Rocky Mountain National Park

Moraine Park Wetland Restoration Project Floodplain Statement of Findings

Recommended:

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1. Introduction

Executive Order (EO) 11988, Floodplain Management requires the National Park Service (NPS) and other federal agencies to evaluate the likely impacts of actions in floodplains. The objective of EO 11988 is to avoid, to the extent possible, the long-term and short-term adverse impacts associated with occupancy, modification, or destruction of floodplains and to avoid indirect support of development and new construction in such areas wherever there is a practicable alternative. The National Park Service administers floodplain policy through Director's Order 77-2: Floodplain Management (DO 77-2) and Procedural Manual 77-2 Floodplain Management (PM 77-2). The National Park Service also complies with Department of Interior guidance outlined in 520 DM 1, Floodplain Management and Wetlands Protection Policy and Responsibilities, and 520 DM 2, Floodplain Management and Wetlands Protection Program Requirements.

It is NPS policy to preserve floodplain functions and values and minimize potentially hazardous conditions associated with flooding, including threats to human health and safety, risk to NPS capital investment, and impacts on natural and beneficial floodplain values. If a proposed action is found to be in, or possibly affecting a floodplain, and relocating the action to a non-floodplain site is considered not to be a viable alternative, then a formal Floodplain Statement of Findings (FSOF) must be prepared unless the action is considered excepted. The FSOF must (a) describe the rationale for selection of a floodplain site, (b) disclose the amount of risk associated with the chosen site (with respect to human life, health, and safety, resource protection, and capital investment), and (c) explain strategies for mitigation of flood risk.

The FSOF will be available for public review in coordination with the National Environmental Policy Act (NEPA) and other compliance procedures, as applicable. If public review is not provided through the NEPA process (e.g. environmental assessment), another opportunity for public review is required.

This FSOF provides:

1. A detailed justification for selecting a proposed action that would adversely impact the Federal Flood Risk Management Standard (FFRMS) floodplain (Section 2).

2. A detailed and comprehensive description of the flood hazard and risk associated with implementation of the proposed action (Section 3).

3. A thorough description of mitigation measures chosen to eliminate, to the extent possible, adverse floodplain impacts associated with the proposed action(s) (Section 4).

This FSOF references modeling and analysis presented in the "*Moraine Park Wetland Restoration Project Hydrology and Hydraulics Report Rocky Mountain National Park"* (Casavant, May 2026). The hydrology and hydraulics (H&H) modeling was based on the 30% project design. The FSOF and H&H provide a comparison between the existing (no project) conditions and the proposed (project) conditions.

1.1 Preparer

This document was prepared in accordance with DO 77-2 and accompanying PM 77-2. Technical aspects of this document were prepared by Elizebeth Casavant, Civil Engineer, Headwaters Corporation. Subsequent non-technical edits were made by the National Park

Service.

1.2 Site Description and Characterization of the Floodplain

ROMO proposes to work with an external party to develop the Moraine Park Wetland Restoration Project, a stream and wetland restoration area approximately 490 acres in size and described in Section 1.3. The site is located approximately 4.5 miles southwest of Estes Park, Colorado, within ROMO at approximately 8,050 feet above mean sea level.

The Big Thompson River flows through the site from its headwaters in the mountains just below the continental divide. Moraine Park offers a relatively expansive and gradually sloped floodplain compared to other reaches of the river that are steeper and more confined. As such the river is less subject to volatile flooding in Moraine Park.

During moderate and high flows in Moraine Park, the river spreads into a network of relict and active tributary channels that reconverge at the Kaley Cottage Bridge on the eastern end of Moraine Park. Peak flows are most likely to occur in the spring and summer (May-July) and are largely fed by snowmelt. Peak park visitation coincides with the May through October thunderstorm-driven flood risk period.

1.3 Proposed Action

The overall goals of the proposed action aim to actively accelerate restoration of key natural characteristics and components of the aquatic system such as floodplain connection and relic stream channel engagement, increased channel structure and complexity, improved wildlife habitat, particularly for beaver, and increased extent of wetlands while maintaining existing habitats and hydrology typical of highly functioning fluvial systems.

The proposed project in Moraine Park will use low-tech, process-based restoration (LTPBR) methods to reconnect relict channels to their floodplains. These methods will include natural wood beaver dam analogs (BDAs), post-assisted log structures (PALS), and “Zeedyk one rock dams” (one-foot-tall rock structures placed in the active channel). Additional non-permanent ungulate exclosure fencing will also be installed to protect woody riparian vegetation.[1] The project includes vegetation management such as exotic plant control, seeding, and riparian plantings (e.g. willow). See Figures 1 and 2 for locations of proposed project elements.

For this analysis, “instream structures” including approximately 20 one-foot-tall rock dams, 60 BDAs, and 80 PALS are proposed to activate relict channels and increase channel/floodplain interaction. BDAs will be placed in tributaries, with adjacent microtopographic features (shallow depressions) excavated along the channel. PALS, BDAs and Zeedyk one rock dams will be constructed in the Big Thompson channel. BDAs and PALS are made of natural wood and mud.

The instream structures are not intended to function as permanent, rigid infrastructure. Consistent with low-tech process-based restoration principles, these structures are designed to work with natural fluvial processes and may experience partial damage, deformation, or mobilization during higher flow events. The structures are designed to remain sufficiently functional to promote the desired geomorphic and ecological processes, including sediment deposition, floodplain connectivity, and increased channel complexity, even if individual

[1] These exclosure fences are temporary, per the Elk and Vegetation Management Plan Record of Decision.

components require periodic maintenance or replacement. The project's success is based on achieving restoration goals such as improved floodplain connection, sediment retention, and stream function, rather than maintaining every structure in its original condition.

Approximately 10,000 linear feet (35-acres) of additional ungulate exclosure fencing will be installed in the meadow to protect woody vegetation. There are currently six ungulate exclosures and four small experimental exclosures in the meadow, approximately 113-acres total. These structures were installed in accordance with the park's 2008 Elk and Vegetation Management Plan (EVMP). During a flood, debris could accumulate upstream of fencing and lead to local changes in flood extent, or the fencing may get knocked down and become a flow obstruction. The modeled flood scenario associated with this proposed action is described in Section 3.0.

Instream structures and ungulate exclosure fences will be monitored post-construction and maintenance will be performed as needed if damage is affecting the project's ability to meet performance standards. An adaptive management approach will be used to ensure the project continues to meet its restoration objectives.

Monitoring of the restoration work will be initiated in the first growing season following construction and will continue until the established restoration performance standards for the project are met (minimum of 5-years). The performance standards allow the ecological function to be evaluated using the following factors:

• Physical—physical and structural integrity of installed in-stream structures (i.e., BDAs, PALS, and Zeedyk structures) to support appropriate flooding and, therefore, natural recruitment of target vegetation.

• Hydrological—appropriate inundation or saturation duration to support the natural recruitment of target vegetation.

• Biological—establishment, growth, and natural recruitment of target vegetation.

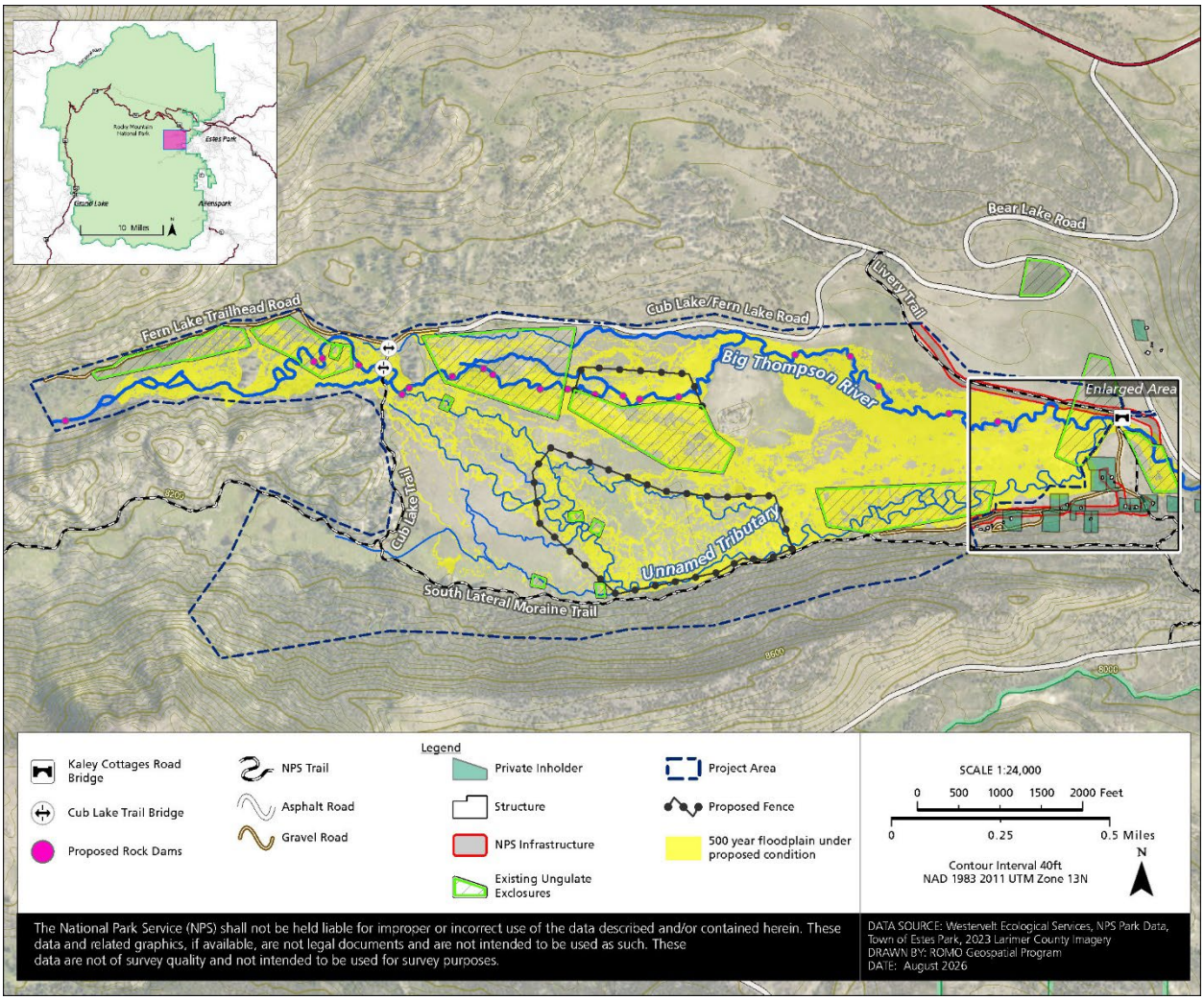

Figure 1. Big Thompson River and unnamed tributary, existing infrastructure, proposed rock dams and existing and proposed fencing. The Federal Flood Risk Management Standard Regulatory Floodplain as described in Section 1.4 (0.2% annual exceedance probability [500-year]) under the proposed condition (with project elements) is shown in yellow. Note the BDAs and PALS are not shown on the figure for clarity; these structures will be placed throughout the Big Thompson River and unnamed tributary, starting west (upstream) of the existing exclosure fences on the far east (downstream) end of the project area. See Figure 2 for the 'Enlarged Area'.

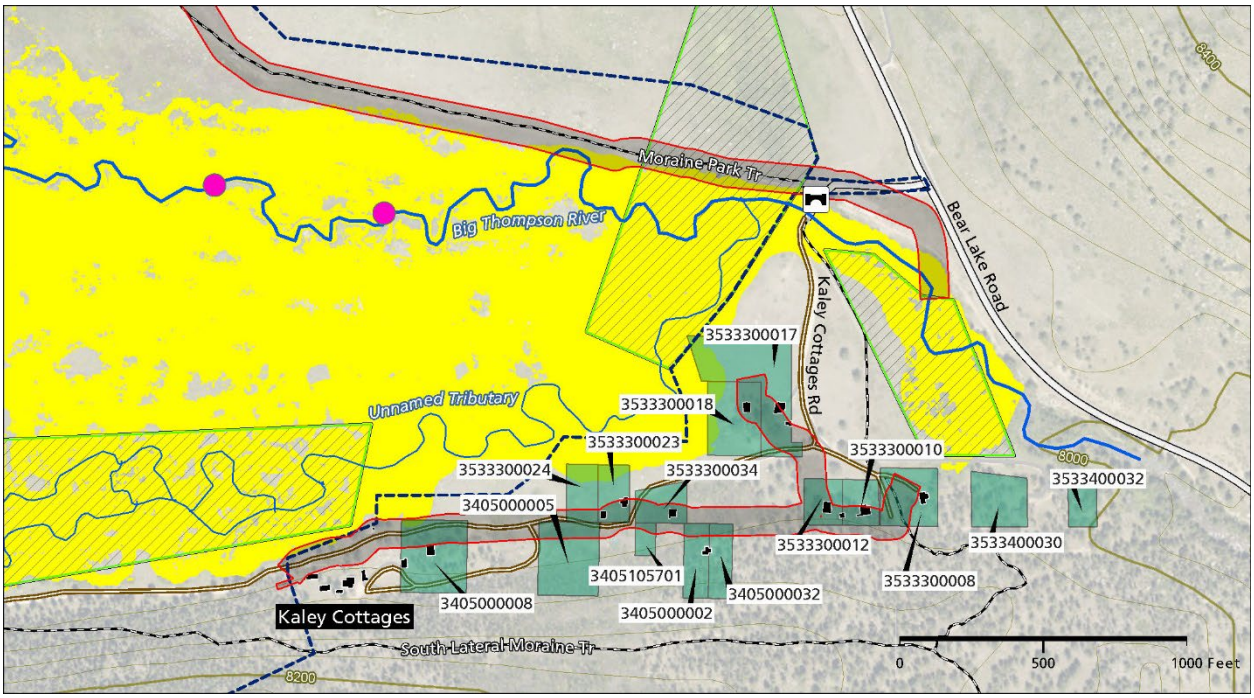

Figure 2. “Enlarged Area” from Figure 1 showing the private properties and access road/bridge in the Kaley Cottage area, as well as the NPS infrastructure at Moraine Park under the proposed condition. Map legend is in Figure 1.

1.4 Determination of Action Class and Regulatory Floodplain

Following PM 77-2, three action classes were considered when establishing the regulatory floodplain:

1. Class I Actions (i.e., non-critical actions) include location or construction of administrative, residential, warehouse, and maintenance buildings; non-excepted parking lots; or other man-made features, which by their nature entice or require individuals to occupy the site, are prone to flood damage, or result in impacts to natural floodplain values.

2. Class II Actions (i.e., critical actions) include any activity for which even a slight chance of flooding is too great, such as construction of schools, medical facilities, emergency services, hazardous material storage, and records/collections storage.

3. Class III Actions include any action that involves human occupation or substantial human exposure in high hazard areas, such as drainages subject to flash flooding.

This project meets the definition of a Class I Action. While private properties (inholdings) are within the regulatory floodplain, none of the private inholder dwellings or structures and no overnight occupation sites or structures are within the regulatory floodplain.

Proposed actions that involve federal capital investment must comply with FFRMS for new construction, substantial improvement, or repairing substantial damage. Per departmental

guidance, agencies may select one of three approaches to implement flood resiliency measures:

1. Climate-Informed Science Approach (CISA) – The elevation and flood hazard area that result from using the best-available, actionable hydrologic and hydraulic data and methods that integrate current and future changes in flooding, including climate change and other physical processes (e.g. land-use change).

2. Freeboard Value Approach (FVA) – The elevation and flood hazard area that result from adding an additional 2 feet to the base flood elevation (BFE) for non-critical actions and by adding an additional 3 feet to the BFE for critical actions.

3. 0.2% Annual-Chance Flood Approach (0.2PFA) – The area subject to flooding by the 0.2% (500-year) annual-chance flood.

A 0.2% Annual Chance Flood Approach establishing FFRMS flood elevations is employed for this proposed action. Therefore, the regulatory floodplain for the proposed action is the 0.2% annual chance (500-year) flood elevation, and the analysis assumes complete blockage of the downstream Kaley Cottage Road Bridge.

1.5 Identification of Potential Receptors

Typically, a FSOF documents the hazards and risks a given proposed action in the regulatory floodplain (e.g., a new NPS asset) may experience during the regulatory flood (for this analysis, the 0.2% annual-chance event with complete blockage at the Kaley Cottage Road Bridge). In this case, however, the asset at risk is not the wetland restoration project – in an undeveloped watershed such a project would be excepted from floodplain compliance under PM 77-2 – but nearby and downstream receptors such as NPS-owned and -maintained bridges, roads, and utilities, as well as private properties. A receptor refers to people, property, infrastructure, or natural resources that may be affected by the regulatory flood.

Potential receptors – Flood hazards and risks evaluated inside the regulatory floodplain:

1. Fern Lake/Cub Lake Road

2. Kaley Cottage Road

3. Kaley Cottage Road Bridge

4. Bear Lake Road (downstream of Kaley Cottage Road Bridge)

5. Moraine Park Sewer Line

6. Private Properties

Section 6.2 of PM 77-2 (2024) states “this procedural manual may not apply to certain park functions that may be located near water but require little physical development, do not involved overnight occupation, and when impacts on floodplain values are mitigated.” Given that the PM does not apply, these receptors are not discussed further in this FSOF.

Potential Receptors excepted from analysis under PM 77-2 (easily replaceable

infrastructure) - Flood hazards and risks not evaluated:

1. Cub Lake Trail (including two multiuse bridges)
2. South Lateral Moraine Trail
3. Big Thompson Livery Trail
4. Ungulate Exclosure Fences

Potential Receptors excepted from analysis under PM 77-2 (buried infrastructure or utilities) - Flood hazards and risks not evaluated:

1. Moraine Park / Headquarters Water System and Electric Lines
2. Greenline Water System

2. Justification for Use of the Floodplain

This project proposes to restore the floodplain of the Big Thompson River in Moraine Park and therefore must be sited within the regulatory floodplain. No permanent infrastructure or development is proposed in the floodplain as part of this design. Fences are considered impermanent as they are planned for removal once the wetland restoration is complete and the vegetation is mature. Rock and wood structures are considered impermanent as they are expected to 'naturalize' or mobilize over time, mimicking natural stream and floodplain processes. Previous restoration efforts in Moraine Park have included vegetation management and ungulate exclosure fencing related to the EVMP, which did not include LTPBR structures. In addition, park staff previously (2010) removed a golf course by leveling the greens, attempting to remove non-native grasses, plugging a drainage ditch and restoring native vegetation.

Park staff have considered several alternatives related to restoration of aquatic resources in Moraine Park. First is the "no-action" alternative in which the proposed project site would continue to experience incision, reduced stream and wetland habitat, and loss of hydrology supportive of the remaining wetlands on site while maintaining existing habitats and hydrology typical of fluvial systems.

The second alternative is using a toolbox of restoration techniques that include LTPBR techniques which are widely used in headwaters streams of the Rocky Mountains and elsewhere. These are low-cost, low-effort treatments using natural materials to address stream and wetland habitat losses.

The third alternative is use "natural channel design" techniques, in which streams can be engineered and altered using significant excavation and stabilization methods. This type of restoration can be very disruptive and damaging to the sensitive habitats during and after construction. It is also much more expensive than LTPBR implementation.

3. Detailed Flood Hazard and Flood Risk Analysis

The following analysis evaluates changes to fluvial flood hydraulics for an event in which materials placed as part of the proposed action (i.e., some or all of the instream structures) are transported downstream and fully block flow under the Kaley Cottage Road Bridge. As noted above, constructed BDAs and PALS is not anticipated to be resilient to the regulatory flooding event; therefore, this series of events seems sufficiently likely under the regulatory flood to consider it as a relevant risk scenario. NPS and privately-held assets may already experience effects associated with flooding; therefore, the evaluation focuses on how much more hazard and risk will potentially affect these receptors.

3.1 Description of Site-Specific Flood Hazard

Using data from USGS Gage #402114105350101 located near the downstream end of the project site, the 0.2% annual-chance flow was estimated to be 1,583 cfs[2]. At this flow, the site will experience widespread flooding under existing (no-project) conditions. Average depths on the floodplain will range from 0 to 2 feet and average channel velocities will be 3-4 ft/s. Velocities at a few meanders will be higher (8 ft/s with shear stress of 2.7 lb/ft2).

Flood hazards for receptors at the site under the proposed conditions are summarized below. The proposed project could increase the amount of wood, rock, and fencing in rivers, tributaries, and on the floodplain. To test the potential ramifications of this scenario, the existing conditions were modified to simulate a 100% blockage under the Kaley Cottage Road Bridge up to the height of the railing, forcing all water to flow over or around the structure.

1. **Fern Lake/Cub Lake Road** - No change to flood depths or extent. No change to velocity or shear stresses and river bends near pullout areas. No change between proposed and existing conditions.

2. **Kaley Cottage Road** - Under existing conditions, this gravel road would be overtopped, leading to erosion and damage. In the proposed condition moderate increases to flow depth (1.1 to 2.3 ft), velocity (5 to 7.3 ft/s), and shear (1.2 to 3.0 lb/ft2) are expected.

3. **Kaley Cottage Road Bridge** - Bridge is not overtopped in the proposed condition where the bridge is blocked up to the railing. Surrounding upstream water elevations increase by up to 1.5 ft.

4. **Bear Lake Road (downstream of Kaley Cottage Road Bridge)** - Road remains at least 12 feet above floodwater in all scenarios. No change between proposed and existing condition.

5. **Moraine Park Wastewater Line** - The proposed condition is not expected to increase risk to the wastewater line. The proposed condition is expected to reduce flow velocity and sheer stress at this location, potentially reducing the risk and rate of bank erosion in the outside river bend. No change between proposed and existing condition.

6. **Private Properties (land only, no buildings or structures)** - Proposed condition increases flooding extent (max 0.08 acres) and depth (max 0.8 ft) over some private property that is already flooded in the existing condition. The properties impacted and

[2] This flow is in agreement with the USGS regional regression equations.

the additional flooded area and depths are as follows:

Property 04-128 - 0.8 feet maximum surface water elevation increase, 0.08 acres increase in flooded area

Property 04-129 – 0.7 feet maximum surface water elevation increase, 0.06 acres increase in flooded area or 3,484 square feet

Property 04-137 – 0.6 feet maximum surface water elevation increase, 0.02 acres increase in flooded area

Property 04-139 – 0.5 feet maximum surface water elevation increase, 0 acres increase in flooded area

Property 04-175 – 0 feet maximum surface water elevation increase, 0 acres increase in flooded area

3.2 Description of Site-Specific Flood Risk

Based on hazards of the modeled scenario provided in Section 3.1, no change in risk to human health/safety, NPS investment, or floodplain function is anticipated during the regulatory flood for the Fern Lake/Cub Lake Road or the Bear Lake Road. That is, risk to human health and safety, NPS investment, and floodplain function as they relate to these receptors for the regulatory event is expected to remain as it was before project implementation.

There is potential risk to Kaley Cottage Road, Kaley Cottage Road Bridge, and private property, summarized as follows:

Kaley Cottage Road and Kaley Cottage Road Bridge: The Kaley Cottage Road and Bridge are inundated in the existing condition during the regulatory flood. In the proposed condition, complete blockage at Kaley Cottage Road Bridge forces more water to flow over the access road and bridge.

- Potential Risk to Human Health and Safety: The Kaley Cottage Road and Bridge are already inundated in the existing condition during the 0.2% annual-chance event (regulatory flood) and will continue to be inaccessible in the proposed condition. Risk to human health and safety associated with use of this road and bridge during the regulatory flood in either event is high.

- Potential Risk to NPS Infrastructure: Modeling indicates increased pressure on the Kaley Cottage Road and Bridge during the proposed condition where the bridge is blocked by debris. While this increases risk of damage to the bridge it is expected that the gravel access road would wash out and relieve pressure prior to major bridge damage. The increased depth (1.2 feet), velocity (2.3 feet per second), and shear stresses (1.8 pounds per square foot) over the road increase the risk of a complete washout.

- Potential Risk (Benefit) to Floodplain Function and Values: The project will improve floodplain function and reduce risk to floodplain values by slowing down runoff, increasing storage and soil moisture, promoting healthy vegetation and decreasing erosion.

Private Property: In some instances, modeling indicates land owned by private in-holders will experience increased flood inundation during the regulatory flood; however, the additionally flooded areas are not anticipated to reach the structures located on these private lands.

- Potential Risk to Human Health and Safety: Lower elevation land areas nearest the Big Thompson River may be affected by flooding. These lands are unoccupied. No existing structures or buildings are affected by flooding associated with the modeled scenario.[3]

- Potential Risk to NPS Infrastructure: There is not NPS-owned infrastructure or other receptors on these inholdings. Not applicable.

- Potential Risk to Floodplain Function and Values: In the 0.2% annual-chance event (regulatory flood), there would be up to .8 feet or .08 acres of additional water on the private lands. Flow velocities in both the existing and proposed conditions are less than 1 cubic foot per second; bank erosion is not likely in either condition. There is no other anticipated change in function to private lands.

3. Mitigation Measures

To mitigate the increased risks, the following mitigation measures will be implemented:

1. For the first 5-years following project implementation, the park will inspect the bridge abutments annually to monitor change of scouring condition and debris build-up. Existing, ongoing bi-annual inspections by the Federal Highway Administration (FHWA) under the National Bridge Inspection program will continue.

2. If scour is observed at the bridge abutments, a licensed engineer will assess and determine appropriate scour countermeasures (e.g. armoring).

4. Summary

Overall, under the regulatory event the project implementation and presence of additional impermanent structures does not significantly increase risks to human health and human safety, NPS infrastructure, or floodplain function when compared to existing conditions.

The scenarios investigated are intended to test the “worst case” scenarios that include complete blockage of the Kaley Cottage Road Bridge and increases to flood water surface elevations resulting from installation of project features. Given these parameters, the results indicate increases in flood area and depth in areas that are already flooded in the existing condition.

[3] Park emergency personnel evacuate park residents, including inholders, if the situation warrants. Park emergency personnel may also require inholders to shelter in place.

The largest differences between existing and proposed results occurred within 1,000 feet of Kaley Cottage Road Bridge where the simulated blockage led to increases in water elevations upstream and decreases in water elevations downstream. In both existing and proposed scenarios, the Kaley Cottage Road and Bridge at the downstream end of the project are the areas most affected by extreme flooding. Although damage is already likely under existing conditions, a complete blockage at Kaley Cottage Road Bridge may increase the extent of damage to the access road.

In addition, the proposed project may result in increased risk to three private properties (land only, no structures or buildings) in a flood scenario as compared to existing conditions. The remaining two properties will be impacted the same between existing and project conditions with no increase in risk.

Beneficial effects of the project that are predicted to ameliorate flood damage such as slowing movement of water across the landscape, increased residence time in the floodplain and increased soil infiltration are not quantified in these scenarios.

5. References

Casavant, Libby, Headwaters Corp. Moraine Park Wetland Restoration Project Hydrology and Hydraulics Report Rocky Mountain National Park. May 2026.

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