Environmental Assessment
for the
Wabash and Ohio River Dikes Project,
Ohio River Mile 847.9 – 849.5

August 2021
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Executive Summary

The U.S. Army Corps of Engineers (USACE) Louisville District has experienced ongoing concerns for the area of the Ohio River at the shoal of the mouth of the Wabash River which has caused a realignment of the navigation channel in the Ohio River and has required constant attention to maintain operational usability of the channel. The proposed Wabash and Ohio Rivers Dikes (Wabash Dikes Project) is located immediately downstream of the mouth of the Wabash River between Ohio River Miles (ORM) 848 – 850. The navigation channel passes on the north side of a bar that builds off Wabash Island. This stretch of river had been relatively stable for over 30 years due to the increased pool level from Smithland Dam and because of its close proximity to John T. Myers Lock and Dam, which is a few miles upstream at ORM 846.0. The substrate in the majority of this section of river is sand, consisting of primarily of material discharged from the Wabash River, which enters the Ohio River at ORM 848. The navigation channel alignment reflects the historically deeper cross section of the river, maintained by natural river flow. However, large volumes of sand pass through this area each year, originating from the Wabash drainage basin. Due to riverbed changes in the Lower Wabash River, a significant increase in outwash material accumulation at the mouth of the Wabash River has increased the need for dredging of outwash material every year since 2008.

The USACE is Congressionally mandated to maintain a 9-foot deep channel in the Ohio River for transport of goods and services by commercial vessels. In order to maintain the navigation channel, maintenance dredging is often required and, in areas where natural deposition of river substrates threatens river navigation, is an ongoing process. Since 2008, the Wabash River has discharged above normal volumes of sand into the Ohio River resulting in the need for annual maintenance dredging and emergency dredging of the navigation channel in 2008, 2010, 2012, and 2018. The need for dredging in the area is both unpredictable and ongoing. As a result, there is often a delay between the threat to navigation in the Action Area and the USACE response because of seasonal restrictions, weather, planning, and other logistical constraints. The proposed construction of seven dikes in the Ohio River – three on the Wabash Island and four on the Illinois shore – will produce the most effective remedy to the shoaling and work to alleviate potential threats to commercial navigation in this location.

Interagency Cooperation under the Endangered Species Act of 1973 (ESA), as amended, 50 CFR Part 402 is required by Federal agencies regarding endangered or threatened species of fish, wildlife, or plants and habitat of such species that has been designated as critical. The ESA requires every Federal agency, in consultation with and with the assistance of the Secretary, to ensure that any action it authorizes, funds, or carries out, in the United States is not likely to jeopardize the continued existence of any listed species or results in the destruction or adverse modification of critical habitat. Biological Assessments (BA)—information prepared by or under the direction of the Federal agency concerning listed and proposed species and designated and proposed critical habitat that may be present in the Action Area, and the evaluation of potential effects of the action on such species and habitats—are required under Section 7(c) of the ESA. The finding in the BA is a determination of no effect to the spectaclecase (*Cumberlandia monodonta*), fanshell (*Cyprogenia stegaria*), purple catspaw (*Epioblasma obliquata*), northern
riffleshell (*Epioblasma rangiana*), ring pink (*Obovaria retusa*), orangefoot pimpleback (*Plethobasus cooperianus*), sheepnose (*Plethobasus cyphyus*), clubshell (*Pleurobema clava*), rough pigtoe (*Pleurobema plenum*), fat pocketbook (*Potamilus capax*), Short’s bladderpod (*Physaria globosa*), interior least tern (*Sterna antillarum*), rusty patched bumble bee (*Bombus affinis*), gray bat (*Myotis grisescens*), northern long-eared bat (*Myotis septentrionalis*), Indiana bat (*Myotis sodalis*), and the federally threatened rabbitsfoot (*Theliderma cylindrica*).
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Front Cover: Before-simulation image generated during bathymetric study conducted U.S. Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory (ERDC-CHL).
1 INTRODUCTION

The U.S. Army Corps of Engineers (USACE) is congressionally mandated to maintain a channel 9 feet deep in the Ohio River for transport of goods and services by barge. In order to maintain the navigation channel for commercial vessels, routine maintenance dredging is often required in areas where natural deposition of river substrates is an ongoing process. One area of concern/investigation is immediately downstream of the Wabash River between Ohio River Miles (ORM) 848 – 850 where an estimated 1,000,000 cubic yards of sediment, originating from the Wabash drainage basin, pass through the area annually (Figure 1). The substrate in much of this section of river is sand, consisting of primarily of material discharged from the Wabash River, which enters the Ohio River at ORM 848. The navigation channel passes on the north side of a bar that builds off of Wabash Island and reflects the historically deeper cross section of the river which, prior to the Wabash avulsion, would be normally maintained by natural river flow.

This stretch of river had been relatively stable for over 30 years due to the increased pool level due to impoundment by Smithland Dam and because of its close proximity to John T. Myers Lock and Dam, which is 1.8 miles upstream at ORM 846.0. Prior to 2008, relatively few dredging events were required at the mouth of the Wabash River; since 2008, dredging is required every year. This recent increase in dredging events is the result of an avulsion that cut off the lower meander loop of the Wabash River in 2008, and again in 2010. Both cutoffs formed after large rainfall events from tropical storms in the region. As a result, large amounts of sediment removed in the avulsion formation process were transported downstream, forming shoals at the confluence with the Ohio River (Figure 2). This sand transport has continued to increase over the last 5 – 6 years as the result of riverbed changes that are occurring in the lower Wabash River above the confluence with the Ohio River. The increased sand discharge began with a persistent rainfall event in early June of 2008, which resulted in an average of 8 – 10 inches of precipitation over about a 10 – 15-day period throughout a large section of the Wabash River drainage basin. Bank failures and bendway cutoffs resulted in mass movement of sand and a large outwash plume at the mouth of the Wabash River that blocked the navigation channel, which necessitated emergency dredging by USACE. The outwash plume extended across the width of the river to Wabash Island. Portions of Wabash Island were covered by the outwash material, while other sections of the island were severely eroded. The accumulation of material made the navigation channel impassable for the commercial towing industry causing an emergency shutdown of the Ohio River navigation channel near ORM 848 downstream of John T. Myers Lock and Dam.

The closure of the Ohio River navigation channel is a great economic concern for the towing industry because of shipping delays and the high expense of inactive cargo incurred during shutdowns. While measures are already in place for maintenance dredging operations conducted at the mouth of the Wabash River to deal with the shoaling, the scope and unpredictability of the problem poses an ongoing threat to navigation which has necessitated emergency dredging operations that are both complex and logistically challenging. This unpredictability also means that the USACE response is a reactionary one which is costly and
relatively inefficient and may not be the most effective long-term strategy to deal with the problem.

The objective of the proposed Wabash and Ohio Rivers Dikes Project (Wabash Dikes Project) is for flow diversion to alleviate the ongoing need for maintenance dredging in the Ohio River downstream of the mouth of the Wabash River. The USACE’s proposed action is to construct seven flow diversion dikes on the Ohio River near the mouth of the Wabash River which will produce the most effective remedy to the shoaling and the ongoing threat to navigation in the area.

This Environmental Assessment (EA) was prepared by the USACE in support of the proposed Wabash Dikes Project. The purpose of this EA is to document the analysis of the environmental impacts of the proposed action and its alternatives, to support a determination of whether the proposed action would significantly affect the quality of the human environment. The EA also provides an opportunity for public involvement in the agency decision-making process.

1.1 Wabash Dikes Project Location

The proposed Wabash Dikes Project is located in Union County, Kentucky and Gallatin County, Illinois. The Action Area lies immediately downstream of the Wabash River confluence between Ohio River Miles (ORM) 848 – 850 and is located approximately 6 miles west of Uniontown, Kentucky and 10 miles east of Shawneetown, Illinois. John T. Myers Lock and Dam is located approximately three miles upstream at ORM 846.0. Figure 1 displays the Wabash Dike Project location within the tri-state Ohio River Basin area.

Because the Wabash Dikes Project lies mostly on the mainstem of the Ohio River, primary access to the project is via the waterway. The surrounding area is mostly agricultural and frequently inundated, so overland access is limited. Wabash Island is almost completely in row crops or fallow fields and is privately owned and accessible by private ferry or barge only. The closest road to the Illinois section of the project is Calico Lane which runs adjacent to the Wabash River.
Figure 1. Location of the proposed Wabash Dikes Project (ORM 847.9 – 849.5), Gallatin County, Illinois and Union County, Kentucky.
1.2 Wabash Dikes Project Overview

A shoal at the mouth the Wabash River has caused a re-alignment of the navigation channel in the Ohio River and has required consistent dredging activities to maintain operational usability. Prior to 2008 there were nine dredging events with the first dating back to 1932. However, since 2008 dredging has been conducted every year. This recent increase in dredging events is the result of an avulsion that cut off the lower meander loop of the Wabash River in 2008 and then again in 2010. Both cutoffs formed after rainfall events from tropical storms. As a result of this realignment, large amounts of sediment are transported downstream and released annually, forming shoals downstream at the confluence with the Ohio River. Figure 2 displays the project area and confluence of the Ohio and Wabash Rivers. Figure 3 shows the results of a 2012 bathymetric survey of the Action Area and the shoaling present there that continues to threaten commercial navigation.

Figure 2. Overview of project area showing confluence of Ohio and Wabash rivers.
In 2014, hydrographical studies conducted by the US Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory (ERDC-CHL) utilized numerical modeling to simulate multiple scenarios as solutions to these sediment issues. The current design, based on the ERDC--CHL analysis (ERDC-CHL 2015), uses seven rock dikes\(^1\) with bank armor (Figure 1). Three of the dikes will be constructed on the Wabash Island side of the Ohio River to control sediment coming directly out of the Wabash River. The four remaining dikes will be constructed downstream of the mouth of the Wabash River to increase the flow velocity, direct sediment, and promote scouring of the navigation channel.

\[\text{Figure 3. Results of 2012 bathymetric survey showing constriction of navigation channel at confluence of Ohio River and Wabash River (source: ERDC-CHL 2015).}\]

1.2.1 Scope of Action Area and General Construction Plans

The Action Area consists of the footprints of the seven proposed dikes from ORM 847.9 – 849.5, three along the Wabash Island bank and extending into the river, and four on the right descending bank along the Illinois shoreline and extending into the river. The three dikes that will extend out from the Wabash Island shoreline would be located at ORM 847.9, ORM 848.1,

\(^1\) Based on the results of a mussel survey conducted in support of the Proposed Action, plans for two additional dikes were ultimately removed from project plans. A detailed summary of the mussel survey is included in the Biological Assessment provided in Appendix A.
and ORM 848.3 and would extend out total lengths ranging between 523 – 595 feet (160 – 181 meters), of which the last 446 – 531 feet (136 – 162 meters) would be within the water. The four dikes that will extend out from the Illinois shoreline will be located at ORM 848.6, ORM 848.9, ORM 849.2, and ORM 849.5. These dikes (#4 – #7) are projected to extend out total lengths ranging between 568 – 978 feet (173 – 298 meters), of which the last 383 – 684 feet (117 – 208 meters) would be within the water (Figure 2).

The Action Area includes the footprints of the seven proposed dike footprints. The three dikes that will extend out from the Wabash Island shoreline would be located at ORM 847.9, ORM 848.1, and ORM 848.3 and would extend out total lengths ranging between 160 – 181 meters, of which 136 – 162 meters would be within the water. The structure footprints of the four dikes that will extend out from the Illinois shoreline will be located at ORM 848.6, ORM 848.9, ORM 849.2, and ORM 849.5, respectively. The Illinois shoreline dikes (#4 – #7) would extend out at lengths ranging between 173 – 298 meters, of which 117 – 208 meters would be within the water. In general, the widths of all of the proposed dike structures will be similar. The maximum disturbed in-stream width for all dikes is estimated to be 100 feet (30.5 m).

The Action Area also includes temporary fleeting areas of the river (immediately outside of the dike footprints) where the work barges will be spudded, as well as sections of shoreline extending inland corresponding to the construction and armoring of the dikes structures (Figure 8). The Action Area also includes an estimated total of 13.25 acres (5.4 hectares) of forested habitat that will be removed from the shoreline in and around each of the proposed dike structures on both sides of the river.

**General Construction Plans**

In an effort to prepare and stabilize the dike footprints prior to construction, an estimated 9,200 cubic yards of accumulated sediment will be excavated from the Ohio River streambed before placement of rip rap material. Because of the volatile and unpredictable nature of the streambed in the area, the depth of sediments there are in a constant state of flux. As such, the dredge volume estimate above is a worst-case value and is based on the most recent geotechnical data available. Dredged material from this pre-construction excavation of the dike footprints is expected to consist primarily of sand, with a smaller proportion of silt, clay, and gravel. Dredged material will be placed onshore nearby in a location currently used for the deposition of materials generated by the current dredge program.

During the pre-construction excavation of the dike footprints, the Contractor may use a hydraulic dredge to remove the sediment thru a piped vacuum system on one barge and empty onto another barge or directly on shore. Depending on conditions on site, the Contractor may also utilize a clamshell excavator on a barge mounted crane. In this situation, the clamshell would reach into the water, grab the material on the river floor, bring the material out of the water and onto a second material barge.

Excavated materials from the pre-construction dredging of the dike footprints will be deposited along the Kentucky shoreline in an area that is currently designated to receive materials from the ongoing dredge program, pursuant to Kentucky Section 401 Water Quality Certification (WQC) No. 2019-100-1M.
Once the construction process initiates, a work barge and material barges will be moved to the site with a standard sized towboat. One work barge will contain a clamshell crane or rip rap conveyor (at the contactor’s discretion), one work barge will contain an excavator, and the material barges will contain large rip rap type limestone rock. The barges will be fleet in the vicinity of the work locations while the dikes are being constructed. The barges will be moved around the site by a towboat. Barges will be secured in place during temporary fleeting and construction activities by spudding them into the river bottom.

At each dike footprint location, the work barge will be moved to the site with either the clamshell crane or a rip rap conveyor on it. The barge will be moved in and out of the area with a towboat typical of the size that operates in and around the fleeting areas. The crane barge will be set up at each dike location and spudded to the river bottom for stability while offloading rock. Material barges containing rock will be set up adjacent to the work barge during offloading, while the dikes are being constructed. The work barges and material barges will be moved to each dike location where the rock will be off-loaded and placed into the dike footprint. The work barge will begin placing rock at the shoreline, then work out toward the river channel while placing rock within the footprint. The rock will be piled within each dike footprint until reaching the desired top elevation of each dike. During rock placement, significant settling of rock into the river bottom is expected. Barges will be spudded into the river bottom next to the dike locations for temporary storage during the construction process of each dike.

The Contractor will be required to provide river soundings as a final submittal verifying the proper rock placement and elevation. Portions of the shoreline work will need to occur during lower water elevations; however, rock placement in the riverward sections can occur at various river stages. Rock placement accuracy will be accomplished using monuments located at the John T. Myers Lock and Dam for survey control. The survey data used for plan development are river soundings obtained from the USACE Operations Division and LIDAR obtained from public sources.

1.2.2 Wabash Island Construction

While constructing the dikes along Wabash Island, rip rap will be placed onto the existing shoreline and river bottom with no need for excavation. The work barges and material barges will be moved to each dike location where the rock will be off-loaded and placed into the dike footprint. The island shoreline around the dike will be armored with the same type rip rap rock for stability. The work barge will begin placing rock at the shoreline, then work out toward the river channel while placing rock within the footprint. The rock will be piled within each dike footprint until reaching the desired top elevation of each dike. During rock placement, significant settling of rock into the river bottom is expected. Barges will be spudded into the river bottom next to the dike locations for temporary storage during the construction process of each dike. The Contractor will be required to provide river soundings as a final submittal verifying the proper rock placement and elevation. Portions of the shoreline work will need to occur during lower water elevations; however, rock placement in the riverward sections can occur at various river stages. Rock placement accuracy will be accomplished using monuments
located at the John T. Myers Lock and Dam for survey control. The survey data used for plan development are river soundings obtained from the USACE Operations Division and LIDAR obtained from public sources.

1.2.3 Illinois Construction

While constructing the dikes along the Illinois shoreline, the dikes will be keyed into the river bank. A land-based excavator will be offloaded from a work barge onto the shoreline within the area where the dike footprint intersects the shoreline. The excavator will travel from the work barge onto the shoreline. All excavation into the river bank will be accomplished from the shore side, unless the river bank is too steep to offload the excavator. If necessary, the excavator may begin digging the trench into the existing bank from the work barge in order to build an offload ramp or slope that is navigable by the excavator. The excavator would then offload from the barge and continue excavating the trench from the shore side. No excavation will occur within the river.

The excavator will dig a trench into the shoreline approximately eight feet deep that matches the width of the dike. The excavated soil will be stored next to the trench for later use. A four feet deep layer of rip rap rock will be placed in the trench, then covered with four feet of the excavated soil. The remaining excavated soil will be spread out across the area. This keying process will effectively secure the dike structure into the steep cut river bank. Outside of the key trench, rip rap will be placed onto the existing shoreline and river bottom with no further need for excavation.

1.3 Authorization

Sections 15-20 of the River and Harbor Act of 1899 mandated that U.S. Army Corps of Engineers (USACE) maintain a 9-foot deep channel in the Ohio River for transport of goods and services by barge. In order to maintain the navigation channel for commercial vessels, routine maintenance dredging is conducted in areas where natural deposition of river substrates is an ongoing process. The objective of the Wabash Dikes Project is for flow diversion to alleviate the ongoing need for maintenance dredging in the Ohio River downstream of the mouth of the Wabash River.

The Department of the Army permit program is authorized by Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act (P.L. 95-217). These laws require permits authorizing structures and work in or affecting navigable waters of the United States and the discharge of dredged or fill material into waters of the United States.

The USACE has determined the Wabash Dikes Project to be in compliance with the Section 404(b)(1) guidelines. A 404(b)1 analysis document was completed (Appendix A) and WQCs from Kentucky is pending. WQC was received from Illinois on 26 July 2021.
1.4 National Environmental Policy Act Overview

This EA has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA) and the Council on Environmental Quality’s (CEQ) Regulations (40 CFR Parts 1500-1508), as reflected in the Corps of Engineers’ Engineering Regulation, ER 200-2-2. The Corps of Engineers’ ER 200-2-2 supplements, and is used in conjunction with, the CEQ regulations. Because ER 200-2-2 is in the process of being updated to conform to the CEQ regulations (as revised effective 14 September 2020), the CEQ regulations will control in the event of a conflict between ER 200-2-2 and the CEQ regulations.

The regulations set forth a process whereby USACE assesses the environmental effects of proposed major federal actions and considers reasonable alternatives to these proposed actions. In general, federal agencies prepare an EA to evaluate whether a federal action has the potential to cause significant environmental effects. If the agency determines that the action would significantly affect the quality of the human environment, the agency prepares an Environmental Impact Statement (EIS) to evaluate the Proposed Action and the alternatives in greater detail. If an EA concludes that the action will not have significant environmental impacts, the agency will issue a Finding of No Significant Impact (FONSI) to document the basis for that conclusion.

The CEQ’s NEPA Regulations do not contain a detailed discussion regarding the format and content of an EA, but an EA must briefly discuss the:

- Purpose and need for the Proposed Action;
- Proposed Action and alternatives (when there is an unresolved conflict concerning alternative uses of available resources);
- Environmental effects of the Proposed Action and alternatives; and
- Agencies and persons consulted in the preparation of the EA.

1.5 Scope of the EA

NEPA requires federal agencies to review potential environmental effects of major federal actions. This EA has been prepared to fulfill USACE’s regulatory requirements under NEPA and provide USACE with the information needed to make an informed decision about the potential effects to the natural and human environment from the construction of the proposed Wabash Dikes project.
2 PURPOSE AND NEED FOR CORPS OF ENGINEERS ACTION

The USACE is congressionally mandated to maintain a 9-foot deep navigation channel in the Ohio River for transport of goods and services by barge. In order to maintain the Ohio River channel for commercial vessels it requires routine maintenance dredging in areas where natural deposition of river substrates is an ongoing process. Since 2008, the Wabash River has been discharging above normal volumes of sand into the Ohio River resulting in shoaling that has required frequent dredging of the navigation channel to maintain operational usability.

The ongoing threat to the Ohio River navigation channel is a great economic concern for the towing industry because of shipping delays and the high expense of inactive cargo incurred during shutdowns. While a maintenance dredging operation is currently in place to deal with the shoaling, the scope and unpredictability of the problem poses an ongoing threat to navigation which has necessitated emergency dredging operations that are both complex and logistically challenging. This nature of the problem also means that the USACE response is a reactionary one which is costly and relatively inefficient and may not be the most effective long-term strategy to deal with the problem.

3 ALTERNATIVES

When preparing this EA, USACE developed a range of alternatives that could reasonably achieve the need that the Proposed Action is intended to address. The alternatives to be considered in this EA are a no action alternative of continuing to operate using the current USACE maintenance dredging program within the Action Area, and the Proposed Action involving the construction of the dikes structures as outlined in the current construction plans. The preparation of an EA, with only two alternatives (continuing to operate with current dredging protocols and the construction of the Wabash dikes in the Action Area) is appropriate because there are currently no other reasonable alternatives to consider for evaluation; no other technically viable alternatives, at a feasible cost available to resolve the problem have been identified. This decision was based on numerical hydrodynamic modeling conducted by ERDC-CHL that simulated existing conditions which was then altered to simulate multiple scenarios as potential solutions to the recurring sediment issues in the Action Area. The current design, which produced the most desirable results, included a combination of 3 dikes on Wabash Island and 4 dikes on the Illinois shore with sloping crest from top of bank to an elevation of 312 feet next to the navigation channel. The results of this analysis showed the current design (detailed herein as the Proposed Action Alternative) best prevented shoaling at and just downstream of the mouth of the Wabash River and protected the outer bend of the Illinois shore from further erosion while creating a better sailing line for navigation.
3.1 No Action
Inclusion of the No Action Alternative is required by CEQ regulations and serves as a basis for comparison against which the effects of the Proposed Action can be evaluated. Under the No Action Alternative, USACE would not complete the proposed Wabash Dikes project. Under this alternative, development and management of the Action Area would likely take the same general direction as it currently exists and would share the same environmental consequences. Therefore, the "No Action" alternative may be thought of in terms of continuing with the present course of action (i.e., dredging events potentially occurring under the existing program) until the hydromorphological conditions of the Action Area improves or otherwise makes dredging unnecessary.

Adoption of this alternative implies acceptance of the existing conditions, including the adverse effects of sediment deposition, bank erosion, and the ongoing threat to navigation and commerce in the Action Area. If adopted, this alternative would forego the bank stabilization benefits and changes to flow regimes that would result from the completed project. While the current WQC allows for normal channel maintenance activities and rapid response capabilities to resolve emergencies year-round, future actions would be conducted on a case-by-case basis which, with the concomitant delays in response, may not be the most effective strategy to deal with ongoing short- and long-term threats to navigation in the area.

3.2 Proposed Action – Approval and Construction of the Wabash Dikes
The objective of the Wabash Dikes Project is for flow diversion to alleviate the ongoing need for maintenance dredging in the Ohio River downstream of the mouth of the Wabash River. The proposed construction of seven dikes in the Action Area will produce the most effective remedy to the shoaling and will offer a long-term solution designed to alleviate potential threats to commercial navigation there.

Under this alternative, the Wabash Dike Project would be approved and implemented using the current scope and design, as developed through numerical modeling. Adoption of this alternative is expected to ameliorate localized bank erosion and sediment deposition and reduce or eliminate the ongoing threat to navigation and commerce in the proposed Action Area caused by shoaling. In addition, this alternative would reduce the need for dredging in the Action Area, thereby eliminating potential effects on the surrounding environment associated with dredging events.

Once construction of the proposed dikes is complete, no operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) will be required. Sediment build up between the dikes is not expected to require removal.
4 AFFECTED ENVIRONMENT/ENVIRONMENTAL CONSEQUENCES

The NEPA and the Council on Environmental Quality’s NEPA Implementing Regulations require that an EA identify the likely environmental effects of a Wabash Dikes Project and that the agency determine whether those impacts may be significant. Effects (or impacts) are changes to the human environment from the proposed action or alternatives that are reasonably foreseeable and have a reasonably close causal relationship to the proposed alternatives. Effects may include ecological, aesthetic, historic, cultural, economic, social, or health effects, and can be either beneficial or adverse.

The determination of whether an impact significantly affects the quality of the human environment must consider the potentially affected environment of an action and the degree of the impacts (40 CFR § 1501.3(b)).

The term “affected environment” refers to the area in which the Proposed Action or other alternatives would take place, and the potentially affected resources of that area (40 CFR § 1502.3(b)). The affected environment includes reasonably foreseeable environmental trends and planned actions in the area, if applicable (40 CFR § 1502.15). The term “degree” is not defined in the regulations, but generally refers to the magnitude of change that would result if the Proposed Action or alternatives were implemented.

All potentially relevant resource areas were initially considered for analysis in this EA. Some resource topics are not discussed, or the discussion is limited in scope, due to the lack of anticipated effect from the Proposed Action on the resource or because that resource is not located within the Project.

This Section presents the adverse and beneficial environmental effects of the Proposed Action and the No Action Alternative and is organized by resource topic, with the effects of alternatives discussed under each resource topic. Impacts are quantified whenever possible. Qualitative descriptions of impacts are explained by accompanying text where used.

Qualitative definitions/descriptions of impacts as used in this section of the EA include:

\textit{Degree}:

- No Effect, or Negligible – a resource would not be affected, or the effects would be at or below the level of detection, and changes would not be of any measurable or perceptible consequence,
- Minor – effects on a resource would be detectable, although the effects would be localized, small, and of little consequence to the sustainability of the resource. Mitigation measures, if needed to offset adverse effects, would be simple and achievable,
- Moderate – effects on a resource would be readily detectable, localized, and measurable. Mitigation measures, if needed to offset adverse effects, would be extensive and likely achievable, and
- Significant – effects on a resource would be obvious and would have substantial consequences. The resource would be severely impaired so that it is no longer functional in the Action Area. Mitigation
measures to offset the adverse effects would be extensive and success of the mitigation measures would not be guaranteed.

**Duration:**
- Short-term – temporary effects caused by the construction and/or implementation of a selected alternative, and
- Long term – caused by an alternative and remain after the action has been completed and/or after it is in full and complete operation.

### 4.1 Commerce, Recreation, River Navigation, and Visitation

#### 4.1.1 Existing Condition

The John T. Myers Locks and Dam (formerly Uniontown Locks and Dam) has been in operation since 1969 and, because of its proximity to the Wabash Dikes Project is the most accurate measure of commerce, recreation, and river navigation occurring in the Action Area. The facility lies approximately 3 miles upstream from the Action Area at ORM 846.0 and is the 17th Lock and Dam on the Ohio River. There are two locks, one for commercial barge traffic that is 1,200 feet long by 110 feet wide, and an auxiliary lock that is 600 feet long by 110 feet wide. The project was authorized as a replacement for existing Locks and Dam 48 and 49 on September 17, 1958, by Secretary of the Army under authority of Section 6 of the Rivers and Harbors Act approved March 3, 1909, as amended. The Water Resources Development Act of 2000 authorized the John T. Myers Locks Improvement Project. This work will extend the 600-foot by 110-foot auxiliary lock chamber to a 1200-foot lock. This will give the project twin 1200-foot locks for efficient movement of projected increases in tow traffic and will enable the facility to manage traffic during main lock closures without significant delays to navigation.

The Ohio River acts as a transportation highway for commercial navigation. More than 184 million tons of cargo are transported on the Ohio River each year, with coal being the most transported product (LPMS 2020); more than 58 million tons of commodities pass through the John T. Myers Locks and Dam annually. Table 1 provides the relative proportion of commodity types locking through John T. Myers Locks and Dam.

Table 1. Proportion of commodities locking through John T. Myers Lock and Dam (2013-2017)

<table>
<thead>
<tr>
<th>Commodity Type</th>
<th>Proportion of Traffic (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>00 - All Units (Ferried Autos, Passengers, Railway Cars)</td>
<td>0</td>
</tr>
<tr>
<td>10 - All Coal, Lignite, and Coal Coke</td>
<td>37</td>
</tr>
<tr>
<td>20 - All Petroleum and Petroleum Products</td>
<td>10</td>
</tr>
<tr>
<td>30 - All Chemicals and Related Products</td>
<td>12</td>
</tr>
<tr>
<td>40 - All Crude Materials, Inedible, Except Fuels</td>
<td>16</td>
</tr>
<tr>
<td>50 - All Primary Manufactured Goods</td>
<td>8</td>
</tr>
<tr>
<td>60 - All Food and Farm Products</td>
<td>17</td>
</tr>
<tr>
<td>70 - All Manufactured Equipment &amp; Machinery</td>
<td>0</td>
</tr>
<tr>
<td>80 - All Waste Material</td>
<td>0</td>
</tr>
</tbody>
</table>

1. Data obtained from Lock Performance Monitoring System (LPMS) 2013-2017 total traffic by commodity
Because the surrounding area is mostly agricultural and sparsely populated, recreation in the Action Area is generally limited to pleasure boating on the Ohio River and, to a lesser degree, the Wabash River. Over the period 2012 – 2019, the total number of annual visits at John T. Myers Lock and Dam is 275,256 visits. During this period, the mean number of recreational craft was 986 and recreational boaters comprised 15.1% of total visits to the facility. Table 2 provides the relative proportion of traffic traveling through the Action Area during calendar years 2012 – 2019.
Table 2. John T. Myers Lock usage by category, Calendar Years 2012-2019.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Delay (Tows) (Hrs)</td>
<td>1.7</td>
<td>1.6</td>
<td>0.8</td>
<td>0.7</td>
<td>0.8</td>
<td>0.8</td>
<td>0.7</td>
<td>0.8</td>
</tr>
<tr>
<td>Average Processing Time (Hrs)</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Barges Empty (#)</td>
<td>15,554</td>
<td>17,568</td>
<td>14,303</td>
<td>14,415</td>
<td>14,701</td>
<td>18,069</td>
<td>16,374</td>
<td>20,485</td>
</tr>
<tr>
<td>Barges Loaded (#)</td>
<td>29,078</td>
<td>31,330</td>
<td>27,696</td>
<td>26,184</td>
<td>30,956</td>
<td>35,384</td>
<td>33,725</td>
<td>39,223</td>
</tr>
<tr>
<td>Commercial Vessels (#)</td>
<td>4,928</td>
<td>5,115</td>
<td>4,440</td>
<td>4,351</td>
<td>4,910</td>
<td>5,386</td>
<td>4,981</td>
<td>5,639</td>
</tr>
<tr>
<td>Commercial Flotillas (#)</td>
<td>4,903</td>
<td>5,103</td>
<td>4,425</td>
<td>4,322</td>
<td>4,865</td>
<td>5,362</td>
<td>4,945</td>
<td>5,589</td>
</tr>
<tr>
<td>Commercial Lockages/Cuts (#)</td>
<td>4,903</td>
<td>5,103</td>
<td>4,425</td>
<td>4,323</td>
<td>4,866</td>
<td>5,362</td>
<td>4,946</td>
<td>5,598</td>
</tr>
<tr>
<td>Non-Vessel Lockages (#)</td>
<td>4</td>
<td>-</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Non-Commercial Vessels (#)</td>
<td>33</td>
<td>54</td>
<td>64</td>
<td>65</td>
<td>51</td>
<td>23</td>
<td>47</td>
<td>34</td>
</tr>
<tr>
<td>Non-Commercial Flotillas (#)</td>
<td>33</td>
<td>54</td>
<td>64</td>
<td>65</td>
<td>51</td>
<td>23</td>
<td>46</td>
<td>34</td>
</tr>
<tr>
<td>Non-Commercial Lockages/Cuts (#)</td>
<td>33</td>
<td>54</td>
<td>64</td>
<td>65</td>
<td>51</td>
<td>23</td>
<td>46</td>
<td>34</td>
</tr>
<tr>
<td>Percent Vessels Delayed (%)</td>
<td>69</td>
<td>68</td>
<td>52</td>
<td>45</td>
<td>50</td>
<td>56</td>
<td>50</td>
<td>48</td>
</tr>
<tr>
<td>Recreational Vessels (#)</td>
<td>1,050</td>
<td>1,000</td>
<td>1,557</td>
<td>1,653</td>
<td>1,598</td>
<td>1,521</td>
<td>1,878</td>
<td>2,131</td>
</tr>
<tr>
<td>Recreational Lockages (#)</td>
<td>758</td>
<td>600</td>
<td>905</td>
<td>1,043</td>
<td>943</td>
<td>1,027</td>
<td>1,188</td>
<td>1,452</td>
</tr>
<tr>
<td>Total Vessels (#)</td>
<td>6,011</td>
<td>6,169</td>
<td>6,061</td>
<td>6,069</td>
<td>6,559</td>
<td>6,930</td>
<td>6,906</td>
<td>7,804</td>
</tr>
<tr>
<td>Total Lockages/Cuts (#)</td>
<td>5,698</td>
<td>5,757</td>
<td>5,394</td>
<td>5,432</td>
<td>5,865</td>
<td>6,413</td>
<td>6,180</td>
<td>7,085</td>
</tr>
</tbody>
</table>

4.1.2 Environmental Consequences

4.1.2.1 No Action

Under the No Action Alternative, USACE would not complete the proposed Wabash Dikes Project; the dike structures would not be constructed and the current dredge program would remain in effect and would result in “no change” from current levels and protocols. Under the No Action alternative, development and management of the Action Area would likely take the same general direction and would share the same environmental consequences. While current WQC allows for normal channel maintenance activities and emergency response capabilities to resolve threats to navigation in Ohio River year-round, future actions conducted under the No Action Alternative would be reactionary in nature which, with the concomitant delays required to mount a response, may not be the most effective and efficient strategy to deal with ongoing short- and long-term threats to navigation in the area.

Based on the history of the area since 2008, the threat posed to commercial shipping by shoaling in the Action Area would be expected to continue. As such, remaining with the current No Action Alternative will potentially have a negative effect on commerce and river navigation, at least until the threat posed by shoaling abates. Because recreation in the area is limited to small pleasure craft of shallow draft, the potential threats to recreation in the Action Area under the No Action Alternative are negligible.

4.1.2.2 Proposed Action

The objective of the Wabash Dikes Project is for flow diversion to alleviate the ongoing need for maintenance dredging in the Ohio River downstream of the mouth of the Wabash River. Threats to navigation in the Action Area caused by the outflow of sediment from the Wabash has the potential to negatively impact commercial shipping. The net effect of the proposed construction of seven dikes in the Action Area is expected to be beneficial as they will produce the most effective remedy to the ongoing shoaling and will offer a long-term solution designed to alleviate potential threats to commerce, recreation, and river navigation there. Potential negative impacts to commerce, recreation, and river navigation are expected to be negligible and short-term in nature while barge vessels are in place and the dike structures are constructed.

4.2 Climate

4.2.1 Existing Condition

The climate of the Action Area exhibits strongly marked seasons. Winters are often cold, and summers are often hot. The transition from cold to hot weather can produce an active spring with thunderstorms and tornadoes. Oppressive humidity and high temperatures arrive in summer. Autumn is generally marked by lower humidity and mostly sunny skies.

Illinois’ location within the continent highly determines this cycle of climate. The Gulf of Mexico is a major player in the region’s climate. Southerly winds from the Gulf region readily transport warm, moisture laden air into the area. The warm moist air collides with continental polar air brought southward by the jet stream from central and western Canada. A third air mass source found in Illinois originates from the Pacific Ocean. Due to the obstructions posed by the Rocky Mountains, however, this third source arrives less frequently in the Action Area.
A winter may be unusually cold or a summer cool if the influence of polar air is persistent. Similarly, a summer may be unusually warm or a winter mild if air of tropical origin predominates. The interaction between these two air masses of contrasting temperature, humidity, and density favors the development of low-pressure centers that move generally eastward and frequently pass over or close to the Action Area, resulting in abundant rainfall. These systems are least active in midsummer and during this season frequently pass north of the region (NCDC 1976). The mean annual temperature in nearby Mount Vernon, Illinois is 54.2°F, the mean high temperature is 64.2°F, and the mean low temperature is 44.2°F. Mount Vernon receives 43.4 inches of rain annually and 14 inches of snow a year (World Climate 2020).

4.2.2 Environmental Consequences

4.2.2.1 No Action

Under the No Action Alternative, the proposed Wabash Dikes Project would not be constructed in the foreseeable future. Under the No Action Alternative, USACE would not complete the proposed Wabash Dikes Project; the dike structures would not be constructed and the current dredge program would remain in effect which would result in “no change” from current levels and protocols. In this scenario, development and management of the Action Area would likely take the same general direction and would generally share the same environmental consequences. As such, no effect to the climate of the Action Area is expected.

4.2.2.2 Proposed Action

No effect to the climate as a result of implementing the Proposed Action. Temporary effects of the proposed construction of seven dikes in the Action Area may result in the production of exhaust emissions from machinery or fugitive dust produced during construction activities but this effect is expected to be short-term and localized in nature.

4.3 Air Quality

4.3.1 Existing Condition

The U.S. Environmental Protection Agency (USEPA) Office of Air Quality Planning and Standards has set National Ambient Air Quality Standards (NAAQS) for six principal pollutants, called “criteria” pollutants. They are carbon monoxide, nitrogen dioxide, ozone, lead, particulates of 10 microns or less in size (PM-10 and PM-2.5), and sulfur dioxide. Ozone is the only parameter not directly emitted into the air but forms in the atmosphere when three atoms of oxygen (O₃) are combined by a chemical reaction between oxides of nitrogen (NOₓ) and volatile organic compounds (VOC) in the presence of sunlight. Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents are some of the major sources of NOₓ and VOC, also known as ozone precursors. Strong sunlight and hot weather can cause ground-level ozone to form in harmful concentrations in the air.

As of 18 September 2020, Gallatin County, Illinois and Union County, Kentucky were in full attainment for all criteria pollutants (USEPA, 2020).
4.3.2 Environmental Consequences

4.3.2.1 No Action

Under the No Action Alternative, the proposed Wabash Dikes Project would not be constructed in the foreseeable future. Under the No Action Alternative, USACE would not complete the proposed Wabash Dikes Project; the dike structures would not be constructed and the current dredge program would remain in effect which would result in “no change” from current levels and protocols. In this scenario, development and management of the Action Area would likely take the same general direction and would generally share the same environmental consequences. Potential impacts to air quality that may occur as a result of the use of diesel engines and other equipment during dredge activities will be short-term and localized in nature. As such, potential impacts to the air quality of the Action Area is expected to be negligible.

4.3.2.2 Proposed Action

Air quality would not be predicted to change from existing conditions as the effects of implementing and construction of the Wabash Dikes Project. There would be some localized and temporary emissions associated with construction of the dike structures as equipment is moved into the area and construction is completed. Emissions from construction actions would typically include byproducts of diesel and gasoline combustion and/or fugitive dust. These emissions would be localized and would occur during constructing the dike structures and their effects on the air quality of the Action Area are expected to be negligible.

It is estimated that two low water seasons (estimated June through November) may be needed to complete the Proposed Action. Because total construction time of the Proposed Action is not expected to exceed two years, the net relative impact to local air quality may be lower, when compared to the potential long-term impact that may occur under the ongoing dredge program.

4.4 Topography, Geology, and Soils

4.4.1 Existing Condition

The Action Area of the Wabash Dikes Project is underlain with strata dating to the Pennsylvanian age—approximately 290 to 350 million years ago (Figure 4). The bedrock is of the McCleansboro Group and includes layers of sandstone, siltstone, shale, and limestone.

The proposed Wabash Dikes Project lies within the Ohio River Floodplain of the Owensboro Lowlands of Kentucky and bottomlands of the Wabash Border Natural Division of Illinois. As part of the Interior Plateau Natural Region of Kentucky, the area is an extension of the southern floodplain forests of the Coastal Plain and contains rich soil deposits created by frequent flooding which supports a wide variety of wetland and forest habitats in addition to rich agricultural lands. The Wabash Border region includes the bottomlands and the loess-covered uplands bordering the Wabash River and its major tributaries in southeastern Illinois. Lowland oak forests with beech, tulip poplar and other species are characteristic of the forested areas.
As in Kentucky, much of the area is frequently flooded and the rich soils create prime farmlands suitable for row crops.

Figure 4. Geologic map of Kentucky (KGS, 2020).

An abbreviated soil report (NRCS, 2020) of the project area is included (Appendix B) to provide information about the soils present in the Action Area. This report details soil locations, properties, and limitations affecting various uses. Soils are mapped according to the boundaries of major land resource areas (MLRAs) which are geographically associated land resource units that share common characteristics shaped by local and regional physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). The objective of soil mapping is to delineate and organize the landscape into landform segments that have similar use and management requirements. Predictions about soil behavior are based on soil properties but also on abiotic and biotic variables as climate and biological activity. In this way, soils occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area (NRCS 2020). Soil conditions are predictable over long periods of time and can be used to develop resource management plans.

Chapter 2 of USACE EM-1110-1-400 recommends avoiding development on slopes greater than 15 percent unless there is no other acceptable alternative. All soil associations with the Wabash Dikes Action Area are suitable for development of this type. According to the Natural Resources Conservation Service (NRCS), three broad soil associations occur at the project site. These soil associations are listed in Table 3 and have been divided into two development suitability categories:

1. Suitable for development
2. Unsuitable for development
Table 3. Soil Associations of the Wabash Dikes Project in Order of Predominance.

<table>
<thead>
<tr>
<th>Soil Association</th>
<th>Typical Slope (%)</th>
<th>Suitability Class and Soil Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huntington-Robinson Complex (Hu)</td>
<td>0 - 4</td>
<td>Suitable. Frequently flooded. Mixed fine silty alluvium. Well-drained soil found on gentle, linear slopes. Prime farmland if protected from flooding.</td>
</tr>
<tr>
<td>Beaucoup Silty Clay Loam (3070A)</td>
<td>0 - 2</td>
<td>Suitable. Seasonally flooded. Silty clay to loamy alluvium. Moderately well drained. Prime farmland</td>
</tr>
<tr>
<td>Tice Silty Clay Loam (3284A)</td>
<td>0 - 2</td>
<td>Suitable. Frequently flooded. Silty, clay to loamy alluvium. Moderately well drained. Prime farmland</td>
</tr>
</tbody>
</table>

4.4.2 Environmental Consequences

4.4.2.1 No Action

Under the No Action Alternative, USACE would not complete the proposed Wabash Dikes Project; the dike structures would not be constructed, and the current dredge program would remain in effect which would result in “no change” from current levels and protocols. In this scenario, development and management of the Action Area would likely take the same general direction and would generally share the same environmental consequences. As such, no effect to the topography, geology, and soils of the Action Area would be expected.

4.4.2.2 Proposed Action

Effects to the topography, geology, and soils of the Action Area are expected to be negligible as a result of the implementation of the Proposed Action. Effects to the resource will be localized and will take the form disturbance to soils that will occur during the movement of heavy machinery and the clearing of surrounding vegetation. Topography, geology, and soils will also be impacted by the laying of rip rap stone to create the dikes and armor the surrounding area. Prior to and during construction of the Wabash Dikes Project, best management practices would be deployed (e.g., use of silt fences) to minimize erosion and soil loss, when appropriate.

4.5 Surface Water Hydrology and Groundwater

4.5.1 Existing Condition

Surface Water Hydrology

Locks and dams are installed on waterways of the U.S. by the USACE for navigation purposes. These structures regulate flow when necessary to maintain a 9 foot minimum river depth in the Ohio River, facilitating the transport of cargo on the river. The last two wicket dams in the lower river, Lock & Dam 52 and Lock & Dam 53, became obsolete in August 2018 with the completion of the Olmsted Locks & Dam. The Ohio River currently has 19 high-lift dams and no remaining
wicket dams. The river has an average depth of 24 feet with an average width of 0.5 miles (ORSANCO 2020).

When raised, each dam creates pools which are typically named for the downstream dam. Beginning on the downstream side of John T. Myers, the Smithland Pool is a 72.5-mile-long (ORM 846.0-918.5) water body bounded by J.T. Myers Locks & Dam upstream and Smithland Locks & Dam on the downstream end. The Wabash River, with a drainage area of 33,100 square miles, empties into this pool at ORM 848. Other tributaries to this navigational pool include the Saline River at mile point 867.3 with a drainage area of 1,170 square miles and the Tradewater River at mile point 873.5 with a drainage area of 1,000 square mile (ORSANCO 2020).

When necessary to maintain navigation depth, the river stage and flow conditions on this section of the Ohio River are managed by the USACE at John T. Myers Locks and Dam located at ORM 846.0, approximately 4.3 kilometers upstream from the site. This section of the Ohio River is navigable by commercial vessels and is used for both commercial and recreational purposes. Normal elevation of the Smithland Pool is 324 feet.
Figure 5. Comparison of recent and historic Ohio River flow data at Smithland, KY (taken from ORSANCO 2020).
Groundwater

About 1,500 people in Union County, Kentucky rely on private domestic water supplies on primarily wells. The Ohio River alluvium is the best source of groundwater in the county. Most wells yield more than 50 gallons per minute; some yield as much as 1,000 gallons per minute. In over half of Union County, most wells shallower than 300 feet penetrating sandstone are adequate for a domestic supply.

Within the project area, alluvium and glacial outwash sediments form terraces and floodplains along the Ohio River and tributaries. Valley train deposits in terraces occur along the Ohio River. These deposits may yield several hundred gallons per minute to drilled wells in the Ohio River Valley, and as much as 5,000 gallons per minute to compound horizontal wells. Nearly all wells furnish more than 500 gallons per day. Alluvium in stream valleys tributary to the Ohio River is fine grained and thin, and most wells do not yield enough for domestic use. Water is hard to very hard and may contain objectionable amounts of iron. Loess forms a thin mantle over alluvial deposits and bedrock over much of the area near the Ohio River. Loess yields practically no water to wells.

Only one known well occurs in the vicinity of the Action Area. In 2014, an agricultural well was dug on Wabash Island to a depth of 68 feet. This well is located inland of the Action Area. A copy of the Uniform Well Construction Record is included in Appendix B.

4.5.2 Environmental Consequences

4.5.2.1 No Action

Under the No Action Alternative, USACE would not complete the proposed Wabash Dikes Project; the dike structures would not be constructed and the current dredge program would remain in effect which would result in “no change” from current levels and protocols. In this scenario, development and management of the Action Area would likely take the same general direction and would generally share the same environmental consequences. Considering the recent history of shoaling in the area and the large amount of sediment that will likely continue to arrive from the Wabash River, maintenance dredging will likely be an ongoing concern. While the exact scope and frequency of future dredge events will be dependent on on-site conditions, dredging has the potential to have a minor impact on the surface water hydrology and of the Action Area.
4.5.2.2 Proposed Action

Because the overall objective of the Wabash Dikes Project is for flow diversion to alleviate the ongoing need for maintenance dredging in the Ohio River downstream of the mouth of the Wabash River, localized modification to the flow regime of the Action Area is an expected project outcome. This effect is designed to be focused and the completion of the Wabash Dikes Project is not expected to have a significant effect on the surrounding inflows to the system or water surface elevations currently present in the Smithland Pool.

4.6 Water Quality

4.6.1 Existing Condition

The water quality management authority of USACE is founded on the Federal Water Pollution Control Act (FWPCA) of 1948 and its amendments including the Clean Water Act of 1977 and the Water Quality Act of 1987. Executive Order 12088, Federal Compliance with Pollution Control Standards (1978), requires Federal facilities to comply with applicable pollution control standards in the same manner as any non-Federal entity. ER 1110-2-8154 stipulates that it is USACE policy to develop and implement a holistic, environmentally sound water quality management strategy for all projects. Furthermore, it is a goal of USACE to responsibly manage our projects to maximize environmental compliance. USACE is also mandated to comply with native State regulations and standards including the Indiana Administrative Code Title 327, Article 2 – Water Quality Standards.

The Ohio River is 981 miles long and borders or runs through six states in the eastern region of the United States; the river begins in Pittsburgh, Pennsylvania at the confluence of the Allegheny and Monongahela rivers and flows southwesterly to its confluence with the Mississippi River in Cairo, Illinois. The Ohio River basin encompasses 203,940 square miles, includes parts of New York, Maryland, Virginia, North Carolina, Tennessee, Georgia, Alabama, and Mississippi. Numerous major tributaries feed the Ohio River including the Allegheny, Cumberland, Green, Kanawha, Monongahela, Tennessee, and Wabash rivers. Approximately ten percent of the U.S. population resides in the basin, equating to more than 30 million people, with five million people relying on the river as a source of drinking water (ORSANCO 2020).

The Ohio River Valley Water Sanitation Commission (ORSANCO) is an interstate agency created to monitor and control water pollution in the Ohio River Basin. Member states and entities include Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia, West Virginia, and the federal government. ORSANCO was created in 1948 with the signing of the Ohio River Valley Water Sanitation Compact which commits each member state to, “…place and maintain the waters of the basin in a satisfactory sanitary condition, available for safe and satisfactory use by public and industrial water supplies after reasonable treatment, suitable for recreation, capable of maintaining fish and other aquatic life…” (ORSANCO 2020).

ORSANCO operates a number of monitoring programs that are used to assess water quality, including: bimonthly sampling (nutrients/ions), clean metals sampling, temperature and dissolved oxygen monitoring, fish and macroinvertebrate population monitoring, contact recreation bacteria monitoring, longitudinal and tributary bacteria surveys, fish tissue sampling,
high volume PCBs and dioxin sampling, algae, and nutrients (ORSANCO 2020). ORSANCO conducts water quality monitoring and assessments on behalf of Ohio River main stem states of Illinois, Indiana, Kentucky, Ohio, Pennsylvania, and West Virginia. ORSANCO completes an assessment and report of Ohio River water quality conditions every two years. This data is compiled into a 305b Report is then compared to water quality criteria to determine if the Ohio River meets its four intended uses that include warm water aquatic life, public water supply, contact recreation, and fish consumption. To this end, three classifications are used in ORSANCO’s assessments to describe the attainment of designated uses: Fully Supporting (good water quality), Partially Supporting (fair water quality), and Not Supporting (poor water quality).

In summary, the entire 981 miles of the Ohio River is designated as impaired for the fish consumption life use designation (based on the presence of polychlorinated biphenyls and dioxin in fish tissue samples). Approximately two-thirds of the river (640.3 miles) is designated as impaired for contact recreation (as a result of Escherichia coli or fecal coliform bacteria contamination) and the entire river is fully supporting the public water supply use and aquatic life use designation (ORSANCO 2020).

Using data more reflective of conditions in the project area, a bioassessment of the fish and macroinvertebrate assemblages conducted in the John T. Myers pool in 2015 characterized both populations as “Good”. Sampling of fish populations in the Smithland Pool in 2013 resulted in a rating of “Good”. Macroinvertebrate data was not available for the Smithland assessment unit (ORSANCO 2020). Table 4 includes the attainment status and miles impacted from ORM immediately up-and downstream of the Wabash Dikes Action Area.

Table 4. Summary of four designated use categories involving pertinent (i.e., near or encompassing the Wabash Dikes Action Area) impaired river miles.

<table>
<thead>
<tr>
<th>State</th>
<th>River Mile (Total Miles)</th>
<th>ALU Impairment</th>
<th>CRU Impairment</th>
<th>PWSU Impairment</th>
<th>FCU Impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN-KY</td>
<td>491.3-848.0 (356.7)</td>
<td>0.0</td>
<td>243.3</td>
<td>0.0</td>
<td>356.7</td>
</tr>
<tr>
<td>IL-KY</td>
<td>848.0-981.0 (133.0)</td>
<td>0.0</td>
<td>41.5</td>
<td>0.0</td>
<td>133.0</td>
</tr>
</tbody>
</table>

Source: Assessment of Ohio River Water Quality 2014- 2018; Aquatic Life (ALU), Contact Recreation (CRU), Public Water Supply (PWSU), and Fish Consumption (FSU) uses (ORSANCO 2020).

**Point and Non-point Pollution**

Because the Ohio River receives input from the entire basin, the list of potential sources of point and nonpoint pollution is extensive. For example, there are approximately 580 permitted discharges into the Ohio River (ORSANCO 2020). Point sources are confined and discrete conveyances such as pipes, ditches, channels, and tunnels or conduits by which pollution is transported directly to a water body. Potential point sources contributing to the water quality of the Ohio River and the Action Area include wastewater treatment plants; straight pipe systems; and sanitary sewer overflows (which may contain sediments), Escherichia coli (E. coli), and nutrients; and regulated stormwater sources.

Nonpoint source pollution are sources of pollution that come from diffuse sources. Potential non-point pollution sources which affect overall project water quality include cropland and
livestock runoff, stream bank erosion, urban stormwater runoff, and failed septic systems. While the area is not densely populated, septic systems are used almost exclusively in the region surrounding the Action Area to handle wastewater treatment. Failure of these systems can affect surrounding water quality via nutrient loading of nitrogen and phosphorus in surface waters, which results in increased microbial populations. High microbial populations in surface waters contaminated by sewage often exceed the maximum allowance under the EPA standards and may result in high levels of *E. coli* and harmful algal blooms (HABs). For example, Purdue University (2005) estimated that 15.3 million gallons of untreated sewage enter the environment each year in the state of Indiana.

**Harmful Algal Blooms (HABs)**

Sampling on the Ohio River has identified over 300 different species of algae (ORSANCO 2020). These algae are divided into eight taxonomic divisions with the most common being diatoms (*Bacillariophyta*), green algae (*Chlorophyta*) and blue-green algae (*Cyanobacteria*). Cyanobacteria can produce toxins (cyanotoxins) which can be harmful if ingested and can also cause contact dermatitis. For this reason, an algae bloom which consists primarily of Cyanobacteria which can produce toxins is defined as a HAB. These cyanotoxins can affect people and animals who ingest them, either through recreation (e.g., swimming), or in drinking water (ORSANCO 2020).

On August 2015, ORSANCO received a National Response Center (NRC) report of a paint-like green material on the Ohio River at Pike Island Locks and Dam (mile 84.2) which covered an area of 100 x 200 feet. This was quickly identified as the blue-green algae *Microcystis aeruginosa*. Within a month, this bloom expanded to cover the Ohio River from Pike Island Locks & Dam to Cannelton Locks & Dam (ORM 84.2 to 720.7). The bloom reached its peak around September and persisted until the end of October. In response to this HAB, Ohio, West Virginia, Kentucky, and Indiana issued recreation advisories; Illinois issued a precautionary statement due to concern that the bloom would reach their border.

ORSANCO collected 150 samples from the Ohio River, which were analyzed for the toxin microcystin. Finished drinking water was also sampled by either the water utilities or State personnel. Of the samples collected by ORSANCO, 15 (or 10%) were greater than 6 μg/L. The highest toxin concentration was 1900 μg/L at river mile 468.8 (Cincinnati, OH). No toxins were detected in finished drinking water.

**4.6.2 Environmental Consequences**

**4.6.2.1 No Action**

Under the No Action Alternative, USACE would not complete the proposed Wabash Dikes Project; the dike structures would not be constructed and the current dredge program would remain in effect which would result in “no change” from current levels and protocols. In this scenario, development and management of the Action Area would likely take the same general direction and would generally share the same environmental consequences. As such, no effect to the water quality of the Action Area is expected. Dredging activities that would likely continue under the No Action Alternative could have temporary/localized effects of water quality, including increased turbidity and re-suspension of contaminants like PCBs and dioxins.
While current WQC allows for normal channel maintenance activities and emergency response capabilities to resolve threats to navigation in Ohio River year-round, future dredge actions (conducted under the No Action Alternative) would be implemented on a reactionary *ad hoc* basis which, with the concomitant delays in response, may not be the most effective strategy to deal with ongoing short- and long-term threats to navigation in the area. In addition, future actions or resource management policies would be implemented without the benefit of a comprehensive analysis (i.e., in the form of an EA) of potential effects on water quality that can be used for planning and decision making.

### 4.6.2.2 Proposed Action

Under the Proposed Action, future development under the proposed Wabash Dikes Project would occur with negligible effect to the water quality of the Ohio River or its tributaries. Although construction activities would result in ground-surface disturbances that could increase runoff and diminish water quality, best management practices during construction would be expected to minimize potential impacts to water quality.

The existing water quality of the Smithland Pool and the Ohio River, in general, is a result of factors substantially unrelated to the actions on Project lands and results from land use and discharges to the watershed upstream from the Project. Because the sediment load of the Ohio River is typically high even under normal conditions, improvements to turbidity levels of the watershed, as a result the construction of the dikes, would likely be minimal. As a designed outcome, the dike structures will alter stream flow in a way that limits or directs sediment deposition and prevents scouring in the Action Area. A detailed analysis of the potential of the Wabash Dikes Project to impact water quality of the Action Area has been conducted in a 404(b)(1) evaluation document located in Appendix A.

### 4.7 Habitats

#### 4.7.1 Existing Condition

The proposed Wabash Dikes Project lies within the Ohio River Floodplain of the Owensboro Lowlands of Kentucky and bottomlands of the Wabash Border Natural Division of Illinois. The Wabash Border Division, stretching from Vermilion County south to Gallatin County, forms the eastern border of Illinois. This division is divided into three sections: Bottomlands, Southern Uplands, and Vermilion River. The Wisconsin glacial episode impacted the Vermilion River Section, while all three sections were influenced by the earlier Illinoian glacial episode. This division is a transition zone between forest and prairie, but lowland and upland forests dominate the landscape, containing a great diversity of tree species.

Habitats of the Wabash Dikes project area are delineated and categorized using the National Land Cover Database (NLCD) which includes land cover classification schemes and quantifies land cover change for the conterminous U.S. between the years 2001 to 2016. The NLCD provides nationwide data on land cover and land cover change at a 30m resolution with a 16-class legend based on a modified Anderson Level II classification system. A total of eight NLCD habitat types are found surrounding the Wabash Dikes Project, including cultivated crops, deciduous forest, mixed forest, grasslands/herbaceous, scrub/shrub, woody wetlands, open
water, and developed, medium degree. The most dominant habitat types are addressed below in order of prevalence.

Open Water

The majority of the project consists of open water habitat type. During a bioassessment conducted in 2013, a total of 36 species of fish were documented in the Smithland Pool including gizzard shad (*Dorosoma cepedianum*), river carpsucker (*Carpiodes carpio*), highfin carpsucker (*Carpiodes velifer*), channel catfish (*Ictalurus punctatus*), bluegill (*Lepomis macrochirus*), longear sunfish (*Lepomis megalotis*), freshwater drum (*Aplodinotus grunniens*), white bass (*Morons chrysops*), spotted bass (*Micropterus punctulatus*), spotfin shiner (*Cyprinella spilotera*), and channel shiner (*Notropis wickliffi*; ORSANO 2013). During this study, the overall biological condition of the Smithland Pool was characterized as Good (ORSANO 2020).

Cultivated Crop/Grasslands/Herbaceous

Like most of the Midwest, states such as Illinois and western Kentucky are dominated by agriculture. Common crops of this region include corn and soybeans and much of the surrounding project area is currently in cultivated fields or currently laying fallow.

Old fields are successional habitats characterized by grasses, shrubs and trees. These habitats are typically transitioning from grasslands to young forests. Grassland/herbaceous habitats are characterized by the following plant species: poison ivy (*Toxicodendron radicans*), blackberry (*Rubus sp.*), switchgrass (*Panicum virgatum*), big bluestem (*Andropogon geraldi*) and little bluestem (*Schizachyrium scoparium*) among other grasses, as well as forbs and shrubs, e.g., hawthorne (*Crataegus sp.*). Wildlife species may include cottontail rabbit (*Sylvilagus floridanus*), white-tailed deer (*Odocoileus virginianus*), turkey (*Meleagris gallopavo*), ruffed grouse (*Bonasa umbellus*), coyotes (*Canis latrans*), and various songbirds and furbearers.

Deciduous Forest/Mixed Forest

The forest community consists of a four-layered plant structure and is highly impacted by the frequent inundation and hydric soils. Dominant tree species in the overstory are silver maple (*Acer saccharinum*), sycamore (*Platanus occidentalis*), cottonwood (*Populus deltoides*), and black willow (*Salix nigra*). Other members of canopy include slippery elm (*Ulmus rubra*), pin oak (*Quercus palustris*), river birch (*Betula nigra*), sweet gum (*Liquidambar styraciflua*), and hickories (*Carya* spp.). Representative species in the subcanopy include hackberry (*Celtis occidentalis*), black locust (*Robinia psuedoacacia*), American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), box elder (*Acer negundo*), pawpaw (*Asimina triloba*), buckeye (*Aesculus* sp.), and black walnut (*Juglans nigra*). Shrubs include spice bush (*Lindera benzoin*), Virginia creeper (*Parthenocissus quinquefolia*), poison ivy, dogwoods (*Cornus* spp.), black elderberry (*Sambucus* sp.), and grape species (*Vitis* spp.). Typical ground cover includes wingstem (*Verbascia alternifolia*), touch-me-nots (*Impatiens* sp.), white snakeroot (*Ageratina altissima*), and several invasive exotic plants including Japanese knotweed (*Reynoutria japonica*), garlic mustard (*Allisaria petiolarata*), and kudzu (*Pueraria* sp.).
Remote sensing and field observations of the Action Area suggest that the forest community varies considerably between the Kentucky and Illinois shorelines. In general, the forest habitat on Wabash Island is more diverse and the trees are both older and larger. Dominant members of the canopy on Wabash Island include cottonwood, sycamore, box elder, and black walnut with some individuals exceeding 100 inches dbh. By comparison, much of the forest community on the Illinois side are much younger and less diverse with many of its members considered early successional (e.g., black willow, silver maple, and river birch) with scrub/shrub dominating a large portion of the area. In this area, the riparian zone is less than 90 meters in width in the area with either active or fallow agricultural fields bordering the forested belts inland, where suitable soils are present.

**Wetlands**

A preliminary desktop analysis of wetland resources potentially found in the project footprint was conducted using USFWS’s National Wetlands Inventory (NWI) database. The NWI mapping tool indicated that approximately 6.3 acres of freshwater wetlands may exist on or near the Wabash Dikes Project including freshwater emergent wetlands and freshwater scrub/shrub wetland habitat types (Figure 5). Freshwater emergent wetlands are characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichen which are present for most of the growing season in most years. Both of these habitat types are located along the shoreline and in low lying areas that are frequently inundated by floodwaters. Some of these potential wetlands are seasonally or otherwise temporarily flooded, meaning surface water is present for brief periods (from a few days to a few weeks) during the growing season, but may recede or be absent by the end of the growing season. However, based on this cycle, they may have one or more of the prerequisite characteristics of wetland habitat, including hydric soils, hydrology, and wetland plants.

On 11 June 2021, a wetland delineation was conducted by USACE personnel within the construction footprint on the Illinois side of the Project. The delineation identified four wetlands consisting of approximately 8.9 acres which were classified as palustrine, forested, broad-leaved, temporarily flooded (PF01, n = 2) and persistent emergent (PEM1, n = 2) wetland habitat types. This effort was conducted subsequent to the public release of the draft EA and supplementary NEPA documents (BA and 404(b)1 Evaluation). While additional data on soil types and plant communities was provided as a result of the delineation, the resulting upward revision in the amount of wetland habitat documented is not significant and all assumptions and conclusions made previously and herein regarding the ecological significance of potential impacts and relative quality of the habitats present remain unchanged.

The complete summary report detailing the results of the wetland delineation is provided in Appendix A.
Figure 6. NWI wetland habitats present within the Wabash Dikes Action Area.
4.7.2 Environmental Consequences

4.7.2.1 No Action

Under the No Action Alternative, USACE would not complete the proposed Wabash Dikes Project; the dike structures would not be constructed and development of the Action Area would likely take the same general direction and would generally share the same environmental consequences. Because the need for maintenance dredging would likely persist in the area, continuing under the No Action Alternative has the potential to impact benthic habitats and the flora and fauna residing there. While not formally recognized in the NLCD habitat classification system, benthic habitats of the Action Area are in a constant state of flux as a result of high currents and sediment loads in the project area. A detailed analysis of the potential effects of dredging on the benthos of the Action Area is provided in Section 4.8 below and in the BA and 404(b)(1) evaluation documents provided in Appendix A.

4.7.2.2 Proposed Action

Under the Proposed Action, there is expected to be impacts to several habitat types that are minor and short-term in nature. In general, habitats currently present in the construction zone are of early successional stages as they are frequently inundated and impacted by scouring from seasonal flooding. An estimated total of 13.25 acres (5.4 hectares) of existing habitat will be removed (or otherwise altered) from the shoreline in and around each of the proposed dike structures on both sides of the river. Of this total, as estimated 8.9 acres of habitat characterized as wetland may be negatively impacted. As required for the implementation of test drilling and dike construction, all vegetation will be removed from approximately 350 feet (106.7 meters) of shoreline, upland 50 feet (15.2 meters) from the water’s edge (at normal pool elevation of 324.0 feet). Vegetation, if present, may also be removed as equipment is moved overland from dike to dike. Much if this impacted habitat will recover once the project is complete. However, a relatively small area will be permanently altered as the underlying habitats are covered by rip rap used in the construction of the dikes. No in-kind replacement of lost or modified habitat is planned.

A detailed analysis of the potential impacts to habitats of the Action Area as a result of implementing the Proposed Action is provided in Section 4.8 below and in the BA and 404(b)(1) documents provided in Appendix A. The technical report summarizing the results of the wetland delineation conducted in support of the Wabash Dikes Project is also provided in Appendix A.

4.8 Listed Species

Lists of threatened, endangered and species of special concern are maintained by the United States Fish and Wildlife Service (USFWS). Under ESA of 1973 (16 U.S.C. §§ 1531-1544), endangered species are generally defined as any species in danger of extinction throughout all or a significant portion of its range. A threatened species is any species likely to become endangered in the foreseeable future. The ESA defines critical habitat of the above species as a geographic area that contains the physical or biological features that are essential to the conservation of a particular species and that may need special management or protection. This
section also covers birds listed under the Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C §§ 703-712) as birds of conservation concern.

### 4.8.1 Existing Condition

Based on data obtained from the USFWS Information for Planning and Consultation (IPaC) resource (USFWS 2020), 16 Federally listed species have been or are known to occur in this section of the Ohio River in the vicinity of the Action Area. Endangered freshwater mussel species potentially affected by activities associated with the Wabash Dikes Project include the spectaclecase (*Cumberlandia monodonta*), fanshell (*Cyprogenia stegaria*), purple catspaw (*Epioblasma obliquata*), northern riffleshell (*Epioblasma rangiana*), ring pink (*Obovaria retusa*), orangefoot pimpleback (*Plethobasus cooperianus*), sheepnose (*Plethobasus cyphyus*), clubshell (*Pleurobema clava*), rough pigtoe (*Pleurobema plenum*), and the fat pocketbook (*Potamilus capax*). The threatened mussel species potentially affected by activities in this location is rabbitsfoot (*Theliderma cylindrica*). These mussel species have been experiencing decades of decline due to habitat modification or loss, over harvesting, and pollution. Although all of these species may have been historically present in this area, the majority will not be expected to be present within the proposed Action Area. Several may be extirpated from large parts of their formal ranges and others may be functionally extinct.

Based on the habitat preferences, historical occurrence records, and recent mussel survey data (Lewis Environmental Consulting, LLC 2019), the endangered fat pocketbook is the only listed mussel species that is reliably known to still occur within or near the Action Area.

Endangered mammals potentially affected by the Wabash Dikes Project include the Federally threatened northern long-eared bat (*Myotis septentrionalis*) and the endangered Indiana bat (*M. sodalis*) and the endangered gray bat (*M. grisescens*). Because both bat species have very large ranges, their presence in the project area is assumed by USFWS. A single Federally endangered bird species, the interior least tern (*Sterna antillarum*) and Short’s bladderpod (*Physaria globosa*) is an endangered plant within range of the Wabash Dikes Project.

There is no known critical habitat known in Action Area.

A Biological Assessment (Appendix A) has been written to assess the potential effects on listed species in greater detail.

### 4.8.2 Environmental Consequences

#### 4.8.2.1 No Action

Under the No Action Alternative, the proposed Wabash Dikes Project would not be constructed in the foreseeable future and there would be no comprehensive planning for the project. In this scenario, development and management of the Action Area would likely take the same general direction and would generally share the same environmental consequences.

Under the No Action Alternative, the current dredge program would remain in effect which would result in “no change” from current levels and protocols. Described in previous sections of this document, the Wabash River dredging program is an ongoing, as needed action that is conducted (under existing 401 WQC and NPDES permits) to remove and dispose of outwash material that encroaches into the Ohio River navigation channel. Dredging activities have the
potential to negatively impact resident mussels. On 9 September 2002, the USFWS Bloomington Field Office provided a Biological Opinion (BO) to the USACE Louisville District in response to formal consultation related to potential impacts to listed species caused by the maintenance dredging of the mouth of the Wabash River. Based on expert opinion and data obtained from mussel surveys, the aforementioned BO authorized the incidental take of up to 3 individual *P. capax* per dredging event. In 2016, the USFWS provided an amended BO that increased allowable take of up to 9 individual *P. capax* per dredging event, based on the results of long-term monitoring of dredge materials (USFWS, 2016).

The existing conditions in this stretch of the Ohio River has required maintenance since 2008 and there is no evidence that this situation will improve in the near future. While the USFWS (2016) determined that the dredging program would not threaten the continued existence of *P. capax*, evidence indicates that adoption of the No Action Alternative (and continuation of the current dredge actions) has the potential to negatively impact mussels that may be present in the dredge and disposal fields. In addition, the large amounts of outwash coming from the Wabash River has the potential to suffocate resident mussels suggesting that the implementation of the No Action Alternative has a negative effect on listed mussel species.

4.8.2.2 Proposed Action

**Listed Species Effects Determination**

The objective of the Wabash Dikes Project is for flow diversion to alleviate the ongoing need for maintenance dredging in the Ohio River downstream of the mouth of the Wabash River. While the construction of the dike structures may have short term in-stream impacts to resident mussels in the form of sedimentation, these effects would be temporary. Mussel surveys conducted in the Action Area documented no mussels in the dike footprints remaining in the current project design. In comparison to the potential impacts to mussels caused by future dredging actions, the Proposed Action is a one-time event and the footprints are relatively small, discrete areas with localized potential impacts. In addition, the high amount of deposited sediments (were the dikes not built) emanating from the Wabash River has the potential to kill mussels via suffocation (USFWS, 2016). When taking into account the possible take of mussels that may occur incidental to future dredging actions and the removal or reduction of the threats to mussels caused by the high amount of Wabash River outwash, the net effect of the Proposed Action would be expected to be beneficial to resident mussels.

A Biological Assessment (Appendix B) was written to assess the potential effects on listed species in greater detail. The finding in the BA is a determination of no effect to the spectaclecase, fanshell, purple catspaw, northern riffleshell, ring pink, orangefoot pimpleback, sheepnose, clubshell, rough pigtoe, fat pocketbook, rabbitsfoot, Short’s bladderpod, rusty patched bumble bee, gray bat, Indiana bat, and northern long-eared bat. To-date, coordination with USFWS is limited to analysis occurring via the agency’s iPAC system. As part of the NEPA process, this EA, the Biological Assessment, and FONSI document public comment and agency review was completed 11 June 2021.
4.9 Demographics and Environmental Justice

4.9.1 Existing Condition

The USEPA online EJScreen environmental justice mapping tool was used to assess the environmental and demographic indicators within the Area of Influence (AOI) which encompassed a 10-mile radius around the Wabash Dikes Project. The AOI encompasses approximately 314 sq. miles and contains all or portions of Gallatin County in Illinois and Union County in Kentucky. With a total population of 6,343 people (2010), the area has a population density of approximately 21 people/sq. mile. Table 5 contains select EJ Index variables within the Wabash Dikes AOI. The full EJScreen Report is located in Appendix B.

Table 5. Select environmental indicators from EJScreen Report in Wabash Dikes Area of Influence.

<table>
<thead>
<tr>
<th>Selected Variables</th>
<th>State Percentile</th>
<th>EPA Region Percentile</th>
<th>USA Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>EJ Index for PM2.5</td>
<td>64</td>
<td>46</td>
<td>50</td>
</tr>
<tr>
<td>EJ Index for Ozone</td>
<td>64</td>
<td>44</td>
<td>50</td>
</tr>
<tr>
<td>EJ Index for NATA® Diesel PM</td>
<td>66</td>
<td>47</td>
<td>50</td>
</tr>
<tr>
<td>EJ Index for NATA® Air Toxics Cancer Risk</td>
<td>67</td>
<td>48</td>
<td>50</td>
</tr>
<tr>
<td>EJ Index for NATA® Respiratory Hazard Index</td>
<td>68</td>
<td>48</td>
<td>50</td>
</tr>
<tr>
<td>EJ Index for Traffic Proximity and Volume</td>
<td>83</td>
<td>61</td>
<td>62</td>
</tr>
<tr>
<td>EJ Index for Lead Paint Indicator</td>
<td>49</td>
<td>23</td>
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<td>EJ Index for Superfund Proximity</td>
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<td>EJ Index for Wastewater Discharge Indicator</td>
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Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Population and Low-Income Populations (Executive Order, 1994), directs federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority population and low-income populations. When conducting NEPA evaluations, the Corps of Engineers incorporates Environmental Justice (EJ) considerations into both the technical analyses and the public involvement in accordance with the USEPA and the Council on Environmental Quality guidance (CEQ, 1997).

The CEQ guidance defines “minority” as individual(s) who are members of the following population groups: American Indian or Alaskan native, Asian or Pacific Islander, Black, not of Hispanic origin, and Hispanic. The Council defines these groups as minority populations when either the minority population of the affected area exceeds 50-percent of the total population, or the percentage of minority population in the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis.

Low-income populations are identified using statistical poverty thresholds from the Bureau of the Census Current Population Reports, Series P-60 on Income and Poverty (USCB, 2019). In identifying low-income populations, a community may be considered either as a group of
individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect. The 2019 poverty threshold for an individual was $13,011 and $26,162 for a family of four (USCB, 2019). These values represent weighted poverty thresholds based on family size in 2019.

Table 6 shows the percentage of the population that is low-income and the percentage of the population that identify as a minority/Person of Color for the AOI, the counties of the Action Area, the states of Kentucky and Illinois, and the United States. The AOI has a comparable percentage of low-income population to Gallatin and Union Counties, both of which have a higher percentage of low-income population than their respective states and the country. The minority populations within the AOI and Gallatin and Union counties form a significantly lower proportion of overall population than the Illinois and national averages, and a comparable percentage to the state of Kentucky. Because the percentage of minority population in the AOI is below 50 percent and is lower than the minority population percentage in the general population and the surrounding area, the CEQ guidance does not consider the AOI to include any “minority populations.”

Table 6. Socioeconomic, and demographic indicators within the Wabash Dikes greater Area of Influence.

<table>
<thead>
<tr>
<th>Geographical Unit</th>
<th>Low-Income Percentage of Population¹ (2020)</th>
<th>Minority/People of Color Percentage of Population² (2020)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of Influence</td>
<td>42.0</td>
<td>13.0</td>
</tr>
<tr>
<td>Gallatin County</td>
<td>43.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Union County</td>
<td>45.0</td>
<td>18.0</td>
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<tr>
<td>Illinois</td>
<td>29.0</td>
<td>38.0</td>
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<td>Kentucky</td>
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<td>15.0</td>
</tr>
<tr>
<td>United States</td>
<td>33.0</td>
<td>39.0</td>
</tr>
</tbody>
</table>


¹ “Percent Low-Income” is defined as the percent of a block group’s population in households where the household income is less than or equal to twice the federal poverty level.

² “Percent People of Color” is defined as the percent of individuals in a block group who list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino.

4.9.2 Environmental Consequences

4.9.2.1 No Action

Under the No Action Alternative, USACE would not complete the proposed Wabash Dikes Project; the dike structures would not be constructed which would result in “no change” from current demographic trends of the Action Area. In this scenario, development and management of the Action Area would likely take the same general direction and would generally share the same environmental and socioeconomic consequences. Under the no
action alternative, the population growth trends in the surrounding area would be expected to continue. No adverse effects to minority or low-income communities would be expected as a result of implementing the no action alternative.

4.9.2.2 Proposed Action

Implementing the Proposed Action alternative is expected to have no effect on the existing demographic trends of the surrounding communities. Because the area surrounding the proposed Wabash Dikes Project is lightly populated and predominantly agricultural, completion of project is expected to cause no effect to low-income or minority populations of the surrounding communities. While the Wabash Dikes Project would help reduce or eliminate the ongoing threat to navigation due to shoaling at this location, it is not anticipated that the project would induce population growth or other types of development in the area.

4.11 Cultural Resources

4.11.1 Existing Condition

A number of steps were taken to identify any historic properties within the Wabash Dikes Project footprint. The Area of Potential Effect (APE) for this project consists of the dike locations, both on land and in the river, workspaces, and access roads. Between 29 June 2020 and 15 September 2020, a review of existing literature, records, and reports was conducted to identify known historic properties that could be impacted by this project. This review included technical reports, site forms, books, articles, historical references, and online resources available through the National Park Service, the Illinois Historic Preservation Agency (IHPA), and USACE offices in Louisville, Kentucky. Results of this review identified no historic properties listed on the National Register of Historic Places (NRHP) within the APE. Four cultural resources are recorded within the APE; all were located in the state of Illinois. Specifically, they are archaeological sites 11G20 (the Galt Site), 11G160, 11G161, and 11G162. An additional archaeological site 11G15 (the Rollman Site) is located near, but outside of, the APE. All of these sites were identified by the Center for Archaeological Investigations at Southern Illinois University, Carbondale during surveys in 1972 and 1978. These resources were not formally evaluated for their eligibility to the NRHP when they were identified, however, all of the sites were reported to have elements that would make them eligible for the NRHP under Criterion D, except for site 11G162.

Consultation under Section 106 of the National Historic Preservation Act (NHPA) was initiated with the Kentucky State Historic Preservation Office, Illinois State Historic Preservation Officer, 44 federally recognized Native American tribes, local governments, non-profit historic preservation groups, and interested members of the public on 14 April 2020. The Cherokee Nation, Quapaw Tribe, Osage Nation, the Kentucky State Historic Preservation Office, and the Illinois State Historic Preservation Officer have accepted an invitation to consult on effects to historic properties determined eligible for listing to the National Register of Historic Places (NRHP). A cultural resources survey was conducted in the portion of the APE located in Gallatin County, Illinois on September 19 and September 28-30 by USACE personnel. Only one site, part of 11G20, was relocated within the APE, however, the portion of 11G20 within the APE was determined ineligible for the NRHP. No other resources were located within the APE. A cultural
resources survey was conducted in the portion of the APE located in Union County, Kentucky on 14 January and 24 February 2021.

4.11.2 Environmental Consequences

4.11.2.1 No Action
Under the No Action Alternative, identified cultural resources and/or historic properties potentially eligible for listing to the NRHP will continue to be affected by the changing hydrology of the Ohio and Wabash rivers, the extent of which will depend largely on regional rainfall, storm run-off, sediment transport, channel development, and the operation of existing USACE flood and navigation infrastructure. To date, sites 11G161 and 11G162 have been partially or completely eroded by the waters of Ohio and Wabash rivers.

4.11.2.2 Proposed Action
Implementing the proposed action is expected to have no adverse effect on cultural resources and/or historic properties that were determined eligible for listing to the NRHP and located within the APE. Concurrence from the IL SHPO, Quapaw, Cherokee, and Osage was sought on 19 November 2020 and the USACE had received concurrence from all parties. The Corps completed consultation under Section 106 of the NHPA with a formal determination of effect on 16 January 2021. As proposed in the findings document, an archaeological monitor will be present for all ground disturbing activities located within the APE near Dike 5 (USACE 2020, SHPO Log #004042220). Should unanticipated cultural resources be discovered during construction activities, work will cease immediately and follow the regulatory guidance set forth by 36 CFR part 800.13 for Post Review Discoveries and the consulting parties will be notified.

The USACE has found that no historic properties would be adversely affected by project actions. Though 11G161 was not relocated, it is mapped within the boundaries of Dike 5 and it is recommended that an archaeological monitor be present during ground disturbing activities at this location. USACE received concurrence with these findings from responding parties on 4 February 2021 (USACE 2020).

4.12 Hazardous, Toxic, and Radioactive Waste Materials (HTRW)

4.12.1 Existing Condition
There are no known permitted hazardous waste disposal facilities in immediate proximity to the Wabash Dikes Project and there are no known sites of hazardous, toxic, or radioactive materials in the Action Area.

4.12.2 Environmental Consequences

4.12.2.1 No Action
Under the no action alternative, the Wabash Dike Project would not be constructed in the foreseeable future and there would be “no change” from current levels of or risks associated with HTRW in the Action Area. Because these substances are not found near the Action Area, no effect to current levels or risks associated with HTRW is expected as a result of implementing the No Action Alternative.
4.12.2.2 Proposed Action

Implementing the Wabash Dikes Project would be expected to have no effect on HTRW materials as there are no known pre-existing sources on or near the Action Area. While the potential to create HTRW materials as a result of equipment malfunction or failure during the construction process exists (e.g., fluid leaks from heavy equipment), best management practices and regular equipment maintenance reduce these risks. The majority of construction-related work will be completed offshore; the possibility of storage, fueling, and lubrication of equipment and motor vehicles associated with the construction process (e.g., pavers, trenchers, cement trucks) would be conducted in a manner that affords the maximum protection against accidents and spills.

4.13 Aesthetics/Visual Qualities

4.13.1 Existing Condition

The Action Area includes diverse scenic and natural resources; the area surrounding the project is sparsely populated and is mostly agrarian. For reference, ordinary high water is elevation 341.5.

4.13.2 Environmental Consequences

4.13.2.1 No Action

Under the No Action Alternative, USACE would not complete the proposed Wabash Dikes Project; the dike structures would not be constructed which would result in “no change” from current aesthetics or visual qualities of the Action Area. In this scenario, development and management of the Action Area would likely take the same general direction and would generally share the same environmental consequences. The No Action Alternative will fail to address the ongoing threat of shoreline erosion in the Action Area which has the potential to negatively affect the aesthetics or visual qualities of the site.

4.13.2.2 Proposed Action

While the project area is a sparsely populated area, the construction of the Wabash Dikes Project will have a minor effect on the aesthetics/visual qualities of the Action Area, as equipment is staged and construction activities are underway. The Illinois dikes are expected to extend into the river at elevation 312.0, while the Wabash Island dikes would extend into the river at elevation 330. Except for low flow conditions, dike structures on Wabash Island will be below the water surface. The dikes constructed on the Illinois side of the project will remain under water year-round. Above the waterline, all dike structures will be exposed where the dikes tie into the shore, at least until the interstitial spaces of the rock pilings are filled in by sediment and ultimately colonized by plants.

While evidence of the dikes will persist in some sections of the Action Area, many of the areas that remain visible will be slowly covered by detritus and soil and ultimately be colonized by plants and algae, potentially limiting or obscuring their aesthetic/visual impact.
4.17 Noise

4.17.1 Existing Condition

Changes in noise are typically measured and reported in units of dBA, a weighted measure of sound level. Because the project area is sparsely populated, the primary sources of anthropogenic noise within the Action Area are limited to the movement of barges and pleasure craft up and down the Ohio River, aircraft, and the use of farm equipment. Few roads are located near the site and they are small un-improved roads generally used for access to farm fields. Noise ranging from about 10 dBA for the rustling of leaves to as much as 115 dBA (the upper limit for unprotected hearing exposure established by the Occupational Safety and Health Administration) may occur on the Ohio River via sources such as pleasure craft, barge traffic, and the use of farm machinery. The rural nature of the area also means that a relatively small number of people may be impacted by any noise generated in the Action Area.

4.17.2 Environmental Consequences

4.17.2.1 No Action

Under the No Action Alternative, USACE would not complete the proposed Wabash Dikes Project which would result in “no change” from current noise levels near the Action Area. In this scenario, development and management of the Action Area would likely take the same general direction and would generally share the same environmental consequences. Because the No Action Alternative will fail to address the ongoing need for dredging in the Action Area, this alternative has the potential to have a periodic negative affect on the soundscape of the Action Area, i.e., increased noise levels estimated to be between 60 and 100 dBA at 100 feet when dredge activities are occurring.

4.17.2.2 Proposed Action

Implementing and construction of the Wabash Dike Project would be expected to have a negligible and short-term effect on the level of background or ambient noise of the Action Area. The primary sources of noise would include the movement of barges and the use of construction equipment used during the construction of the dike structures. These impacts would be temporary and localized in nature.
5 SUMMARY OF ENVIRONMENTAL EFFECTS

If and when the Wabash Dikes Project is implemented, the loss or modification of potential habitat and other localized and temporary construction-related effects (e.g., diesel/gasoline engine emissions, noise, fugitive dust, changes in the aesthetics of the area) is expected to be the extent of the environmental consequences. None of these impacts are expected to be significant and most will be temporary in nature. Table 7 provides a summary of the potential environmental effects caused as a result of implementing the Proposed Alternative.

Table 7. Summary of Environmental Effects Caused by the Proposed Alternative (PA).

<table>
<thead>
<tr>
<th>Environmental Resource</th>
<th>Degree of Effect caused by PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commerce, Recreation, and River Navigation</td>
<td>Beneficial</td>
</tr>
<tr>
<td>Climate</td>
<td>No Effect</td>
</tr>
<tr>
<td>Air Quality</td>
<td>Negligible</td>
</tr>
<tr>
<td>Topography, Geology, and Soils</td>
<td>Negligible</td>
</tr>
<tr>
<td>Surface Water Hydrology and Groundwater</td>
<td>No Effect</td>
</tr>
<tr>
<td>Water Quality</td>
<td>Negligible</td>
</tr>
<tr>
<td>Habitats</td>
<td>Minor, short-term</td>
</tr>
<tr>
<td>Listed Species</td>
<td>No Effect</td>
</tr>
<tr>
<td>Demographics and Environmental Justice</td>
<td>No Effect</td>
</tr>
<tr>
<td>Recreation and Visitation</td>
<td>No Effect</td>
</tr>
<tr>
<td>Cultural Resources</td>
<td>No Effect</td>
</tr>
<tr>
<td>Hazardous, Toxic and Radioactive Waste Materials</td>
<td>No Effect</td>
</tr>
<tr>
<td>Aesthetic/Visual Qualities</td>
<td>Minor, long-term</td>
</tr>
<tr>
<td>Noise</td>
<td>Negligible</td>
</tr>
</tbody>
</table>
6 COMPLIANCE WITH ENVIRONMENTAL LAWS

Construction of the proposed Wabash Dikes Project would not commence until the proposed actions achieve environmental compliance with the applicable laws and regulations, as described below. Environmental compliance for any proposed actions would be achieved upon coordination of this Environmental Assessment with appropriate agencies, organizations, and individuals for their review and comments.

Bald and Golden Eagle Protection Act, 16 U.S.C. 668a-668d.

*In compliance.*

The Bald and Golden Eagle Protection Act contains requirements on Corps of Engineers projects concerning bald and golden eagles. Approval and implementation of the proposed Wabash Dikes Project would not adversely affect bald eagles or their habitat. A field survey conducted on 10 June 2020 documented no evidence that bald or golden eagles currently nest in the project area.

Clean Air Act, as amended, 42 U.S.C. 7401, *et seq.*

*In compliance.*

The purpose of this Act is to protect public health and welfare by the control of air pollution at its source, and to set forth primary and secondary National Ambient Air Quality Standards to establish criteria for States to attain or maintain. Minor and temporary releases (e.g., fugitive dust, internal combustion engine emissions) would occur in the course of construction of the Project. However, these emissions would be short term, small-scale, and the effect on air quality in the Action Area would be negligible.


*In compliance.*

The objective of this Act is to restore and maintain the chemical, physical and biological integrity of the Nation’s waters. The USACE regulates discharges of dredge or fill material into waters of the United States pursuant to Section 404 of the Clean Water Act. This permitting authority applies to discharge of dredged or fill material into Waters of the United States. For USACE projects involving the discharge of dredged or fill material into Waters of the United States, USACE does not issue permits to itself, but evaluates proposed discharges under the same guidelines developed by the United States Environmental Protection Agency (known as the Section 404(b)(1) guidelines) that apply to non-USACE projects. Because the Wabash Dikes Project will result in the placement of fill material into the Ohio River, evaluation under Section 404(b)(1) is required, and a Section 401 WQC from the states in which the discharge originates will be obtained. Section 404(b)(1) analysis for the Wabash Dikes Project has been completed in is included in Appendix A.

Not applicable.

CERCLA is triggered by (1) the release or substantial threat of a release of a hazardous substance into the environment; or (2) the release or substantial threat of a release of any pollutant or contaminant into the environment that presents an imminent threat to the public health and welfare. To the extent such knowledge is available, 40 CFR Part 373 requires notification of CERCLA hazardous substances in a land transfer. The implementation of the proposed Wabash Dikes Project would not involve the hazardous substances, pollutants, or contaminants.

Endangered Species Act, as amended (ESA), 16 U.S.C. 1531, et seq.

In compliance.

Section 7 of the ESA (16 U.S.C. 1536) states that all Federal departments and agencies shall, in consultation with and with the assistance of the Secretary of the Interior (Secretary), insure that any actions authorized, funded, or carried out by them do not jeopardize the continued existence of any threatened or endangered (T&E) species, or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary to be critical.

This EA (and accompanying Biological Assessment) serves as a means with which evaluations are made regarding the potential effects on listed species as it relates to the proposed Wabash Dikes Project. This effort has resulted in a determination of no effect to the spectaclecase (Cumberlandia monodonta), fanshell (Cyprogenia stegaria), purple catspaw (Epioblasma obliquata), northern riffleshell (Epioblasma rangiana), ring pink (Obovaria retusa), orangefoot pimpleback (Plethobasus cooperianus), sheepnose (Plethobasus cyphyus), clubshell (Pleurobema clava), rough pigtoe (Pleurobema plenum), and the fat pocketbook (Potamilus capax). The threatened mussel species potentially affected by activities in this location is rabbitsfoot (Theliderma cylindrica), interior least tern (Sterna antillarum), Short’s bladderpod (Physaria globosa), rusty patched bumble bee (Bombus affinis), gray bat (Myotis grisescens), Indiana bat (M. sodalis), and northern long-eared bat (M. septentrionalis).

Environmental Justice (E.O. 12898).

In compliance.

Federal agencies shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States. The Wabash Dikes Project is expected to have no effect on minority or low-income populations.
Fish and Wildlife Coordination Act, as amended (FWCA), 16 U.S.C. 661, et seq.

In compliance.

The FWCA requires governmental agencies, including USACE, to coordinate activities so that adverse effects on fish and wildlife would be minimized when water bodies are proposed for modification. For the Wabash Dikes Project, all modifications to the existing environment are limited in scope and, when implemented with the BMPs designed to limit potential impacts, negative effects to the surrounding environment are expected to be short-term in nature. Once construction of the dike structures is complete, there is expected to be a net long-term benefit to fish and aquatic macroinvertebrate communities as the dike structures stabilize the area and provide slack areas in which these communities can reside.


In compliance.

The Migratory Bird Treaty Act of 1918 (MBTA) is the domestic law that implements the United States' commitment to four international conventions with Canada, Japan, Mexico, and Russia for the protection of shared migratory bird resources. The MBTA governs the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts and nests. The take of all migratory birds is governed by the MBTA's regulation of taking migratory birds for educational, scientific, and recreational purposes and requiring harvest to be limited to levels that prevent over utilization. Executive Order 13186 (2001) directs agencies to take certain actions to implement the act. USACE will afford an opportunity for the USFWS (through their review of the draft EA and BA) to provide input with regard to their consideration of the effects of the Wabash Dikes Project for potential effects on migratory birds. No effects to migratory birds are anticipated.


In compliance

The NHPA requires that federal agencies having jurisdiction over a federal or federally assisted undertakings will consider their effects to historic districts, sites, buildings, structures, or objects that are listed on, or determined eligible for inclusion to, the NRHP. The project activities were determined to have no effect to historic properties (CFR 800.4(d)(1)) for the project area located in Illinois and concurrence was reached on 4 February 2021. A formal no effect to historic properties determination was coordinated with the Kentucky State Historic Preservation Office and concurrence was reached on 15 June 2021.

National Environmental Policy Act (NEPA), as amended, 42 U.S.C. 4321, et seq.

In compliance

This EA and Finding of No Significant Impact (FONSI) have been prepared in accordance with the Council on Environmental Quality's NEPA Implementing Regulations (40 CFR 1500-1508). An Environmental Impact Statement (EIS) is not required.

In compliance.

This Act establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. Federal agencies are required to limit noise emissions to within compliance levels. Noise emission levels in the Action Area would increase above current levels temporarily due to geological surveys and construction of the Project. Appropriate measures would be taken to keep the noise level within compliance levels.


In compliance.

This law requires authorization from the Secretary of the Army, acting through USACE, for the construction of any structure in or over any navigable water of the United States, or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters. The creation of any obstruction to the navigable capacity of any of the waters of the United States is unlawful unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army.

Floodplain Management (E.O. 11988).

In compliance.

Section 1 requires each agency to provide leadership and take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities. The actions occurring as a result of completing the proposed Wabash Dikes Project are not expected to affect the flood holding capacity or flood surface profiles of the Ohio River.

Protection of Wetlands (E.O. 11990).

In compliance.

Federal agencies shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency’s responsibilities. Each agency, to the extent permitted by law, shall avoid undertaking or providing assistance for new construction located in wetlands unless the head of the agency finds (1) that there is no practicable alternative to such construction, and (2) that the Proposed Action includes all practicable measures to minimize harm to wetlands, which may result from such use. While the actions identified in the proposed Wabash Dikes Project would involve the loss or alteration of seasonally inundated wetland habitats, the total acreages involved are very low; the wetland habitats present are only seasonally inundated and may be considered to be of marginal ecological significance.
Late in the course of development of the Wabash Dikes Project, the PDT was made aware of an existing conservation easement on sections of property within the project footprint. The easement currently held by the National Resources Conservation Service (NRCS) of the United States Department of Agriculture (USDA) encumbers approximately 99+/- acres, corresponding to Dikes 4 - 7 (on the Illinois shoreline of the project area).

The stated purpose of the conservation easement is “... to restore, protect, manage, and maintain the functional values of wetlands and other lands for fish and wildlife habitat, water quality improvement, flood water storage and retention, groundwater discharge, open space, aesthetic values, the reduction of soil erosion and sedimentation, and environmental education.” Restoration efforts planned by NRCS include bottomland tree plantings on 24 acres and the conversion of an additional 27 acres of agricultural field with native grass plantings. Through informal correspondence, NRCS personnel have expressed the view that the construction the Wabash Dikes Project is fundamentally compatible with the restoration prescriptions and conservation goals of the easement. Over the long-term, the construction of the dikes has the potential to improve conditions that currently hamper restoration and conservation efforts by reducing erosion and stabilizing the shoreline and hydrology of the area.

At the time of writing, coordination efforts are ongoing to determine what arrangements, agreements, mitigation, or other actions may be required in order for USACE to move forward with the easement acquisitions.

7 Public Involvement

On 12 May 2021, the draft Wabash Dikes EA (this document), BA, and 404(b)1 document was released to concerned agencies, organizations, and the interested public for a 30-day public review period, in compliance with 40 CFR 1501.6(a)(1). No comments were received during this review period. Additional correspondence from various agencies and/or tribes are included in Appendix B of this document.
8 REFERENCES


U.S. Army Corps of Engineers (USACE). 1996. ER 1130-2-550, Project Operations. –


Appendix A

Supporting Materials
Appendix B

Agency and Tribal Coordination