
**SECTION B. ENVIRONMENTAL ASSESSMENT FOR THE BIG LAKE NATIONAL WILDLIFE
REFUGE LAKE RESTORATION IN MISSISSIPPI COUNTY, ARKANSAS**

Date: March 2022

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INTRODUCTION

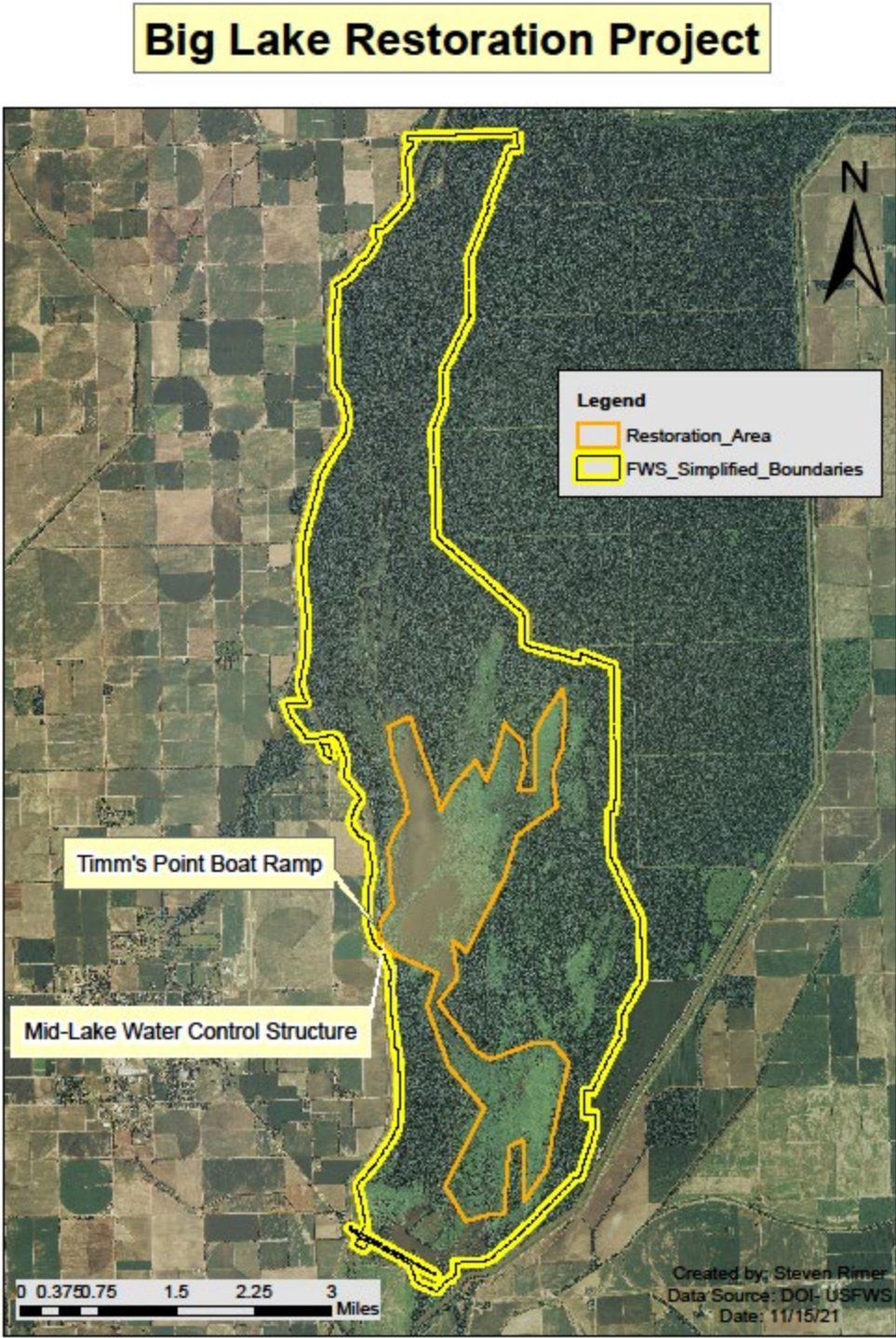
This Environmental Assessment (EA) is being prepared to evaluate the effects associated with the active rehabilitation of Big Lake on Big Lake National Wildlife Refuge (NWR or refuge), Mississippi County, Arkansas and complies with the National Environmental Policy Act (NEPA) in accordance with Council on Environmental Quality regulations (40 CFR §§1500-1509) and Department of the Interior (43 CFR Part 46; 516 DM 8) and U.S. Fish and Wildlife Service (550 FW 3) regulations and policies. NEPA requires examination of the effects of proposed actions on the natural and human environment. Compliance with other applicable statutes, executive orders and regulations are addressed (Appendix A).

PROPOSED ACTION

The U.S. Fish and Wildlife Service (Service) is proposing to actively rehabilitate Big Lake in accordance with the Big Lake NWR Comprehensive Conservation Plan (CCP) and Spatial Habitat Management Plan (SHMP; USFWS 2009 and 2019; Figure 1). The purpose of the proposed action is to compact the buildup of sediments and organic matter on the lake substrate, reduce invasive species, replace the mid-lake water control structure (WCS), and provide waterfowl with food resources to help meet refuge, state, and Lower Mississippi Valley Joint Venture (LMVJV) energy objectives for waterfowl. The refuge would contract the control of invasive species by aerial spraying of herbicide in June-July of 2022. Staff would begin to remove boards from the Spillway WCS, located on the south side of the refuge, to lower lake water levels June- July 2022. Boards will be removed to allow a gradual reduction of water level in the lake. The drawdown will take approximately 2 weeks, depending on rainfall. At the end of the drawdown period, the refuge may work with partners to aerially seed portions of the lake bottom with millet, rice, and/or milo that will provide waterfowl food and help suppress growth of invasive or other undesirable plants (e.g., cocklebur, coffeeweed, black willow). Prior to and/or during the drawdown, the Service may apply herbicides to control invasive or undesirable species and increase energetic carrying capacity for waterfowl. By mid-October, staff will place the boards back into the south WCS and open the north WCS to allow water in the lake area and bring the lake gradually back to full pool by early November 2022. As the Service monitors the rehabilitation of Big Lake, further similar actions may be needed in the future on a reoccurring, as-needed basis and is included in the Proposed Alternative. Ideally, Big Lake NWR would conduct a drawdown every 4-6 years, depending on environmental conditions, to help meet their wildlife objectives, control sedimentation of the lake basin, encourage native plant communities (e.g., submersed aquatic vegetation, moist-soil vegetation), improve forest health, and facilitate management activities (Van der Valk and Davis 1978, Bellrose et al. 1983, Sparks et al., 1998, Hine et al. 2017).

This proposed action is often iterative and evolves over time during the process as the agency refines its proposal, responds to environmental conditions, and learns more from the public, Native American Tribes, and other agencies. Therefore, the final proposed action may be different from the original. The final decision on the proposed action would be made after the conclusion of the public comment period for the EA.

Figure 1. Big Lake National Wildlife Refuge.



BACKGROUND

National Wildlife Refuges are guided by the mission and goals of the National Wildlife Refuge System (NWRS), the purposes of an individual refuge, Service policy, and laws and international treaties. Relevant guidance includes the NWRS Administration Act of 1966 (NWRSA), as amended by the NWRS Improvement Act (NWRRIA) of 1997 (16 U.S.C. §668dd et seq.); NWR Recreation Act of 1962; and Fish and Wildlife Service Manual.

The mission of the NWRS, as outlined by the NWRSA, and as amended by the NWRRIA, is to:

“... to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans”

The NWRRIA mandates the Secretary of the Interior in administering the System to:

- Provide for the conservation of fish, wildlife, and plants, and their habitats within the NWRS;
- Ensure that the biological integrity, diversity, and environmental health of the NWRS are maintained for the benefit of present and future generations of Americans;
- Ensure that the mission of the NWRS described at 16 U.S.C. §668dd(a)(2) and the purposes of each refuge are carried out;
- Ensure effective coordination, interaction, and cooperation with owners of land adjoining refuges and the fish and wildlife agency of the States in which the units of the NWRS are located;
- Assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the NWRS and the purposes of each refuge;
- Recognize compatible wildlife-dependent recreational uses as the priority general public uses of the NWRS through which the American public can develop an appreciation for fish and wildlife;
- Ensure that opportunities are provided within the NWRS for compatible wildlife-dependent recreational uses; and
- Monitor the status and trends of fish, wildlife, and plants in each refuge.

Big Lake NWR, located near the town of Manila in Mississippi County, Arkansas, was established in August 1915, by Executive Order of President Woodrow Wilson, to serve as a reserve and breeding ground for native birds. It is one of the Nation’s oldest inland refuges and encompasses 11,038 acres. The New Madrid earthquakes of 1811 – 1812 changed the Big Lake area from a free-flowing river system to its present lake/swamp environment. An extensive network of ditches in the Missouri bootheel ecoregion drains approximately 2,500 square miles of farmland directly through the refuge.

Big Lake NWR’s official purposes are:

“...as a refuge, reserve, and breeding ground for native birds” (Executive Order 2230, dated August 2, 1915).

“...for use as an inviolate sanctuary, or for any other management purposes, for migratory birds.” 16 U.S.C. 715d (Migratory Bird Conservation Act).

To manage the Big Lake Wilderness as part of the National Wilderness Preservation System according to the Wilderness Act of 1964, as compatible with the purposes for which Big Lake NWR was established.

The refuge is located at the end of over 1,000 miles of drains that remove water from over 1 million acres of cropland in the Missouri bootheel. Due to the refuge's location, large amounts of silt-laden water enter the refuge during different times of the year and then the silt settles out in the lake causing the lake to become shallower year after year. The water entering the refuge during flooding has been described as "too thick to drink but too thin to plow." This also allows undesirable species, such as American lotus, to become established and leave the lake with less open water and generally outcompetes more desirable plants beneficial to waterfowl and other species. Drawing down the lake and exposing the lake bottom during summer will facilitate soil compaction through decomposition of organic matter and other nutrient cycles. Periodic drawdowns are desirable, natural processes that are necessary in floodplain wetlands to encourage nutrient cycling, consolidate sediments, and encourage growth of desirable, native vegetation that provides food and other habitat resources for waterfowl and other wetland-dependent wildlife. Typically, floodplain wetlands and associated semi-permeant wetlands (e.g., swamps, oxbow lakes) are drawdown naturally during drought periods that can occur on a 5-10 year frequency. The refuge completed a similar drawdown and seeding of the lake bottom in 1988, and refuge staff counted an estimated 900,000 ducks using the refuge that winter.

Management of the refuge is based on the 2009 CCP and Finding of No Significant Impact (USFWS 2009) and 2019 SHMP (USFWS 2019). Goals, objectives, and strategies in the Big Lake NWR CCP and SHMP directly support management of Big Lake:

Big Lake NWR CCP Goal 1: Manage and protect migratory birds and native wildlife populations on Big Lake NWR to fulfill the purposes for which it was established and to contribute to the mission of the Refuge System.

Big Lake NWR CCP Objective 1-1: Migratory Waterfowl - Annually maintain 8,442 acres of managed waterfowl foraging habitats in swamp (5,250 acres), open water (2,600 acres), marsh (300 acres), moist-soil (250 acres), and cropland (42 acres) habitats in sanctuaries (November 1 – February 28), sufficient to meet the habitat and population goals of the NAWMP [North American Waterfowl Management Plan] as stepped-down through the LMVJV.

Strategies:

- Ensure sufficient sanctuary for wintering waterfowl and other water birds by maintaining appropriate quantity and quality of non-disturbance areas throughout the refuge.
- Maintain a majority of the 2,600-acre lake as a sanctuary for waterfowl during key use periods (early November through early March).
- Utilize best management practices, including drawdowns, vegetation control, water quality sampling, lake bottom consolidation, and other measures to enhance forage availability and overall habitat quality for dabbling and diving ducks in the lake and associated waters, and the 250-acre moist-soil unit.
- Assess the need, feasibility, and options for lake water manipulation and consider potential benefits and drawbacks of such actions.

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- Monitor trends in lake vegetation communities and siltation levels over time, to determine the need, timing, and type of water management actions warranted to maintain quality waterfowl habitat.
 - Use information gained from monitoring to adjust management actions accordingly to better achieve waterfowl management objectives (adaptive management).

Big Lake NWR CCP Objective 1-3: Shorebirds – Annually provide a minimum of 5 – 10 acres of shorebird habitat flooded to 4 inches or less from July – October to contribute to the objectives set forth in the U.S. Shorebird Conservation Plan, Lower Mississippi Valley/West Gulf Coastal Plain Shorebird Management Plan, and by the LMVJV.

Strategies:

- Consider whether implementation of periodic lake drawdowns and the use of prescribed fire and herbicides as vegetation control methods for invasive plant species, such as lotus and cutgrass, would provide improved habitats (e.g., temporary mudflats, shallow wading water) for shorebirds.
- Conduct shorebird counts on at least one water management unit, with emphasis on fall migration (July - October), that overlap with waterfowl counts, to provide information on shorebird species occurrence and habitat use and determine if opportunities exist to manage water levels to benefit waterfowl and shorebirds.
- Use results of these actions to adjust water management strategies as indicated (adaptive management).

Big Lake NWR SHMP Waterfowl and Waterfowl Habitat Objective: Manage 8,500 acres of waterfowl foraging habitats in swamp (4,940 acres), open water (2,660 acres), marsh (860 acres), and moist-soil (45 acres) at > 500 pounds of seed/acre or > 50 percent coverage in desired moist-soil plants (e.g., wild millet, annual smartweed, sedges, panic grass) that would annually provide 83,239 DEDs of food for wintering waterfowl to meet LMVJV waterfowl DED objectives.

In 2020, the Central Arkansas NWR Complex further refined the waterfowl objectives for Big Lake, Wapanocca, Cache River, and Bald Knob NWRs using an updated process to step-down continental waterfowl objectives from the NAWMP to individual NWRs in the Southeast (Hagy et al. 2020). New energy and population objectives were set for Big Lake NWR, including 5.395 million WED for 86,000 dabbling ducks, 0.266 million WED for 6,000 diving ducks, and 1.5 million WED for 9,000 geese using habitat resources during October–April annually.

Big Lake NWR SHMP Shorebird and Habitat Objective: Annually provide a minimum of 5 -10 acres of shorebird mudflat foraging habitat flooded to 4 inches or less from July –October on the 2,600-acre Big Lake and marsh fringes to contribute to the objectives set forth in the U.S. Shorebird Conservation Plan, Lower Mississippi Valley/West Gulf Coastal Plain Shorebird Management Plan, and by the LMVJV.

Big Lake NWR SHMP Colonial Waterbird and Wading Bird and Habitat Objective: Annually provide 250 acres of managed foraging habitat (open water to vegetated wet areas) for long-legged wading birds and protect rookery sites from habitat modification to contribute to the objectives set forth in the North American Waterbird Conservation Plan.

Big Lake NWR SHMP Secretive Marshbird and Habitat Objective: Annually, from March to August, maintain a minimum of 50 acres of treeless wetlands with dense emergent vegetation at 40 to 80 percent coverage and open water from 20 to 60 percent coverage, flooded < 12 inches deep, to provide high-quality breeding habitat for marshbirds in conjunction with meeting waterfowl habitat requirements.

Big Lake NWR CCP Goal 2: Protect, restore, and manage the functions and values associated with diverse bottomland hardwood forests and open wetland systems in order to achieve refuge purposes, wildlife population objectives, and to benefit migratory waterfowl and other native wildlife.

Big Lake NWR CCP Objective 2-1: Moist Soil Habitat Management: Expand the current level of managed moist-soil habitat from 250 acres to 400 acres and increase production of desired moist-soil plants (e.g., wild millet, annual smartweed, sedges, panic grass) to > 500 pounds of seed/acres or 50 percent coverage that will annually provide 747,200 DEDs of waterfowl foraging habitat and meet the LMVJV forage objectives.

Strategies:

- Consult and implement recommendations from the July 2005 “Moist-Soil Management Guidelines for the USFWS, Southeast Region,” available from the Regional Migratory Bird Program.
- Improve moist-soil habitats and forage yields for waterfowl and other migratory birds by:
 - Maintaining about 200 acres of quality moist-soil habitat and provide 20-40 acres of green browse on nearby upland sites.
- Obtaining, using, and/or installing necessary equipment required for more intensive management actions (e.g., tractors, special plows, mobile pumping equipment, water control gates, and water gauges).
- Monitoring and evaluating moist-soil vegetation growth during summer and fall, and change and refine manipulations as needed.
- Utilizing intensive water control/manipulations and recording associated water depth conditions throughout spring/summer drawdowns.
- Sampling plant responses within the first 30 days of drawdowns and responding to resulting conditions with further water level management as needed to encourage preferred plant communities.
- Sampling units in the fall to determine the composition of poor, fair, and good waterfowl foods.
- Conducting seed estimation surveys in late summer and/or early fall.
- Disturbing soils through disking or other action to set back succession and enhance desired plant responses every 2 to 3 years.
- Monitoring and evaluating waterfowl use at least monthly throughout the winter period.
- Recording observations and associated management practices, and adjusting actions accordingly to meet waterfowl and shorebird objectives (adaptive management).

Big Lake NWR CCP Goal 3: Promote communication, cooperation, and partnerships between local, state, and federal agencies, land managers, and private citizens to minimize impacts from extended habitat degradation and other threats to the functions and values of the refuge’s associated wetland ecosystems and watersheds.

Big Lake NWR CCP Objective 3-1: Water Management and Sedimentation: Collaborate with the COE [U.S. Army Corps of Engineers] (and AGFC [Arkansas Game and Fish Commission]) to modify water management actions and guidelines related to the operation of structures and

water levels in Ditch 81 by revising and reauthorizing the Memorandum of Understanding (MOU) between the Service and the COE.

Strategies:

- Recruit a hydrologist based at Big Lake NWR (but serving all refuges in the Complex) to coordinate with COE on water management programs, sedimentation, and flood control issues, and to coordinate research, assessments, and monitoring of aquatic habitats and water systems.
- Coordinate with AGFC regarding collaborative management of Big Lake NWR and Big Lake WMA [Wildlife Management Area] to accomplish mutually beneficial and compatible programs for water management, water quality, aquatic habitat restoration, and lake enhancement, and to ensure the integrity of the Big Lake Wilderness.
- Pursue land acquisitions from willing sellers and via a Minor Boundary Expansion between the levees near the southern water control structure on the Diversion Canal to reduce the chance of any enhanced water management operations negatively impacting several hundred acres of adjacent private agricultural areas.
- Coordinate with Arkansas and Missouri state wildlife agencies, NRCS [Natural Resources Conservation Service], and COE to identify and implement solutions to water level issues and to seek potential partners for cooperative projects (e.g., new water control structures and levee modifications).
- Coordinate with NRCS to encourage and reward private landowners for conservation actions that reduce erosion and sedimentation on farmed lands in the watershed on a basin-wide approach.
- Document current habitat quality and plant composition of the Big Lake Wilderness, including studies to establish baseline conditions and evaluate impacts of siltation.

Big Lake NWR CCP Objective 3-3: Invasive Plant and Nuisance Animal Control - Annually identify and eradicate or control invasive, exotic, or nuisance plants and animals, and develop and implement a database to systematically track occurrences and treatments within 2 years of the date of this CCP.

Strategies:

- Implement invasive species prevention and control programs in compliance with 50 CFR 29.1 and EO 13112.
- Control beaver, nutria, and muskrat populations as necessary in order to protect roads, levees, structures, infrastructure, and certain forested tracts.
- Utilize mechanical, water drawdown, chemical, and prescribed fire techniques to control undesirable aquatic (e.g., cutgrass and lotus) and upland (e.g., mimosa and saw tooth oak) species that impact wildlife habitat on the refuge.
- Initiate public outreach to alert the public that swine introductions are illegal, and there are negative impacts of feral swine on wildlife and their habitats.
- Do not allow introduction of swine or encourage recreational hunting of this species.
- As feasible and desirable, utilize commercial trapping and hunting to help reduce damage to habitats and infrastructure from beaver, nutria, muskrat, and other nuisance animals, and to protect priority species from disease or over-predation.

Big Lake NWR CCP Goal 4: Develop compatible, wildlife-dependent recreation programs that lead to enjoyable experiences, a greater understanding of fish, wildlife, and habitat conservation, and a greater appreciation for the value of Big Lake NWR.

Big Lake NWR Objective 4-4: Fishing - Annually provide and expand quality, compatible fishing opportunities as feasible.

Strategies:

- Enhance the refuge's main lake habitats for the benefit of aquatic life and to improve fishing success.
- Lower lake levels or drain the lake periodically, in conjunction with waterfowl habitat management, as necessary and feasible to enable habitat improvements and lake bed rehabilitation.

PURPOSE AND NEED

The purpose of this EA is to rehabilitate habitat while providing waterfowl with winter food resources. The need of the EA is to meet the Service's priorities, mission, and mandates; protect biological integrity, diversity, and environmental health; meet the purposes of Big Lake NWR and implement the CCP and SHMP (USFWS 2009 and 2019).

ALTERNATIVES

Several ideas were initially considered and closely evaluated for inclusion in this EA. Two alternatives were fully developed for review: Alternative A, Continue Current Management (No Action Alternative) and Alternative B, Restoration of Big Lake on Big Lake NWR (Proposed Action).

ALTERNATIVE A – CONTINUE CURRENT MANAGEMENT (NO ACTION ALTERNATIVE)

Under this alternative the current management of Big Lake would be continued. This would include not removing boards for the drawdown of the lake. Passive water management would continue and the lake would only be lowered with natural conditions, such as abnormally lengthy periods of drought, and become flooded during extremely wet periods. No additional management would take place to help improve habitat, minimize invasive species and encourage desirable species, compact lake bottom sedimentation, or improve wintering waterfowl food resources.

ALTERNATIVE B – BIG LAKE ACTIVE MANAGEMENT AT BIG LAKE NWR (PROPOSED ACTION ALTERNATIVE)

Under the Proposed Action Alternative, the refuge would actively manage Big Lake. The refuge would contract the control of invasive species by aerial spraying of herbicide in late spring or early summer (May-July) if environmental conditions allow. Staff would begin to remove boards from the south WCS to lower lake water levels after the herbicide spraying, with exact timing dependent on environmental conditions and other factors (i.e., June-August). Application of the aquatic-labeled herbicide would be used on the target plant species such as, American lotus and giant cutgrass. The herbicide would be applied by aerial spraying at the manufacturer's recommended rate. There would be a buffer of at least 40 feet around non-targeted areas and plants such as bald cypress (*Taxodium distichum*) and hardwood trees. The target kill rate would be 85% with little to no impact on non-targets due to the buffer zone created and the herbicide being aquatic approved. At least 2 weeks after herbicide application, boards would be removed from the south WCS to allow a gradual reduction of water in the lake that would take about 2-3 weeks. Anglers would be allowed to net fish after the water draws down so that the fisheries resource is used. Following the drawdown (June-August), the refuge would contract to have the lake bottom seeded with millet, rice, or milo that would help the refuge meet its energy objectives. By mid-October, staff would place the boards back into the south WCS and open the north and middle WCSs to allow water to flow from Ditch 81 into the lake area. The Service plans to remove encroaching vegetation at Timm's Point boat ramp with heavy equipment and rehabilitate Mud Slough moist-soil impoundment by removing debris from the control structure and mowing the impoundment (See Figure 1). Herbicides may also be used to control perennial, invasive, and undesirable vegetation in the moist-soil impoundment. Fish would be restocked in coordination with AGFC after the water levels are back up in October. As the Service monitors the rehabilitation of Big Lake, further similar actions may be needed in the future on a reoccurring, as-needed, basis and is included in the Proposed Alternative. Ideally, Big Lake NWR would conduct a drawdown every 4-6 years, depending on environmental conditions, to help meet their wildlife objectives, control sedimentation of the lake basin, encourage native plant communities (e.g., submersed aquatic vegetation, moist-soil vegetation), improve forest health, and facilitate management activities (Van der Valk and Davis 1978, Bellrose et al. 1983, Sparks et al., 1998, Hine et al. 2017).

Use of Pesticides for Treatment of Invasive Plants and Pests on Units of the NWRS

Recently, the Service clarified four tiers of analysis to support NEPA compliance related to the use of pesticides on units of the NWRS to support refuge purposes, goals, and objectives, as listed.

- Pesticide specific analysis by the US Environmental Protection Agency (EPA)
- Pesticide specific analysis through the Service's Pesticide Use Proposal (PUP) system
- General pesticide analysis for a specific refuge, group of refuges, or refuge complex through an EA/FONSI or Environmental Impact Statement
- General pesticide analysis through a periodic Environmental Action Statement (EAS) or other NEPA document that documents the pesticide use/treatment planned for a specific refuge, group of refuges, or refuge complex

Overviews of the EPA and PUP processes are provided below. The EA and FONSI for the CCP for Big Lake NWR and this EA (and subsequent FONSI; USFWS 2009) would serve the third and fourth tiers listed above for the use of pesticides on Big Lake NWR to help meet refuge purposes, goals, and objectives, including the waterfowl energy and population objectives stepped down from NAWMP.

Overview of EPA's Risk Assessment Process

The Service only considers the use of EPA-registered pesticides, in conjunction with other control measures as needed, to control pests, protect crops, and enhance production to meet economic thresholds for cooperators. All pesticides distributed or sold in the United States must be registered (licensed) by EPA. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) provides for federal regulation of pesticide distribution, sale, and use. Before EPA may register a pesticide under FIFRA, the applicant must show, among other things, that using the pesticide according to specifications "will not generally cause unreasonable adverse effects on the environment." According to EPA, the pesticide registration process under FIFRA, which includes the risk assessment process, is functionally equivalent to the NEPA process and thus the pesticide registration process under FIFRA is exempt from the procedural requirements of NEPA. The process EPA uses for evaluating the potential for health and ecological effects of a pesticide is called risk assessment. Risk assessment is crucial to the process of making decisions about pesticides, both new and existing. EPA requests, reviews, and evaluates the pesticide risks to the environment and then publishes those findings in the Federal Register for public review and comment for 30 to 60 days. EPA also conducts national Endangered Species Act (ESA) consultations with the Service and the National Oceanic and Atmospheric Administration on pesticides. Upon completion, these national consultations become part of the EPA's risk assessment documentation.

Overview of the Service's Pesticide Use Proposal Process

Stepping down from EPA's analysis, the Service conducts an analysis regarding the application of all pesticides through the Service's PUP process. Pesticides must be approved through the Service's PUP process before they can be applied to refuge land and application of pesticides must follow the Department of the Interior's Pesticide Use Policy ([517 DM 1](#)) and the Service's Integrated Pest Management (IPM) policy ([569 FW 1](#)). The Service's PUP process includes review and assessment of treatment location information, chemical profiles, risk assessment, and Section 7 Intra-Service ESA (Section 7) Consultation, with review and approval by regional and national Integrated Pest Management coordinators. Best Management Practices (BMPs) are also utilized in addition to label restrictions imposed by EPA to reduce the chances of any negative effects on non-target species, including bats, pollinators, aquatic species, and threatened and endangered species. Example BMPs include a minimum buffer distance to water or restricting a pesticide to one application per field.

In almost all cases, Service pesticide use restrictions are more restrictive than the EPA-registered pesticide label restrictions. Any Service use of pesticides is to help the Service serve refuge purposes, goals, and objectives, including waterfowl energy and population objectives stepped down from NAWMP.

This alternative is often iterative and evolves over time during the process as the agency refines its proposal and learns more from the public, tribes, and other agencies. The final proposed action may be quite different from the original and the action will also need to be revised to reflect any changes.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section is organized by affected resource categories and discusses both (1) the existing environmental and socioeconomic baseline in the action area for each resource and (2) the effects and impacts of the proposed action and any alternatives on each resource. The effects and impacts of the proposed action considered here are changes to the human environment, whether adverse or beneficial, that are reasonably foreseeable and have a reasonably close causal relationship to the proposed action or alternatives. This EA includes the written analyses of the environmental consequences on a resource only when the impacts on that resource could be more than negligible and therefore considered an “affected resource.” Any resources that would not be more than negligibly impacted by the action have been dismissed from further analysis.

For more information regarding the affected environment, please see Chapter 2 of the refuge’s CCP, which is incorporated herein by reference (USFWS 2009) and can be found here: <https://ecos.fws.gov/ServCat/Reference/Profile/8478>.

Table 1 identifies those resources that either don’t exist within the project area or would not be affected or only negligibly affected by the proposed action and those resources that may have greater than negligible impacts. Those resources for which the action is not applicable or no negligible impacts exist are not further analyzed in this EA.

Table 1. Potential for Adverse Impacts from Proposed Action and Alternatives

Resources	Not Applicable: Resource does not exist in project area	No/Negligible Impacts: Exists but no or negligible impacts	Greater than Negligible Impacts: Impacts analyzed in this EA
Migratory and Resident Birds	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other Wildlife and Aquatic Species	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Threatened and Endangered Species and Other Special Status Species	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Habitat and Vegetation (including vegetation of special management concern)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Physical Resources	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Wilderness	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Visitor Use and Experience	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Cultural Resources	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Refuge Management and Operations	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Socioeconomics	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Tables 2-5 provide for each resource of the refuge:

1. a brief description of the relevant general features of the affected environment;
2. a description of relevant environmental trends and planned actions;
3. a brief description of the affected resources in the proposed action area; and
4. impacts of the proposed action and any alternatives on those resources.

Table 2. Affected Natural Resources and Anticipated Impacts

AFFECTED RESOURCE	ANTICIPATED IMPACTS
<p>Migratory and Resident Birds</p> <p>Affected Environment Description</p> <p><i>Birds</i> – The refuge’s bird checklist contains over 225 species of birds known to inhabit the refuge (USFWS 2009). Big Lake NWR is designated as a Globally Important Bird Area by the American Bird Conservancy, and it has been designated as an Audubon Important Bird Area.</p> <p>On the refuge, the most abundant wintering waterfowl species is the mallard (<i>Anas platyrhynchos</i>), followed (in no particular order) by ring-necked duck (<i>Aythya collaris</i>), green-winged teal (<i>Anas crecca</i>), northern pintail (<i>Anas acuta</i>), northern shoveler (<i>Anas clypeata</i>), and gadwall (<i>Anas strepera</i>), among the ducks, and snow (<i>Chen caerulescens</i>) and greater white-fronted geese (<i>Anser albifrons</i>) among the geese. Wood ducks (<i>Aix sponsa</i>) and hooded mergansers (<i>Lophodytes cucullatus</i>) are common nesters in the spring and summer. In addition to wintering waterfowl, wading birds, mainly great blue herons (<i>Ardea Herodias</i>) and great egrets (<i>Ardea alba</i>), along with a variety of shorebirds, use the refuge.</p> <p>Environmental Trends and Planned Actions Description</p> <p>The refuge is located in the Mississippi Flyway for waterfowl. During the 2018 and 2019 hunting seasons, duck harvests in the State of Arkansas were estimated to be 1,006,200 (±25%) and 1,091,000 (±12%), respectively, with 60,700 (±15%) estimated duck hunters in 2018 and 75,400 (±10%) estimated hunters in 2019 (Raftovich et al. 2020). The most recent annual midwinter aerial duck survey (January 4-8, 2021) conducted by AGFC during the 2020 season estimated a total of 1.08 million ducks in the delta region of Arkansas (Arkansas Game and Fish Commission 2021). The 2019 Trends in Duck Breeding Populations estimated overall duck populations at 38.9 million breeding ducks (USFWS 2019). This estimate was 6% lower than the 2018 estimate, but 10% higher than the long-term average.</p> <p>Migratory land birds are declining at alarming rates, and much of the decline has been attributed to forested habitat fragmentation and loss. Creation and conservation of large contiguous blocks of forest habitat would be necessary to slow and reverse negative trends in migratory bird populations in the Mississippi Flyway (Rich et al. 2004). Central Arkansas NWR Complex serves an important role in providing bottomland hardwood wetlands for forest breeding birds. The LMVJV considers forest breeding birds that use bottomland hardwood forests a priority resource, particularly Kentucky, Swainson’s and cerulean warblers (LMVJV Forest Resource Conservation Working Group 2007).</p> <p>Threats to shorebird and waterbird populations include destruction of inland and coastal wetlands, introduced predators and invasive species, pollutants, human-induced mortality, disturbance, and conflicts arising from abundant species.</p>	<p>Alternative A:</p> <p>Under the No Action Alternative, the refuge would fail to meet its energy objective of 7.2 million waterfowl energy days and provide enough resource for 101,000 waterfowl. In addition to this, open water would continue to diminish with invasive species expanding their coverage across the refuge. The lake bottom sediment would not be compacted and would continue to expand with the lake getting shallower, decreasing the amount of habitat available to these species. Resident and migratory birds would not have additional foods resources from plants growing from the drawdown and mudflats won’t be exposed to allow for foraging.</p> <p>Alternative B:</p> <p>Under the Proposed Alternative, the refuge would increase the amount of energy provided with a goal of reaching 7.2 million WEDs through a combination of natural plant communities and agricultural grains. The drawdown should help sustain an increased amount of energy production in the years following the drawdown as well, with restoration of moist-soil vegetation and submersed aquatic vegetation communities. This action should also increase production of native moist-soil plants (due to drawdown and increase in available nutrients) in the shallow areas and submergent aquatic plants in the deeper open water, resulting in benefits to diving ducks, fish, and other wildlife species for several years after the drawdown. The local wintering waterfowl population would be predicted to be considerably larger due to the available food resources the refuge provides through seeded crops and native moist-soil plants. The use of pesticides would not be likely to adversely impact species due to the close analysis done through the Service’s PUP System where pesticides are proposed for use. During this process, each proposed pesticide goes through a Section 7 Consultation. In addition to following the pesticide label when applying the pesticides, the list of approved pesticides used each includes BMPs and restrictions imposed through the PUP process.</p> <p>In 1988, a similar draw-down was completed with the wintering waterfowl population anecdotally reported to have been 900,000 ducks. Bald eagles do nest on the refuge but would be fledged by this time and would not be impacted. Wood ducks nest in spring and early summer. Ducklings would mostly be fledged by the time of the mid-summer drawdown, but those that aren’t mobile enough to move to beaver ponds, ditches and the adjacent state managed areas until maturity. Wood ducks would not be expected to have remained in the center of the lake or near the spillway due to there being little food and cover in those areas primarily impacted by the drawdown. Wading birds would continue to use the refuge for resources in the beaver ponds, ditches, and what little water may remain in the lake and may move to adjacent state-managed lands for additional resources. They would most likely benefit from the remaining fish that do not escape from the drawn down lake and feed on any trapped fish. Shorebirds would capitalize on the increased amount of mudflats that would be available during the drawdown and the additional invertebrate food resources that would be available.</p> <p>The effects of disturbance, such as displacement, habitat loss, and noise, to other migratory birds are expected to be short term and temporary due to the limited time this project would take and the timing of the project in relation to when most birds would be using the refuge. Once the proposed action is complete, improved habitat quality and availability, reduced invasive vegetation, and increased food availability from the proposed action would benefit bird species using the refuge.</p>
<p>Other Wildlife and Aquatic Species</p>	<p>Alternative A:</p>

AFFECTED RESOURCE	ANTICIPATED IMPACTS
<p>Affected Environment Description</p> <p>The diversity of aquatic and terrestrial habitats supports a variety of resident and migratory wildlife species. A species list of refuge biota is provided in Appendix I of the 2009 CCP (USFWS 2009).</p> <p>Mammals - Some 72 species of mammals occur in Arkansas, and 52 of them have been documented or are likely to occur on the Big Lake NWR (USFWS 2009). There is limited information regarding bat species found on the refuge; however, there are believed to be five species of bats that inhabit the refuge. A mobile acoustical bat survey on the refuge began in 2012 and, according to the detections, the tricolored and evening bats appear to be the most common on the refuge (https://ecos.fws.gov/ServCat/Reference/Profile/138011).</p> <p>Amphibians and Reptiles - Detailed information on the refuge's reptiles and amphibians is relatively scant; however, the refuge's herpetofauna species list includes 35 species that have been identified, or are expected to exist, in the county of the refuge.</p> <p>Fish and other Aquatic Species- Bottomland hardwood wetlands provide spawning and nursery habitat to many species of fish. Hydrology (primarily extent, duration, and periodicity of flooding) is one of the primary factors regulating use and reproductive success of fishes in wetlands. Among the fish found in refuge waters are various species of crappie (<i>Pomoxis nigromaculatus</i>), bream (<i>Lepomis macrochirus</i>), catfish (<i>Ictalurus spp.</i>), bass (<i>Micropterus spp.</i>), buffalo (<i>Cycleptus elongtaus</i>), carp species, drum (<i>Aplodinotus grunniens</i>), and gar (<i>Lepisosteus spp.</i>). Frogs and crawfish are also present in wetlands, ditches, ponds, riverbanks, and bayous. Many non-game and commercial fishes are also found in the various habitats within Big Lake NWR. There are limited data regarding adult and larval fishes within the refuge; however, it is likely that many species occur in refuge waters as larvae, juveniles, and adults. Between 75 and 100 species of fish in the lower Mississippi River basin complete one or more of their life stages in bottomland hardwood wetlands (Killgore and Miller 1995). Freshwater mussels are likely found throughout the refuge in flowing waters and to a lesser degree in permanent backwater sloughs and lakes. Specific information on the abundance, species richness, and distribution of mussels within the refuge is limited.</p> <p>Environmental Trends and Planned Actions Description</p> <p>Amphibian and reptile conservation and management are of great interest to conservationists due to global declines. Habitat loss, fragmentation, and degradation appear to be the primary factors influencing declines. This group of animals requires quality wetland habitat and their population numbers serve as important indicators of environmental health (Trauth et al. 2004).</p> <p>The state Wildlife Action Plan (SWAP) provides detailed descriptions of the habitats, assessment of threats to those habitats, and conservation actions are needed to address those threats (Fowler and Anderson 2015). The SWAP recognizes that much of the state is privately owned, and state and Federal land management is only a small part of the conservation efforts statewide. The SWAP describes the need for limiting habitat fragmentation, degradation, and reduced conversion of habitats from development and agriculture as examples of the major stressors to populations of reptiles, amphibians, and other nongame animals in the state. The SWAP identifies Conservation Opportunity Areas where partners are needed to create opportunities for conservation in identified priority geographic areas. The refuge in this proposal is located in the Mississippi River Alluvial Plain. Priority habitats were ranked in this geographic area to create a comprehensive opportunity area with species of greatest conservation need from threats ranging from climate change to direct human disturbance. Examples in the SWAP range based on species needs and habitat limitations. Examples of threats such as: sand and gravel mining, transportation infrastructure, off-road vehicles, stream modification, Feral Hogs, pollution, and climate change apply to many species that occur on the refuge.</p>	<p>Under the No Action Alternative, effects would be similar to those in past years. The number of rough fish would most likely continue to increase with sport fishing declining. Amphibians and reptiles would remain the same. Mammals, including aquatic mammals, would remain the same.</p> <p>Alternative B:</p> <p>Under this Alternative, amphibians and reptiles would remain the same. Mammals, including aquatic mammals, would remain the same. Most fish would escape through the south WCS as the water level is lowering. After the water level has reached a low level and the AGFC has approved, anglers would be able fish and net fish so the resource can be utilized. All other fish could move into beaver ponded areas to spend the rest of the summer or would perish. After water fills the lake again, the refuge would work with the AGFC to restock the lake as needed and effective to provide better fishing for the public; but also, fish would enter into the lake when water is allowed to enter through the North WCS to bring the lake back to full pool. With the amount of nutrients that would be released by decomposition of organic matter, there would be a large number of fish entering into the system to take advantage of these fresh resources, such as aquatic invertebrates. Research shows that the use of approved aquatic herbicides would have negligible impacts on freshwater aquatic organisms while improving habitat by increasing the amount of open water that would outweigh any potential toxic effects (Breckels and Kilgour 2018). The use of pesticides would not be likely to adversely impact species due to the close analysis done through the Service's PUP System where pesticides are proposed for use. During this process, each proposed pesticide goes through a Section 7 Consultation. In addition to following the pesticide label when applying the pesticides, the list of approved pesticides used each includes BMPs and restrictions imposed through the PUP process.</p> <p>Aquatic systems on the refuge would benefit from improved water quality and decreased sedimentation from the rehabilitation and implementing of Best Management Practices used to enhance the hydrology of the landscape. Freshwater fish and other aquatic species have complementary habitat requirements that are expected to benefit from the management strategies outlined in this plan.</p> <p>Disturbed wildlife will relocate to avoid management actions and expend more energy than if they had remained at rest. While, management actions will have temporary, localized short-term impacts to populations of game and non-game species, disturbance is not a long-term threat to populations because the relocation is temporary and food is generally not a limiting factor. Most animals will be able to readily replace those energy reserves they use.</p> <p>Overall, impacts to other wildlife and their habitats and impacts to the biological diversity of the refuge will be minor. As public use levels on the refuge expand across time, unanticipated conflicts between user groups may occur. The Refuge's Visitor Services programs will be adjusted as needed to eliminate or minimize each problem and provide quality wildlife dependent recreational opportunities while promoting public safety and maintaining healthy populations of wildlife.</p>

AFFECTED RESOURCE	ANTICIPATED IMPACTS
<p>Threatened and Endangered Species and Other Special Status Species</p> <p>Affected Environment Description</p> <p>A key objective of the refuge is to provide habitat and protection for threatened, endangered, candidate, and experimental, non-essential populations and species. The Service conducted an Intra-Service ESA Section 7 analysis on the Proposed Action, which is incorporated herein by reference (Appendix C). The following species could occur on the refuge:</p> <ul style="list-style-type: none"> • Fat Pocketbook (<i>Potamilus capax</i>) – Endangered • Scaleshell (<i>Leptodea leptodon</i>) – Endangered • Pondberry (<i>Lindera melissifolia</i>) – Endangered • Piping Plover (<i>Charadrius melodus</i>) – Threatened • Eastern Black Rail (<i>Laterallus jamaicensis</i>) – Threatened • Red Knot (<i>Calidris canutus</i>) – Threatened • Whooping Crane (<i>Grus americana</i>) – Experimental, non-essential • Monarch Butterfly (<i>Danaus plexippus</i>) – Candidate species • Alligator Snapping Turtle (<i>Macrochelys temminckii</i>) – Candidate species <p>Fat Pocketbook - The fat pocketbook mussel inhabits the very lowest reaches of the White River below Cache River NWR, but also has been found in other streams in the vicinity of Big Lake NWR but has not been found within the boundaries of Big Lake NWR in recent surveys. The fat pocketbook mussel has a limited distribution with only specimens located on the Right Hand Chute of Little River south of the refuge. Historical accounts indicate this species requires large rivers with flowing water and stable substrate and occurs in a full range of habitat types (i.e. shifting sand and flocculent mud to hard clay and gravel). Due to their sedentary nature and longevity, they are especially vulnerable to stream disturbances such as impoundments, siltation, and pollution. Mussels feed by filtering algae, bacteria, phytoplankton and other small particles out of the water column. No fat pocketbook mussels have been documented on any of the refuges in the Central Arkansas NWR Complex.</p> <p>Scaleshell- Scaleshell inhabits medium-sized to large rivers with stable channels and good water quality. The abundance and distribution of scaleshell have decreased due to habitat loss and adverse effects associated with water quality degradation, reservoir construction, sedimentation, channelization, and dredging. These habitat changes have resulted in significant extirpations, restricted and fragmented distributions, and poor recruitment within the Little River system this species is typically restricted to the upper tributaries and the mainstem downstream to near the confluence with the Black River. One specimen was documented from the White River in Jackson County near Newport in 1999. No scaleshell mussels have been documented on Big Lake NWR.</p> <p>Pondberry - Pondberry occupies microhabitats of seasonally flooded depressions and sinks in wooded areas, where it characteristically grows in discrete colony patches of sparsely branched deciduous woody stems with aromatic leaves. In Arkansas, few scattered colonies are known. Pondberry is mapped and believed extant at about 99 sites, although some of these are in close proximity, so the number of extant populations may be somewhat less. A few extant populations appear quite large, but may contain few different genetic individuals; many sites are small and isolated. Believed extirpated from Louisiana and possibly Florida; extant populations are known from the coastal plain in North Carolina south to Georgia and Alabama and from the Mississippi Embayment in Mississippi, Arkansas, and Missouri. Extensive clearing and drainage of bottomland forests is probably the major factor affecting the species, both historically and currently. Also the species appears susceptible to the emerging Red Bay or Laurel Wilt disease; one Georgia population is known to be infected, but the full potential range and impact of the disease is unknown at this time. Limited sexual reproduction, dispersal, and recruitment are also a concern for the species' persistence in its now highly fragmented habitat.</p>	<p>Alternative A:</p> <p>A consultation pursuant to Section 7 of the Endangered Species Act (ESA) was formerly conducted as part of the 2009 CCP and EA for the Central AR Complex. There is no expected change to the scaleshell, fat pocketbook, pondberry, eastern black rail, alligator snapping turtle, or monarch butterfly with this alternative but the piping plover, red knot, and whooping crane may be negatively impacted by not providing mudflat habitat for these species with a drawdown that would allow them to acquire additional food resources.</p> <p>Alternative B:</p> <p>In addition to the 2009 CCP ESA Section 7, the Service analysis of the proposed action impacts are detailed here. The use of pesticides would not be likely to adversely impact federally listed threatened and endangered species due to the close analysis done through the Service's PUP System where pesticides are proposed for use. During this process, each proposed pesticide goes through a Section 7 Consultation. In addition to following the pesticide label when applying the pesticides, the list of approved pesticides used each includes BMPs and restrictions imposed through the PUP process.</p> <p>An inventory of all freshwater mussels was conducted in 2017 within all suitable habitat for the mussels and no fat pocketbook or scaleshell were found. Due to the nature of their location in riverbed areas under deep water, the drawdown restoration project should have no effect on these aquatic species. Potential impacts to mussel species from the release of water downstream would be negligible as it would be a slow release of water in which these mussel species may be present. An aquatic approved herbicide would be applied aerially to treat invasive plant species. The chemical would stick to the targeted invasive plant with the plants absorbing most of the chemical so little to no run-off would occur and get into the water and with it being made for aquatic environments and quick dilution there should be no effect on these species.</p> <p>Pondberry has been documented only in one small area on Wapanocca NWR; however, vegetation surveys on other refuges were not designed to specifically detect this species; therefore, we cannot preclude its existence on Big Lake NWR. Regardless, activities associated with the lake drawdown would not alter the habitat of this species and only foot travel is allowed in any areas of potential habitat for Pondberry, so it is unlikely that any individual plants would be damaged or destroyed. This species would not be in the targeted area for herbicide spraying so there would be no effect on this species.</p> <p>The piping plover would be a transient migrant with most potential for occurrence outside of the drawdown timeframe. The activities associated with the restoration of Big Lake NWR are not negatively habitat altering in any areas that this species might occur and disturbance from restoration work should be minimal. Due to the transient nature of this species, its occurrence on and use of mud flats, and physical characteristics, the drawdown of the lake is more likely to benefit the piping plover by providing additional mudflat areas for foraging and adding to fat reserves for additional energy during migration. This species would not be in the targeted area for herbicide spraying so there would be no effect on this species.</p>

AFFECTED RESOURCE	ANTICIPATED IMPACTS
<p>In Arkansas, pondberry colonies are found in the upper reaches of the Village Creek bottoms and other tributaries to the Black River in Jackson, Lawrence, and Clay Counties; the St. Francis Sunken Lands Wildlife Management Area in Craighead County, and the most recently discovered colony at Wapanocca NWR, in Crittenden County. It has not been documented on Big Lake NWR.</p> <p>Piping Plover- Piping plover is a transient migrant occurring infrequently and for short duration (1-2 days) during southward migration during July to September. For example, only one bird was recorded over a two-day period in August 2000 on Bald Knob NWR. Breeding occurs along the Atlantic coast from North Carolina to southern Canada and along rivers and wetlands of the northern Great Plains from Nebraska to the southern Prairie Provinces. Plover use on the refuges may occur on mud flats that are created in July and August from fields that were planted in crops and flooded the previous year. Shorebirds may also occur near areas of active soybean production. Northward migration occurs from mid-February to mid-May.</p> <p>Eastern Black Rail- Eastern Black Rail is a transient migrant that uses shallow emergent freshwater wetland habitats areas. Eastern black rails typically occupy areas with overhead cover that permits little or no view of bare ground. Occurrences would be infrequent and of short duration during the spring and fall months, presumably from migration to and from the Texas Gulf Coast. Use on the Refuge Complex has not been documented but if present, would most likely occur in marsh or moist soil managed wetlands. Although no observations have occurred on the refuges, there have been observations near the lower Cache River NWR.</p> <p>Red Knot- The Red Knot is a transient migrant that uses shorelines of lakes or freshwater marshes. The Red Knot is mostly a migrant and winter resident along the Atlantic and Gulf coasts. Occurrences are likely to be infrequent and of short duration during the summer to early fall. Sightings have occurred on lands near the Complex, specifically Bald Knob NWR. Red Knot use of the Complex would likely occur on mudflats that are created when fields flooded for waterfowl are de-watered or when lakes dry up during late summer.</p> <p>Whooping Crane- The only fully wild population of whooping cranes nests in the Northwest Territories and adjacent areas of Alberta, Canada, primarily within the boundaries of Wood Buffalo National Park. Whooping cranes arrive at this breeding area in late April. The birds winter along the central Texas Gulf of Mexico coast at Aransas NWR and adjacent areas, typically arriving between late October and mid-November. Occasionally, stragglers may not arrive until late December. It would be rare for individuals from this population to occur on refuges within the Complex. A migratory non-essential experimental Eastern Population was designated in 2001 its designated range includes Arkansas. (66 FR 33903-33917). This population would summer and breed in central Wisconsin and winter in west-central Florida. Whooping cranes from this population may occur anywhere in the southeastern United States, including Arkansas.</p> <p>Another attempt to establish a non-migratory, non-essential experimental population occurred in Louisiana in 2011 (76 FR 6066-6082). More than 60 birds were known to be alive as of October 2018. Occurrences are likely to be infrequent on the Complex. However, a female crane from this population has visited Holla Bend NWR in the fall of 2019 and 2020 before traveling to Wheeler NWR in Alabama to winter and then onto Louisiana. Whooping cranes have never been observed on the other refuges in the Complex.</p> <p>Monarch Butterfly – The Monarch Butterfly travels through Arkansas on its way to central Mexico where they overwinter. While in Arkansas, they depend on flowering plants that are being lost due to habitat loss and degradation (from conversion of grasslands to agriculture, widespread use of herbicides, logging/thinning at overwintering sites in Mexico, urban development, and drought) (USFWS 2020). The diversity of the habitats on the refuge are managed in a way (i.e. selective timber thinning, and early successional scrub-shrub, grassland, and moist-soil habitat restoration and management) that actually encourages flowering plants that would be used by Monarchs; however, the majority of the habitats on the refuges are forested bottomland hardwoods with little value to a butterfly. However, there are actively managed habitats such as grassland units, cropland margins, forest management areas, reforestation sites, early successional scrub-shrub, and moist-soil units that contain flowering</p>	<p>Eastern black rail have not yet been documented on the refuge. The activities associated with the drawdown would not alter the habitat in a way that would be negative for this species. Due to the Eastern Black Rails' highly transient and reclusive nature, timing of its southward migration, and limited habitat suitable for their use. The restoration activities of the lake, including aerial spraying of herbicide, are not likely to adversely affect this species.</p> <p>The red knot is a migrant and winter resident along the Atlantic and Gulf coasts. Lake restoration activities on Big Lake NWR would not alter habitat in a way that would be detrimental to this species. This transient species would only be found on bare wetland habitats in the late summer and the drawdown of the lake is more likely to benefit this species by providing additional mudflat areas for foraging and adding to fat reserves for additional energy for migration. These types of habitats would only exist on the fringes of lakes/ponds or units managed for wintering waterfowl but with this drawdown, over 2000 acres of mudflats may be available for use that would not be available under normal management conditions. The restoration work is not likely to adversely affect this bird. This species would not occur in the area that would be aerially sprayed with herbicide and therefore would not be impacted.</p> <p>The whooping crane would likely only occur in wet, open-field habitats during the fall and winter and would not use the lake at Big Lake during full pool. It is possible for individuals from the Louisiana experimental population to occasionally stray from normal migratory pathways. Restoration work is unlikely to occur in places or during times where/when a crane might be present and even if it did the proximity of the traffic to the crane likely would not result in disturbance. The crane that has visited Holla bend NWR the past few years used moist-soil units and croplands on the refuge that are managed for wintering waterfowl. This species would not be affected by this restoration activity. This species would not occur in the area that would be aerially sprayed with herbicide and therefore would not be impacted.</p> <p>The timing of monarch butterfly occurrence on the refuge, behavior, and habitat occupied put them at little risk of being encountered during the restoration work of the lake. Accidental mortality due to vehicular collision or being trampled underfoot mortality is not controllable, but the level of mortality is expected to be insignificant. Restoration work on the lake would not alter habitat in a way that would be detrimental to this species. The lake area is typically not an area inhabited by monarchs and most open water or streams where monarchs are likely would not be encountered with any frequency. Noise/sound vibrations from restoration activity likely cannot be detected by monarchs. The lake restoration is not likely to affect this species. This species would not occur in the area that would be aerially sprayed with herbicide and therefore would not be impacted.</p> <p>The alligator snapping turtle is known to move considerable distances to find the necessary resources needed to live with the biggest impact to the alligator snapper being habitat degradation and overharvesting. This species would be able to move to the adjacent Wildlife Management Areas, ditches, and beaver ponds to find necessary resources during the drawdown. The lake restoration is not likely to affect this species. An aquatic approved herbicide would be applied aerially to treat invasive plant species. The chemical would stick to the targeted invasive plant with the plants absorbing most of the chemical so little to no run-off would occur and get into the water and with it being made for aquatic environments and quick dilution there should be no effect on this species.</p>

AFFECTED RESOURCE	ANTICIPATED IMPACTS
<p>plants that could be used by Monarchs.</p> <p>Alligator Snapping Turtle – The Alligator Snapping Turtle is a primarily aquatic species that uses medium to large-sized lakes, rivers, and oxbows. Unlike the common snapping turtle it is not found in isolated ponds or lakes. Nesting occurs from late April until early June. The Alligator Snapper is known for lying on the bottom of a water body with its mouth open and wiggling a wormlike luring device attached to the floor of its mouth. This device is used to lure fish and other food prey items close enough so they can be caught and eaten. Although they are known for being “sit and wait” predators, radiotelemetry data has shown that they would move considerable distances (Trauth et al. 1998). The significant decline of the alligator snapper in is attributed to habitat degradation and overharvesting.</p> <p>Environmental Trends and Planned Actions Description</p> <p>Population trends for each species are discussed in the Affected Environment Discussion above. The Service is not aware of any planned actions that in combination with the proposed action would have an impact on the threatened and endangered species discussed.</p>	<p>It is the policy of the Service to protect and preserve all native species of fish, amphibians, reptiles, birds, mammals, invertebrates, and plants, which are designated threatened or endangered, including their habitats, the proposed action would not likely affect any threatened species, endangered species, candidate species, non-essential, experimental populations, or species of concern. The legal authority available to the refuge manager to close areas to public access, when necessary, ensures that Alternative B would not be likely to adversely affect threatened and endangered species similar the no action alternative.</p>
<p>Habitat/Vegetation (including vegetation of special management concern) Affected Environment Description</p> <p>In the northern Arkansas/Missouri Bootheel region, the Big Lake area is the last remnant of what had been the vast Mississippi Delta forest that contains trees such as bald cypress, overcup oak, water oak and others. The fertile soils, which were once covered with bottomland hardwoods, are now row-cropped to produce soybeans and cotton. The refuge persists as a forested oasis in an agricultural desert, and this isolated area of natural beauty is cherished by citizens of Arkansas. Except for the spoil levees and administrative areas, the rest of the refuge is classified as wetlands. The land contour ranges from 223 feet msl in the deepest channels near the south end to 240 feet msl near the north end.</p> <p>Environmental Trends and Planned Actions Description</p> <p>In the northern Arkansas/Missouri Bootheel region, the Big Lake area is the last remnant of what had been the vast Mississippi Delta forest. The fertile soils, which were once covered with bottomland hardwoods, are now row-cropped to produce soybeans and cotton. The refuge persists as a forested oasis in an agricultural desert, and this isolated area of natural beauty is cherished by citizens of Arkansas</p>	<p>Alternative A:</p> <p>Except for the spoil levees and administrative areas, this area of the refuge is classified as wetlands. With the continued influx of sedimentation and muddy waters, the habitat in the lake would continue to decline and invasive species, such as giant cutgrass and American lotus, would continue to take over decreasing habitat quality.</p> <p>Alternative B:</p> <p>Under this alternative invasive plant species would be removed from the lake. With maintenance the invasives would be treated and removed. Removal of the invasive plants would allow native aquatic plant species to proliferate. Currently, giant cutgrass and American lotus invasions in the lake are cause for concern. Mimosa and saw tooth oaks would need to be controlled if they proliferate. The use of pesticides would not be likely to adversely impact species due to the close analysis done through the Service’s PUP System where pesticides are proposed for use. In addition to following the pesticide label when applying the pesticides, the list of approved pesticides used each includes BMPs and restrictions imposed through the PUP process. Rehabilitation of Big Lake would improve the habitat for many native species, provide important waterfowl, wading bird and early migrant shorebird foods, decrease invasive species, control undesirable species, and increase habitat quality.</p>
<p>Physical Resources Affected Environment Description</p> <p>An extensive network of ditches in the Missouri bootheel drains approximately 2,500 square miles directly through Big Lake NWR. The refuge is situated between Ditch 81 and its associated levee to the west and Ditch 28 and its levee to the east.</p> <p>During flood periods the inflows are so heavily laden with silt that an accurate description of the water would be “too thick to drink and too thin to plow.” Sediment fallout has provided continual fill to the bottomlands and swamp until there now exists a very shallow lake, averaging only 3 feet in depth. Continued siltation has restricted any aquatic</p>	<p>Alternatives A:</p> <p>Under this alternative Big Lake would continue to be subjected to the floods from the vast Missouri bootheel agricultural lands. The lake would continue to be filled with sediment and to receive and store large amounts of sediment, trash, and pollutants resulting from flood events in the Missouri bootheel. Water quality would continue to be compromised. Invasive vegetation would continue to spread and dominate the lake.</p> <p>Local fishermen complain of lower water levels and increased aquatic vegetation (e.g., lotus) where none was present 20 years ago. The 2,500-square-mile watershed from the Missouri Bootheel</p>

AFFECTED RESOURCE	ANTICIPATED IMPACTS
<p>production, and hampered forest growth and development. Under the Water Management Plan, the refuge has served primarily as a sump.</p> <p>Approximately 15 miles of meandering stream channels run the length of the refuge, but past siltation has made portions of these channels indistinguishable. These channels were once a part of the Little River, but today only a small portion of the original river channel exists just south of the refuge.</p> <p>Through mutual agreements with regional drainage districts, the Corps, the Service and local interest groups, a plan to improve the situation was implemented to divert some of the silt-laden waters around Big Lake and still provide for adequate inflow to maintain and hopefully improve the area's ecosystem.</p> <p>Since the implementation of the new regime of water management, water quality has improved, aquatic production has returned, waterfowl populations have become more stable, threatened and endangered species have returned to the area, and recreational interests have increased. Additional water management practices are being explored, which should enhance the refuge's contribution toward the improvements even more.</p> <p>Despite these improvements, the refuge is still frequently subjected to silt-laden flood waters due to continued drainage projects occurring upstream in Missouri. The frequency of the floods coupled with the silt and drift imported by floods are damaging to the refuge. Geologists from the University of Arkansas took core samples from the bottom of Big Lake in May 1991. Preliminary data from radiocarbon dating revealed that since 1938, more than 3 feet of silt have been deposited into Big Lake. Such siltation rates have greatly accelerated the eutrophication of the Big Lake system.</p> <p>The majority of the soil types in the basin are hydric, and the spatial relationships of the various soil types and associations present further evidence of their fluvial origin and influence. By and large, the soils of the basin are rich and fertile, and thus the reason for draining and clearing of most of the original forests for agricultural production. Most of the soils have a high clay content, which results in their capability to perch water at the surface, but this also prevents most areas from contributing to significant groundwater recharge through infiltration. These soil characteristics allow the cultivation of rice over a significant percentage of the lands in the basin. Where water retention and flooding characteristics of individual soils are not suited to rice, the dominant crops are soybeans, winter wheat, and milo, with minor acreages of corn and cotton occurring on the highest, most well-drained sites. Physiochemical and physiographic characteristics of soils (e.g., high clay content, susceptibility to erosion, water retention capabilities, and compressibility), and their relationships to ongoing hydrologic processes necessitate careful consideration during assessment of potential impacts of management and land use activities, if restoration and conservation of ecosystem functions are to be successful.</p> <p><i>Environmental Trends and Planned Actions Description</i></p> <p>Changing climate, whether it results from anthropogenic or natural sources, is expected to affect a variety of natural processes and associated resources. The complexity of ecological systems within the Complex points to a tremendous amount of uncertainty about the impact climate change would actually have. In particular, the localized effects of climate change are still a matter of much debate. The primary role of the refuges in light of future change associated with global climate change and other anthropogenic factors is maintenance of a functioning ecosystem for native wildlife and fisheries and monitoring to contribute to an understanding of the ongoing changes and potential for mitigation through active management. Monitoring of range expansions of invasive or exotic species, and monitoring of composition, distribution and health of forests are also potentially valuable efforts, particularly if in coordination with regional efforts.</p> <p>Across the watershed, improved conservation practices on private agricultural lands could significantly improve the quality and quantity of waters entering the refuge. Additional efforts aimed at promoting use of United States</p>	<p>provided adequate water supplies during the year. The water was delivered to the head of Big Lake by way of four major drainage ditches. As long as incoming flows were less than 238' msl, refuge personnel manipulated WCSs to create inflows of good quality water into the refuge or to divert poor quality (e.g., muddy) water around the refuge via the diversion canal. When water levels exceeded 238' msl, the refuge operated both the Diversion and north-end structures in the open position to aid in the movement and storage of flood waters, as directed in a multi-agency water management agreement.</p> <p>Water quality will continue to be compromised. Invasive vegetation will continue to spread and dominate the lake. If the current processes continue, the lake and bottomland forests will be unable to function as productive habitats supporting numerous fish and wildlife species. Furthermore, the Big Lake Wilderness is also suffering from these negative impacts, and its future as a healthy cypress swamp system is questionable.</p> <p>Alternatives B:</p> <p>Using best management practices, including drawdowns, vegetation control, water quality sampling, lake bottom consolidation, and other measures would enhance forage availability and overall habitat quality for dabbling and diving ducks and other wildlife and aquatic species in the lake and associated waters, and the 200-acre moist-soil unit. The drawdown would allow native moist soil plants to grow from the lake bed and those plants would provide food for ducks and other wildlife. The use of pesticides would not be likely to adversely impact physical resources due to the close analysis done through the Service's PUP System where pesticides are proposed for use. In addition to following the pesticide label when applying the pesticides, the list of approved pesticides used each includes BMPs and restrictions imposed through the PUP process</p>

AFFECTED RESOURCE	ANTICIPATED IMPACTS
<p>Department of Agriculture conservation methods on private lands should be a priority for the Service's private land initiatives. For lands adjacent to the refuge, another priority should be partnering with NRCS to bring together each agency's outreach programs (i.e., the Service's Partners' Program and the NRCS's Conservation Security Program).</p> <p>Although the WCSs in Ditch 81 reduce a large volume of the undesirable silt and water, more flexible water management operations are needed. This is due primarily to improvements made on statewide drainage lines in Missouri and Arkansas and due to a greater frequency of major flood events.</p>	

Table 3. Affected Visitor Use and Experience and Anticipated Impacts

AFFECTED RESOURCE	ANTICIPATED IMPACTS
<p>Affected Environment Description</p> <p>The refuge is open to all six priority wildlife dependent public uses – hunting, fishing, wildlife observation, photography, environmental education, and interpretation.</p> <p>Environmental Trends and Planned Actions Description</p> <p>Currently, visits for hunting (4000), fishing (14,000), wildlife observation (53,000), photography (4,000), environmental education (usually 250), and interpretation (very little) remain fairly steady on Big Lake NWR. The Service is unaware of any other environmental trends or planned actions that would adversely impact visitor use and experience on the refuge or surrounding areas.</p>	<p>Alternative A:</p> <p>Under this alternative, current refuge wildlife dependent opportunities would continue across the refuge. The refuge would continue to serve as habitat for fish and wildlife as well as provide outdoor recreational opportunities for all six priority wildlife dependent public uses – hunting, fishing, wildlife observation, photography, environmental education and interpretation. Opportunities to improve outdoor recreation experiences by improving the Lake would be lost. Over time visitors would have less open water to recreate in and the amount of open water with waterfowl foods would continue to diminish.</p> <p>Alternative B:</p> <p>Under this alternative fishing would be temporarily impacted by the lake drawdown, but with the drying out of the lake bottom to consolidate the buildup of sediment and organic matter, fishing would ultimately be improved. This would also allow the lake bottom to flourish with native moist soil plants that would provide wintering waterfowl with food and also a flush of energy into the system through macroinvertebrates that would boost the fish population. The refuge would continue to serve as habitat for fish and wildlife as well as provide outdoor recreational opportunities for all six priority wildlife dependent public uses – hunting, fishing, wildlife observation, photography, environmental education and interpretation.</p> <p>Although visitor use would be temporarily impacted by the lake being drawn down and less fishing opportunities available, the lake would be slowly drawn down from June to October. The primary fishing months on the lake are March through May. In addition to this, with the lake drawn down and the lake substrate compacting, this should reduce the expansion of cutgrass and American lotus while improving the sport fishery and offering more open water, and native plants beneficial to fish and other aquatic species to allow greater opportunities for public fishing.</p>

Table 4. Affected Cultural Resources and Anticipated Impacts

AFFECTED RESOURCE	ANTICIPATED IMPACTS
<p>Affected Environment Description</p>	<p>Alternatives A and B:</p> <p>Neither of these alternatives have the potential to affect cultural resources. No buildings, structures, or sites that are listed on or eligible for the National Register of Historic Places are in the</p>

AFFECTED RESOURCE	ANTICIPATED IMPACTS
<p>Located at the north end of the refuge is the Zebree Site (3MS20). The site was excavated by the Arkansas Archeological Survey prior to the completion of the Ditch 81 project. A number of other archaeological investigations have occurred near the western edge of the refuge, along Highway 181 and for the Big Lake-Manila Distribution Line Relocation. The last two areas are located at the south end of the refuge. A review of the Southeast Region Master Site Files did not reveal any recorded historic properties within the proposed project area.</p> <p><i>Environmental Trends and Planned Actions Description</i> The Service is unaware of any other environmental trends or planned actions that would adversely impact cultural resources on the refuge or surrounding areas. Should artifacts be detected during the implementation of the action, the relevant Tribes and the Arkansas Historic Preservation Program would be notified and a Section 106 consultation initiated.</p>	<p>action area. As the drawdown is not a consumptive activity, it does not pose any threat to historic properties on and/or near the refuge.</p>

Table 5. Affected Wilderness Impacts

AFFECTED RESOURCE	ANTICIPATED IMPACTS
<p>Wilderness</p> <p><i>Affected Environment Description</i></p> <p>Big Lake NWR contains about 5,000 acres of lands designated as a National Natural Landmark Area in the mid-1970s. The tract includes seasonally flooded bottomlands, open water, and permanently flooded swamplands. Pure stands of bald cypress, the only significant stands of virgin timber in the area, dominate the overstory species. A mixture of white ash, tupelo, and some scattered oaks also occur in the forested areas. A 2,144-acre tract within the National Natural Landmark Area was designated as The Big Lake Wilderness, part of the National Wilderness System. The American Bird Conservancy also has listed the refuge as a Globally Important Bird Area.</p> <p><i>Environmental Trends and Planned Actions Description</i></p> <p>The Service is unaware of any other environmental trends or planned actions that would adversely impact wilderness.</p>	<p>Alternatives A and B:</p> <p>The drawdown would not pose a threat to the Wilderness areas since the Wilderness Area is not a part of the lake that under normal pool conditions would not have water on it.</p>

MINIMIZATION MEASURES TO AVOID CONFLICTS

The Proposed Action Alternative would implement best management practices in order to reduce adverse impacts from restoration of the lake (USFWS 2009 and 2019). Time and space zoning would be implemented in order to continue to provide wildlife-dependent recreation while the lake is being restored. Coordination with the public and refuge stakeholders, including AGFC, would promote continuity and understanding of refuge and Service resource goals and objectives and would help assure that the decision-making process takes into account all interests.

MONITORING

Wildlife and habitat response would be monitored during and after project implementation. The Service will conduct vegetation surveys following the drawdown allowed estimation of energy production. The Service will also conduct waterfowl surveys during winters before and following the drawdown. The Service would use best management practices and adaptive management to achieve refuge purposes.

SUMMARY OF ANALYSIS

Alternative B – Implement Big Lake Rehabilitation on Big Lake NWR (Proposed Action)

The Proposed Action would not have any significant adverse effects on the quality of the human environment, including public health and safety. Further, because the purpose of the proposal is to protect, maintain and, where possible, enhance the natural habitat of the lands within the refuge, the proposal is not expected to have any significant adverse effects on the area's wetlands and floodplains, pursuant to Executive Orders 11990 and 11988.

Implementation of the Proposed Action would not involve any highly uncertain, unique, unknown, or controversial effects on the human environment. The Proposed Action would not establish a precedent for future actions with significant effects, nor would it represent a decision in principle about a future consideration. No cumulatively significant adverse impacts on the environment would be anticipated.

In addition, the proposal would not significantly affect any unique characteristic of the geographic area, such as historical or cultural resources, wild and scenic rivers, or ecologically critical areas. The proposal would not significantly affect any site listed in or eligible for listing in the National Register of Historic Places, nor would it cause loss or destruction of significant scientific, cultural, or historic resources. The area's cultural resources would be protected under the regulations of the National Historic Preservation Act of 1966, as amended, the Archaeological Resources Protection Act, and the Advisory Council on Historic Preservation (36 CFR 800).

This alternative helps meet the purpose and needs of the Service as described above because it improves wildlife habitat and achieves the purposes of the refuge while meeting the Service's priorities and mandates. Refuge habitat objectives for migratory birds would be more easily achieved with the resulting increase in habitat quality. This alternative also helps increase wildlife-dependent recreation for the American public. The use of pesticides would not be likely to adversely impact species, habitats, nor physical resources due to the close analysis done through the Service's PUP System where pesticides are proposed for use. In addition to following the pesticide label when applying the pesticides, the list of approved pesticides used each includes BMPs and restrictions imposed through the PUP process.

Conclusion

Based on the above analyses, the Service has determined that none of the alternatives considered above would have any significant adverse impacts on the human environment. No significant adverse impacts would be anticipated under either of the alternatives.

LIST OF PREPARERS AND COORDINATION

LIST OF PREPARERS

Steven Rimer
Tina Blancett

STATE COORDINATION

The Service coordinated with and sent letters along with the release of this Draft EA to the public to the Arkansas Game and Fish Commission requesting comments or concerns regarding the proposed action.

TRIBAL CONSULTATION

The Service sent letters in November 2021, and followed up with emails in the winter of 2022, requesting input to:

- Osage Nation;
- Quapaw Tribe;
- Shawnee Tribe;
- Absentee Shawnee Tribe of Indians
- Delaware Nation of Oklahoma
- Delaware Tribe of Indians
- Eastern Shawnee Tribe of Oklahoma
- Stockbridge Munsee Community
- United Keetoowah Band of Cherokee;

PUBLIC OUTREACH

The Service sent letters to nine potentially interested Native American Tribes and the Arkansas State Clearinghouse requesting comments or concerns regarding the proposed action. The EA for the refuge was made available for public review and comment in March of 2022 locally at the Refuge Complex office, on refuge website (https://www.fws.gov/refuge/big_lake/), and in the local media outlets.

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APPENDIX A - OTHER APPLICABLE STATUTES, EXECUTIVE ORDERS & REGULATIONS

STATUTES, EXECUTIVE ORDERS, AND REGULATIONS	
Cultural Resources	
American Indian Religious Freedom Act, as amended, 42 U.S.C. 1996 – 1996a; 43 CFR Part 7	
Antiquities Act of 1906, 16 U.S.C. 431-433; 43 CFR Part 3	
Archaeological Resources Protection Act of 1979, 16 U.S.C. 470aa – 470mm; 18 CFR Part 1312; 32 CFR Part 229; 36 CFR Part 296; 43 CFR Part 7	
National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470-470x-6; 36 CFR Parts 60, 63, 78, 79, 800, 801, and 810	
Paleontological Resources Protection Act, 16 U.S.C. 470aaa – 470aaa-11	
Native American Graves Protection and Repatriation Act, 25 U.S.C. 3001-3013; 43 CFR Part 10	
Executive Order 11593 – Protection and Enhancement of the Cultural Environment, 36 Fed. Reg. 8921 (1971)	
Executive Order 13007 – Indian Sacred Sites, 61 Fed. Reg. 26771 (1996)	
Fish & Wildlife	
Bald and Golden Eagle Protection Act, as amended, 16 U.S.C. 668-668c, 50 CFR 22	
Endangered Species Act of 1973, as amended, 16 U.S.C. 1531-1544; 36 CFR Part 13; 50 CFR Parts 10, 17, 23, 81, 217, 222, 225, 402, and 450	
Fish and Wildlife Act of 1956, 16 U.S.C. 742 a-m	
Lacey Act, as amended, 16 U.S.C. 3371 et seq.; 15 CFR Parts 10, 11, 12, 14, 300, and 904	
Migratory Bird Treaty Act, as amended, 16 U.S.C. 703-712; 50 CFR Parts 10, 12, 20, and 21	
Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds, 66 Fed. Reg. 3853 (2001)	
Natural Resources	
Clean Air Act, as amended, 42 U.S.C. 7401-7671q; 40 CFR Parts 23, 50, 51, 52, 58, 60, 61, 82, and 93; 48 CFR Part 23	
Wilderness Act, 16 U.S.C. 1131 et seq.	

Wild and Scenic Rivers Act, 16 U.S.C. 1271 et seq.	
Executive Order 13112 – Invasive Species, 64 Fed. Reg. 6183 (1999)	
Water Resources	
Coastal Zone Management Act of 1972, 16 U.S.C. 1451 et seq.; 15 CFR Parts 923, 930, 933	
Federal Water Pollution Control Act of 1972 (commonly referred to as Clean Water Act), 33 U.S.C. 1251 et seq.; 33 CFR Parts 320-330; 40 CFR Parts 110, 112, 116, 117, 230-232, 323, and 328	
Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.; 33 CFR Parts 114, 115, 116, 321, 322, and 333	
Safe Drinking Water Act of 1974, 42 U.S.C. 300f et seq.; 40 CFR Parts 141-148	
Executive Order 11988 – Floodplain Management, 42 Fed. Reg. 26951 (1977)	
Executive Order 11990 – Protection of Wetlands, 42 Fed. Reg. 26961 (1977)	

APPENDIX B. INTRA-SERVICE DRAFT SECTION 7 BIOLOGICAL EVALUATION

REGION 4 INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Steven Rimer
Telephone Number: 870-623-6687 **E-Mail:** steven_rimer@fws.gov
Date: March 2022

PROJECT NAME:
Big Lake Restoration on Big Lake NWR

I. Service Program:

- Ecological Services
- Federal Aid
- Clean Vessel Act
- Coastal Wetlands
- Endangered Species
- Section 6 Partners for
- Fish and Wildlife
- Sport Fish Restoration
- Wildlife Restoration
- Fisheries
- Refuges/Wildlife

II. State/Agency: n/a

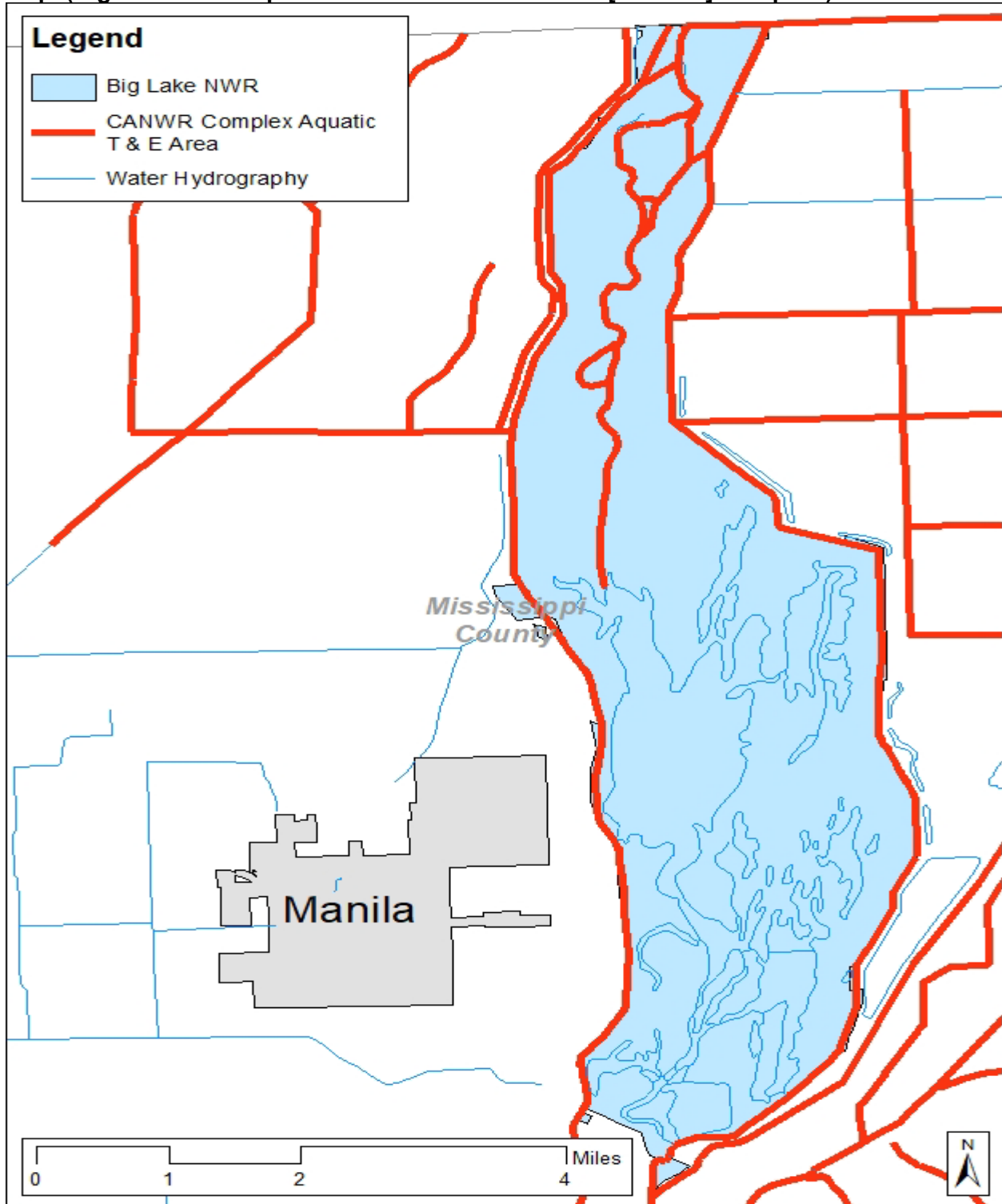
III. Station Name: Big Lake NWR

IV. Description of Proposed Action:

The U.S. Fish and Wildlife Service (Service) is proposing to rehabilitate Big Lake in accordance with the Big Lake NWR Comprehensive Conservation Plan and Spatial Habitat Management Plan (USFWS 2009 and 2019). The purpose of the proposed action is to compact the buildup of sediments and organic matter on the lake substrate, reduce invasive species, replace the mid-lake water control structure (WCS) and provide waterfowl with food resources to obtain the refuge's objective for duck energy days (DEDs). The refuge would contract the control of invasive species by aerial spraying of herbicide in June-July. Staff would begin to remove boards from the Spillway WCS, located on the south side of the refuge, to lower lake water levels after the herbicide spraying, which is estimated to be in late-July. Boards would be removed to allow a gradual reduction of water in the lake that would take about 2 weeks. At the end of July or beginning of August, the refuge would contract to have the lake bottom seeded with high-energy waterfowl plants, such as millet and milo, that would provide for DEDs. By mid-October staff would place the boards back into the Spillway WCS and open the North WCS to allow water into the lake area to bring the lake back to full pool.

- V. Pertinent Species and Habitat:
A. Include species/habitat occurrence maps:

Figure 1. Big Lake National Wildlife Refuge (NWR) Pertinent Species and Habitat Occurrence Map. (Big Lake NWR is part of Central Arkansas NWR [CANWR] Complex.)

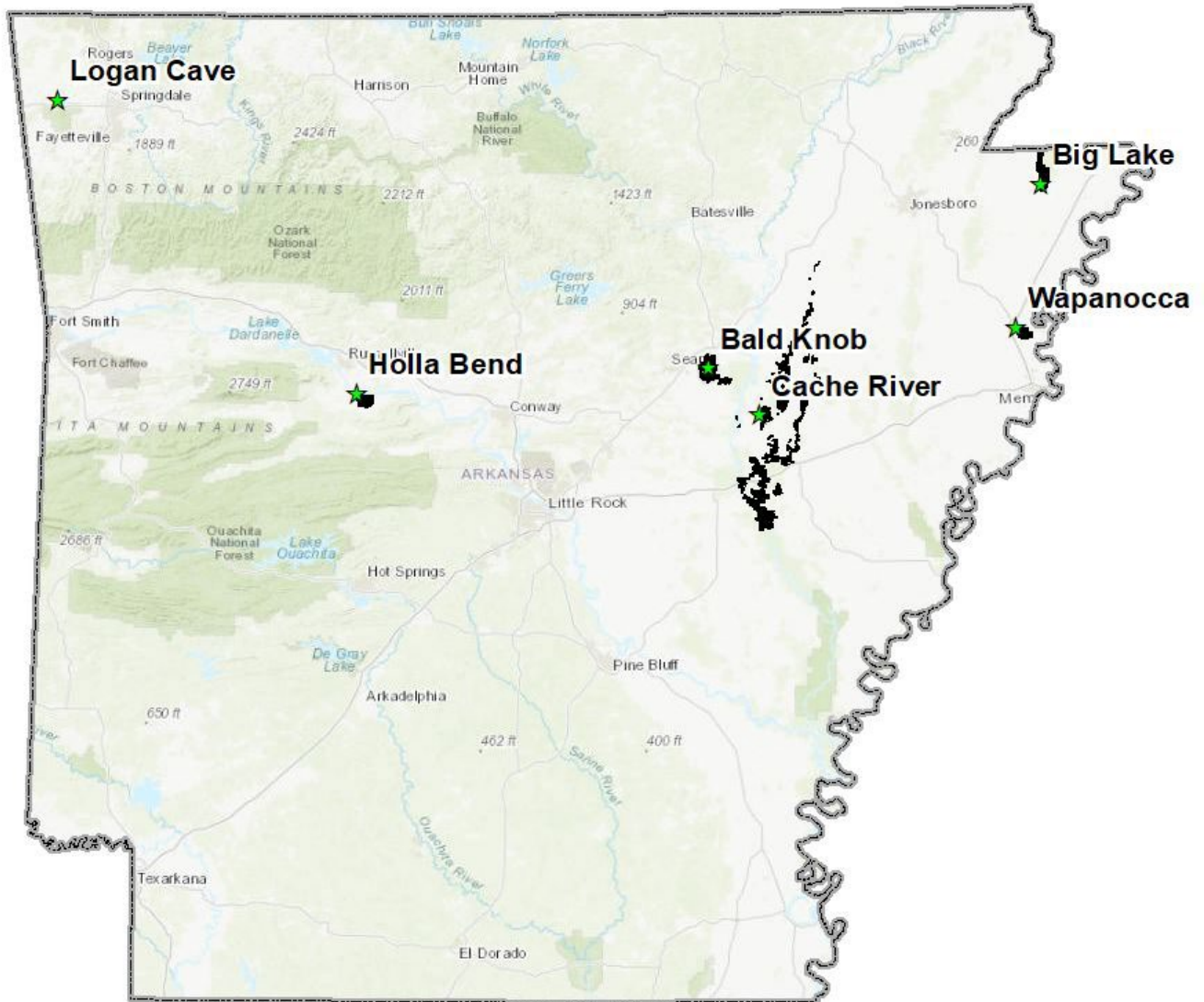


B. Consultation areas by species based on IPaC and conferral with Arkansas Ecological Services Field Office.

SPECIES/CRITICAL HABITAT	STATUS ¹
Fat Pocketbook (<i>Potamilus capax</i>)	E
Scaleshell (<i>Leptodea leptodon</i>)	E
Pondberry (<i>Lindera melissifolia</i>)	E
Piping Plover (<i>Charadrius melodus</i>)	T
Eastern Black Rail (<i>Laterallus jamaicensis</i>)	T
Red Knot (<i>Calidris canutus</i>)	T
Whooping Crane (<i>Grus americana</i>)	E, Experimental, Non-Essential
Monarch Butterfly (<i>Danaus plexippus</i>)	C
Alligator Snapping Turtle (<i>Macrochelys temminckii</i>)	C

¹STATUS: E=endangered, T=threatened, C=candidate species

VI. Location (attach map):



A. Ecoregion Number and Name:

Ecosystem Area I, Ecosystem 27: Mississippi Alluvial Valley

B. County and State:

Mississippi County, Arkansas (Big Lake NWR)

C. Section, township, and range (or latitude and longitude):

Big Lake NWR - T14N & T15N R9E, one tract in T17N R3E, and, T18N R2E & R3E

D. Distance (miles) and direction to nearest town:

Big Lake NWR - 3 Miles west of Manila, Arkansas, on Hwy 18.

E. Species/habitat occurrence:

Listed species and habitat occurrence on the Central Arkansas NWR Complex are based on the expert opinion of Service biologists, supplemented with information from the Environmental Conservation Online System (ECOS, <https://ecos.fws.gov/ecp/>) and Information for Planning and Consultation (IPaC, <https://ecos.fws.gov/ipac/>) databases.

Since research activities are ongoing in this area and since the ECOS and IPaC databases are regularly updated approximately every 90 days, it is possible that the specific threatened and endangered species identified as present on or near the refuge may change between the finalization of this Biological Evaluation and its publication. The approved acquisition boundaries for the refuge involved in this biological evaluation were used in IPaC, and final determination of the species consultation list and refuge where consultation was warranted was based on conferring with Arkansas Ecological Services Field Office.

Fat Pocketbook - The fat pocketbook mussel inhabits the very lowest reaches of the White River below Cache River NWR but also has been found in other streams in the vicinity of Big Lake NWR; it has not been found within the boundaries of Big Lake NWR in recent surveys. The fat pocketbook mussel has a limited distribution with specimens located only on the Right Hand Chute Little River south of the refuge. Historical accounts indicate this species requires large rivers with flowing water and stable substrate and occurs in a full range of habitat types (e.g., shifting sand and flocculent mud to hard clay and gravel). Due to their sedentary nature and longevity, they are especially vulnerable to stream disturbances such as impounding, siltation, and pollution. Mussels feed by filtering algae, bacteria, phytoplankton and other small particles out of the water column. No fat pocketbook mussels have been documented on any of the refuges in the Central Arkansas NWR Complex.

Scaleshell- Scaleshell inhabits medium-sized to large rivers with stable channels and good water quality. The abundance and distribution of scaleshell have decreased due to habitat loss and adverse effects associated with water quality degradation, reservoir construction, sedimentation, channelization, and dredging. These habitat changes have resulted in significant extirpations, restricted and fragmented distributions, and poor recruitment within the Little River system; this species is typically restricted to the upper tributaries and the mainstem downstream to near the confluence with the Black River. One specimen was documented from the White River in Jackson County near Newport, Arkansas, in 1999. No scaleshell mussels have been documented on Big Lake NWR.

Pondberry - Pondberry occupies microhabitats of seasonally flooded depressions and sinks in wooded areas, where it characteristically grows in discrete colony patches of sparsely branched deciduous woody stems with aromatic leaves. In Arkansas, few scattered colonies are known. Pondberry is mapped and believed extant at about 99 sites, although some of these are in close proximity, so the number of extant populations may be somewhat less. A few extant populations appear quite large, but may contain few different genetic individuals; many sites are small and isolated. Believed extirpated from Louisiana and possibly Florida, extant populations are known from the coastal plain in North Carolina south to Georgia and Alabama and from the Mississippi Embayment in Mississippi, Arkansas, and Missouri. Extensive clearing and drainage of bottomland forests is probably the major factor affecting the species, both historically and currently. Also the species appears susceptible to the emerging Red Bay or Laurel Wilt disease; one Georgia population is known to be infected, but the full potential range and impact of the disease is unknown at this time. Limited sexual reproduction, dispersal, and recruitment are also a concern for the species' persistence in its now highly fragmented habitat.

In Arkansas, pondberry colonies are found in the upper reaches of the Village Creek bottoms and other tributaries to the Black River in Jackson, Lawrence, and Clay Counties; the St. Francis Sunken Lands Wildlife Management Area in Craighead County, and the most recently discovered colony at Wapanocca NWR, in Crittenden County. It has not been documented on Big Lake NWR.

Piping Plover- Piping plover is a transient migrant occurring infrequently and for short duration (1-2 days) during southward migration during July to September. For example, only one bird was recorded over a two-day period in August 2000 on Bald Knob NWR. Breeding occurs along the Atlantic coast from North Carolina to southern Canada and along rivers and wetlands of the northern Great Plains from Nebraska to the southern Prairie Provinces. Plover use on the refuges may occur on mud flats that are created in July and August from fields that were planted in crops and flooded the previous year. Shorebirds may also occur near areas of active soybean production. Northward migration occurs from mid-February to mid-May.

Eastern Black Rail- Eastern black rail is a transient migrant that uses shallow emergent freshwater wetland habitats areas. Eastern black rails typically occupy areas with overhead cover that permits little or no view of bare ground. Occurrences would be infrequent and of short duration during the spring and fall months, presumably from migration to and from the Texas Gulf Coast. Use on the Refuge Complex has not been documented but, if present, would most likely occur in marsh or moist-soil managed wetlands. Although no observations have occurred on the refuge, there have been observations near the lower Cache River NWR.

Red Knot- The red knot is a transient migrant that uses shorelines of lakes or freshwater marshes. The red knot is mostly a migrant and winter resident along the Atlantic and Gulf coasts. Occurrences are likely to be infrequent and of short duration during the summer to early fall. Sightings have occurred on lands near the Complex, specifically Bald Knob NWR. Red knot use of the Complex would likely occur on mudflats that are created when fields flooded for waterfowl are de-watered or when lakes dry up during late summer.

Whooping Crane- The only fully wild population of whooping cranes nests in the Northwest Territories and adjacent areas of Alberta, Canada, primarily within the boundaries of Wood Buffalo National Park. Whooping cranes arrive at this breeding area in late April. The birds winter along the central Texas Gulf of Mexico coast at Aransas NWR and adjacent areas, typically arriving between late October and mid-November. Occasionally, stragglers may not arrive until late December. It would be rare for individuals from this population to occur on refuges within the Complex. A migratory, non-essential experimental Eastern Population was designated in 2001; its designated range includes Arkansas (66 FR 33903-33917). This population would summer and breed in central Wisconsin and winter in west-central Florida. Whooping cranes from this population may occur anywhere in the southeastern United States, including Arkansas.

Another attempt to establish a non-migratory, non-essential experimental population occurred in Louisiana in 2011 (76 FR 6066-6082). More than 60 birds were known to be alive as of October 2018. Occurrences are likely to be infrequent on the Complex; however, a female crane from this population visited Holla Bend NWR in the fall of 2019 and 2020 before traveling to Wheeler NWR in Alabama to winter and then onto Louisiana. Whooping cranes have never been observed on the other refuges in the Complex.

Monarch Butterfly – The Monarch butterfly travels through Arkansas on its way to central Mexico where they overwinter. While in Arkansas, they depend on flowering plants that are being lost due to habitat loss and degradation (from conversion of grasslands to agriculture, widespread use of herbicides, logging and thinning at overwintering sites in Mexico, urban development, and drought. The diversity of the habitats on the refuge are managed in a way (e.g., selective timber thinning and early successional scrub-shrub, grassland, and moist-soil habitat restoration and management) that actually encourages flowering plants that would be used by monarchs; however, the majority of the habitats on the refuge are forested bottomland hardwoods with little value to a butterfly. There are, however, actively managed habitats, such as grassland units, cropland margins, forest management areas, reforestation sites, early successional scrub-shrub, and moist-soil units, that contain flowering plants that could be used by monarchs.

Alligator Snapping Turtle – The alligator snapping turtle is a primarily aquatic species that uses medium to large-sized lakes, rivers, and oxbows. Unlike the common snapping turtle, it is not found in isolated ponds or lakes. Nesting occurs from late April until early June. The alligator snapper is known for lying on the bottom of a water body with its mouth open and wiggling a wormlike luring device attached to the floor of its mouth. This device is used to lure fish and other prey items close enough so they can be caught and eaten. Although these turtles are known for being “sit and wait” predators, radiotelemetry data has shown that they would move considerable distances (Trauth et al. 1998). The significant decline of the alligator snapping turtle is attributed to habitat degradation and overharvesting.

VII. Determination of Effects:

A. Explanation of effects of the action on species and critical habitats in item V. B (attach additional pages as needed):

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Fat Pocketbook	An Inventory of all freshwater mussels was conducted in 2017 within all suitable habitat for mussels and no fat pocketbook were found. Due to the nature of their location in riverbed areas under deep water, the drawdown restoration on Big Lake NWR should have no effect on this aquatic species, if it even exists on the refuge. Potential impacts to mussel species from the release of water downstream would be negligible as it would be a slow release of water in which this mussel species may be present. An aquatic-approved herbicide would be applied aerially to treat invasive plant species. The chemical would stick to the targeted invasive plant with the plants absorbing most of the chemical so little to no run-off would occur and get into the water. Additionally, with it being made for aquatic environments and quick dilution, there should be no effect on this species.
Scaleshell	An Inventory of all freshwater mussels was conducted in 2017 within all suitable habitat for the mussels and no scaleshell were found. Due to the nature of their location in riverbed areas under deep water, the drawdown restoration project should have no effect on this aquatic species, if it even exists on these refuges. Potential impacts to mussel species from the release of water downstream would be negligible as it would be a slow release of water in which this mussel species may be present. An aquatic-approved herbicide would be applied aerially to treat invasive plant species. The chemical would stick to the targeted invasive plant with the plants absorbing most of the chemical so little to no run-off would occur and get into the water. Additionally, with it being made for aquatic environments and quick dilution, there should be no effect on this species.
Pondberry	Pondberry has been documented only in one small area on Wapanocca NWR. Vegetation surveys on other refuges, however, were not designed to specifically detect this species; therefore, we cannot preclude its existence on Big Lake NWR. Regardless, activities associated with the lake drawdown would not alter the habitat of this species. In addition, only foot travel is allowed in any areas of potential habitat for pondberry, so it is unlikely that any individual plants would be damaged or destroyed. This species would not be in the targeted area for herbicide spraying, so there would be no effect on this species.

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Piping Plover	<p>The activities associated with the restoration of Big Lake NWR would not negatively alter habitat in any areas where this species might occur and disturbance from restoration work should be minimal. The piping plover, if it even occurs on the refuge, would be a transient migrant with most potential for occurrence outside of the drawdown timeframe. Due to the transient nature of this species, its occurrence on and use of mud flats, and physical characteristics, the drawdown of the lake is more likely to benefit the piping plover by providing additional mudflat areas for foraging and adding to fat reserves for additional energy during migration. This species would not occur in the area that would be aerially sprayed with herbicide and therefore would not be impacted.</p>
Eastern Black Rail	<p>This species has not yet been documented on any of the refuges on the Central Arkansas NWR Complex. The activities associated with the drawdown would not alter the habitat in a way that would be negative for this species due to eastern black rails' highly transient and seclusive nature, timing of southward migration, and limited habitat suitable for their use. The restoration activities of the lake, including the application of herbicide from the air, are not likely to adversely affect this species.</p>
Red Knot	<p>The red knot is a migrant and winter resident along the Atlantic and Gulf coasts. Lake restoration activities on Big Lake NWR would not alter habitat in a way that would be detrimental to this species. This transient species would only be found on bare wetland habitats in the late summer; the drawdown of the lake is more likely to benefit this species by providing additional mudflat areas for foraging and adding to fat reserves for additional energy for migration. Typically, these types of habitats would only exist on the fringes of lakes, ponds, and units managed for wintering waterfowl but, with this drawdown, over 2000 acres of mudflats may be available for use that would not be available under normal management conditions. The restoration work is not likely to adversely affect this bird. This species would not occur in the area that would be aerially sprayed with herbicide and therefore would not be impacted.</p>

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Whooping Crane	This transient species would likely only occur in wet, open-field habitats during the fall and winter and would not use the lake at Big Lake during full pool. It is possible for individuals from the Louisiana experimental population to occasionally stray from normal migratory pathways. Restoration work is unlikely to occur in places or during times where and when a crane might be present and, even if it did, the proximity of the traffic to the crane likely would not result in disturbance. The crane that has visited Holla bend NWR the past few years used moist-soil units and croplands on the refuge that are managed for wintering waterfowl. This species would not be affected by this restoration activity. This species would not occur in the area that would be aerially sprayed with herbicide and therefore would not be impacted.
Alligator Snapping Turtle	The alligator snapper is also know to move considerable distances to find the necessary resources needed to live. The biggest impact to the alligator snapper is habitat degradation and overharvesting. This species would be able to move to the adjacent state wildlife management areas, ditches, and beaver ponds to find necessary resources during the drawdown. The lake restoration is not likely to affect this species. An aquatic-approved glyphosate would be applied aerially to treat invasive plant species. The chemical would stick to the targeted invasive plant, with the plants absorbing most of the chemical so little to no run-off would occur and get into the water. With the chemical being made for aquatic environments and quick dilution, there should be no effect on this species.
Monarch Butterfly	The behavior, preferred habitat, and timing of occurrence of monarch butterflies on the refuge put them at little risk of being encountered during the restoration work of the lake. Although the accidental mortality due to vehicular collision or being trampled underfoot is not controllable, the level of mortality is expected to be insignificant. Restoration work on the lake would not alter habitat in a way that would be detrimental to this species. The lake area is typically not an area inhabited by monarchs, and most open water or streams where monarchs are likely would not be encountered with any frequency. Noise and sound vibrations from restoration activities will most likely not be detected by monarchs. The lake restoration is not likely to affect this species. This species would not occur in the area that would be aerially sprayed with herbicide and therefore would not be impacted.

B. Explanation of actions to be implemented to reduce adverse effects:

1. The refuge will modify restoration activities if unusual concentrations of threatened and endangered species are known to be present and would be threatened by the restoration activities.

2. The refuge will complete a slow drawdown of the lake to make sure that species in the lake will have adequate time to move to other areas and that downstream species will not be impacted.

References

Trauth, S. E., J. D. Wilhide, and A. Holt. 1998. Population structure and movement patterns of alligator snapping turtles (*Macroclemys temminckii*) in northern Arkansas. *Chelonian Conservation Biology* 3: 64-70.

VIII. Effect Determination and Response Requested:

<u>SPECIES/CRITICAL HABITAT</u>	<u>DETERMINATION¹</u>			<u>RESPONSE¹ REQUESTED</u>
	<u>NE</u>	<u>NA</u>	<u>AA</u>	
Fat Pocketbook (<i>Potamilus capax</i>)		X		Concurrence
Scaleshell (<i>Leptodea leptodon</i>)		X		Concurrence
Pondberry (<i>Lindera melissifolia</i>)		X		Concurrence
Piping Plover (<i>Charadrius melodus</i>)		X		Concurrence
Eastern Black Rail (<i>Laterallus jamaicensis</i>)		X		Concurrence
Red Knot (<i>Calidris canutus</i>)		X		Concurrence
Whooping Crane (<i>Grus americana</i>)		X		Concurrence
Monarch Butterfly (<i>Danaus plexippus</i>)		X		Concurrence
Alligator Snapping Turtle (<i>Macrochelys temminckii</i>)		X		Concurrence

¹DETERMINATION/RESPONSE REQUESTED:

NE = no effect. This determination is appropriate when the proposed action would not directly, indirectly, or cumulatively impact, either positively or negatively, any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested is optional but a "Concurrence" is recommended for a complete Administrative Record.

NA = not likely to adversely affect. This determination is appropriate when the proposed action is not likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat or there may be beneficial effects to these resources. Response Requested is a "Concurrence."

AA = likely to adversely affect. This determination is appropriate when the proposed action is likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested for listed species is "Formal Consultation." Response Requested for proposed or candidate species is "Conference."

Signature/Title **Date**

IX. Reviewing Ecological Services Office Evaluation:

A. Concurrence X **Non-concurrence** _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):

Signature/Date

Field Supervisor/Arkansas Ecological Services Field Office
Title/Office

