

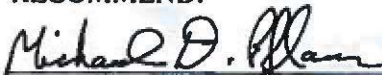
**APPENDIX A: FLOODPLAIN MANAGEMENT STATEMENT OF FINDINGS**

**STATEMENT OF FINDING FOR EXECUTIVE ORDER 11988: FLOODPLAIN MANAGEMENT, AND NPS DIRECTOR'S ORDER 77-2: FLOODPLAIN MANAGEMENT**

**CEDAR PASS DEVELOPMENT CONCEPT PLAN / ENVIRONMENTAL ASSESSMENT**

**BADLANDS NATIONAL PARK**

RECOMMEND:



SUPERINTENDENT, BADLANDS NATIONAL PARK

12/12/2018  
DATE

CERTIFICATION OF TECHNICAL ADEQUACY AND SERVICEWIDE CONSISTENCY:



CHIEF, WATER RESOURCES DIVISION

1/29/2019  
DATE

CONCURRED:



REGIONAL DIRECTOR, MIDWEST REGION

1-30-19  
DATE

## INTRODUCTION

Badlands National Park (the park) is preparing a development concept plan / environmental assessment for the Cedar Pass Developed Area (Cedar Pass area) of the park.

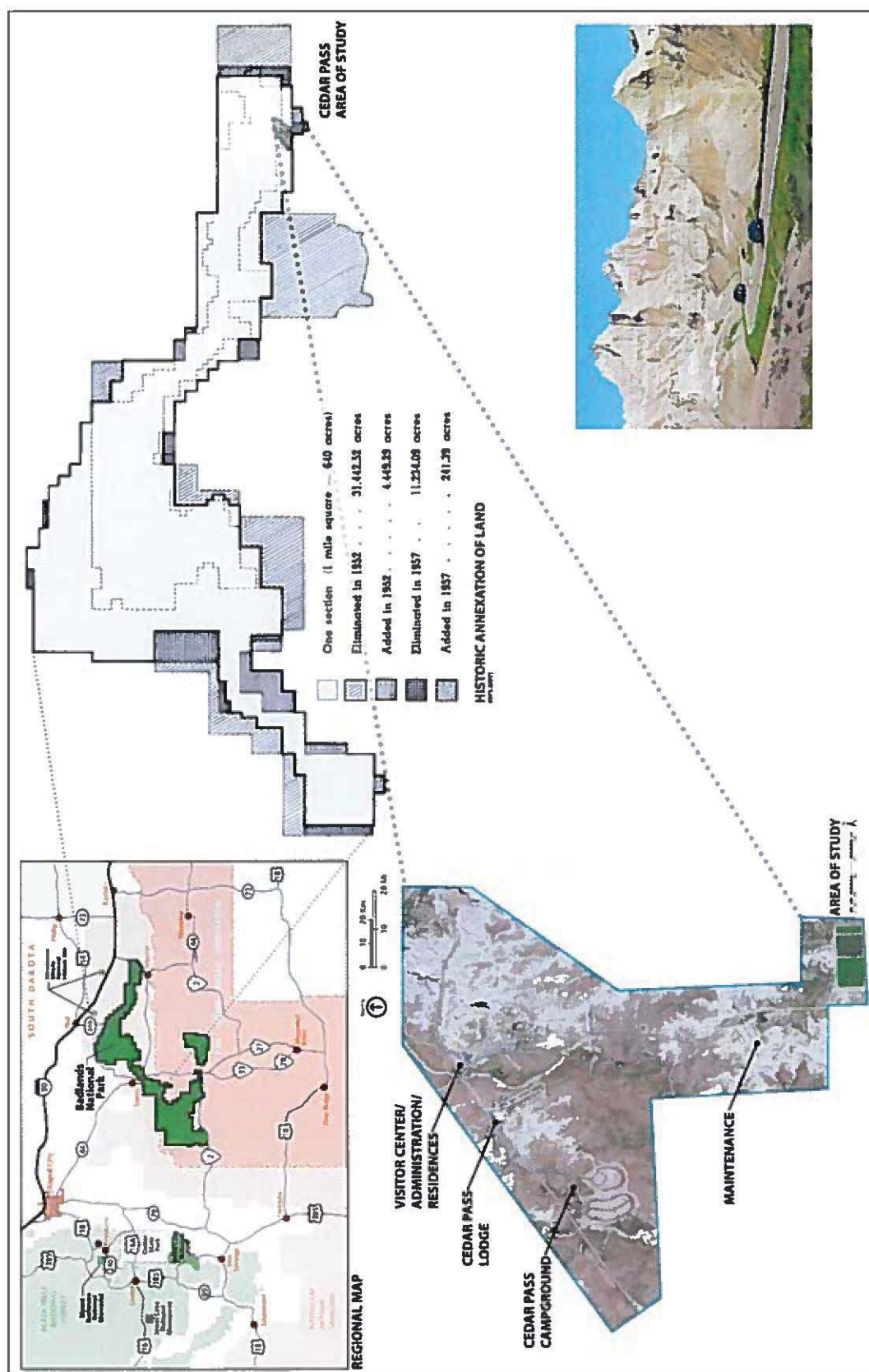
Executive Order 11988, "Floodplain Management," requires federal agencies to evaluate the likely impacts of actions in floodplains, avoid "adverse impacts associated with the occupancy and modification of floodplains, and avoid direct and indirect support of floodplain development wherever there is a practicable alternative." If federal actions must take place in a floodplain, the agency is required to minimize potential impacts on human safety, health, and welfare and the risk of flood losses, and to protect and restore natural, beneficial floodplain values. Director's Order 77-2: *Floodplain Management* and the Procedural Manual 77-2: Floodplain Management provide National Park Service (NPS) policies and procedures for complying with Executive Order 11988. Pursuant to Director's Order 77-2, the National Park Service must strive to preserve floodplain values and minimize hazardous floodplain conditions (NPS 2003). This statement of findings has been prepared according to Director's Order 77-2 and Procedural Manual 77-2 and in compliance with Executive Order 11988.

NPS Procedural Manual 77-2: Floodplain Management indicates, "[if] there is a chance that the proposed action will be in the applicable regulatory floodplain, then that floodplain must be determined." In this case, the applicable regulatory floodplain is the 1% annual chance floodplain, commonly referred to as the base floodplain or the 100-year floodplain. A preliminary floodplain assessment may provide enough qualitative flood hazard information for low-cost, low-risk actions like parking lots and day use areas. However, large capital investments and risks to human life may require a detailed floodplain analysis and the delineation of the regulatory floodplain, with information on flood conditions and hazards. Procedural Manual 77-2 states, "[if] the cost of obtaining precise floodplain information is prohibitive, the NPS will assume the project is within a regulatory floodplain." For this level of planning, it is assumed that the project area is located within the regulatory floodplain (base floodplain) because of the previously observed flooding and the proximity to defined channels. This statement of findings provides (1) justification for choosing a floodplain location, (2) a description of the associated flood hazard, and (3) proposed mitigation for floodplain impacts.

### Site Description

The project area is located within the 215-acre Cedar Pass area of the north unit of the park, approximately 70 miles east of Rapid City, South Dakota (figure 1). Federal Emergency Management Agency (FEMA) floodplain mapping indicates that the Cedar Pass area is located in an unmapped area of the Jackson County unincorporated areas. The Federal Emergency Management Agency has not completed a study to determine flood hazard or floodplains for the Cedar Pass area; therefore, a flood map has not been published (FEMA n.d.). However, areas surrounding the streams running through the Cedar Pass area are susceptible to flooding risk on a seasonal basis from intense precipitation events (figure 2). Two intermittent streams in the Cedar Pass area receive drainage from land north of Badlands Loop Road, including the Badlands Wall. A heavy rainfall in mid-2014 resulted in flooding from stormwater runoff and associated riverine overflows. Areas near the Cedar Pass Lodge that flooded during the 2014 storm event included the cabins in the southeastern portion of the cabin loop, the northwestern portion of the campground, the parking lot between the visitor center and the natural resource office, and the bus parking area. In addition to the known flooded zones, areas of potential flood risk include the undeveloped area between Cedar Pass Lodge and the Ben Reifel Visitor Center along the Cedar Pass area's main drainage channel. Flooding during the 2014 rain event also damaged and breached the wall of the western wastewater lagoon located adjacent to the campground.





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# Badlands National Park

Cedar Pass Concept Development Plan & EA  
South Dakota

National Park Service  
U.S. Department of the Interior

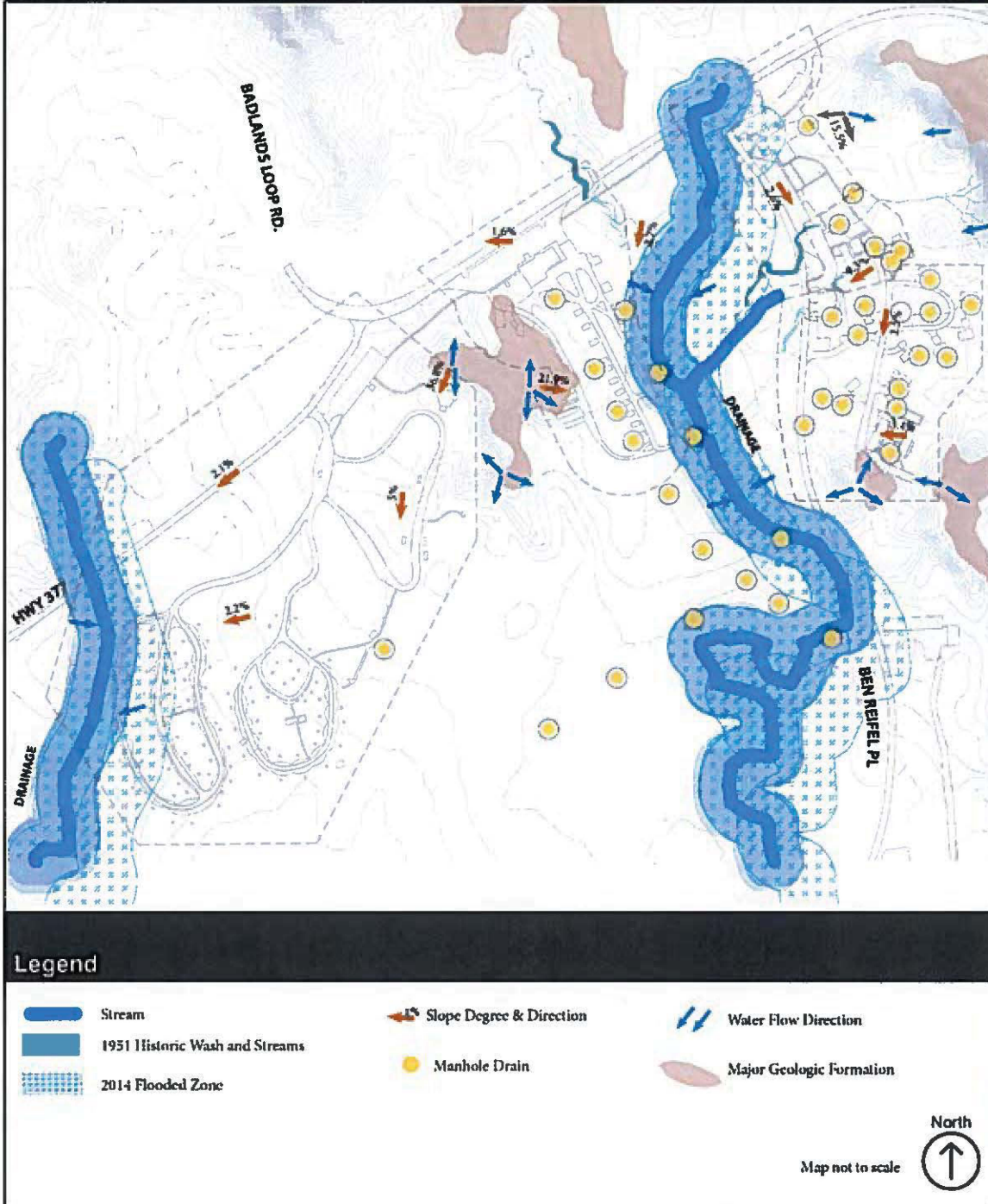


FIGURE 2: CEDAR PASS HYDROLOGIC RESOURCES



## Proposed Action

The purpose of this project is to improve visitor experience, management capabilities, and park facilities at the Cedar Pass area by creating a plan for redevelopment of this area that would be consistent with the character-defining aspects of the associated historic district and cultural landscape and protect the fragile resources in the area. The development concept plan would identify these needs and determine how they can be accommodated at the Cedar Pass area.

The proposed project is needed because current visitor and employee facilities at the Cedar Pass area do not meet the needs of visitors, the concessioner, or the park. A development concept plan would address these and future development needs within the context of the park's resources and engineering limitations. The Cedar Pass area is the primary visitor center in the park, with the earliest facilities constructed during the early to mid-20th century. These facilities were influenced by New Deal era infrastructure and the NPS Mission 66 program. Over time, the existing facilities have become inadequate for various reasons. The facilities lack office space and housing for park employees, and the existing temporary buildings installed to alleviate these problems have reached the end of their useful life. Visitor amenities, such as the visitor center, lodging, campground, parking, and traffic circulation cannot accommodate increased visitation and changing visitor needs. The concessioner operates from one of the oldest buildings in the Cedar Pass area that has developed structural issues; is in need of costly repairs; and presents life, health, and safety issues. These issues make servicing the park and visitors difficult.

The preferred alternative, as shown in figure 3, includes construction of new facilities and infrastructure, and the renovation and/or expansion of existing facilities, roads, parking areas, and outdoor areas for visitor enjoyment. The development footprint would be expanded in along 2 new campground loops with 5 new camper cabins. The footprint would also be expanded at (1) the amphitheater, (2) a new lodge check-in building on the east side of Cedar Pass Lodge, (3) a new laundry building and 15 new visitor cabins serving the Cedar Pass Lodge, (4) a new approximately 15,000-square-foot (SF) visitor center, (5) 7 relocated NPS recreational vehicle (RV) pads, (6) 6 new staff housing facilities, (7) a new approximately 5,500-SF ranger station in the operational support area, and (8) a new interpretive trail to the north of the Badlands Loop Road. The development proposed in the employee housing area and in the operational support area is not in a floodplain and would not directly or indirectly affect floodplain resources or values; therefore, these elements are not discussed further in this statement of findings. Chapter 2 of the development concept plan / environmental assessment includes a description of the development proposed in these clusters.

The proposed development, including new and expanded structures, would increase impervious surfaces by approximately 5 acres. Increased impervious surface would increase stormwater runoff, contribute to erosion and sedimentation concerns, reduce opportunities for infiltration and groundwater recharge, and increase flooding and flood risks. A portion of the campground and Cedar Pass Lodge cabin court would continue to be located in the floodplain, as would a portion of the proposed visitor center parking lot proposed for construction. The increase in impervious surface and proposed development within the floodplain would result in long-term, direct, adverse impacts on floodplains.

The visitor center function would be relocated to a new approximately 15,000-SF building on the south side of Badlands Loop Road between the Cedar Pass Lodge and the Ben Reifel Visitor Center. The visitor and staff parking associated with the visitor center would be relocated to a new parking lot that would wrap around the south side of the new visitor center building. While the area proposed for the visitor center is within the Cedar Pass Development Zone between the existing visitor center and Cedar Pass Lodge development clusters, it has not been previously developed. The main drainage channel is located near the southeastern portion of the proposed visitor center parking lot. The construction of the new visitor center, parking lots, pedestrian sidewalks, and multiuse trails would increase impervious surface in this new development cluster by 1.7 acres. Approximately 0.4 acre of land proposed for the parking lot and multiuse trails is within the known flood zone and is at risk for potential flooding. The added

impervious surface within the floodplain and adjacent to the main drainage channel through Cedar Pass would result in an increase in stormwater runoff and the potential for erosion, sedimentation, and downstream flooding in both the Cedar Pass area and downstream areas, resulting in direct and indirect, long-term, adverse impacts.

The existing parking lot and administrative buildings on the south side of the Ben Reifel Visitor Center would be demolished, and the area would be converted to pervious open space composed largely of native grasses. This area has flooded in the past, and the conversion would mostly restore the natural surface water flow of the area, allowing for infiltration and retention of stormwater runoff from the adjacent buttes and reducing floodwater volume and velocity into the drainage basin west of the Ben Reifel Visitor Center. These improvements would result in direct and indirect, long-term, beneficial impacts.

Within the Cedar Pass Lodge development cluster, proposed development would increase impervious surfaces, resulting in direct and indirect, long-term, adverse impacts from the corresponding increases in stormwater runoff and reductions in opportunities for groundwater infiltration. However, the drainage channel east of the lodge would be repaired to alleviate flooding into the cabin court, resulting in direct, long-term, beneficial effects on stormwater and floodplains because drainage patterns would be improved to reduce erosion, sedimentation, and the likelihood of flooding within the development footprint.

Expansion of the campground and amphitheater and construction of new multiuse trails would increase the amount of impervious surfaces and associated runoff. While the northwestern portions of the campground would continue to be located within soils that frequently flood and the 2014 flood zone, some campsites would be relocated outside the flood zone, reducing the risk of flooding for the actively used portions of the campground.



### Legend



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## JUSTIFICATION FOR USE OF THE FLOODPLAIN

The park's 2006 general management plan for the north unit zones the Cedar Pass area for future development and identifies it as the principal area for visitor contact and park administration (NPS 2006a). The Cedar Pass area contains geologic formations such as outcrops and buttes, erodible and frequently flooded soils, and areas that are already developed. Flood zones exist along the two intermittent streams and near the base of many geologic formations. The proposed site for the new visitor center meets the project's purpose and need because it is within the Cedar Pass Development Zone and could accommodate increasing visitation and changing visitor needs. A portion of the visitor center parking lot would disturb a small portion of the known flood zone. Relocating the existing cabins outside the known flood zone is not practical because of the high demand for these amenities and because these cabins were newly constructed in 2012. Stormwater management and drainage controls would be implemented within the Cedar Pass Lodge and visitor center development clusters to reduce the flood risk in these locations. Therefore, although the construction of the new visitor center parking would occur within the flood zone and a portion of the cabin court would continue to be located within the flood zone, the extent of development, placement of structures, and types of structures and associated facilities would be selected to minimize impacts.

In addition to the preferred alternative, two other action alternatives and a no-action alternative were considered. Various elements of the alternatives would be sited in different locations, have greater resource effects, and would not meet the stated purpose and need of the project.

### **Alternative 1: No Action**

Under the no-action alternative, there would be no new impacts on floodplains; however, stormwater runoff, flooding, erosion, and sedimentation of drainage ways and building foundations would continue to pose operational issues for the park, resulting in direct and indirect, long-term, adverse impacts on floodplain resources. Previously flooded areas, including a portion of the Cedar Pass Lodge visitor cabins, the parking areas south of the existing visitor center, and the western campsites would continue to be at risk for flooding. There would be no beneficial effects under this alternative.

### **Alternative 2: Preserve and Restore Mission 66 at Cedar Pass Alternative**

The proposed development would increase impervious surfaces by approximately 1.5 acres, resulting in long-term, direct, adverse impacts on floodplains from increased stormwater runoff, erosion and sedimentation concerns, reduced opportunities for infiltration and groundwater recharge, and increased flood risks. The NPS staff RV pads would be expanded and relocated south of the operational support area in a flood-prone area and would be elevated with fill to reduce the risk of flooding. The northwestern part of the campground would continue to be located within the flood zone, but some campsites would be relocated outside the flood zone to reduce flood risks. The parking area between the visitor center and the proposed headquarters building would include installation of a stormwater swale and culverts to direct water away from park facilities and into the main drainage channel on the west side of Ben Reifel Road, which would improve stormwater management and reduce flood risk. The drainage channel east of the existing Cedar Pass Lodge would be repaired to alleviate flooding of the cabin court.

### **Alternative 3: Minimize Building Footprint**

The proposed development would increase impervious surfaces by approximately 4 acres, resulting in long-term, direct, adverse impacts on floodplains from increased stormwater runoff, erosion and sedimentation concerns, reduced opportunities for infiltration and groundwater recharge, and increased flood risks. The NPS staff RV pads would be expanded and relocated south of the operational support



area in a flood-prone area and would be elevated with fill to reduce the risk of flooding. The drainage channel east of the existing Cedar Pass Lodge would be repaired to reduce flooding of the cabin court. The northwestern part of the campground would continue to be located within the flood zone, but some campsites would be relocated outside the flood zone to reduce flood risks. A consolidated headquarters and visitor center would be constructed in the general location of the existing visitor center, and the area south of this facility and associated parking would be revegetated. A stormwater swale would direct water into the drainage channel on the west side of Ben Reifel Road, improving stormwater management and reducing flood risk.

Other alternatives were initially considered but eliminated from further study. None of those alternatives or actions met the definition of a reasonable alternative that is “practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant” (CEQ 1981). In addition, alternatives were eliminated that did not meet project objectives, resolve need, or alleviate potentially significant impacts on important resources. A detailed discussion of these alternatives considered but dismissed can be found in chapter 2 of the development concept plan / environmental assessment.

## DESCRIPTION OF SITE-SPECIFIC FLOOD RISK

Currently, no known detailed floodplain analyses or flood risk studies at the site document the recurrence intervals of flooding or flood depths and velocities; however, there is observational evidence of flooding in both nearby ephemeral channels. It is reasonable to assume that a high magnitude flood such as the 1% annual chance flood could inundate large areas adjacent to the channels and possibly create dangerous and destructive conditions.

A rain event in June 2014 delivered 2.06 inches of rain in 45 minutes, flooding portions of the Cedar Pass area. The two intermittent streams in the project area overflowed their banks during the rain event with some flood levels reaching 8 to 12 inches in depth. In the project area, flooding was observed in areas surrounding the streams up to 115 feet from the stream channels (NPS, Thompson, pers. comm. 2017). The resultant runoff created flooding throughout the developed area, including in the immediate vicinity of the Cedar Pass Lodge and headquarters of the park, the parking lot adjacent to the temporary administrative facilities, and the Ben Reifel Visitor Center. The Cedar Pass developed area would continue to be at risk of flooding from intense, seasonal precipitation events on a yearly basis.

During the 2014 event, data from the US Geological Survey White River Stream monitoring station showed a flow increase of 1,600 cubic feet per second (ft<sup>3</sup>/second) at the monitoring station within four hours (NPS, Thompson, pers. comm. 2017). The increased volume of water that passed through the White River monitoring station corresponded to five times the normal rate of approximately 430 ft<sup>3</sup>/second. Using the available observational information, the time required for flooding to occur is approximately 45 minutes. Ample high ground surrounds the flood-prone ephemeral channels as seen in figure 3. Therefore, evacuation in 45 minutes would be easily accomplished by moving to areas of higher elevation to the east or west of the stream channels that have not experienced flooding.

The project area is characterized by various thin non-porous soils and shallow underlying bedrock that prevents infiltration of stormwater or snowmelt. The lack of infiltration results in sheet flow throughout the developed area, which is not easily absorbed by the soils. Because much of the area's precipitation ends up as direct runoff, the intermittent drainage channels are unable to contain the runoff during high-volume precipitation events. Sheet flow through the Cedar Pass area erodes soils and carries sediments from the surrounding Brule Formation downslope. The flooding in the Cedar Pass area has resulted in geomorphic issues, including erosion and sediment deposition, which create concerns for the delicate prairie soils in the Cedar Pass area. The 2014 rain event buried previously exposed sewer manhole covers under 6 to 8 inches of silt and alluvium (NPS, Thompson, pers. comm. 2017). Culverts transporting water under Ben Reifel Road and Badlands Loop Road, as well as other stormwater management infrastructure have been clogged because of sediment accretion. Large precipitation events in the future would continue to contribute to the erosion and sedimentation within the floodplain areas of Cedar Pass, further exacerbating the inability of the drainage channels to move water south toward the White River rapidly enough to avoid flooding. Sedimentation of culverts prevents the diversion of runoff from park facilities, parking lots, and roadways, creating additional drainage issues and potentially increasing the risk for further flooding or damage from erosional undercutting.



## **DESIGN AND MODIFICATION OF PROPOSED ACTION**

As stated in Director's Order 77-2, if the National Park Service determines a facility must be placed within an area subject to natural hazards, then the "design and siting will be based on a thorough understanding of the nature of the physical processes and avoiding or mitigating (1) the risks to human life and property, and (2) the effect of the facility on natural physical processes and the ecosystem." The park proposes to mitigate floodplain impacts associated with the proposed project as described below.

For all new development in the Cedar Pass area, drainage and stormwater management infrastructure would be designed to reduce the risk of flooding to park facilities while preserving or restoring the natural surface water flows and erosional processes of the area to the greatest extent practicable. The National Park Service would employ best management and low-impact development practices to make park facilities and infrastructure resilient to the potential increase in intense precipitation events in the future. The park would create a stormwater management plan during the design process, which would include detailed hydrologic studies and drainage plans for new construction, as well as additional avoidance, minimization, and mitigation measures based on future engineering and design work. Additional measures to avoid, minimize, and mitigate adverse impacts are included in chapter 2 of the development concept plan / environmental assessment. Some examples include pervious pavement, infiltration basins, revegetation, and other low-impact development practices.

Some park assets that are within the known flood zone would be relocated outside the identified flood zones. The preferred alternative would restore natural floodplain values south of the Ben Reifel Visitor Center and north of the employee housing area. The parking lot in this location would be demolished, and the area would be converted from an impervious surface to a vegetated pervious surface. The restored landscape would restore natural surface water flows and increase infiltration opportunities, slowing runoff, attenuating floodwaters, and reducing discharge to the main drainage channel on the west side of Ben Reifel Road. Additionally, the campground site configuration would be adjusted to relocate tent sites currently within the floodplain and in danger of collapsing into the adjacent stream. All associated campground infrastructure would be low cost and sacrificial under severe flood conditions. The park would plant additional native riparian species to slow erosion and provide shade and privacy for the tent sites. All tent sites would be constructed on an elevated pad framed with timbers and filled with sand and gravel to minimize ponding following precipitation events and reduce the risk of flooding. These actions would restore natural floodplain values that previously had been affected by development activities within the flood zone. Finally, the stormwater management and drainage infrastructure east of the Cedar Pass Lodge would be rehabilitated to alleviate flooding in the lodge complex and the cabin courts to the south.

Under the preferred alternative, 0.4 acre of the new visitor center parking would be constructed within a known flood zone. Flooding or risk of flood damage at the visitor center would be mitigated up the level of the regulatory floodplain through elevation of the facility, using fill, piles, or other appropriate means, and elements of flood resiliency would be incorporated into the design. The park would facilitate the development of specific design criteria through a focused floodplain analysis conducted at the site. These criteria would provide input to the preliminary and final grading plans and construction designs for the visitor center and associated infrastructure to incorporate flood hazard mitigation, floodplain value protection, and flood resiliency measures into the investment.

Implementing appropriate drainage structures such as channels, berms, or swales would be included to move runoff away from the facilities and avoid ponding. The park would perform or facilitate any additional drainage and hydrologic studies during the design of the facility to identify appropriate flood control and stormwater management strategies to convey water away from the new facility while avoiding erosion and sediment accretion in the drainage channel, and reducing flood risks to downstream park assets such as the Cedar Pass Lodge cabins.



## CONCLUSION

Activities associated with the preferred alternative would be located in a known flood zone and assumed regulatory floodplain and would potentially result in impacts on floodplain resource functions or values. The proposed action, including an approximately 5-acre increase in impervious surface and the construction of 0.4 acre of parking lot within the assumed regulatory floodplain would increase stormwater runoff, contribute to erosion and sedimentation concerns, reduce opportunities for infiltration and groundwater recharge, and increase flooding and flood risks. However, floodplain values and functions would be restored between the Ben Reifel Visitor Center and the employee housing cluster. The campground site configuration would be adjusted to relocate tent sites to be outside the floodplain; and the stormwater management and drainage infrastructure east of the Cedar Pass Lodge would be rehabilitated to alleviate flooding into the lodge complex and the cabin courts to the south. A detailed floodplain analysis would be completed to provide design criteria for preliminary and final construction plans and diagrams. The park would perform or facilitate any drainage and hydrologic studies during the design phase to provide appropriate design criteria for flood control and stormwater management to reduce flood risks to park assets and human life and health, and preserve/restore natural and beneficial floodplain values, to the extent practicable. Compliance with applicable regulations and policies to minimize impacts on floodplain resources and loss of property or human life would be strictly adhered to during and after the construction. As a result, impacts on floodplain resources from the proposed project would be limited and localized.

The National Park Service finds the proposed action to be consistent with Executive Order 11988 and Director's Order 77-2.