Draft Environmental Assessment

Two Rivers National Wildlife Refuge Continued Aerial Herbicide Application

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Prepared by

Two Rivers NWR, Brussels, IL

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Environmental Assessment for Continued Aerial Herbicide Application on Two Rivers National Wildlife Refuge

This Environmental Assessment (EA) is being prepared to evaluate the effects associated with the proposed action 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 46; 516 DM 8) and U.S. Fish and Wildlife Service (550 FW 3) regulations and policies. The NEPA requires examination of the effects of proposed actions on the natural and human environment. Appendix A outlines all law and executive orders evaluated through this environmental assessment.

Proposed Action

The U.S. Fish and Wildlife Service (hereafter; Service) is proposing to continue the use of aerially applied herbicides for vegetation management to control invasive species and undesirable woody plants on Two Rivers National Wildlife Refuge (hereafter; refuge). The aerial application of herbicides is used as a habitat management strategy in accordance with the Comprehensive Conservation Plan (CCP) and the Habitat Management Plan (HMP) for the refuge and is often the only feasible method to control invasive species and undesirable woody plant species located in remote or inaccessible areas where other methods have proved inefficient. The refuge utilized an aerially applied herbicide in 2017 to control woody plant encroachment in otherwise inaccessible areas of large wetland impoundments. Aerial herbicide applications would continue to control, prevent, and limit the spread of invasive species and undesirable woody plant species in wetland habitats within the refuge.

A different proposed action may evolve during the NEPA process as the agency refines its proposal and gathers feedback from the public, Federally Recognized Tribes and tribal entities, and other agencies or organizations. Therefore, the final proposed action may be different from the original. The agency action will be finalized at the conclusion of the public comment period for the EA.

Background

National Wildlife Refuge System Mission

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 National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, Refuge

Recreation Act of 1962, and selected portions of the Code of Federal Regulations and Fish and Wildlife Service Manual. The mission of the National Wildlife Refuge System (NWRS), as outlined by the National Wildlife Refuge System Administration Act (NWRSAA), as amended by the National Wildlife Refuge System Improvement Act (16 U.S.C. 668dd et seq.), is

"... 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"

Additionally, the NWRSAA mandates the Secretary of the Interior in administering the NWRS (16 U.S.C. 668dd(a)(4)) 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.

The following provides information for a cooperative agreement, enabling legislation, and habitat management goals for Two Rivers NWR. Two Rivers NWR was established in 2000, however much of the land that makes up Two Rivers NWR joined the NWRS in the 1940's and in 1958 with the establishment of the Mark Twain NWR Complex (hereafter; Mark Twain Complex). With several changes in management authority since the early 1900's, it is important to first define the previous management authorities and the existing cooperative agreement

between the Service and the U.S. Army Corps of Engineers (hereafter; USACE) to understand current management objectives.

Cooperative Agreement

The USACE have managed the Upper Mississippi River for navigation since 1871. From 1930 to 1940, 26 locks and dams were constructed between Alton, Illinois and Minneapolis, Minnesota. During that time the USACE purchased lands in fee title, known as Navigation Project Lands, that would be flooded after lock and dam construction. During initial construction, the USACE and the Bureau of Biological Survey observed damage being done to floodplain wildlife as flowage decreased and pools formed behind dams. As a result, a cooperative agreement was established where the USACE could transfer management authority on USACE owned lands to the Service.

The cooperative agreement has evolved through time, namely in a memorandum to the National Wildlife Refuge System Administration Act Oct. 15, 1966, 16 U.S.C. 668dd(a)(1), whereby lands under a cooperative agreement were recognized, and subjected to laws and policies of, the NWRS to the extent outlined the cooperative agreement. Specifically, the cooperative agreement between the NWRS in the Upper Mississippi River (including Two Rivers NWR) and the USACE includes lands purchased for the Navigation Project unnecessary for navigation and states:

"The Corps … hereby makes available to the Service the land and water areas of the Navigation Project … for the conservation, maintenance, and management of fish/wildlife resources thereof, and its habitat thereon, in connection with the national migratory bird management and other fish/wildlife species programs in accordance with said General Plans. The Service shall manage these lands consistent with the National Wildlife Refuge System."

The cooperative agreement also states:

"The Corps retains responsibility to provide protection of forest or other vegetative cover on reservoir areas …"

Two Rivers NWR intends to uphold the conditions specified in the cooperative agreement with the USACE, and does not propose any actions in this environmental assessment that would violate the conditions of the agreement. This environmental assessment addresses wetland habitats on cooperative agreement Navigation Project lands the USACE granted the Service management authority of through the NWRS, as well as Service owned lands.

Enabling Legislation

The designation of cooperative agreement land as part of the NWRS led to Batchtown NWR and Calhoun NWR administered by Upper Mississippi River National Wildlife and Fish Refuge in the 1940's. In 1958, Upper Mississippi River National Wildlife and Fish Refuge was split into two refuges where lands between the Quad Cities and the mouth of the Ohio River became part of the Mark Twain National Wildlife Refuge Complex. Afterwards, Batchtown and Calhoun NWRs were renamed the Brussels District. In 2000, the Mark Twain Complex was divided into five stand-alone refuges and the Brussels District was renamed Two Rivers NWR. In addition to Navigation Project Lands, Two Rivers NWR manages Service owned lands with acquisitions dating back to the 1940's.

The Mark Twain Complex was established under several authorities;

> the Migratory Bird Conservation Act, Feb. 18, 1929, 16 U.S.C 715d "*for use as an inviolate sanctuary, or for any other management purpose, for migratory birds*";
>
> the Fish and Wildlife Coordination Act, March. 10, 1934, 16 U.S.C 664 as to "*be administered by [Secretary of the Interior] directly or in accordance with cooperative agreements…. and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon*";
>
> the Refuge Recreation Act, Sept. 28, 1962, 16 U.S.C 460k-1 as "*suitable for- (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species*";
>
> the Emergency Wetlands Resources Act of 1986, Nov. 10, 1986, 16 U.S.C 3901(b) for "*the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions*";
>
> and the 1985 Food Security Act in conjunction with the transfer of Farm Service Agency (formerly Farmers Home Administration) property "*for conservation purposes*".

The Audubon Society has identified Two Rivers NWR as a United States Important Bird Area due to the large number of birds that congregate during migration (https://netapp.audubon.org/IBA/Reports/2639). The refuge was also recognized for supporting more than 200 species of birds, including over 5 million waterfowl (*Anatidae*), hundreds of lesser yellowlegs (*Tringa flavipes*), least sandpipers (*Calidris minutilla*), and pectoral sandpipers (*Calidris melanotos*) annually. The report also states the refuge supports up to 5% of the U.S. population of American white pelicans (*Pelecanus erythrorhynchos*) during migration and serves

as an important nesting area for prothonotary warblers (*Prothonotaria citrea*), great egrets (*Ardea alba*), great blue herons (*Ardea herodias*), and little blue herons (*Egretta caerulea*).

Habitat Management Goals

In 2004 the CCP titled "Mark Twain National Wildlife Refuge Complex" was completed. The CCP includes broad goals for all lands once in the Mark Twain Complex, and strategies for each refuge established from the Mark Twain Complex (https://ecos.fws.gov/ServCat/Reference/Profile/103392).

In 2011 the HMP for Two Rivers NWR was completed as a step-down plan of the CCP that adds specific guidance for the implementation of habitat management strategies, including invasive species and undesirable woody plant control (https://ecos.fws.gov/ServCat/Reference/Profile/16620).

As of 2022, Two Rivers NWR consists of 9,360 acres spread throughout five counties in two states (Figure 1). Two Rivers NWR is divided into six divisions, reflective of geographical separation, each with unique habitat management goals.

The treatment area covered by this environmental assessment includes wetland habitat in three divisions of Two Rivers NWR: Batchtown, Calhoun, and Gilbert Lake (Figures 2 and 3). Appendix B describes the approach the refuge used to assign land cover classes into a broad wetland habitat category to describe areas intended for treatment. In the Mark Twain Complex CCP, habitat goals one and three for wetlands and aquatic habitat, and other terrestrial habitats (i.e., wet meadow) respectively, address habitats relevant to this environmental assessment.

> Habitat goal 1, *"Restore, enhance, and manage refuge wetland and aquatic areas to provide quality diverse habitat for waterfowl, shorebirds, big river fish, and other wetland-dependent species."*.

> Habitat goal 3, *"Protect, enhance, and restore other terrestrial habitats to benefit grassland birds, waterfowl, and neotropical migrants."*.

To achieve the wetlands and aquatic habitat goal, the Mark Twain Complex CCP identified three strategies related to invasive species and undesirable woody plant control;

> Strategy 1.A.22 Gilbert Lake in the Gilbert Lake Division, *"Push back willows in upper end.";*

Strategy 1.A.23 Gilbert Lake S-trap and U-trap in the Gilbert Lake Division, *"Control willow encroachment and manage for moist soil conditions.";*

Strategy 1.A.24 for the Prairie Pond area of the Batchtown Division, *"Push back willow encroachment along edges of waterways when dry enough."*.

For the other terrestrial habitats (i.e., wet meadow) goal, the Mark Twain CCP identified one strategy for the Gilbert Lake Division:

Strategy 3.C.6, "*Manage for the enhancement of Boltonia decurrens … control encroaching willow by mowing and disking as needed*.".

The Two Rivers HMP identified three objectives for wetlands and aquatic habitat relevant to this environmental assessment;

Objective 1.A., "*Provide an annual average of 2,930 acres of permanently flooded wetland vegetation types in refuge wetland impoundments for waterfowl, shorebirds and other wetland-dependent wildlife species*.";

Objective 1.B., *"Protect, enhance, and maintain a 6-year average of 420 acres of isolated backwaters and ephemeral wetlands, providing seasonal and semi permanently flooded wetland vegetation types in undiked areas of the refuge with little water level control for the benefit of migratory birds and other wetland-dependent species.;*

Objective 1.C., *"Protect, enhance, and maintain 3,000 acres of contiguous backwater and side channel habitat in undiked areas of the refuge for migratory birds and fish. Increase bathymetric diversity and wetland plant growth in these areas as feasible by 2015 where little or no local water level control exists."*.

Purpose and Need for the Action

The purpose of this proposed action is to evaluate the use of aerial application of herbicide to control, prevent, and limit the spread of invasive species and undesirable woody plant species in wetland habitats on Service-owned lands and lands in cooperative agreement with the USACE within Two Rivers NWR. Conditions created after invasive species and undesirable woody plants establish monocultures conflict with refuge goals and purposes. Refuge wetland habitat goals mentioned above reflect the conditions needed to meet the energetic needs of migratory waterbirds. Nationwide, wetlands have declined dramatically in acres (Dahl 2011), and many historically food-rich stopover sites for migratory birds are now unavailable or provide low-quality foraging. Available and quality foraging opportunities contribute to the overall body

condition of a bird. In turn, body condition affects a birds' ability to complete energy-intensive activities including migration, courtship, and breeding (Warren et al. 2014, Sedinger and Alisauskas 2014). Therefore, food-energy in stopover habitat plays an important role in maintaining bird populations (Devries et al. 2008, Beatty et al. 2017). Two Rivers NWR manages wetland habitats to provide high-quality seed foraging opportunities for migratory birds. Invasive species and undesirable woody plants produce less seed which directly translates to less food-energy available for waterbirds. In addition, woody plant establishment in wetlands decreases the connectivity of wetland units. Connectivity is essential for the refuge to mimic historic wet-dry cycles to maintain productive wetlands. When woody plants establish within a wetland, channels that move water in and out of wetland units can become isolated. Areas cut off from water management activities are unable to produce the desired wetland conditions outlined in the CCP and HMP.

The need of the proposed action is to meet the Service's priorities and mandates as outlined by the NWRSAA to "provide for the conservation of fish, wildlife, and plants, and their habitats within the System" in addition to "ensuring the biological integrity, diversity, and environmental health of refuges is maintained" (16 U.S.C. 668dd(a)(4)). The threats posed by invasive species and undesirable woody plant species have increased due to changing environmental conditions associated with climate change. This puts additional pressure on lands in the Mississippi and Illinois river floodplains that have already undergone dramatic alterations after lock and dam installation and agriculture conversion.

The proposed action supports wetland goals in the CCP and HMP outlined above by controlling invasive species and undesirable woody plants to promote productive wetlands. In addition, refuge planning documents outline measures used to achieve CCP and HMP goals. An environmental assessment was completed during CCP development that includes the treatment of invasive species as a management strategy to meet conservation goals. The HMP also identifies herbicide application as a necessary measure to control woody and invasive species to maintain desired wetland conditions. Furthermore, the HMP describes aerial spraying as a potential chemical control method to achieve habitat goals.

Two Rivers NWR has used aerial applications of herbicides in wetlands as needed to meet the conservation obligations from the establishing authorities and goals outlined above. Two Rivers NWR is re-evaluating the use of aerially applied herbicides in response to increased pressure from invasive species and undesirable woody plant species resulting from environmental alterations associated with climate change. The threats posed by emerging invasive species and undesirable woody plant species are expected to continue and worsen should affected areas remain untreated.

Alternatives

Alternative A – Continued Use of Aerial Herbicide Applications (No Action and Preferred Alternative)

Under the no action and preferred alternative, aerial application of herbicides would continue to be used as a tool to control, prevent, and limit the spread of invasive species and undesirable woody plant species in wetland habitats described earlier. Aerial applications would be done with fixed-wing aircraft, rotary-winged aircraft, and unmanned aerial vehicles (UAVs). Under the no action and preferred alternative, aerial herbicide applications would continue to be integrated with ground herbicide applications and non-herbicide control methods including water level management, mowing, prescribed fire, hand-pulling, and biological control when possible.

Areas within the refuge to be considered for aerial treatment include monotypic stands of invasive species and undesirable woody plant species within wetland areas including but not limited to, willow (*Salix spp.*), eastern cottonwood (*Populus deltoides*), Johnson grass (*Sorghum halepense*), and perennial water smartweed (*Polygonum coccineum*). Given the geographical location of the refuge and its regional importance to migrating waterbirds, aerial applications would take place outside of waterbird migrations. Mid-summer applications would typically target herbaceous invasive plants in an attempt to eliminate invasive species early enough to allow desirable native vegetation to flourish afterwards. The refuge has had success using this timing at small scales using ground-based herbicide application or mechanical disturbance methods. For example, the refuge used herbicides to control perennial water smartweed and observed desirable wetland plants germinated in place of perennial water smartweed afterward. Late-summer aerial herbicide applications would target a broader range of plants, including woody vegetation. During late-summer herbicide applications, the targeted plant species begin the process of senescence, in which they are re-distributing nutrients to other parts of the plant (typically roots) for winter. This is an effective time to apply herbicides as the plant carries the chemical down into the root system. Senescence typically occurs between the seasonal transition from summer to fall. In fall and spring, wetland impoundments are filled with water so birds can access food and rest.

The Service's Integrated Pest Management (IPM) Policy (569 FW 1) requires a sustainable approach to managing pests that uses the following kinds of tools to minimize health, environmental, and economic risks: (1) **Biological** (e.g., predators, parasites, and pathogens), (2) **Cultural** (e.g., crop rotation, alterations in planting dates, and sanitation), (3) **Physical** (e.g., barriers, traps, hand-pulling, hoeing, mowing, and tilling), and (4) **Chemical** (e.g., pesticides, such as herbicides, insecticides, or fungicides). The IPM Policy also requires review and approval of a Pesticide Use Proposal (PUP) prior to all herbicide applications. All PUPs require a site-specific Endangered Species Act (Section 7) consultation. All herbicide applications on the Refuge are required to follow product label restrictions and regionally approved Best

Management Practices (BMPs) as described below. The BMPs are designed to minimize environmental and safety risks and include:

- Slopes - Do not apply pesticides to slopes greater than 5% if significant rainfall is predicted within 24 hours.
- Wind speed - Do not apply pesticides when wind velocity exceeds 7 miles per hour or when inversion conditions exist.
- Air temperature - Do not spray pesticide containing 2,4-D when air temperatures exceed 85°F.
- Droplet size - Select nozzles and operate application equipment with boom pressures such that spray droplets produced medium (236 - 340 microns) or coarser (341 - 403 microns) sized droplets.
- Dye -Where possible, use a dye for non-crop spot treatment to indicate treated areas.

The Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. §136 et seq. (1996)) requires all herbicide applications follow product label restrictions. These restrictions detail measures to minimize the potential for contamination and non-target effects. The Environmental Protection Agency is the lead agency for approving herbicide product labels (40 CFR 156) and this process includes NEPA analysis and Endangered Species Act (Section 7) consultations with the USFWS. While this process serves to assess and mitigate potential environmental impacts, additional NEPA may apply to specific actions or projects involving the use of herbicides on federal lands or involving federal funding or permits, requiring agencies to conduct additional evaluations of potential impacts and alternatives.

Additional BMP's that are capable of protecting the environment and wildlife while considering economic factors, availability, technical feasibility, ability to implement, and effectiveness. Two Rivers NWR intends to adopt these additional BMP's:

- All chemical applications will be planned and conducted with the coordination and under the supervision of a licensed applicator, certified in the appropriate State category that covers the aerial application.
- Inversion conditions will be avoided since these conditions can facilitate large-scale herbicide drift.
- Spraying will not be conducted on days when there is a 30% or higher forecast for rain within 6 hours.
- Applications of herbicides prone to leaching will also not be made within 24-48 hours of (greater than 50% chance of) moderate to heavy rainfall. Certain herbicides are less likely to leach and more effective following a light rainfall that moistens the soil, and these conditions are usually indicated as optimal on the label.
- Pilot of the aerial application platform will determine wind speed at the application site, and wind direction will be used to evaluate relative to any sensitive sites. If the wind

temporarily increases, lowering the nozzle pressure, thereby increasing droplet size, can reduce drift. If wind speeds stay above operating speeds, the operation will be shut down.

- A nontoxic anti-drift agent will also be used when allowed by the label, especially adjacent to sensitive sites.
- Equipment will be calibrated as necessary to ensure that herbicide applications rates are accurate and that terrain features calculated.
- Herbicide applications information (i.e., wind/weather, chemical type, application method, operator(s), acres sprayed, and location) should be recorded before and/or after each aerial herbicide application.

Alternative B – Discontinue Aerial Herbicide Applications

Under Alternative B, the refuge would discontinue use of aerial herbicide application and use only ground-based methods to treat invasive species and undesirable woody plant species. Ground based methods include herbicide application, prescribed fire, mowing, disking, and other mechanical disturbance methods, hand-pulling, water level management, and biological control. Herbicide application would take place using sprayers mounted on a tractor or UTV, and using hand pump and backpack sprayers. Limited, if any, ground-based herbicide applications would be applied on large invasive species or undesirable woody plant infestations in remote areas that largely make up the targeted wetland areas, due to the time required to treat those areas and the inability to access those location with ground-based equipment.

Affected Environment and Environmental Consequences

This section is organized by affected resource categories, and for each affected resource 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 will not be more than negligibly impacted by the action have been dismissed from further analyses.

Direct, indirect, and cumulative impacts are evaluated in this environmental assessment. Direct effects are those which are caused by the action and occur at the same time and place. Indirect effects are those which are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Cumulative impacts result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions.

The proposed action would occur on wetland areas of Service-owned land and cooperative agreement lands within the Two Rivers NWR. Wetland areas covered in this environmental assessment occur within the Batchtown (729.41 acres) and Calhoun (3,018.89 acres) divisions in Calhoun County, Illinois, and the Gilbert Lake Division (283.94 acres) in Jersey County, Illinois (Appendix B). Wetland areas include managed impoundments where water levels can be manipulated using water pumps and water control structures, unmanaged impoundments, and a wet meadow area in the Gilbert Lake Division. The refuge considers forested wetlands to be floodplain forest and outside the scope of this environmental assessment. The invasive species that threaten floodplain forests, like Japanese hops *(Humulus japonicus)*, are difficult to control aerially without contacting floodplain trees. Given these conditions, and USACE's program to manage forests under the cooperative agreement, the refuge has no intention of aerially applying herbicides in floodplain forests. The refuge is not targeting grassland areas under this EA because the refuge only manages 568.21 acres of grasslands (6% of the total refuge area; Appendix B) that are all accessible to ground-based equipment during most years. This allows the refuge to have a preferred small-scale approach to invasive species and undesirable woody plant management in grasslands.

For more information regarding the general characteristics of the refuge's environment, please see Chapter 3 of the Two Rivers HMP (https://ecos.fws.gov/ServCat/Reference/Profile/16620).

The following resources either (1) do not exist within the project area, or (2) would either not be affected or only negligibly affected by the proposed action. Detailed explanations and laws and executive orders related to the following resources can be found in Appendix A:

- Cultural Resources – No buildings or structures exist on-site within the treatment area that are listed on the National Register of Historic Places. Aerial herbicide application is not expected to cause ground disturbance to any sites, including those that could have known or unknown cultural artifacts. The Service Midwest Regional Historic Preservation Officer has determined that the previously described alternatives would have no potential effect to historic properties.

- Floodplains – The improvement of wetland habitat will not affect water flow or other factors relevant to flooding and floodplain landscapes. If connectivity is improved by eliminating woody vegetation, wetlands can be more effectively drained. Due to the small scale of the refuge within the floodplain and the small amount of water that could be additionally drained after the removal of undesirable woody plant encroachment, no impacts on flooding and navigation will occur. No modifications will be made that will

increase the floodplain elevation or negatively impact its function and value and thus there will be no impacts to E.O. 11988 – Floodplain Management.

- Air Quality – Following BMP's detailed earlier, the action is unlikely to cause air quality effects outside the treatment area. Temporary reduction in air quality may be observed at the time of treatment but are not expected to last and will be localized. The amount of air pollution produced by the mechanical system applying the herbicide is negligible and requires less fuel than ground-based methods.

- Wilderness – The refuge does not have any designated wilderness areas per the Wilderness Act, 16 U.S.C. 1131 et seq. nor does the refuge have any waterways that fall under the Wild and Scenic Rivers Act, 16 U.S.C. 1271 et seq. Given this, no effect to wilderness or wild and scenic rivers are expected. The proposed action complies with the Wilderness Act, 16 U.S.C. 1131 et seq. and the Wild and Scenic Rivers Act, 16 U.S.C. 1271 et seq.

As such, these resources will not be further analyzed. As stated above, this section predicts the foreseeable impacts of aerial application of herbicides in each of the alternatives. When detailed information may be deficient or unavailable, we base our comparisons on professional judgement and experience. We usually identify potential impacts within a long-range timeframe (i.e., 15 years); beyond that timeframe, they become more speculative.

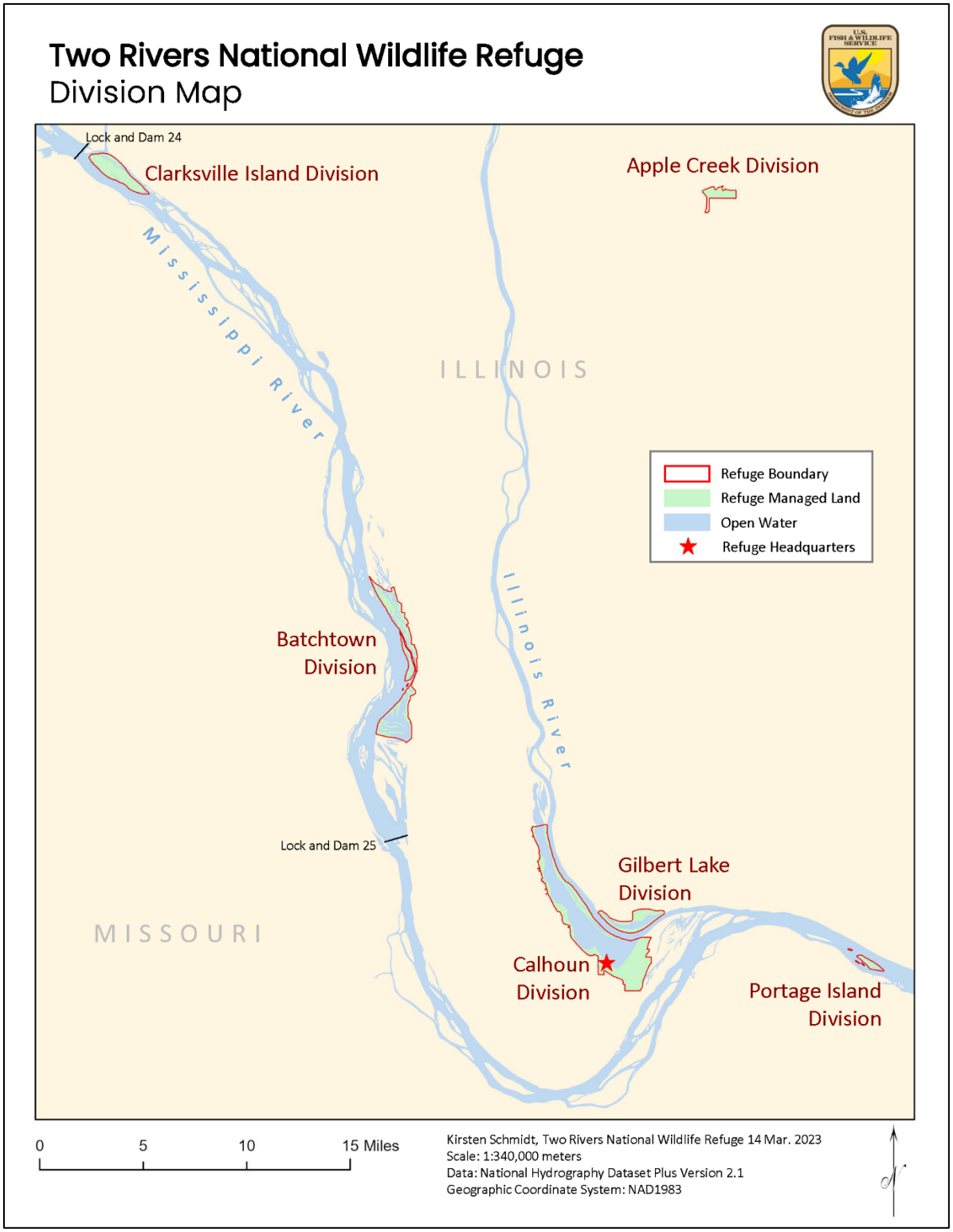

Figure 1. Division map of Two Rivers NWR within the Illinois and Mississippi river floodplains. Lands in green are refuge managed lands. Lands in blue within the red refuge boundary are wetlands. Due to the scale, not all wetlands are visible on the map.

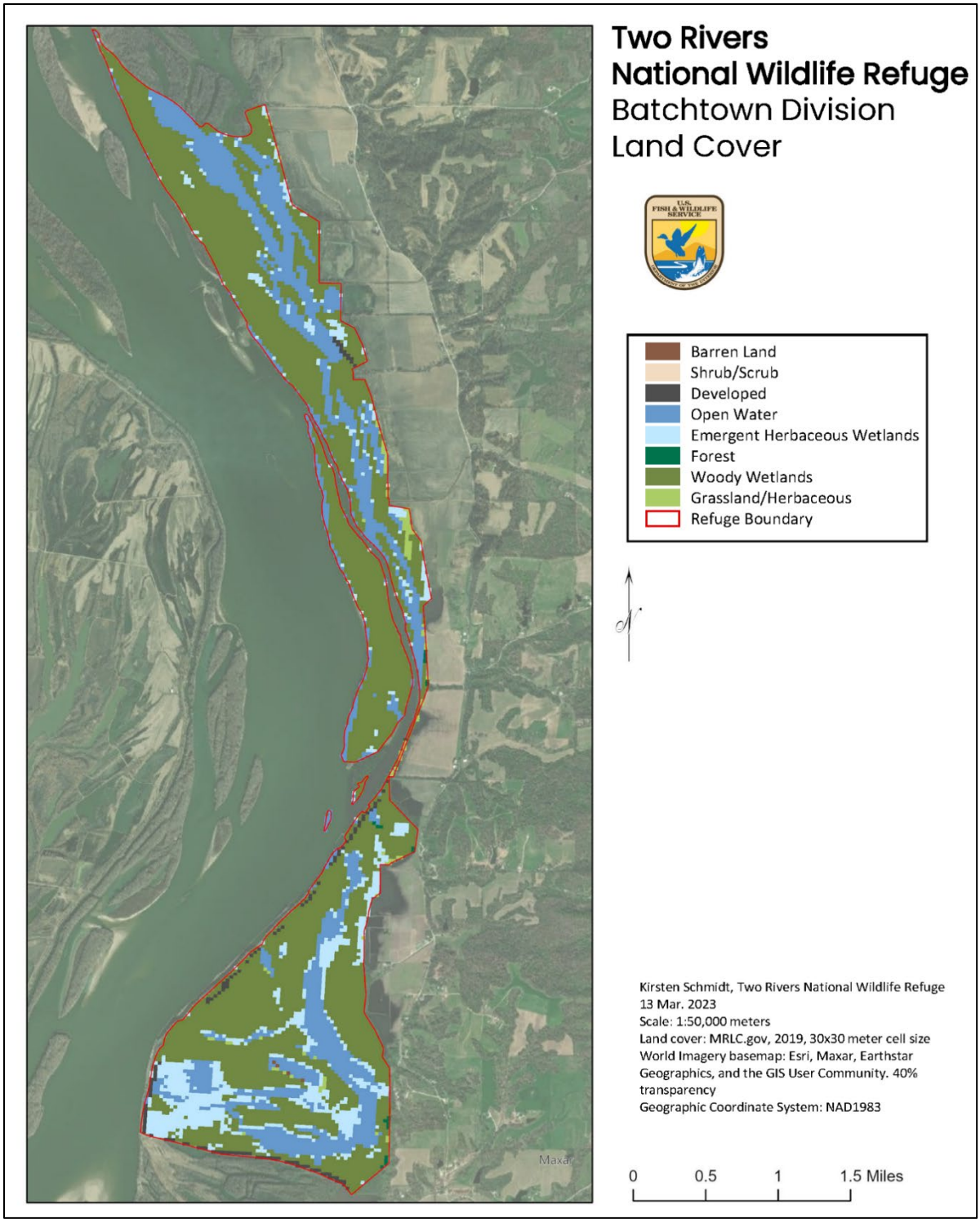

Figure 2. Land cover map of the Batchtown Division. Wetland areas include barren land, open water, and emergent herbaceous wetlands. Methods to combine land cover classes, and explanations for classes included or excluded as target areas for the purpose of this EA are included in Appendix B.

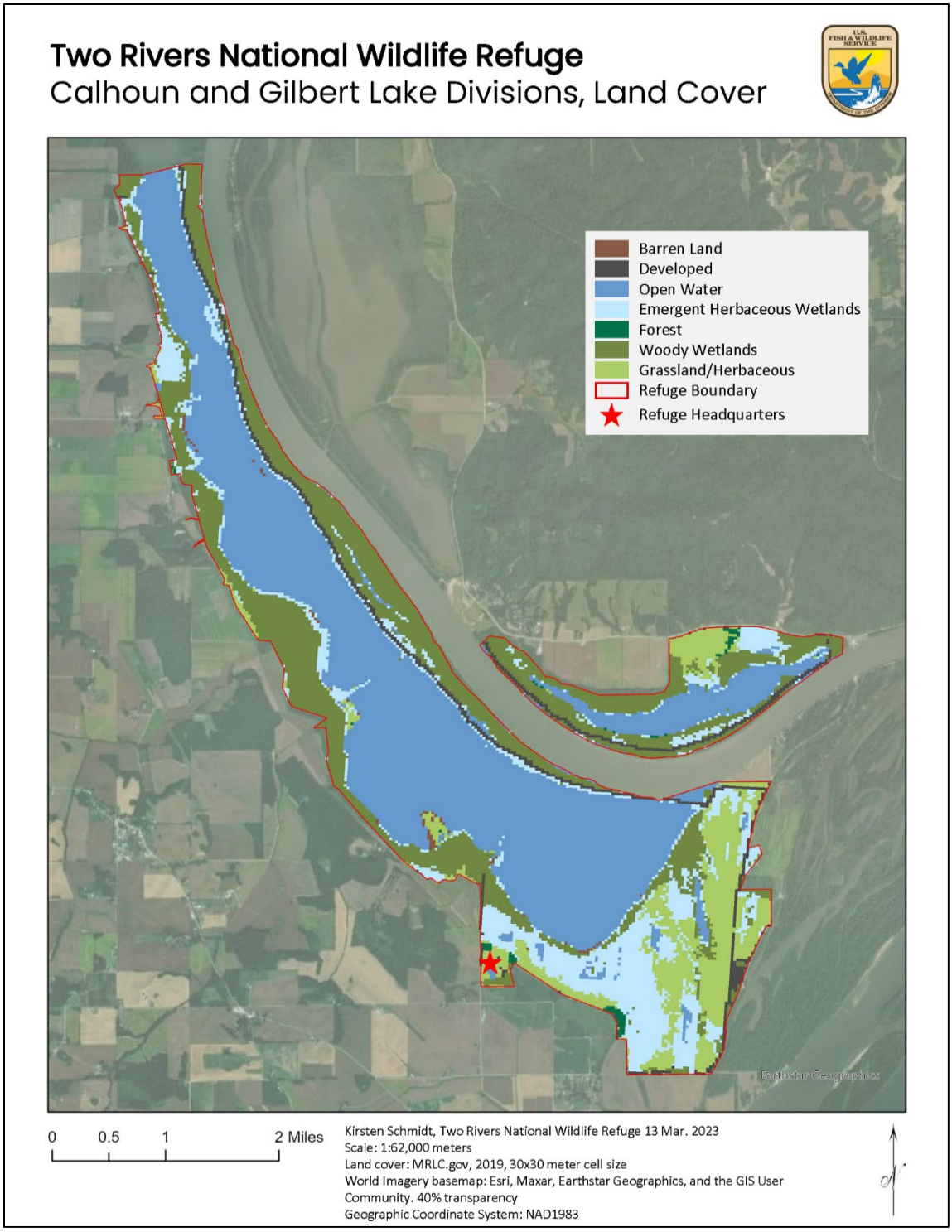

Figure 3. Land cover map of the Calhoun and Gilbert Lake divisions. Wetland areas include barren land, open water, and emergent herbaceous wetlands. Methods to combine land cover classes, and explanations for classes included or excluded as target areas for the purpose of this EA are included in Appendix B.

Natural Resources

Terrestrial Wildlife and Aquatic Species

Affected Environment

Description of Affected Environment for the Affected Resource

Two Rivers NWR is located in the confluence region of the Illinois and Mississippi rivers. This creates unique floodplain habitats of which an abundance of species reside or use seasonally.

The refuge hosts over 250 species of resident or migratory birds including waterfowl, songbirds, marsh and wading birds, shorebirds, raptors, and upland game birds. Waterfowl and habitat condition surveys have been conducted annually on about 3,000 acres of wetland habitat in the Calhoun Division since 2010 using the Integrated Waterbird Monitoring and Management (IWMM) framework. According to IWMM data, the average waterfowl yearly peak is about 100,000 waterfowl during mid-November. The most numerous species include mallard (*Anas platyrhynchos*), pintail (*Anas acuta*), and American green-winged teal (*Anas carolinensis*). Wood ducks (*Aix sponsa*) nest in tree cavities and Canada geese (*Branta canadensis*) nest near wetlands scattered throughout the refuge. The Calhoun Division hosts thousands of greater and lesser yellowlegs (*Tringa melanoleuca, T. flavipes*), and pectoral sandpipers. Northern bobwhite (*Colinus virginianus*), wild turkey (*Meleagris gallopavo*), and woodcock (*Scolopax minor*) nest in refuge grasslands and peripheries of wetland areas.

The refuge supports a variety of resident mammals that are locally abundant depending on the availability of food sources, loafing areas, and security habitat. White-tailed deer (*Odocoileus virginianus*), eastern cottontail rabbit (*Sylvilagus floridanus*), squirrels (*Sciuridae spp.*), and raccoon (*Procyon lotor*) are abundant. Furbearers include red fox (*Vulpes vulpes*), coyote (*Canis latrans*), muskrat (*Ondatra zibenthicus*), skunk (*Mephitis mephitis*), mink *(Neovison vison*), beaver (*Castor canadensis*), river otter (*Lontra canadensis*), and badger (*Taxidea taxus*). Often, racoon, otter, and muskrat leave prints and middens in the mud on the periphery of wetland impoundments. Beaver build lodges, dams, and plugs around wetlands that can hinder water level management. Muskrats build dens, burrows, and runs in refuge levees that divert water out of wetland impoundments. The refuge also hosts many bat species during summer. In 2014 the USACE documented two northern long-eared bat (*Myotis septentionalis*) roost trees in floodplain forests adjacent to Swan Lake, and one roost tree adjacent to Gilbert Lake. The USACE also deployed mist nets in floodplain forests adjacent to Gilbert Lake in 2014 and captured eastern red bats (*Lasiurus borealis*), tri-colored bats (*Perimyotis subflavus*), and Indiana bats (*Myotis sodalis*). The USACE's efforts to monitor bats in and around Two Rivers NWR is ongoing.

The refuge supports a variety of turtles, frogs, toads, salamanders, and snakes. Site-specific abundance data is limited for the refuge, however, in the late 1990's and early 2000's the refuge participated in a region-wide amphibian monitoring effort that documented malformations in frogs. Several species were documented at Two Rivers NWR during this effort, including plains leopard frogs (*Lithobates blairi*), southern leopard frogs (*Lithobates sphenocephalus*), cricket frogs (*Acris crepitans*), and tree frogs (*Hylidae spp.*). These species are important food sources for many mammals, birds, and fish, and populations and diversity are often indicators of the health of an ecosystem. Common snakes observed on the refuge include black snakes (*Pantherophis obsoletus*), common water snakes (*Nerodia sipedon*), and kingsnakes (*Lampropeltis spp.*). Many species of turtles also use the refuge to nest and feed. In 2023 anecdotal observations of turtle species on the refuge included common snapping turtle (*Chelydra serpentina*), painted turtle (*Chrysemys picta*), eastern box turtle (*Terrapene carolina carolina*), false map turtle (*Graptemys pseudogeographica*), musk turtle (*Sternotherus odoratus*), red-eared slider (*Trachemys scripta elegans*), and smooth softshell turtle (*Apalone mutica*).

Refuge lands also contain, or are directly adjacent to, disconnected and connected backwaters of the Mississippi and Illinois rivers. Backwaters are important habitats for many species of freshwater mussels and snails, of which nearly three-quarters are extinct, federally listed, or in need of conservation status in North America (Master et al. 2000). A study conducted in Swan Lake in 2002 documented sixteen species of unionids. Since the study, structures allowing for water level management were installed in Swan Lake, shifting conditions from a backwater lake to a seasonally flooded moist soil impoundment. Changes in Swan Lake coupled with increased sedimentation from amplified flood events and agriculture runoff, the introduction of invasive species, and the decline or loss of host fish species have made Swan Lake largely unsuitable for many freshwater mussels. Although no survey for mussels has been conducted since 2002, shells of giant floaters (*Pyganodon grandis;* a generalist species) are commonly observed in predator middens along the perimeter of Swan Lake. In 2023 anecdotal observations of freshwater mussels (*Unionidae*) in the Batchtown Division include giant floater, flat floater (*Utterbackia suborbiculata*), maple leaf (*Quadrula quadrula*), three-ridge mussel (*Amblema plicata*), and threehorn wortyback (*Obliquaria reflexa*).

Refuge backwaters also support 50 species of fish. The refuge manages three large impoundments separated from the Mississippi and Illinois rivers by water control structures. When water control structures are open, fish move into refuge impoundments. Impoundments retain water from fall through late spring. During winter they serve as overwintering locations for fish. During spring water is removed from impoundments, first passively by opening a water control structure connected to the river. The change in water level signals native fishes to move out of the area to deeper water. Water can be removed passively until water in the wetland impoundments are level with the river. At this point, the water control structure must be closed,

trapping any fish within the impoundment that did not move out when the structure was open. After the water control structure is closed, the remaining water in the impoundment is pumped out. Invasive carp do not interpret the change in water levels as a signal to move to deeper water, leaving many inside the impoundment after the water control structure is closed. As a result of wetland management activities, Two Rivers NWR has an annual fish-kill of one million invasive carp with little incidental kills of native fishes. This is thought to contribute to the overall health of the rivers as invasive carp destroy aquatic habitat, outcompete native species, and silver carp (*Hypophthalmichthys molitrix*) even pose as a danger to boaters.

Description of Environmental Trends and Planned Actions

The refuge conducts habitat unit condition and waterbird surveys in fall and spring using the Integrated Waterbird Monitoring and Management (IWMM) framework. Data collected using the IWMM framework allows staff to better understand the timing of migration which in turn informs the timing of refuge activities, including aerial spraying, to have the least impact on species. With the changing climate, waterbird activities and the timing of events in their annual cycle are shifting during the calendar year (Andersson et al. 2022). By recording waterbird observations, the IWMM framework allows staff to make informed management decisions, like the timing of aerial spraying. Additionally, the IWMM framework requires staff to record habitat cover used to monitor undesirable woody plant encroachment in impoundments. This data can be used to evaluate the effects of management activities including efforts to remove woody plants from impoundments. Since 2010 waterbird surveys have been timed to coincide with historic waterfowl migrations. Starting in 2020 the refuge added survey dates to record shorebird migration peaks that typically occur outside of waterfowl migrations. All surveys record waterfowl, shorebirds (*Charadriiformes*; gulls, terns, plovers, stilts, avocets, sandpipers, and snipes), rails (*Rallidae*), grebes (*Podicipedidae*), cormorants (*Nannopterum spp.*), and medium to large waterbirds (*Pelecaniformes*; ibises, herons, bitterns, and pelicans).

Surrounding partner agencies conduct various surveys on areas in and around Two Rivers NWR. Invasive carp surveys were conducted by the U.S. Fish and Wildlife Service-Fisheries in Swan Lake during 2021 and 2022 to estimate the number of carp killed during annual water management activities. The Audubon Center at Riverlands surveys forested areas of the refuge for forest birds on a rotational yearly basis. The USACE conduct forest inventory surveys in forested areas of the refuge on a rotational 10-year cycle. The USACE also conduct acoustic and mist net surveys for bats in select forests of the refuge annually. Finally, the Illinois Department of Natural Resources surveys select areas of the refuge for upland birds.

The effects of invasive species and other undesirable vegetation are expected to be amplified in the future because of shifting precipitation patterns and altered disturbance regimes, which are associated with a changing climate (Angel et al. 2018, Briscoe Runquist et al. 2019). Population

growth and urbanization around the refuge and within the Mississippi and Illinois river floodplains will likely increase anthropogenic pressures. This almost guarantees a continual source of new invasive species and other undesirable vegetation for the foreseeable future.

Impacts on Affected Resource

Alternative A

Invasive species and undesirable woody plant species would be treated with aerial herbicide application and ground-based methods. Aerial herbicide application enables treatment of remote portions of the refuge that are inaccessible by other means. This will allow the refuge to control and prevent the expansion of invasive species and undesirable woody plant species and promote desirable habitat for wildlife. Increasing the quality of habitat across the refuge would lead to increased wildlife use and abundance.

This alternative would result in the direct effect of wildlife disturbance during aerial and ground herbicide applications. Disturbance to wildlife and short-term displacement would likely occur during aerial application. Aerial herbicide application would allow for larger remote areas to be treated and the potential exists for greater numbers of wildlife to be disturbed in a short period. The duration of the disturbance would most likely be shorter for aerial herbicide applications than ground applications. Timing of aerial applications within the target plant's susceptibility window could also be modified to reduce disturbance issues. Wildlife disturbance would be temporary, lasting approximately the amount of time it would take to treat the desired site. Disturbances associated with ground treatments would be limited to wetland areas of the refuge with solidified sediments that allow for vehicular entry and road access. Additionally, wildlife disturbance associated with ground herbicide application would include traveling to and from application sites. The aircraft noise may disturb wildlife temporarily while the treatment is ongoing. The refuge already suspends ground-based herbicide application during the breeding season, and will continue to do so with aerial applications. The effects of continued herbicide use would indirectly benefit wildlife as the desired habitat diversity and structural conditions detailed above would be maximized under this alternative because invasive species and other undesirable vegetation would not survive to alter them.

Wildlife exposure to herbicide needs to be considered, regardless of application methods. Wildlife can be exposed to herbicide through direct spray and drift, direct exposure to contaminated water/vegetation, or ingestion of contaminated water, vegetation, or prey animals. Direct spray contact with larger wildlife species is less likely given the slower application rate while using ground equipment. However, the noise disturbance of certain aerial application equipment, such as fixed-wing aircraft or helicopters may give wildlife advanced warning to move out of the area. This potential non-target effect associated with aerial applications has been analyzed as part of the labeling process for all herbicides and measures to minimize those effects,

including restrictions, are listed on the product label. Also as noted above, each herbicide application is individually reviewed and approved prior to treatment as part of the PUP process. This includes regionally approved BMPs. Since all label restrictions and regionally approved BMPs must be followed and each herbicide application is reviewed and approved, the potential for indirect negative effects to wildlife are expected to be very minimal. Indirectly, herbicide applications are expected to benefit many wildlife groups through improved habitat quality.

Under the No Action and Proposed Alternative, aerial herbicide applications would be combined with ground-based herbicide applications and non-herbicide methods and could have cumulative effects. Following combined treatments, a reduction in plant and invertebrate abundance and diversity could occur. Such reductions would be localized but could alter the food and cover requirements for wildlife and result in displacement as organisms move to other areas on the refuge to locate necessary habitat requirements. Such cumulative effects are expected to be temporary, lasting no more than one year as the habitat recovers from unaffected perennial root stock, seed bank resources, and immigration from surrounding untreated sites. Cumulative impacts can be negated through timing of management options, amount, and location of treatments to minimize or eliminate the compounding influence of multiple management programs.

Maintaining the refuge's plant and structural diversity maintains its resilience in the face of stressors like climate change, new invasive species introductions, and disease outbreaks. This would directly affect the refuge's environmental health and would be a cumulative effect of continued herbicide use. Indirectly, maximizing habitat diversity on the refuge maximizes insect diversity, including pollinators. Improved pollination directly benefits plants, and increased insect diversity has trophic level cumulative benefits.

Continued herbicide use has the potential of contributing to herbicide resistance of target plants. This indirect effect can be minimized by following label instructions, using herbicides with different modes of action, and/or using tank mixes of different herbicides.

Alternative B

Under Alternative B, only ground application of herbicides and non-herbicide management would continue. With this alternative, less herbicide would be applied due to limited access resulting in fewer acres managed for quality habitat.

Herbicide would be applied more selectively using hand-held, backpack, or UTV/tractor mounted sprayers. Soil and desirable vegetation impacts could be observed on the ground from equipment tires or tracks. These methods could disturb wildlife on a daily basis for an extended period of time in this alternative. Wildlife would benefit from increased habitat diversity in select

treatment areas, however, treatment areas would be relatively small. Invasive plants located in rough-terrain or inaccessible areas of the refuge would remain largely untreated and their populations would continue to expand throughout the refuge. Undesirable woody vegetation expansion would continue to eliminate moist soil habitat, reducing the seed forage for many wetland dependent wildlife species. The expansion of woody vegetation would eventually lead to the transition of wetland habitat to forest, eliminating essential habitat for fish, reptiles, amphibians, mammals, and waterbirds that rely on wetlands to complete their lifecycle. Invasive species would continue to expand in both presence and size, outcompeting moist soil plants and leaving wildlife with little seed forage. Ultimately, desirable wetland habitat would continue to be degraded, leading to a decline in wildlife use and abundance across the refuge.

Threatened and Endangered Species, and Other Special Status Species

Affected Environment

Description of Affected Environment for the Affected Resource

There are four federally endangered species, one federally threatened species, one candidate species, and one proposed endangered species that may occur on Two Rivers NWR as defined by the 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. Below is a list of the species and the counties relative to the refuge the species may occur in according to the Service's Information for Planning and Consultation (IPaC) tool.

- Decurrent False Aster (*Boltonia decurrens*), Threatened; Calhoun, Greene, and Jersey Counties in Illinois, and St. Charles County in Missouri
- Gray Bat (*Myotis grisescens*), Endangered; St. Charles County, Missouri
- Indiana Bat (*Myotis sodalis*), Endangered; Calhoun, Greene, and Jersey Counties in Illinois, and St. Charles County in Missouri
- Monarch butterfly (*Danaus plexippus*), Candidate; Calhoun, Greene, and Jersey Counties in Illinois, and St. Charles County in Missouri
- Northern Long-Eared Bat (*Myotis septentrionalis*), Endangered; Calhoun, Greene, and Jersey Counties in Illinois, and St. Charles County in Missouri
- Spectaclecase mussel (*Cumberlandia monodonta*), Endangered; Calhoun, Greene, and Jersey Counties in Illinois, and St. Charles County in Missouri
- Tricolored bat (Perimyotis subflavus), Proposed Endangered; Calhoun, Greene, and Jersey Counties in Illinois, and St. Charles County in Missouri

The bald eagle (*Haliaeetus leucocephalus*) was removed from the endangered species list in 2007 (USFWS 2021). This species' recovery was largely the result of removal of the insecticide DDT from the environment and efforts to restore bald eagles to their former range. Illegal

shooting of bald eagles led Congress to pass the Bald Eagle Protection Act in 1940, which prohibited killing, selling, or possessing the species. In 1962 the Act was amended to include the golden eagle (*Aquila chrysaetos*), and the law became the Bald and Golden Eagle Protection Act. Although no longer included as a threatened or endangered species, the bald eagle maintains protection under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Bald eagles utilize the refuge year-round. There are breeding populations of bald eagles in the Batchtown, Calhoun, and Gilbert Lake divisions of the refuge. Golden Eagles are also protected by the Bald and Golden Eagle Protection Act but are rarely observed in and near the refuge.

Decurrent False Aster

Decurrent false aster is endemic to the Illinois River floodplain. Decurrent false aster thrives with regular disturbance and is thought to have declined after river water levels stabilized after lock and dam installation when much of its range became permanently submersed or converted to forest or agriculture. Without a disturbance regime, it can take as little as three years for an area to become unsuitable for decurrent false aster (Mettler-McClure 1997). Areas become unsuitable for decurrent false aster seed germination when sunlight is limited by a closed canopy (Smith et al. 1993). Prior to major flooding in the confluence region of the Illinois, Mississippi, and Missouri rivers in 1993, there were only five known populations of decurrent false aster, all in the Illinois River floodplain. The flood of 1993 dispersed decurrent false aster seeds, and the widespread ground disturbance caused by the flood allowed decurrent false aster to occupy 20 new sites by the year 2000 (Smith 2000). Disturbances like major flooding can initially reduce decurrent false aster. However, the changes in habitat structure, namely canopy openings, that occur after major disturbances cause a rebound effect of decurrent false aster populations the following year (Mettler-McClure et al. 2006). Conversely, populations of decurrent false aster are likely to be reduced following years with minimal flooding (Mettler-McClure et al. 2006). Disturbance events must be routine for decurrent false aster to maintain a robust seed bank. On average, decurrent false aster seeds remained viable for less than one year in moist soil conditions (Redmond 1993). In drier conditions, decurrent false aster seeds can remain viable for up to seven years (Smith and Keevin 1998). The only documented occurrence of decurrent false aster on the refuge is within a small wet meadow area of the Gilbert Lake Division and is one of the most robust self-sustaining populations of decurrent false aster across its range. The Gilbert Lake population of decurrent false aster has been included in numerous studies by Dr. Marian Smith within the Biological Sciences Department at Southern Illinois University-Edwardsville to describe the basic biology, ecology, physiology, and population demography of decurrent false aster.

Gray Bat

Throughout the year gray bats primarily use caves and occasionally human-made structures (USFWS 2009). Gray bats are considered regional migrants, averaging migrations of 200 km,

and show high philopatry to summer and winter sites (USFWS 2009). Female gray bat hibernation can start as early as September, and emergence as early as late March, compared to males who enter hibernation later in the year (Tuttle 1976). Females give birth in late May and young are volant within 21-33 days. Female gray bats form maternity colonies of a few hundred individuals to a few thousand individuals during summer. Maternity colonies are typically in caves with domed ceilings. Summer caves are almost always within 4 km of a river or reservoir (Tuttle 1976). Gray bats prefer to fly under a forest canopy between forage and roost sites, and some individuals travel up to 35 km between foraging areas and caves. Young bats feed and take shelter in forested areas near the roost (LaVal et al. 1977, USFWS 2009). Gray bats forage within roughly three meters of the water's surface. Gray bats feed selectively on aquatic insects but are considered opportunistic feeders as they also consume beetles and moths. An estimated 98% of gray bats hibernate in 15 caves. Human disturbance in caves used by gray bats is the main factor attributed to gray bat population declines. White-nose syndrome has been confirmed in gray bats, however, the effect of the disease on gray bat populations remains uncertain (White-nose Syndrome Response Team 2021). The refuge does not contain Priority 1 or Biologically Significant Hibernacula (USFWS 2009).

Indiana Bat

Indiana bats hibernate in underground caves and occasionally mines from October through April. During swarming in fall and as early as late July, large numbers of bats fly in and out of cave entrances at dusk and dawn. Foraging during swarming near hibernaculum allows bats to replenish fat reserves lost during summer reproductive activities and migration. In summer females form maternity colonies in wooded areas to raise young (USFWS 2007, USFWS 2019). Summer roosts are typically behind exfoliating bark of large, often dead, trees. Roost trees are typically in canopy gaps, or a fence line or wooded edge. Roost habitats include riparian zones, bottomland and floodplain habitats, wooded wetlands, and upland communities (Carter and Feldhamer 2005, USFWS 2007). Roost tree height ranges from 16 to 26 m (USFWS 2007). There have been 45 species of trees documented as Indiana bat roost trees. Broadly, Indiana bats select for roost trees with suitable structure and availability, rather than a particular species of tree. However, Indiana bats demonstrated preference to some trees at the local scale, including ash, elm, and pin oak in Illinois. Indiana bat maternity colonies use 10 to 20 trees each year, with one tree used as a primary roost by the majority of bats for some or all of summer. Individuals within a maternity colony are constantly entering and leaving the colony, with members leaving the colony for alternate roosts for only one or a few days. In addition, Indiana bats utilize night roosts in trees, bridges, caves, and bat houses. Indiana bats exhibit high site fidelity to both summer maternity roosts and winter hibernaculum. Female bats give birth from June to early July. Young bats are volant within 3-5 weeks. Indiana bats prefer to forage in semi-open to closed wooded areas with an open understory. Foraging areas are typically in forests, forest edges, and riparian areas (LaVal et al. 1977, USFWS 2007). Forest connectivity is also important

as forest patches may not be used by Indiana bats without the presence of a wooded corridor (USFWS 2007). Indiana bats forage after sunset on flying insects including moths, beetles, flies, and caddisflies, and less commonly on spiders. Indiana bats forage 2 to 30 m above ground level. The distance between roost and foraging areas used by female bats ranges from 0.5 to 8.4 km. The primary cause of Indiana bat population declines since 2009 is the spread of white-nose syndrome throughout the species' range (White-nose Syndrome Response Team 2021). In addition, habitat loss at winter hibernaculum and summer roosts is an ongoing threat throughout its range (USFWS 2019).

Monarch Butterfly

Monarchs are one of the most distinguishable butterfly species in North America, however, populations have declined significantly over the past two decades. An extensive status assessment was completed by the Service in 2020, which determined that listing the monarch under the Endangered Species Act is warranted but was precluded at that time (USFWS 2020). Monarch butterfly larvae are specialists adapted to feeding solely on otherwise toxic milkweed (*Asclepias*) plants. Adult monarchs are considered generalists and drink nectar from milkweed and a variety of other flowers in many habitats. It takes as long as 37 days between initial egg laying to enclosing, with about half that time spent in the larval stage. Summer or breeding adult monarchs live 2-5 weeks, while overwintering adults can live up to nine months. Widespread habitat loss and fragmentation is believed to be the primary driver of the species' decline. This includes the loss of nectar resources during all life-history stages for adults, and the loss of milkweed for larva. Indiscriminate herbicide use for agriculture and loss of habitat have also had devastating effects on milkweed stem counts in the Midwest (Thogmartin et al. 2017, USFWS 2020).

Northern long-eared bat

Northern long-eared bats overwinter in underground caves and structures or habitat that exhibit cave-like conditions. During swarming in fall, NLEBs roost in caves or forests adjacent to caves. In summer, reproductive females roost singly or in maternity colonies beneath bark or in cavities of live or dead trees. Non-reproductive bats also roost in cooler locations. Roost trees are typically 3 inches in diameter at breast height or greater, and commonly occur within 1,000 ft of other forested habitat. Northern long-eared bats have been observed using over 35 species of trees for roosts. Due to the diversity in roost tree selection, NLEBs are not thought to be dependent on specific tree species, rather, the availability of cavities or bark retained on a suite of trees and the structural diversity of a forest stand. While uncommon, NLEBs have been documented roosting in human-made structures likely a result from unsuitable roost trees in the area. Northern long-eared bats live in groups with individuals constantly leaving or returning to the main group. As a result, NLEB roost sites often change every 2 to 3 days. Female bats give birth from late May to mid-July, and juvenile bats are volant within 21 days. Northern long-eared

bats typically travel 40-50 miles between winter hibernacula and summer habitat; however, some have been known to travel distances of 160 miles or more. Northern long-eared bats forage on a suite of insects, most commonly moths (lepidopterans) and beetles (coleopterans), and arachnids. Northern long-eared bats mostly forage above the understory but under the canopy, 1 to 3 m above the ground, on forested hillsides and ridges. Northern long-eared bats also forage over small forest clearings, water, and along roads. Foraging peaks around 5 hours after sunset and 8 hours after sunset. The primary factor affecting NLEB populations are fatalities caused by white-nose syndrome (USFWS 2022a).

Spectaclecase mussel

The spectaclecase mussel is a large mussel, growing to lengths over 9.25 inches. The spectaclecase mussel occurs in large rivers and is found primarily aggregated in areas sheltered from currents and in firm mud, but can also be found in sand, gravel, cobble, and boulder substrates. Unlike most mussel species the spectaclecase does not move readily, making them susceptible to stranding during droughts (USFWS 2022b). Research suggests spectaclecase mussels begin significantly investing in reproduction at 10 years of age (Baird 2000). The fish host species of the spectaclecase mussel are mooneye (*Hiodon tergisus*) and goldeneye (*Hiodon alosoides;* Sietman et al. 2017).

Tricolored bat

Tricolored bats hibernate in caves, mines, and culverts in winter and exhibit high fidelity to hibernaculum sites. Tricolored bats prefer forested areas when moving between hibernacula and summer roosting sites. The tricolored bat primarily roosts in leaf clusters of live or recently dead deciduous hardwood trees in spring, summer, and fall. In summer tricolored bats may also roost in pine needles, eastern red cedar (*Juniperus virginiana*), artificial roosts, and rarely in caves (USFWS 2021). Female tricolored bats exhibit high fidelity to summer roost sites. Tricolored bats are opportunistic feeders and consume insects. During foraging, tricolored bats emerge early in the evening and forage in or above treetops, with some moving closer to the ground later in the evening (USFWS 2021). Tricolored bats most commonly forage over waterways and forest edges. The maximum distance tricolored bats travel from roosts to foraging areas is 4.3 km. The average size of a foraging area for an adult male tricolored bat is 5,807 acres. Female tricolored bats typically give birth to two young between May and July, and young are volant at 3 weeks of age. The primary factor affecting tricolored bat populations are fatalities caused by white-nose syndrome (USFWS 2021).

Description of Environmental Trends and Planned Actions

Decurrent False Aster

The refuge has only one documented location of decurrent false aster in the Gilbert Lake Division. The area is mostly open and remains dry for most of the year but can experience high

water pulses that set back succession. The refuge maintains wet meadow in the area to support decurrent false aster. Other areas of the refuge have been searched but no plants were documented. The refuge uses a variety of management activities to mimic historic flood conditions decurrent false aster thrives with, including mowing or disking when decurrent false aster is not observed. Herbicide is intended for use when conditions over multiple seasons do not allow heavy equipment to enter the area, causing woody encroachment or invasive species establishment and a subsequent decline in decurrent false aster. When applying herbicides in wetland units adjacent to the wet meadow, the refuge uses a buffer around the wet meadow to avoid trampling or applying herbicide to decurrent false aster.

Gray Bat

Gray bats have not been captured on the refuge. The USACE monitored bats at locations within and adjacent to the refuge in 2012, 2014, 2016, and 2020. Throughout the four-year study, only one gray bat was captured during 2012 in an area within a nightly foraging range to the Calhoun, Gilbert Lake, and Portage Island divisions. Gray bat calls were detected on the refuge during 2020 in the Batchtown and Gilbert Lake divisions. In the same year, calls were also detected in forests managed by the Illinois Department of Natural Resources directly adjacent to the Batchtown and Calhoun divisions. Gray bat calls were detected in the same forest adjacent to the Batchtown Division during 2014. There are vast cave networks part of the limestone bluffs that outline the Mississippi and Illinois river floodplains in the areas around the refuge. These caves, while off the refuge, could provide suitable roosting habitat for gray bats. Given the detection of gray bat calls in forests adjacent to the refuge for multiple years, the capture of a gray bat within foraging distance to the refuge, and the presence of caves within foraging distance to the refuge, gray bats could be utilizing the refuge.

Gray bats rely on caves with woody corridors to water for foraging and migration. Most wetlands within the refuge are surrounded by forest. The refuge applies herbicide for invasive species in forests using ground-based spot spraying on an as-needed basis. Harm to bats is mitigated by ground-based spot spraying in forests instead of broadcast spraying to prevent drift and minimize bat exposure. Best Management Practices are followed in all herbicide applications. In addition, herbicide applications are made during the day while bats are inactive. Bat monitoring is ongoing on the refuge. If a roost site is located, the refuge will record the location of the roost and enforce a buffer around the roost to mitigate effects to bats. The refuge does not contain Priority 1 or Biologically Significant Hibernacula to the gray bat.

Indiana Bat

The St. Louis District of the USACE monitored bats at locations within or adjacent to the refuge in 2012, 2014, 2016, and 2020 with a goal to obtain baseline population data on Indiana and Northern long-eared bats. During the study, Indiana bats were captured in the Batchtown

Division in 2012, and in the Batchtown and Gilbert Lake divisions in 2014 (USACE 2012, SCI Engineering 2014). Indiana bats were captured in forests directly adjacent to the Batchtown Division in 2012, 2016, and 2020, and the Calhoun Division in 2012, 2014, and 2020 (Orbis 2016, USACE 2020). During 2014 and 2020, the USACE documented Indiana bat calls throughout the study area. Using radio telemetry on captured bats, the USACE identified Indiana bats used cottonwood, elm, and maple trees as roost sites. One roost site was in a forest within the Prairie Pond area of the Batchtown Division. Another roost was located on Six Mile Island adjacent to Swan Lake in the Calhoun Division. Six Mile Island is a thin, six-mile-long forested island between Swan Lake and the Illinois River. Between Swan Lake and Six Mile Island is thin strip of human-constructed land referred to as the Swan Lake Levee. The Swan Lake Levee creates a minimum 10-meter buffer between Swan Lake and Six Mile Island, minimizing the potential for chemical drift onto Six Mile Island. Given the close proximity of Indiana bat captures and roost site locations to Swan Lake, Indiana bats may be using Swan Lake to forage. Further, Indiana bat captures throughout the refuge and in areas adjacent to the refuge or within nightly foraging distance to the refuge, suggest Indiana bats could be using the refuge to forage, roost, or as a migratory staging site.

The refuge applies herbicide for invasive species in forests using ground-based spot spraying on an as-needed basis. Harm to bats is mitigated by ground-based spot spraying in forests instead of broadcast spraying to prevent drift and minimize bat exposure. Best Management Practices are followed in all herbicide applications. Bat monitoring is ongoing on the refuge. If another roost site is located, the refuge will record the location of the roost and enforce a buffer around the roost to mitigate effects to bats. The refuge does not contain critical habitat to the Indiana bat. The refuge does not allow tree clearing in any division between April 1st and November 1st to avoid impacts to bat roosting trees. In addition, herbicide applications are made during the day while bats are inactive.

Monarch butterfly

Monarchs are found throughout the refuge in a variety of habitats. Limited monitoring has been conducted on this species and the milkweed it requires as a host plant. Based on anecdotal observations, milkweed is typically seen growing in refuge grasslands, ditches, and along the sides of levees and roads. The refuge documents plant species present in managed moist soil impoundments in the Calhoun Division by conducting IWMM vegetation surveys (Loges et al. 2021). Since surveys began in 2014, the refuge has not recorded any milkweed species occurrence in the units surveyed. It should be noted the IWMM protocol states a plant species will only be recorded if they contribute to 5% or more of the total canopy cover in the survey quadrat. In addition, only a subset of moist soil impoundments are surveyed for vegetation annually, though the impoundments not selected are typically bare ground from summer mowing or disking activities and would likely not contribute additional plant species. Still, results from

IWMM surveys show milkweed is not common in refuge wetlands targeted in this environmental assessment. Given these considerations, monitoring data suggest milkweed is not abundant in wetlands where aerial herbicide application would take place.

Adult monarchs are considered generalists and drink nectar from milkweed and a variety of other flowers. Adult monarchs have been anecdotally observed widely across the refuge. Fifteen nectar-producing plant species have been documented in IWMM surveys in managed moist soil impoundments in the Calhoun Division. Given the presence of nectar-producing plants, it is likely adult monarchs use the wetlands targeted for aerial spraying. Areas targeted for herbicide application support less nectar-producing plants.

Northern long-eared bat

No Northern long-eared bats have been captured on the refuge. The St. Louis District of the USACE monitored bats at locations within or adjacent to the refuge in 2012, 2014, 2016, and 2020 with a goal to obtain baseline population data on Indiana and Northern long-eared bats. Throughout the study only two Northern long-eared bats were captured, both during 2012. One Northern long-eared bat was captured adjacent to the Batchtown Division at Red's Landing managed by the Illinois Department of Natural Resources, the other was captured at Calumet Creek managed by the Missouri Department of Conservation approximately 2 miles northwest of the Clarksville Island Division (USACE 2012, SCI Engineering 2014, Orbis 2016, USACE 2020). During 2012 and 2014, the USACE documented Northern long-eared bat calls throughout the study area. During 2016 and 2020 no Northern long-eared bat calls were recorded. Given the presence of Northern long-eared bats in forests adjacent to the refuge in 2012, the bats could be utilizing the refuge as foraging, roosting, or migratory staging sites. Northern long-eared bats forage in a variety of habitats and rely on habitat connectivity and availability throughout their annual life history. Maintaining structurally diverse forests will add to the sustainability of this species.

The refuge applies herbicide for invasive species in forests using ground-based spot spraying on an as-needed basis. Harm to bats is mitigated by ground-based spot spraying in forests instead of broadcast spraying to prevent drift and minimize bat exposure. Best Management Practices are followed in all herbicide applications. Bat monitoring is ongoing on the refuge. If a roost site is located, the refuge will record the location of the roost and enforce a buffer around the roost to mitigate effects to bats. The refuge does not allow tree clearing in any division between April 1st and November 1st to avoid impacts to bat roosting trees. In addition, herbicide applications are made during the day while bats are inactive.

Spectaclecase mussel

There are no records of live or dead spectaclecase mussels found in any division of the refuge. A study in Swan Lake conducted by the Illinois Natural History Survey in 2002 did not find spectaclecase mussels (Tucker et al. 2002). Spectaclecase mussels are generally sessile and are not expected to move long distances into refuge wetland impoundments with direct connections to the Illinois or Mississippi rivers.

Tricolored Bat

Three tricolored bats were captured on the refuge in 2014 by the USACE. Two were in the Gilbert Lake Division and one was in the Batchtown Division (SCI Engineering 2014). Tricolored bats were also captured in forests directly adjacent to the Batchtown Division, and in forests within a nightly foraging range to the Calhoun and Portage Island divisions during 2012 and 2020 (USACE 2012, USACE 2020). The USACE recorded tricolored bat calls in 2014 and 2020 in areas within and surrounding the refuge.

Tricolored bats rely on forest habitats with woody corridors for foraging and migration. Most wetlands within the refuge are surrounded by forest. In forests, the refuge applies herbicide for invasive species using ground-based spot spraying on an as-needed basis. Harm to bats is mitigated by ground-based spot spraying in forests instead of broadcast spraying to prevent drift and minimize bat exposure. Best Management Practices are followed in all herbicide applications. The refuge does not allow tree clearing in any division between April 1st and November 1st to avoid impacts to bat roosting trees. Bat monitoring is ongoing on the refuge. If a new roost site is located, the refuge will record the location of the roost and enforce a buffer around the roost to mitigate effects to bats. In addition, herbicide applications are made during the day while bats are inactive.

Impacts on Affected Resource

Alternative A

The refuge has a history of aerial herbicide application without incident. Swan Lake was treated for undesirable woody plant encroachment in 2017 using aerial herbicides. The application was performed in summer when water was removed from wetlands and followed all label restrictions and BMPs. The timing of the application also reduced herbicide exposure to migratory birds, reptiles, fish, amphibians, and mammals due to the absence of water. Aerial herbicide application would be done using a fixed-wing aircraft, rotary-winged aircraft, and unmanned aerial vehicles (UAVs) in areas with limited ground-based access that contain large monocultures of undesirable woody plants or invasive species. An ESA Section 7, Intra-Service Consultation analyzing the potential effects of herbicide applications by aerial application equipment was performed by the local Ecological Services Field Station. The evaluation resulted in a determination of no effects to spectaclecase mussels; may affect but not likely to adversely affect Indiana bats, Northern-long-eared bats, tricolored bats, and decurrent false aster; and not likely to jeopardize the monarch butterfly.

Aerial herbicide application is intended for use in the wet meadow where decurrent false aster has been recorded to maintain habitat requirements of decurrent false aster. Aerial herbicide application will be used when conditions over multiple seasons do not allow ground equipment to enter the area, causing woody encroachment or invasive species establishment. The refuge enforces restrictions on management activities in the wet meadow site when decurrent false aster is observed. Aerial application in the wet meadow site will only occur when decurrent false aster is not observed. When decurrent false aster is present, herbicides in the wet meadow site will be applied using a ground-based spot spray application method to avoid spraying decurrent false aster. A buffer around decurrent false aster will continue to be implemented to prevent drift or incidental spraying of decurrent false aster. Allowing the refuge to utilize aerial herbicide application is expected to enhance habitat for decurrent false aster by creating favorable conditions for decurrent false aster on a more routine basis. This will also allow decurrent false aster to maintain a robust seed bank to sustain the Gilbert Lake population (Mettler-McClure 1997). Given the low viability of decurrent false aster seeds following sustained moisture, maintaining the seed bank is critical as climate change continues to alter historic flood patterns. An increase in flood duration and intensity of floods observed in recent years has made accessing the wet meadow area with ground equipment difficult, leaving the refuge with few options to maintain conditions for decurrent false aster.

According to IPaC, gray bats only occur in the Portage Island Division, not intended for aerial spraying. However, gray bat calls have been detected in and adjacent to other divisions within the last five years, although no visual confirmations have been made. Given these considerations, gray bats are included in this analysis. Applications will be made during the day when bat species are inactive, thus limiting exposure to bats. In addition, the habitats bats use to roost during the day (i.e., forests) are not targeted under this environmental assessment. The refuge will use buffers when spraying wetlands directly next to a forest. In some cases, a levee or dike acts as a buffer between forest and wetland habitats, limiting the potential of herbicide drift into forests. There may be a temporary reduction or shift in insect production within herbicide application areas due to changes in vegetation structure. Any short-term reduction in insect populations will be offset by additional suitable foraging habitat available on the refuge. Tricolored and Indiana bats are more likely to forage over waterways and forest edges. The refuge will enforce a buffer around treatment areas directly adjacent to water and forest edges to prevent chemical drift in areas bats are likely using. Additionally, the chemicals used are for control of vegetation and do not include insecticides. Thus, the proposed action is not likely to affect gray, Indiana, tricolored, and Northern long-eared bats.

Milkweed required by larval monarchs is absent from refuge wetlands based on IWMM vegetation monitoring data. Individual milkweed plants may be observed on levees adjacent to

refuge wetlands and could be impacted by aerial spraying operations. Following regional BMPs reduces the potential of herbicide drift to areas outside of refuge wetlands that contain milkweed. Given the low abundance of milkweed in and around wetland areas targeted for aerial spraying, the proposed action would not have large-scale impacts on monarch butterfly recruitment. A change in vegetation structure resulting from aerial herbicide application could temporarily limit the availability of nectar plants for adult monarchs. The impacts to adult monarch butterflies are likely to be mediated by increased nectar-producing plants. Adult monarchs could come in direct contact with herbicide during aerial application. Given the low nectar reserves in areas targeted for treatments, aerial herbicide application is not expected to have lasting impacts on the local population of monarch butterflies.

No impacts to spectaclecase mussels are expected from the proposed action as they have not been documented in the area. In addition, spectaclecase mussels are generally sessile and are not expected to move into wetland impoundments with a direct connection to the Illinois or Mississippi rivers. Wetlands disconnected from the Illinois or Mississippi rivers are unavailable to spectaclecase mussels except for during major flooding when water levels of either river could rise and connect with otherwise disconnected wetlands. The sessile nature of the spectaclecase mussel further reduces the odds of the mussel migrating into disconnected wetlands during a flood event. Refuge levees also act as buffers between wetland areas and the Illinois and Mississippi rivers where spectaclecase mussels could be present. Thus, following regional BMPs further reduces potential impacts to spectaclecase mussels by avoiding chemical drift to off-refuge areas where spectaclecase mussels are more likely to be found.

The refuge currently has active bald eagle nests located in forested areas, with several adjacent to refuge wetlands. All known bald eagle nests are located in forest stands separated from wetland areas by levees which act as a buffer to aerial herbicide application. In addition, the refuge enforces a 300-foot buffer between eagle nests and all management activities during the breeding season, typically winter through summer. The refuge enforces a 100-foot buffer during fall when eagles are typically not using the nests to avoid impacts to nest trees and trees directly adjacent to nest trees.

Under the No Action and Proposed Alternative, aerial herbicide applications would be combined with ground-based methods and could have cumulative effects. Following treatments, a reduction in plant and invertebrate abundance and diversity could occur. Such reductions would be localized but could alter the food and cover requirements for threatened and endangered species and result in displacement as organisms move to other areas on the refuge to locate necessary habitat requirements. Such cumulative effects are expected to be temporary, lasting no more than one year as the habitat recovers from unaffected perennial root stock, seed bank resources, and immigration from surrounding untreated sites. As noted above, cumulative

impacts can be negated through timing of management options, amount, and location of treatments to minimize or eliminate the compounding influence of multiple management programs.

Maintaining the refuge's plant and structural diversity maintains its resilience in the face of stressors like climate change, new invasive species introductions, and disease outbreaks. This would directly affect the refuge's environmental health and would be a cumulative effect of continued herbicide use. Indirectly, maximizing habitat diversity on the refuge maximizes insect diversity including pollinators. Improved pollination directly benefits plants, and increased insect diversity has trophic level, cumulative benefits. Continued aerial herbicide use has the potential of contributing to herbicide resistance of target plants. This indirect effect can be minimized using herbicides with different modes of action and/or using tank mixes of different herbicides.

Alternative B

Under Alternative B, aerial herbicide applications would be discontinued, and management of undesirable woody plants and invasive plants would be limited to ground-based methods. A Section 7 biological evaluation was performed in 2023 to evaluate ground-based herbicide application within all refuge habitats excluding the Clarksville Island and Portage Island divisions. The evaluation covered potential impacts to the threatened and endangered species listed above excluding the gray bat. The evaluation resulted in a determination of; no effects to the spectaclecase mussel; may affect but not likely to adversely affect Indiana and Northern long eared bats, and decurrent false aster; not likely to jeopardize candidate or proposed species/critical habitat for the monarch butterfly and tricolored bat. These determinations were made using the same rationale for wetlands described in Alternative A, along with analysis of impacts to prairie and forest habitats used by monarch butterflies, and Indiana, Northern long eared, and tricolored bats. The gray bat was excluded from the 2023 Section 7 biological evaluation process because it is reported to only occur within the Portage Island Division of the refuge. The Clarksville Island and Portage Island divisions were excluded from the 2023 Section 7 consultation because they are islands that are difficult to access, a necessity to achieve invasive species control. Thus, potential impacts to the grey bat are the same as Alternative A.

When utilizing ground-based herbicide application and other methods, potential for unintentional damage exists for non-target plant species, such as decurrent false aster and milkweed species, which may be impacted either by herbicides or trampling of plants during application. This may further impact decurrent false aster populations and monarch butterfly reproduction. The impacts to non-target species are likely to be mediated by increased plant diversity and overall habitat quality improvements where treatments could occur.

The effects of discontinuing aerial herbicide use on threatened and endangered species would be mostly indirect. The habitat structural changes and conversions detailed above would be caused by uncontrolled succession, which would be an indirect effect of discontinuing aerial herbicide use. Conversion of habitats to monotypic stands of invasive species or undesirable woody vegetation would greatly reduce the refuge's diversity. The loss of plant and structural diversity would reduce the refuge's resilience in the face of stressors like climate change, new invasive species introductions, and disease outbreaks. This would directly affect the refuge's environmental health and would be a cumulative effect of discontinued herbicide use.

Habitat and Vegetation (including vegetation of special management concern)

Affected Environment

Description of Affected Environment for the Affected Resource

The refuge CCP identified two habitat types and nine community types or alliances across the refuge using the U.S. National Vegetation Classification System (USNVCS; Faber-Langendoen 2001). The USNVCS use alliances to describe groups of vegetation communities with similar dominant canopy and structure. The two habitat types described by the USNVCS include wooded swamps and floodplains, and open and emergent marshes. Only the open and emergent marsh habitat type applies to the treatment area under this environmental assessment. Within the open and emergent marsh habitat type, there are five community types described by the USNVCS that occur within Two Rivers NWR. Below is the USNVCS definition and associated plant lists for the five community types present at Two Rivers NWR within the open and emergent marsh habitat type. Since rare and federally listed plants are inherently uncommon and cannot reliably define a community type, they are left out of the USNVCS plant lists. The plant lists below are refined to represent plants present at Two Rivers NWR, and the rare plant Walter's millet (*Echinochloa walteri*) and federally listed decurrent false aster were added to plant lists when plants of the same genus were listed by the USNVCS. The USNVCS definition is followed by a brief description of the community observed within Two Rivers NWR.

Bulrush – cattail – bur-reed shallow marsh: Generally, the soils in these areas are saturated, with some patches up to 15 cm deep throughout most of the growing season. Common plants include softstem bulrush (*Schoenoplectus tabernaemontani*), river bulrush (*Schoenoplectus fluviatilis*), hardstem bulrush (*Schoenoplectus acutus*), rice cutgrass (*Leersia oryzoides*), spike rush (*Eleocharis palustris*), bur-reed spp. (*Sparganium spp*.), common water-plantain (*Alisma plantago-aquatica*), broadleaf arrowhead (*Sagittaria latifolia*), water-hyssop (*Bacopa rotundifolia*), ducksalad (*Heteranthera limosa*), Pennsylvania smartweed (*Polygonum pensylvanicum*), longroot smartweed (*Polygonum coccineum*), and curlytop knotweed (*Polygonum lapathifolium*). Floating leaved aquatic plants including duckweed spp. (*Lemna spp*.), and greater duckweed (*Spirodela polyrrhiza*). At Two Rivers NWR, this broad community type is highly interspersed with the *Smartweed species seasonally flooded herbaceous alliance*

community type. These areas generally display great vertical diversity with grasses and bulrush stretching above a thick layer of smartweed while inconspicuous duckweeds rest atop small water pockets several centimeters deep. Wading in wetter areas are common water-plantain, broadleaf arrowhead, and water-hyssop. Plants in this community type thrive in spring and much of the summer in saturated soils. In mid to late summer and under dry conditions, soils dry and restrict the area of this community type.

North-central interior wet meadow – shrub: Annual prolonged flooding prevents woody vegetation from establishing and dominating in this community. This community contains a variety of textured grasses, low sedges, rushes, and forbs including switchgrass (*Panicum virgatum*), swamp milkweed (*Asclepias incarnata*), rice cutgrass, sprangletop (*Scholochloa festucacea*), and manna grass (*Glyceria grandis*). The wet meadow in the Gilbert Lake Division containing decurrent false aster is classified as a wet meadow subjected to seasonal inundation and drying out periods. The open canopy that defines a wet meadow allows decurrent false aster to thrive. Anthropogenic changes have impacted the flooding regime of the wet meadow site. Annual flood conditions have been scaled back after lock and dam installation, allowing woody plants to persist at the site. As a result, Two Rivers NWR must manipulate conditions within the wet meadow to avoid the area converting to forest. This can be especially difficult as the saturated soils of the wet meadow make it difficult to operate ground equipment.

Smartweed species seasonally flooded herbaceous alliance: These areas are characterized by a brief spring flood with an early summer draw down. Annual herbaceous vegetation colonizes exposed mudflats, and the constant flooding schedule typically eliminates perennial plants. Common plants include Japanese millet (*Echinochloa crus-galli*), Walter's millet, purple ammannia (*Ammannia coccinea*), curlytop knotweed, Pennsylvania smartweed, softstem bulrush, red-root flatsedge (*Cyperus erythrorhizos*), yellow nutsedge (*Cyperus esculentus*), rusty flatsedge (*Cyperus odoratus*), nodding beggarticks (*Bidens cernua*), and devil's beggarticks (*Bidens frondose*). This collection of community types represents most of the managed wetland impoundments within the refuge. Within the Calhoun Division, Walter's millet towers above the smartweed, nutsedges, and beggarticks below. Although not described in the USNVCS description, sprangletop is commonly found vertically between the smartweed and nutsedge canopy layer. Plants in this habitat type produce energy-rich seeds and tubers that are consumed by migrating waterbirds.

River bulrush seasonally flooded herbaceous alliance: This collection of community types is defined by the presence of river bulrush, which often forms mono-dominant patches. Other plant associates include softstem bulrush and bur-reed species. Conditions in this alliance are similar to the *smartweed species seasonally flooded herbaceous alliance* where a brief spring flood and early summer draw down allow for plant germination on exposed mud flats. Broadly, this group has an extensive range along major rivers in the Midwestern USA. At Two Rivers NWR, small patches of this alliance are found interspersed within the *smartweed species seasonally flooded herbaceous alliance,* occupying wetter soils. These habitats are susceptible to siltation from

extreme flood events occurring more frequently in the Illinois and Mississippi rivers largely attributed to climate change.

Mississippi River channel and its associated tributaries and backwaters: Tributaries and backwaters are inundated year-round. Plant communities in tributaries and backwaters of the Mississippi River vary between the headwaters in Minnesota and the delta in Louisiana. Aquatic vegetation is mostly restricted to the dammed area of the Mississippi River between Minneapolis, Minnesota and St. Louis, Missouri. Locks and dams in the Mississippi River create pools by impounding water between two dams. Thus, Mississippi River reaches in the dammed portion of the river are named according to the number or name of the lock and dam on the downstream border of the reach. Following lock and dam installation in the 1930's, aquatic vegetation thrived in most newly created pools. The flood of 1993 had devastating impacts on aquatic vegetation in pools south of the Quad Cities (Pool 14) where backwaters were filled with sediment carried by flood waters. As a result, aquatic vegetation south of the Quad Cities never returned to the levels previously observed. Two Rivers NWR contains backwaters in pools 25 and 26. The refuge has attempted to restore American lotus (*Nelumbo lutea*), American white waterlily (*Nymphaea odorata*), and submersed aquatic vegetation to tributaries and backwaters without success. As a result, these areas are still largely devoid of plant life.

Description of Environmental Trends and Planned Actions

The threats posed by invasive species and undesirable woody plant species have increased due to changing environmental conditions associated with climate change. This puts additional pressure on lands in the Illinois and Mississippi river floodplains that have already undergone dramatic alterations after lock and dam installation and agriculture conversion.

Annual wet-dry cycles once controlled woody vegetation and invasive species in the Illinois and Mississippi river floodplains. Wet-dry cycles were characterized by a flood pulse in spring and a drying out period in summer as water receded. Prior to lock and dam installation in the mid-1900's, plant species within the floodplains adapted to these annual water level fluctuations by using the flood pulse as a means of seed dispersal, competition control, or to initiate growth. Today, locks and dams in both the Illinois and Mississippi rivers stabilize water levels to allow for commercial shipping. In addition, levees built to minimize flood damage constrict the once wide-reaching floodplains to a narrow passageway. Both have dramatically restricted floodplain area in both rivers and in turn altered floodplain ecology. To mimic pre lock and dam wet-dry cycles, Two Rivers NWR controls water levels by moving water both passively through water control structures and actively by pumping water in or out of wetlands. In fall, the Illinois River is used to passively move water into Gilbert Lake within the Gilbert Lake Division, and Swan Lake within the Calhoun Division. The Mississippi River is used to passively move water into Prairie Pond within the Batchtown Division. In spring, passive water movement is dependent on river water levels. Water is passively moved out of impoundments to the river until water levels

reach equilibrium, after which the remaining water is pumped out of the impoundments and into the river. Sediment deposition from water that enters the impoundments from the Illinois or Mississippi rivers creates a physical barrier for moving water and limits water movement to water control structures or pumps. This prevents areas from drying, resulting in standing water and soft sediments throughout the summer. Soft sediments impede the refuge's ability to use ground equipment to perform disturbances necessary to set back undesirable woody plants and invasive species. Sedimentation rates are further amplified with the increased duration and intensity of flood events. These events have been amplified in recent years. Standardized water level records in the river pools around Two Rivers NWR began in 1948. Since then, the highest flood crest on record occurred in 1993. In addition, 14 of the 20 highest flood crests recorded since 1948 were observed between 1993 and 2023 in Pool 26 of the Mississippi River (National Weather Service 2020).

Two Rivers NWR is working to fix current limitations on water level management by working with the USACE on the Yorkinut Habitat Rehabilitation and Enhancement Project (Yorkinut HREP) aimed to improve water management capabilities in the Calhoun Division, with interest in improving other divisions in the future. The Yorkinut HREP addresses management limitations caused by sedimentation and will update infrastructure used for water level management. Ultimately, the project has the potential to reduce the refuge's dependance on aerial herbicide use.

Many undesirable woody plants and invasive plants prioritized for control already occur on Two Rivers NWR and threaten wetland habitat if left untreated. The refuge uses mowing, prescribed fire, water level management, and ground-based chemical application to combat invasive species and undesirable woody plant encroachment in accessible areas. Many areas are inaccessible due to unsolidified sediments, leaving the refuge with limited resources to control invasive species or undesirable woody plants. For example, the refuge maintained several inches of water on a dense willow stand for over a year in an area of Swan Lake with no ground equipment access. The water had little effect on the willow stand and given the remote nature of the site the refuge has few, if any, other control options available. Similarly, the refuge has little ability to control perennial smartweed. Perennial smartweed relies on clonal reproduction and creates dense colonies in wetland units, shading out seed producing annual plants consumed by migrating waterbirds, nectar producing plants for pollinators, and federally listed plants. Perennial smartweed does not produce a high seed biomass compared to annual smartweeds, therefore it is not a desired plant in refuge wetlands. The refuge uses a combination of mowing and ground-based chemical application to control perennial smartweed in accessible units, however, large wetland units within the refuge are inaccessible to ground equipment, leaving these areas vulnerable to invasion.

Impacts on Affected Resource

Alternative A

The continuation of aerial herbicide application will allow for larger, more remote patches of invasive species and undesirable woody plant species to be treated annually across the refuge. Increased sediment input threatens water channels and ditches used to add or remove water from wetland impoundments and makes areas difficult to access. Backwaters have filled with sediments and lack the depth and water quality needed to sustain aquatic plant life. As farming practices continue to become more efficient, additional pressure will be placed on already fragmented habitat in the floodplain to withstand the sediments that come from upland farming sources along with the sediments carried by rivers. Climate change also puts enormous pressure on the floodplains as flood events increase in severity and frequency. Aerial application will allow for more areas to be controlled, more even coverage, reduced levels of overspray, and increased safety for the applicator. This alternative would maximize the refuge's ability to control and prevent the expansion of invasive species and undesirable woody plant species by promoting suitable and desirable habitat for wildlife species. This alternative would be expected to directly benefit refuge habitats and meet habitat goals outlined in the refuge CCP and HMP.

There would be some risk of incidental treatment of non-target native species under any methodology for herbicide application. Potential negative effects of herbicide treatments would be indirect and include herbicide inadvertently being applied to non-target plants while treating invasive species and other undesirable vegetation. The greatest potential for non-target effects occurs when herbicides are applied aerially. This is because the potential for drift is much higher for aerial herbicide applications. Aerial applications would be used in areas that would limit the potential for non-target drift. The potential for non-target effects can be minimized using plant phenology and water management activities. Many invasive species begin actively growing before native species in the spring, allowing the refuge to target the invasive species before desired plant species emerge. Ground herbicide applications using sprayers mounted on tractors would be used in small wetland areas that are not logistically feasible for aerial application. Spot treatment of undesirable woody plants and invasive species using a UTV mounted sprayer will continue to be used to prevent invasion in accessible areas.

As noted above, the potential for non-target effect has been analyzed as part of the labeling process for all herbicides and measures to minimize those effects, including restrictions, are included in the product label. Because the label is the law, the potential for indirect negative effects are expected to be minimal. This potential negative affect is further minimized by the refuge following regionally approved BMPs, and all PUPs being reviewed and approved as detailed above. The indirect benefits of herbicide applications through improved habitat diversity and health are expected to benefit wetlands and increase diversity.

This alternative would result in the direct effect of ground disturbance during ground herbicide applications and is expected to have short-term effects. Ground herbicide applications would result in the direct effect of disturbance to vegetation such as trampling. These effects are expected to be short-term as vegetation is expected to quickly recover from this disturbance. Desired wetland annual plants require an open canopy. Eliminating undesirable woody plants and invasive species opens the canopy and allows for desirable wetland plants to germinate. The desired habitat diversity and structural conditions detailed above would maximize wetland benefits under this alternative.

Herbicide applications would be combined with non-herbicide methods like prescribed fire, mowing, and disking and could have cumulative effects. Following combined treatments, a reduction in plant abundance and diversity could occur. Such reductions would be localized but could result in a reduction in habitat quality. Such cumulative effects are expected to be temporary, lasting no more than one year as the habitat recovers from unaffected perennial root stock, seed bank resources, and immigration from surrounding untreated sites. As noted above, cumulative impacts can be negated through timing of management options, amount, and location of treatments to minimize or eliminate the compounding influence of multiple management programs.

Maintaining the refuge's wetland health and diversity maintains its resilience in the face of stressors like climate change, new invasive species introductions, and disease outbreaks. This would directly affect the refuge's environmental health and would be a cumulative effect of continued herbicide use. Continued herbicide use has the potential of contributing to herbicide resistance of target plants. This indirect effect can be minimized by using herbicides with different modes of action and/or using tank mixes of different herbicides.

Alternative B

Under the Alternative B, only ground application of herbicides with truck, tractor, ATV/UTV, or hand sprayers would be allowed in addition to other ground-based methods. Treatments would be primarily limited to the drier, smoother terrain portions of the refuge. Wetland habitats with little to no access, or woody vegetation that is too dense or large to treat with ground equipment would remain largely untreated or would be limited to hand application in small, accessible areas. Ultimately, the lack of control would allow undesirable woody vegetation and invasive species to expand in area and spread to new areas of the refuge. In areas accessible to ground equipment, non-target impacts would be significantly lower than Alternative A. There would still be risks to non-target species via chemical drift and trampling from ground equipment. Ground-based herbicide application allows for a more targeted application of herbicides.

The amount of area treated annually using ground spraying applications is limited due to the time required to treat an area and the cost of operating equipment. Additionally, applying herbicides

evenly on the landscape can be difficult using ground equipment due to uneven terrain, which reduces the operator's ability to maintain a constant speed and the need to avoid obstacles. There is also chance for overlap due to difficulties in navigating terrain and vegetation features leading to the application of more herbicide than initially planned. Increased duration of application and the increased amount of chemical used also elevates the chemical exposure to the applicator.

Under the Alternative B, wildlife habitat will continue to degrade in large inaccessible areas as large expanses of monotypic stands of undesirable woody plants and invasive species remain untreated and continue to spread. Undesirable woody plant species in wetlands would further decrease the amount of wetland habitat and the extent of desirable vegetation would continue to decline. Invasive species in target wetland areas will continue to outcompete native and desirable annual plant species, thus reducing the amount of available habitat to migrating waterbirds. The loss of plant diversity would reduce refuge's resilience in the face of stressors like climate change, new invasive species introductions, and disease outbreaks. This would directly affect the refuge's environmental health and would be a cumulative effect of discontinued herbicide use.

Geology and Soils

Affected Environment

Description of Affected Environment for the Affected Resource

Soils formed in the alluvial fan/terrace complex of the Calhoun and Gilbert Lake Division include Oakville fine sandy loam; Worthen, Tice, Littleton, Hurst, Radford, Wakeland, and Blyton silt loams; and Beaucoup, Quiver, and Darwin silty clay loams. Worthen, Tice, and Littleton soils formed under native prairie and mixed forest-grass communities (Fehrenbacher and Downey 1966). Beaucoup soils are haplaquolls that formed under bottomland forest and marsh grass vegetation in seasonally saturated areas. Wakeland, Quiver, and Blyton soils typically were formed under bottomland forest sites in floodplains and adjacent terraces. Darwin soils formed on natural levees under bottomland forest vegetation. Tice silt loams soils formed on higher ridges and Beaucoup silty clay loams in the bottoms of swales. Small, often unmapped, outcrops of Oakville fine sandy loams are present on some point bar ridges.

Since the refuge manages habitats to maximize diversity whenever possible, soil health on refuge lands is expected to be very good. This combined with the soil characteristics noted above, and the timing of herbicide application when water is removed from the landscape, indicates herbicide absorption and decomposition on refuge lands should be very good.

Description of Environmental Trends and Planned Actions

The soils and geology of refuge lands are not expected to change. An increase in duration and intensity of flood events from anthropogenic changes to the floodplains and climate change

could result in large sediment deposits. These events are outside the refuge's control, nonetheless major flood events could introduce pollutants to refuge soils from contaminated soils and water runoff. These large-scale flood events have destroyed surrounding levees, leaving the refuge vulnerable to erosion and further sediment deposition. These events are expected to continue and worsen with the conversion of floodplain habitat to agriculture or development, and increased effects from climate change. The Yorkinut HREP in the Calhoun Division requires shallow soil disturbance using ground equipment to build or move levees in wetland impoundments. The wetland impoundments targeted under the Yorkinut HREP have undergone ground construction in the past and prior to refuge establishment were extensively farmed. The Yorkinut HREP is not expected to disturb previously undisturbed soils.

Impacts on Affected Resource

Alternative A

Invasive species and undesirable woody plant species would be treated with herbicide using both aerial and ground-based methods. This alternative would maximize the refuge's ability to control and prevent the expansion of invasive species and undesirable woody plant species on a large scale and in inaccessible areas. Although the differences between this alternative and Alternative B may be negligible, this alternative would be expected to maximize soil health on the refuge by reducing the amount of herbicide applied to an area as aerial herbicide application introduces less change of herbicide overlap and allow for shorter herbicide application under more constant conditions. In addition, invasive species can affect soil chemistry, microbial, and mycorrhizal fungal communities (McNeish and McEwan 2016, Rai 2022). Alternative A allows for more areas on the refuge to be controlled for invasive species by accessing areas inaccessible to heavy equipment. This would be an indirect effect of maximizing plant diversity in the habitats on the refuge.

Healthy, organic soils help with absorption and breakdown of herbicides. Best management practices aimed at minimizing herbicide contact with soil are likely the best tool to mitigate any threats to soil health; these include minimizing soil compaction and disturbance, maximizing plant diversity, and maintaining permanent plant cover. Extra precaution is used when applying herbicides to sandy or well drained soils to minimize any herbicide to soil contact that may have detrimental effects to soil health. Aerial and ground-based treatments could cause direct herbicide contact with soil. However, aerial application eliminates equipment contact with soil. Ground-based herbicide application, and non-herbicide control methods including mowing and disking all increase soil disturbance, exposure of soils to herbicides, and could increase erosion.

Herbicide applications would be combined with other non-herbicide methods and could have cumulative effects. Following combined treatments, a reduction in plant abundance and diversity could occur. Such reductions would be localized but could result in a reduction in habitat quality. Such cumulative effects are expected to be temporary, lasting no more than one year as the

habitat recovers from unaffected perennial root stock, seed bank resources, and immigration from surrounding untreated sites. The cumulative effect of fire and herbicide to control invasive plants has been shown to increase soil nitrogen and net nitrogen transformation rates, which improves native plant performance and diversity (Rhoades et al. 2002). As noted above, cumulative impacts can be negated through timing of management options, amount, and location of treatments to minimize or eliminate the compounding influence of multiple management programs.

Alternative B

Under this alternative, aerial herbicide application would be discontinued, and only ground-based herbicide application and other management methods would be used. This alternative would result in the direct effect of ground disturbance during herbicide applications. Operating ATV/UTVs and tractors on the landscape to conduct herbicide treatments could cause erosion, compaction, or displacement of soil, which would take place repeatedly over extended time periods. Herbicide may be added to the soil due to accidental overspray. Soil health benefits would be observed under this alternative but may be more limited when compared to the Alternative A, due to the limited scope of treatment in accessible areas. A reduction in application area would result in a conversion of habitats to monotypic stands of invasive species and undesirable woody plant species, which would likely result in an indirect effect of reduction in soil health.

Water Quality

Affected Environment

Description of Affected Environment for the Affected Resource

Lock and dam installation in the Mississippi River changed the water dynamics in the floodplain dramatically. River water levels are now higher and more stabilized during summer and early fall. During high flow periods water levels increased 2-4 feet from historic levels, and during low flow periods water levels increased on average by 8-9 feet for the entire year. Higher elevations in the floodplain now have greater soil moisture due to the higher water levels. The Illinois River experienced similar dramatic changes when large volumes of water were diverted to the river via the Chicago Sanitary and Ship Canal. In addition, seasonal runoff in the Illinois River increased after floodplain habitat was converted to agriculture. During that time, spring floods increased by nearly 22% in the Illinois River, leading to the formation of drainage and levee districts to manage new water levels and prolonged flood events. Eventually, the Illinois River would also have locks and dams installed to maintain water levels necessary for navigation. Many of the "lakes" the refuge manages were historically backwaters of the Illinois and Mississippi rivers that were permanently inundated and grew substantially in size when water levels rose after lock and dam installation.

Water quality in the Mississippi River has dramatically declined since the early 1900's. Many aquatic areas south of the Quad Cities (Pool 14) have become eutrophic (Chick et al. 2013). An excess of agriculture runoff flows into the Mississippi River, causing elevated nutrient and organic matter levels that generally worsen in downstream reaches of the river (Houser et al. 2010). Annual discharge has also dramatically increased since 1970, which impacts physical processes and features, ultimately affecting all life in the river (Johnson and Hagerty 2008). The Illinois River has experienced similar water quality decline as the Mississippi River (Johnson and Hagerty 2008).

Description of Environmental Trends and Planned Actions

Factors related to water quality are not expected to change in the future. This includes geology (e.g., karst features), depth to groundwater, location of wetlands, streams, impoundments, soil characteristics, and the influx of agricultural chemicals from offsite agricultural lands. The Long Term Resource Monitoring Program collects limnological data in several reaches of the Upper Mississippi River to monitor water quality, including in Pool 26.

Impacts on Affected Resource

Alternative A

Under the Alternative A, the aerial application of herbicides will allow for the treatment of more habitat and will help mitigate the degradation that the invasive species and undesirable woody plant species cause. The reduction and prevention of further establishment of these species will result in an increase of habitat available for priority resources. Furthermore, maintaining healthy and diverse ground cover indirectly benefits water quality because vegetation filters water before it gets to surface water and/or groundwater.

Potential negative effects of aerial herbicide treatments would be indirect and include herbicide inadvertently dripping off target plants and leaching through the soil into groundwater and/or running off into nearby surface waters. Application of aerial herbicides could affect water quality by accidental overspray. This risk can be mitigated by adjusting the timing of herbicide application, and following regional and refuge BMPs. When herbicide applications are near water, herbicide use would be restricted to those approved for use over or near water. The potential for groundwater and surface water contamination has been analyzed as part of the labeling process for all herbicides and measures to minimize those effects, including restrictions, are included in the product label. Since herbicide labels are legally enforceable and must be followed, the potential for groundwater or surface water contamination is expected to be very minimal. Additionally, wetland units are surrounded by levees that act as a buffer between treatment areas and open water. The refuge has a history of aerial and ground-based herbicide application, and no groundwater or surface water contamination has occurred.

Herbicide applications would be combined with non-herbicide methods like prescribed fire, mowing, and disking and could have cumulative effects. Following combined treatments, a reduction in plant abundance and diversity could occur. Such reductions would be localized but could result in a reduction in habitat quality. Disking introduces air into the soil making it more susceptible to erosion, thus resulting in a potential for increased siltation of water resources. The cumulative effect of using herbicides with non-herbicide methods could potentially increase both siltation and chemical contamination of water resource. Timing the use of non-herbicide methods to reduce erosion would assure minimal siltation. Furthermore, following herbicide label instruction accordingly would ensure undesirable vegetation control can be achieved through minimal runoff into water resources. Such cumulative effects are expected to be temporary, lasting no more than one year as the habitat recovers from unaffected perennial root stock, seed bank resources, and immigration from surrounding untreated sites. As noted above, cumulative impacts can be negated through timing of management options, amount, and location of treatments to minimize or eliminate the compounding influence of multiple management programs.

Alternative B

Under the Alternative B, the chemical treatment of invasive species and undesirable woody plant species would be limited, and the refuge would rely on ground-based herbicide application and other non-herbicide methods. This limitation would allow uncontrolled populations of undesirable woody plants and invasive species to further expand in wetlands, decreasing plant diversity. Woody encroachment also displaces water in wetlands. This reduces the capacity of the wetlands within the refuge and the floodplain, affecting water depth and aquatic area available for wildlife. The effect of discontinuing aerial herbicide application in otherwise inaccessible areas could result in conversion of habitats to monotypic stands of invasive species and undesirable woody vegetation, which could also affect water quality through diminished water filtration.

This alternative may result in herbicide entering a waterbody as accidental overspray from ATV/UTVs or tractor mounted sprayers. The potential for groundwater and surface water contamination has been analyzed as part of the labeling process for all herbicides and measures to minimize those effects, including restrictions, are included in the product label.

Visitor Use and Experience

Affected Environment

Description of Affected Environment for the Affected Resource

The refuge does not track annual visitor use. In 2016 and 2017 the refuge participated in a study focused on reporting economic contributions associated with recreational visitation (Caudill and Carver 2019). Over the course of the study, Two Rivers NWR had 21,420 recreation visits. The refuge sees the greatest influx of visitors during the spring and fall waterbird and songbird migrations, and during fall hunting activities. Popular activities on the refuge include deer hunting, turkey hunting, wildlife viewing, fishing, hiking, and dog walking. The refuge enforces a sanctuary period from October 16th through December 31st in the Calhoun Division where managed wetland impoundments are closed to all public access to provide waterbirds undisturbed opportunities to feed and rest. The refuge has a small visitor center open during business hours, Monday through Friday. Hiking trails are available in the Batchtown, Calhoun, and Gilbert Lake divisions. The refuge also maintains several boat launches for motorized and nonmotorized boat recreation.

The refuge provides visitors with a variety of environmental education events throughout the year for local schools, universities, and other groups. The refuge also works closely with partner organizations to host and participate in events around the greater St. Louis area.

The refuge is located on a peninsula surrounded by the Illinois and Mississippi rivers. Visitors from the most populated areas adjacent to the refuge (St. Louis, Missouri, and Alton, Illinois) must cross one of two possible ferries to visit the refuge. One ferry is a fee-free ferry, the other costs $17 round-trip. Ferry rides negatively impact refuge visitation, as some groups are not allowed to ride a school bus on a ferry. The Gilbert Lake Division is the only refuge area located on the east side of the Illinois River within a reasonable driving distance (45 miles) from St. Louis, Missouri without the need to ride a ferry. The refuge accommodates groups by hosting events at the Gilbert Lake Division, but the lack of restrooms and other public amenities make the Gilbert Lake Division less popular than the Calhoun Division.

Description of Environmental Trends and Planned Actions

The refuge is planning to expand visitor amenities in the Gilbert Lake Division to accommodate groups that cannot ride a ferry, or visitors who do not feel comfortable riding a ferry. As a result, visitation is expected to increase over time in the Gilbert Lake Division. The refuge also made changes to hunting regulations in 2020, opening more of the refuge to more types of hunting. Since then, the refuge has seen an increase in visitors using the refuge for hunting. The refuge expects to see an increase in hunters using the refuge as news about the new hunting regulations continues to spread. Some treatments may take place during hunting seasons when hunters could

otherwise be occupying lands adjacent to or within where applications are taking place. Three hiking trails are open year-round, the rest are closed during the waterbird sanctuary period. Most trails are adjacent to refuge wetlands for optimal wildlife viewing.

Impacts on Affected Resource

Alternative A

Aerial application and ground-based application of herbicide will result in a temporary closure of the treatment areas when an area would otherwise be open for public use. The length of closure is dependent on the herbicide being applied and is detailed as the "*Restricted Entry Interval*" on the product label. Because the restricted entry interval is detailed in the product label, it is a requirement. The restricted entry interval for most herbicides is "Until Dry," but some are as restrictive as 48 hours. Areas would be closed as needed at least 24 hours prior to treatment and remain closed for 24 hours afterward or longer if required per the restricted entry interval. The preferred timing of aerial herbicide treatment typically falls outside of peak public use, both during the calendar year and time of day. All closures would be posted with signs indicating ongoing herbicide treatment. Little, if any, hunting occurs in refuge wetlands and many wetland areas proposed for treatment are remote areas requiring a several-mile hike access. Boating access to these areas is limited by water levels and refuge regulations. As a result, few visitors are expected to be impacted by entry limitations caused by aerial or ground-based herbicide application.

Spraying herbicide may have a negative visual and noise impact. Reducing large monotypic stands of dense undesirable woody vegetation or invasive species will improve recreation areas for people. Improved wildlife habitat will benefit wildlife viewing as well. Reduced woody shrub cover will improve sight lines and access for anglers and wildlife viewers. However, screening structures for these groups to conceal themselves from wildlife may be reduced.

Herbicide applications would be combined with non-herbicide methods like prescribed fire, mowing, and disking and could have cumulative effects. Following combined treatments, a reduction in plant abundance and diversity could occur. Such cumulative effects are expected to be temporary, lasting no more than one year as the habitat recovers from unaffected perennial root stock, seed bank resources, and immigration from surrounding untreated sites. As noted above, cumulative impacts can be negated through timing of management options, amount, and location of treatments to minimize or eliminate the compounding influence of multiple management programs.

The cumulative effects could both positively and negatively impact wildlife viewers and hunters. Treatments to dense undesirable woody vegetation or invasive species will improve viewing opportunities for wildlife viewers. However, the reduction of trees and shrubs would reduce the amount of screening structure in the treatment areas, for both wildlife and people. Wildlife could observe people more easily and take refuge in other off-refuge areas. Wildlife viewers and

hunters could potentially find fewer locations in which to conceal themselves. Another effect of aerial spraying would be the increased noise during application. This may disturb visitors who come to the refuge to seek solitude and quiet. However, this noise would only persist during application and refuge staff would be able to alter the schedule of flights depending on refuge events and the rate of public use if necessary. In addition, the noise could cause wildlife sought out by visitors to leave the area temporarily, impacting visitor satisfaction.

This alternative would result in the desired habitat diversity and structural conditions detailed above, which would improve conditions for wildlife and therefore wildlife-dependent recreation. Maintaining the refuge's health and diversity of its habitats helps maintain its resilience in the face of stressors like climate change, new invasive species introductions, and disease outbreaks. This would directly affect the refuge's environmental health and would be a cumulative effect of continued herbicide use, both aerial and ground-based application methods. Continued herbicide use has the potential of contributing to herbicide resistance of target plants. This indirect effect can be minimized using herbicides with different modes of action and/or using tank mixes of different herbicides.

Alternative B

For ground-based spraying, signs will be placed along trails warning visitors not to enter areas that are being sprayed. The legal minimum length of closure is dependent on the herbicide being applied and is detailed as the "*Restricted Entry Interval*" on the product label. Because the restricted entry interval is detailed in the product label, it is a requirement. The restricted entry interval for most herbicides is "Until Dry," but some are as restrictive as 48 hours. The refuge will close treatment areas to the public for 24 hours after spraying or longer if required by the label. Ground-based herbicide treatment is more time consuming. Spraying a single wetland unit could take place over 2-4 days using ground-based equipment compared to one day of arial spraying. Thus, this alternative is expected to directly impact visitor experiences longer than Alternative A. However, improved wildlife habitat will benefit wildlife viewing for individual visitors and during refuge events. Reduced woody vegetation cover will improve waterbird viewing that many people visit for. These visitor benefits will take more time to establish in Alternative B than in Alternative A.

Administration

Affected Environment

Description of Affected Environment for the Affected Resource

Two Rivers NWR has five permanent staff including administrative, biological, maintenance, management, and visitor services duties. The refuge shares a law enforcement officer with neighboring refuges. Staffing levels can vary with funding levels with some additional positions funded through grants and agreements. Seasonal staff varies from year to year with the use of volunteers and biological science technicians. The administrative capacity to coordinate aerial

spraying actions through contractors or other partners has been available for past efforts. Aerial spraying contracts will be funded with a variety of funds, including refuge appropriated funds and grant funds.

Description of Environmental Trends and Planned Actions

Primary refuge staff positions tend to remain flat with other positions added as funding allows. There may be times when there are vacancies that limit refuge capacity. However, treatment of invasive species is generally a refuge habitat management priority and some duties associated with invasive species management can be handled by other staff during vacancies.

Impacts on Affected Resource

Alternative A
Aerial herbicide treatment reduces the amount of staff-time required to conduct undesirable woody plant and invasive species control. Staff will have to devote time to posting the area before and after treatment, and monitoring the area for chemical effectiveness and visitor compliance. Staff time would also be required to procure a contractor or partner to perform the treatment. Remote areas are only accessible by aerial herbicide application. Siltation and unsolidified sediments in remote areas with limited vehicle access pose as a risk to staff performing ground-based herbicide application where tractors or ATV/UTVs can become stuck and/or sink quickly. As a result, staff do not perform ground-based herbicide treatments in these areas. Ultimately, aerial treatment is more cost effective per acre than ground treatments and would allow for more areas to be treated. Ground-based treatments will be utilized for small patches of woody and invasive species. Staff will be required to mix herbicide, calibrate equipment, and perform treatments, or hire a contractor to perform treatments. Conducting ground-based treatments requires pesticide certification and equipment training that only qualified staff can perform, requiring a minimum of three workdays to become certified before treatments.

Alternative B
Under the ground-based treatment alternative, significantly more staff time would be required to treat areas, and remote areas would be left untreated. Treatments would take several days to complete, using valuable employee time and resources on an annual basis. Most of the work would be primarily performed by maintenance and biology staff, with assistance from other divisions as needed. Conducting ground-based treatments requires pesticide certification and equipment training that only qualified staff can perform, requiring a minimum of three workdays to become certified before treatments. The refuge would have to maintain a stock of herbicide for treatments and personal protective equipment for applicators, and follow hazardous material storage guidelines and OSHA safety regulations.

Socioeconomics

Local and Regional Economies

Affected Environment

Description of Affected Environment for the Affected Resource

Crop farming is the major industry within Calhoun and Pike counties in Illinois. Greene and Jersey counties in Illinois have crop farming as a major industry, along with more wholesale businesses than Calhoun and Pike counties. The Portage Island Division is included in St. Charles County in Missouri but is not intended for arial spraying under this environmental assessment due to the lack of wetland habitat within the division. The major crops of the area include corn, soybeans, and wheat. There are also peach and apple orchards that attract visitors during mid to late summer and early fall.

Description of Environmental Trends and Planned Actions

Development and industry growth around the refuge is expected to remain stable or slightly increase in the future. This is a result of the increasing population density around cities and towns and the popularity of aquatic recreation areas.

Impacts on Affected Resource

Alternative A and Alternative B

Treatment by aerial or ground application will have little, if any, effect on the local and regional economies. Small businesses that supply herbicide or offer treatment will benefit from federal contracts. Aerial herbicide application will require a contractor since the refuge lacks certification and equipment needed for aerial spraying. Potential negative effects of herbicide treatments would be indirect and include herbicide inadvertently being applied to non-target plants while treating invasive species and undesirable woody plant species. Care is taken during the planning process to ensure that herbicide is only applied to targeted areas and adequate buffers are in place around any boundary where ownership changes to ensure private property is not damaged. However, spray drift can occur from both ground and aerial application of herbicides and could potentially impact non-target areas if regulations and label directions are not followed.

Environmental Justice

Affected Environment

Description of Affected Environment for the Affected Resource

Executive Order 12898, February 11, 1994 (59 FR 7629), requires each Federal agency to make environmental justice a part of its mission. Environmental justice means that, to the greatest extent practicable and permitted by law, all communities or populations are provided the

opportunity to comment before decisions are rendered on proposed Federal actions. Furthermore, the principles of environmental justice require that certain populations or communities are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner by government programs and activities affecting human health or the environment.

In Calhoun County, Illinois, where the Calhoun and Batchtown divisions and refuge headquarters and visitor center are located, 97.7% of residents identified as white, 1.8% as Hispanic or Latinx, and less than 1% as either American Indian or Alaska native, Black or African American, Asian, or two or more races in the 2021 census (U.S. Census Bureau, 2021). Of residents older than 25, 17.3% earned a bachelor's degree. The median household income in 2021 was $74,792. Calhoun County is 253.83 square miles with 18 people per square mile (U.S. Census Bureau, 2021).

Areas that surround the refuge fall below the 50th percentile for all the environmental justice indexes, according to the Environmental Protection Agency's Environmental Justice Screening and Mapping Tool (EPA 2023). Areas with significantly higher environmental justice indexes are located 15 air miles southeast in Alton, IL and 20 air miles southeast in St. Louis, MO.

Description of Environmental Trends and Planned Actions

The refuge has a robust urban wildlife conservation program that aims to provide inclusive and safe outdoor experiences. The program focuses on refuge staff traveling to underserved communities in the greater St. Louis area to teach outdoor skills to grade school students, and facilitating field trips to the refuge headquarters. As a result, many programs are off the refuge. Programs on the refuge are carefully coordinated amongst all the staff to ensure students are not exposed to ground-based chemical applications or other management actions. Most of the events the refuge participates in are free to the public, with the refuge or partners providing outdoor equipment to participants. Books and binoculars are available to use for free at the refuge visitor center. Outside the refuge visitor center are benches for visitors to use, several viewing blinds, and informational panels at refuge trailheads. The refuge has made improvements to visitor access by updating driving directions on the website, replacing most signs on public roadways, fixing errors in mobile mapping applications, and producing a trail brochure all within the last two years.

Impacts on Affected Resource

Alternative A and Alternative B
The Service has not identified any potential high and adverse environmental or human health impacts from this proposed action under either alternative. Mitigation measures are required to be followed for herbicide application to reduce impacts to the human environment. Minority or low-income communities will not be disproportionately affected by any impacts from this proposed action.

Alternative A
Treatment of undesirable plants in remote areas will benefit wetland restoration efforts, which will improve ecosystem services, help reduce the negative effects of pollution, and increase local access to high-quality natural areas. The refuge's urban program and visitor experience will be enhanced by the increase of high-quality habitat acreage that will likely attract more wildlife to the refuge. Aerial herbicide application will expedite the control of undesirable plant populations, hastening the benefits to the local community. The refuge offers one of the largest continuous waterfowl sanctuary areas in the confluence region at nearly 3,100 acres in the Calhoun Division. The local community largely attributes the number of waterfowl in the area to the sanctuary at Two Rivers NWR. The arrival of waterfowl to the area contributes to the local economy by attracting waterfowl hunters and bird watchers. Thus, enhancing wetland habitat for waterfowl using aerially applied herbicides will ensure the refuge can continue to support the local community.

Alternative B
Treatment of undesirable plants will benefit conservation efforts to establish productive wetlands, which will improve ecosystem services, help reduce the negative effects of pollution, and increase local access to high quality natural areas. This process will likely be slower and less efficient without aerial herbicide treatment, and the community will benefit more slowly as a result. Moreover, inaccessible areas will remain untreated including a large portion (2,500 acres) of the waterfowl sanctuary area in the Calhoun Division.

Cumulative Impacts

Cumulative impacts are defined as the incremental, additional effects to the environment that result from implementing any of the alternatives under consideration. The cumulative impact analysis must consider this incremental impact of the proposed action, and any alternative actions, in addition to the impact of past, present, and reasonably foreseeable actions regardless of the jurisdiction of their origin.

Under the No Action and Preferred Alternative, aerial herbicide applications may be combined with ground-based treatments including non-herbicide methods like prescribed fire, mowing, and disking and could have cumulative effects. Following combined treatments, a reduction in plant abundance and diversity could occur. Such reductions would be localized but could result in a reduction in habitat quality. Such cumulative effects are expected to be temporary, lasting no more than one year as the habitat recovers from unaffected perennial root stock, seed bank resources, and immigration from surrounding untreated sites. The cumulative effect of fire and herbicide to control invasive plants has been shown to increase soil nitrogen and net nitrogen transformation rates, which improves native plant performance and diversity (Rhoades et al. 2002). Cumulative impacts can be negated through timing of management options, amount, and location of treatments to minimize or eliminate the compounding influence of multiple management programs.

Maintaining the health, diversity, and structure of plants, habitats, and soils on the refuge maintains their resilience in the face of stressors like climate change, invasive species introductions, and disease outbreaks. Improving habitat diversity on the refuges increases insect diversity, including pollinators. Improved pollination directly benefits plants and increased insect diversity has cumulative benefits for multiple trophic levels.

This alternative would result in the desired habitat diversity and structural conditions detailed, which would improve conditions for wildlife and therefore wildlife-dependent recreation. The cumulative effects could both positively and negatively impact wildlife viewers and hunters. Treatments to monotypic stands of willow, cottonwood, or perennial smartweed promotes seed-producing annual plants consumed by migrating waterbirds. However, a reduction of trees or shrubs in wetland habitats would reduce the amount of screening structure in the treatment areas. Wildlife viewers and hunters could potentially find fewer locations in which to conceal themselves.

Cumulative impacts to water quality and soils from aerial or ground applications of herbicide on the refuge is negligible. Herbicides are only applied to specific areas during certain times of the year on an as needed basis. Once invasive species or woody plants in any particular area are under control, herbicides do not need to be applied for several years or possibly ever again. The refuge is also constantly working to find passive ways to control for invasive species without the need for constant intervention through large-scale HREP projects, or the use of native vegetation or water to control undesirable vegetation.

Under the Alternative B, wildlife habitat will continue to degrade in large inaccessible areas when limited to ground spraying. Some stands of invasive plants would remain untreated or partially treated and would continue to spread. Encroachment of undesirable plants would likely result in a reduction in plant diversity. Woody plant encroachment would further decrease the area of wetland habitat and the extent of desirable aquatic vegetation would continue to decline. Discontinuing aerial herbicide application could result in conversion of habitats to monotypic stands of invasive species, and this could affect water quality through diminished water filtration. The loss of plant diversity would reduce the refuges' resilience in the face of stressors like climate change, new invasive species introductions, and disease outbreaks. This would directly affect the refuges' environmental health and would be a cumulative effect of discontinued aerial herbicide use.

Monitoring

Monitoring will take place as part of regular management actions. The USFWS, Midwest Region, requires all herbicide applications are recorded via the *R3 Management Actions Chemical Plant Map*. The *R3 Management Actions System* is also used to record non-herbicide treatments like mowing, disking, and hand-pulling. The recorded information includes the

treatment area and amount of herbicide used. The refuge monitors vegetation response to herbicides with visual observations. Monitoring will focus on the health and survival of both target and non-target plants. Observations of wildlife may also be used as indicators of effectiveness, especially with regard to species that are habitat specialists, as well as species that are mentioned in the Natural Resources section of this environmental assessment. No formal monitoring plans or biological monitoring protocols will be created for this project. Existing monitoring protocols focus on first documenting plant species, abundance, and seed head size and average yield in randomly selected wetland impoundments. Later in the season, waterbird use in all wetland units and cover conditions in all wetland units are recorded on a weekly basis starting when waterbirds arrive until they leave. Data generated is used to estimate the total number of waterbird use-days on the refuge during a season. A use-day can be defined as an estimate of the number of animals a habitat supported for a defined amount of time. Recording weekly waterbirds counts allows the refuge to estimate the number of birds that stayed on the refuge between surveys, which informs the total number of use-days across a season. The total number of waterbird use-days is compared against the amount of food estimated from seed head samples collected from wetland units. The comparison allows to refuge to evaluate whether waterfowl ran out of food at Two Rivers NWR. This information is ultimately used to evaluate management practices and develop cost-effective and time saving alternatives to wetland management. Data collected may be used to evaluate waterbird response to areas with herbicide treatments based on the differences in plant community structure and food availability. The refuge has an Inventory and Monitoring Plan in place to determine whether habitat management objectives are being met (https://ecos.fws.gov/ServCat/DownloadFile/40555?Reference=40828).

Summary of Analysis

Alternative A – Continued use of Aerial Application Equipment

Under the No Action and Preferred Alternative (Alternative A), aerial herbicide application would continue to be used as another tool to control and prevent the spread of undesirable woody plant encroachment and invasive species. This would be used in conjunction with other mechanical methods, prescribed fire, and water level management. Given the challenges in managing a heavily altered and fragmented landscape, aerial herbicide application is needed to effectively reduce populations of undesirable woody vegetation and invasive species.

One of the main concerns for environmental impact under both alternatives is the application of herbicides and their associated risks. Several measures are in place to mitigate the negative impacts of herbicides. All herbicides applied are certified and have an approved product label by the Environmental Protection Agency. Herbicides are regulated both by the federal government and individual states to ensure that that unreasonable risks to human health or the environment are not present. Pesticide use on Service lands requires an individual Pesticide Use Proposal (PUP) for each chemical, which specifies the target pest(s), the method of application and the

timing and location of application. These PUPs can be approved (or disapproved) at the refuge, regional, or National level, depending on the pesticide being proposed, method of application, and site conditions. Additionally, Best Management Practices are followed during chemical application and the application is part of an overarching pest management framework, where multiple management actions are used together to reduce and eliminate populations of undesirable woody vegetation and invasive species.

Aerial herbicide application on lands within the refuge is often more efficient in both effectiveness and associated costs when compared to ground applications. This would ultimately facilitate the treatment of larger areas on an annual basis, promoting the desired habitat conditions on refuge lands.

This alternative fulfills the Service's mandate under the NWRSAA. This alternative also fulfills the purpose and mission of the refuge as well as the mission of the NWRS.

Alternative B – No Aerial Spraying

Under Alternative B, only ground application of herbicide and other non-herbicide management methods would be allowed on lands within the refuge for the control of undesirable woody vegetation and invasive species. The total habitat acreage treated under this alternative would remain small given the difficult terrain, remote locations, size, and other limiting factors. Costs per acre are also significantly more when compared to the efficiency of aerial application methods. Undesirable woody vegetation and invasive species populations will continue to expand and will likely move to other areas of the refuge and adjacent private lands. As a result, more wetland habitat will be lost, resulting in the displacement of both wildlife and native plant communities.

With this alternative the refuge would not be expected to meet their purpose or mission, as habitats would eventually be degraded with undesirable woody vegetation encroachment and invasive species monocultures. This would negatively affect refuge resources like migratory birds, resident wildlife, and threatened and endangered species. The loss of habitat diversity would negatively affect wildlife-dependent recreation and the refuge's environmental health. This would then limit the refuge's resilience in the face of stressors like climate change, new invasive species introductions, and disease outbreaks.

List of Sources, Agencies and Persons Consulted

Tribes, other federal agencies, state, county, and local agencies, non-governmental organizations, and other Service personnel have been invited to review the draft for this EA. Their comments will be included when provided.

List of Preparers
Kirsten Schmidt, Wildlife Biologist, Two Rivers NWR

Public Outreach
This draft Environmental Assessment will be available for public review and comment for 22 days from July 8th through July 29th.The draft document will be available at the Two Rivers NWR office (364 Wildlife Conservation Road, Brussels, IL 62013) or via email (Charles_Deutsch@fws.gov), and can be downloaded from the refuge website (https://www.fws.gov/refuge/two-rivers/). Comments can be sent by email to Charles_Deutsch@fws.gov or mailed to the refuge office.

Determination

This section will be filled out upon completion of the public comment period and at the time of finalization of the Environmental Assessment.

- ☐ The Service's action will not result in a significant impact on the quality of the human environment. See the attached **"Finding of No Significant Impact".**
- ☐ The Service's action **may significantly affect** the quality of the human environment and the Service will prepare an Environmental Impact Statement.

Signatures

Submitted By:

Project Leader Signature

Date:

Concurrence:

Refuge Supervisor Signature

Date:

Approved:

Regional Chief, National Wildlife Refuge System Signature

Date:

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Appendix A

This Appendix lists all applicable statutes, regulations, and executive orders not otherwise addressed specifically within the "Affected Environment and Environmental Consequences" section of this environmental assessment, as well as how the proposed action and environmental assessment analysis comply with each, and any additional compliance steps taken by FWS.

Cultural Resources

- 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

The only physical disturbance to the ground would occur in accessible areas using specialty tracked equipment when conducting ground applications or traveling through areas frequently wet, or seasonally flooded. If a known or suspected cultural site is in the application area and ground disturbance could occur, the Regional Historic Preservation Office will be contacted for a determination for specific application projects. This will ensure compliance with the Archaeological Resources Protection Act and National Historic Preservation Act. No ground applications with tracked equipment will occur in areas with known cultural resources to avoid any adverse effects. It is determined there would be no adverse effects to cultural resources as the Preferred Alternative is described given the site-specific compliance that will take place if cultural resources are present in the application area. There are no impacts to cultural resources under the proposed action given this site-specific review that will occur in special circumstances and the nature of the proposed action.

Fish and Wildlife

Impacts to wildlife and aquatic species under the Preferred Alternative is described in detail on pages 18-23 of this environmental assessment. As indicated in the Preferred Alternative section of this document (pages 9-12), Federal law requires all herbicide applications follow product label restrictions to minimize the potential contamination of air, soil, and water and effects on non-target organisms. Additionally, Best Management Practices identified in pages 10-12 of the Alternatives section of this document employ herbicide application methods that protect wildlife and the resources on which they rely, while also controlling non-native, invasive or undesirable plant species Service policy also requires review and approval of a Pesticide Use Proposal (PUP) prior to the application of any herbicide. These PUPs must consider potential impacts to

protected resources and environmental quality and implement mitigation measures such as restricting timing of application to assure no take of migratory birds or eagles and ensure compliance with the Gold and Bald Eagle Protection Act and the Migratory Bird Treaty Act. The approval of PUPs ensures compliance with the laws and Executive orders listed above not specifically mentioned in this more detailed description.

Bald and Golden Eagle Protection Act, as amended, 16 U.S.C. 668-668c, 50 CFR 22

The Bald and Golden Eagle Protection Act prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald or golden eagles, including their parts (including feathers), nests, or eggs.

Potential harm or disturbance to bald eagles under the proposed action will be mitigated by taking place outside of their nesting areas. The refuge documents current nest locations and limits management activities around the nest by enforcing a 100-foot buffer where no activities can occur during or outside the breeding season, following guidance from the Division of Migratory Bird Management. Golden eagles are seldom observed on the refuge and are not known to breed at or near the refuge. The refuge will continue to document bald and golden eagle nests and restrict activities around eagle nests.

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, 450

The purpose of the ESA is to conserve federally endangered and threatened species and the ecosystems upon which they depend. Pursuant to Section 7 of the ESA, Federal agencies shall, in consultation with the Secretaries of the Interior or Commerce, ensure that any action that they authorize, fund, or carry out is not likely to jeopardize the continued existence of any federally endangered or threatened species, or result in the destruction or adverse modification of designated critical habitat. Before initiating an action, the Federal agency, or its non-Federal permit applicant, must determine if any threatened, endangered, proposed, or candidate species, or designated critical habitat, may be present in the project area.

Impacts to threatened and endangered species that may occur on the refuge is described in detail on pages 23-32 of this environmental assessment. An ESA Section 7, Intra-Service Consultation analyzing the potential effects herbicide applications, by either ground application equipment, or aerial application equipment has been submitted to the local Ecological Services Field Station for concurrence. The language of potential effects on threatened and endangered species in this Environmental Assessment are the same determination of effects in the herbicide application ESA Section 7 consultation. This analysis and Section 7 consultation meets requirements under the ESA. Decurrent false aster, the gray bat, the Indiana bat, the monarch butterfly, the northern long-eared bat, the spectaclecase mussel, and the tricolored bat occur on or in proximity to select refuge divisions described on page 23. Decurrent false aster has been observed in a wet meadow area in the Gilbert Lake Division. False aster (*Boltonia asteroides*) is a close relative to decurrent

false aster and has been observed in most refuge divisions. Staff have inspected *Boltonia spp.* plants in other refuge divisions and have never recorded the presence of decurrent false aster outside the wet meadow area in Gilbert Lake. The proposed action will benefit decurrent false aster by removing undesirable woody plant species and invasive species that continue to encroach on the wet meadow. Indiana bats and northern long-eared bats have been observed in Calhoun and Portage Island divisions, and near the Gilbert Lake Division. The proposed action will not be implemented in common roost habitats of the northern long-eared bat or Indiana bat, or in the Portage Island Division. The proposed action will benefit monarch butterflies by reducing woody plant cover and encouraging diversity of nectar plants for adult monarchs.

Fish and Wildlife Act of 1956, 16 U.S.C. 742a-m

The Fish and Wildlife Act of 1956 establishes a comprehensive national fish and wildlife policy and authorizes the Secretary of the Interior to take steps required for the development, management, advancement, conservation, and protection of fisheries resources and wildlife resources through research, acquisition of refuge lands, development of existing facilities, and other means.

The purpose of the proposed action is to improve habitat by reducing the overgrowth of woody vegetation in the refuge, which benefits the conservation and protection of wildlife resources.

Migratory Bird Treaty Act, as amended, 16 U.S.C. 703-712; 50 CFR Parts 10, 12, 20, and 21

The MBTA protects all migratory birds and their eggs, nests, and feathers and prohibits the taking, killing, or possession of migratory birds.

The proposed action will benefit migratory birds by reducing invasive plant cover, which can directly and indirectly harm migratory birds. Herbicide-related harm to migratory birds will be mitigated by timing treatments to take place after spring migration, before or after bird breeding seasons, and before fall migration.

Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds, 66 Fed. Reg. 3853 (2001)

This Executive Order directs government agencies to support migratory bird conservation through habitat protection, analysis of migratory bird populations, and cooperation with conservation organizations, among other methods.

The proposed action will benefit migratory birds by reducing invasive plant cover, which can directly and indirectly harm migratory birds. Herbicide-related harm to migratory birds will be mitigated by timing treatments to take place after spring migration, before or after bird breeding seasons, and before fall migration.

Natural Resources

Clean Water Act compliance is not specifically required for this action as there is no discharge of a pollutant from a point source. Herbicide application is considered a non-point source for introducing a pollutant into the environment. As indicated in the Preferred Alternative section of this document (pages 9-12), Federal law requires all herbicide applications follow product label restrictions to minimize the potential contamination of air, soil, and water and effects on non-target organisms. Additionally, Best Management Practices identified in pages 10-12 the Alternatives section of this document employ herbicide application methods that protect wildlife and the resources on which they rely, while also controlling non-native, invasive or undesirable woody plants. Service policy also requires review and approval of a Pesticide Use Proposal (PUP) prior to the application of any herbicide. These PUPs must consider potential impacts to protected resources and environmental quality. The approval of PUPs ensures compliance with the laws and Executive orders listed above.

The executive orders for wetland and floodplain management do not apply to this action as there will not be adverse effects to floodplains or wetlands and no loss or degradation of wetlands.

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

The Clean Air Act (CAA) regulates air emissions from stationary and mobile sources to protect human health and the environment. Any activities associated with the restoration projects that result in air emissions (such as aircraft or ATV/UTV operation) will be in compliance with the CAA and any local air quality ordinances.

Federal Water Pollution Control Act (CWA; 33 USC § 1251 et seq.)

The CWA is intended to protect surface water quality and regulates discharges of pollutants into waters of the United States.

Impacts to water quality will be mitigated through the use of herbicide approved for aquatic use and by following best practices and prescribed mitigation measures.

Occupational Safety and Health Act of 1970, as amended (OSHA; 29 USC §§ 651 et seq.)

The OSHA governs the health and safety of employees from exposure to recognized hazards, such as exposure to toxic chemicals, excessive noise, mechanical dangers, and unsanitary conditions.

All staff and partners applying herbicide will be licensed to do so and will wear appropriate personal protective equipment. Necessary personal protective equipment will also be worn while operating vehicles and machinery as well. All relevant safety regulations and best management practices will be implemented to ensure employee safety.

Wilderness Act, 16 U.S.C. 1131 et seq. And Wild and Scenic Rivers Act, 16 U.S.C. 1271 et seq.

The treatment area does not have any designated wilderness or wild and scenic rivers and as such there would be no effect to these resources and is in compliance with these laws.

The Audubon Society has identified Two Rivers NWR as a United States Important Bird Area due to the large number of birds that congregate during migration (https://netapp.audubon.org/IBA/Reports/2639). The proposed action will not permanently decrease the total area of habitat available to migratory birds or prevent the refuge from continuing current management actions. The proposed action aims to enhance existing habitat, thus large-scale declines in migratory bird use of refuge wetlands that define the Two Rivers NWR designation are not expected.

Appendix B

Land cover classes were derived from the NLCDs 16-class classification system. For clarity in this environmental assessment, classes were combined to represent a broader group of habitat characteristics used to define treatment areas. The most recent NLCD data was used from aerial images taken in 2019. It should be noted the confluence area of the Illinois and Mississippi rivers, and the Mississippi River at Lock and Dam 24 experienced the second highest flood on record in 2019 (National Weather Service 2023*a*, National Weather Service 2023*b*). While most of the images used in classification were from after floodwaters receded, impacts to vegetation or retained flood waters could have led to misclassification. Staff carefully reviewed the NLCD and no large areas of misclassification were observed aside from a developed area in the Calhoun Division. In addition, managed and unmanaged impoundments are mostly classified as open water due to the time of year the aerial photos were taken. These impoundments are not areas of permanent water cover and were thus added to the total acreage of the treatment area in the proposed action. Likewise, during a spring drawdown water is removed from impoundments to expose mudflats that transition to vegetation later in the growing season. Mudflats are classified as barren land by the NLCD. Barren land pixels within the refuge were always adjacent to open water or emergent herbaceous wetlands. Staff concluded these areas would likely transition to emergent herbaceous wetlands during the growing season given optimal conditions. As a result, barren land was added to the total acreage of the treatment area. Woody wetlands are described by the NLCD as areas where forest or shrubland vegetation account for greater than 20% of vegetative cover (Dewitz and USGS 2021). Since these areas can be broadly described as forested areas, they were not included in the treatment area as described in page 10. Pasture/hay and cultivated crops do not occur on the refuge but were included in initial NLCD classification. This likely occurred due to refuge management actions appearing as crop field management on aerial images. After staff reviewed the locations, these classes were combined with the grassland/herbaceous class. The mixed forest class was added to the forest class. The mixed forest class is partially defined by evergreen species that are not common in this area of the floodplain. The few times this class was recorded it was likely a misclassification. Finally, the Albers equal-area projection was used to preserve the area of features in the map and was used to calculate acreages. A description of land cover classes can be found on the NLCD website (MRLC, 2022).

Table B.1 Acres of land cover classes by division at Two Rivers National Wildlife Refuge derived from the National Land Cover Database (Dewitz and USGS 2021). Some land cover classes were combined to represent a broader group of habitat characteristics.

Land Cover Type	Apple Creek	Batchtown	Calhoun	Clarksville Island	Gilbert Lake	Portage Island
Barren Land	0.67	0.82	15.04	0	0	0
Developed	1.11	28.03	[a]150.57	0	46.38	0
Emergent Herbaceous Wetlands	32.94	224.53	695.45	5.73	77.61	1.64
Forest	67.15	4.48	14.88	0	7.66	0
Grassland/Herbaceous	0.44	22.48	483.62	0	61.67	0
Open Water	6.61	504.06	2,308.40	52.80	206.33	31.01
Shrub/Scrub	0	0.22	0	0	0	0
Woody Wetlands	191.63	1,226.20	996.01	723.75	289.26	108.24
Total Acres	300.56	2,010.83	4,663.97	782.29	688.92	140.90
[b]Total Acres within Proposed Action	NA	729.41	3,018.89	NA	283.94	NA

[a]On the southeast side of the Calhoun Division, an area consisting of grassland/herbaceous and woody wetlands was misclassified as the developed class in the NLCD resulting in a substantial increase (17%, 25 acres) in the developed class acreage. Classification can be difficult when the landscape is highly interspersed. This case, however, was clearly misclassification as staff confirmed there is no developed area beyond the road.

[b]The total number of acres the preferred action in this environmental assessment applies to. This was calculated by adding the emergent herbaceous wetlands, open water, and barren land classes. Divisions with NA are not included in this environmental assessment because there are not enough acres or continuous wetlands to aerial spray herbicides while following BMPs.

Table B.2 Percent land cover of total land cover by division at Two Rivers National Wildlife Refuge using data presented in Table B.1.

Land Cover Type	Apple Creek	Batchtown	Calhoun	Clarksville Island	Gilbert Lake	Portage Island
Barren Land	0.2	<0.01	0.3	0	0	0
Developed	0.4	1.4	3.2	0	6.7	0
Emergent Herbaceous Wetlands	11.0	11.2	14.9	0.7	11.3	1.2
Forest	22.3	0.2	0.3	0	1.1	0
Grassland/Herbaceous	0.1	1.1	10.4	0	9.0	0
Open Water	2.2	25.1	49.5	6.7	29.9	22.0
Shrub/Scrub	0	<0.01	0	0	0	0
Woody Wetlands	63.8	61.0	21.4	92.5	42.0	76.8

Table B.3 Land cover classes used to represent a broader group of habitat characteristics in table B.1 and relative to this environmental assessment from NLCD classes.

Classes used in the Environmental Assessment	National Land Cover Database Classes
Developed	Developed Open Space Developed Low Intensity Developed Medium Intensity Developed High Intensity
Forest	Forest Mixed Forest
Grassland/Herbaceous	Grassland/Herbaceous Pasture/Hay Cultivated Crops