Three Rivers Southeast Arkansas Study

Appendix E: Biological Evaluation

THREE RIVERS SOUTHEAST ARKANSAS

Introduction

The Three Rivers Study, which encompasses the confluence of the Arkansas and White rivers with the Mississippi River in southeast Arkansas, is being conducted by the U. S. Army Corps of Engineers (USACE) to recommend modifications to the McClellan-Kerr Arkansas River Navigation System (MKARNS) that would provide long-term sustainable navigation and promote the continued safe and reliable economic use of the MKARNS.

There is a risk of breach of the existing containment structures near the entrance channel to the MKARNS on the White River. During high water events, water backing up the Mississippi can create significant head differentials between the Arkansas and the White rivers. The existing containment structures are subject to damaging overtopping, flanking and seepage that could result in a catastrophic breach. The uninhibited development of a breach, or cutoff, has the potential to create navigation hazards, increase the need for dredging, and adversely impact an estimated 110 acres of bottomland hardwood forest in the isthmus between the Arkansas and White Rivers.

Stage of Planning Process

This is a feasibility study. A planning Charette was conducted in September 2015, and an Alternatives Milestone Meeting was completed in December 2015. The study is in the Alternative Formulation and Analysis Phase. Utilizing a reasonable level of detail, the PDT has analyzed, compared, and evaluated the array of alternatives to identify a Tentatively Selected Plan.

Study Authority

Section 216, Flood Control Act of 1970 (Public Law 91-611) authorizes a feasibility study due to examine significantly changed physical and economic conditions in the Three Rivers study area. The study will evaluate and recommend modifications for long-term sustainable navigation on the MKARNS. Section 216 of the Flood Control Act of 1970 (Public Law 91-611) states:

> "*The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest*."

Non-Federal Sponsor

The Arkansas Waterways Commission is the non-federal sponsor for the Three Rivers Southeast Arkansas Study. An amended feasibility cost-sharing agreement was executed in June 2015.

Purpose

Based on the Section 216 authority, the study is investigating alternatives that would minimize the risk of cut-off development and develop National Economic Development (NED) benefits associated with these navigation improvements.

BIOLOGICAL EVALUATION
Three Rivers Feasibility Study

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February 3, 2017

1.0 BACKGROUND/HISTORY

The purpose of this Biological Assessment (BA) is to address the effects of the Three Rivers Feasibility Study's Tentatively Selected Plan (TSP) (or proposed action) on Endangered Species Act (ESA) species listed as endangered or threatened, or their designated critical habitat. The U.S. Army Corps of Engineers (USACE) intends to seek authorization to fund and execute the action described below, pursuant to Section 216, Flood Control Act of 1970 (Public Law 91-611), which authorizes a feasibility study due to significantly changed physical and economic conditions in the Three Rivers study area.

Implementation of the proposed action will ensure safe and reliable navigation on the lower White River leading to the Arkansas Post Canal and MKARNS in southeast Arkansas. It has the potential to impact the following ESA-listed species that occur in the area: pallid sturgeon (*Scaphirhynchus albus*), fat pocketbook mussel (*Potamilus capax*), rabbitsfoot (*Quadrula cylindrica cylindrica*), pink mucket pearly mussel (*Lampsilis abrupta*), ivory-billed woodpecker (*Campephilus principalis*), interior least tern (*Sterna antillarum athalassos*), and the bald eagle (*Haliaeetus leucocephalus*). There are no candidate or proposed species, or critical habitat in the study area.

This BA has been prepared in compliance with requirements outlined under Section 7(c) of the Endangered Species Act (ESA). Section 7(a)(2) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened, and with respect to its critical habitat, if any is being designated. USACE is the lead federal agency for the proposed project, and will oversee compliance with applicable federal laws, ordinances, and regulations required for the project as well as protection measures for sensitive biological resources.

The purpose of the proposed action is to implement a long-term environmentally sustainable navigation solution on the McClellan-Kerr Arkansas River Navigation System (MKARNS), which includes the lower 10 miles of the White River in southeast Arkansas. Reliable navigation on the lower White River is threatened by a risk of failure of existing containment structures. Failure of the structures affects the consistent safe use of the MKARNS and results in continued federal investment in short term maintenance solutions to prevent long term lost navigation.

The proposed action includes construction of a new containment structure, modification of the existing containment structure at the Historic Cutoff, and removal of one structure. These actions will serve to reduce existing head differentials of several feet between the White and Arkansas Rivers during flood events. This head differential results in scouring flows when the existing containment structure is overtopped, increasing the risk of a catastrophic breach of the structure. These scouring flows are also adversely impacting floodplain ecosystems.

2.0 PREVIOUS ACTIONS IN THE STUDY AREA

The Three Rivers Project Area has experienced numerous construction actions related to development and maintenance of the MKARNS since the 1960's. While none of these actions have been linked to any direct or indirect impact to listed species in the Project Area, similar type activities (e.g. navigation and flood control) have been identified as major factors of decline for some of the species across their historic range. The following is a brief description of past navigation related activities in the Three Rivers Project Area.

Historic Cutoff Closure

Prior to 1963, a hydrologic connection existed between the White and Arkansas Rivers in the Project Area. Designers of the MKARNS project were concerned about reported dangerous cross-currents that sometimes occurred in the White River when flow passed between the rivers. Additionally, there was concern that the higher sediment loads in the Arkansas River would be deposited in the lower White River, thus impacting navigation. To address these concerns, USACE closed the Historic Cutoff in 1963 by constructing a soil cement structure across the opening.

Melinda Weir

Headcutting from the Arkansas River through the isthmus between the White and Arkansas Rivers began in the early 1970's, in an area known as the Melinda Corridor. In response to this headcutting, USACE constructed the Melinda Headcut Structure (weir) in 1989 to contain the headcut at Owens Lake. The Melinda Weir was one of three structures planned to reduce damaging flows and prevent future headcutting. The Melinda Weir has had to be reconstructed or repaired several times due to damaging flows and erosion.

Owens Lake Structure

Owens Lake Structure was constructed in 1991 to provide a connection to the soil-cement dike system while preventing Owens Lake from draining into the White River. The top elevation is at Elevation 145, three feet higher than that of Melinda Structure and five feet lower than the soil-cement dike. It is overtopped almost every year.

Soil Cement Headcut Containment Structure

A Containment Structure (soil-cement dike) was constructed in 1989-1992 to reduce the amount of cross flow between the Arkansas and White Rivers while allowing some inflow into Owens Lake to sustain the lake water. This structure included an approximate 17,300 feet soil-cement dike built from the Historic Cutoff Structure westward along the south bank of the White River to the railroad embankment west of Lagrue Lake. With the exception of an overflow crest structure at Owens Lake structure (elevation 145 feet), the containment structure was constructed to a 150 foot elevation (USACE 1987; page 21).

Jim Smith Lake Structures

By 2002, the Arkansas River (*House Bend*) had migrated northward enough to capture Jim Smith Lake, requiring the Containment Structure near the north end of Jim Smith Lake to be repaired. Two structures were constructed in Jim Smith Lake to reduce the risk of a breach between the Arkansas and White Rivers through Jim Smith Lake. These structures were constructed of geotubes filled with sand and topped with soil and live willow fascines. One structure was on the south end of the lake near the Arkansas River, and the other was on the

north end adjacent to the soil-cement structure. In the winter (February) of 2005, the geotubes were breached by high flows, but the containment structure remained intact. Both the North and South ends of Jim Smith Lake were repaired in 2005 (November) and 2009 (February), respectively, by placing stone in the footprint of the damaged geotube structures.

Maintenance Dredging – White River

Periodic dredging has been on-going since the MKARNS was first opened to navigation. Most dredging occurs around White River miles (Rmi) 8.0 – 10.0, just before the navigation channel enters the Arkansas Post Canal. Completion of Montgomery Point Lock and Dam in 2004 at Navigation Mile 0.6 has significantly reduced the amount of dredging.

Montgomery Point Lock and Dam

Construction of the Montgomery Point Lock and Dam was in response to a chronic low water problem in the White River Entrance Channel of the MKARNS. Other than Montgomery Point Lock and Dam, there currently are no dams on the lower White River, which link navigation from the Mississippi River to the main stem of the Arkansas River.

When Mississippi River levels get low, the White River stage drops correspondingly. Because of changes in the Mississippi River, the stage has, at times, fallen lower than the designers of the McClellan-Kerr System ever thought it would. This has caused repeated navigation restrictions, and has prompted the need for extensive dredging. The reason for this extreme drop is due to headcutting in the Mississippi River, and is described below under Mississippi River Channel Modifications.

The lock and dam was designed to eliminate the recurrent navigation restrictions and reduce dredging needs by more than 90 percent. The dam also has gates that normally remain on the channel bottom. During low Mississippi River levels, the gates are raised to form a navigable pool in the lower White River, with traffic utilizing the lock.

Wilber Mills Dam (Dam #2)

While outside of the Three Rivers Project and Study Area, Dam #2 on the Arkansas River was constructed to provide the necessary navigation pool on the Arkansas River immediately upstream of the Arkansas Post Canal, which connects the Arkansas River to the lower White River. Construction of this dam, along with the subsequent addition of hydropower capabilities, altered the normal hydrologic flow downstream on the lower Arkansas River in the study area.

Lower Arkansas River Alterations

The lower Arkansas River below Dam 2 is not part of the inland navigation system; however, significant alterations to the river channel and its associated floodplain have been done. A levee has been constructed along the south and west sides of the Arkansas River from above Dam 2 nearly to the mouth of the river. The distance of the river from the levee varies from about 200 feet at its closest to about 1,370 feet at its farthest location. It widens considerably near the mouth of the river. The most notable river engineering works that have been done on the lower Arkansas River below Dam 2 are the meander cutoffs that were constructed. The first one, the Morgan Point cutoff was done in 1966 for construction of the dam. Other

man-made cutoffs include the Red Fork cutoff (1945), Hopedale cutoff (1946), Sawmill Bend cutoff (1960), Avenue Landing cutoff (1962-1963) (Pinkard *et al*. 2003). Several natural cutoffs on the Arkansas River also occurred during this time.

Mississippi River Channel Modifications

While outside the Project Area, a brief mention of channel modifications on the lower Mississippi River (LMR) is relevant, as these modifications have had impacts on the lower Arkansas and White Rivers. The LMR is defined as the Mississippi River from the Mississippi-Ohio rivers confluence to the Gulf of Mexico, a distance of approximately 958 Rmi.

Between 1929 and 1942, USACE constructed numerous bendway cutoffs on the LMR to straighten the channel for navigation. These cutoffs shortened the LMR by 152 Rmi over a 503 mi reach. The LMR was reduced an additional 55 Rmi between 1939 and 1955 by constructing artificial channels that bypassed natural river meanders. This channel length reduction resulted in the river entrenching in steeper gradient reaches and eroding large amounts of material from the channel banks and bed. This entrenchment moved up the LMR, and into tributary streams, including the White and Arkansas Rivers. Research on the lower White River has documented this entrenchment – or headcutting – occurring up the White River to approximately St. Charles, Arkansas. This headcutting appears to have subsided, perhaps due to construction of the Montgomery Point Lock and Dam on the White River near its confluence with the LMR. While not documented, it's reasonable to assume this headcutting on the lower White River impacted many mussel species that historically occurred there.

USACE navigation and flood control projects listed above have modified the hydrology in the study area. All projects have been coordinated with the USFWS under section 7 consultation procedures (ESA), and will continue to be in the future, as applicable. To date, no activities have been found to jeopardize any listed threatened or endangered species in the study area. It is reasonable to assume that cumulative effects could occur in the future depending upon the type of project proposed but as with all major federal actions, section 7 coordination (ESA) would have to be conducted.

3.0 DESCRIPTION OF THE ACTION & ACTION AREA

The proposed action includes construction of a new containment structure, modification of the HCCS, removal of the Melinda Structure, and creating openings in the Owens Lake Weir (the Project Area – see Figure 1).

The new containment structure would be approximately 2.5 miles long, at an elevation of 157 feet above sea level (Figure 1). The new structure would begin on natural high ground south and west of the existing Melinda Structure located on the south side of Owens Lake. It would continue east and cross the Melinda Headcut south of the existing Melinda Structure. From there, it would head northeast and connect to the existing containment structure north of J. Smith Lake. It continues to follow the existing containment structure alignment,

terminating at the existing Historic Cutoff Containment Structure (HCCS). Construction of the 2.5 mile containment structure will result in the temporary loss of approximately 25 acres of mature bottomland hardwood forest along the alignment of the structure. Once construction is complete, the containment structure will be allowed to reforest naturally. Regeneration will proceed through typical successional habitat changes. In the first couple of years the area will mostly consists of grass species, with a progression toward more woody, mature species over time. Given the change in elevation of the structure, it is possible that a different species assemblage will colonize the structure than previously existed.

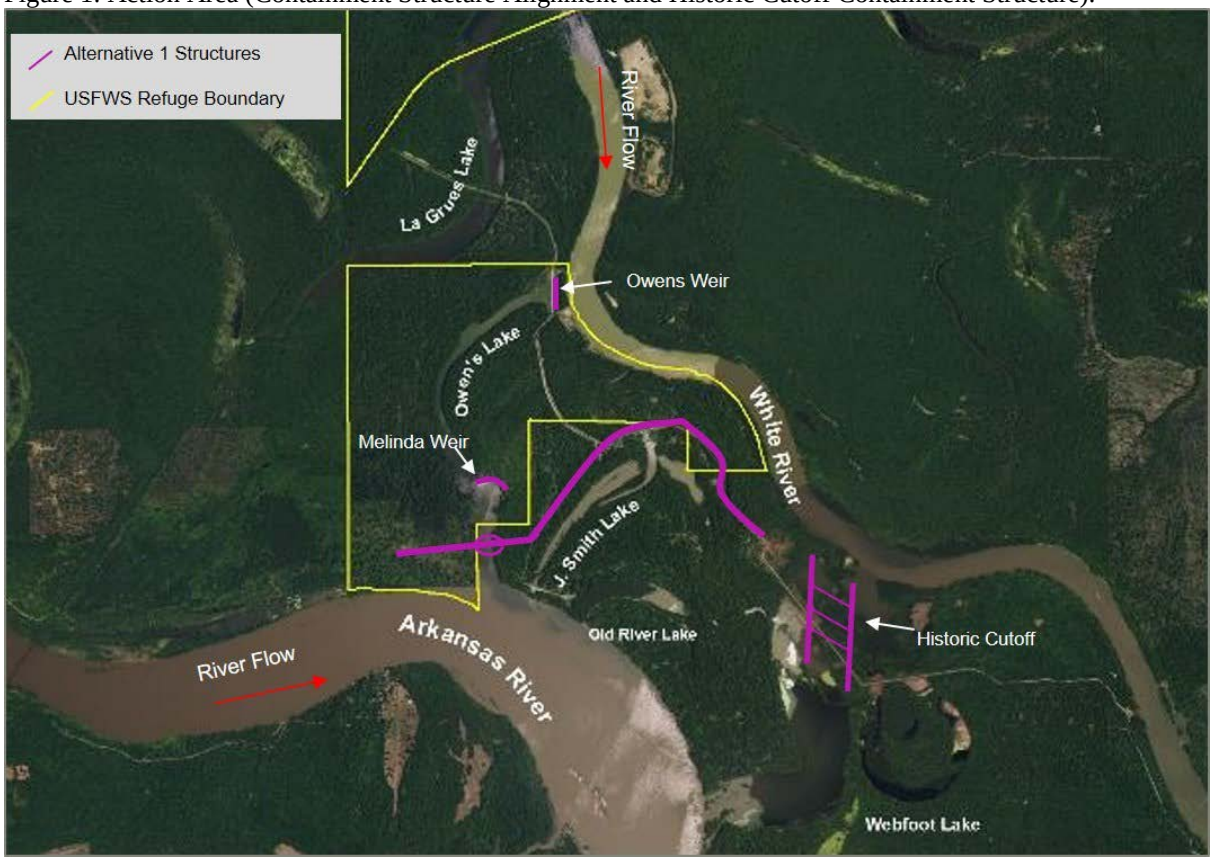
The HCCS would be modified by lowering a portion of it from elevation 170 to elevation 145 feet above mean seal level (MSL), for an undetermined width (estimated between 500 – 1,000 feet). The final elevation and width will be optimized during the Preconstruction Engineering and Design (PED) phase of this study. Modification of the HCCS will be limited to an already altered landscape from the original construction. The new opening provides a much wider flow path with less velocity than currently exists through the Melinda Corridor. This action reduces the maximum head differential across the isthmus due to the interchange of White and Arkansas River waters at a lower elevation. Opening the HCCS provides ecosystem restoration, as it allows waters from the Arkansas and White Rivers to interchange at an elevation closer to historic conditions, providing a more frequent exchange of nutrients, as well as increased fish passage. Further, the opening will restore the function of Webfoot Lake by reducing or eliminating active erosion on the east side of the lake that is adversely affecting aquatic habitat. This eroded area has existing nick points that will likely lead to future headcutting that will adversely impact the surrounding bottomland hardwood forest. Additionally, future headcutting in this area would threaten navigation by breaching the MKARNS containment structure.

The Melinda Structure at the south end of Owens Lake would be demolished in place (the debris will be pushed into the deep scour hole below the structure) as part of the proposed action. This reduces the turbulence of water against the toe of the new containment structure, increasing its resiliency. As an ancillary environmental benefit, this action will have a positive effect on many aquatic species by reconnecting the “current” Owens Lake with its disjunct eastern half that was severed by the Melinda Structure. Currently, this eastern half, or “arm” of Owens Lake only floods during extreme flooding events. As the flood waters recede, this arm drains quickly and remains dry much of the year. Removal of the Melinda Structure will allow this eastern arm to receive flood waters at a lower surface elevation and remain inundated for a longer period, providing an increase in spawning and nursery habitat for many fish species.

Outlet structures would be installed through the existing containment structure at the Owens Lake Weir. These structures are necessary to prevent an increase in duration of flooding of the bottomland hardwood forest surrounding Owens Lake. As an ancillary environmental benefit, these openings would increase the frequency and duration of fish passage from the White River into Owens Lake. Modification of the Owens Weir will be limited to an already altered landscape from the original construction.

The project has been designed in such a way to avoid and minimize impacts to the environment. Extensive hydrologic modeling of the proposed action confirms no significant changes in flood frequency or duration in the Three Rivers Study Area. The only changes would be minimal (less than 7 days change to the hydrograph over the entire year), and would occur in low-lying areas already inundated for a significant part of the year; therefore, hydrologic induced habitat changes are not anticipated. As well, erosion and subsequent land loss is significantly reduced by opening up the HCCS and reducing the velocities induced by constructing the containment structure.

Figure 1: Action Area (Containment Structure Alignment and Historic Cutoff Containment Structure).



4.0 ENVIRONMENTAL BASELINE CONDITIONS

The study area exhibits long hot humid summers and short mild winters, and is dominated by wetland and aquatic habitats. The diverse topography of the study area is characteristic of alluvial river systems. It is evidenced by the various floodplain features found there including backswamps, natural levees (i.e., ridges), sloughs, bayous, and oxbow lakes. This complex topography combines with seasonal, annual, and long term high and low water cycles and flooding to create a diversity of hydrologic conditions vital to the productivity of

the system, and a spatial and temporal range of habitat conditions. Both fish and wildlife are dependent on flooded forest for breeding, nesting, spawning, and nursery habitat in the inundated floodplain. They also depend on higher drier sites for food, cover, and as refuge from floodwaters. The vast forested wetlands in the three Rivers Study Area also perform numerous other beneficial functions including floodwater detention, nutrient cycling, and water quality improvement.

Land use/land cover in the Three Rivers Study Area is predominately bottomland hardwood forest (BLH), similar to the lower White River and lower Arkansas River basins inside the levees. By contrast, land use outside the levees in the MAV portion of river basins is primarily agriculture. The forest associations found within the study area vary depending on the frequency and duration of flooding. Cypress-tupelo (*Taxodium distichum/Nyssa aquatica*) and scrub-shrub swamps are located in low lying areas permanently or semi-permanently flooded. Water hickory/overcup oak (*Carya aquatica/Quercus ovata*) associations are located in frequently flooded low lying areas, which characterizes the majority of the Three Rivers Study Area. Somewhat more elevated areas, which are still influenced by overbank flooding, support American elm (*Ulmus Americana*), ash (*Fraxinus* spp.), sugarberry (*Celtis laevigata*), sycamore (*Platinus occidentalis*), Nuttall oak (*Q. nuttallii*), willow oak (Q. phellos), and sweetgum (*Liquidambar styraciflua*). Infrequently flooded, poorly drained areas are vegetated with willow oak, water oak (*Q. nigra*), swamp chestnut oak (*Q. michauxii*), cherrybark oak (*Q. pagodifolia*), and shagbark hickory (*Carya ovata*). Black willow (*Salix nigra*) is common on elevated point bars and cottonwood (*Populus deltoides*), river birch (*Betula nigra*), and boxelder (*Acer negundo*) are found on natural levees.

A notable exception to the major land cover type found in the study area are two dredge disposal areas totaling approximately 160 acres (~ 80 acres each) on the White River National Wildlife Refuge adjacent to the White River at RMs 8 & 9. These sites are elevated approximately 30 to 50 feet above the White River floodplain and contain several million cubic yards of dredge material. Both sites contain large areas of mostly unvegetated open sand, with smaller areas of primarily willow growth.

Major landowners in the study area include the U.S. Fish and Wildlife Service (FWS), U.S. Army Corps of Engineers (USACE), Arkansas Game and Fish Commission (AGFC), and Anderson-Tully Company (ATCO). Other private ownerships are interspersed among these larger ownerships. The FWS and AGFC lands are managed to benefit fish and wildlife resources. ATCO land is managed primarily for timber production with collateral management for fish and wildlife. USACE lands not used for navigation are managed, in part, by the AGFC for fish and wildlife.

The BLH ecosystem in and around the Three Rivers Study Area provides habitat for resident game species, waterfowl, threatened and endangered species, neotropical migrants, and various species of fish and aquatic life. The ecosystem serves to improve water quality, retain sediment, alter flood flows, and provide food chain support. The area is sufficiently large to provide abundant interior forest areas for those species that are disturbance

intolerant. It is likely that the study area and surrounding undeveloped bottomlands lands act as a source area for Neotropical Migratory Birds (NTMB).

The wetlands within and adjacent to the study area that are under federal or state protection are considered to be of international importance. These wetlands were designated as Wetlands of International Importance in 1990 under the RAMSAR Convention.

5.0 LISTED SPECIES & CRITICAL HABITAT IN THE ACTION AREA

Section 7 consultation included a review of the U.S. Fish and Wildlife Service (FWS) Information for Planning and Conservation website (USFWS 2017) and a request to the FWS Ecological Service Office in Arkansas for a Planning Aid Report (PAR). The PAR was received November 10, 2015 (Appendix A). The report and website listed several federally listed species that may be present in the vicinity of the study area. The following list contains those species. There are no candidate or proposed species, or critical habitat in the study area.

Threatened and Endangered Species possibly occurring in the Three Rivers Study Area		
Common Name	**Scientific Name**	**Federal Status**
Pallid sturgeon	*Scaphirhynchus albus*	Endangered
Fat pocketbook mussel	*Potamilus capax*	Endangered
Rabbitsfoot	*Quadrula cylindrica cylindrica*	Threatened
Pink mucket pearly mussel	*Lampsilis abrupta*	Endangered
Scaleshell mussel	*Leptodea leptodon*	Endangered
Ivory-billed woodpecker	*Campephilus principalis*	Endangered
Interior least tern	*Sterna antillarum athalassos*	Endangered
Piping Plover	*Charadrius melodus*	Threatened
Rufa Red Knot	*Calidris canutus rufa*	Threatened
Sources: USFWS Planning Aid Report, November 10, 2015 / IPaC Website, February 2, 2017		

Pallid Sturgeon

The pallid sturgeon is a long-lived, riverine sturgeon species native to the Missouri River, lower Yellowstone River, lower and middle Mississippi River (downstream of its confluence with the Missouri River), and the Atchafalaya River (Kallemeyn, 1983). They are also found in the lower reaches of some of the larger tributaries to these rivers. It is one of the largest fish species found in the Missouri/Mississippi River drainage. Adult pallid sturgeon collected from the upper Missouri River are generally larger, with a maximum recorded weight of 86 lbs. The maximum recorded weight in the lower Missouri River (South Dakota and Nebraska), and Mississippi River, is approximately 46 and 26 lbs, respectively.

Habitat alteration, particularly construction of large impoundments in the Missouri River, as well as river channelization, bank stabilization, and altered flow regimes throughout its' range led to listing the Pallid Sturgeon as a federally endangered species in 1990. Since listing, the status of the species has improved and is currently stable (USFWS 1993, 2013, 2014).

The historic floodplain habitat of the Missouri and Mississippi Rivers provided important functions for the native large river fish. Floodplains were the major source of organic matter, sediments, and woody debris for the main stem rivers when flood flows crested the rivers' banks. The transition zone between the vegetated floodplain and the main channel included habitats with varied depths described as chutes, sloughs, or side channels. The chutes or sloughs between the islands and shore were shallower and had less current than the main channel. These areas provided valuable diversity to the fish habitat and probably served as nursery and feeding areas for many aquatic species. The still waters in this transition zone allowed organic matter accumulations, important to macroinvertebrate production (USFWS 1993).

Pallid Sturgeon primarily utilize main channel, secondary channel, and channel border habitats throughout their range. Juvenile and adult Pallid Sturgeon are rarely observed in habitats lacking flowing water which are removed from the main channel (i.e., backwaters and sloughs). Specific patterns of habitat use and the range of habitat parameters used may vary with availability and by life stage, size, age, and geographic location (USFWS 2014). Recent telemetry research on pallid sturgeon in the lower Mississippi River revealed a strong affiliation for island tip and natural bank habitats, and, to a lesser degree, revetted bank habitat. Although frequently used, pallid sturgeon exhibited negative selection for the expansive main channel habitat. Secondary channel habitat was frequently used in the spring, when available. Fifty percent of pallid sturgeon detections were in relatively narrow ranges of depths (6.2-13.6 m / 20.3-44.6 ft), and surface current velocities of 0.64-1.05 m/s (2.1-3.4 ft/s). Use of different habitats was related to river stage and water temperature, suggesting use of some habitats was seasonal (Herrala, et.al. 2014).

Habitat requirements of larval and young-of-year pallid sturgeon remain largely undescribed across the species' range, primarily as a result of low populations of spawning adults and poor recruitment. Research on other age-0 *Scaphirhynchus* sturgeon in the middle Mississippi River revealed they were most often found in channel border and island-side channel habitats and positively associated with low velocities (~0.1 m/s, 0.33 ft/s), moderate depths (2-5 m, 6.6-16.4 ft), and sand substrate (Phelps, et al. 2010).

Pallid Sturgeon can be long-lived, with females reaching sexual maturity later than males. Based on wild fish, estimated age at first reproduction was 15 to 20 years for females and approximately 5 years for males (Keenlyne and Jenkins 1993). Like most fish species, water temperatures influence growth and maturity. Females do not spawn each year. Observations of wild Pallid Sturgeon collected as part of the Pallid Sturgeon Conservation Augmentation Program (PSCAP) in the northern part of the range indicates that female spawning periodicity is 2-3 years. Spawning appears to occur between March and July, and can involve long migrations to suitable habitat. Spawning appears to occur adjacent to or over coarse substrate (boulder, cobble, gravel) or bedrock, in deeper water, with relatively fast, converging flows, and is driven by several environmental stimuli including day length, water temperature, and flow (USFWS 2014).

Numerous research articles reveal that juvenile and adult pallid sturgeon diets are generally composed of fish and aquatic insect larvae with a trend toward piscivory as they increase in

size. This research, coupled with habitat utilization by prey items, indicates that pallid sturgeon will feed over a variety of substrates (USFWS 2014).

Destruction and alteration of habitats by human modification of river systems is believed to be the primary cause of declines in pallid sturgeon. It is unlikely that successfully reproducing populations of pallid sturgeon can be recovered without restoring the habitat elements (morphology, hydrology, temperature regime, cover, and sediment/organic matter transport) of the Missouri and Mississippi Rivers necessary for the species continued survival. On the main stem of the Missouri River, approximately 36 percent of riverine habitat within the pallid sturgeon's range was eliminated by construction of six massive earthen dams between 1926 and 1952 and another 40 percent has been channelized. The remaining 24 percent has been altered due to changes in water flows caused by dam operations. These dams also are believed to have adversely affected pallid sturgeon by blocking migration routes and by causing inundation of spawning and nursery areas.

An increase in pallid sturgeon research "post-listing" indicates that main-stem tributaries and tributary confluences may be used more frequently than previously recognized. Several captures of pallid sturgeon have occurred within tributaries, near the mouth of tributaries, and within close proximity to tributary confluences with the Mississippi River. These habitats may be important to the pallid sturgeon during certain times of the year or perhaps during certain life stages.

The Mississippi River at its confluence with the Arkansas and White Rivers is considered by the USFWS to be a high priority recovery (management) area for this species. During 2011-2012, three radio-tagged pallid sturgeon were documented using the lower 40 river miles of the Arkansas River from the confluence with the Mississippi River upstream to the Wilbur D. Mills Dam (Dam 2). These individuals were recorded during late winter through spring (Kuntz 2012, and Kuntz and Schramm 2012). Personal communication with Dr. Hal Schramm (USGS) and Paul Hartsfield (USFWS) indicated that presence of the pallid sturgeon in the lower Arkansas River was incidental and likely limited to high water events on the Mississippi River when the fish seek refuge from high flows.

There is no documentation of the pallid sturgeon using the White River, although individuals have been captured near its confluence with the Mississippi River.

Fat Pocketbook Pearly Mussel

On June 14, 1976, the fat pocketbook was designated as endangered throughout its entire range in Arkansas, Illinois, Indiana, Kentucky, Missouri, and Mississippi. A recovery plan was approved October 4, 1985, and subsequently revised November 14, 1989. The most recent 5-year review for this species was approved in 2012 which indicated the status is improving, with population expansions in the St. Francis River and Ohio River drainages. Additionally, a new population has been discovered in the Lower Mississippi River (USFWS 2012).

The fat pocketbook is a large (reaching approximately 130 mm in length) freshwater mussel with a shiny, tan or light brown shell without rays. Like other freshwater mussels, the fat

pocketbook feeds by filtering food particles from the water column. The specific food habits of the species are unknown, but other juvenile and adult freshwater mussels have been documented to feed on detritus, diatoms, phytoplankton, and zooplankton. The diet of fat pocketbook glochidia, like other freshwater mussels, comprises water (until encysted on a fish host) and fish body fluids (once encysted).

The reproductive cycle of the fat pocketbook is similar to that of other native freshwater mussels. Males release sperm into the water column; the sperm are then taken in by the females through their siphons during feeding and respiration. The females retain the fertilized eggs in their gills until the larvae (glochidia) fully develop. The mussel glochidia are released into the water, and within a few days, they must attach to the appropriate species of fish, which they parasitize for a short time while they develop into juvenile mussels. Recent laboratory studies indicate that the freshwater drum (*Aplodinotus grunniens*) was the only suitable glochidial host of 28 fish species tested.

The fat pocketbook was once widely distributed in the Mississippi River drainage from the confluence of the Minnesota and St. Croix rivers downstream to the White River system and was known in Minnesota, Wisconsin, Iowa, Illinois, Indiana, Missouri, Kentucky, and Arkansas. Most historic records for this species are from the upper Mississippi River (above St. Louis), the Wabash River in Indiana, and the St. Francis River in Arkansas. The fat pocketbook appears to have expanded its range in the St. Francis River drainage since it was listed, based on collection records. It is now known from at least 27 stream and ditch channels, including approximately 200 miles of the St. Francis River, the St. Francis River Floodway, Right Hand Chute Little River, Left Hand Chute Little River, L'Anguille River, Tyronza River, Staight Slough, Iron Mines Creek, State Line Ditch, and in other drainage ditches associated with these streams in Arkansas, and Belle Fountain Ditch in Missouri. The occurrence of the fat pocketbook in the St. Francis River below the Marked Tree siphon is likely dependent upon the population in the St. Francis Floodway and the passage of glochidia-infected fish through the siphons.

Reports of the fat pocketbook in the White River have been sporadic with no reports of live specimens since the 1960's, until Harris and Christian (2003) found a single live specimen in the main channel White River at Gunbarrel Reach (Rmi 11 – 12.4).

In the Ohio River drainage, the species is now found in a 163 mi reach of the Ohio River between RM 782 – 945 in Kentucky, Illinois and Indiana. The species is present in approximately 100 mi of the lower Wabash River, Indiana and Illinois, and in the lower reaches of some Wabash River tributaries, including the White and Little Wabash rivers, and Big Creek. The fat pocketbook also occurs in the lower reaches of other Ohio River tributaries, including the Cumberland River, Kentucky, and possibly in the lower Tennessee River, Kentucky, based on the recent collection of a dead shell (USFWS 1989). The species also has been discovered inhabiting some secondary channels and cutoffs along a 300 mile reach of the Lower Mississippi River between the confluence of the St. Francis River and Natchez, Mississippi, and a single live individual has been reported from the lower White River, Arkansas (Harris and Christian 2003).

An attempt was made in 1989 to re-establish fat pocketbook populations at two locations in the Upper Mississippi River (Rmi 291 & 355), however, it was apparently unsuccessful. Surveys of 27 sites in the Middle Mississippi River (i.e., the reach between the Missouri and Ohio rivers confluences) during a period of extreme and unusual low water conditions found no evidence of fat pocketbook (USFWS 2009).

In summary, a comparison of the past and recent collection history of fat pocketbook suggests that the species is expanding its range within the St. Francis and Ohio River drainages. Harris *et al*. (1997, *in litt*. 2009) revised the fat pocketbook conservation status in Arkansas from endangered to threatened, due to the number of new occurrence records in the St. Francis River drainage. While this improvement may be due, at least in part, to increased collection efforts in both systems, the distribution and demographics of fat pocketbook collected in some St. Francis and Ohio rivers drainage populations suggest at least local expansions in population size and range. The presence of the species in the Lower Mississippi River is more likely to be due to the discovery of an unknown historical population than the recent expansion of the species into that geographical area.

The fat pocketbook is a large river species, which requires flowing water and stable substrate. There is conflicting information in the literature regarding the fat pocketbook's habitat preference. Surveys have reported the fat pocketbook from sand and mud bottoms, in flowing water a few inches to more than eight feet in depth. Individuals have also been found in sand, mud, and fine gravel substrates in the St. Francis River, Arkansas. Some researchers have reported this species primarily from sand substrates in the St. Francis River, Arkansas. Others reported this species from the full range of habitat types, including shifting sand and flocculent mud, to hard clay and gravel. According to their findings, the most likely habitat is a mixture of sand, silt, and clay.

The greatest impact on the habitat of the fat pocketbook throughout its historic range has been from activities related to navigation and flood control. Channel maintenance dredging has been particularly destructive. The upper Mississippi River has been impounded for navigation and is dredged routinely to maintain a nine-foot navigation channel. This species, once widespread in this river, has disappeared in recent years, even from areas where other species (including the endangered species *Lampsilis higginsi*) continue to exist. Channel dredging may physically remove fat pocketbook from its habitat, initiate accelerated channel erosion, decrease habitat diversity, increase bedload, and/or increase habitat instability. The effects of channel dredging also may alter the behavior of host fish due to changes in flow patterns, decreased biomass, and/or altered species composition and abundance. However, the expansion of range and records of the species within the Ohio, Mississippi, and St. Francis River systems may be due to the stabilization and occupation of areas not subject to dredging (e.g., secondary channels of the Ohio and Mississippi rivers), reduced dredge frequency (all three river systems), or dredging methods (St. Francis River system) allowing adaptation of either or both the fat pocketbook and its host fish (freshwater drum) to existing conditions. There is also evidence that fat pocketbook survival and population recovery may be high in some dredge or cleanout situations. Harris (1997) has noted that fat pocketbook mussels comprise a high percentage of the mussel fauna in some St. Francis River drainage ditches 4 to 7 years following maintenance dredging. Prior to maintenance dredging of

Stateline Outlet Ditch, the fat pocketbook mussel population in the project area was estimated at more than 3,000 individuals (Harris 2001, Harris *et al*., *in litt*. 2009). An attempt to minimize the effect of the project involved collecting and relocating more than 2,000 fat pocketbook (USFWS 2012). Although approximately 60 percent of the estimated pre-dredging population was relocated, a 2005 post-project survey estimated the fat pocketbook population size in Stateline Outlet Ditch at more than 6,000 individuals (Harris *et al*., *in litt.* 2009). It is currently unknown if the post-project increase in fat pocketbook in Stateline Outlet Ditch is due to dredge method or quantity, vertical movement of mussels in the substrate, robust recruitment following dredging, a combination of these factors, or some other unforeseen factor.

The USFWS (2012) lists numerous research articles that address new threats to the fat pocketbook mussel. Since being listed, the Ohio, Mississippi, and White (Arkansas) rivers have been occupied by the invasive zebra mussel *(Dreissena polymorpha)*. Effects of zebra mussels on native unionids may include competition for food and habitat resources. Additionally, there is a growing concern that climate change may lead to increased frequency of severe storms and droughts. Research has documented mollusk declines within small perennial streams that have lost flow as a direct result of drought. Habitats occupied by the fat pocketbook include small streams and ditches to large rivers. Low gradient ditches and streams (e.g., upper St. Francis drainage) and large rivers (e.g., Mississippi, Ohio, St. Francis, Ouachita Rivers) where fat pocketbook is known to occur are less susceptible to total loss of flow by drought.

Rabbitsfoot Mussel

The rabbitsfoot mussel was federally listed as Threatened under the Endangered Species Act on September 17, 2013. A recovery plan is currently being developed for this species.

It is found in rivers and streams in Alabama, Arkansas, Georgia, Kansas, Kentucky, Illinois, Indiana, Louisiana, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, Tennessee, and West Virginia. The USFWS estimates that it has been lost from about 64 percent of its historical range. While 51 of 140 historical populations are still present, only 11 populations are viable. Most of the existing rabbitsfoot populations are marginal to small and isolated. The majority of stable and reproducing populations left within its historical range occur in Arkansas. The USFWS has designated 1,437 river miles in 12 states, including Arkansas, as critical habitat for the rabbitsfoot. The White and Arkansas Rivers are not included in this designation.

According to Harris, et.al. (2009) rabbitsfoot mussels in Arkansas are relatively widespread but never exceptionally abundant. The Arkansas Natural Heritage Commission mussel database has records of rabbitsfoot collections from 48 sites across the state from 1997 – 2008. While rabbitsfoot mussels have been collected in the White River upstream of the study area, none are known to occur in the study area. Populations in the White River are concentrated in the sections from Batesville to the mouth of the Little Red River, and from Clarendon to St. Charles, Arkansas. It is not known to occur in the lower Arkansas River.

Dams, reservoirs, and impoundments have flooded much of this mussel's habitat, and contributed directly to the extirpation of rabbitsfoot populations in some streams and resulted in the highly fragmented habitat and isolated populations currently seen in the species. Large dams also affect the flow and water quality downstream (reduced temperature, oxygen, and flow, and bank and substrate instability and erosion), which continues to negatively affects rabbitsfoot populations. Rabbitsfoot, like most other mussels, are sensitive to water quality and sediment.

The rabbitsfoot has a reproductive strategy similar to that of other mussels: females release parasitic larvae (glochidia) that attach to the gills of specific species of host fish and later drop off as juvenile mussels. Rabbitsfoot mussels use multiple species of shiners (minnows) as host fish.

Rabbitsfoot generally inhabits small- to medium-sized stream and some larger rivers. It occurs shallow water areas along the bank and in shoals with reduced water velocity. Individuals have also been found in deep water runs (9-12 ft.). Primary substrate includes gravel and sand.

Pink Mucket Pearly Mussel

The pink mucket is a freshwater mussel that was listed as endangered June 14, 1976.

The USFWS recovery plan for the pink mucket indicates its range is primarily in the Ohio, Tennessee and Cumberland River drainages, with occasional records from the Mississippi River drainage. A status review of mussels in Arkansas by Harris, et.al. (2009) reveals most pink mucket pearly mussel populations occur in the Ouachita Mountain ecoregion of west Arkansas. Three live pearly mussels were found at two sites in the White River. Both sites are located upstream of the study area at White River mile 155.6 and 221. Preferred habitat is medium to large rivers in gravel with sand substrate.

Dams, reservoirs, and impoundments have flooded much of this mussel's habitat, and contributed directly to the extirpation of pink mucket populations in some streams and resulted in the highly fragmented habitat and isolated populations currently seen in the species. Large dams also affect the flow and water quality downstream (reduced temperature, oxygen, and flow, and bank and substrate instability and erosion), which continues to negatively affects pink mucket populations. As with other mussels, pink mucket are also sensitive to water quality and sediment. The pink mucket was also one of the mussels in Arkansas that was commercially harvested for use in the button and pearl industry.

The pink mucket's reproductive cycle is similar to other species of freshwater mussels. The female uses a spotted mantle flap to lure in specific host fish; host fish for the pink mucket include the largemouth bass and walleye. When a host fish draws near, the female pink mucket releases tiny parasitic glochidia (larvae) that latch onto its gills and then drop off later as juvenile mussels. The pink mucket spawns August to September, and releases glochidia the following June.

Scaleshell Mussel

The scaleshell mussel was listed as endangered October 9, 2001. The final recovery plan was approved in February 2010.

The scaleshell historically occurred in 56 rivers in 13 states within the Mississippi River Drainage including Alabama, Arkansas, Illinois, Indiana, Iowa, Kentucky, Minnesota, Missouri, Ohio, Oklahoma, South Dakota, Tennessee, and Wisconsin. The species has undergone a dramatic reduction in range and is believed to be extirpated from 9 of the 13 states it historically occurred in (USFWS 2010). When the species was listed in 2001, it was known from 14 rivers in three states (USFWS 2001). These rivers include the Meramec, Bourbeuse, Big, Gasconade, and Osage rivers in Missouri; Frog Bayou and the St. Francis, Spring, South Fork Spring, South Fourche LaFave, and White rivers in Arkansas; and the Little, Mountain Fork, and Kiamichi rivers in Oklahoma. An additional six streams were listed in 2001 as possibly supporting the species in Arkansas and Oklahoma including the Cossatot, Little Missouri, Saline, and Strawberry rivers, and Myatt and Gates creeks (USFWS 2001). Since 2001, living specimens have only been found in the Meramec, Bourbeuse, and Gasconade rivers in Missouri.

Fresh-dead specimens have been found in the Big River in Missouri, Missouri River in South Dakota, and the Kiamichi River in Oklahoma. In addition to the limited number of rivers it has been found since 2001, the USFWS considers extant populations to be declining because the species remains very difficult to find (even at the best known extant sites) and 60 percent of resurveyed scaleshell sites have been lost or have declined significantly (USFWS 2010a).

Several scaleshell sites known when the species was listed in the 2001 no longer appear to be suitable for mussels. These sites were also mussel beds supporting a diversity and an abundance of other mussel species. Of the 78 extant scaleshell sites, 21 have been resurveyed since 2001. Mussel beds have entirely disappeared, or significant declines have occurred at 13 (62%) of the 21 sites. This includes 4 of 5 revisited sites in the Meramec River, 3 of 5 revisited sites in the Bourbeuse River, and 2 of 5 revisited sites in the Gasconade River in Missouri. In Oklahoma, 4 of 5 revisited sites have been lost from the Kiamichi River (USFWS 2010a).

The scaleshell occurs in medium to large rivers with low to medium gradients. It primarily inhabits stable riffles and runs with gravel or mud substrate and moderate current velocity. The scaleshell requires good water quality, and is usually found where a diversity of other mussel species are concentrated. More specific habitat requirements of the scaleshell are unknown, particularly of the juvenile stage (USFWS 2010).

The scaleshell must complete a parasitic phase on freshwater drum (*Aplodinotus grunniens*) to complete its life cycle. The scaleshell's complex life cycle and extreme rarity hinders its ability to reproduce. The sedentary nature of the species and the low density of remaining populations exacerbate threats to its survival posed by the natural and manmade factors. Further, the relatively short life span of the scaleshell may render it less able to tolerate periods of poor recruitment. The remaining populations are very susceptible to local

extirpation, with little chance of recolonization because of their scattered and isolated distribution (USFWS 2010a).

Water quality degradation, sedimentation, channel destabilization, sand and gravel mining, dredging, and impoundments are contributing to the decline of the scaleshell throughout its range. The spread of the non-native zebra mussel (*Dreissena polymorpha*) may threaten scaleshell populations in the near future.

Harris and Christian (2000) reported a single live specimen from the White River downstream of Newport, White County, Arkansas. They suggested that this probably represents the downstream limit for the scaleshell in the White River drainage, as it is considered an Interior Highlands species that prefers small to medium sized rivers in Arkansas.

Ivory-billed Woodpecker

The Ivory-billed woodpecker (IBWO) was listed as endangered March 11, 1967. The final recovery plan was approved April 2010.

The Ivory-billed woodpecker is the largest woodpecker in the United States. This species ranged from east Texas to North Carolina and from southern Illinois to Florida and Cuba. The species was always thought to be relatively rare, but it became more so during the late 19th century, when land clearing reduced most of the mature forests within its range. However, some forests remained in remote and largely inaccessible swampy bottomlands throughout the Southeast and it is in these habitats that this species made its last stand in the United States. In Cuba, most of the land clearing occurred in the lowlands taking away tropical hardwoods, with remaining forests used by this species composed primarily of pine in the remote and mostly inaccessible mountains. With modernization in both countries, the last refuges of mature forest came under the saw and were largely cleared by the 1940's.

The Ivory-billed Woodpecker historically preferred expansive patches of mature forestland, often with embedded patches of recently disturbed forest from hurricanes, tornadoes, fire, insect outbreaks, and to some degree logging as long as some damaged trees were left standing. Its' diet is known to be largely dependent on wood boring beetle larvae found in recently dead and dying trees. The bird uses its enormous white bill to hammer, wedge, and peel the bark off recently dead and dying trees to find the insects. This species is unique among woodpeckers in being able to pull out the beetle larvae that are close to the interface between freshly dead sapwood and the tight bark (usually too tight for any other woodpeckers to pry loose). During some times of the year, the species feeds on fruit and other vegetable matter.

Like all woodpeckers, the Ivory-bill is a cavity-nester. In the Mississippi Delta, it is known to nest in a variety of hardwood and cypress trees while in other areas throughout its' historic range, including Cuba, it also nested in mature pines. The species has an extraordinarily large home-range, and it has been estimated that one pair of Ivory-billed Woodpeckers need 6 – 10 square miles or more of habitat. The larger the home range, the less quality habitat there may be to support a pair.

Pairs are thought to mate for life and are known to travel together. These paired birds will mate every year between January and May. Before they have their young, they excavate a nest in a dead or partially dead tree about 8-15 meters up from the ground. Usually three eggs are laid and incubated for 3-5 weeks. Both parents sit on the eggs and are involved in taking care of the chicks, with the male taking sole responsibility at night. They feed the chicks for months. About five weeks after the young are born, they learn to fly. Even after the young are able to fly, the parents will continue feeding them for another two months. The whole family will eventually split up in late fall or early winter.

Numerous reports from credible sources of Ivory-billed woodpeckers in recent decades have left the species status questionable. In 2005, a possible sighting of an Ivory-billed woodpecker occurred on the Cache River National Wildlife Refuge and the Arkansas Game and Fish Commission Dagmar Wildlife Management Area. Additionally, the existence of potential habitat and numerous reports from credible sources of Ivory-billed Woodpeckers in recent decades provided motivation to carry out surveys for the species throughout its range. Searches have taken place in Texas, Arkansas, Louisiana, western Tennessee, Mississippi, southern Illinois, Georgia, South Carolina, North Carolina, and Florida. While suggestive evidence has been found in several states, no clear, conclusive photograph or video has been made as of the publication of the final recovery plan (USFWS 2010).

According to the U.S. Fish and Wildlife Service (2010), the IBWO potential range comprises that portion of Arkansas and Mississippi in and around the bottomland hardwood forest of the lower White River basin where the 2005 IBWO sighting occurred; the lower Arkansas River basin, and the batture (floodplain) of the Mississippi River in the vicinity of the confluence of the White, Arkansas, and Mississippi Rivers ("Big Woods" area), which includes the Three Rivers Project Study Area.

Interior Least Tern

The interior least tern was listed as endangered in 1985, with a final recovery plan published in 1990.

This small bird winters in Central and South America. During breeding season, they inhabit the sandbars of the Arkansas, Mississippi, and Red Rivers in Arkansas (April through August), while they nest and raise their young. They nest in small colonies on exposed salt flats, reservoir beaches, river sandbars along most of the larger rivers, and at the Salt Plains National Wildlife Refuge near Jet, Oklahoma. Along the Arkansas River in Oklahoma, the interior least tern breeds in Kay, Osage, Pawnee, Creek, Tulsa, Wagoner, Muskogee, and Sequoyah Counties. In Arkansas, the breeding range on the Arkansas River was once considered that area above Little Rock (USFWS, 1990). Since 1990, least terns have been found on sandbars of the Arkansas River below Little Rock all the way to its confluence with the Mississippi River, including sandbars on the Arkansas River in the Three Rivers Study Area. On the Mississippi River, interior least terns occur almost entirely in the lower valley south of Cairo, Illinois to Vicksburg, Mississippi (USFWS, 1990).

Nests are small scrapes in the sand with 2-3 eggs laid in a clutch. The young are mobile soon after hatching and both parents feed and remain with the young until fall migration. They feed mostly on small fish.

The interior least tern is endangered due to destruction, alteration, and curtailment of its nesting habitat. Channelization, irrigation, and the construction of reservoirs and pools have contributed to the elimination of much of the tern's sandbar nesting habitat in Arkansas and Red River systems. Human disturbance and predation are other threats to this species.

The smallest North American tern (length 21-24 cm); breeding adult is mainly gray above, with a black cap and nape, white forehead, black line running from the crown through the eye to the base of the bill, orange-yellow bill often with a dark tip, white or grayish underparts, short deeply forked tail, and yellow-orange legs and feet; a black wedge on the outer primaries is conspicuous in flight. Adult in winter plumage has a dingy cap, dark nape, a black line through the eye, a dark bill, and yellowish feet and legs. Juvenile is pinkish-buff above, with brownish U-shaped marks on the back; crown is dusky; dark bar is present on the front part of the folded wing. First-summer birds resemble adults but retain the dark bar on the wing and have a dark bill and dark feet and legs, dusky primaries, a dark nape, and a black line through the eye.

Courtship behavior includes chases, vocalizations, and sometimes presentation of a fish to the female by the male. Lays eggs mostly in May-June (July-August nests probably are re-nests). Re-nesting may occur after egg loss associated with heavy rains and/or flooding. Clutch size usually is 2-3, rarely up to 4-5. Incubation usually lasts 20-25 days (also reported as 21-22 days), by both sexes but mostly by female. Hatching success varies greatly and is affected by factors such as weather, tides, predation, and human disturbance; may be high under optimal conditions. Young are tended by both parents, leave nest after a few days, brooded for several days; fly at about 3-4 weeks, dependent for a few weeks more. Reproductive success rarely exceeds one chick per pair. First breeds generally when about one year old, sometimes not until two years old. Maximum known natural longevity is 21 years. In recent years, colonies generally have included not more than 20 pairs, sometimes up to about 75 pairs, rarely up to several hundred pairs. Colony may be divided into subcolonies.

Adults do not require cover during the breeding season, but chicks may use sparse vegetation and debris for shade and protection. Parents may lead chicks toward the periphery of the colony into more heavily vegetated areas, where the young utilize debris and vegetation for cover. Along river systems, willow (*Salix spp*.) is the common vegetation adjacent to sites. On Oklahoma salt flats, almost 60% of the nests were within 5 cm of debris.

Interior populations nest mainly on riverine sandbars or salt flats that become exposed during periods of low water. As a result of vegetational succession and/or erosion, preferred nesting habitat typically is ephemeral. Nests are usually located at higher elevations and away from the water. Water levels determine the size of sand bars and the extent of nesting areas. Dams above colonies generally lower habitat quality by eliminating the spring floods that are necessary for alluvium deposition and the scouring of vegetation.

Since least terns always nest near water, they are vulnerable to flood inundation and seem to seek high ground. Interior least tern nests on salt plains in Oklahoma were located an average of 110.5 m away from the nearest water. However, nests on the Platte River in Nebraska were located at an average of 18.9 m away from the nearest river channel on sand bars that averaged 58.9 m wide.

Eats mainly small fishes (generally less than 9 cm long), sometimes crustaceans or insects, obtained by diving from air into shallow water usually less than 4 m deep. Interior populations depend almost entirely on cyprinids. Feeding in newly plowed fields has been observed in Texas.

This bird is commonly observed during the summer along the Mississippi and lower Arkansas Rivers. The Melinda Sandbar directly across the Arkansas River from the Melinda Channel is commonly used for nesting by this species. They are also known to use other large sandbars on the Arkansas and Mississippi Rivers at several sites within the project area. They have been observed foraging along the lower White River, but are not known to nest along this river – likely due to the lack of suitable sand bars.

Piping Plover

The piping plover was officially listed January 10, 1986. This listing did not recognize subspecies, however the rule's preamble acknowledged the continuing recognition of two subspecies, *Charadrius melodus melodus* (Atlantic Coast of North America) and *Charadrius melodus circumcinctus* (Northern Great Plains of North America). The final rule determined the species as endangered in the Great Lakes watershed of both the U.S. and Canada, and as threatened in the remainder of its range in the U.S. (Northern Great Plains, Atlantic and Gulf Coasts, Puerto Rico, Virgin Islands), Canada, Mexico, Bahamas, and the West Indies (USFWS 1985).

Subsequent Endangered Species Act (ESA) actions have consistently recognized three separate breeding populations of piping plovers, on the Atlantic Coast (threatened), Great Lakes (endangered), and Northern Great Plains (threatened). Observations in Arkansas are likely those of the Northern Great Plains (NGP) population, based on likely migration corridors to their wintering grounds. Most of the NGP plovers winter along the Texas coast, extending into Mexico.

Northern Great Plains population's breeding range includes southern Alberta, northern Saskatchewan, and southern Manitoba; south to eastern Montana, North and South Dakota, southeastern Colorado, Iowa, Nebraska, and east to Lake of the Woods in north-central Minnesota. The majority of the United States' pairs are in the Dakotas, Nebraska, and Montana. Fewer birds nest in Minnesota, Iowa, and Colorado, with occasional nesting in Oklahoma and Kansas (USFWS 2001). They nest on the shorelines and islands of alkali (salty) lakes in North Dakota and Montana. They nest on sandbar islands and reservoir shorelines along the Missouri River and reservoirs in Montana, North Dakota, South Dakota, and Nebraska. In Nebraska, they nest on the Platte River system, Niobrara, Loup, and Elkhorn rivers as well as limited locations in Minnesota and Colorado.

For nesting, piping plovers make shallow scrapes in the sand which they line with small pebbles or rocks. The female lays three to four eggs and both parents share in incubation duties. The eggs hatch after about 28 days, and the young leave the nest within hours. The chicks can forage for themselves immediately, but remain near their parents for several weeks for protection and temperature control (brooding or shading). Depending on food availability, it takes the young from around 18 to 28 days to begin flying.

Plovers from all three breeding populations winter along coastal beaches and barrier islands from North Carolina to Texas, the eastern coast of Mexico, and on Caribbean islands. They migrate to their nesting grounds in mid-April and depart mid-July to late August. During fall and spring, plovers use rest sites along the migration pathway including shorelines of reservoirs/man-made lakes, industrial ponds/fish farm ponds, rivers, marsh/wetlands, and natural lakes. These stopover sites are highly influenced by local water levels, and tend to consist of locations with muddy/sandy substrates. Plovers do not concentrate in large numbers at inland stopover sites; instead, they stay for just a few days and then move on. They do not use the same stopover sites between years. Migration stopover habitat is not well documented, but migrating piping plovers have been observed in Arkansas.
Habitat loss is one of the main reasons for the decline of the piping plover. Starting in the 1930's, dam construction, water diversion and water withdrawals changed river flow regimes and drastically reduced the amount of available nesting habitat. Too much water can flood the plovers' nests, while too little water can cause vegetation to grow on what was nesting habitat and make it unsuitable for the plovers. Many of the coastal beaches used as nesting habitat have been developed for commercial, recreational, and residential use. This has also led to an increase in nest disturbance and predation, as plovers will abandon their nests when disturbed by humans or other predators. Unwary people can crush the well-camouflaged eggs and young birds, and dogs, cats and other wildlife often harass or eat young plovers and eggs.

Rufa Red Knot

The Rufa Red Knot was listed as threatened on January 12, 2015. There is no approved recovery plan for this species. In the final listing rule, the USFWS (2014a) concluded that sufficient reliable data to derive a precise range-wide population estimate for the red knot was unavailable. The few dependable surveys, however, have shown sharp declines in population numbers. Recent Tierra del Fuego survey data from 2000 to 2013 shows a 75% decline from 1980's baseline numbers. Similar declines were noted from Delaware Bay surveys during the same time period. These two areas (Tierra del Fuego and Delaware Bay) supported a large majority of rangewide knots during the baseline 1980s period.

Rufa red knots are one of six red knot subspecies of knots recognized, each with distinctive morphological traits (i.e., body size and plumage characteristics), migration routes, and annual cycles. Each subspecies is believed to occupy a distinct breeding area in various parts of the Arctic, but some subspecies overlap in certain wintering and migration areas (USFWS 2013b). The Rufa Red Knot breeds in the central Canadian Arctic and winters along the Atlantic coast and the Gulf of Mexico coast (Gulf coast) of North America, in the Caribbean, and along the north and southeast coasts of South America including the island of Tierra del Fuego at the southern tip of Argentina and Chile. The best available information indicates

that *Calidris canutus* in the Northwest Gulf of Mexico wintering area are predominantly the *rufa* subspecies. Resightings of marked birds show considerable movement between Texas and both the Southeast wintering area and the Delaware Bay stopover site (USFWS 2013b).

Annual migrations of this species is one of the longest known in the animal kingdom, traveling up to 19,000 miles annually. Red knots undertake long flights that may span thousands of miles without stopping. Most red knot subspecies tend to migrate in single-species flocks with departures typically occurring in the few hours before twilight on sunny days. Size of the departing flocks tends to be large (greater than 50 birds). Rufa Red Knots are thought to migrate during both day and night based on the duration and distance of migratory flight segments estimated from geolocator data (USFWS 2013b).

During both the northbound (spring) and southbound (fall) migrations, red knots use key staging and stopover areas to rest and feed. Most Rufa Red Knots migrate by way of the Atlantic coast. Major spring stopover areas along the Atlantic coast include Río Gallegos, Península Valdés, and San Antonio Oeste (Patagonia, Argentina); Lagoa do Peixe (eastern Brazil, State of Rio Grande do Sul); Maranhão (northern Brazil); the Virginia barrier islands (United States); and Delaware Bay (Delaware and New Jersey, United States). These birds often use Delaware and New Jersey's Delaware Bay area as a stopover, refueling on Horseshoe Crab eggs.

Geolocator results from eight red knots (one with 2 years of data) wintering in Texas showed that these birds used a central, overland flyway across the Midwest United States. Birds flew 1,600 to 2,000 mi (2,600 to 3,300 km) to the first stopover. A Northern Great Plains stopover (Saskatchewan, Canada, and North Dakota, United States) was used by five of six birds in 2010, while southern Hudson Bay in Manitoba, Canada (the Nelson River delta and James Bay), was used by 1 bird in 2010 and all three birds in 2011 (USFWS 2013b). All eight Texas red knots departed in the second half of May. While these geolocater results show the use of the central flyway, resightings of marked birds suggests a more complex pattern of movements between Texas and the Atlantic coast.

Red knots are restricted to the ocean coasts during winter, and occur primarily along the coasts during migration. However, small numbers of rufa red knots are reported annually across the interior United States (i.e., greater than 25 miles from the Gulf or Atlantic Coasts) during spring and fall migration—these reported sightings are concentrated along the Great Lakes, but multiple reports have been made from nearly every interior State (USFWS 2013b).

Red Knots use different habitats during the breeding, wintering, and migration seasons. In the Arctic, they nest in extremely barren habitats, such as windswept ridges, slopes, or plateaus. Nesting sites are usually located in dry, south-facing locations, near wetlands or lakes, where the young are led after hatching. Red Knots generally feed in damp or barren areas that can be as far as 10 km from the nest.

Migratory stopovers and wintering grounds are vast coastal zones swept by tides twice a day, usually sandflats but sometimes mudflats. In these areas, the birds feed on mollusks,

crustaceans, and other invertebrates. The species also frequents peat-rich banks, salt marshes, brackish lagoons, mangrove areas, and mussel beds. In South America, they frequent restingas, which are rocky, tide-swept platforms, rich in invertebrates. This species' various habitats must provide suitable rest areas, sheltered from predators. It is unlikely that the extent of this species' Arctic breeding habitat has undergone any significant change. However, habitat changes brought about by climate change are likely to affect knots, probably in a negative fashion (SARPR 2017).

On the breeding grounds, knots eat mostly spiders, arthropods, and larvae obtained by surface pecking, and on the wintering and migratory grounds they eat a variety of hard-shelled prey such as bivalves, gastropods and small crabs that are ingested whole and crushed by a muscular stomach. In Delaware Bay, they feed in large numbers on the eggs of horseshoe crabs which spawn just as the birds arrive in mid-summer.

The main threat to the Red Knot of the rufa subspecies is the overfishing of Horseshoe Crabs in Delaware Bay, which has decimated the supply of this invertebrate's eggs. During the spring migration, these eggs are the birds' most important food source at their final stopover before returning to Canada. The impact is greater on this Red Knot subspecies because its migratory route is significantly longer than that of the other subspecies.

Other threats against this species, particularly the rufa and islandica subspecies, include the decreased availability of wetland habitats during the migration in eastern North America. Other potential threats include human disturbance, the increased frequency and force of hurricanes during migration, and pollution caused by oil and chemical use in North and South America. In addition, the effects of climate change (such as rising sea levels and the changing conditions of Arctic breeding grounds) and the increased predation (resulting from the rebounding of predator populations including falcons) could pose a long-term threat to Red Knot populations. Global warming, which is expected to cause the Arctic zone to shift northward, will have a particularly significant impact on individuals of the rufa subspecies that nest in the southern Arctic (SARPR 2017).

Rufa red knots have been documented in Arkansas during their migration period. Currently, four counties have recorded sightings – including Desha County, partial location of the Three Rivers Study Area. They are considered uncommon in the state.

6.0 EFFECTS OF THE ACTION

Pallid Sturgeon

The lower Arkansas River provides some habitat for the pallid sturgeon. Research conducted on pallid sturgeon movements and habitat use in the lower Mississippi River documented the presence of two individuals in the lower Arkansas River near the Yancopin Bridge in 2011, located approximately 2 miles upstream of the project area (Kuntz and Schramm 2012). Further sampling in 2012 documented the presence of one of these individuals, and one new fish, using the lower 10 miles of the Arkansas River. As discussed previously, personal communication with Dr. Hal Schramm (USGS) and Paul Hartsfield (USFWS) indicated the

presence of pallid sturgeon in the lower Arkansas River was incidental and likely limited to high water events on the Mississippi River when the fish seek refuge from high flows.

Numerous research projects and fish samples conducted on the lower White River over several decades have failed to document the presence of pallid sturgeon in this river. They have been collected from the Mississippi River, near the confluence with the White River. It is possible that the lower White River lacks required habitat conditions for this species.

Despite documentation of incidental use of the lower Arkansas River by pallid sturgeon, the proposed action will not alter the frequency or duration of flooding, thus will not impact the species. Construction related activities would likely increase sediment in the lower Arkansas River, reducing the quality of the habitat, however it will be of short duration. It is highly unlikely that construction activities could directly impact pallid sturgeon (e.g. habitat avoidance, kill) because activities in which equipment would be in the water would be during low-flow conditions (i.e. summer), when pallid sturgeon are most likely to remain in the Mississippi River channel.

Fat Pocketbook Mussel

Suitable habitat for the fat pocketbook mussel may exist in the lower Arkansas River in the immediate area of the project, but no individuals have been found there. A mussel survey conducted in the vicinity of the project area, including the Melinda Channel, revealed only one species of live mussel, the pink papershell, present in the Melinda Channel, and only badly eroded relics of the Asian clam collected from the main channel of the river (Harris 2009).

Suitable habitat for the fat pocketbook in the lower White River in the immediate area of the project is unlikely. This area (~ Rmi 7-10) has undergone periodic dredging since the 1960's to maintain an adequate navigation channel. Suitable habitat may exist downstream of the project area on the lower White River (below ~Rmi 7) but no individuals have been documented there. Bates and Dennis (1983) reported that much of the substrate of the White River, Arkansas, now consists of shifting sand bars. The only stable substrate left in these areas is found along the bank where some undredged mud ledges remain. The nearest documented occurrence of this species on the White River was one live individual recorded in the main channel at Gunbarrel Reach (Rmi 11 – 12.4), located upstream of the project area (Harris and Christian 2003).

The proposed action does not alter the frequency or duration of flooding, thus no impacts are anticipated downstream of the project area on either river. Construction related activities would likely increase sediment in the lower reaches of both rivers, however it will be of short duration. It is highly unlikely that construction activities would directly impact fat pocketbook mussels (e.g. habitat avoidance, kill) as construction best management practices will be implemented to minimize sediment reaching streams. The apparent lack of suitable habitat downstream of the project area on both rivers is perhaps the most compelling reason that the proposed action is unlikely to effect this species. The absence of fat pocketbook mussels from numerous surveys conducted in the area is a likely indicator of the lack of suitable habitat.

Rabbitsfoot Mussel

As discussed in Section 5, rabbitsfoot mussels have been collected in the White River upstream of the study area. The closest recorded occurrence is near St. Charles, Arkansas, 47 river miles upstream of the project area. It is not known to occur in the lower Arkansas River.

While the rabbitsfoot mussel was listed in the FWS PAR as potentially occurring in the Three Rivers Study Area, the PAR went on to state that this species is very unlikely to occur in areas potentially affected by the project alternatives being discussed. The reason it is on the PAR list is because it has been found in the White River. However, the closest known occurrence of the rabbitsfoot is approximately 47 river miles above the study area. Another reason for the unlikelihood of their presence is due to lack of quality habitat (gravel, shoals, etc.) present in the Three Rivers Study Area. Based on the reasons listed, no impacts to this species is anticipated from the alternatives being considered, including the Proposed Action.

Pink Mucket Pearly Mussel

Statewide surveys of mussel species over several years has indicated most pink mucket pearly mussel populations occur in the Ouachita Mountain ecoregion of west Arkansas.

While the pink mucket pearly mussel was listed in the FWS PAR as potentially occurring in the Three Rivers Study Area, the PAR went on to state that this species is very unlikely to occur in areas potentially affected by the project alternatives being discussed. The reason it is on the PAR list is because it has been found in the White River. While three live pearly mussels were found at two sites in the White River, the sites are over 145 and 211 river miles, respectively, upstream of the Study Area (White River mile 155.6 and 221). Based on the reasons listed, no impacts to this species is anticipated from the alternatives being considered, including the Proposed Action.

Scaleshell Mussel

The scaleshell mussel was identified on the FWS IPaC website as possibly occurring in the Three Rivers Study Area, likely due to their presence in the upper White River, downstream of Newport, Arkansas (Harris and Christian 2009). This location is approximately 246 river miles above the Three Rivers Project Area.

While suitable habitat for the scaleshell mussel may have existed at one time in the lower White River, its presence now is unlikely. The lower ten miles of the White River has undergone periodic dredging since the 1960's to maintain an adequate navigation channel. Additionally, the lower White River has experienced headcutting originating from the Mississippi River. Any suitable habitat, or individual mussels, that may have been present in the Three Rivers Project Area has likely been destroyed by these, and possibly other, impacts.

Another reason for the unlikelihood of their presence is due to lack of quality habitat (gravel, shoals, etc.) present in the Three Rivers Study Area. Harris and Christian (2009) indicated the area around Newport (White River mile 246) probably represents the downstream limit for the scaleshell in the White River drainage, as it is considered an Interior Highlands species that prefers small to medium sized rivers in Arkansas.

Based on the reasons listed, no impacts to this species is anticipated from the alternatives being considered, including the Proposed Action.

Ivory-billed Woodpecker

Extensive surveys conducted by bird experts throughout potential habitat in the Cache and White River basins and the Big Woods region of southeast Arkansas failed to document any IBWO individuals. Impacts that could potentially affect IBWO habitat is limited to the 25 acres of bottomland hardwood forest in alignment with the new containment structure. Vegetation data collected along this alignment by Arkansas Game and Fish Commission (AGFC), USFWS, and USACE biologists, revealed few large trees capable of supporting cavities, as well as very few snags.

According to the U.S. Fish and Wildlife Service (2010), the IBWO potential range comprises that portion of Arkansas and Mississippi in and around the bottomland hardwood forest of the lower White River basin where the 2005 IBWO sighting occurred; the lower Arkansas River basin, and the batture (floodplain) of the Mississippi River in the vicinity of the confluence of the White, Arkansas, and Mississippi Rivers ("Big Woods" area), which includes the Three Rivers Project Study Area. Since that initial sighting, numerous state and federal agency personnel, and other bird experts, spent several thousands of hours conducting official surveys for the IBWO throughout potential habitat. While suggestive evidence was found, no clear, conclusive photograph or video has been made documenting its continued existence in the Big Woods area, including in the Three Rivers Study Area.

The permanent loss of 25 acres of bottomland hardwood trees, plus a temporary loss of 10-15 acres of trees due to construction, will not impact the IBWO. Similarly, modifications to the Melinda Structure, Owens Lake Structure, and the HCCS, are not expected to have direct impacts to the bird. Indirect effects are possible during construction (habitat avoidance from noise and activity), however, they will be temporary and of short duration. The presence of several thousand acres of contiguous habitat in the Big Woods area provides ample room to escape disturbance.

The USFWS PAR indicates the Service no longer recommends official pre-project surveys, however any observations of birds or potential signs of occupation (foraging signs or cavities) should be reported to the Service.

Interior Least Tern

Interior Least Terns (ILTs) are known to use the project area. The nearest nesting location is the Melinda Sandbar, directly across the Arkansas River from the Melinda Channel and location of the new containment structure.

An analysis of sandbar elevations on the lower Arkansas River show elevations ranging from 129' to 134' MSL. Under the Proposed Action, water exchange between the White and lower Arkansas Rivers will not occur until elevation 145' MSL. Once water begins to exchange at elevation 145' MSL, the sandbars, and any nests, would have already been

inundated by flood waters from the Arkansas River. Therefore, reducing the height of the HCCS would not not impact nesting habitat.

Construction related activities will result in a temporary increase in noise and human disturbance in the area, which could lead to habitat avoidance by the ILT. ILTs are known to use sandbars on the Arkansas River throughout its length in Arkansas and eastern Oklahoma, as well as sandbars on the Mississippi River, thus there is ample habitat available should disturbance be an issue. Construction related impacts will be of short duration, and will likely occur during low-flow conditions (summer/fall), which is outside the nesting season for ILTs. ILTs are believed to be seasonal migrants to Central and South America and the Caribbean. ILTs using the Arkansas River begin to migrate in mid- to late August, thus will likely be gone during much of the construction period (USACE 2016).

In a recent 5-year review of the status of ILT, USFWS recommended removing the species from the Federal list of endangered and threatened species due to recovery; however, prior to delisting, the USFWS recommended future actions to be taken before initiation of a delisting proposal of the ILT. The recommendations called for the completion of a habitat metapopulation model, the development of conservation agreements for post-listing monitoring and management, and the development of a post-delisting monitoring strategy plan (USFWS 2013a). In response to this recommendation, USACE Southwestern Division developed a Draft Conservation Plan for the ILT (USACE 2016). The purpose of this ESA Section 7(a)(1) Conservation Plan is to identify operational modifications incorporated into USACE operations and navigation projects that benefit ILT, in partial fulfillment of the USFWS recommendations to assist with the delisting process of the ILT. USACE is committed to continue post-delisting operational modifications, as well as additional conservation actions for ILT, that the agencies are disposed to conduct based upon opportunity and availability of funds.

Piping Plover

According to the U.S. Fish and Wildlife Service, migrating piping plovers have been observed in Arkansas. While their presence has not been confirmed in or near the Three Rivers Study Area, suitable stopover (resting) habitat (river shorelines with muddy/sandy substrates) is present on the lower Arkansas and Mississippi rivers.

Any occurrence of piping plovers in the study area would likely occur during summer months when this bird is migrating to its breeding grounds in the northern U.S. and Canada (late April – May), or migrating to its wintering habitat along the Gulf Coast (July – August).

Construction related activities will result in a temporary increase in noise and human disturbance in the area, which could lead to habitat avoidance by piping plovers using sandbars in the immediate vicinity of the Project Area. Given that piping plovers only stay at resting sites for a few days, it is unlikely that this would be an issue. Regardless, ample habitat is available downstream on the Arkansas River, as well as on the Mississippi River, should any birds be disturbed.

An analysis of sandbar elevations on the lower Arkansas River show elevations ranging from 129' to 134' MSL. Under the Proposed Action, water exchange between the White and lower Arkansas Rivers will not occur until elevation 145' MSL. Once water begins to exchange at elevation 145' MSL, the sandbars will have already been inundated by flood waters from the Arkansas River. Therefore, reducing the height of the HCCS would not impact resting habitat for plovers.

Rufa Red Knot

While considered uncommon in Arkansas, the rufa red knot has been documented from four counties in Arkansas, including Desha County. A portion of the Three Rivers Study Area is located in this county, thus the presence of a rufa red knot in the study area during migration is possible, albeit unlikely.

Documented habitat use by rufa red knots during migration is usually sandflats, but mudflats are sometimes used. Suitable stopover (resting) habitat (river shorelines with muddy/sandy substrates) is present on the lower Arkansas and Mississippi rivers.

Any occurrence of rufa red knots in the study area would likely occur during summer months when this bird is migrating to its breeding grounds in the Artic (mid to late May), or migrating to its wintering habitat along the Gulf Coast and South America (July – August).

Construction related activities will result in a temporary increase in noise and human disturbance in the area, which could lead to habitat avoidance by rufa red knots using sandbars in the immediate vicinity of the Project Area. Similar to plovers, red knots only stay at resting sites for a few days before continuing their migration. As such, it is unlikely that disturbance would be an issue. Regardless, ample habitat is available downstream on the Arkansas River, as well as on the Mississippi River, should any birds be disturbed.

An analysis of sandbar elevations on the lower Arkansas River show elevations ranging from 129' to 134' MSL. Under the Proposed Action, water exchange between the White and lower Arkansas Rivers will not occur until elevation 145' MSL. Once water begins to exchange at elevation 145' MSL, the sandbars will have already been inundated by flood waters from the Arkansas River. Therefore, reducing the height of the HCCS would not impact resting habitat for rufa red knots.

7.0 CUMULATIVE EFFECTS

Cumulative effects or impacts are defined under 50 CFR §402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation".

The Three Rivers Study Area, to a large part, is made up of lands owned by the federal government (USFWS and COE) as well as lands managed by the Arkansas Game and Fish Commission (Trusten Holder Wildlife Management Area) and some owned by the Arkansas Department of Parks and Tourism. Private landowners consist of timber companies, hunting clubs, and individuals.

The majority of State or private activities in the study area include operation and maintenance of lands owned by the Arkansas Game and Fish Commission, and timber harvesting by those timber companies located in the study area. Recreational activities such as hunting and fishing are the predominate activities by the public. It is unlikely recreational activities could have an effect on any endangered or threatened species found in the area. Timber companies in the area will likely continue harvesting plots on a rotational basis into the foreseeable future. As a result, suitable habitat for the Ivory-billed woodpecker would be lost.

8.0 AFFECTS DETERMINATION

In conclusion, the Corps of Engineers has made the following determinations for threatened or endangered species that may occur in the Three Rivers Study Area:

Pallid Sturgeon

The Proposed Action **may affect, but is not likely to adversely affect** the Pallid Sturgeon.

- Pallid sturgeon use of the lower Arkansas River is thought to be incidental by experts studying this species. The current theory is that this species moves in to the lower Arkansas during flood events on the Mississippi River to avoid high water flows.
- Temporary impacts would reduce the quality of potentially suitable habitat in the lower Arkansas River, however construction activities would likely occur during low water conditions when pallid sturgeon prefer the Mississippi River.
- Pallid sturgeon are not known to occur in the lower White River.

Fat Pocketbook Mussel

The Proposed Action **may affect, but is not likely to adversely affect** the Fat Pocketbook Pearly Mussel.

- The Proposed Action does not alter the frequency or duration of flooding, thus no impacts are anticipated.
- Construction related activities may increase sediment in the lower Arkansas River, however it will be of short duration and would likely occur during low-flow conditions.
- The presence of suitable habitat downstream of the project area on the lower White River is unlikely due to maintenance dredging for navigation.

Rabbitsfoot Mussel

The Proposed Action **may affect, but is not likely to adversely affect** the Rabbitsfoot Mussel.

- The closest known populations are near St. Charles, Arkansas, 47 river miles upstream of the project area.
- Dredging and incision on the lower White River has likely destroyed any suitable habitat that may have once been present.
- It is not known to occur in the lower Arkansas River. Past mussel surveys on the lower Arkansas River have failed to record any mussel species.

- The USFWS PAR states that this species is very unlikely to occur in areas potentially affected by the project alternatives being discussed, therefore no impacts to this species is anticipated.

Pink Mucket Pearly Mussel

The Proposed Action **may affect, but is not likely to adversely affect** the Pink Mucket Pearly Mussel.

- The majority of pink mucket pearly mussel populations occur in the Ouachita Mountain ecoregion of west Arkansas.
- The closest specimens documented in the White River are located 150 – 200+ miles upstream of the study area.
- Preferred habitat is medium to large rivers in gravel with sand substrate. Gravel substrate is uncommon in the project area.
- Dredging and incision on the lower White River has likely destroyed any suitable habitat that may have once been present.
- The Pink Mucket Pearly Mussel is not known to occur in Arkansas River. Past mussel surveys on the lower Arkansas River have failed to record any mussel species.
- The USFWS PAR states that this species is very unlikely to occur in areas potentially affected by the project alternatives being discussed, therefore no impacts to this species is anticipated.

Scaleshell Mussel

The Proposed Action **may affect, but is not likely to adversely affect** the Scaleshell Mussel.

- The closest documented occurrence of the Scaleshell Mussel in the White River is approximately 236 river miles above the Project Area.
- Harris and Christian (2009) indicate that the Scaleshell Mussel prefers small to medium sized rivers in Arkansas and is considered an Ozark Highlands species.
- Preferred habitat for the Scaleshell is stable riffles and runs with gravel or mud substrate and moderate current velocity. The lower White and Arkansas rivers lack riffle-run habitat, and gravel substrate.
- The Scaleshell Mussel is not known to occur in the Arkansas River. Mussel surveys on the lower Arkansas River have failed to record any mussel species.
- Dredging and incision on the lower White River has likely destroyed any suitable habitat that may have once been present.

Ivory-billed Woodpecker

The Proposed Action **may affect, but is not likely to adversely affect** the Ivory-billed Woodpecker.

- Surveys conducted throughout potential habitat in the Big Woods region failed to document any IBWO individuals.
- Construction actions will have no direct effect to the IBWO. Approximately 25 acres of bottomland hardwood forest will be lost due to construction of the containment structure, but several thousand acres of suitable habitat exists adjacent to this area.

- Indirect effects are possible during construction (habitat avoidance from noise and activity), however, they will be temporary and of short duration. The presence of several thousand acres of contiguous habitat in the Big Woods area provides ample room to escape disturbance.
- The USFWS PAR indicates the Service no longer recommends official pre-project surveys, however any observations of birds or potential signs of occupation (foraging signs or cavities) should be reported to the Service.

Interior Least Tern

The Proposed Action **may affect, but is not likely to adversely affect** the Interior Least Tern (ILT).

- ILTs are known to use sandbars near the project area for nesting. The closest known nest site is located on the Melinda Sandbar, located immediately across the lower Arkansas River from the Melinda Channel.
- Flood frequency and duration analysis data presented in Section 5 documents no direct impacts to ILT nests due to elevations of sandbars, versus elevation of water exchange from the proposed action.
- Construction related activities will result in a temporary increase in noise and human disturbance in the area, which could lead to habitat avoidance by the ILT. Ample habitat elsewhere on Arkansas and Mississippi Rivers if disturbance is an issue.
- Construction will likely occur during low-flow conditions (summer/fall), when ILTs are in Central and South America and the Caribbean.

Piping Plover

The Proposed Action **may affect, but is not likely to adversely affect** the Piping Plover.

- While suitable stopover habitat is present, no birds have been documented in the Three Rivers Study Area.
- Flood frequency and duration analysis data presented in Section 5 documents no direct impacts to piping plover stopover habitat due to elevations of sandbars, versus elevation of water exchange from the proposed action.
- Construction related activities will result in a temporary increase in noise and human disturbance in the area, which could lead to habitat avoidance by piping plovers. However, ample habitat exists nearby on lower Arkansas and Mississippi Rivers if disturbance is an issue.
- Plovers typically use stopover sites for only a few days, thus would be relocating regardless of any disturbance.

Rufa Red Knot

The Proposed Action **may affect, but is not likely to adversely affect** the Rufa Red Knot.

- Rufa Red Knots are considered an uncommon species in Arkansas, as they primarily use coastal areas during migration and wintering.
- While suitable stopover habitat is present, no birds have been documented in the Three Rivers Study Area.

- Flood frequency and duration analysis data presented in Section 5 documents no direct impacts to rufa red knot stopover habitat due to elevations of sandbars, versus elevation of water exchange from the proposed action.
- Construction related activities will result in a temporary increase in noise and human disturbance in the area, which could lead to habitat avoidance by rufa red knots. However, ample habitat exists nearby on lower Arkansas and Mississippi Rivers if disturbance is an issue.
- Rufa red knots typically use stopover sites for only a few days, thus would be relocating regardless of any disturbance.

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APPENDIX A

THREE RIVERS FEASIBILITY STUDY

PLANNING AID REPORT

U.S. FISH AND WILDLIFE SERVICE

United States Department of the Interior
FISH AND WILDLIFE SERVICE

November l 0, 2015

Colonel Courtney W. Paul
District Engineer
Little Rock District U.S. Army Corps of Engineers
P.O. Box 867
Little Rock, AR 72203-0867

Dear Colonel Paul:

This planning aid report (PAR) discusses fish and wildlife related concerns, comments, and recommendations relative to the Three Rivers Study (TRS). This feasibility study is being conducted in order to investigate alternatives to ensure reliable commercial navigation on the McClellan-Kerr Arkansas River Navigation System (MKARNS), as well as explore opportunities for environmental restoration. This PAR has been prepared in accordance with the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), but does not constitute our final report as required by section 2(b) of the FWCA. The U.S. Fish and Wildlife Service (Service) has signed on as a cooperating agency and regularly attends coordination meetings and is assisting in efforts to formulate and evaluate alternatives.

The TRS shares many similarities with a previous U.S. Anny Corps of Engineers (Corps) study entitled the Arkansas-White Cutoff Study (AWCS). This previous study encompassed a similar project area and considered several identical alternatives. Although environmental restoration is now a project authorization in addition to navigation and several new alternatives may be considered, these two studies are similar enough in scope and design such that many of the comments from the last study are still applicable today. This is especially true as it pertains to lists of fish and wildlife that inhabit the study area, narratives regarding the history of Corps activities in the area, and descriptions of important habitats and natural processes. For detailed information regarding these subjects, please reference our previous PARs and our Draft Coordination Act Report (USFWS 2003, 2004, 2009). These documents are available in Appendices G and H within the AWCS Draft Environmental Impact Statement (USACE 2010). These previous Service reports will be cited frequently throughout this report in order to avoid unnecessary duplication. This PAR will focus on updated information about existing conditions and comments or recommendations regarding the alternatives that are currently under consideration.

PRIOR REPORTS

Several reports have been written by the Service on the MKARNS including the Arkansas-White Cutoff and associated work. The findings of the most pertinent reports are summarized below.

November 1986 - Draft FWCA Report

The Service defined fish and wildlife problems and needs for the Arkansas-White Cutoff Study, discussed the projected amount of bottomland hardwood habitat that would be lost from the project, and recommended the amount of land that would be needed to mitigate for project impacts.

April 1987 - Planning Aid Report
The Service provided the Corps with an inventory of natural resources for the proposed White River Entrance Channel Arkansas and Desha Counties, Arkansas, with a one mile corridor on either side of the White River from river miles 1 to 10. It included a discussion of the significance of those resources, and a projection of presence or absence of those resources into the future.

August 1990 - Draft FWCA Report
The Service defined fish and wildlife problems and needs for the Montgomery Point Lock and Dam Study, discussed the projected amount of bottomland hardwood habitat that would be lost from the project, and recommended the amount of land that would be needed to mitigate for project impacts.

October 8, 2003 - Planning Aid Report
The Service provided lists of species inhabiting the project area, descriptions of existing resources, detailed potential impacts associated with various alternatives, and provided recommendations for studies.

August 6, 2004 - Planning Aid Report
The Service provided updates to the previous PAR detailing information about threatened and endangered species within the project area.

July 22, 2009 - Draft FWCA Report
The Service provided background information regarding fish and wildlife resources and habitat in the project area and assessed the potential impacts associated with various project alternatives. We recommended that the Corps proceed with the "No Action" alternative until a comprehensive "Three Rivers Study" could be completed to help identify historic and current hydrologic and geomorphic conditions in an effort to craft a solution that is sustainable and compatible with the purposes of the Dale Bumpers White River National Wildlife Refuge (DBWRNWR).

DESCRIPTION OF STUDY AREA

The study area for the previous AWCS was located at the lower end of the Arkansas River and White River basins near their confluence with the Mississippi River and encompassed about 66,000 acres. The area extended from the confluence of the Arkansas Post Canal with the White River (WR) at WR Mile 10 and the Arkansas River (ARR) near the Wilbur Mills Dam (Dam 2) at approximate ARR Mile 35 eastward to their confluences with the Mississippi River (MR) at approximate MR Miles 599 and 581, respectively. The boundary of the study area for this study has not been finalized but has been discussed several times at meetings attended by Corps and other agency planners. Everything that was included

previously would remain and most contributors have suggested that the study area should expand northward to encompass the lower end of the DBWRNWR. Most draft renderings of the project area have it extending to a point near the mouth of Bayou LaGrue at approximately WR Mile 17. Detailed descriptions of the "Three Rivers" region including historical and current geology, geomorphology, land use, and vegetative cover can be found in the Service's AWCS PAR and Draft FWCA Report (USFWS 2003, 2009).

DESCRIPTION OF FISH AND WILDLIFE RESOURCES

The Service's PARs and Draft FWCA Report (USFWS 2003, 2004, 2009) for the AWCS provide extensive detail regarding historical and current species known to inhabit the "Three Rivers" region. Any changes from these reports are detailed in the following sections.

Aquatic Resources

The AWCS PARs and Draft FWCA (USFWS 2003, 2004, 2009) briefly describe aquatic habitats and detail the known aquatic resources in terms of fisheries and freshwater mussels. Since the publication of these reports, more data was made available regarding the freshwater mussel resources of the Arkansas River in the vicinity of the project area. Corps funded studies revealed few freshwater mussels and little suitable habitat in the area of the Melinda Structure and the Arkansas River within the Melinda Bend (Harris 2009). New information regarding the Pallid Sturgeon *(Scaphirhynchus albus)* and Rabbitsfoot *(Quadrula cylindrica)* has become available since our previous reports. These updates are discussed in the section regarding federally listed species.

Terrestrial Resources

Detailed lists of the terrestrial species (including birds, mammals, reptiles, and amphibians) are available in the AWCS PARs and Draft FWCA Report (USFWS 2003, 2004, 2009). This information is still useful for the evaluation of the TRS. Updated information regarding the Ivory-billed Woodpecker *(Campephilus principalis)* is provided in the following section.

Federally Listed Species

Federally listed species that occur in or near the project area include:

Pallid Sturgeon (endangered) - This species has long been presumed to possibly enter the lower Arkansas and White Rivers. In recent years, individuals tagged in the Mississippi River have been documented as far upstream on the Arkansas River as Dam 2. There is still no documentation Pallid Sturgeon using the White River, although individuals have been captured in the Mississippi River near the confluence of these two rivers.

Fat Pocketbook *(Potamilus capax)* (endangered) - This species of freshwater mussel is widespread, though rarely locally abundant, in the Mississippi River. It was considered absent from the White River since the 1960's until a survey in 2003 revealed an individual between RMs 11 and 12. It is still considered uncommon in the White River. This species

could occur in the Arkansas River, although surveys in 2009 revealed none present in the Melinda Channel or the Arkansas River one mile upstream and downstream (Harris 2009). Freshwater mussels in general were rare in the area surveyed (only one live individual encountered).

Pink Mucket *(Lampsilis abrupta)* (endangered)-This species of freshwater mussel likely occurred throughout the White River historically. Recent documented occurrences are limited to sites well upstream of the project area. It is not known to inhabit the lower Arkansas River. It is very unlikely that this species occurs in areas potentially affected by the project alternatives being discussed.

Rabbitsfoot (threatened) - This species of freshwater mussel likely occurred throughout the White River historically. It was recently listed as threatened and currently populations in the White River are concentrated in the sections from Batesville to the mouth of the Little Red River and from Clarendon to St. Charles, Arkansas. It is not known to occur in the lower Arkansas River. It is very unlikely that this species occurs in areas potentially affected by the project alternatives being discussed.

Interior Least Tern *(Sterna antillarum)* (endangered)-This bird is commonly observed during the summer along the Mississippi and lower Arkansas Rivers. They nest on large sandbars and are frequently observed foraging for small fish along these rivers. The Melinda Sandbar directly across the Arkansas River from the Melinda Channel is commonly used for nesting by this species. They are also known to use other large sandbars on the Arkansas and Mississippi Rivers at several sites within the project area. They have been observed foraging along the lower White River but are not known to nest along this river.

Ivory-billed Woodpecker (endangered)-The project area is within the "Big Woods" area, considered to be potential habitat for this species. The Service provided detailed survey recommendations for this species during our comments on the AWCS. Since that time, many thousands of hours were spent conducting official surveys for this species throughout potential habitat. This effort was unsuccessful at replicating the observations documented in 2004/2005. At this time, the Service no longer recommends official pre-project surveys. However, any observations of birds or potential signs of occupation (foraging signs or cavities) during planning or construction should be reported to the Service.

Determination of effects on these listed species is the responsibility of the Corps in coordination with the Service. It appears that the Pallid Sturgeon and Interior Least Tern are most likely to occur in areas that may be altered due to the proposed alternatives. The other species listed all occur in the White River above the MKARNS channel and are less likely to experience adverse effects due to this project.

FISH AND WILDLIFE RESOURCE PROBLEMS

The AWCS PARs and Draft FWCA Report (USFWS 2003, 2004, 2009) provide details regarding the decline of neotropical migrant birds, freshwater mussels, fishes, and their habitats within the project area.

SPECIAL DESIGNATIONS

The "Three Rivers" area is an important component of the last remaining large contiguous block of bottomland hardwood forest in the Mississippi Alluvial Valley. With over 80 percent of the forested wetlands of the MAV gone, the value of this area to neotropical migratory songbirds, waterfowl, and black bear is without question, of primary importance. The wetland functions performed, including flood water retention and nutrient transformation, help to mitigate the flooding downstream, improve water quality, and enhance fish and wildlife habitat.

In recognition of their importance to migratory birds and other wildlife, the wetlands of the Lower White/Cache Rivers have been identified as one of 37 Ramsar Wetlands of International Importance in the United States. The Ramsar Convention is the only international accord dedicated to the worldwide protection of wetlands. Wetlands are selected for inclusion on the List of Wetlands of International Importance based on international significance in terms of ecology, botany, zoology, limnology, or hydrology.

The lower Arkansas River from Dam 2 to its confluence with the Mississippi River has been designated by the state of Arkansas as a natural and scenic waterway, and an ecologically sensitive waterbody. The natural and scenic designation recognizes river segments with potential for adoption into the National Wild and Scenic Rivers System, while the ecologically sensitive designation recognizes river segments known to provide habitat within the existing range of threatened, endangered or endemic species of aquatic or semi-aquatic life forms (Arkansas Pollution Control and Ecology Commission 2001). It is also listed by the National Park Service (NPS) on the Nationwide Rivers Inventory (NRI). The NRI is a register of rivers that may be eligible for inclusion in the National Wild and Scenic River System. Rivers are listed on the NRI based on the degree to which they are free flowing, the degree to which the rivers and their corridors are undeveloped, and because they possess one or more "outstandingly remarkable" natural or cultural values judged to be of more than local or regional significance. The lower Arkansas River was listed on the NRI because it is free flowing and possesses outstandingly remarkable scenic, geologic, and wildlife values.

The intent of the NRI is to provide information to assist in making balanced decisions regarding use of the nation's river resources. Section 5(d) of the National Wild and Scenic River Act requires that, "In all planning for the use and development of water and related land resources, consideration shall be given by all federal agencies involved to potential national wild, scenic and recreational river areas." All federal agencies are required to consult with the NPS, which is charged with compilation and maintenance of the NRI, prior to taking actions that could effectively foreclose inclusion into the national system. Additionally, a 1979 Presidential Directive and a related Council on Environmental Quality Directive require federal agencies to seek to avoid or mitigate actions that would adversely affect one or more NRI segments (National Park Service 2011).

The Service has previously identified the bottomland hardwoods in a portion of the study area as Resource Category 2 and the White River fishery habitat as Resource Category 3 (USFWS 1986). The Service's mitigation policy (USFWS 1981) defines four resource categories based on their value and relative abundance and further identifies the mitigation goals and guidelines for Service recommendations for each of these categories. The designation criteria for habitat in Resource Category 2 is "habitat to be impacted is of high quality for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section." The mitigation goal for habitat in Resource Category 2 is "no net loss of in-kind habitat value." The designation criteria for Resource Category 3 is "habitat to be impacted is of high to medium value for evaluation species." The mitigation goal for habitat in Resource Category 3 is "no net loss of habitat value while minimizing loss of in-kind habitat value." (USFWS 1993).

PAST AND CURRENT WATER DEVELOPMENT CONSTRUCTION IN THE STUDY AREA

A full account of historical developments in the project area through 2009 and their potential effects is provided in the AWCS PARs and Draft FWCA (USFWS 2003, 2004, 2009). Since these reports were published, no major new construction has taken place in the project area. However, maintenance activities in the form of dredging and structure repairs have continued. Of special note is the repair of the Melinda Structure following the near record flood events of spring 2011. The structure was nearly bypassed via a headcut on the western flank and required substantial repairs.

ALTERNATIVES

At this time, a final list of alternatives has not been approved for this study. The preliminary alternatives identified so far include:

1. No action

   This alternative would maintain the status quo. All existing structures would be maintained and repaired as needed. Up to three additional structures could be built if necessitated due to accelerated headcutting through Owens Lake or other pathways. If needed, these structures would be studied and funded independently. The risk of an uncontrolled reconnection of the White and Arkansas Rivers would remain similar to current estimates.

2. Distributed relief

   Multiple step down structures at multiple relief openings that will allow the exchange of flow between the Arkansas and White Rivers. The type of structure, the number of

openings and the location of the relief openings will depend on an allowable cross-current threshold flow that has yet to be established. The threshold flow is the maximum diverted flow that will minimize dangerous cross-currents at any given location.

- These structures can be built in one or more of the following locations: Owens Lake, Melinda, LeGrues Lake, John Smith Lake, Historic Cutoff, Webfoot, Mayhorn, Coono, Mud Sough, and other areas of low relief. This can also include v-notches in the existing soil cement levee. This will allow flow to exchange at a lower frequency event and decrease the possibility of introducing dangerous cross-currents into the navigation channel by distributing the flow across multiple locations instead of concentrating it at one location. Structures can be rip rap, soil cement, concrete, soldier piles, or a variety of other materials or construction.

3. New Channel from Mississippi/Old White River Channel to the Arkansas River

   Instead of reopening the historic cutoff, a new channel would be built that would allow the exchange of flow between the Mississippi and the Lower Arkansas.

   - This alternative would reconnect the lower Arkansas River to the Mississippi River to re-establish the flow regime prior to filling in the historic cutoff in 1964. This would also cause water to backup into the Arkansas River around the Melinda corridor and therefore reduce damaging head differentials between the White and the Arkansas during a flow exchange event. This alternative may allow the reopening of the historic cutoff at a lower elevation than it is currently and decrease flood duration of lower frequency events in the DBWRNWR without introducing dangerous cross-currents in the navigation channel.

4. Restore historic hydrology with a relief structure

   Build a structure that releases flow to and from the Arkansas River to decrease head differentials. This plan effectively restores the natural hydrology and cutoff channel that was closed in the early 1960's. Decreased head differentials will also decrease erosive forces and the need to maintain the Melinda Structure and Jim Smith Lake Structures. This idea can be accomplished by a structure with gates similar to the others on the navigation system, or a weir structure.

   - Gated spillway (active restoration structure) similar to the AWCS Alternative 2A.
   - Weir Spillway (passive restoration structure) similar to the AWCS Alternative 2B.

5. Raising / extending the existing soil-cement dike

This would involve raising the elevation of the soil-cement levee from the Historic Cutoff Closure Structure westward to a point south of the ship canal.

- Raising the soil-cement levee to an elevation of 155 feet above mean sea level (AMSL). This is similar to alternative 6A in the AWCS.

- Raising the soil-cement levee to an elevation of 160 feet AMSL. This is similar to alternative 6B in the AWCS.

DESCRIPTION OF POTENTIAL IMPACTS

2. No action

The study area is currently experiencing significant geomorphic instability that is manifesting itself through accelerated and excessive bank erosion on the Arkansas and White Rivers, headcutting near the Melinda Structure at the base of Owen's Lake and within other flow paths, and damage to Corps structures. Additionally, the hydrology within the study area has been altered by these structures and other navigation and flood control activities nearby. If this alternative were selected, the area would continue to suffer from channel instability and altered hydrology, resulting in additional terrestrial habitat loss and modification, adverse modification of in-channel habitats, and degraded water quality.

2. Distributed Relief

This alternative has not been described in detail. It would involve diverting flows from the White River to the Arkansas River, or vice versa, via hardened passive structures. The specific location, elevation, design, and capacity of these structures has yet to be determined. Given enough total flow capacity, the general effect to hydrology would be similar to that expected with an opening of the historic cutoff. The depth and duration of flooding upstream of these structures (White River basin) should be reduced while the depth and duration downstream (Arkansas River basin) would be increased. It is important to note that the lower White River basin, specifically the DBWRNWR, has been identified as suffering from a shift to more water tolerant vegetation due to extended flooding and soil saturation during the growing season. Any alternative that simulates the function of the historic cutoff should benefit terrestrial resources in the DBWRNWR and surrounding areas. The effects of this study on sediment transport patterns and flow patterns is currently unclear. It appears likely that with multiple smaller connections, induced cross-currents within the MKARNS may be reduced when compared with the diversion of all flows through the historic cutoff. Because of this, it may be possible to design these multiple structures at a lower elevation that more closely matches historic conditions.

3. New Channel from Mississippi/Old White River Channel to the Arkansas River

This alternative has not been described in detail. The general concept involves diverting water from the channel separating Big Island and Montgomery Island (former White River channel that was captured by the Mississippi River) across Big Island to a point in the Arkansas River near the old cutoff. This would allow high flows from the Mississippi River to reach this point at nearly the same time as they do so on the White River. Currently, backwaters must travel 4-5 times farther up the Arkansas River than the White River, resulting in a large head differential. By creating a shortcut for water to reach this point on the Arkansas River, this head differential could be reduced, thereby mimicking the effect of the old cutoff and reducing the erosive potential of any connecting flows between the White and Arkansas Rivers. There are several potential challenges and unknowns regarding this alternative.

- It is unknown how the diversion of water from the Mississippi River to the Arkansas River would affect the sediment transport patterns within the Arkansas River. Some planners have suggested that the Arkansas River is sediment-starved due to upstream dams and that the addition of sediment-laden waters from the Mississippi would return it to a more natural condition. It was also suggested that the amount of sediment introduced via this alternative may be no more than that expected by the diversion of flows from the White River through the old cutoff or multiple outlets. Others have suggested that the Mississippi River may carry so much sediment as to be detrimental to the lower Arkansas River. At this point, no studies addressing this question have been carried out in order to determine potential effects of this alternative.

- It is assumed that the constructed channel required for this alternative would make maximum use of existing sloughs or low areas along the crossing of Big Island. However, it is inevitable that forested areas/wetlands would be impacted due to the construction of a channel and associated spoil piles. This may result in this alternative requiring more compensatory mitigation. Additionally, it is unclear how receptive the current landowners or lease holders may be to such an idea. It is likely that a crossing, either a bridge or culverts, would be necessary to maintain land-based access to the southern end of Big Island.

- The lower Arkansas River below Dam 2 has both state and federal designations. These regulations may influence which activities are deemed appropriate (see SPECIAL DESIGNATIONS section).

4. Restore historic hydrology with a relief structure

Impacts associated with this alternative depend on the specific designs chosen. Options included a gated structure capable of releasing water at an adjustable range of volumes and elevations or a passive weir constructed at a set elevation. These two options equate to alternatives 2A and 2B from the AWCS. Alternative 2A included a gated structure capable of releasing water down to an elevation of 115 feet AMSL. It

would be married to a passive weir placed at an elevation of 145 feet AMSL. Alternative 2B featured a two-stage fixed weir with elevations of 140 and 144 feet AMSL. Both alternatives would have similar effects on hydrology, although the passive design would result in more direct effects to terrestrial habitat. Under these alternatives, the White River flood height decreases by approximately one foot for the two year event (50 percent annual chance of exceedance). Duration of White River flooding would be decreased by approximately two days above elevation 155 feet and five days for elevation 150 feet. The height of Arkansas River flooding would increase by approximately one foot for the two year event and duration of flooding above 150 feet would increase by about 4.5 days. Construction of the gated structure in the Historic Cutoff would result in 122 acres of direct impacts. Riverine wetlands would incur a loss of 8,062 FCU and Flat wetlands would incur a 506 FCU loss. Construction of the fixed weir structure in the Historic Cutoff would result in 152 acres of direct impacts. Riverine wetlands would incur a loss of 5,280 FCU and Flats would incur a 1,529 FCU loss. Probability of an uncontrolled cutoff occurring over the 50 year project life is estimated at 14 and 10 percent, respectively, for alternatives 2A and 2B.

These alternatives would restore some of the hydrologic function of the Historic Cutoff, reduce pressure on other flow paths across the area and improve hydrology upstream along the White River. Reduced flood depth and duration on the lower refuge would be beneficial to Swainson's Warbler, which require higher sites. Conditions along the White River would be more favorable to the Nuttall's oak-green ash bottomland hardwood forest communities, which are more favored by waterfowl than the lower overcup oak - bitter pecan dominated communities. The hydrologic improvement associated with these alternatives would likely meet refuge compatibility requirements and would also preclude the need for the Corps to obtain construction flood easements from the refuge.

5. Restore histo1ic hydrology with a relief structure

Impacts associated with this alternative depend upon the chosen design elevation. The two options are synonymous with alternatives 6A and 6B in the AWCS. Alterative 6A was initially the selected plan for the AWCS. It would prevent all overland flow from passing between the two rivers below the 155 foot dike elevation. It would increase White River flood heights by 1.5 feet over existing conditions at the pre-project elevation of 150 feet (three percent exceedance). Duration of White River flooding above 150 feet is lengthened by two days. Duration of flooding on the Arkansas River decreases by approximately 0.5 days for stages higher than elevation 150, while flood height for the 2-year event increases by approximately eight inches. Raising and extending the containment structure to 155 feet would result in 95.4 acres of direct impacts and the conversion of approximately 18 acres of prime and unique farmland. Riverine wetlands would incur a loss of 14,261 FCU and Flats would incur a 6,302 FCU loss. Probability of an uncontrolled cutoff occurring over the 50 year project life is estimated at 10 percent.

Alternative 6B (AWCS) would prevent all overland flow from passing between the two rivers below the 160 foot dike elevation. It would increase White River flood heights by two feet over existing conditions at the pre-project elevation of 150 feet (three percent exceedance). Duration of White River flooding above 150 feet would be lengthened by two days. Duration of flooding on the Arkansas River would decrease by approximately 0.5 days for stages higher than elevation 150, while flood height for the 2-year event would increase by approximately eight inches. Raising and extending the containment structure to 160 ft. elevation would result in 104.1 acres of direct impacts. Riverine wetlands would incur a loss of 22,278 FCU and Flats would incur a 12,362 FCU loss. Probability of an uncontrolled cutoff occurring over the 50 year project life is estimated at 1 percent.

In our evaluation of the AWCS, the Service did not support these alternatives for several reasons. We were concerned that the complex hydrology and interactions between the Mississippi, Arkansas, and White Rivers are poorly understood and that the study was too limited in scope to address the complexity. The Corps listed three reasons for closing the Historic Cutoff when constructing the MKARNS, one of which was that the system designers believed that the Historic Cutoff was a geologic relic (Arkansas - White Rivers Cutoff Study Draft General Reevaluation Report (DGRR), Pg. 1-11), and, while the importance of this feature is becoming increasingly appreciated [1], it appears that the history of projects in the area indicate otherwise, as these projects have been "band-aid" approaches that did little to expand the capacity of the system to handle surface water interactions. The engineers acknowledge that "The confluence of the Arkansas and the White Rivers with the Mississippi River is an area of complex and evolving flow patterns" (DGRR, Appendix A. Hydrology and Hydraulic Analysis, Pg. A-6). Yet, these alternatives would appear to encompass a direction that is the antithesis of this realization. With the construction of the various structures over the years, the rivers' inevitable response has resulted in continued environmental damage and loss of terrestrial habitat on both DBWRNWR and private land. These damages have not been mitigated and the Service has never been compensated for these continued damages.

[1] "Maintenance costs have risen as new failure paths have developed leading observers to suspect the Historic Cutoff was not a geologic relic, but an important connection formed to govern the water surface behavior at the confluence of the three rivers." (DGRR, Pg. 1-13).

Much of the land upon which Alternatives 6A or 6B would be constructed, as well as much of the land that would be affected by the project, is on the DBWRNWR. As stewards of one of the most significant bottomland hardwood ecosystems left in the lower Mississippi Valley, the Service was concerned that impacts from these alternatives could exceed those identified in the study, and that these impacts would be imposed upon a system that is already perturbed by past hydrologic modifications to the river basin. The hydrologic alteration resulting from these alternatives would impact forest health and productivity, wildlife habitat quality and availability, and infrastructure. The hydrologic modeling that was the basis for the Hydrogeomorphic

Wetland Assessment (HGM) focused on surface water changes, but did not take into account the effect of extended flooding on soil saturation, which could have as significant of an effect as inundation on tree health and survival.

The Service's concern that there would be impacts, especially on the refuge, in addition to those identified by the HGM and lake connectivity studies, was exemplified by the Corps' proposed acquisition of a flowage easement for ~1,216 acres of refuge land for project induced flooding. This flooding was projected to last 2 weeks when river stage of 152 feet causes 8 inches of induced flooding on a 2 year recurrence interval (DGRR, Pg. 7-3, Lines 21-26). The impact of this induced flooding could be more extensive than anticipated because of the complex web of sloughs, bayous, and other depressional features that connect the floodplain and backwater areas to the White River.

The Service also had concerns that the 8, 10'x10' gated box culverts proposed to be installed at Wild Goose Bayou would have impacts on hydrology of the land between the White River, Arkansas River, and Arkansas Post Canal that were not captured by the Corps' hydraulic models and environmental analyses. These structures would prevent inflow from the White River and limit outflow, which would affect fish access to the bayou and floodplain, and forest community composition and health. Finally, the issue of operation and maintenance of these structures would be problematic from the execution and responsibility aspects. The Corps indicated that operation and maintenance responsibility for the Wild Goose structure would be transferred after construction; however, both Arkansas Game and Fish Commission and the Service indicated that they would not assume that responsibility.

DISCUSSION

The ecosystem of the lower White and Arkansas Rivers is characterized by the complex interaction of hydrologic, geomorphic, and biotic processes. These processes regularly experience wide fluctuations around a set of average conditions. Normal low river stages with periodic extreme low water during dry climatic conditions act in concert with seasonal high water and wet climatic cycles to create and maintain a diverse and incredibly rich environment. Fish and wildlife that live in or stop over during annual migrations have adapted to endure or even exploit these extreme conditions. Detailed descriptions of the aquatic and terrestrial animals and plant communities that are found in the lower White and Arkansas River basins can be found in previous Service comments regarding the AWCS (USFWS 2003, 2004, 2009).

The numerous detrimental impacts to habitat (channel incision, channel instability, hydrology/vegetation alteration) observed within the project area all have a causal link to previous navigation and flood control efforts within the MKARNS and the larger lower White, Arkansas, and Mississippi River basins. The attempted reconnection of the Arkansas and White Rivers via a new pathway is likely a direct result of efforts to block the historical flow path (i.e. the Historic Cutoff). The causes of the problems identified in the project area are complex, as are the solutions. In comments on the AWCS, the Service recommended that

the Corps carry out a "Three Rivers Study" that would investigate the historic and current hydrology and geomorphology of the "Three Rivers" area (White, Arkansas, and Mississippi Rivers) and seek solutions that are compatible with navigation and environmental concerns. The ultimate goal of the proposed study was to aid in the development of a solution that would go beyond the reactionary "band-aid" approach that has been implemented over the last 50 years.

Although the current feasibility study is entitled the "Three Rivers Study", it does not represent the scope and intensity of the study called for by the Service and others during the review of the AWCS. Essentially, the current study largely replicates the previous AWCS and will likely leave many unanswered questions. Several of the same alternatives will be evaluated. The current study is an improvement, acknowledging environmental as well as economic benefits associated with various alternatives. Constraints such as state and federal designations and refuge compatibility under the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) have also been discussed early on during the planning of this study.

DISCUSSION OF FUTURE FWCA ACTIVITIES

The TRS is evaluating the impacts, costs, and benefits of several alternatives selected to address headcutting, channel erosion, and potential cutoff development problems in the lower White and Arkansas Rivers. There is potential for adverse impacts to nationally important resources, including resources within the national wildlife refuge system, from any of the alternatives being selected, including the no action alternative.

The Service has agreed to be a Cooperating Agency on the TRS and a member of the planning team. The Service has and will continue to participate in interagency meetings; participate in the environmental, economic and hydrological studies; evaluate the impacts of the alternatives developed; consult on potential impacts to endangered species; and prepare draft and final Fish and Wildlife Coordination Act reports. In order to successfully complete these tasks, the Corps has transferred funds to the Service. We also anticipate that additional data will be developed by the Corps and provided to the Service. The following are some data the Service will need to evaluate any alternatives developed.

1. Detailed descriptions of all alternatives as developed.

2. The hydrologic conditions associated with each alternative.

3. The number, size, area, and location of any structures proposed.

4. Results of all environmental, economic, and hydrological studies associated with this project being conducted or under contract by the Corps.

5. Proposed public recreation access areas or other public recreation facilities associated with all alternatives.

6. Proposed mitigation features associated with all alternatives.

7. Analysis of the cumulative impacts of the proposed project and other existing and proposed projects and regulations on the fish and wildlife resources in the lower White River basin.

RECOMMENDATIONS

Changes in the hydrology of the study area associated with any proposed project are unknown for all alternatives at this time, but are being investigated by the Corps as part of the TRS. If any changes to hydrology are anticipated as a result of the proposed project, such changes should be quantified and their impacts to waterfowl, fisheries, vegetation, and other resources evaluated. Further, as hunting and fishing are important to the economy of the project area, any reduction in these resources resulting from the project would have a negative impact on the economy within the project area.

The Service has not yet determined the potential compatibility of the various alternatives with the purposes of the DBWRNWR; however, we are concerned that some of the proposed alternatives, specifically alternative five (raising /extending the existing soil-cement dike), could have significant adverse impacts on fish and wildlife resources of national and international importance, both within and beyond Service property, and could lead to revocation of some of the area's special designations. Therefore, the Service recommends that the following be incorporated into future planning and study investigations:

1. Investigate the pre-construction (i.e., historic) hydrologic conditions (flow patterns, velocities, and flood frequency, duration, and extent) in the study area.

2. Eliminate alternative five from further consideration.

3. Evaluate alternatives two, three, and four as stand-alone or combined alternatives.

4. Obtain new LIDAR data (either via project funds or other sources) to improve the resolution of the digital elevation models for the area.

5. Work with ecologists and geomorphologists to develop an improved model of potential vegetation in the project area, especially within the lower White River section.

6. Investigate cumulative impacts of this proposed project along with other potential projects and regulations that are likely to impact fish and wildlife resources in the lower Arkansas and White River basins.

7. Provide information requested in the previous section to the Service as soon it is available.

8. In cooperation with the Service and other resource agencies, identify and quantify impacts and develop an adequate mitigation plan for unavoidable impacts to be implemented concurrently with any project.

9. Quantify the amount of past, current, and future anticipated bottomland hardwood forest habitat lost to construction of the MKARNS along with mitigation provided or proposed for these losses.

10. Recognize and fully consider the importance of the natural resources in the area and the legal mandates under which the DBWRNWR operates. It is very likely that the refuge will have to make a compatibility determination of any project proposed in the area that requires construction or flowage easements on lands under refuge management.

11. As the study proceeds and alternatives are refined, they should be designed to avoid, rather than to compensate for, adverse impacts to fish and wildlife resources associated with the construction and maintenance of the proposed project.

12. The study should consider the lower Arkansas River's NRI, natural and scenic waterway, and ecologically sensitive waterbody listings and evaluate potential impacts to the free flowing condition, water quality, and the outstandingly remarkable values of the listed segments. Steps to avoid/minimize impacts to the extent practicable should be included in the alternatives.

13. Finally, unavoidable losses associated with the project will need to be quantified and a mitigation plan which compensates for all unavoidable losses, aquatic, as well as terrestrial, developed and implemented concurrently with project features.

SUMMARY AND SERVICE POSITION

The Service has identified a number of potential environmental concerns associated with the possible construction of alternative 5 (AWCS 6A/6B). Of particular concern to the Service are the cumulative impacts associated with this and other potential projects planned in the Arkansas-White River basin; the continued erosion of land around Owens Lake and the Melinda Channel; possible further alteration of the hydrology on the floodplain; and the potential adverse impacts to the high value fish and wildlife resources of the lower Arkansas-White River basins. Any alternative that would allow continued damage to occur on Service lands located in the study area could lead to a determination of non-compatibility with refuge purposes. We do not support any alternatives that would lead to the revocation of any of the area's special designations. Therefore, the Service recommends that the proposed project place a high emphasis on protecting these public resources. The Service will participate with the Corps in evaluating economic, hydrological, and environmental impacts associated with the study as well as other reasonably foreseeable changes in the basins that may contribute to cumulative impacts of resources within the Arkansas-White River Basins. We acknowledge that there may be some ecosystem restoration opportunities associated with this study.

However, these opportunities may be limited due to the relatively intact habitats present on the lower river. Most impacts noted in the area have a direct link to past hydrologic alterations and attempts to separate the flows of the White and Arkansas Rivers. It is possible that a sustainable solution that improves navigation reliability may also provide ecosystem benefits if it moves in the direction of replicating the historical connectivity among the three rivers in the study area.

The Service appreciates the opportunity to provide these preliminary comments and recommendations and looks forward to working with you and your staff as the study progresses. If you have questions regarding our comments please contact Jason Phillips at jason_phillips@fws.gov or (870)503-1101.

Sincerely,

Original signed.

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Field Supervisor

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