National Park Service
U.S. Department of the Interior

Glacier National Park
Waterton-Glacier International Peace Park
Montana

STATEMENT OF FINDINGS FOR FLOODPLAINS

McDonald Creek Bank Stabilization at Milepost 19.25 on the Going-to-the-Sun Road

Glacier National Park, Montana

Recommended: _____ 9/23/08
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Approved: _____ 9/24/08
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INTRODUCTION

Glacier National Park (GNP) has prepared and made available an Environmental Assessment (EA) analyzing bank stabilization techniques for McDonald Creek at Milepost 19.25 (MP 19.25) along the Going-to-the-Sun Road (GTSR) in order to prevent the road and stream bank from further deteriorating at this location. In November 2006, the park experienced a rain on snow event that caused damage throughout the west side of the park. Emergency repair took place on several sections of the GTSR. At MP 19.25, emergency road repair involved the installation of "soil nails" which were used to stabilize unconsolidated soils along the bank of McDonald Creek. This was intended to be a temporary action to keep the road open to visitor traffic. No vegetation was planted or stream improvements were made. Permanent stabilization of the bank is necessary to ensure that further slumping does not occur (leading to loss of the GTSR at this location) and to protect natural resources.

Executive Order 11988 ("Floodplain Management") requires the National Park Service and other agencies to evaluate the likely impacts of actions in floodplains. NPS Director's Order #77-2: Procedural Manual 77-2: Floodplain Management provides NPS policies and procedures for complying with EO 11988. This Statement of Findings (SOF) has been prepared in accordance with these NPS floodplain management procedures.

PROPOSED ACTION

The preferred alternative would take the following action to stabilize approximately 100 feet of the bank and prevent further erosion. Stone riprap, and vegetation would be used to armor the bank above the high water line. The riprap would ensure long-term stabilization at the site while the vegetation would further stabilize the bank.

Large (Class VII), angular riprap would be placed over the sloughed streambank area as well as up and downstream in order to armor the bank toe; totaling approximately 300 lateral feet. The riprap revetment would extend from the stream edge to the shoulder of the GTSR and instream work would be required to place the riprap at the toe of the slope. The riprap would ensure long-term stabilization at the site. It would extend laterally approximately 90 feet from the stream edge of the eroding slope to the road shoulder currently being held by soil nails. A geotextile would be installed between the riprap and the subgrade. Additional armoring of the bank toe would be buried in the streambed to reduce scour along the toe a 6-foot by 3-foot would be installed at or slightly below stream bottom. The armored bank toe would require excavation into the natural channel substrate and creation of a rock "toe" to ensure high flows do not compromise the structural integrity of the stabilization. The armored bank toe would extend 100 feet upstream of the riprap revetment and approximately 65 feet downstream and would rise 10 feet about the stream bottom. In-channel work would involve the excavation of approximately 3,000 ft^3 of native streambed material, which would be replaced with riprap to form the toe of the slope (see figure 1).

The site would be accessed by excavating that portion of the GTSR down to almost stream level. Access might also occur by driving an excavator up McDonald Creek from the pullout below this location, along the open gravel banks and occasionally crossing the stream. If the stream access is selected, the excavator would only make one trip up to the site and one trip down. If the access road is selected, the area of impact would extend the length of the treatment area (approximately 300ft) and would be within the road prism. Temporary construction pads, made

of rock, would be located at the base of the slope to provide a landing for the construction equipment above the water line.

Vegetation would be used to stabilize the upper portion of the bank and along the shoulder of the road. Restoration would include incorporating native species (such as dogwood, cottonwood and willows seedlings) into the riprap revetment between four and ten feet about the stream bottom (see figure 2). The seedlings would further stabilize the stream bank as they sprout and take root. The seedlings would be planted in the soil and then riprap would be placed around them and planting pockets would be incorporated into the upper portions of the riprap.

Final touches, revegetation and project cleanup would most likely occur in early summer after spring runoff. McDonald Creek would not be diverted during the project. Project work would be started during low water times in the fall and would take about two months to complete.

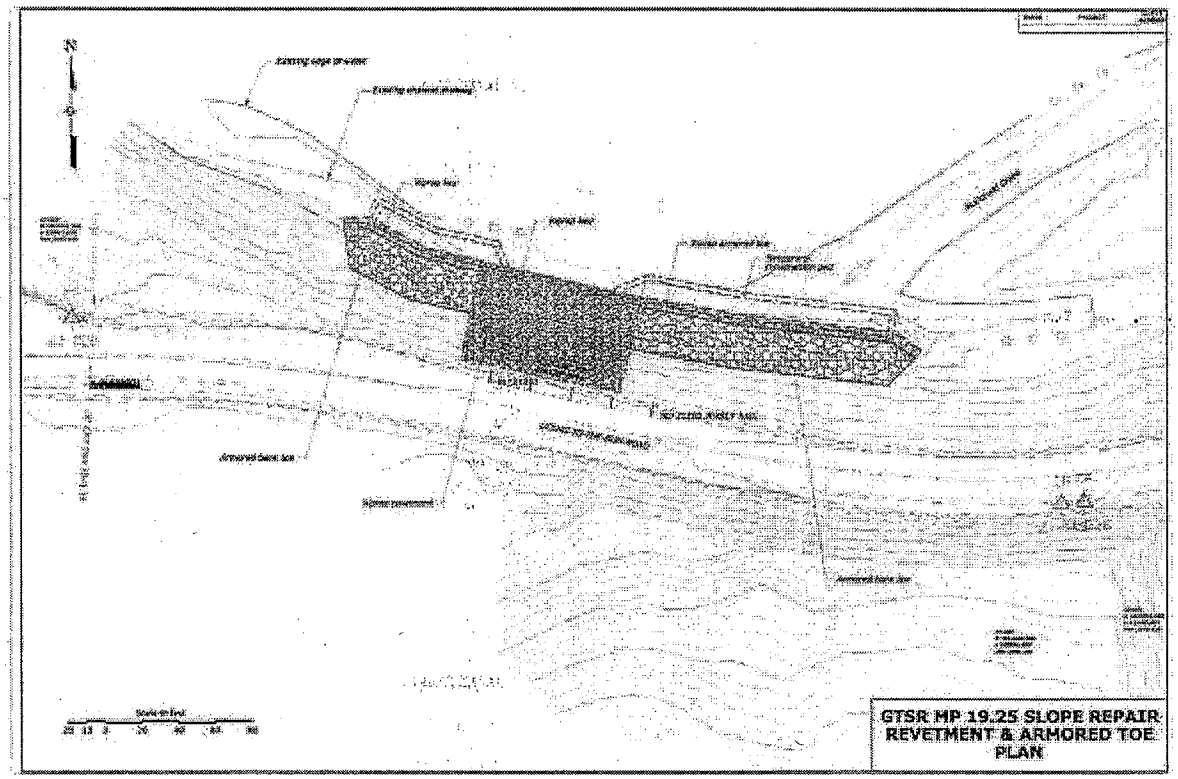

Figure 1. General design layout, revetment and armored toe

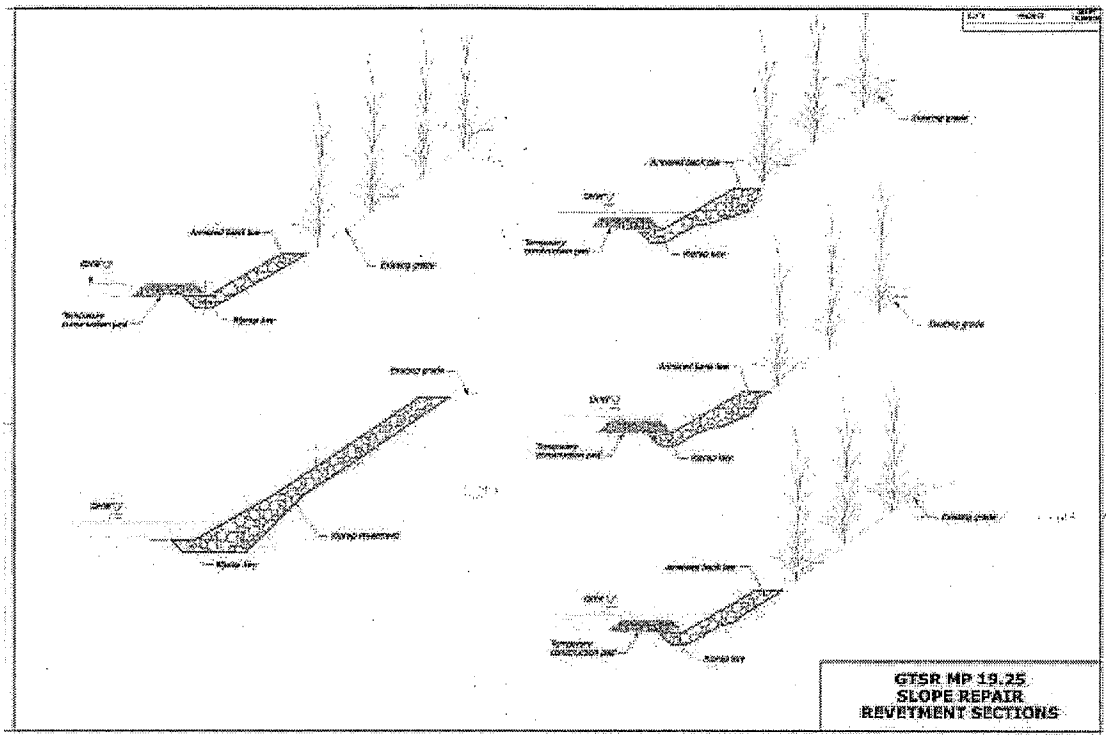

Figure 2. General design layout of revetment with vegetation incorporated

SITE DESCRIPTION

FLOODPLAIN

Arising at a 6,080 foot (1,853 m) elevation, McDonald Creek flows 25.8 miles (41.5km) and contains 8.8 miles (14.2 km) of lake and drains into the Middle Fork of the Flathead River at an elevation of 3,151 feet (960 m). The creek flows in a southeasterly direction, and then turns at the Glacier Wall and flows southwesterly, cascading into Lake McDonald. The Going-to-the-Sun Road forms the east boundary of the stream channel in most areas. Bull trout are known to inhabit Lake McDonald and rear in the lower portion of upper McDonald Creek but are physically unable to access the portions of McDonald Creek adjacent to the project area due to several waterfalls that occur between spawning grounds and the project area. Information on floodplain boundaries along Going-to-the-Sun Road corridor is incomplete, but previous studies and interpretation based on terrain and observations during flood events provide an indication of the 100-year floodplain areas, of which the project site is inclusive. The project site is approximately half way down the McDonald Creek drainage with approximately two-thirds of the drainage area above the location (see map 1). Major streams flowing into McDonald Creek above the site include Mineral, Alder, Haystack, and Logan Creeks. The head of Lake McDonald is located approximately at MP 14.5, Avalanche Creek is at MP16.2, and Logan Creek is at MP 20.5.The watershed remains largely un-roaded except for GTSR and a few minor spur roads. Results of HEC-RAS modeling of the project area are in table 1.

Table 1. HEC-RAS model output for McDonald Creek, site conditions for the project area.

Flood Event	Discharge	Maximum Channel Flow Depth	Average Channel Flow Velocity
2-year	3,000 ft^3/sec	5.5 ft	6.7 ft/sec
50-year	5,700 ft^3/sec	8 ft	8.7 ft/sec
100-year	7,600 ft^3/sec	9.2 ft	9.7 ft/sec

Alluvial and wet soils are found immediately adjacent to McDonald Creek. Composition of alluvial soils varies widely, but is generally characterized by coarse textures and unconsolidated coarse fragments from periods of deposition. These soils may support riparian deciduous vegetation, coniferous forest, or transitional shrubs and grasses. The erosion potential is high to moderate (depending on slope) and subject to periodic flooding. Productivity and revegetation potential is low where well-drained coarse soils are present, such as the west side of the creek, and high where finer textured material with high organic matter is present, such as on the east side of the creek. Wet soils are found where the water table is shallow adjacent to McDonald Creek. These soils are rich in organic matter and have loamy to silty textures. Vegetation on wet soils may include sedges, willows, cottonwoods, and other riparian species. Erosion potential is low; productivity and revegetation potential is high on wet soils.

Glacial, landslide and mixed soils formed in glacial deposits contain a mixture of semi-round rock and cobble. These soils are found along the McDonald Creek drainage. Soil textures include silty clay loams, sandy loams, and clay loams. Soils within this group vary widely over short distances due to mixing and landslides. Coniferous forest covers most of these soils. Erosion potential is high when these soils are disturbed due to the loamy and silty surface soil textures and limited rock content. Productivity and revegetation potential varies from low to high depending on soil texture, rock content and water and nutrient holding capacity.

Within the vicinity of the project area along McDonald Creek, riparian vegetation is present. Common riparian forest trees include western red cedar, Engelmann spruce, and subalpine fir with black cottonwood and paper birch in the overstory. Understory plants include mountain maple, snowberry, red-osier dogwood, alder, willow, serviceberry, kinnikinnick, sedges, goldenrod and mosses. The herbaceous understory is currently sparse due to recent slumping of the bank. Species that might be expected in a less disturbed situation would include thimbleberry, spirea, wild rose, twinflower, bunchberry, prince's pine, queencup beadlily, fairy bells, sarsaparilla, bedstraw, oakfern, starry false Solomon's seal, foam flower, trillium, and violets. Some non-native species are present along the road shoulder, in particular the noxious weed, spotted knapweed.

WETLAND

Since the proposed project would be conducted in the stream channel and would not disturb the area beyond the stream channel, park personnel did not conduct a wetland determination.

JUSTIFICATION FOR USE OF THE FLOODPLAIN

The purpose of this project is to evaluate alternative ways to permanently stabilize the bank of McDonald Creek along the GTSR at milepost 19.25 (see Map 1) in order to reduce sedimentation in the creek and avoid undercutting of the road. Peak run off for streams along the GTSR corridor usually occurs during fall rain on snow events, during the spring in response

to snowmelt, or during summer thunderstorms. The GTSR limits the eastern side of McDonald Creek near the project area allowing flooding to only occur on the western stream bank or undercutting the road. The GTSR is a national historic landmark and allows an average of 1.9 million visitors to access the park each season (based on the last ten years, GNP files).

Well-vegetated stream banks perform a variety of functions important to aquatic species. They provide shade to maintain cool water temperatures, provide thermal cover to minimize the development of anchor ice on stream-bottoms in winter months, provide low-overhanging hiding cover, provide sources of productivity and food, and provide a source of large-woody (LWD) debris for the stream channel. Healthy riparian corridors provide habitat for wildlife as well as stream stability through lateral enhancement and stable meander patterns.

In order to meet the purpose and needs of the project and to minimize adverse impacts to natural and cultural resources the following objectives would be addressed in the project:

- Minimize impacts on aquatic species, water quality and vegetation
- Protect a national historic landmark road
- Maintain visitors' access and experiences across the park

The preferred alternative would have the least impacts to natural resources and protect the cultural resource near the site, including the floodplain. Mitigation measures ensure immediate impacts would not adversely affect the environment (see Mitigation section).

INVESTIGATION OF ALTERNATIVE SITES

Alternative sites are not available as this project is a site-specific action based on a need to stabilize the bank on a portion of McDonald Creek in order to protect a portion of the GTSR that is threatened. However, in addition to the preferred alternative, a no action and an action alternative were analyzed.

No Action

Under the no action alternative, McDonald Creek would continue to function in its current semi-natural state. The GTSR forms the east boundary of the stream channel in most areas limiting the streams ability to move across the valley bottom, deposit sediment and channelize in a natural state. The soil nails and jersey concrete barriers would remain in place. The paved widening on the ditch-side of the road would also remain in order to provide adequate travel land width. The road and bank would be monitored and appropriate safety measures would be implemented if the road became hazardous to drive.

Stabilize the Bank Riprap and Rock Barbs

Under this alternative, the following actions would be taken to stabilize approximately 150 feet of the bank and prevent further erosion and sedimentation. Large (class V and VII riprap, 2 – 5 feet in diameter), angular rock would be used to create "barbs" and armor the slope from the toe of the slope to the shoulder of the road. The temporary soil nails would be removed and riprap would be placed for about 160 feet along the bank below high water line (see figure 3). The site would be accessed as is described for the preferred alternative (riprap only).

The riprap and barbs would require excavation into the natural channel substrate to install a large rock "toe" that would ensure high flows do not compromise the structural integrity of the stabilized bank. In-channel work would involve the excavation of approximately 3,000 ft^3 of native streambed material, which would be replaced with riprap to form the toe of the slope and footer material for the barbs. Most of the streambed material would be hauled away. A small amount would be incorporated into the riprap promote growth of vegetation. Project work would occur during low water times in the late fall/early winter.

Two barbs would be placed in the creek. One barb would be placed immediately upstream and one barb downstream of the sloughed bank area. Barbs are sloping stone sills, angled upstream and used to reduce bank erosion by re-directing currents away from the bank. The barbs would be about 30 feet long total and extend about 15 feet from the bank, angled upstream 25 degrees, counter sunk in the streambed about 3 to 4 feet, and keyed into the eroding bank. The barbs would be about 25 feet wide at the bank end and slope down from a 6 to 7-foot wide center crest into the stream bed. They would be about 5 feet in height above the stream bottom at the bank end and level with the stream bottom at the stream end (not including the countersinking). Consequently, they would have a low profile with only the segment next to the stream bank visible during most of the visitor season. During low water periods about one-half to one-third of the barbs would be exposed. The barbs would be designed based on a 50-year flood event depth and velocity.

Stone riprap revetment and vegetation would be used to armor the bank above the high water line. The riprap would ensure long-term stabilization at the site. It would extend approximately 100 feet from the stream edge of the eroding slope to the road shoulder currently being held by soil nails. A geotextile would be installed between the riprap and the subgrade. An additional 8-foot wide riprap – toe would be buried in the streambed.

Vegetation would be used to stabilize the upper portion of the bank and along the shoulder of the road. Restoration would include incorporating native species (such as dogwood, cottonwood and willows seedlings) into the riprap revetment between four and ten feet about the stream bottom. The seedlings would further stabilize the stream bank as they sprout and take root. The seedlings would be planted in the soil and then riprap would be placed around them (see appendix A, figure 4) and planting pockets would be incorporated into the upper portions of the riprap. No planting would be done on the barbs. Final touches, revegetation and project cleanup would most likely occur in early summer after spring runoff. McDonald Creek would not be diverted during the project.

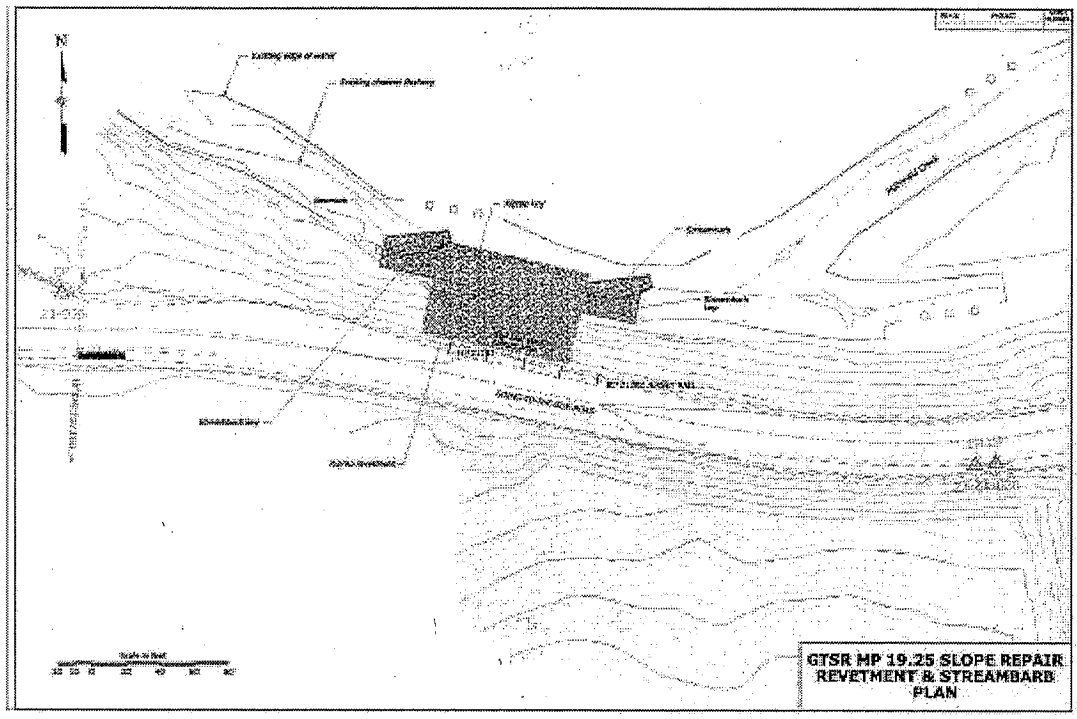

Figure 3. General design layout of alternative using revetment and stream barbs

SITE-SPECIFIC FLOOD RISK

The November 2006 flood exceeded the 100-year flood levels, and the park must take into consideration all reasonable scenarios as weather patterns might become more sporadic and severe. The front edge of the point bar directly across and immediately downstream of the projects site would likely retreat a few feet to maintain an effective channel width. The potential for bank erosion would be immediately reduced upon project completion as stream flow energy is dissipated and the flow is redirected across the stream. Natural adjustments to accommodate flow on the opposite side of the creek are expected to occur and would help maintain natural floodplain processes, and beneficial, resulting from maintaining the floodplain process northwest of the creek.

MITIGATION

Actions proposed in the floodplain would not affect the flood storage capacity of the floodplain. The natural floodplain value would not be reduced but slight alterations would be expected. Alterations would not influence the overall dynamics of the floodplain. The project design would further minimize potential hazards to human life and property destruction.

- Development within the floodplain would not result in an increase of the base flood level more than 0.5 feet.
- Work would be completed during the fall at low water times such that any impact to the floodplain would be remediated by spring floods.

SUMMARY

The preferred alternative was designed to avoid and minimize impacts to the floodplain along McDonald Creek while stabilizing the bank in order to protect the historic Going-to-the-Sun Road.

There would be no loss of floodplain area or impacts to floodplain dynamics upon implementation of the proposed action. Therefore the NPS finds this proposed action is consistent with the policies and procedures of NPS Director's Order #77-2: Procedural Manual 77-2: Floodplain Management which provides NPS policies and procedures for complying with Executive Order 11988.

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Map 1. Location Map of Bank Stabilization Efforts