranch) property, in which a key section of the OYTS roadway is located. Also, existing segments of the OYTS cross active agricultural fields; however, no new impacts are anticipated to occur on prime or unique farmland.

Park County has coordinated with and would continue to coordinate with the land owners to develop avoidance measures and/or ways to mitigate for impacts.

2.1 Public Involvement

Private lands within the corridor include ranches, agricultural lands, and property owned by the Church Universal and Triumphant. A public information session was held on May 31st, 2018 to describe the OYTS planning study and to receive feedback from the community. Also, private land owners have been encouraged to submit comments and suggestions regarding the study.

Additional public information sessions would be held as the project progresses, also, a public meeting and comment period would likely be held during the NEPA process.

2.2 Property Acquisition

Certain sections of the OYTS corridor that are in need of restoration may require acquisition of property, but would not require obtaining structures or displacing residents. Any property acquisitions would need to comply with the Uniform Relocation Assistance and Real Property Acquisition Act of 1970. Property or easement acquisitions could increase project timelines and/or alter project alternatives.

2.3 Section 4(f) of the Department of Transportation Act

If FHWA is involved in construction activities related to the project, FHWA would need to comply with Section 4(f) of the Department of Transportation Act, which stipulates that "FHWA and other DOT agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites unless the following conditions apply:

- There is no feasible and prudent avoidance alternative to the use of land; and the action includes all possible planning to minimize harm to the property resulting from such use;

OR

- The Administration determines that the use of the property will have a *de minimis* impact." (https://www.environment.fhwa.dot.gov/legislation/section4f.aspx)

FHWA would need to determine if 4(f) properties exist in the project area, then determine if the project will "use" those 4(f) properties. If the "4(f) use" is *de minimis,* meaning "for parks, recreation areas, and wildlife and waterfowl refuges, a *de minimis* impact is one that will not adversely affect the features, attributes, or activities qualifying the property for protection under Section 4(f)" then it will be noted in the file and project can proceed. If the "4(f) use" is determined to be greater than *de*

minimis, then a written evaluation must be prepared that describes the use and evaluates the alternatives, and proposes mitigation and minimization measures.

While it is likely that the project would use 4(f) resources, it is also likely that the impact would be *de minimis* or that one of the designated exceptions to the law would apply.

2.4 Section 6(f) of the Land and Water Conservation Act

Section 6(f) of the Land and Water Conservation Act requires that the conversion of lands or facilities acquired with Land and Water Conservation Act funds be coordinated with the Department of Interior.

Section 6(f) resources, such as fishing accesses, may be present within the OYTS study area. The proposed project is being developed to enhance recreational opportunities within the OYTS corridor; therefore, Section 6(f) resources would not be eliminated or degraded as part of the proposed project.

3.0 Environmental Justice

The project would be open to all and would likely not impact any environmental justice communities disproportionately.

4.0 Cultural/Historic Resources

Because the OYTS corridor crosses federal lands, consideration of impacts to cultural/historic resources is mandated under Section 106 of the National Historic Preservation Act.

Preliminary information from the NPS, USFS, and the Yellowstone Gateway Museum indicates that there are known cultural/historic resources in the study area. Prior to project implementation and construction, additional cultural/historic resource investigations may be required, including an Archaeological Resources Protection Act (ARPA) permit for archaeological investigations.

The federal project lead would be required to coordinate with the State Historic Preservation Office to ensure that the project complies with Section 106.

5.0 Tribal Coordination

Tribal coordination, or government-to-government consultation regarding concerns the tribes may have regarding the OYTS project, will be conducted by the USFS, NPS, and/or the FHWA as the project progresses.

6.0 Wetlands and Waters

According to National Wetland Inventory mapping (https://www.fws.gov/wetlands/data/mapper.HTML – Accessed 12/28/18), small areas of riverine wetlands (freshwater emergent and forested/shrub) associated with the banks of the Yellowstone River as well as widely scattered palustrine emergent persistent seasonally/temporarily flooded wetlands are mapped within the study area. However, a site visit has not been conducted to confirm that the OYTS crosses potentially jurisdictional wetlands.

The OYTS crosses eight named creeks that are tributaries to the Yellowstone River, from south to north within the study area (upstream to downstream of the Yellowstone River) these creeks are as follows:

- Landslide Creek
- Stephens Creek
- Reese Creek
- Spring Creek
- Mulherin Creek
- Sphinx Creek
- Tom Miner Creek
- Rock Creek

The OYTS also crosses numerous unnamed drainages. These waterways are also tributaries to the Yellowstone River.
The proposed project may include new and/or upgraded bridge and culvert crossings, as applicable. A site visit has not been conducted to confirm which waterways would require a crossing, if work below the ordinary high-water mark (OHWM) of the respective waterways would be necessary, or whether the respective waterways may be considered jurisdictional by the U.S. Army Corps of Engineers (USACE).

Any construction within jurisdictional wetlands or within the OHWM of jurisdictional waterways (rivers, streams, creeks, drainages, etc.) would require to be permitted in accordance with the USACE 404 - Clean Water Act (CWA) permitting process. The permitting process would include a wetlands/waters delineation and report, consultation with the USACE to determine the net impact on wetlands/waters, and appropriate mitigation, as necessary, to resolve wetland/waters impacts. The Section 404 permit would need to be obtained prior to beginning construction activities.

Impacts to wetlands/waters would also require a 401 Water Quality Certification from the Montana Department of Environmental Quality (MDEQ). The 401 Water Quality Certification is obtained jointly as part of the Section 404 Permit process.

Also, a MDEQ Temporary Turbidity - 318 Authorization may be required if proposed construction activities result in a release of sediment or turbid water to wetlands/waterways and a Montana Stream Protection Act Permit (SPA 124 Permit) from the Montana Department of Fish, Wildlife, & Parks (MFWP) if project activities affect the natural existing shape and form of any stream or its banks or tributaries.

6.1 Water Quality

Water bodies that do not meet water quality standards are placed on the list of impaired water bodies, the CWA Section 303(d) list, by MDEQ. The Yellowstone River within the study area is 303(d) listed for ammonia, arsenic, copper, lead, nitrate-nitrite, and sedimentation-siltation. Probable sources include: abandoned mine lands, surface mining, subsurface mining, natural sources, highway runoff, land clearance, streambank modifications, and loss of riparian habitat. Water quality permits will dictate the level of required conservation measure.

The Yellowstone River (from Reese Creek to the end of the study area), Reese Creek, and Mulherin Creek are designated as a Water Quality Category 4C by MDEQ. A 4C water quality designation is characterized as “Identified threats or impairments result from pollution categories such as dewatering or habitat modification and, thus, a Total Maximum Daily Load is not required”.

The Yellowstone River (from the start of the study area to Reese Creek) and Tom Miner Creek are designated as a Water Quality Category 5 by MDEQ. A water quality designation of 5 is characterized as "Waters where one or more applicable beneficial uses are impaired or threatened, and a TMDL is required to address the factors causing the impairment or threat". The MDEQ is responsible for developing necessary TMDLs and implementation plans.

The U.S. Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Program requires a permit for all construction activities that disturb more than 1 acre of land. The MDEQ Permitting and Compliance Division administers the NPDES Program through the Montana Pollutant Discharge Elimination System (MPDES) Program. If project activities disturb more than 1 acre of land, the project would need to obtain a "General Permit for Storm Water Discharges Associated with Construction Activity" (General Permit) prior to the initiation of construction activities. As part of the permitting process, completion of a Notice of Intent (NOI) Package and preparation of a Storm Water Pollution Prevention Plan (SWPPP) would be required.

Construction contract requirements, including a soil erosion and sediment control plan, would minimize temporary water quality impacts. The project is not expected to permanently impact water quality.

6.2 Floodplains

Portions of the OYTS corridor are within the Federal Emergency Management Agency (FEMA) 100-year floodplain of the Yellowstone River and the corridor crosses through the FEMA mapped 100-year floodplains of Mulherin Creek and Tom Miner Creek.

Structures constructed within a mapped FEMA 100-year floodplain would require either a "no-rise" certification (information here: https://www.fema.gov/no-rise-certification-floodways), or a Conditional Letter of Map Revision (CLOMR information here: https://www.fema.gov/conditional-letter-map-revision). Also, construction activities within a floodplain must meet local floodplain zoning ordinance requirements, such as the Park County Floodplain Hazard Management Regulations.

6.3 Navigable Waterways

The Yellowstone River is considered navigable by the U.S. Coast Guard (USCG) within the study area; therefore, any structures constructed within or over the Yellowstone River, such as a pedestrian bridge, may require a Section 9 USCG permit and/or a Land-Use License or Easement on Navigable Waters permit from the Montana Department of Natural Resources and Conservation.

The Yellowstone River is not considered navigable by the USACE within the study area; therefore, a USACE Section 10 permit would not be required. The USACE considers the Yellowstone River navigable from Emigrant, Montana downstream to its confluence with the Missouri River.

6.4 Wild and Scenic Rivers

Currently, neither the Yellowstone River, nor its tributaries, are designated as a Wild and Scenic River.

6.5 Groundwater

Numerous groundwater wells may be located within the OYTS study area, additional investigation of the precise locations of groundwater wells may be warranted as the project progresses.

7.0 Fish and Wildlife

7.1 Fish

The Yellowstone River and several of the streams in the OYTS study area support native species such as Yellowstone cutthroat trout, mountain whitefish, longnose sucker, longnose dace, and mottled sculpins. Non-native species may include brown trout, rainbow trout, and carp. Many of these species are considered “game” fish.

Coordination with local/state agencies during the design phase of waterway crossings is recommended to include improved fish passage to the tributaries of the Yellowstone River, where applicable, as well as aquatic and riparian habitat enhancements.

7.2 Wildlife

The OYTS corridor passes through areas utilized by a variety of large wildlife species such as: elk, deer (mule and whitetail), bighorn sheep, pronghorn antelope, bison, bears (black and grizzly), wolves, moose, coyotes, and eagles. Many of these animals migrate annually between the higher elevations in Yellowstone Park and the lower elevations of the Gardiner Basin. According to the MFWP, the study area is an important migratory corridor for numerous species. In particular, Yankee Jim Canyon provides important habitat for migrating species because it provides a pinch point between Paradise Valley and Gardiner Basin/Yellowstone Park.

Other wildlife that may be present within the study area include a variety of species including small mammals, upland birds and waterfowl, amphibians, and reptiles.

As the project progresses, field investigations for the presence and extent of wildlife species within the study area may be warranted with project design and related construction activities kept in consideration to avoid and/or minimize impacts on these species.

7.3 Threatened, Endangered, and Special-Status Species

Canada lynx (with designated critical habitat) and grizzly bear are federally listed under the Endangered Species Act (ESA) as *threatened* within the study area and the North American wolverine is proposed for listing as threatened. All three species are under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS).

The ESA requires that federal agencies consult with the USFWS regarding potential impacts to federally listed species and/or critical habitat. ESA compliance for the project should follow the lead federal agencies procedure for complying with the requirement of the ESA, which may include the use of a programmatic biological opinion or completing a biological assessment.

Furthermore, possible usage within the OYTS corridor or surrounding vicinities by State and USFS special-status species include but are not limited to the following: gray wolf, elk, bald eagle, olive-sided

flycatcher, peregrine falcon, trumpeter swan, northern goshawk, harlequin duck, great gray owl, and Yellowstone cutthroat trout. Coordination with the USFS and MFWP would need to be conducted to address potential impacts to special-status species and to develop applicable avoidance and mitigation measures.

7.4 Migratory Bird Treaty Act

The Migratory Bird Treaty Act prohibits the taking of any migratory birds, their parts, nests, or eggs, except as permitted by regulations. Consultation with the USFWS would be required if impacts to migratory birds are anticipated during construction activities.

7.5 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act provides for the protection of bald and golden eagles by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds. Consultation with the USFWS would be required if impacts to bald or golden eagles are anticipated during construction activities.

8.0 Recreational Resources

The OYTS corridor provides many opportunities for recreation, including, but not limited to, the following: fishing, hunting, hiking, rafting/kayaking, camping, wildlife viewing, ATV, horseback and bicycle riding, cross country skiing and snowshoeing. The Yellowstone River within the study area has been recognized as a blue-ribbon recreational fishery for wild trout and Yankee Jim Canyon includes world-class whitewater for rafting and kayaking.

The OYTS study area currently includes approximately three boat launches, two picnic areas, one campground as well as several unimproved (non-formalized) campgrounds, and five trailheads.

The proposed project is being developed to enhance recreational opportunities within the OYTS corridor without degradation of the natural environment.

9.0 Traffic

The existing OYTS roadway is comprised of gravel surfacing, has a seasonal average daily traffic (SADT) of 100, and is maintained by Park County. The road is currently impassible by vehicles due to washout sections in Yankee Jim Canyon.

Improvements to the OYTS roadway and associated corridor would create the potential for the OYTS to be an alternate emergency route for Emergency Services in case of closures on U.S. Highway 89. Should U.S. Hwy 89 become inaccessible as a result of rock slides, accidents, wildfires, etc., OYTS would provide the only ingress and egress to the community of Gardiner and the original and only year-round access to Yellowstone National Park.

In addition to providing emergency access for motor vehicles, improvements to the OYTS roadway may increase vehicle traffic within the study area as it would provide better access to public lands and potential recreation areas.

10.0 Noise

The OYTS study area consists of park lands, recreation sites, and federally listed Canada lynx critical habitat. Short-term and minor noise impacts from construction-related activities (clearance of rockfall areas, culvert installation, etc.) would occur to soundscapes during the duration of each construction activity. Long-term impacts to soundscapes as a result of the project are not anticipated; however, an evaluation of noise impacts may be warranted in the future if improvements to the road/trail results in an appreciable increase in vehicle traffic.

11.0 Visual Quality

The OYTS corridor is encompassed by the Yellowstone River and its tributaries, valleys, mountains, riparian areas, cultural and historic resources, and open spaces free of anthropogenic structures.

Short-term visual impacts from construction-related activities may occur; however, long-term visual impacts to the landscape as a result of the project are not anticipated.

12.0 Air Quality

The OYTS corridor is not located within an EPA designated air quality maintenance or non-attainment area. A lack of dense population centers and large industrial facilities limit the likelihood for long-term and measurable impairment of air quality within the OYTS study area.

Heavy machinery used during construction activities would contribute to an increase in exhaust fumes and fugitive dust. These increases would be short-term, isolated, and minor. If necessary, dust emissions would be controlled by applying water to construction areas and access roads. It is not anticipated that the project, short-term or long-term, would result in an exceedance of air quality standards.

13.0 Hazardous Materials

No known EPA hazardous materials sites are within the OYTS corridor or project vicinity.

The Montana DEQ data mapper (http://svc.mt.gov/deq/wmadst/) shows verified locations of currently in-use and temporarily out-of-use regulated underground storage tanks (USTs) and locations of open cut mines that are present within the OYTS study area. Additional investigation of the precise locations of the USTs and mines may be warranted as the project progresses. However, it is not anticipated that the proposed project would affect hazardous materials or be a source of hazardous materials.

14.0 Cumulative and Indirect Impacts

In addition to an analysis of direct impacts to relevant environmental categories from a proposed project and its alternatives, cumulative and indirect impacts are also required to be addressed in NEPA documentation.

14.1 Cumulative Impacts

Cumulative impacts are defined as:

"…impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from

individually minor but collectively significant actions taking place over a period of time. (40 CFR § 1508.7)"

Other "past, present, and reasonably foreseeable future actions" that may be included as cumulative impacts are anthropogenic bank stabilizations and flood confinements on the upper Yellowstone River within or near the OYTS study area.

14.2 Indirect Impacts

Indirect impacts are defined as:
…caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. (40 CFR § 1508.8)"
(https://www.environment.fhwa.dot.gov/nepa/QAimpact.aspx)

Indirect impacts that could be "reasonably foreseeable" as a result of the proposed project may include the following: impacts to wildlife as a result of increased human-wildlife interactions, theft of archaeological assets, and environmental degradation from increased recreation activities.

15.0 Summary of Permits and Clearances

Below is a summary of Federal, State, and local agency permits and/or clearances that may be required as part of the project:

U.S. Fish and Wildlife Service

- Section 7 Consultation – Endangered Species Act
- Migratory Bird Treaty Act/Bald and Golden Eagle Protection Act Clearances

U.S. Army Corps of Engineers

- Section 404 Permit – Clean Water Act

U.S. Coast Guard

- Section 9 Permit – Rivers and Harbors Act

Federal Emergency Management Agency

- No-rise Certification

Montana Department of Natural Resources and Conservation

- Montana Land-Use License or Easement on Navigable Waters

Montana State Historic Preservation Office

- Section 106 Clearance – National Historic Preservation Act
- Archaeological Resources Protection Act (ARPA) Permit

U.S. Department of Transportation

- Section 4(f) Clearance

Montana Department of Fish, Wildlife, and Parks

- SPA 124 Permit – Montana Stream Protection Act

Montana Department of Environment Quality

- MPDES "General Permit for Storm Water Discharges Associated with Construction Activities" including a Notice of Intent (NOI) and a Stormwater Pollution Prevention Plan (SWPPP). A soil erosion and sediment control plan and an Authorization for turbidity-related construction activities would also be required from the MDEQ.
- Section 401 Water Quality permit if a Section 404 permit is required by the USACE
- Section 318 Water Quality permit (generally approved by the MFWP on behalf of the MDEQ)

Park County – Floodplain Administrator

- Park County Floodplain Permit

Department of Housing and Urban Development

- Uniform Relocation Assistance and Real Property Acquisition Act Clearance

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Appendix C: Planning Cost Estimate

Provided as separate attachment

Cost Summary

Project Assumptions: *Captured major bid items; will need to include the following:*
Mobilization
Use 3% of Contract total for Lump Sum Traffic Control -assume use for signs
Use 3% of Contract total for Lump Sum Erosion and Sediment Control

Segment 1: MP 0 to MP 4.4

Road: R1

Cost for 20' Rd ($)	Cost widen to 24' Rd ($)	Cost for 28' Rd ($)
$ 108,420.00	$ 495,206.42	$ 881,992.84

Recondition Roadway & install X-Culverts every 500 ft.
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

TRAIL: T1 Formalize Trailhead

Option A

Cost to Formalize ($)
$ 3,194.08

Recondition parking area & install signage

Option B

Asphalt Trail	Aggregate Trail	Existing Trail: Dirt
$ 963,547.20	$ 372,916.62	$ 195,856.00

Build 10ft wide Trail in ROW, Two options provided
Clear existing dirt trail of vegetation and regrade

Option C

Pedestrian Bridge ($)
$ 4,247,688.00

Build Ped Bridge over Yellowstone River (10' x 340')

TRAIL: T3 Trail condition Improvements

Asphalt Trail ($)	Aggregate Trail ($)	Existing Trail: Dirt
$ 770,900.53	$ 304,432.09	$ 195,856.00

Use existing ROW to build a 10 ft. wide trail, provide 2 options, Aggregate only & Asphalt
Clear existing dirt trail of vegetation and regrade

Segment 2: MP 4.4 to MP 7.7

Road: R2

Cost for 20' Rd ($)	Cost for 24' Rd ($)	Cost for 28' Rd ($)
$ 80,915.00	$ 370,924.81	$ 669,239.63

Recondition Roadway & install X-Culverts every 500 ft.
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

TRAIL: T4 MP 4.4 Stream Crossing

Option A

Trail Bridge Type	Cost ($)
Box Culvert	$ 30,000.00
Pre-fabricated Steel Bridge	$ 52,500.00
Wooden Bridge	$ 15,000.00

Build a trail bridge on the existing alignment 10ft. wide X 15ft. Long. Three options provided

Option B

Asphalt Trail ($)	Aggregate Trail ($)
$ 63,042.00	$ 24,398.81

Shift trail alignment 600 ft. to use existing bridge

TRAIL: T5 MP 4.4-7.0 Private Property Crossing

Option A

Asphalt Trail ($)	Aggregate Trail ($)	Widen Shoulder ($)
$ 722,660.40	$ 505,554.13	$ 101,110.83

Share roadway and widen shoulder 2 ft. entire length
Build separate trail adjacent to roadway with a 10 FT offset

Option B

Asphalt Trail ($)	Aggregate Trail ($)
$ 722,660.40	$ 505,554.13

Acquire easements and install signing
use LPSM Traffic Control for signing 3% of contract total
provide 2 Trail resurfacing options, Aggregate only & Asphalt

Option C

Asphalt Trail ($)	Aggregate Trail ($)
$ 197,421.00	$ 138,110.52

Use the railroad bed, but shift the alignment to run beside the river 4760 LF

Segment 3 MP 7.7 to MP 8.3

Road: R3

Cost for 20' Rd ($)	Cost for 24' Rd ($)	Cost for 28' Rd ($)
$ 15,730.00	$ 68,662.69	$ 150,285.39

Recondition Roadway & install X-Culverts every 500 ft.
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

TRAIL: T6 Trail Improvements

Cost ($)
$ 55,852.27

Clear overgrown vegetation and add aggregate to trail

Segment 4 MP 8.3 to MP 10.6

Road: R4

Cost for 20' Rd ($)	Cost for 24' Rd ($)	Cost for 28' Rd ($)
$ 57,365.00	$ 259,686.99	$ 462,008.98

Recondition Roadway & install X-Culverts every 500 ft.
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

TRAIL: T7 Trail Improvements

Option A

Asphalt Trail ($)	Aggregate Trail ($)	Widen Shoulder ($)
$ 503,672.40	$ 352,355.91	$ 70,471.18

Share roadway and widen shoulder 2 ft. entire length
Build separate trail adjacent to roadway with a 10 FT offset

Option B

Asphalt Trail ($)	Aggregate Trail ($)
$ 503,672.40	$ 352,355.91

Average Per Mile Costs

ROAD

		Widen Road 2' and 4'	
	Current W=20'	*W=24'*	*W=28'*
	Cost/Mile	Cost/Mile	Cost/Mile
Roadway Recondition & Drainage	$ 28,000.00	$ 108,000.00	$ 187,000.00

Assume recondition roadway and install cross culvert (18" diam.) for drainage
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen t

TRAIL

Trail Width is 10.0 ft.	Cost/Mile
Asphalt Trail	$ 195,000.00
Aggregate Trail	$ 118,000.00
Widen Shoulder 2ft. (share ROW)	$ 31,000.00
Existing Dirt Trail Width = 6ft	$ 45,000.00

Assume Asphalt Trail Section : 3in. Asphalt over 6in. Aggregate
Assume Aggregate only Trail Section: 12in. Aggregate
Assume widen shoulder 2.0' Section: 12in Aggregate
Assume design Trail to ada standards, 2% cross slope and shoulders at (1:6)
Assume Clearing and Grubbing for Trail only on specific segments
Low Cost option is assumed to be clearing veg. & grading of existing dirt trail at 6.0 ft. wide
All costs per mile rounded to nearest whole thousand

Cost Summary

Average Per Mile Costs

Acquire easements and install signing
use LPSM Traffic Control for signing 3% of contract total
provide 2 Trail resurfacing options, Aggregate only & Asphalt

Segment 5 **MP 10.6 to MP 13.6**

Road: R5	Cost for 20' Rd ($)	Cost for 24' Rd ($)	Cost for 28' Rd ($)
	$ 73,850.00	$ 337,553.47	$ 601,256.93

Recondition Roadway & install X-Culverts every 500 ft.
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

Trail: T8	Asphalt Trail ($)	Aggregate Trail ($)	Widen Shoulder ($)
Option A	$ 661,964.00	$ 464,594.67	$ 96,918.93

Clear vegetation from trail
Share roadway and widen shoulder 2 ft. entire length
Build separate trail adjacent to roadway with a 10 FT offset

Option B	Asphalt Trail ($)	Aggregate Trail ($)
	$ 656,964.00	$ 459,594.67

Acquire easements and install signing
use LPSM Traffic Control for signing 3% of contract total
provide 2 Trail resurfacing options, Aggregate only & Asphalt

Segment 6 **MP 13.6 to MP 15.6**

Road: R6	Cost for 20' Rd ($) with Turnouts	Cost for 24' Rd ($) with Turnouts	Cost for 28' Rd ($) with Turnouts
	$ 148,791.56	$ 207,405.42	$ 240,056.03

Recondition Roadway & install X-Culverts every 500 ft.
Add Turnouts every 1000 ft.
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

TRAIL: T9 Trail Improvements

Option A	Widen Shoulder ($)
	$ 61,279.29

Share roadway and widen shoulder 2 ft. entire length

Segment 7 **MP 15.6 to MP 17.5**

Road: R8	Cost for 20' Rd ($)	Cost for 24' Rd ($)	Cost for 28' Rd ($)
	$ 14,345.00	$ 174,871.86	$ 335,398.72

Recondition Roadway
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

TRAIL: Trail	Widen Shoulder ($)
	$ 58,215.32

Share roadway and widen shoulder 2 ft. entire length

Segment 8 **MP 17.5 to MP 21.1**

Road: R9	Cost for 20' Rd ($)	Cost for 24' Rd ($)	Cost for 28' Rd ($)
	$ 89,580.00	$ 345,193.44	$ 600,806.88

Recondition Roadway & install X-Culverts every 500 ft.
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

TRAIL: Trail	Widen Shoulder ($)
	$ 110,302.72

Share roadway and widen shoulder 2 ft. entire length

OYTS Planning Estimate

Segment 1

MP BEG	MP END	Length (Mi)	Length (Ft)
0	4.4	4.4	23,232.00

0.209

ROAD substantial width through stretch, and is in fair to good condition.

					Exist Avg. width		Widen 4'		Widen 8'
							Width (ft.)	Width (ft.)	Width (ft.)
							20.00	24.00	28.00
Item No.	**Unit**	**Description**	**Quantity-20'**	**Unit Cost**	**Amount 20' Rd**	**Quantity -24'**	**Amount 24' Rd**	**Quantity-28'**	**Amount 28' Rd**
20401-0000	CUYD	Roadway Excavation		$ 35.00	$ -	3,441.78	$ 120,462.22	6,883.56	$ 240,924.44
20420-0000	CUYD	Embankment Construction		$ 8.00	$ -	3,441.78	$ 27,534.22	6,883.56	$ 55,068.44
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]		$ 33.00	$ -	6,780.30	$ 223,749.97	13,560.60	$ 447,499.95
30301-6000	MILE	Roadway reconditioning	4.40	$ 7,550.00	$ 33,220.00	4.40	$ 33,220.00	4.40	$ 33,220.00
60201-0600	LF	18 in. Pipe culvert	Varies-see table P1	$ 80.00	$ 75,200.00	1,128.00	$ 90,240.00	1,316.00	$ 105,280.00
				Total $	**$ 108,420.00**		**$ 495,206.42**		**$ 881,992.84**
				COST/MI	$ 24,640.91		$ 112,546.91		$ 200,452.92

Assumptions:
Recondition roadway as needed in this segment
Install cross culvert every 500 ft. for entirety of road to address drainage
Culvert 18in. Diam CMP
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

Table:P1

Rd Length / 500'	Quantity Pipe, LF, based on Rd Width			
	W = 20 ft.	W = 24 ft.	W = 28 ft.	
47.00	940.00	1,128.00	1,316.00	LF
	(L x No. Crossings)			

(L x W X D) /27 1.97TON/CY

Width Widen Road (ft.)	Depth of Roadway (ft.)	Roadway Excav. (CY)	Embankment Construction (CY)	Aggregate (TONS)
4	1.00	3,441.78	3,441.78	6,780.30
8	1.00	6,883.56	6,883.56	13,560.60

TRAIL **On NPS Land** use the trail on the existing alg- separated from the OYTS road.

T1: Formalize Trailhead

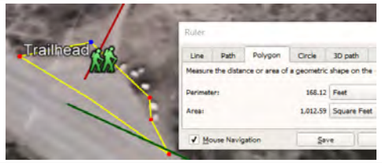
Option A *Add signage & recondition parking area*

Item No.	Unit	Description	Quantity	Unit Cost	Amount $
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	73.91	$ 33.00	$ 2,439.08
30301-6000	MILE	Roadway reconditioning	0.1	$ 7,550.00	$ 755.00
				Total	**$ 3,194.08**
				Cost/MI	$ 725.93

Assumptions:
Recondition the existing area for small parking area-approx. 5 vehicles. Area
Trailhead signing included in Temp. TC. Which is assumed at 3%
Add 12 in. Aggregate for parking area
Conversion Agg. CY/TON = 1.97
Trail segment from Trailhead to end segment 1, Measures Approx. 21,000 ft. length on Google Earth. Use the longer length by MP for calcs.
Parking area reconditioning is based on measurement from Google Earth= 0.10MI

Parking Calcs 1.97CY/TON (LxWxD)/27

TONS	Vol. CUYD	Area (SF)	Depth (ft.)
73.91	37.52	1,013.00	1.00



Option B *Build Trail in ROW*

Item No.	Unit	Description	Asphalt Trail Quantity	Unit Cost	Amount	Aggregate Trail Quantity	Unit Cost	Amount	Exist Dirt Trail Quan.	Exist Dirt Trail Amount
20440-0000	LNFT	Rounding Cut Slopes		$ 8.00					23,232.00	$ 185,856.00
20102-0000	LPSM	Clearing and Grubbing		$ 10,000.00			$ 10,000.00		1.00	$ 10,000.00
20401-0000	CUYD	Roadway Excavation	6,453.33	$ 35.00	$ 225,866.67	0	$ 35.00		0.00	$ -
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	8,475.38	$ 22.00	$ 186,458.31	16,950.76	$ 22.00	$ 372,916.62	0.00	$ -
40301-0000	TON	Asphalt Concrete Pavement Type 1	4,409.78	$ 125.00	$ 551,222.22	0	$ 125.00		0.00	$ -
				Total	**$ 963,547.20**		Total	**$ 372,916.62**		**$ 195,856.00** Total
				Cost/MI	$ 218,988.00		Cost/MI	$ 84,753.78		$ 44,512.73 Cost/MI

Assumptions:
Use existing ROW to build a 10 ft. wide trail: 2 options, Aggregate only & Asphalt
Asphalt Trail; Pavement depth =3in. (0.25ft) two lifts with 6 in. aggregate base-Section based on discussions with former Materials Eng. (Should Confirm Section Depths for Design)
Aggregate only trail depth is 1.0ft
Conversion Asphalt CY/TON = 2.05

Conversion Aggregate CY/TON = 1.97
Option Added to clear vegitation and regrade existing dirt trail -assume cut slope.

Trail Calcs:

Trail Width (ft.)	Asphalt Depth (ft.)	Depth of Agg. for Asphalt Trail (ft.)	Roadway Excav. (CY) Asphalt Trail	Asphalt Vol (CY)	Asphalt (ACP-1) (TONS)	Aggregate for Asphalt Trail (CY)	Aggregate for Asphalt (TONS)
10.00	0.25	0.50	6,453.33	2,151.11	4,409.78	4,302.22	8,475.38

Depth of Aggregate only trail (ft.)	Roadway Excav. (CY) Agg. Trail	Aggregate only Vol (CY)	Aggregate only Trail (TONS)
1.00	8,604.44	8,604.44	16,950.76

OYTS Planning Estimate

Segment 1

MP BEG	MP END	Length (Mi)	Length (Ft)	
0	4.4	4.4	23,232.00	0.209

Option C Build Ped Bridge over Yellowstone River

Item No.	Unit	Description	Quantity	Unit Cost / SF	Amount
55504-0000	LPSM	Single Span, Suspension Bridge	3,400.00	$ 1,249.32	**$ 4,247,688.00**

Assumptions: Used "Stoddard Bridge Project" for Cost per SF — $ 1,249.32

Cost estimate Attached in Separate Tab for Reference

Single Span, Suspension — 3,400.00 SF Bridge

Width = 10 ft., length = 340 (Measure Length from Google Earth across the Yellowstone River at desired location — See Screen Shot on "New Ped Bridge" tab

T3: Trail Condition Improvements Trail is highly used and in fairly good condition in this segment. "Spot Improvements"

Item No.	Unit	Description	Asphalt Trail Quantity	Unit Cost	Amount	Aggregate Trail Quantity	Unit Cost	Amount	Exist Dirt Trail Quan.	Exist Dirt Trail Amount
20440-0000	LNFT	Rounding Cut Slopes		$ 8.00					23,232.00	$ 185,856.00
20102-0000	LPSM	Clearing and Grubbing		$ 10,000.00			$ 10,000.00		1.00	$ 10,000.00
30301-6000	MILE	Roadway Reconditioning	4.40	$ 7,550.00	$ 33,220.00	4.4	$ 7,550.00	$ 33,220.00		
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	8,475.38	$ 22.00	$ 186,458.31	16,950.76	$ 16.00	$ 271,212.09		
40301-0000	TON	Asphalt Concrete Pavement Type 1	4,409.78	$ 125.00	$ 551,222.22	0				
				Total	**$ 770,900.53**		Total	**$ 304,432.09**		**$ 195,856.00**
				Cost/MI	$ 175,204.67		Cost/MI	$ 69,189.11		$ 44,512.73

Assumptions: Use existing ROW to build a 10 ft. wide trail: 2 options, Aggregate only & Asphalt

Asphalt Trail; Pavement depth =3in. (0.25ft) two lifts with 6 in. aggregate base-Section based on discussions with former Materials Eng. (Should Confirm Section Depths for Design)

Aggregate only trail depth is 1.0ft

Conversion Asphalt CY/TON = 2.05

Conversion Aggregate CY/TON = 1.97

Option Added to clear vegitation and regrade existing dirt trail cut slope.

Trail Calcs:

Trail Width (ft.)	Asphalt Depth (ft.)	Depth of Agg. for Asphalt Trail (ft.)	Roadway Excav. (CY) Asphalt Trail	Asphalt Vol (CY)	Asphalt (ACP-1) (TONS)	Aggregate for Asphalt Trail (CY)	Aggregate for Asphalt (TONS)
10.00	0.25	0.50	6,453.33	2,151.11	4,409.78	4,302.22	8,475.38

Depth of Aggregate only	Roadway Excav. (CY)	Aggregate only Vol (CY)	Aggregate only Trail
1.00	8,604.44	8,604.44	16,950.76

OYTS Planning Estimate

Segment 2

MP BEG	MP END	Length (Mi)	Length (Ft)
4.4	7.7	3.3	17,424.00

0.156

ROAD NPS

Road: R2

					Exist Avg. width		Width (ft.) 20.00 Widen 4'		Width (ft.) 24.00 Widen 8'	
Item No.	**Unit**	**Description**	**Quantity-20'**	**Unit Cost**	**Amount 20' Rd**	**Quantity -24'**	**Amount 24' Rd**	**Quantity-28'**	**Amount 28' Rd**
20401-0000	CUYD	Roadway Excavation		$ 35.00	$ -	2,581.33	$ 90,346.67	5,162.67	$ 180,693.33
20420-0000	CUYD	Embankment Construction		$ 8.00	$ -	2,581.33	$ 20,650.67	5,162.67	$ 41,301.33
30202-2000	TON	Roadway Aggregate, Method 2 [Xi		$ 33.00	$ -	5,085.23	$ 167,812.48	10,170.45	$ 335,624.96
30301-6000	MILE	Roadway reconditioning	3.30	$ 7,550.00	$ 24,915.00	3.30	$ 24,915.00	4.40	$ 33,220.00
60201-0600	LF	18 in. Pipe culvert	700.00	$ 80.00	$ 56,000.00	840.00	$ 67,200.00	980.00	$ 78,400.00
				Total $	**$ 80,915.00**	Total $	**$ 370,924.81**	Total $	**$ 669,239.63**
				COST/MI	$ 24,519.70	COST/MI	$ 112,401.46	COST/MI	$ 202,799.89

Assumptions: Recondition roadway as needed in this segment

Install cross culvert every 500 ft. for entirety of road to address drainage

Culvert 18in. Diam CMP

Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

Table:P1

Rd Length / 500'	Quantity Pipe, LF, based on Rd Width W = 20 ft.	W = 24 ft.	W = 28 ft.	
35.00	700.00	840.00	980.00	LF

(L x No. Crossings)

(L x W X D) /27 1.97TON/CY

Width Widen Road (ft.)	Depth of Roadway (ft.)	Roadway Excav. (CY)	Embankment Construction (CY)	Aggregate (TONS)
4	1.00	2,581.33	2,581.33	5,085.23
8	1.00	5,162.67	5,162.67	10,170.45

TRAIL **On NPS Land**

T4: MP 4.4 Stream Crossing trail may need to share road ROW for a large portion of this segment

Option A Build a trail bridge on the existing alignment

Item No.	Unit	Description	Quantity (sf)	Unit Cost	Amount
	SF	Box Culvert	150	$ 200.00	**$ 30,000.00**
55504-0000	SF	Pre-fabricated Steel Bridge	150	$ 350.00	**$ 52,500.00**
	SF	Wooden Bridge	150	$ 100.00	**$ 15,000.00**

Assumptions:

Box Culvert	$200/SF	Length (ft.)	15
prefab steel bridge	$350/SF	Width (ft.)	10
build wooden bridge	$100/SF		

Cost per SF for bridges discussed with B. Oltmann (structures) average price provided for pre-fab steel and Wooden bridge. Cost/SF box culvert derived from discussions/median between structure types

Option B Shift the trail alignment to cross at the road bridge about 600 feet away

Item No.	Unit	Description	Asphalt Trail Quantity	Unit Cost	Amount	Aggregate Trail Quantity	Unit Cost	Amount
20401-0000	CUYD	Roadway Excavation	422.22	$ 35.00	$ 14,777.78	0	$ 35.00	$ -
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	554.52	$ 22.00	$ 12,199.41	1,109.04	$ 22.00	$ 24,398.81
40301-0000	TON	Asphalt Concrete Pavement Type 1	288.52	$ 125.00	$ 36,064.81	0	$ 125.00	$ -
				Total $	**$ 63,042.00**		Total $	**$ 24,398.81**
				$	19,103.64		Cost/MILE	$ 7,393.58

Assumptions: Asphalt section is not based on ESALS, Only a ped and bicycle trail. Assume ACP Type 1

Conversion Asphalt CY/TON = 2.05

Pavement depth =3in. (0.25ft) two lifts with 6 in. aggregate base

ACP Type 1 Unit Cost EEBACS Avg MT + WY similar quantity; inflation added = $125.00

Aggregate only trail depth is 1.0ft

Result of shifting trail 600 feet to existing bridge is an addition of 1520 LF of trail-Google Earth Measured , screen shot included

Trail Calcs:

Trail Width (ft.)	Asphalt Depth (ft.)	Depth of Agg. for Asphalt Trail (ft.)	Roadway Excav. (CY) Asphalt Trail	Asphalt Vol (CY)	Asphalt (ACP-1) (TONS)	Aggregate for Asphalt Trail (CY)	Aggregate for Asphalt (TONS)
10.00	0.25	0.50	422.22	140.74	288.52	281.48	554.52

Length of Trail Realign (ft.)	Depth of Aggregate only trail (ft.)	Roadway Excav. (CY) Agg. Trail	Aggregate only Vol (CY)	Aggregate only Trail (TONS)
1520	1.00	562.96	562.96	1,109.04

OYTS Planning Estimate

Segment 2

MP BEG	MP END	Length (Mi)	Length (Ft)	
4.4	7.7	3.3	17,424.00	0.156

T5: MP 4.4 to 7.0 Private Property Crossing

Option A Use Road ROW-either share roadbed or separate from roadway

Item No.	Unit	Description	Asphalt Trail Quantity	Unit Cost	Amount	Aggregate Trail Quantity	Unit Cost	Amount	Widening Road Quantity	Unit Cost	Amount
20401-0000	CUYD	Roadway Excavation	4,840.00	$ 35.00	$ 169,400.00	6,453.33	$ 35.00	$225,866.67	1,290.67	$ 35.00	$ 45,173.33
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	6,356.53	$ 22.00	$ 139,843.73	12,713.07	$ 22.00	$279,687.47	2,542.61	$ 22.00	$ 55,937.49
40301-0000	TON	Asphalt Concrete Pavement Type 1	3,307.33	$ 125.00	$ 413,416.67	0	$ 125.00	$ -	0	$ 125.00	$ -
				Total	**$ 722,660.40**		Total	**$505,554.13**		Total	**$101,110.83**
				Cost/Mile	$ 218,988.00		Cost/Mile	$ 153,198.22		Cost/Mile	$ 30,639.64

Assumptions:
share roadway and widen shoulder 2 ft. entire length
build separate Trail adjacent to roadway with a 10 FT offset
Asphalt section is not based on ESALS, Only a ped and bicycle trail. Assume ACP Type 1
Conversion Asphalt CY/TON = 2.05

Pavement depth =3in. (0.25ft) two lifts with 6 in. aggregate base
Aggregate only trail depth is 1.0ft

Trail Calcs:

Trail Width (ft.)	Asphalt Depth (ft.)	Depth of Agg. for Asphalt Trail (ft.)	Roadway Excav. (CY) Asphalt Trail	Asphalt Vol (CY)	Asphalt (ACP-1) (TONS)	Aggregate for Asphalt Trail (CY)	Aggregate for Asphalt (TONS)
10.00	0.25	0.50	4,840.00	1,613.33	3,307.33	3,226.67	6,356.53

Depth of Aggregate only trail (ft.)	Roadway Excav. (CY) Agg. Trail	Aggregate only Vol (CY)	Aggregate only Trail (TONS)
1.00	6,453.33	6,453.33	12,713.07

Width Widen Road (ft.)	Depth of Aggregate only trail (ft.)	Roadway Excav. (CY) Agg. Trail	Aggregate add for trail Vol (CY)	Aggregate add for Trail (TONS)
2	1.00	1,290.67	1,290.67	2,542.61

Option B Acquire easements from the private property owners to use the railroad bed. This option is the straightest, but passes through agricultural fields and near ranch buildings at MP 4.6-5.4 and MP 5.8-6.3.

Item No.	Unit	Description	Asphalt Trail Quantity	Unit Cost	Amount	Aggregate Trail Quantity	Unit Cost	Amount
63501-0000	LPSM	Temporary Traffic Control	3%					
20401-0000	CUYD	Roadway Excavation	4,840.00	$ 35.00	$ 169,400.00	6,453.33	$ 35.00	$225,866.67
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	6,356.53	$ 22.00	$ 139,843.73	12,713.07	$ 22.00	$279,687.47
40301-0000	TON	Asphalt Concrete Pavement Type 1	3,307.33	$ 125.00	$ 413,416.67	0	$ 125.00	
				Total	$ 722,660.40		Total	$ 505,554.13
				Cost/MI	$ 218,988.00		Cost/MI	$ 153,198.22

Assumptions:
Acquire easements and install signing
use LPSM Traffic Control for signing 3% of contract total
Asphalt Trail; Pavement depth =3in. (0.25ft) two lifts with 6 in. aggregate base-Section
Aggregate only trail depth is 1.0ft
Conversion Asphalt CY/TON = 2.05
Conversion Aggregate CY/TON = 1.97
Asphalt and Aggregate options included

Trail Calcs:

Trail Width (ft.)	Asphalt Depth (ft.)	Depth of Agg. for Asphalt Trail (ft.)	Roadway Excav. (CY) Asphalt Trail	Asphalt Vol (CY)	Asphalt (ACP-1) (TONS)	Aggregate for Asphalt Trail (CY)	Aggregate for Asphalt (TONS)
10.00	0.25	0.50	4,840.00	1,613.33	3,307.33	3,226.67	6,356.53

Depth of Aggregate	Roadway Excav. (CY)	Aggregate only Vol (CY)	Aggregate only Trail
1.00	6,453.33	6,453.33	12,713.07

OYTS Planning Estimate

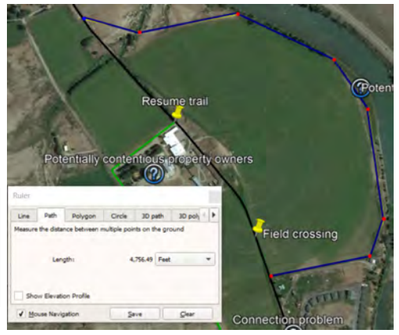
Segment 2

MP BEG	MP END	Length (Mi)	Length (Ft)	
4.4	7.7	3.3	17,424.00	0.156

Option C Use the railroad bed, but shift the alignment to run beside the river at MP 4.6-5.4 and MP 5.8-6.3, where the railroad bed passes through agricultural fields. This option would probably also need easements from private property owner, but would skirt the fields and ranch buildings.

Construction Costs only

Item No.	Unit	Description	Asphalt Trail Quantity	Unit Cost	Amount	Aggregate Trail Quantity	Unit Cost	Amount
20401-0000	CUYD	Roadway Excavation	1,322.22	$ 35.00	$ 46,277.78	1,762.96	$ 35.00	$ 61,703.70
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	1,736.52	$ 22.00	$ 38,203.41	3,473.04	$ 22.00	$ 76,406.81
40301-0000	TON	Asphalt Concrete Pavement Type 1	903.52	$ 125.00	$ 112,939.81	0	$ 125.00	$ -
				Total Cost	$ 197,421.00		Total Cost	$ 138,110.52
				Cost/Mile	$ 59,824.55		Cost/Mile	$ 41,851.67



Assumptions: Length of Trail around the field, along the river is measured at 4760ft via Google Earth

Trail Calcs:	Trail Width (ft.)	Asphalt Depth (ft.)	Depth of Agg. for Asphalt Trail (ft.)	Roadway Excav. (CY) Asphalt Trail	Asphalt Vol (CY)	Asphalt (ACP-1) (TONS)	Aggregate for Asphalt Trail (CY)	Aggregate for Asphalt (TONS)
	10.00	0.25	0.50	1,322.22	440.74	903.52	881.48	1,736.52

Length new Trail alg. (ft.)	Depth of Aggregate only trail (ft.)	Roadway Excav. (CY) Agg. Trail	Aggregate only Vol (CY)	Aggregate only Trail (TONS)
4760	1.00	1,762.96	1,762.96	3,473.04

OYTS Planning Estimate

Segment 3

MP BEG	MP END	Length (Mi)	Length (Ft)
7.7	8.3	0.6	3,168.00

0.028

Area (SQYD)	Width (ft.)	Width (ft.)	Width (ft.)
7,040.00	20.00	24.00	28.00

ROAD greatly deteriorated w/ excessive rutting

R3: Road Condition Improv. Overlay with X inches of aggregate and XX to address drainage.

					Exist Avg. width		Widen 4'		Widen 8'
Item No.	**Unit**	**Description**	**Quantity-20**	**Unit Cost**	**Amount 20' Rd**	**Quantity -24'**	**Amount 24' Rd**	**Quantity-28'**	**Amount 28' Rd**
20401-0000	CUYD	Roadway Excavation		$ 35.00	$ -	469.33	$ 16,426.67	938.67	$ 32,853.33
20420-0000	CUYD	Embankment Construction		$ 8.00	$ -	469.33	$ 3,754.67	938.67	$ 7,509.33
30202-2000	TON	Roadway Aggregate, Method 2 [Xi		$ 33.00	$ -	924.59	$ 30,511.36	1,849.17	$ 61,022.72
30301-6000	MILE	Roadway reconditioning	0.60	$ 7,550.00	$ 4,530.00	0.60	$ 4,530.00	4.40	$ 33,220.00
60201-0600	LF	18 in. Pipe culvert	140.00	$ 80.00	$ 11,200.00	168.00	$ 13,440.00	196.00	$ 15,680.00
				Total $	**$ 15,730.00**		**$ 68,662.69**		**$ 150,285.39**
Assumptions:		Recondition roadway as needed in this segment		COST/MI	$ 26,216.67		$ 114,437.82		$ 250,475.64

Install cross culvert every 500 ft. for entirety of road to address drainage

Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

Culvert 18in. Diam CMP

Table:P1

Rd Length / 500'	Quantity Pipe, LF, based on Rd Width		
	W = 20 ft.	W = 24 ft.	W = 28 ft.
7.00	140.00	168.00	196.00 LF

(L x No. Crossings)

(L x W X D) /27 1.97TON/C

Width Widen Road (ft.)	Depth of Roadway (ft.)	Roadway Excav. (CY)	Embankment Constructi	Aggregate (TONS)
4	1.00	469.33	469.33	924.59
8	1.00	938.67	938.67	1,849.17

TRAIL On USFS Land condition is quite good

T6: Trail Improv. Vegetation overgrowth has become more significant and the surface condition is much rougher from rocks and dead plants.

Clear the vegetation from the trail and add xx inches aggregate .

Item No.	Unit	Description	Quantity	Unit Cost	Amount Agg.$
20102-0000	LPSM	Clearing and Grubbing	1	$ 5,000.00	$ 5,000.00
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	2,311.47	$ 22.00	$ 50,852.27
					$ 55,852.27 Total $
Assumptions:		Clear trail vegetation			$ 93,087.11 Cost/Mile

place aggregate

Clear and Grub unit cost based on very small amount of Clearing and Grubbing

Aggregate only trail depth is 1.0ft

Trail Width (ft.)	Depth of Aggregate only trail	Roadway Excav. (CY) Agg. Trail	Aggregate only Vol (CY)	Aggregate only Trail (TONS)
10.00	1.00	1,173.33	1,173.33	2,311.47

OYTS Planning Estimate

Segment 4	MP BEG	MP END	Length (Mi)	Length (Ft)		Area (SQYD)	Width (ft.)	Width (ft.)	Width (ft.)
	8.3	10.6	2.3	12144	0.109	26,986.67	20.00	24.00	28.00

ROAD

R4: Road Condition Improv. Overlay with X inches of aggregate and XX to addr **Exist Avg. width** **Widen 4'** **Widen 8'**

Item No.	Unit	Description	Quantity-20'	Unit Cost	Amount 20' Rd	Quantity -24'	Amount 24' Rd	Quantity-28'	Amount 28' Rd
20401-0000	CUYD	Roadway Excavation		$ 35.00	$ -	1,799.11	$ 62,968.89	3,598.22	$ 125,937.78
20420-0000	CUYD	Embankment Construction		$ 8.00	$ -	1,799.11	$ 14,392.89	3,598.22	$ 28,785.78
30202-2000	TON	Roadway Aggregate, Method 2 [Xin		$ 33.00	$ -	3,544.25	$ 116,960.21	7,088.50	$ 233,920.43
30301-6000	MILE	Roadway reconditioning	2.30	$ 7,550.00	$ 17,365.00	2.30	$ 17,365.00	2.30	$ 17,365.00
60201-0600	LF	18 in. Pipe culvert	500.00	$ 80.00	$ 40,000.00	600.00	$ 48,000.00	700.00	$ 56,000.00
				Total $	**$ 57,365.00**		**$ 259,686.99**		**$ 462,008.98**
				COST/MI	$ 24,941.30		$ 112,907.39		$ 200,873.47

Table:P1

Rd Length / 500'	Quantity Pipe, LF, based on Rd Width			
	W = 20 ft.	W = 24 ft.	W = 28 ft.	
25.00	500.00	600.00	700.00	LF
	(L x No. Crossings)			

(L x W X D) /27 1.97TON/C

Width Widen Road (ft.)	Depth of Roadway (ft.)	Roadway Excav. (CY)	Embankment Constructio	Aggregate (TONS)
4	1.00	1,799.11	1,799.11	3,544.25
8	1.00	3,598.22	3,598.22	7,088.50

Assumptions:
Recondition roadway as needed in this segment
Install cross culvert every 500 ft. for entirety of road to address drainage
Culvert 18in. Diam CMP
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

TRAIL Rail bed on Private Property

T7: Trail Improv.

Option A Use the road ROW. Depending on how wide the ROW is, the trail could share the roadbed or could be separated from the roadway.

Item No.	Unit	Description	Asphalt Trail Quantity	Unit Cost	Amount	Aggregate Trail Quantity	Unit Cost	Amount	Widening Road 2.0' Quantity	Unit Cost	Amount
20401-0000	CUYD	Roadway Excavation	3,373.33	$ 35.00	$ 118,066.67	4,497.78	$ 35.00	$ 157,422.22	899.56	$ 35.00	$ 31,484.44
20420-0000	CUYD	Embankment Construction									
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	4,430.31	$ 22.00	$ 97,466.84	8,860.62	$ 22.00	$ 194,933.69	1,772.12	$ 22.00	$ 38,986.74
40301-0000	TON	Asphalt Concrete Pavement Type 1	2,305.11	$ 125.00	$ 288,138.89	0	$ 125.00	$ -	0	$ 125.00	$ -
				Total	**$ 503,672.40**		Total	**$ 352,355.91**		Total	**$ 70,471.18**
				Cost/Mile	$ 218,988.00		Cost/Mile	$ 153,198.22		Cost/Mile	$ 30,639.64

Assumptions:
share roadway and widen shoulder 2 ft. entire length
excavate roadway and construct embankment
build separate Trail adjacent to roadway with a 10 FT offset
Asphalt section is not based on ESALS, Only a ped and bicycle trail. Assume ACP Type 1
Conversion Asphalt CY/TON = 2.05
Pavement depth =3in. (0.25ft) two lifts with 6 in. aggregate base
Aggregate only trail depth is 1.0ft

Trail Calcs:

Trail Width (ft.)	Asphalt Depth (ft.)	Depth of Agg. for Asphalt Trail (ft.)	Roadway Excav. (CY) Asphalt Trail	Asphalt Vol (CY)	Asphalt (ACP-1) (TONS)	Aggregate for Asphalt Trail (CY)	Aggregate for Asphalt (TONS)
10.00	0.25	0.50	3,373.33	1,124.44	2,305.11	2,248.89	4,430.31

Depth of Aggregate only trail (ft.)	Roadway Excav. (CY) Agg. Trail	Aggregate only Vol (CY)	Aggregate only Trail (TONS)
1.00	4,497.78	4,497.78	8,860.62

Width Widen Road (ft.)	Depth of Aggregate only trail (ft.)	Roadway Excav. (CY) Agg. Trail	Aggregate add for trail Vol (CY)	Aggregate add for Trail (TONS)
2	1.00	899.56	899.56	1,772.12

Option B Acquire easements from private property owners to use the railroad bed.

Item No.	Unit	Description	Asphalt Trail Quantity	Unit Cost	Asphalt Trail Amount	Aggregate Trail Quantity	Unit Cost	Aggregate Trail Amount
63501-0000	LPSM	Temporary Traffic Control	3%					
20401-0000	CUYD	Roadway Excavation	3,373.33	$ 35.00	$ 118,066.67	4,497.78	$ 35.00	$ 157,422.22
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	4,430.31	$ 22.00	$ 97,466.84	8,860.62	$ 22.00	$ 194,933.69
40301-0000	TON	Asphalt Concrete Pavement Type 1	2,305.11	$ 125.00	$ 288,138.89	0	$ 125.00	
				Total	**$ 503,672.40**		Total	**$ 352,355.91**
				Cost/MI	$ 218,988.00		Cost/MI	$ 153,198.22

Assumptions:
Acquire easements and install signing
use LPSM Traffic Control for signing 3% of contract total
Asphalt Trail; Pavement depth =3in. (0.25ft) two lifts with 6 in. aggregate base-Section
Aggregate only trail depth is 1.0ft
Conversion Asphalt CY/TON = 2.05
Conversion Aggregate CY/TON = 1.97
Asphalt and Aggregate options included

Trail Calcs:

Trail Width (ft.)	Asphalt Depth (ft.)	Depth of Agg. for Asphalt Trail (ft.)	Roadway Excav. (CY) Asphalt Trail	Asphalt Vol (CY)	Asphalt (ACP-1) (TONS)	Aggregate for Asphalt Trail (CY)	Aggregate for Asphalt (TONS)
10.00	0.25	0.50	3,373.33	1,124.44	2,305.11	2,248.89	4,430.31

Depth of Aggregate only trail (ft.)	Roadway Excav. (CY) Agg. Trail	Aggregate only Vol (CY)	Aggregate only Trail (TONS)
1.00	4,497.78	4,497.78	8,860.62

Y

OYTS Planning Estimate

Segment 5

MP BEG	MP END	Length (Mi)	Length (Ft)		Area (SQYD)	Width (ft.)	Width (ft.)	Width (ft.)
10.6	13.6	3	15,840.00	0.142	35,200.00	20.00	24.00	28.00

ROAD The condition of road in this section varies

R5: Road Condition Improv. Overlay with X inches of aggregate & address drainage.

Item No.	Unit	Description	Quantity-20'	Unit Cost	Exist Avg. width Amount 20' Rd	Quantity -24'	Widen 4' Amount 24' Rd	Quantity-28'	Widen 8' Amount 28' Rd
20401-0000	CUYD	Roadway Excavation		$ 35.00	$ -	2,346.67	$ 82,133.33	4,693.33	$ 164,266.67
20420-0000	CUYD	Embankment Construction		$ 8.00	$ -	2,346.67	$ 18,773.33	4,693.33	$ 37,546.67
30202-2000	TON	Roadway Aggregate, Method 2 [Xir		$ 33.00	$ -	4,622.93	$ 152,556.80	9,245.87	$ 305,113.60
30301-6000	MILE	Roadway reconditioning	3.00	$ 7,550.00	$ 22,650.00	3.00	$ 22,650.00	3.00	$ 22,650.00
60201-0600	LF	18 in. Pipe culvert	640.00	$ 80.00	$ 51,200.00	768.00	$ 61,440.00	896.00	$ 71,680.00
				Total $	**$ 73,850.00**		**$ 337,553.47**		**$ 601,256.93**
				COST/MI	$ 24,616.67		$ 112,517.82		$ 200,418.98

Table:P1

Rd Length / 500'	Quantity Pipe, LF, based on Rd Width W = 20 ft.	W = 24 ft.	W = 28 ft.	
32.00	640.00	768.00	896.00	LF
	(L x No. Crossings)			

(L x W X D) /27 1.97TON/C

Width Widen Road (ft.)	Depth of Roadway (ft.)	Roadway Excav. (CY)	Embankment Constructi	Aggregate (TONS)
4	1.00	2,346.67	2,346.67	4,622.93
8	1.00	4,693.33	4,693.33	9,245.87

Assumptions:
Recondition roadway as needed in this segment
Install cross culvert every 500 ft. for entirety of road to address drainage
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.
Culvert 18in. Diam CMP

TRAIL

T8: Trail Improv. Clear the path of vegetation and add X inches of aggregate.

Option A Use the road ROW for the portion on private property (MP 10.6-10.85). Depending on how wide the ROW is, the trail could share the roadbed or could be separated from the roadway.

Item No.	Unit	Description	Asphalt Trail Quantity	Unit Cost	Amount	Aggregate Trail Quantity	Unit Cost	Amount	2' Widening Road Quantity	Unit Cost	Amount
20102-0000	LPSM	Clearing and Grubbing	1	$ 5,000.00	$ 5,000.00	1	$ 5,000.00	$ 5,000.00	1	$ 5,000.00	$ 5,000.00
20401-0000	CUYD	Roadway Excavation	4,400.00	$ 35.00	$ 154,000.00	5,866.67	$ 35.00	$ 205,333.33	1,173.33	$ 35.00	$ 41,066.67
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	5,778.67	$ 22.00	$ 127,130.67	11,557.33	$ 22.00	$ 254,261.33	2,311.47	$ 22.00	$ 50,852.27
40301-0000	TON	Asphalt Concrete Pavement Type 1	3,006.67	$ 125.00	$ 375,833.33	0	$ 125.00	$ -	0	$ 125.00	$ -
				Total Cost	**$ 661,964.00**		Total Cost	**$ 464,594.67**		Total Cost	**$ 96,918.93**
				Cost/Mile	$ 220,654.67		Cost/Mile	$ 154,864.89		Cost/Mile	$ 32,306.31

Assumptions:
share roadway and widen shoulder 2 ft. entire length
build separate Trail adjacent to roadway with a 10 FT offset
Asphalt section is not based on ESALS, Only a ped and bicycle trail. Assume ACP Type 1
Conversion Asphalt CY/TON = 2.05
Pavement depth =3in. (0.25ft) two lifts with 6 in. aggregate base
Aggregate only trail depth is 1.0ft

Trail Calcs:

Trail Width (ft.)	Asphalt Depth (ft.)	Depth of Agg. for Asphalt Trail (ft.)	Roadway Excav. (CY) Asphalt Trail	Asphalt Vol (CY)	Asphalt (ACP-1) (TONS)	Aggregate for Asphalt	Aggregate for Asphalt
10.00	0.25	0.50	4,400.00	1,466.67	3,006.67	2,933.33	5,778.67

Depth of Aggregate only trail (ft.)	Roadway Excav. (CY) Agg. Trail	Aggregate only Vol (CY)	Aggregate only Trail (TONS)
1.00	5,866.67	5,866.67	11,557.33

Width Widen Road (ft.)	Depth of Aggregate only trail (ft.)	Roadway Excav. (CY) Agg. Trail	Aggregate add for trail Vol (CY)	Aggregate add for Trail (TONS)
2	1.00	1,173.33	1,173.33	2,311.47

Option B Acquire easements from private property owners to use the railroad bed.

Item No.	Unit	Description	Asphalt Trail Quantity	Unit Cost	Amount	Aggregate Trail Quantity	Unit Cost	Amount
63501-0000	LPSM	Temporary Traffic Control	3%					
20401-0000	CUYD	Roadway Excavation	4,400.00	$ 35.00	$ 154,000.00	5,866.67	$ 35.00	$ 205,333.33
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	5,778.67	$ 22.00	$ 127,130.67	11,557.33	$ 22.00	$ 254,261.33
40301-0000	TON	Asphalt Concrete Pavement Type 1	3,006.67	$ 125.00	$ 375,833.33	0	$ 125.00	
				Total	**$ 656,964.00**		Total	**$ 459,594.67**
				Cost/MI	$ 218,988.00		Cost/MI	$ 153,198.22

Assumptions:
Acquire easements and install signing
use LPSM Traffic Control for signing 3% of contract total
Asphalt Trail; Pavement depth =3in. (0.25ft) two lifts with 6 in. aggregate base-Section based on
Aggregate only trail depth is 1.0ft
Conversion Asphalt CY/TON = 2.05
Conversion Aggregate CY/TON = 1.97
Asphalt and Aggregate options included

Trail Calcs:

Trail Width (ft.)	Asphalt Depth (ft.)	Depth of Agg. for Asphalt Trail (ft.)	Roadway Excav. (CY) Asphalt Trail	Asphalt Vol (CY)	Asphalt (ACP-1) (TONS)	Aggregate for Asphalt Trail (CY)	Aggregate for Asphalt (TONS)
10.00	0.25	0.50	4,400.00	1,466.67	3,006.67	2,933.33	5,778.67

Depth of Aggregate only trail (ft.)	Excav. (CY) Agg. Trail	Aggregate only Vol (CY)	Aggregate only Trail (TONS)
1.00	5,866.67	5,866.67	11,557.33

OYTS Planning Estimate

Segment 6

MP BEG	MP END	Length (Mi)	Length (Ft)
13.6	15.6	2	10,560.00

0.095

Width (ft.)	Width (ft.)	Width (ft.)
20.00	24.00	28.00

ROAD

R6: Road Condition Improv.

Overlay with X inches of aggregate and XX to address drainage. Since road is narrow and one-lane, add turnout(s).

R7: Road Condition Improv.

					Exist Avg. width		Widen 4' + turnouts		Widen 8' No turnouts
Item No.	**Unit**	**Description**	**Quantity**	**Unit Cost**	**Amount 20' Rd**	**Quantity -24'**	**Amount 24' Rd**	**Quantity-28'**	**Amount 28' Rd**
30301-6000	MILE	Roadway reconditioning	2.00	$ 7,550.00	$ 15,100.00	2.00	$ 15,100.00	2.00	$ 15,100.00
60201-0600	LF	18 in. Pipe culvert	440.00	$ 80.00	$ 35,200.00	528.00	$ 42,240.00	616.00	$ 49,280.00
20401-0000	CUYD	Roadway Excavation	1140.74	$ 35.00	$ 39,925.93	1,564.44	$ 54,755.56	3,128.89	$ 67,303.70
30202-2000	TON	Roadway Aggregate, Method 2	2247.26	$ 22.00	$ 49,439.70	5,778.67	$ 59,327.64	6,163.91	$ 83,341.21
20420-0000	CUYD	Embankment Construction	1140.74	$ 8.00	$ 9,125.93	4,497.78	$ 35,982.22	3,128.89	$ 25,031.11
				Total $	**$ 148,791.56**		**$ 207,405.42**		**$ 240,056.03**
				Cost/Mile	$ 74,395.78		$ 103,702.71		$ 120,028.01

Rd Length / 500'	Quantity Pipe, LF, based on Rd Width W = 20 ft.	W = 24 ft.	W = 28 ft.	
22.00	440.00	528.00	616.00	LF

	Roadway Excav. (CY) Turnout	**Aggregate Turnout Vol (CY)**	**Aggregate Turnout (TONS)**
W = 20 ft.	1,140.74	1,140.74	2,247.26
W = 24 ft.	1,368.89	1,368.89	2,696.71
W = 28 ft.	1,922.96	1,922.96	3,788.24

(L x W X D) /27 1.97TON/CY

Width Widen Road (ft.)	**Depth of Roadway (ft.)**	**Roadway Excav. (CY)**	**Embankment Construction (CY)**	**Aggregate (TONS)**
4	1.00	1,564.44	1,564.44	3,081.96
8	1.00	3,128.89	3,128.89	6,163.91

Assumptions: Existing Rd width AVG = 20 ft.
Recondition this segment of road as needed
Turnout width = 10 ft.

Park Turnout Turnout Spacing EQ: T=DS/36, where D = delay in sec. S = speed
CL 4 Rd. assume max speed of 45 MPH
42.4 – Exhibit 05 FSH 7709.56 – ROAD PRECONSTRUCTION HANDBOOK
Assume roadway excavation for turnouts
AASHTO Green book : Exhibit 5-17 Turnout Design; Length = 100 ft. + Transition 50' + 50', Width added for turnout approx. 1.7* RD Width
Assumed depth of turnout section is 12in -based on assumption of future loss of Agg. due to blading
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

Turnout Spacing Calcs.

D (sec/MI)	30	T = 37.50
S (MI/HR)	45	using Graph Exhibit 03
T increase in Travel Time		Every 1000 ft. add turnout

1000 ft.
200 Length (ft.) turnout
14 width of added turnout (ft.) 47.6
1 depth (ft.) 23.6

11 No.of Turnouts

TRAIL: T9

The trail is the same as the road for the entirety of this segment. The ROW is on the railroad bed on USFS property. Continue to utilize the road, since the corridor is narrow and would be difficult to separate a trail. There are some sections where a mountain bike trail could veer from the road, but not for the full length of the segment. The second highest scoring unstable slope is above the potential mountain bike trail (US 16 - score 433).

Item No.	**Unit**	**Description**	**Widening Road Quantity**	**Unit Cost**	**Amount**
20401-0000	CUYD	Roadway Excavation	782.22	$ 35.00	$ 27,377.78
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	1,540.98	$ 22.00	$ 33,901.51
40301-0000	TON	Asphalt Concrete Pavement Type 1	0	$ 125.00	$ -

Assumptions: share roadway and widen shoulder 2 ft. entire length
depth of Aggregate 1.0 ft.

$ 61,279.29 Total $
$ 30,639.64 Cost/Mile

Width Widen Road (ft.)	**Depth of Aggregate only trail (ft.)**	**Roadway Excav. (CY) Agg. Trail**	**Aggregate add for trail Vol (CY)**	**Aggregate add for Trail (TONS)**
2	1.00	782.22	782.22	1,540.98

OYTS Planning Estimate

Segment 7

MP BEG	MP END	Length (Mi)	Length (Ft)	
15.6	17.5	1.9	10,032.00	0.090

ROAD Condition is excellent

R8: Road Condition Improv.

					Exist Avg. width		Widen 4'		Widen 8'	
Item No.	**Unit**	**Description**	**Quantity-20'**	**Unit Cost**	**Amount 20' Rd**	**Quantity -24'**	**Amount 24' Rd**	**Quantity-28'**	**Amount 28' Rd**	
20401-0000	CUYD	Roadway Excavation		$ 35.00		1,486.22	$ 52,017.78	2,972.44	$ 104,035.56	
20420-0000	CUYD	Embankment Construction		$ 8.00		1,486.22	$ 11,889.78	2,972.44	$ 23,779.56	
30202-2000	TON	Roadway Aggregate, Method 2 [Xi		$ 33.00		2,927.86	$ 96,619.31	5,855.72	$ 193,238.61	
30301-6000	MILE	Roadway reconditioning	1.90	$7,550.00	$ 14,345.00	1.90	$ 14,345.00	1.90	$ 14,345.00	
				Total $	**$ 14,345.00**	Total $	**$ 174,871.86**	Total $	**$ 335,398.72**	
				COST/MI	$ 7,550.00	COST/MI	$ 92,037.82	COST/MI	$ 176,525.64	

(L x W X D) /27 1.97TON/CY

Width Widen Road (ft.)	Depth of Roadway (ft.)	Roadway Excav. (CY)	Embankment Construction (CY)	Aggregate (TONS)
4	1.00	1,486.22	1,486.22	2,927.86
8	1.00	2,972.44	2,972.44	5,855.72

Assumptions: Recondition roadway as needed in this segment
Roadway options include recondition existing roadway at 20ft width, widen to 24ft and widen to 28 ft.

TRAIL The railroad bed travels through private property, clearly marked with signs, and serves as access to a farm. The trail would likely share the road ROW.

Item No.	**Unit**	**Description**	**Widening Road Quantity**	**Unit Cost**	**Amount**
20401-0000	CUYD	Roadway Excavation	743.11	$ 35.00	$ 26,008.89
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	1,463.93	$ 22.00	$ 32,206.44
40301-0000	TON	Asphalt Concrete Pavement Type 1	0	$ 125.00	$ -
				Total $	**$ 58,215.32**
				Cost/Mile	$ 30,639.64

Assumptions: share roadway and widen shoulder 2 ft. entire length
depth of Aggregate 1.0 ft.

Width Widen Road (ft.)	Depth of Aggregate only trail (ft.)	Roadway Excav. (CY)	Aggregate add for trail Vol (CY)	Aggregate add for Trail
2	1.00	743.11	743.11	1,463.93

OYTS Planning Estimate

Area (SQYD)	Width (ft.)	Width (ft.)	Width (ft.)
42,240.00	20.00	24.00	28.00

Segment 8

MP BEG	MP END	Length (Mi)	Length (Ft)
17.5	21.1	3.6	19,008.00

0.171

ROAD Old Yellowstone Trail South Road terminates at MP 21.1 where it meets US89. The roadway is smooth and appears to be well graded, but the gravel surface is thin, and patches of soil have started to show through.

R9: Road Condition Improv. Add XX of aggregate and do XX to improve drainage. Spot improvements.

					Exist Avg. width		Widen 4'		Widen 8'	
Item No.	**Unit**	**Description**	**Quantity**	**Unit Cost**	**Amount 20' Rd**	**Quantity -24'**	**Amount 24' Rd**	**Quantity-28'**	**Amount 28' Rd**	
30301-6000	MILE	Roadway reconditioning	3.6	$ 7,550.00	$ 27,180.00	3.60	$ 27,180.00	3.60	$ 27,180.00	
60201-0600	LF	18 in. Pipe culvert	780.00	$ 80.00	$ 62,400.00	936.00	$ 74,880.00	1,092.00	$ 87,360.00	
20401-0000	CUYD	Roadway Excavation	0.00	$ 35.00	$ -	2816.00	$ 98,560.00	5,632.00	$ 197,120.00	
30202-2000	TON	Roadway Aggregate, Method 2	0.00	$ 22.00	$ -	5547.52	$ 122,045.44	11,095.04	$ 244,090.88	
20420-0000	CUYD	Embankment Construction	0.00	$ 8.00	$ -	2816.00	$ 22,528.00	5632.00	$ 45,056.00	
				Total $	**$ 89,580.00**		Total $ **$ 345,193.44**		**$ 600,806.88**	Total $
				Cost/Mi	$ 24,883.33		Cost/Mi $ 95,887.07		$ 166,890.80	Cost/Mi

Rd Length / 500'	Quantity Pipe, LF, based on Rd Width			
	W = 20 ft.	W = 24 ft.	W = 28 ft.	
39.00	780.00	936.00	1,092.00	LF

(L x W X D) /27 1.97TON/C

Width Widen Road (ft.)	**Depth of Roadway (ft.)**	**Roadway Excav. (CY)**	**Embankment Constructi**	**Aggregate (TONS)**
4	1.00	2,816.00	2,816.00	5,547.52
8	1.00	5,632.00	5,632.00	########

Assumptions: Recondition roadway as needed in this segment
Install cross culvert every 500 ft. for entirety of road to address drainage
Culvert 18in. Diam CMP

TRAIL The railroad bed travels through private property. The trail would likely share the road ROW.

Item No.	**Unit**	**Description**	**Widening Road Quantity**	**Unit Cost**	**Amount**
20401-0000	CUYD	Roadway Excavation	1,408.00	$ 35.00	$ 49,280.00
30202-2000	TON	Roadway Aggregate, Method 2 [Xin. Depth]	2,773.76	$ 22.00	$ 61,022.72
40301-0000	TON	Asphalt Concrete Pavement Type 1	0	$ 125.00	$ -
					$ 110,302.72 Total $
					$ 30,639.64

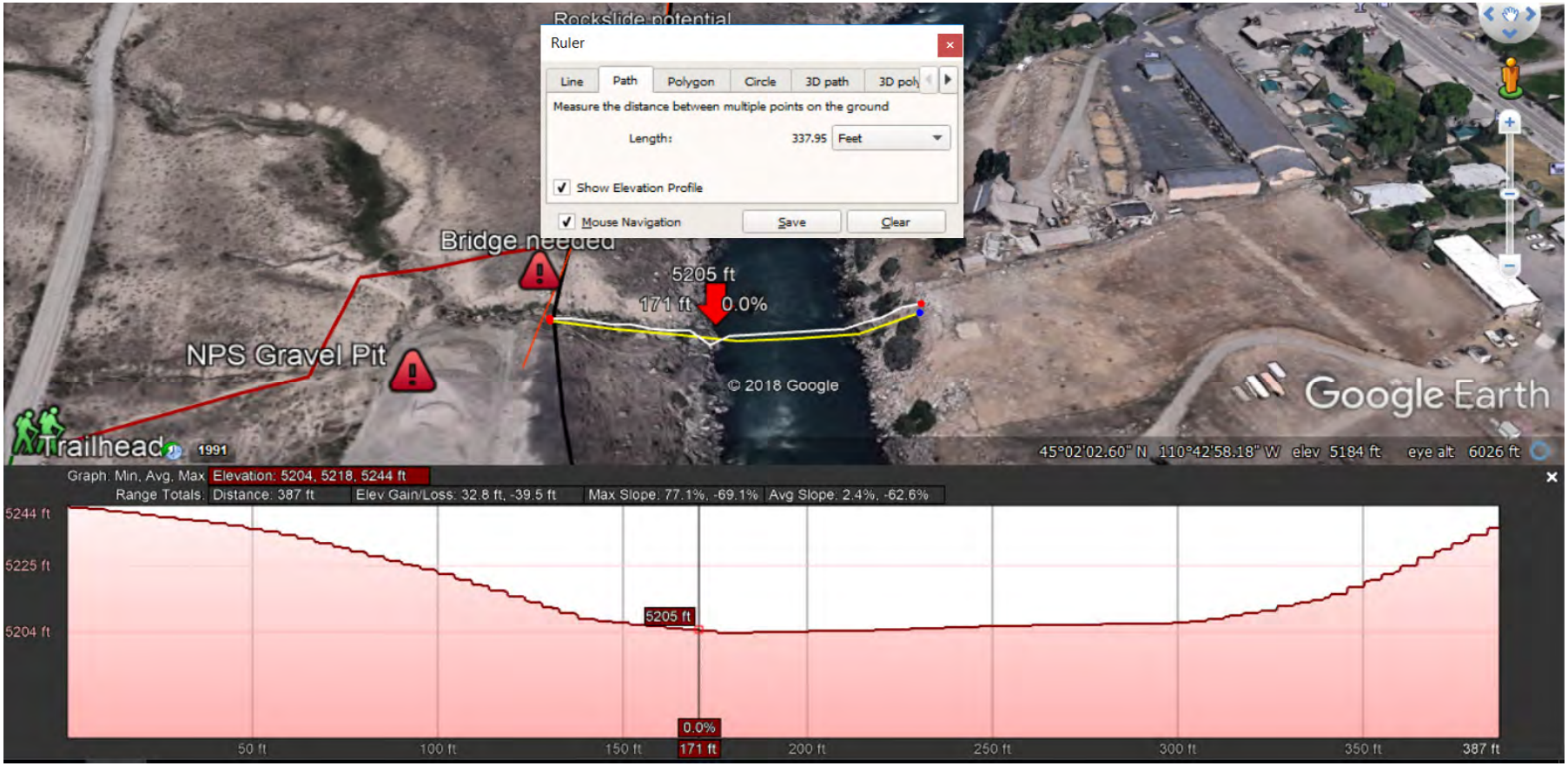
Assumptions: share roadway and widen shoulder 2 ft. entire length
depth of Aggregate 1.0 ft.

Width Widen Road (ft.)	**Depth of Aggregate only trail (ft.)**	**Roadway Excav. (CY) Agg. Trail**	**Aggregate add for trail Vol (CY)**	**Aggregate add for Trail (TONS)**
2	1.00	1,408.00	1,408.00	2,773.76

	ID FS ERFO 2017(1)-29(1) - Stoddard Suspension Bridge 70% EE	B. Oltmann	8/1/2019	

Single Span, Suspension Bridge 365 ft total					
Item #	Description	Unit	Quantity	Unit price	Amount
20801-0000	Structure Excavation (Bridge)	CUYD	100	$ 50.0	$5,000.0
25602-0000	Ground Anchor	LNFT	1680	$ 300.0	$504,000.0
25605-0000	Performance Test	EACH	2	$ 10,000.0	$20,000.0
55201-0000	Structural Concrete Class A(AE)	CUYD	59.00	$ 2,500.0	$147,500.0
55401-2000	Reinforcing Steel, Epoxy Coated	LB	18000	$ 2.5	$45,000.0
55502-0000	Structural steel, furnished, fabricated, and erected	LB	76500.00	$ 3.00	$229,500.0
55601-0900	Bridge Rail, Steel	LNFT	730	$ 200.0	$146,000.0
55701-2000	Structural timber and lumber, treated	MFBM	20	$ 4,500.0	$90,000.0
56202-0000	Temporary Supports Structure	LPSM	1	$ 150,000.0	$150,000.0
56401-1000	Bearing Device, Elastomeric	EACH	4	$ 1,000.0	$4,000.0
56901-0000	Micropiles	LNFT	248	$ 750.0	$186,000.0
56905-0000	Micropile load verification test	EACH	1.00	$ 7,500.0	$7,500.0
58101-1000	Cables and Anchor Components, Main Cable System	LPSM	1	$ 750,000.0	$750,000.0
			Total:		$2,284,500.00

Area of Bridge to be built	SQFT	1825
Rounded Estimated Cost of Proposed Bridge		$2,280,000.00
Cost per SQFT of new bridge	$	$1,249.32


Rockslide potential
Ruler
Line
Path
Polygon
Circle
3D path
Measure the distance between multiple points on the ground
Length:
337.95
Feet
Show Elevation Profile
Mouse Navigation
Save
Clear
Bridge needed
5205 ft
171 ft
0.0%
NPS Gravel Pit
© 2018 Google
Google Earth
Trailhead
1991
45°02'02.60" N 110°42'58.18" W elev 5184 ft eye alt 6026 ft
Graph: Min, Avg, Max Elevation: 5204, 5218, 5244 ft
Range Totals: Distance: 387 ft
Elev Gain/Loss: 32.8 ft, -39.5 ft
Max Slope: 77.1%, -69.1%
Avg Slope: 2.4%, -62.6%
5244 ft
5225 ft
5204 ft
5205 ft
0.0%
50 ft
100 ft
150 ft
171 ft
200 ft
250 ft
300 ft
350 ft
387 ft

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Appendix D: Cost by Improvement Option

Provided as separate attachment

			Option 1: 20' road with minimal	Option 2: 24' road with moderate		Option 3: 28' road with high	
				6 ft aggregate trail	10 ft aggregate trail	Low	High
Segment 1	Road		$ 108,420	$ 495,206	$ 495,206	$ 881,993	$ 881,993
	Trailhead		$ 3,194	$ 3,194	$ 3,194	$ 3,194	$ 4,247,688
	Trail		$ 195,856	$ 223,750	$ 372,917	$ 372,917	$ 250,000
Segment 2	Road		$ 80,915	$ 370,925	$ 370,925	$ 669,240	$ 669,240
	Trail		$ 101,111	$ 303,332	$ 505,554	$ 505,554	$ 505,554
	Crossing		$ 15,000	$ 24,399	$ 30,000	$ 30,000	$ 52,500
Segment 3	Road		$ 15,730	$ 68,663	$ 68,663	$ 150,285	$ 150,285
	Trail		$ 5,000	$ 35,500	$ 55,852	$ 55,852	$ 55,852
Segment 4	Road		$ 57,365	$ 259,687	$ 259,687	$ 462,009	$ 462,009
	Trail		$ 70,471	$ 211,000	$ 352,356	$ 352,356	$ 352,356
Segment 5	Road		$ 73,850	$ 337,553	$ 337,553	$ 601,257	$ 601,257
	Trail		$ 96,919	$ 280,760	$ 464,595	$ 464,595	$ 464,595
Segment 6	Road		$ 148,792	$ 207,405	$ 207,405	$ 240,056	$ 240,056
	Trail		$ 61,279	$ 61,279	$ 61,279	$ 61,279	$ 61,279
		Rockfall mitigation	$ 50,000	$ 75,000	$ 125,000	$ 150,000	$ 250,000
Segment 7	Road		$ 14,345	$ 174,872	$ 174,872	$ 335,399	$ 335,399
	Trail		$ 58,215	$ 58,215	$ 58,215	$ 58,215	$ 58,215
Segment 8	Road		$ 89,580	$ 345,193	$ 345,193	$ 600,807	$ 600,807
	Trail		$ 110,303	$ 110,303	$ 110,303	$ 110,303	$ 110,303
	Subtotal		$ 1,356,345	$ 3,646,237	$ 4,398,770	$ 6,105,310	$ 10,349,388
10%	Mobilization		$ 135,634	$ 364,624	$ 439,877	$ 610,531	$ 1,034,939
3%	Signs		$ 40,690	$ 109,387	$ 131,963	$ 183,159	$ 310,482
3%	Erosion and sediment co		$ 40,690	$ 109,387	$ 131,963	$ 183,159	$ 310,482
30%	Design Contingency		$ 406,903	$ 1,093,871	$ 1,319,631	$ 1,831,593	$ 3,104,816
	Total		$ 1,980,264	$ 5,323,507	$ 6,422,204	$ 8,913,753	$ 15,110,106

Comments about the level of estimate:

Phase of Project Development: Planning

Planning Level Estimate based on using 1-5% Level of Definition, Google Earth measurements and mile post to mile post calculations used

General Estimate Basis: Historical data used from State of Montana for similar quantity and size of project

Components of Cost Estimate: Construction Only (Could include separate costs for PE, ROW, CE)

The mobilization is appropriately estimated at 10%

The Design Contingency is appropriately estimated at 30% based on: "AASHTO Practical Guide to Cost Estimating" Fig 5-4 Moderate projects in Planning phase