

**STATEMENT OF FINDINGS**  
**FOR**  
**EXECUTIVE ORDER 11988 FLOODPLAIN MANAGEMENT**

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HOUCHIN FERRY SITE:  
DEVELOPMENT CONCEPT PLAN

PMIS# 237900  
PEPC# 70636

MAMMOTH CAVE NATIONAL PARK  
Kentucky

Recommended:	<div style="display: flex; align-items: center;"><div style="margin-right: 10px;"><b>BARCLAY TRIMBLE</b></div><div><small>Digitally signed by BARCLAY TRIMBLE Date: 2020.07.23 10:54:32 -05'00'</small></div></div> <div style="border-top: 1px solid black; margin-top: 5px;">Superintendent, Mammoth Cave National Park</div>	<div style="border-top: 1px solid black; margin-top: 5px;">Date</div>
Concurred:	<div style="display: flex; align-items: center;"><div style="margin-right: 10px;"><b>FORREST HARVEY</b></div><div><small>Digitally signed by FORREST HARVEY Date: 2020.07.23 15:12:51 -06'00'</small></div></div> <div style="border-top: 1px solid black; margin-top: 5px;">Chief, Water Resources Division (Certification of technical adequacy and servicewide consistency)</div>	<div style="border-top: 1px solid black; margin-top: 5px;">Date</div>
Approved:	<div style="border-top: 1px solid black; margin-top: 5px;">For Regional Director, Interior Region 2, South Atlantic – Gulf National Park Service</div>	<div style="border-top: 1px solid black; margin-top: 5px;">Date</div>

## INTRODUCTION

Executive Order 11988, “Floodplain Management” requires the National Park Service (NPS) and other federal agencies to evaluate the likely impacts of actions in floodplains. The objectives of the executive order are 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 NPS administers floodplain policy through Directors Order 77-2 Floodplain Management (DO 77-2), and Procedural Manual 77-2 Floodplain Management (PM 77-2).

It is NPS policy to preserve floodplain functions and values and minimize potentially hazardous conditions associated with flooding, including threats to human health/life, risk to capital (NPS) investment, and impacts to natural and beneficial floodplain values. If a proposed action is found to be in an applicable regulatory 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” must be prepared. The “Statement of Findings” must (a) quantify flood conditions and associated hazards as a basis for management decision making, (b) describe the rationale for selection of a floodplain site, (c) disclose the resources and amount of risk associated with the chosen site, and (d) explain flood mitigation plans. The “Statement of Findings” must be available for public review and comment, generally by including it in an applicable National Environmental Policy Act compliance documentation.

This “Draft Floodplain Statement of Findings” presents the rationale for the continued use of existing park infrastructure and development within the 100-year floodplain of the Green River at the Houchin Ferry recreation site, Mammoth Cave National Park, Kentucky. It also presents the rationale for adding new improvements at this location, including expansion of existing parking, camping, and picnicking areas, a canoe/kayak launch, a pedestrian suspension bridge, and other related improvements (described below). This Floodplain Statement of Findings quantifies the flood hazard associated with the proposed action, documents the anticipated negative impacts of these improvements on human health/life, capital investment, floodplain functions and values, and presents mitigations to these impacts. All of the elements of the proposed action are included as components of Alternative C (preferred alternative) of the *Houchin Ferry Development Concept Plan and Environmental Assessment*.

## PROPOSED ACTION

The Houchin Ferry site consists of a 4-acre site situated on a narrow bluff on the south side of the Green River at River Mile 185.2, together with a 1-acre site on the north side of the river. Existing site facilities are aging and need improvements. The purpose of the *Houchin Ferry Development Concept Plan* (Plan) is to address the site's deficient facilities and re-establish safe river access at Houchin Ferry. The Plan also seeks to restore connectivity between the south and north sides of the river now that the ferry has been permanently discontinued. The plan seeks to re-establish the Houchin Ferry site as a destination dedicated to a variety of user groups and recreational activities, including safe access to the river. It requires evaluating the site to accommodate these user groups and provide facilities to allow for the anticipated increase in recreational use at the site.

The catastrophic failure of Lock and Dam No. 6 in November 2016 and its subsequent removal in 2017 caused a river elevation drop of approximately 8 to 10 feet at the Houchin Ferry site. Both the north and south side concrete ramps at Houchin Ferry no longer reach the river. Lock and Dam No. 5 is slated for removal as well which will result in a projected loss of 3 to 5 feet of river elevation. Initially after the breach, the park discontinued river access at Houchin Ferry due to the lower water level. As a result, no permanent take-out locations existed anywhere along the 17 river miles downstream of the Green River Ferry crossing within the park. However, the park has recently installed a temporary canoe/kayak access launch on the south side of the river until a permanent solution can be installed.

Given the foregoing site conditions, the National Park Service proposes to implement Alternative C (preferred alternative) of the Plan. The elements of Alternative C are as follows:

### South Side

Alternative C would balance day and overnight use, with an enhanced level of facility improvements. The campground would have 12 camping sites, each with a fire ring and picnic table. Of the 12 sites, 8 would be tent-only spaces (1 accessible) at the west end of the campground, and 4 spaces would have water and electric hookups for vehicles 20-feet long or less. An additional RV campsite with water and power would be provided to serve a campground host. A dump station with holding tank would be available for vehicles. There would be one accessible group picnic shelter holding about 7-8 picnic tables for group activities, plus about 6-8 accessible picnic tables for individual or family gatherings. At least half of the individual/family picnic tables would have shelters. Water and electric hookups would be provided in the picnic area, together with a composting toilet.

Steps to the river's edge would be constructed in the day use area, away from the campground.

The number of parking spaces would be increased to 25, to include 2 accessible spaces (1 car, 1 van). Up to seven of the spaces would be located in front of a portable toilet station (accessible) near the eastern edge of the campground. In addition, there would be 6 trailer spaces (1 accessible). Vehicular circulation would be improved by adding a turnaround to the east end of the site, which would include a livery staging loop for two vans with trailers. This turnaround would also provide access to an emergency boat launch. A concrete canoe/kayak launch would be provided at the river, with two rails (no chairlift). This launch would require removing a portion of the former ferry ramp. Also included is an accessible trail to an overlook (accessible) which would allow dramatic views of the river from above. The overlook would be located near the picnic shelters.

### North Side

The north side would be open primarily for river users and hikers seeking primitive riverside camping but would have limited vehicle access.

Alternative C would provide a simple turnaround for vehicles, including vehicles with trailers. Three parking spaces would be provided. One of these spaces would be accessible and one would be for park staff. More walking paths would be provided than under Alternative B. An accessible trail would lead to a north-side overlook above the river. This trail would also serve three to four accessible picnic tables. There would be about 6-9 primitive tent campsites, 3 to 5 of which would be reservable, with the rest being first come, first served. Boaters paddling the planned Green River National Water Trail could use the campsites as a stopover on a multi-day floating trip. The campsites would have fire rings and picnic tables. There would be a canoe/kayak launch similar to the one on the south side, but about 50% smaller and without a rail. No water would be provided at the site.

Alternative C would also provide a pedestrian suspension bridge over the Green River to connect recreational facilities on the south and north sides of the river. The bridge would have a deck elevation of around 450 feet and would be reached either by stairs or ramps extending from the ground surface to the bridge deck. The bridge would be approximately 370 feet in length, with the actual distance depending on whether the bridge was served by stairs or ramps. The principal bridge supports would be located on the benches above the riverbanks, thereby eliminating obstructions at the river's edge.

The following schematic details the facilities contemplated by the preferred Schematic of Preferred Alternative.

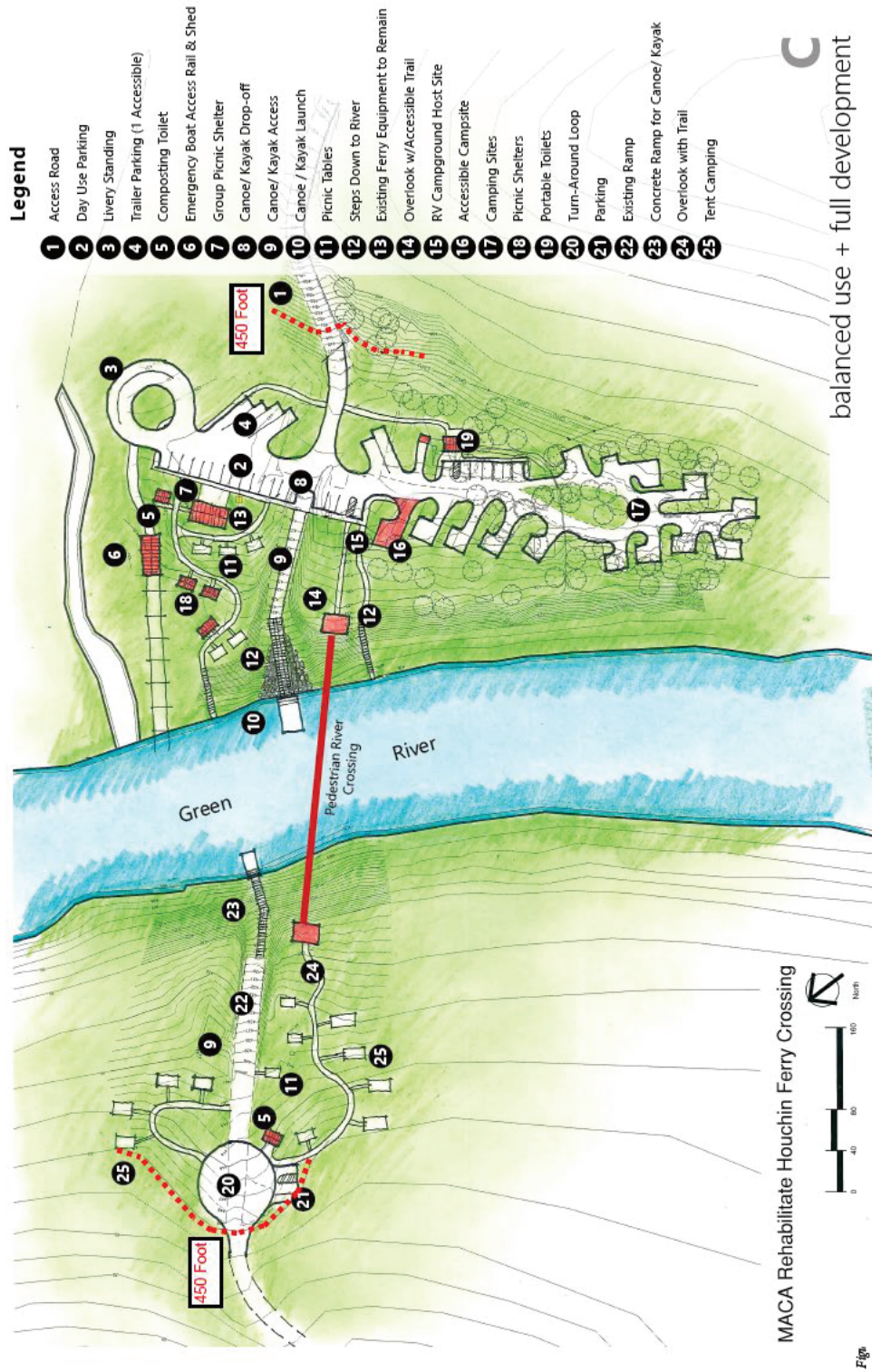
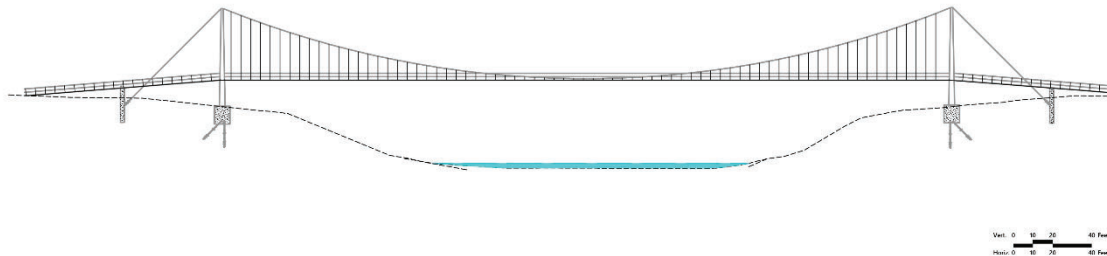


Figure 1. Site Schematic of Preferred Alternative Showing 450-Foot Flood Elevation (100-year flood is 459 feet)





The proposed bridge design is shown in the figure below:



- **APPROXIMATE SPAN TRUSS TYPE LENGTH 370 FT**
- **TRUSS TYPE WITH RAMPS**
- **APPROXIMATE DECK ELEVATION 450 FT**
- **RAMP LENGTHS**
  - **EAST 80' @ 8.0%**
  - **WEST 100' @ 8.0%**
- **ESTIMATED 100-YR FLOOD ELEVATION IS 459' (9' ABOVE BRIDGE DECK)**

**Figure 3.** Pedestrian Suspension Bridge

The following table compares the levels of development in the No-Action and Preferred alternatives:

**Table 1: Comparison of No Action and Preferred Alternatives**

	<b>Alternative A Continue Current Management (Take No Action)</b>	<b>Alternative C Balanced Day &amp; Overnight Use with Enhanced Level of Facility Improvements</b>
<b>South Side</b>	12 parking spaces	25 parking spaces

	No accessible parking spaces	2 accessible parking spaces (1 car, 1 van), included in about 25 parking spaces
	No designated trailer spaces	6 trailer spaces (1 accessible)
	No loop	Livery standing loop – two vans with trailers
	12 campsites, with fire rings and picnic tables	12 campsites: 8 tent-only spaces (1 accessible), and 4 with water and electric hookups for vehicles 20-feet long or less; dump station
	No RV campground host campsite	1 RV campground host campsite with water and electric
	Water spigot at picnic area only	Water spigots/hookups at picnic area and 4 vehicle camping spaces
	No electric at campsites	4 spaces for vehicles 20 ft. or less with water and electric hookups
	Some picnic tables	6-8 picnic tables (accessible), at least 50% to have shelters
	Large group picnic shelter	Group shelter with 7-8 picnic tables (accessible)
		Portable toilets (accessible) and 1 composting toilet
	No emergency boat launch	Emergency boat launch
	No canoe/kayak launch	Canoe/kayak launch with two rails
		Steps to river edge in day use area
	No trail to overlook	Trail to overlook (accessible)
	No overlook	Overlook (accessible)
	Closed ferry; existing ramps above water line; no pedestrian bridge	Pedestrian suspension bridge over river
<b>North Side</b>	Currently closed to visitors, except canoes/kayaks pulling out of Green River	Open for river users and walk-in campers, with primitive riverside camping
		Simple turnaround
		3 parking spaces (1 for park staff, 1 accessible)



		Trail leading to overlook (accessible)
		3-4 picnic tables (accessible)
		1 composting toilet
		Primitive canoe/kayak launch without a rail
		No water on site
		Moderate walking trails
		6-9 primitive campsites with fire rings and picnic tables (3-5 reservable, others first come, first serve)

The preferred alternative is designed to meet the needs of the increasing numbers of visitors to the Houchin Ferry area of the park, to enhance the quality of their experiences there, and to ensure safety and improved efficiency of management and operations. Moving recreation activities away from the Houchin Ferry site was considered and rejected because it would not be as cost-effective or efficient operationally as the proposed project.

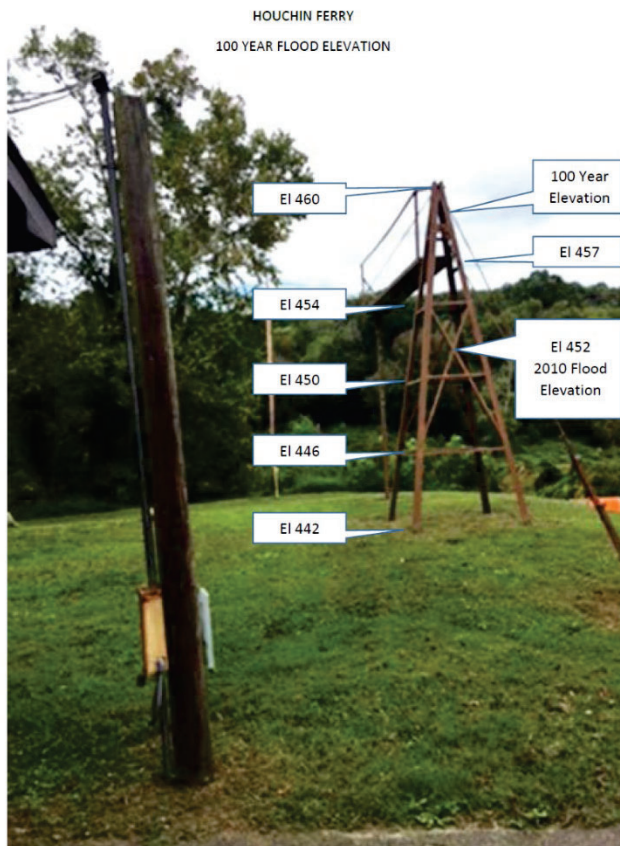
## FLOODPLAINS WITHIN THE HOUCHIN FERRY PROJECT AREA

Under the preferred alternative, the Houchin Ferry recreation site would consist of a five-acre site on the western side of Mammoth Cave National Park (four acres on the south side of the river; one acre on the north side). This site had been used as an automobile ferry for many years until budget sequestration in 2013 prompted the National Park Service to close it. The south side of the site has also long been used as a National Park Service campground. The campground is situated on levelled land on a low bluff above the Green River. The ferry ramps are incised through this bluff (and corresponding high ground on the north side of the river) to reach the former water level. The campground is reached by a single paved road that descends through steep terrain to reach the levelled area that contains all existing visitor use facilities.

All of the Actions associated with the proposed alternative are Class I Actions , and therefore, the Regulatory Floodplain is that associated with the One-Percent Annual Chance Flood, also referred to as the 100-year Flood or the Baseflood (DO 77-2).

The Base floodplain at the Houchin Ferry site near Brownsville, Edmonson County, Kentucky, was mapped in 2010 by the Federal Emergency Management Agency. The entire site, on both sides of the river, is within the base elevation for 100-year flooding, which is estimated to be 459 feet above sea level at this location.

The figure below shows the 100-year floodplain elevation in relation to the ferry towers on the south side of the river. Note that the bottom of the ferry tower (442 feet) is roughly the same elevation as the existing campground and picnic area.



**Figure 4.** Flood elevations, south side of Houchin Ferry site, as measured against former ferry tower. The tower is on contoured bench above river, which flows past the tower in the background. The pedestrian suspension bridge would be at the 450-foot elevation, which is below the 100-year foot elevation.

As is evident from Figure 3, the Houchin ferry site is, and has been, susceptible to flooding during 100-year flood events. In recent years several floods have required equipment evacuation and closure of facilities at Houchin Ferry. These events have caused minor flooding at the Houchin Ferry site. Most of the damage to the facilities at Houchin Ferry has been floodwater induced. Minor flooding would continue to occur from time to time under both the no-action and preferred alternatives. The proposed action will occur well within the 100-year floodplain, which is the Regulatory Floodplain for this type of action, and that flood is expected to have an elevation of 459 feet.

It is expected that similar levels of flooding will continue in the future despite the removal of Lock and Dam No 6 and the anticipated removal of Lock and Dam No. 5. Both of these dams were constructed with low dam heights, meaning that although they worked to back water up into the Green River valley, their impact on water levels during major flood events was and is (in the case of Dam No. 5) essentially undetectable. Based on the "GREEN RIVER - KENTUCKY EXISTING CONDITION -- PERCENT CHANCE EXCEEDENCE FLOODS" graph in the *Green and Barren River Navigation Disposition Study* (USACE 2014, Appendix C), projected flood levels at Houchin Ferry before removal of Lock and Dam No 6 were as follows (based on the discharge versus elevation graph for Brownsville, KY):

<b>Flood</b> (percent chance exceedence)	<b>Elevation</b>	<b>Discharge</b> (cfs) (at Brownsville, KY)*
500 yr (0.2%)	464.5 ft	Not available
100 yr (1%)	459 ft	73,000
50 yr (2%)	456 ft	62,700
20 yr (5%)	452 ft	45,000
10 yr (10%)	449.5	Not available
5 yr (20%)	446.5	Not available
2 yr (50%)	443.5	Not available

\*Includes discharge from Nolin River

Source: USACE 2014, Appendix C

However, the report indicates that the elevation models the same prior to and after removal of Lock and Dam No. 6 for discharges above 16,000 cubic feet per second (cfs). And, according to the Brownsville graph, an annual flood (exceedence frequency 100 per 100 years) has a discharge of 24,900 CFS. Therefore, the flood levels above should be valid even after removal of Lock and Dam No. 6. Stated another way, flood levels at Houchin Ferry should be the same with or without Lock and Dam No. 6 for all but the smallest floods. The park is therefore working on the assumption that flooding will continue along historic lines notwithstanding the substantial drop in the Green River's normal water elevation at Houchin Ferry.



**Figure 5.** View of Current Picnic Shelter, Looking in Direction of Green river. This photograph, and the ones on the following page, were taken on February 26, 2019, when water reached the approximately 440-foot elevation level (about 19 feet below the 100-year flood level). The river commonly floods to this level every few years.





View of Top of Existing Ramp Down to Green River



View Towards Western End of Camp Sites

**Figure 6.** Flooding on February 26, 2019.

## JUSTIFICATION FOR USE OF THE FLOODPLAIN

As noted above, the Houchin Ferry site generally, and the south bank campground in particular, have been in place for many years. Under the preferred alternative, the existing recreational facilities on the four-acre site south side of the river would remain in place. In addition, some new facilities would be added on the south side, and the one-acre site on the north side of the river would be newly developed. No areas outside of the Regulatory Floodplain for this type of action were considered by the study team. The incised nature of the Green River valley means that the terrain near the river is too steep for recreational development except in those locations flat enough to have been used historically for ferry crossings. Even in these locations, developable land is at a premium, and the Houchin Ferry site is no exception. The artificial, contoured bench on the south side of this site was created many years ago to make possible the present recreation area. The north side is less

steep than the south side, but a developable area that is both outside the Regulatory Floodplain and acceptably close to the river is not available.

The justification for retaining, upgrading, and augmenting existing structures in the 100- year floodplain is as follows:

- As noted above, the steep adjacent topography prevents moving the existing facilities farther up-slope on the south side.
- The Houchin Ferry site is needed to provide park visitors with opportunities for land and water-based recreation in the western part of the park. Most of the park's recreational facilities are located in the central and eastern part of the park. Demand for recreational facilities is increasing on the west end and there is no place other than Houchin Ferry to provide these facilities safely and at reasonable cost. Demand for canoe and kayaking opportunities has been growing especially quickly in this part of the park, with Houchin Ferry being projected as a stop on the Green and Nolin Rivers National Water Trail.
- Existing motor boat launching facilities need to be retained and improved because they support park management activities that require access to the Green River. At present, the only available river access points are (a) the Green River Ferry crossing area, located 12 river miles upstream from the Houchin Ferry site, and (b) the Brownsville boat ramp, located down river and outside of the park. Improving the Houchin Ferry site will greatly improve access to the river for all park staff but will be of particular benefit to law enforcement rangers, who will be able to reduce response times and thereby enhance visitor safety. At present, in certain river conditions, park staff must either access the river at the Green River Ferry access point or else use a canoe or kayak to obtain local access to areas between Houchin Ferry and Lock 6.
- Retaining facilities at Houchin Ferry will allow the park to take advantage of a previously disturbed site with existing, albeit limited utilities.
- The pedestrian bridge needs to be built in the Regulatory Floodplain because it is fundamental to the viability of the proposed action. The bridge is needed to meet strong local sentiment for the National Park Service to restore connectivity between the two sides of the Green River at the former ferry site. Moreover, the bridge is also needed to make it feasible for the National Park Service to develop and maintain visitor facilities on the north side of the river. The driving distance between the south and north Houchin Ferry sites is such that without a bridge it would not be feasible in terms of either time or cost for the National Park Service to operate recreational facilities on the north bank of the river. The National Park Service has looked at alternative crossing methods (e.g., a low-water bridge) but all have proved too costly, both financially and in the nature and amount of environmental impacts. The pedestrian bridge is the most cost-effective and environmentally friendly approach to meeting anticipated recreational demand at the Houchin Ferry site.

## FLOOD HAZARDS

Flood risks associated with the proposed action include risk to human health and life due to overnight occupation and risk to capital investment resulting from damage to existing and expanded infrastructure. As shown in Figures 1 and 4 above, virtually all existing and new infrastructure at the Houchin Ferry site would be subject to inundation during the Regulatory Flood. Infrastructure would be subject to flood depths ranging from as little as 1 foot to as much as 17 feet during the



Regulatory Flood. Electrical transformers would be located on poles outside the Regulatory Floodplain.

Planned construction activities would occur in areas of the site already impacted by development, but the extent of new construction means that new impacts to property and to floodplain functions and values would occur. Additional pavement would have to be installed to accommodate new parking spaces and the livery standing area. Other new facilities affecting the floodplain and subject to flood damage include the emergency boat launch, increased number of picnic tables, and composting and portable toilets. However, the additional pavement and structures are unlikely to negatively affect flood storage or groundwater recharge to a measurable degree, or degrade overall riparian services, because (a) the paving footprint will still be small even after expansion, (b) the boat launch will be designed so as to minimally impede floodwaters, and (c) the portable toilets can be removed from the 100-year floodplain during flood events.

The principal flood risk associated with the preferred alternative comes from the proposed suspension bridge. Although no piers supporting the bridge would be placed in the active river channel or along the riverbanks, and although the bridge supports would be constructed on contoured benches on low bluffs above the river, the supports would still be within the 100-year floodplain. Likewise, the bridge deck's proposed elevation of 450 feet above sea level is less than the 100-year flood elevation of 459 feet. Portions of the bridge would thus be subject to damage during 1%- Chance Annual Flood events. However, even though portions of the footbridge will be within the Regulatory Flood, the effect on flow is not expected to increase the associated flood hazard, as floods are not "flashy" in this area and floodwaters are typically slow to rise. To address risks associated with the bridge, the bridge would be designed to minimize both obstruction to floodwaters and damage to the structure itself (see "Mitigation" section below).

The flood hazard to capital investment at Houchin ferry is moderated by the fact that typical basin lag times for flood events are approximately one day. A basin lag of one day suggests that after a significant regional rainfall event, approximately one day will elapse before flood conditions occur at the Houchin Ferry site, providing ample time for evacuation of removable property as well as park visitors. Furthermore, the experience of park personnel is that smaller, local rainfall events typically do not produce flood conditions at the site. More regional rainfall is typically needed to produce flooding conditions at the site.

There is no evidence of scour on the terrace level that the development would occur on. This suggests low velocities of flow, and the main risk on the terrace is sedimentation (getting covered by mud) rather than removal by scouring. Water depths are typically shallow when it does reach the floodplain, but water depths during extreme flood events could reach 20 feet.

Regarding risk to human health and safety, ample notice of severe weather is provided by the National Weather Service and other agencies, making warning and evacuation a practical option for protection of human life both at the bridge and the entire Houchin Ferry site.

## **MITIGATION**

The situations that lead to storm-caused high-water events, and the scope and duration of these events, are known by park staff, making warning and evacuation a practical option for protection of human life. Mammoth Cave National Park will continue to maintain an active floodplain evacuation protocol. This protocol entails removing or securing park property during a flood; monitoring

communications during floods; and conducting rescue and salvage operations if necessary. This protocol has proven effective in maintaining safety and reducing property damage during storms, and it will continue to be reviewed and updated.

Some site infrastructure, including portable toilets, could easily be moved in advance of flooding. One composting toilet would remain in place on each side of the river below the 100-year flood level and could not be moved. These and other facilities that cannot be moved would be subject to flood damage. However, based on historical precedent, the nature of the facilities is such that damage would either be minor or the items, being of low value, could easily be replaced. The existing campground and picnic area have been in place for many years and have experienced a number of flooding incidents. Damage to property/facilities has been minor.

The design of new structures throughout the Houchin Ferry site would incorporate methods for minimizing storm damage as contained in the National Flood Insurance Program's Floodplain Management Criteria for Flood-Prone Areas (44 CFR section 60.3) and in accordance with local, county or state requirements for flood-prone areas. For the pedestrian suspension bridge, bridge decking would consist of metal slats spaced so as to minimize resistance to flood waters while still ensuring human safety during regular use. Periodic damage to the bridge would still likely occur given that the bridge decking is 9 feet below the Regulatory Flood. Still, the footbridge is sufficiently important to the project that the park is willing to accept periodic flood damage to the structure as the price of providing recreational facilities on both sides of the river.

The environmental analysis contained in the Plan and this Statement of Findings constitute the environmental compliance necessary to implement the Houchin Ferry development should the preferred alternative be selected.

## **SUMMARY**

Through the FSOE process the National Park Service has determined that there are no practicable, non-floodplain locations for the proposed action. Potential impacts to human life and health will be mitigated through the existing MACA Flood Evacuation Plan. The potential impacts to the proposed capital investment will be mitigated through a combination of implementing design standards consistent with the National Flood Insurance Program's Floodplain Management Criteria for Flood-Prone Areas (44 CFR section 60.3) and in accordance with local, county or state requirements for flood-prone areas, and selecting movable or sacrificial infrastructure such as the bridge deck, picnic tables, and fire rings, portable toilets, etc. Despite an increase in parking spaces, trailer spaces, other paved areas, and the emergency boat launch, the natural and beneficial floodplain values are not expected to be negatively impacted to any measurable extent because the cumulative amount of additional paving to the site will be small and above-ground structures, when not removable, will be designed to minimally impede flood water flows. The replacement, restoration, or development of facilities and infrastructure within the site would not expand beyond the currently disturbed campground/ferry footprint. Therefore, the National Park Service finds that the proposed action would not have any material additional adverse impacts on floodplains and their associated values.

### ***Statement of Findings References:***

Executive Order 11988, "Floodplain Management" (May 28, 1980). Executive Order of the President of the United States.

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