



Hatchie/Loosahatchie, Mississippi River Mile 775-736, TN and AR Final Integrated Feasibility Report and Environmental Assessment



Appendix 2a – Endangered Species

February 2024

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Section 1

Introduction

1.1 INTRODUCTION

This appendix addresses the potential impacts of the recommended plan on species federally listed under the Endangered Species Act (ESA) of 1973, as amended, that are known to use the types of aquatic and floodplain habitats in the proposed action area. Potential effects to candidate species are also discussed. There are no critical habitats that intersect with the proposed action area. The effects analyses are based on existing data, knowledge, experience, and discussions with the interagency environmental team and wildlife experts from the non-Federal sponsor (NFS) during the plan formulation stages of this study. The U.S. Army Corps of Engineers (USACE) and the NFS, which includes stakeholders from various state and Federal wildlife agencies, formulated the measures in the recommended plan for the overall benefit of federally listed threatened and endangered species, Birds of Conservation Concern, and priority state listed species identified on the State Wildlife Action Plans as described throughout the main report. However, there is the potential for some minor temporary impacts to listed species and/or their habitats, such as minimal tree clearing for access and temporary aquatic disturbances during construction. Thus, the effects determination for the recommended plan is a may affect but not likely to adversely affect (NLAA) determination for listed species. Site-specific ESA surveys and associated tiered ESA consultations will be conducted for any measure in the recommended plan prior to implementation. Additional details on the site-specific surveys are included in the monitoring Appendix 9 (i.e., baseline monitoring) and within this appendix. These surveys and associated tiered ESA consultations during implementation stages will allow for time-sensitive (1-2 years) effect determinations and will incorporate any changed habitat or species presence/absence conditions, or changes in listing status that could occur at each of the measure locations included in the recommended plan (RP) prior to its implementation. Throughout this appendix, the measures that comprise the recommended plan are grouped and discussed according to measure type (i.e., forest stand improvements, dike notching within secondary channels, etc.) due to the similar potential for impacts.

1.2 CONSULTATION TO DATE

Table 2a-1 describes the ongoing project ESA coordination to date. U.S. Fish and Wildlife Service (USFWS) offices and personnel involved included: Jason Phillips (USFWS-AR and primary POC), Robbie Sykes (USFWS-TN), Angie Rodgers (USFWS-Lower Mississippi River Conservation Committee (LMRCC) Coordinator and NFS lead), Angela Erves (USFWS-LMRCC), Yvonne Allen (USFWS – GIS and Remote sensing), Keith McKnight (USFWS – Lower Mississippi Valley Joint Venture), Randy Cook (USFWS – Lower Hatchie National Wildlife Refuge), Evan Boone (USFWS – Fisheries Biologist), and Caleb Aldridge (USFWS – Invasive Carp Coordinator).

Table 2a-1. Coordination Table

Event	Date(s)	Results
Interagency planning charrettes	1 Sept. 2021, 21-22 Sept. 2021	Described purpose and need, planning process overview, schedule, coordination requirements, GIS portal for data sharing, resource significance, conceptual ecological model, identified problems and opportunities, constraints, coordination requirements, schedule, identified need for sub-teams, planned virtual public scoping meeting
Endangered Species Act (ESA) Consultation Species Lists	15 Sept. 2021, 17 Nov. 2022	Received initial ESA species list early in the study and an updated list since it was over 1-year. Per 88 Federal Rule 4908, the Northern long-eared bat has been reclassified from a threatened to an endangered species under the ESA with an effective date of March 31, 2023.
Meetings of Interagency sub-teams for each of 4 objectives	27 October 2021, 17-18 Nov. 2021, 1-2 December 2021, 8-9 December 2021	Sub-team meetings held for each of the 4 objectives where experts in their respective fields identified and compiled relevant ecological data, added data to the GIS Portal for data sharing, and refined measures for each objective: 1) measures to benefit the vegetative mosaic, 2) measures to benefit large river habitats, 3) measures to benefit floodplain waterbodies, and 4) measures to improve recreational opportunities and access to public spaces.
Interagency Geographic Complexes Meetings	10 February 2022, 1 March 2022, 8 April 2022, 14 April 2022, 27 April 2022, 10 May 2022, 19 May 2022, 17 June 2022, 21 June 2022	Study area was delineated into 11 geographic complexes based off hydrological and geomorphological attributes allowing team to move from conceptual ideas to site-specific locations of measures.
USFWS scoping comments	1 December 2022	USFWS letter supporting the proposed restoration efforts, documenting that the Arkansas Field Office is partnering with the Tennessee Field Office to provide technical assistance and identifying the Arkansas Field Office as the lead office and primary POC for the study.
Draft Fish and Wildlife Coordination Act	12 January 2023	USFWS draft Fish and Wildlife Coordination Act report assesses impacts of the proposed project on fish and wildlife resources and was integrated into the draft report.
ESA Section 7(a)(1) Conservation Plan for the Interior Least Tern, Pallid Sturgeon, and Fat Pocketbook	November 2014	Strategies and actions identified in the conservation plan to benefit ESA species such as increased connectivity and habitat complexity of secondary channels were used throughout

Event	Date(s)	Results
Mussel in the Lower Mississippi River (LMR)		the study's plan formulation and are incorporated into the measures comprising the RP.
ESA Section 7(a)(2) Concurrence	22 February 2023	Received concurrence with the may affect, not likely to adversely affect determination for listed species.

1.3 PURPOSE AND NEED FOR THE PROJECT

The purpose and need for the proposed action are to restore habitat and ecosystem function along an approximate 39-mile reach of the LMR and its floodplain in harmony with the existing USACE mission areas of ensuring navigation and flood risk reduction.

The effort is a final response to the 2018 study authority to investigate habitat restoration for one of the eight reaches identified as priorities in the report prepared by the Secretary pursuant to section 402 of the Water Resources Development Act of 2000, titled "Lower Mississippi River Resource Assessment; Final Assessment in Response to Section 402 of WRDA 2000" and dated July 2015.

1.4 PROJECT DESCRIPTION AND LOCATION

The project area is a 39-mile reach of the Mississippi River and the surrounding batture (the riverside area between the levee and main channel) beginning at the mouth of the Hatchie River and extending south to the mouth of the Wolf River Harbor (River Mile 775-736) (Figure 2a-1). The project area is located in Lauderdale, Tipton, and Shelby Counties, in Tennessee and Mississippi and Crittenden Counties in Arkansas.

The recommended plan, Alternative C3, is a comprehensive plan that collectively addresses historically significant and ecologically important habitats across the 11 geographic complexes of the study area. There are 38 proposed measures across the study area designed to restore ecological structure and function to the mosaic of habitats along the Mississippi River and its active floodplain and an additional two measures designed to improve recreational opportunities, public education, and access to public spaces in the study area. The proposed activities include reforestation and forest stand improvements to the bottomland hardwood (BLH) community focusing on increases in hard mast producing species, creation and enhancement of cypress-tupelo forest communities, creation of riparian buffers along the Mississippi River, restoration and creation of wetland complexes and moist soil management areas, restoration of flow in meander scarps by lowering invert elevations of obstructions and dike notching, increasing connectivity of secondary channels through dike notching, bank protection within secondary channels, installation of large woody debris traps in secondary channels for aquatic invertebrates and fish, and restoring flow/connectivity to floodplain waterbodies primarily through lowering invert elevations of obstructions.

The recommended plan provides 4,673 average annual habitat units (AAHUs) to eight unique habitats that support federally listed endangered aquatic species, such as the fat pocketbook mussel and the pallid sturgeon, and critical vegetative habitats, such as rivercane, that host numerous species of conservation concern. The recommended plan also supports the promotion of alligator gar spawning habitats, a species known to assist in the control of invasive species such as invasive carp. This recommended plan selection also contributes to the protection of meander scarps, which are rare geological features that no longer occur naturally due to engineering controls along the Mississippi River. Restoring hydrologic connectivity to meander scarps would promote habitat resiliency to sensitive species that are at risk of endangerment resulting from increases in drought intensity due to climate change.

The recommended plan (Alternative C3) and 38 measures with ecological output and is displayed in Figure 2a-1 below. Measure descriptions associated with the recommended plan are included in Table 2a-2 below. Additional details of the measures included can be found in the main report.

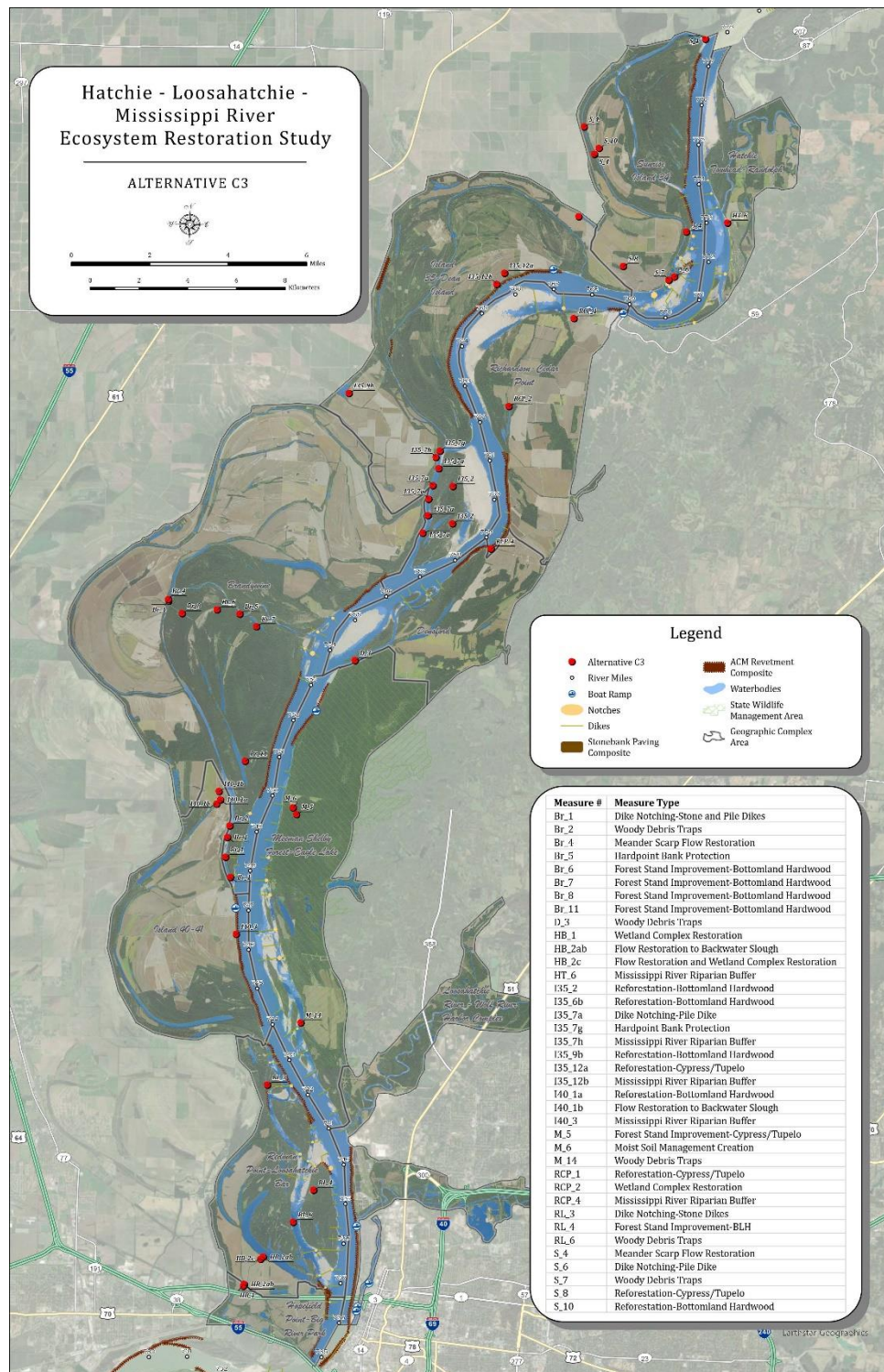


Figure 2a-1. Map of the study area and ecosystem restoration measures comprising the recommended plan.

Table 2a-2. Measure descriptions of the recommended plan and associated habitats.

	Measure Number	Habitat	Measure Type
1	BR_1	Secondary Channels	Dike Notching – Stone and Pile Dikes
2	BR_2	Secondary Channels	Woody Debris Traps
3	BR_4	Meander Scarp/Tertiary Channels	Meander Scarp Flow Restoration
4	BR_5	BLH	Hardpoint Bank Protection
5	BR_6	BLH	Forest Stand Improvements - BLH
6	BR_7	BLH	Forest Stand Improvements - BLH
7	BR_8	BLH	Forest Stand Improvements - BLH
8	BR_11	BLH	Forest Stand Improvements - BLH
9	D_3	Secondary Channels	Woody Debris Traps
10	HB_1	Seasonally Herbaceous Wetland	Wetland Complex Restoration
11	HB_2ab	Slough	Flow Restoration to Backwater Slough
12	HB_2c	Seasonally Herbaceous Wetland	Flow Restoration and Wetland Complex Restoration
13	HT_6	Riverfront Forest – Riparian Buffers	Restoring Habitat Complexity in Borrow Area
14	I35_2	BLH	Reforestation-BLH
15	I35_6b	BLH	Reforestation-BLH
16	I35_7a	Secondary Channels	Dike Notching-Pile Dike
17	I35_7g	Secondary Channels	Hardpoint Bank Protection
18	I35_7h	Riverfront Forest – Riparian Buffers	MS River Riparian Buffer
19	I35_9b	BLH	Reforestation-BLH
20	I35_12a	Cypress Tupelo	Reforestation-Cypress/Tupelo
21	I35_12b	Riverfront Forest – Riparian Buffers	MS River Riparian Buffer
22	I40_1a	BLH	Reforestation-BLH
23	I40_1b	Slough	Flow Restoration to Backwater Slough
24	I40_3	Riverfront Forest – Riparian Buffers	MS River Riparian Buffer
25	M_5	Cypress Tupelo	Forest Stand Improvements-Cypress/Tupelo
26	M_6	Moist Soil	Moist Soil Management Creation

	Measure Number	Habitat	Measure Type
27	M_14	Secondary Channels	Woody Debris Traps
28	RCP_1	Cypress Tupelo	Reforestation-Cypress/Tupelo
29	RCP_2	Seasonally Herbaceous Wetland	Wetland Complex Restoration
30	RCP_4	Riverfront Forest	MS River Riparian Buffer
31	RL_3	Secondary Channels	Dike Notching-Stone Dikes
32	RL_4	BLH	Forest Stand Improvement-BLH
33	RL_6	Secondary Channels	Woody Debris Traps
34	S_4	Meander Scarp/Tertiary Channels	Meander Scarp Flow Restoration
35	S_6	Secondary Channels	Dike Notching-Pile Dike
36	S_7	Secondary Channels	Woody Debris Traps
37	S_8	Cypress Tupelo	Reforestation-Cypress/Tupelo
38	S_10	Riverfront Forest – Riparian Buffers	Reforestation-BLH
39	LW_1	N/A – Recreation only	Interpretive Media and Demonstration
40	M_2	N/A – Recreation only	Trails and Signage

The cost share NFS for the proposed activities is the Lower Mississippi River Conservation Committee comprised of the state water quality and wildlife agencies along the LMR. Likely cost-share construction sponsors would be comprised of the States of Arkansas and Tennessee and construction is expected to extend for several years dependent on future annual appropriations.

1.5 ACTION AREA

The action area is the specific spatial polygon encompassing all the areas where land, water, or air will be detectably changed due to the proposed project and any other activities that would not occur but for the proposed action. The action area is shown in Figure 2a-2 below with habitats associated with each measure described in Table 2a-2. Additional details regarding the measures included can be found in the main report.

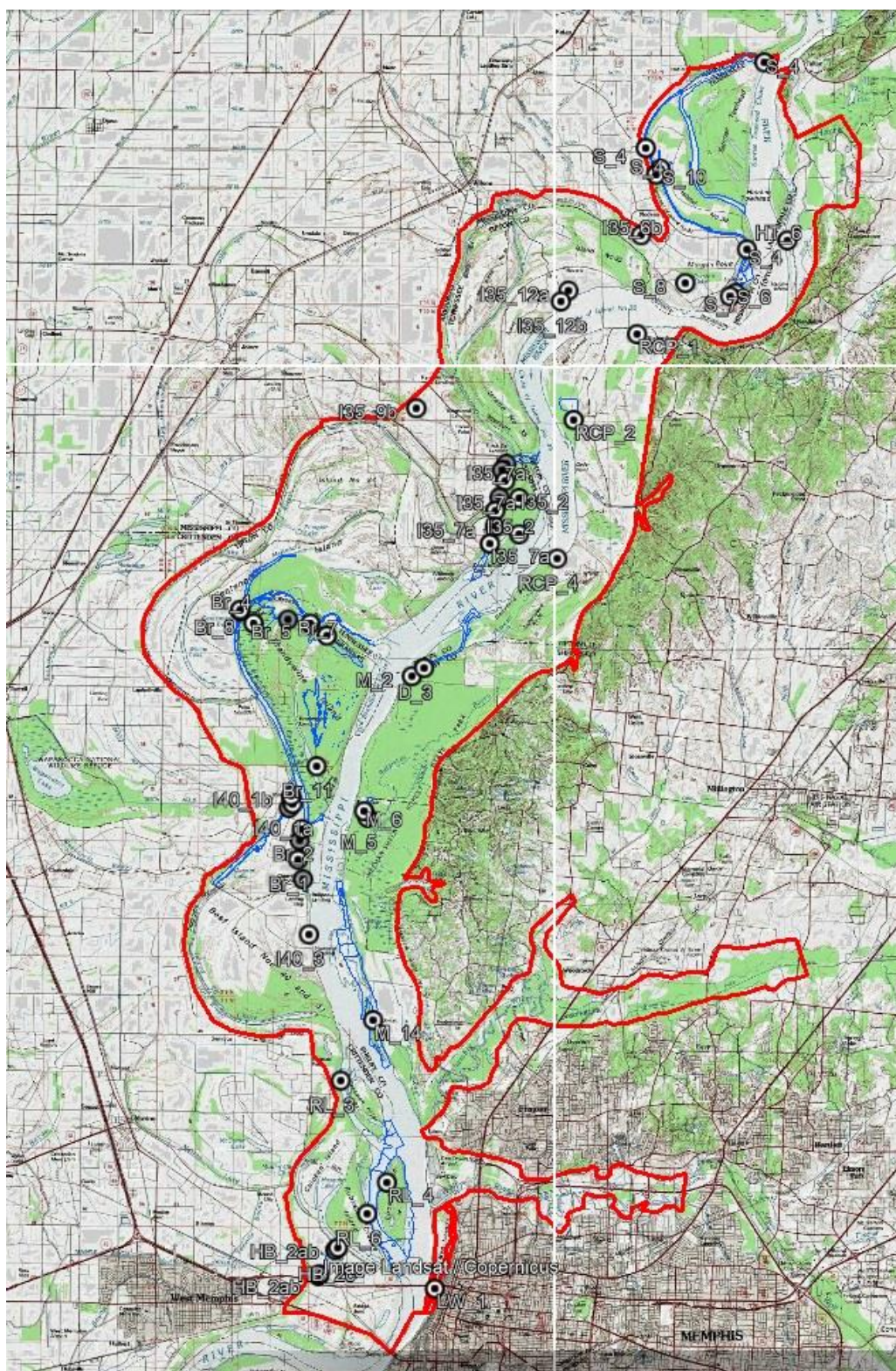


Figure 2a-2. Map of the action area (shown in blue), study area (shown in red) and ecosystem restoration measures comprising the recommended plan.

Section 2

Species Effects

2.1 THREATENED, ENDANGERED, PROPOSED THREATENED OR PROPOSED ENDANGERED SPECIES

In letters dated 15 September 2021 and (updated) 17 November 2022, the USFWS provided a list of threatened, endangered, proposed and candidate species that may occur within the boundaries of the study area and/or may be affected by the proposed project. Additional correspondence with USFWS resulted in one additional species (alligator snapping turtle) to be included as a proposed threatened species that may be affected by the proposed project. The list of species is shown in Table 2a-3 below.

Table 2a-3. Threatened, endangered, or candidate species in study area.

Species (Common Name)	Scientific Name	Species Group	Status
Indiana Bat	<i>Myotis sodalis</i>	Mammal	Endangered
Northern Long-eared Bat	<i>Myotis septentrionalis</i>	Mammal	Threatened*
Tricolored Bat	<i>Perimyotis subflavus</i>	Mammal	Proposed Endangered
Eastern Black rail	<i>Laterallus jamaicensis</i> spp. <i>jamaicensis</i>	Bird	Threatened
Piping Plover	<i>Charadrius melodus</i>	Bird	Threatened
Red Knot	<i>Calidris canutus rufa</i>	Bird	Threatened
Pallid Sturgeon	<i>Scaphirhynchus albus</i>	Fish	Endangered
Fat Pocketbook Mussel	<i>Potamilus capax</i>	Clam	Endangered
Monarch Butterfly	<i>Danaus plexippus</i>	Insect	Candidate
Pondberry	<i>Lindera melissifolia</i>	Flowering Plant	Endangered
Alligator Snapping Turtle	<i>Macrochelys temminckii</i>	Reptile	Proposed Threatened

*Northern Long-eared Bat is being reclassified as an endangered species under the Endangered Species Act of 1973, as amended with an effective date of March 31, 2023 (88 FR 4908).

2.1.1 Species Descriptions

This section provides information on the species' background, its biology and life history that is relevant to the proposed project within the action area that helped to inform the effects analysis.

2.1.1.1 Indiana Bat

The Indiana bat was listed as federally endangered in 1967 (32 FR 4001). The Indiana bat is a medium-sized *Myotis*, closely resembling the little brown bat (*Myotis lucifugus*) but differing in coloration. Its fur is a dull grayish chestnut rather than bronze, with the basal portion of the hairs on the back a dull-lead color. This bat's underparts are pinkish to cinnamon, and its hind feet are smaller and more delicate than in *M. lucifugus*. The calcar (heel of the foot) is strongly keeled.

Indiana bats are found over most of the eastern United States. They hibernate in large numbers in relatively few caves and are thus, vulnerable to disturbances. During summer, they roost under the peeling bark of dead and dying trees and often forage on flying insects along rivers or lakes and in upland forests. There are no known caves within the action area; however, the floodplain forests provide suitable roosting habitat.

2.1.1.2 Northern Long-eared Bat

The northern long eared bat (NLEB) was listed as federally threatened with an interim 4(d) rule in 2015 (80 FR 17973) and was proposed for reclassification to endangered in 2022 (87 FR 16442). Per 88 FR 4908, the NLEB has been reclassified from a threatened to an endangered species under the ESA with an effective date of 31 March 2023. The NLEB is a medium-sized bat about 3 to 3.7 inches in length but with a wingspan of 9 to 10 inches. As its name suggests, this bat is distinguished by its long ears, particularly as compared to other bats in its genus, *Myotis*, which are bats noted for their small ears (*Myotis* means mouse-eared). The NLEB is found across much of the eastern and north central United States and all Canadian provinces from the Atlantic coast west to the southern Northwest Territories and eastern British Columbia. The species range includes 37 states. White-nose syndrome, a fungal disease known to affect bats, is currently the predominant threat to this bat, especially throughout the northeast, where the species has declined by up to 99 percent from pre-white-nose syndrome levels at many hibernation sites. Although the disease has not yet spread throughout the NLEB entire range (white-nose syndrome is currently found in at least 25 of 37 states where the NLEB occurs), it continues to spread. Experts expect that where it spreads, it will have the same impact as seen in North America.

During summer, NLEB roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. The NLEB seems opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. It has also been found, rarely, roosting in structures like barns and sheds. In winter, NLEBs hibernate in

caves and mines. NLEB could be found roosting in trees within the action area during the summer.

2.1.1.3 Tricolored Bat

The tricolored bat was proposed for Federal listing under the ESA in 2022 (87 FR 56381). The tricolored bat is a small insectivorous bat that is distinguished by its unique tricolored fur and often appears yellowish to nearly orange. The once common species is wide ranging across the eastern and central United States and portions of southern Canada, Mexico and Central America. During the winter, tricolored bats are often found in caves and abandoned mines, although in the southern United States, where caves are sparse, tricolored bats are often found roosting in road-associated culverts where they exhibit shorter torpor bouts and forage during warm nights. During the spring, summer, and fall, tricolored bats are found in forested habitats where they roost in trees, primarily among leaves of live or recently dead deciduous hardwood trees, but may also be found in Spanish moss, pine trees, and occasionally human structures. Tricolored bats face extinction due primarily to the range-wide impacts of white-nose syndrome, a deadly disease affecting cave-dwelling bats across the continent. White-nose syndrome has caused estimated declines of more than 90 percent in affected tricolored bat colonies across majority of the species range.

During summer, tri-colored bats may roost underneath bark, in cavities, or in crevices of both live and dead trees. They could also be found foraging in open areas, along edges, or over water within the action area.

2.1.1.4 Eastern Black Rail

The Eastern Black Rail was listed as federally threatened in 2020 (85 FR 63764). The black rail is the smallest rail species in North America. Black rails can be found in tidally or non-tidally influenced freshwater or brackish saltwater meadows and marshes. These habitats are usually densely vegetated; however, this species may occasionally occupy upland portions of these habitats. In addition, black rails may occupy impounded and non-impounded wetlands. Little is known about the black rail during migration; however, some evidence suggest that it may use wet prairies, meadows and hayfields during migration. Documented detections of this species inland along the Mississippi River are exceptionally rare, though there have been scattered reports.

2.1.1.5 Piping Plover

The piping plover was listed as federally threatened in 1985 (50 FR 50626). The piping plover (*Charadrius melodus*) is a small migratory shorebird that nests and feeds along coastal sand and gravel beaches in North America. Identifying characteristics include the following:

Size: 18 cm (7.25 in) in length. Color: Pale brown above, lighter below; black band across forehead; bill orange with black tip; legs orange; white rump. Male: Complete or incomplete black band encircles the body at the breast. Female: Paler head band; incomplete breast band. Winter coloration: Bill black; all birds lack breast band and head band.

Breeding season: The piping plover is a potential transient migrant and wintering species that almost exclusively use open sand and beach habitat. The piping plover could potentially occur in the Mississippi Alluvial Valley for a brief period during the fall and/or spring migration likely found along exposed sand bars near secondary channels in the action area.

2.1.1.6 Red Knot

The red knot was listed as federally threatened in 2014 (79 FR 73706). The red knot is a medium-sized, highly migratory shorebird that can travel more than 9,300 miles from their wintering grounds in the Atlantic and Gulf coastal areas and extending down to South America and their nesting grounds in the high Canadian Arctic. Identifying characteristics include the following:

Length: 25-28 cm. Adults in spring: Above finely mottled with grays, black and light ochre, running into stripes on crown; throat, breast and sides of head cinnamon-brown; dark gray line through eye; abdomen and undertail coverts white; uppertail coverts white, barred with black. Adults in winter: Pale ashy gray above, from crown to rump, with feathers on back narrowly edged with white; underparts white, the breast lightly streaked and speckled, and the flanks narrowly barred with gray. Adults in autumn: Underparts of some individuals show traces of the "red" of spring.

Although not expected, the red knot could potentially occur in the Mississippi Alluvial Valley for a brief period during the fall and/or spring migration seasons. Potential habitats would be wetland or sandbar habitats near secondary channels of the Lower Mississippi River.

2.1.1.7 Pallid Sturgeon

The pallid sturgeon was listed as federally endangered in 1990 (55 FR 36641). The pallid sturgeon was first recognized as a species different from shovelnose sturgeon by S. A. Forbes and R. E. Richardson in 1905 based on a study of nine specimens collected from the Mississippi River near Grafton, Illinois (Forbes and Richardson 1905). They named this new species *Parascaphirhynchus albus*. Later reclassification assigned it to the genus *Scaphirhynchus* where it has remained (Bailey and Cross 1954; Campton et al. 2000). Pallid sturgeon's have a flattened shovel-shaped snout; a long, slender, and completely armored caudal peduncle (the tapered portion of the body which terminates at the tail); and lack a spiracle (small openings found on each side of the head) (Forbes and Richardson 1905). As with other sturgeon, the mouth is toothless, protrusible (capable of being extended and withdrawn from its natural position), and ventrally positioned under the head. The skeletal structure is primarily composed of cartilage rather than bone.

Pallid sturgeon are a main channel species that avoid backwaters and small tributaries. They inhabit deep thalwegs with hard-packed, sandy substrate, or channel border areas with steep shorelines near fast water. Pallid Sturgeon access meander scarps and secondary channels as young-of-year based on trawling data.

2.1.1.8 Fat Pocketbook Mussel

Fat pocketbook mussels prefer sand, mud and fine gravel bottoms of large rivers, with their primary fish host being freshwater drum. The species range currently includes the St. Francis River Basin in Arkansas, the Ohio River Basin, and a recent range expansion into some secondary channels on the LMR. Smaller secondary channels like meander scarps would provide suitable habitat for the species due to refugia from high flows and the stable sand, silt, clay substrates they support.

2.1.1.9 Monarch Butterfly

The monarch butterfly is a candidate species and not yet listed or proposed for listing. Adult monarch butterflies are large and conspicuous, with bright orange wings surrounded by a black border and covered with black veins. The black border has a double row of white spots, present on the upper side of the wings. Adult monarchs are sexually dimorphic, with males having narrower wing venation and scent patches. The bright coloring of a monarch serves as a warning to predators that eating them can be toxic.

During the breeding season, monarchs lay their eggs on their obligate milkweed host plant (primarily *Asclepias* spp.), and larvae emerge after two to five days. Larvae develop through five larval instars (intervals between molts) over a period of nine to 18 days, feeding on milkweed and sequestering toxic chemicals (cardenolides) as a defense against predators. The larva then pupates into a chrysalis before emerging six to 14 days later as an adult butterfly. There are multiple generations of monarchs produced during the breeding season, with most adult butterflies living approximately two to five weeks; overwintering adults enter reproductive diapause (suspended reproduction) and live six to nine months.

In many regions where monarchs are present, monarchs breed year-round. Individual monarchs in temperate climates, such as eastern and western North America, undergo long-distance migration, and live for an extended period of time. In the fall, in both eastern and western North America, monarchs begin migrating to their respective overwintering sites. This migration can take monarchs distances of over 3,000 km and last for over two months. In early spring (February-March), surviving monarchs break diapause and mate at the overwintering sites before dispersing. The same individuals that undertook the initial southward migration begin flying back through the breeding grounds and their offspring start the cycle of generational migration over again.

The monarch butterfly lives in a variety of habitats throughout North America but need milkweed for breeding. Monarch butterflies could be found in much of the available habitat where flowering plants are present in the study area.

2.1.1.10 Pondberry

Pondberry was listed as federally endangered in 1986 (50 FR 32581). Pondberry, *Lindera melissifolia*, is a deciduous shrub, growing from less than 1 ft. (30 cm) to, infrequently, more than 6 ft. (2 m) in height. Leaves are aromatic, alternate, elliptical, somewhat thin and membranaceous, with entire margins. Shrubs usually are sparsely branched, with fewer branches on smaller plants. Plants are rhizomatous, frequently propagating by vegetative sprouts and forming clonal colonies. Plants are dioecious (each plant is either a male or a

female) and produce clusters of small, yellow flowers in early spring prior to leaf development from buds on branches produced from the growth during the preceding year. Fruits are drupes that green when immature and ripen to red by fall.

Pondberry populations are generally associated with the shade of a mature forest. In general, it occupies wetland habitats that are normally flooded or saturated during the dormant season, but infrequently flooded during the growing season for extended periods (Tucker 1984). Very few pondberry colonies are known to occur near or within the study area; however, potential locations would be on slight ridges in a ridge and swale BLH community, which is either frequently or periodically flooded or is in proximity to a permanent water body.

2.1.1.11 Alligator Snapping Turtle

Alligator snapping turtle was proposed for federal listing under the ESA in 2021 (86 FR 62434). The alligator snapping turtle (*Macrochelys temminckii*) may be found in large rivers, canals, lakes, oxbows, and swamps adjacent to large rivers. It is most common in freshwater lakes and bayous, but also found in coastal marshes and sometimes in brackish waters near river mouths. Typical habitat is mud bottomed waterbodies, having some aquatic vegetation. Floodplain waterbodies within the study area, including sloughs, borrow areas, meander scarps, and secondary channels are conducive habitat for alligator snapping turtle.

2.1.2 Effects of the Proposed Action

This section describes the effects of the proposed action on listed, proposed, and candidate species, and the habitat on which they depend. Effects include direct interactions (something happening directly to the species) or indirect interactions (something happening to the environment on which a species depends that could then result in effects to the species). These interactions encompass effects that occur both during project construction and those which could be ongoing after the project is finished, including those cumulative effects that are reasonably certain to occur within the action area.

2.1.2.1 Indiana bat, Northern Long-eared bat, and Tricolored bat

USACE anticipates the proposed action may affect but is NLAA the Indiana bat, NLEB, and tricolored bat. Effects to these three bat species are common due to their similar summer roosting habitats in the floodplain forests (i.e., tree cavities, exfoliating bark, and snags) and summer foraging habitats along the floodplain waterbodies within the study area. Negative direct effects to these habitats include minor tree clearing that may be required for access and some increased turbidity of floodplain waterbodies during construction. However, these negative impacts would be minimized by reforesting the disturbed areas after construction. Overall, there will be a positive effect to bat roosting habitat through direct reforestation (i.e., conversion of agricultural fields to BLH and establishment of riparian buffers along the Mississippi River) as trees mature and become large enough for quality roosting habitats. Forest stand improvements are expected to provide for increased bat roosting habitats via tree girdling and promotion of native mast producing trees as well as through optimizing hydrology for forest health (either through reduced ponding or increased connectivity of

floodplain forests depending on hydrologic conditions). Measures affecting these forested bat habitats are shown in Table 2a-2. From a cumulative effects standpoint, there are no expected long-term shifts in land use away from forest in the study area that would negatively impact these species since the study area is entirely within the active Mississippi River floodplain. However, white nose syndrome, a fungal disease that causes mortality in bats, is expected to continue to negatively impact bat populations. This emerging disease was first detected in the United States in 2006 and has since spread to 33 states and seven Canadian provinces. The proposed action should help to provide some resiliency to the bat populations in the larger Mississippi Alluvial Valley with the proposed benefits to forested habitats.

Site-specific ESA surveys related to listed bats and associated tiered ESA consultations will be conducted for any measure in the recommended plan requiring tree clearing prior to implementation. USACE would consult with the local USFWS Ecological Services Field Office after congressional appropriations are received when the baseline monitoring is conducted prior to construction. USACE would review the most updated bat survey guidelines to determine if presence/absence surveys for listed bats are necessary and how the survey must be conducted in consultation with the USFWS.

2.1.2.2 Eastern Black Rail

USACE anticipates the proposed action may affect but is NLAA the eastern black rail. Presence of the eastern black rail within the study area would be exceptionally rare. However, those measures described in Table 2a-2 that restore wetland complexes through restoring hydrology and converting agricultural lands to seasonal herbaceous wetlands via a wetland seed mix, and those measures focused on moist soil management areas provide the potential for increased eastern black rail habitat.

2.1.2.3 Piping plover and Red Knot

USACE anticipates the proposed action may affect but is NLAA the piping plover and the red knot. Both species are extremely rare migrants that could be found and benefit from those measures shown in Table 2a-2 focused on moist soil management areas, seasonal herbaceous wetlands through wetland complex restoration, and possibly sandbars and mudflats within secondary channels through increased connectivity via dike notching.

2.1.2.4 Pallid Sturgeon

USACE anticipates the proposed action may affect but is NLAA the pallid sturgeon. Pallid sturgeon would benefit from the measures shown in Table 2a-2 focused on increasing connectivity of secondary channels through dike notching, increasing habitat complexity via woody debris traps, and restoring flow in meander scarps. These measures are consistent with the strategies and actions identified in the ESA Section 7(a)(1) Conservation Plan for the Interior Least Tern, Pallid Sturgeon, and Fat Pocketbook in the Lower Mississippi River (Killgore et al. 2014). Trawling data has shown young-of-year pallid sturgeon use secondary channels and meander scarps; thus, increasing the connectivity, longevity, and sustainability of these habitats would increase both the suitability and availability of these habitats for

pallid sturgeon. The addition of large woody debris traps located in secondary channels would benefit pallid sturgeon by increasing habitat complexity to include the aquatic macroinvertebrate communities and other prey species used by the benthic feeding pallid sturgeon. There could be some temporary disturbances to the aquatic communities during the river-based construction of these measures; however, any negative impacts would be minor and short lived. These measures were formulated to not affect the USACE channel improvement program and associated navigation activities along this reach of the Mississippi River. Construction associated with the USACE channel improvement program to maintain navigation will continue as described in the Section 7(a)(1) Conservation Plan and associated Section 7(a)(2) programmatic biological opinion under the ESA.

2.1.2.5 Fat pocketbook mussel

USACE anticipates the proposed action may affect but is NLAA the fat pocketbook mussel. Fat pocketbook mussel would likely benefit from the measures shown in Table 2a-2 focused on increasing connectivity of secondary channels through dike notching and restoring flow in meander scarps. These measures are consistent with the strategies and actions identified in the ESA Section 7(a)(1) Conservation Plan for the Interior Least Tern, Pallid Sturgeon, and Fat Pocketbook in the Lower Mississippi River (Killgore et al. 2014). With expected increases in intensity of drought in the LMR due to climate change, increasing connectivity of secondary channels, and meander scarps are of great importance to fat pocketbook mussels, as well as other freshwater mussel species. Fat pocketbook mussels can migrate horizontally and vertically in river channels to avoid becoming desiccated during low water and periods of drought; however, there are limitations to this length of time. Flowing meander scarps provide ideal habitat for the fat pocketbook mussel due to the unaltered natural banks, stable sand/silt/clay substrates, refugia from high flows and other navigation impacts (e.g., wave wash, etc.) and being high quality environments for their fish host (freshwater drum). While fat pocketbook mussels have not yet been collected in the study area, the two measures restoring flow to meander scarps (Br_4 and S_4) should provide ideal habitat for sources of recruitment in the LMR and an important habitat for resiliency and recovery of the species. There could be some temporary disturbances to the aquatic communities during the river-based construction of these measures; however, any negative impacts would be minor and short lived. Baseline aquatic surveys (including freshwater mussels) would be collected prior to work in the meander scarps as detailed in the monitoring Appendix 9 of the main report. If fat pocketbook mussels are collected, tiered ESA consultations would be conducted prior to implementation of those measures to incorporate any avoidance and/or minimization measures such as mussel relocations prior to construction. These measures were formulated to not affect the USACE channel improvement program and associated navigation activities along this reach of the Mississippi River. Construction associated with the USACE channel improvement program to maintain navigation will continue as described in the Section 7(a)(1) Conservation Plan and associated Section 7(a)(2) programmatic biological opinion under the ESA.

2.1.2.6 Monarch butterfly

USACE anticipates the proposed action may affect but is not likely to adversely affect the monarch butterfly. Presence of the monarch butterfly within the vegetated habitats of the study area is likely. Those measures described in Table 2a-2 that restore wetland complexes through restoring hydrology and converting agricultural lands to seasonal herbaceous wetlands via a wetland seed mix, those measures focused on moist soil management areas, those measures focused on reforestation and restoring Mississippi River riparian buffers, and those measures associated with forest stand improvements via canopy gaps provide the potential for increased monarch butterfly habitat through an increase in nectar producing plants.

2.1.2.7 Pondberry

USACE anticipates the proposed action may affect but is not likely to adversely affect the pondberry. While not documented within the footprint of any of the measures in Table 2a-2, pondberry could occur within the BLH forest community and along the margins of the floodplain waterbodies like sloughs, borrow pits, and meander scarps. Long term, those measures described in Table 2a-2 that focus on reforestation provide increased potential for pondberry colonization. Baseline vegetative surveys would be conducted prior to implementation of the measures in the recommended plan, as described in the monitoring Appendix 9 of the main report. If pondberry is documented prior to construction, tiered ESA consultations would occur to incorporate any avoidance and minimization measures needed, particularly related to any of the vegetative clearing that may be required for access.

2.1.2.8 Alligator Snapping Turtle

USACE anticipates the proposed action may affect but is NLAA the alligator snapping turtle. Alligator snapping turtles can be found within any of the floodplain waterbodies in the study area. Those measures in Table 2a-2 focused on flow restoration to the backwater sloughs through increased connectivity and increasing connectivity to meander scarps are expected to provide benefits to alligator snapping turtles by sustaining those habitats over the project life. There may be some temporary impacts to those alligator gar habitats during construction but those would be minimized by best management practices for erosion control. A stormwater pollution prevention plan (SWPPP) would be prepared, outlining temporary erosion control measures, such as silt fences, and the construction contracts would include permanent erosion control measures such as turbing and placement of riprap.

2.2 CRITICAL HABITAT EFFECTS ANALYSIS

No critical habitats were identified within the project action area.

Section 3

Summary and Conclusion

3.1 CONCLUSION AND DETERMINATION OF EFFECTS

The proposed measures were formulated to restore the ecological functions of lower Mississippi River habitats, including threatened and endangered species. USACE and the NFS, which includes stakeholders from various state and Federal wildlife agencies, formulated the measures in the recommended plan for the overall benefit of federally listed threatened and endangered species, Birds of Conservation Concern, and priority state listed species identified on the State Wildlife Action Plans as described throughout the main report. However, there is the potential for some minor temporary impacts to listed species and/or their habitats, such as minimal tree clearing for access and temporary aquatic disturbances during construction. Thus, the USACE effects determination for the recommended plan is a may affect but NLAA determination for listed species. The USFWS concurred with this NLAA effects determination on 22 February 2023. Site-specific ESA surveys and associated tiered ESA consultations will be conducted for any measure in the recommended plan prior to implementation. Additional details on the site-specific surveys are included in Monitoring Appendix 9 (i.e., baseline monitoring) and within this appendix. These surveys and associated tiered ESA consultations during implementation stages will allow for time-sensitive (1-2 years) effect determinations and will incorporate any changed habitat or species presence/absence conditions, or changes in listing status that could occur at each of the measure locations included in the recommended plan prior to its implementation. Table 2a-4 summarizes the determination of effects for each of the protected resources.

Table 2a-4. Determination of effects

Species (Common Name)	Determination	Rationale
Indiana Bat	<i>May affect but not likely to adversely affect</i>	The project will result in additional forested lands and improved forested stands available for Indiana bat summer roosting. Some minor tree clearing may be needed for access; however, site-specific surveys and tiered ESA consultations during implementation would avoid and minimize potential impacts.
Northern Long-eared Bat	<i>May affect but not likely to adversely affect</i>	The project will result in additional forested lands and improved forested stands available for northern long-eared bat summer roosting. Some minor tree clearing may be needed for access; however, site-specific surveys and tiered ESA consultations during implementation would avoid and minimize potential impacts.
Tricolored Bat	<i>May affect but not likely to adversely affect</i>	The project will result in additional forested lands and improved forested stands available for tricolored bat summer roosting. Some minor tree clearing may be needed for access; however, site-specific surveys and tiered ESA consultations during implementation would

Species (Common Name)	Determination	Rationale
		avoid and minimize potential impacts.
Eastern Black rail	<i>May affect but not likely to adversely affect</i>	The project will result in an increase in vegetated wetlands and restored functions to existing wetlands for the eastern black rail. Some minor vegetative clearing may be needed for access; however, site-specific surveys and tiered ESA consultations during implementation would avoid and minimize potential impacts.
Piping Plover	<i>May affect but not likely to adversely affect</i>	The project will result in restored functions to wetland complexes and secondary channels particularly through increased connectivity. There may be temporary disturbances to these and adjacent sandbar and mudflat habitats during construction; however, site-specific surveys and tiered ESA consultations during implementation would avoid and minimize potential impacts.
Red Knot	<i>May affect but not likely to adversely affect</i>	The project will result in restored functions to wetland complexes and secondary channels particularly through increased connectivity. There may be temporary disturbances to these and adjacent sandbar and mudflat habitats during construction; however, site-specific surveys and tiered ESA consultations during implementation would avoid and minimize potential impacts.
Pallid Sturgeon	<i>May affect but not likely to adversely affect</i>	The project will restore functions to meander scarps and secondary channels through increased connectivity and large woody debris traps providing forage and increased habitat suitability for YOY pallid sturgeon. There will be temporary increases in turbidity to the aquatic habitats during construction; however, site-specific surveys and tiered ESA consultations during implementation would avoid and minimize potential impacts.
Fat Pocketbook Mussel	<i>May affect but not likely to adversely affect</i>	The project will restore functions to meander scarps and secondary channels primarily through increased connectivity allowing for more suitable habitat for fat pocketbook mussel particularly during low water times. There will be temporary increases in turbidity to the aquatic habitats during construction; however, site-specific surveys and tiered ESA consultations during implementation would avoid and minimize potential impacts.
Monarch Butterfly	<i>May affect but not likely to adversely affect</i>	The project will result in an increase in nectar producing plants available to the monarch butterfly due to reforestation and wetland restoration. There may be temporary disturbances to vegetated habitats due to access during construction.
Pondberry	<i>May affect but not likely to adversely affect</i>	The project will result in an increase in wetland habitats available for pondberry colonization. There may be temporary disturbances to vegetated habitats due to access during construction; however, site-specific surveys and tiered ESA consultations during implementation would avoid and minimize potential impacts.
Alligator Snapping Turtle	<i>May affect but not likely to adversely affect</i>	The project will result in restored functions to floodplain waterbodies including sloughs, meander scarps, and secondary channels, primarily through increased connectivity. There will be temporary increases in turbidity to these waterbodies during construction.

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List of Acronyms and Abbreviations

AAHU	Average Annual Habitat Units
BLH	Bottomland Hardwood
ESA	Endangered Species Act
LMR	Lower Mississippi River
LMRCC	Lower Mississippi River Conservation Committee
NFS	Non-federal Sponsor
NLAA	Not likely to adversely affect
NLEB	Northern Long-Eared Bat
SWPPP	Stormwater Pollution Prevention Plan
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service