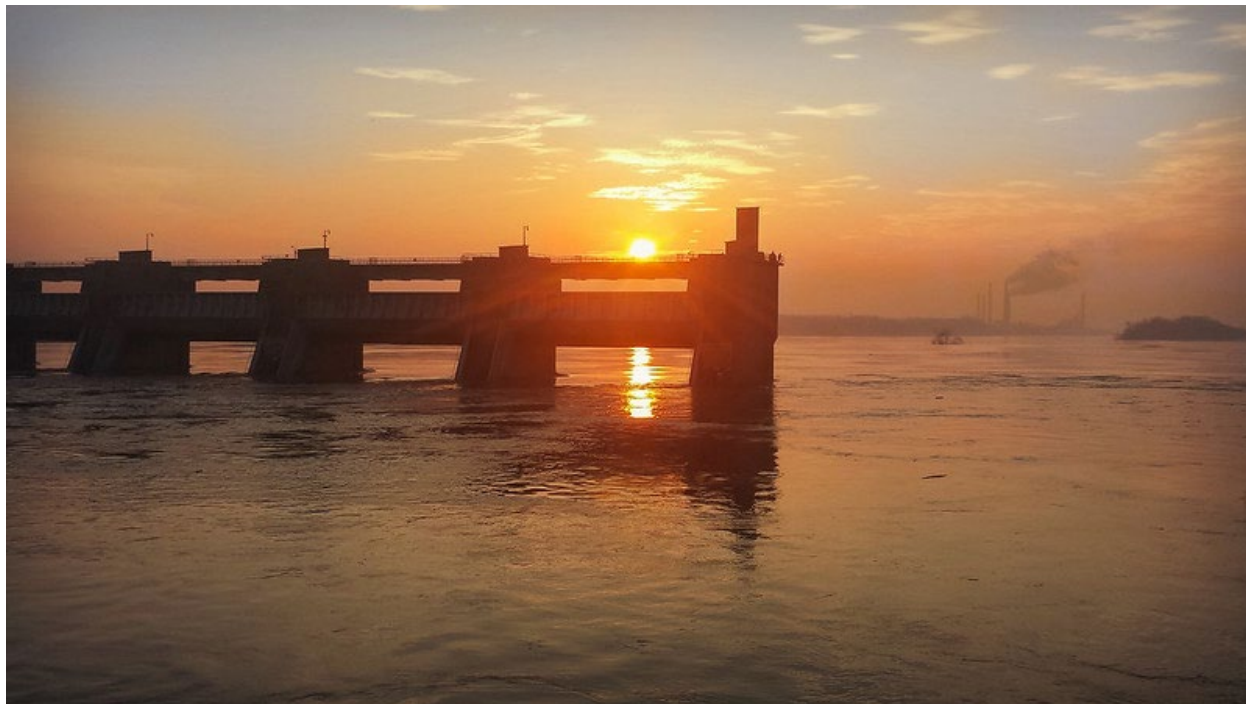




US Army Corps  
of Engineers®

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# **Plan for the Ohio River Basin**

## **—2020 - 2025 —**

Planning Assistance to States Study

# Plan for the Ohio River Basin

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Front Cover Photo: *Sunrise over the Newburgh Locks and Dam, Newburgh, Indiana. (U.S. Army Corps of Engineers Louisville District photo by Cork McMannis)*

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## **1.0 Introduction**

### **1.1 Study Purpose**

This report is prepared by the U.S. Army Corps of Engineers (USACE) Louisville District in collaboration with the Ohio River Valley Water Sanitation Commission (ORSANCO) and the Ohio River Basin Alliance (ORBA). The purpose of this study is to create an Ohio River Basin-wide strategy, modeled after similar collaborative efforts that have achieved notable success in many other major river basins such as the Federal Great Lakes Restoration Initiative. The study entails a collaborative, multi-state effort to create a "blueprint" that presents goals, objectives and actions for general improvements in economic health, ecological well-being, and quality of life for residents throughout the Basin.

Federal agencies will not participate in strategic actions involving advocacy. Unless otherwise noted, advocacy will be facilitated by ORBA in collaboration with existing interested non-federal organizations and agencies

### **1.2 Ohio River Basin Overview**

The Ohio River Basin covers 204,000 square miles encompassing parts of 15 states. It is home to over 25 million people equaling 10% of the population of the United States. The Ohio River alone is 981 miles long and runs from the confluence of the Allegheny and the Monongahela Rivers in Pittsburgh, Pennsylvania and ends in Cairo, Illinois. Along the way the Ohio River provides drinking water to several million people (Ohio River Foundation, 2020) (Figure 1). Other systems in the Ohio River Basin include the Cumberland River which is 688 miles long, draining about 18,000 square miles of Kentucky and Tennessee before joining the Ohio River. The Tennessee River is 652 miles long from its confluence with the Holston River, flowing from Virginia and North Carolina, and the French Broad River flowing from North Carolina. Other major systems include the Kentucky, the Allegheny, the Wabash and the Miami Rivers, to name a few. The Tennessee is the largest tributary of the Ohio River. The Ohio River and its tributaries run through diverse landscapes including forests, agricultural, and urban lands and are home to 164 species of fish and over 100 species of mussels, including a number of threatened and endangered species.



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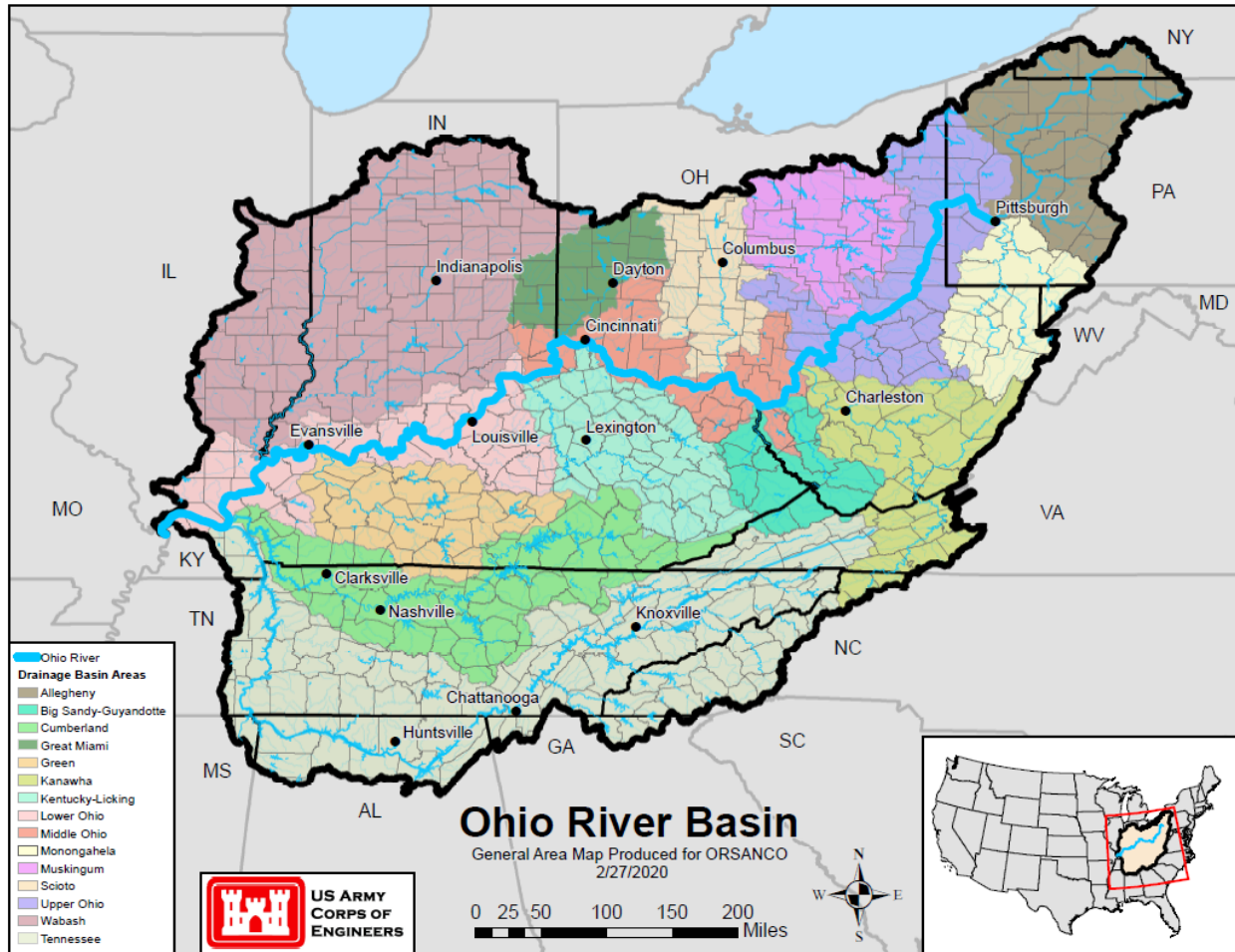


Figure 1: The 204,000 square mile Ohio River Basin.

The waters contained in the Ohio River Basin provide a wide range of functions including reliable and safe drinking water; transportation of goods and people; and ecosystem services such as flood control, recreation, and supporting diverse wildlife.

The Ohio River and its seven navigable tributaries comprise over 2,500 miles of waterways, upon which more than 270 million tons of coal, aggregates, chemicals, agricultural, industrial and petroleum products are transported annually. This waterway transportation provides a less costly means for companies to transport bulk goods, moving 35% of the nation's waterborne commerce. The Ohio River is home to 38 coal-fired power plants, representing 20 percent of nation's coal-fired electricity generation capacity (ORSANCO). The Ohio River provides more than half a million jobs and generates billions of dollars in business activity.

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Figure 2: ORSANCO organizes river clean ups annually.

The Ohio River Basin faces many challenges that threaten the health and security of its ecosystems and residents. For example, many of the locks and dams that are critical to the economic success of the water transportation system are beyond their 50-year design life and have to be shut down routinely for maintenance. This causes significant traffic delays for barges navigating the system (Inland Waterways, 2017).

According to the climate change models performed in the Ohio River Basin- Climate Change Pilot Study Report, a half- degree average temperature rise per decade is expected

for 2011-2040. That number increases to one whole degree Fahrenheit per decade for 2041-2099. Additionally, precipitation changes are expected to impact flows. These changing precipitation patterns drive increased water related challenges for agriculture, river transportation, water-dependent industries, and communities that require reliable water.

From 2005 to 2015, coal employment dropped by 51% in eastern Kentucky and by 39% in West Virginia. Societal and governmental responses to climate change may lead to continued shifts in the types of industry that operates in the Basin. For many people and Appalachian counties, this is a disorienting economic crisis. For inland waterways transportation industries, this is also a challenge as coal has been the backbone commodity of the Basin. An important challenge is developing or attracting sustainable businesses that create good jobs and utilize the river transportation system and port infrastructure.

Urban runoff, agricultural activities, and abandoned mines are major causes of water pollution. Worse, soils and nutrients are being washed away from farmland at an order of magnitude greater rate than it can be replenished. Soil retention on farms is necessary for sustainable crop production and food security for the nation. When new industries produce new pollutants and emerging contaminants of concern are recognized, significant concerns should be addressed quickly, as the negative impacts of pollution will only become more expensive and difficult to remedy as time passes. Populations of wildlife are also at risk from pollution, as well as habitat destruction and invasive species. Habitat destruction may also increase flooding. Change in hydrologic regime, arising in part from loss of riparian zone and wetlands and loss of ash trees from the emerald ash borer, are major threats to habitat and water quality. Emerging contaminants of concern, impairment of recreational use due to bacteria contamination, excess nutrients, litter and debris and sedimentation also threaten the health and prosperity of the Ohio River Basin.

Non-native invasive species are moving year by year in the Basin and threaten native species and the values they provide - timber, fishing, and tourism as examples among many. Invasive species present within the Basin include Asian carp, zebra mussels, emerald ash borer, white-nose syndrome fungal pathogen, purple loosestrife, kudzu, and many other plant and wildlife species.

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These invasive species are capable of outcompeting native species for resources, causing disease, altering ecosystem functions, and causing harm to the economy, environment, and human health. The impacts of invasive species on our natural ecosystems and economy in the U.S. cost billions of dollars each year, and many of our commercial, agricultural, and recreational activities depend on healthy native ecosystems.

### 1.3 Organizations Facilitating the Ohio River Basin Planning

#### Ohio River Valley Water Sanitation Commission

ORSANCO was established on June 30, 1948 to control and abate water pollution in the Ohio River Basin. ORSANCO is an interstate commission representing eight states and the federal government. Member states include: Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia, and West Virginia. ORSANCO operates programs to improve water quality in the Ohio River Basin, with a current focus on the Ohio River, including: setting waste water discharge standards; performing biological assessments; monitoring for the chemical and physical properties of the waterways; and conducting special surveys and studies. ORSANCO also coordinates emergency response activities for spills or accidental discharges to the Ohio River, and promotes public participation in programs, such as the Ohio River Sweep (Figure 2).

#### Ohio River Basin Alliance

The ORBA, a collaboration of Ohio River Basin stakeholders and stakeholder organizations, was formed in 2009 to fill the need for an organization to speak for the Basin holistically by capturing the highest priorities of the numerous organizations of the Basin and advocating for the ecological health and economic well-being of this 'world class' basin through sound laws, policies, and projects, and the funds to support them. ORBA is a collaboration that includes more than 250 representatives from over 130 states, local and federal agencies, industry, academia, and nonprofit organizations in the Ohio River Basin. ORBA's purpose is to foster broad collaboration to advance education and science; promote the conservation of natural resources in the Ohio River Basin; and achieve sustainable economic growth, ecological integrity and public safety across and within political jurisdictions within the Ohio River Basin.

ORBA Mission: To maintain a successful collaboration that will recommend strategies and coordinate actions to address complex water resource challenges and priorities in the Ohio River Basin with a unified voice.

#### ORBA Goals:

- Determine and regularly re-assess the Basin's priorities;
- Facilitate discussions and collaborations among Basin stakeholders;
- Inform the Ohio River Basin Congressional Caucus on critical issues; and

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- Help facilitate the development, coordination and delivery of projects safely and in a timely manner.

### ORBA Guiding Principles:

- Include all Ohio River Basin stakeholders;
- Leverage existing authorities, resources and capabilities to accomplish ORBA's goals;
- Capitalize on existing collaborations; and
- Do not impede or infringe on the mission of any other organization.

### U.S. Army Corps of Engineers

The mission of the US Army Corps of Engineers is to deliver vital public and military engineering services; partnering in peace and war to strengthen our nation's security, energize the economy and reduce risks from disasters. There are four USACE district offices within the study area (Huntington, Nashville, Louisville and Pittsburgh) all of whom participated in the production of the ORSANCO Planning Assistance to States study.

The Ohio River Basin contains numerous and diverse USACE owned and operated projects. The projects comprise both flood risk management infrastructure as well as navigation projects. Flood risk management includes approximately 83 reservoirs and more than 100 local protection projects (e.g. levees and floodwalls). Seventy-eight of the dams are multipurpose structures that store and discharge quantities of water that support human activities and ecological systems. In addition to flood risk management, these multipurpose projects provide water supply, hydropower, low-flow augmentation that supports downstream water quality and aquatic ecosystem purposes, recreation, fish and wildlife management and other authorized purposes. Navigation projects along the Ohio River are incredibly important to the economy as more than \$41 billion in freight, commodities and manufactured goods transit the Ohio River system annually.

## 1.4 Planning Assistance to States Study

Driven by ORSANCO, and later by the Clean Water Act and other environmental regulations, billions of dollars have been invested by states, the federal government, and communities to improve water quality and restore ecosystems in the Ohio River Basin. In addition to the government initiatives, many agricultural, business, and watershed organizations have been integral to the Basin improvement. While there has been substantial progress over the past 70 years, much work remains to address both existing and emerging challenges. Resources are likely to be adequate to continue progress if water resources and ecosystems are a high priority. Clear priorities for the Ohio River Basin were identified as a critical need by the U.S. Environmental Protection Agency (U.S. EPA), USACE, and ORSANCO at their inaugural 2009 Summit. The Summit is now an annual event where Basin stakeholder groups come together to discuss and plan improvements throughout the Basin.

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Since the 2009 Summit in Covington, Kentucky, one or more of the key Ohio River organizations identified above planned and facilitated eleven collaborative summits in five Basin states as well as coordinated webinars and focus groups that were key to developing the goals of the PAS study:

Columbus, OH (2010)  
Charleston, WV (2010)  
Indianapolis, IN (2011)  
Huntington, WV (2011)  
Nashville, TN (2012)  
Pittsburgh, PA (2012)  
Louisville, KY - with the America's Watershed Initiative (2013)  
Cincinnati, OH - with the Ohio River Basin Consortium for Research and Education (ORBCRE) (2016)  
Huntington, WV - with ORBCRE (2017)  
Covington, KY - with ORBCRE (2018)  
Athens, OH - with ORBCRE (2019)  
Webinar Series- 5 interactive stakeholder webinars to discuss the priorities for each of the goals (Summer 2019)  
Pittsburgh, PA, Cincinnati, OH and Nashville, TN- Focus group series (January 2020)

This resulted in the development of the six driving goals adopted by ORBA, and the USACE study that resulted in the report entitled: Ohio River Basin - Formulating Climate Change Mitigation/Adaptation Strategies through Regional Collaboration.

To help build upon this extensive background of cooperation, this Planning Assistance to States (PAS) initiative facilitated broad collaboration to develop this Ohio River Basin-wide Strategic Plan with strategies to advance Ohio River Basin goals (Table 1). Two goals were added to the original six to better guide conversations during the outreach effort.

### Strategic Goals

- **Abundant Clean Water**
- **Healthy Productive Ecosystems**
- **Knowledge Informed Decisions**
- **Nation's Most Valuable River Transportation Corridor**
- **Reliable Flood Control and Risk Reduction**
- **Timely Change Adaption and Resilience**
- **Vibrant Economy**
- **World-Class [Nature-based] Recreation Opportunities**

*Table 1: Eight goals were adopted at the beginning of the study. Through the planning process, Timely Change Adaption and Resilience and Vibrant Economy were removed and combined under the other goals.*



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*Figure 3: USACE project team members facilitate focus groups in Pittsburgh, PA.*

Key activities to establish strategic plans for each Ohio River Basin goal include:

- Holding a stakeholder webinar in which an array of state collaborations, organizations and interested stakeholders were invited to help identify gaps in collaborations, stakeholders, and strategic documents that should be included.
- Holding four webinars, each focused on two of the original goals, in which experts representing stakeholders for the goal areas were invited to participate specifically to help

ensure that there were no significant gaps in the priorities for each goal area.

- Holding eight goal-focused, facilitated discussions (described in Section 1.5) at the 2019 ORBA Summit to vet the strategies identified through the efforts to date, to seek any higher priorities that are missing, and to evaluate the level of consensus on the strategies for each goal.
- Following the Summit, focus groups (Figure 3) (described in Section 1.5) were convened for any goal area that lacked a consensus set of objectives and strategic actions in order to refine the goals so that consensus could be reached.
- Preparing and circulating a formal draft strategy among key stakeholders for comment.

## 1.5 Ohio River Basin Collaborative Planning Process

### Stakeholder Outreach

This collaboration strives to engage all organizations in the planning process to create a strategic plan to address the myriad of issues in the Ohio River Basin. While federal, state and local governments have vested interest in the river, non-governmental organizations are vital to the discussion of the needs and wishes of the people and wildlife in the Basin. Through the planning process, USACE and ORSANCO/ORBA strived to include non-profits, universities, private sector organizations and tribal groups that all have unique goals and priorities.

The focal point of the outreach process for this study was ORBA/ORBCRE Summit held at Ohio State University in Athens, OH on October 2-4, 2019. This is an annual symposium for non-profits, universities, government agencies, and other entities working within the Ohio River Basin to come together to address regional water-related issues and stimulate solutions. The

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theme for 2019 was “Managing our Water in a Changing World: from Social, Environmental, and Policy Perspectives”. Additionally, breakout groups were held during the conference to enable stakeholders to provide input for this PAS study.

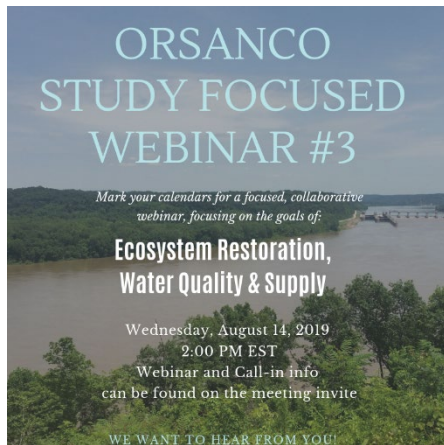


Figure 4: Digital notices were sent out to stakeholders for the five webinars.

Leading up to the Summit, USACE and ORSANCO/ORBA worked together to create stakeholder lists and pertinent strategic document lists. Initial outreach efforts were accomplished through a series of webinars. This series began with a kick-off meeting that gave general information about USACE and the non-federal sponsors, provided a brief overview of the PAS study process, and began collecting input from stakeholders. Four additional webinars were held that focused specifically on goal areas. The webinars were intended to begin the engagement process and reach out to key organizations within the Basin (Figure 4).

Stakeholder engagement was approached at the Summit by organizing eight breakout groups, each centered on one of the preliminary strategic goals (see Table 1).

Each breakout group was assigned a facilitator and a moderator to guide the discussion and keep activities within the given time frame. A scribe was also assigned to ensure that all discussion was recorded accordingly. It was explained to participants that solutions would be reached by consensus, meaning that as long as participants could “live with it” the solution or strategy should not be ruled out.

Each session was an hour long and began with a brief presentation on the study, the eight goals, and the objective of the focus goal for that hour. The facilitator then presented the existing strategic documents that the study team had identified and asked for feedback from participants on other Basin-wide reports of which they were aware. Responses were recorded by the moderator (Figure 6).

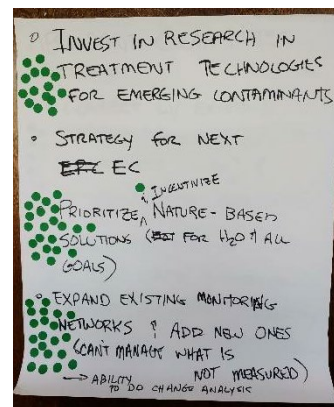


Figure 5: Dot voting was used at the Summit breakout groups to help prioritize strategies.

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*Figure 6: After facilitated discussion for strategies under each goal, participants were asked to vote on their priorities and place a red dot on any “showstoppers”.*

The facilitator then gave an overview of the existing strategies that had been either collected from the existing documentation or gathered from input during the webinars. The participants were asked to add strategies they felt were missing or revise any existing strategy they felt was not complete or incorrect. Additionally, groups also voted on their top priority strategic actions with dot voting (Figure 5).

During the process of synthesizing the input from the Summit, the number of goals was cut from eight to six. Both the vibrant economy and adaptive and resilience goal were incorporated either within other goals or as an overarching ideal of the strategic document.

The last outreach effort of the study consisted of a series of focus groups. During the week of January 26, 2020, focus groups were held in Pittsburgh, Cincinnati and Nashville. The intent of these meetings was to refine and revise the existing objectives and strategies that were synthesized from the previous outreach activities. The focus groups consisted of small group activities with focused discussion on objectives and strategies organized by goal. A larger group discussion was held to focus on the Knowledge and Education to Inform Decisions goal. This goal was the least fleshed out up to this point and warranted more holistic discussion.

Throughout the outreach process, stakeholder input was synthesized and incorporated into the existing draft of the strategic document. A formal draft was submitted to key stakeholders for comment at the end of February 2020. Comments were addressed and incorporated into this final Ohio River Basin-wide Strategy.



## **2.0 Foundational Elements**

### **2.1 Vision Statement:**

Through collaboration with a diverse mix of organizations working in the Ohio River Basin, we envision a basin that is a healthy, clean, and productive system that sustains ecosystems and provides valuable services for all, now and in the future.

### **2.2 Values:**

Through the planning process, several themes arose that crossed the boundaries between goals to provide guidance by setting the overarching values of this plan. While these did not contribute directly to the objectives and strategies presented, they are underlying principles that the stakeholders hope permeate throughout the plan.

- **Comprehensive, Connected System** There is a need to consider the Ohio River Basin as a connected system; solutions should be approached from this perspective in order to impact the Basin as a whole. In the same measure, it is imperative that input be gathered from a wide array of stakeholders, including both governmental and non-governmental organizations. Having a comprehensive approach that recognizes the interconnectedness of the river system as well as the entities working within the Basin will provide solutions that address the complexity of the system and the correlated impacts of those working to improve it.



*Figure 7: Healthy aquatic and riparian ecosystems must be sustained throughout the Basin. Here, a Spring Azure butterfly shares a Poison Hemlock flower with a beetle and bee.*

- **Long Term Considerations** This plan strives to incorporate long term strategic actions that ensure that climate change, resiliency and sustainability are all prioritized and influence the preferred strategies. The plan will incorporate identification and preparation for slow-developing or non-linear threats, such as droughts, increased flooding, human population impacts, disruptive technologies, earthquakes, and infrastructure disturbances into all goals. This plan acknowledges that climate changes needs to be addressed locally, regionally, nationally and globally to prevent the impacts from warming temperatures.

Inaction will only exacerbate efforts to restore and protect the Ohio River Basin (Figure 7).

- **Nature-Based Considerations** Prioritize and incentivize nature-based solutions in order to take an innovative, environmentally sensitive approach to problem solving. These solutions include the consideration of positive ecosystem restoration opportunities in transportation infrastructure and flood risk management projects.

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- **Research and Education** Ensure that research and education accelerates improvement in the Ohio River Basin, including the promotion of further academic studies of climate change to reduce uncertainty of future conditions. Ensure that the education program, focused on K-16 and community organizations, furthers a wider base of support and understanding of the ecological and environmental issues facing the Ohio River Basin.
- **Consideration of Vulnerable Populations** Prioritize the needs and vulnerabilities of at-risk, low-income or underserved communities given the history of ecological and social injustice. Ensure that all strategic actions are just and equitable with a focus on flood risk management measures that target areas most in need, address issues of environmental justice, and recognize the importance of tribal communities' contributions to our culture and history. Giving representation to vulnerable populations when decisions are being made can help support restoration priorities, policy solutions, and investment decisions that lead to equitable and just outcomes so that all of the people in the region benefit from the implementation of the regional strategy.
- **Active Public Engagement** Elevate pride of place in the Ohio River Basin by engaging the public broadly with the benefits of the streams and rivers of the Basin and the services they provide. Provide easy access to the recreational infrastructure that gets people on and by the streams and rivers. Encourage the public to participate in citizen science initiatives. Utilize social media and other communications to connect with and educate citizens (Figure 8).



*Figure 8: Public engagement at USACE lake.*

### **3.0 Goals**

The goals provide for long term end products of the plan based on the different areas of concern throughout the Basin. The study team, including USACE, ORBA, ORSANCO and other stakeholders, agreed on these goals during the planning process to provide comprehensive strategies and solutions for the Ohio River Basin. The goals are qualitative and are meant to guide the objectives as well as guide the function of working groups aligned with the goals.

**Abundant Clean Water:** Ensure the quality and quantity of water in the Ohio River Basin is adequate to support the economic, social, and environmental functions that are dependent on it.

**Healthy and Productive Ecosystems:** Conserve, enhance, and restore ecosystems within the Ohio River Basin to support natural habitats and the fish and wildlife resources that depend upon them.

**Knowledge and Education to Inform Decisions:** Ensure that research and education adequately inform Ohio River Basin-wide economic, social, and environmental decisions; enhance the profile of education organizations in the Basin that synergize efforts to garner effective public involvement in the stewardship and management of the Basin's resources.

**Nation's Most Valuable River Transportation and Commerce Corridor:** Provide for safe, efficient, and dependable commercial navigation within the Ohio River Basin to ensure a competitive advantage for our goods in global and regional markets; sustain a water use system to efficiently and effectively support agricultural, industrial, and energy productivity.

**Reliable Flood Risk Management:** Provide reliable flood risk management through well-managed and maintained infrastructure, including appropriate floodplain connections for water conveyance and ecosystem benefits, and management of surface and storm water runoff to better protect life, property, and economies.

**World-class Nature-based Recreation Opportunities:** Enrich the quality of life for people and recreation-based economies by maintaining and enhancing riverine, lake, and wetland-associated recreation within the Basin.

### **4.0 Objectives and Strategies**

The objectives below are meant to meet each goal and are quantitative in nature. The strategies under each objective are meant to be tangible steps that can be taken to meet the given objective. Each strategy is color coded based on theme as shown in Table 2 below.

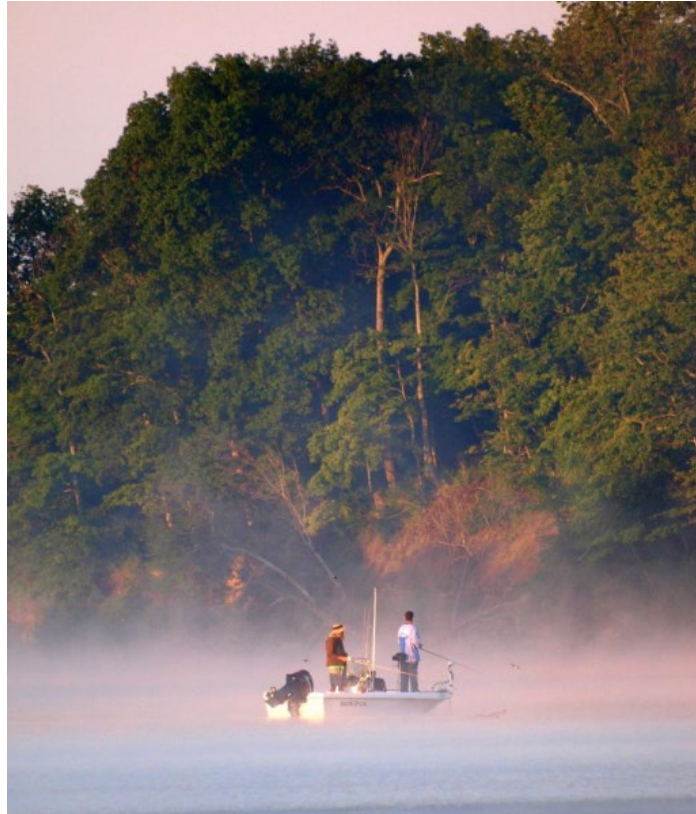
Funding
Partnerships/Collaboration
Advocacy Targets
Data Collection/ Monitoring
Analysis/Reporting/Outreach

*Table 2: Each strategy is color coded by theme.*

### 4.1 Abundant Clean Water

The Ohio River Basin's abundant supply of clean, fresh water is vital to the regional economy and the health of its natural and human communities (Figure 9). Recognizing this, federal and state laws have been designed to ensure that water quality is sufficient to allow for a safe and sustainable public water supply, water-dependent economic activities, agriculture, healthy fish and wildlife populations, and water-related tourism and recreation. Additionally, water quality is increasingly linked to water quantity, as governments address the threat of water shortages due to the extremes in flooding and drought events anticipated with future climate change in the Basin (Drum et al, 2017).

Basin states and the U.S. EPA, in collaboration with ORSANCO, Cumberland River Compact, Tennessee Valley Authority (TVA), conservation organizations and federal agencies have made significant progress, yet work remains to improve water quality to levels that support sustainable use while maximizing benefits. Challenges such as non-point source pollution, legacy and emerging contaminants, and uncertainty associated with climate change remain. Non-point source pollution, exacerbated by impervious surfaces and flashy streams, conveys soil and associated contaminants into the Basin's waters on a routine basis. Beneficial uses and engineered activities can have short- and long-term side effects that can degrade water quality by suspending sediments and contaminants into the water column for downstream transport, negatively impacting aquatic habitat and biological communities. Monitoring is a critical action to inform decision making. There is a need to continue support for or expand coordination of monitoring for core physical, chemical and biological indicators throughout the Basin. Harmful Algal Blooms (HABs) are a routine and documented item of concern in waterbodies across the Basin including USACE reservoirs because of the cyanotoxins they produce and the harm they can cause to aquatic ecosystems (e.g. dissolved oxygen depletion). Of late, two unprecedented bloom events have occurred in the Ohio River (2015, 2019), causing serious health risks and economic impacts throughout the Basin. In response, ORSANCO organized communication and monitoring activities, utilizing its HAB monitoring and response plan that included state, federal, and local agencies and utilities. These efforts proved to be critical in obtaining the data necessary to properly advise the public of HAB risk.



*Figure 9: Safe fishing in the waters of the Ohio River Basin requires clean water.*



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Hydropower dams on the Ohio River and its tributaries can also provide water quantity and quality data in addition to producing clean energy for Ohio River Basin residents. Currently there are over 130 hydroelectric facilities on dams within the Basin. As part of requirements of Federal Energy Regulatory Commission (FERC) licensing agreements, hydropower facilities collect water quality data, enhancing real-time and discrete datasets available to the USACE and other stakeholders. Additionally, hydropower activities improve local economies by providing jobs for local residents. The McAlpine Locks and Dam in Louisville, KY is one example of a hydropower dam on the Ohio River (Figure 10).



*Figure 10: The hydropower station at McAlpine Locks and Dam in Louisville, KY.*

While episodes of drought and flooding have occurred historically throughout the Ohio River Basin, these events have been isolated and infrequent. Climate change has the potential to increase the frequency and magnitude of extreme weather events, so testing the existing operating schemes and infrastructure will be important. Recognition of this may be driving a recent interest in obtaining water quality and water quantity data, resulting in a net increase in U.S. Geological Survey (USGS) gage sites throughout the Basin over approximately the past 10 years, with particular growth in Indiana and Ohio (J. Woods, personal communication, August 6, 2020). Improvements in water quantity modeling of the Ohio River, especially during low flow conditions, could provide significant benefits.

While many challenges to water quality and quantity exist such as bacteria impairments to recreational uses, legacy pollutant and other impairments - sufficient expertise in private, public and academic sectors are available to address needs, conduct research and answer questions that

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arise. Additionally, strong and longstanding partnerships exist in the Basin between state agencies, ORSANCO, U.S. EPA, USGS, USACE, TVA, other government agencies, universities, utilities, non-profits and other stakeholders. This provides a strong foundation and leverage for new efforts.

Objective 1: Organizations and states, enabled by the Clean Water Act will work collaboratively to demonstrate an increased number of water bodies that meet the Clean Water Act's drinkable, swimmable, and fishable uses by 2030 as compared to 2020.

*Strategic Actions (See Table 2 for color key):*

- Secure financial and other necessary resources through an Ohio River Basin Restoration Initiative and other appropriate funding mechanisms to support all Strategic Actions under this Objective (See Appendix 1). Examples of projects include: Water Control Manual Updates, Watershed Management Plans, and Environmental Infrastructure Projects.
- Develop and maintain a comprehensive Ohio River Basin geographic information system (GIS) platform to support Clean Water Act related initiatives such as water quality monitoring and assessment, location of critical assets, water quality standards attainment and other related initiatives.
- Support the actions of state, federal, interstate and other Ohio River Basin organizations to implement Clean Water Act designated use requirements through improved water quality standards attainment; Basin state water quality protection efforts; the Ohio River Valley Water Sanitation Compact; and Ohio River Basin watershed organizations' missions to improve water quality for water bodies within the Ohio River Basin leading to improved use attainment.
- Support state, federal, interstate and other strategic organizations' efforts to monitor and assess the presence and health risks of Contaminants of Emerging Concern, such as per- and polyfluoroalkyl substances (PFAS), mercury, microplastics, 1,4-dioxane and plasticizers.
- Stabilize and expand the installation and maintenance of USGS super gages for Ohio River Basin rivers, streams and critical watersheds to enable the ability to perform change analysis and support Clean Water Act related flow and water quality monitoring.
- Support the development of a Basin-wide GIS inventory of acid mine/rock drainage sites, coal ash ponds, and underground mine pools associated with active and inactive coal mines prioritized based upon risk of failure, and develop a reclamation strategy to address 10 inventoried, high priority locations.

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Objective 2: By 2025, develop effective strategies which can support and enhance the individual utility source water protection programs to meet Safe Drinking Water Act requirements as they are developed and use best practices from these strategies to build collaborative programs to help support Ohio River Basin drinking, industrial, surface and ground water organizations that do not currently have source water protection programs.

*Strategic Actions:*

- Secure financial and other necessary resources through an Ohio River Basin Restoration Initiative and other appropriate funding mechanisms to support all Strategic Actions under this Objective.
- Develop and maintain data layers for inclusion in the comprehensive Ohio River Basin GIS platform to support source water protection related initiatives such as mapping source water protection areas, contaminant source inventories, contaminant spill locations, source water protection risk zones and other related initiatives.
- Maintain and expand ORSANCO's Ohio River Organics Detection System to help detect and respond to volatile and other organic compound spills and detectible emerging contaminants of concern both reported and unreported that may impact the Ohio River and its tributaries as a drinking and industrial water supply.
- Utilize ORSANCO's source water protection program template as well as other identified Basin source water protection templates to build collaborative source water protection strategies for all water bodies within the Basin that serve as a drinking or industrial water supply.
- Identify and expand existing source water protection collaborations within the Ohio River Basin to help ensure the protection of water supplies to drinking and industrial water customers.

Objective 3: By 2025, identify priority waters with high incidences of HABs and convene stakeholders to prepare an Ohio River Basin-wide strategy to help respond to HABs and that will result in measurable reduction in HAB occurrence by 2030 as compared to 2020 for priority areas.

*Strategic Actions:*

- Secure financial and other necessary resources through an Ohio River Basin Restoration Initiative, and other appropriate funding mechanisms to support all Strategic Actions under this Objective.
- Develop and maintain data layers for inclusion in the comprehensive Ohio River Basin GIS platform to map water bodies that have HAB occurrence to support the Basin-wide effort to achieve measurable reduction in HAB occurrences.
- Support HAB monitoring and response strategies of state, federal, interstate and other Ohio River Basin organizations to maintain safe recreation and drinking water for Ohio River Basin citizens.



## Plan for the Ohio River Basin

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- Identify and inventory point and non-point nutrient sources, communicate and implement nutrient reduction best management practice strategies to support reductions in nutrient contributions for identified sources to Ohio River Basin water bodies.
- Support the December 2016 Federal Hypoxia Task Force Strategy as it relates to nutrient contributions from the Ohio River Basin, including advocacy\* for the Federal Hypoxia Task force to summarize literature and identify additional measurement and modeling needs on the general location and significance of nutrient sources in the Ohio River Basin, including both point and nonpoint sources contributing nutrients to particular tributaries and/or mainstem segments.
- Support existing market-based solutions (e.g., Electric Power Research Institute's Ohio River Basin Water Quality Trading Project, etc.) working across stakeholder groups to reduce nutrient loading to waterbodies from point sources and non-point sources.

Objective 4: By 2025, The Ohio River Valley Water Sanitation Commission(ORSANCO) will convene water quantity managers Basin-wide such as USGS and Division of Water (DOW) to establish common goals directed at identifying Basin-wide problems affecting water quantity management and recommend strategies to address these goals.

### *Strategic Actions:*

- Secure financial and other necessary resources through an Ohio River Basin Restoration Initiative and other appropriate funding mechanisms to support all Strategic Actions under this Objective.
- Develop and maintain data layers for inclusion in the comprehensive Ohio River Basin GIS platform to support water quantity related initiatives such as mapping flood risk areas, drought mitigation planning areas, water supply deficit/surplus areas and related initiatives.
- Develop partnerships to leverage available funding streams to maintain and expand USGS Stream Gage network to be able to accurately measure flow in Ohio River Basin streams. Utilize this data to improve hydrologic and hydraulic models so as to test existing infrastructure resiliency as it pertains to expected climate changes.
- Build upon ORSANCO's water quantity initiatives developed through its Water Quantity Committee to convene Ohio River Basin Water Quantity Stakeholders to conduct discussions and long-term planning to develop strategies to address water shortages and other relevant challenges within the Basin related to climate change, population growth and other stressors.
- Collaborate with domestic and international water quantity-related commissions to share information, exchange strategies, incentivize conservation, and advance common

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\* Federal agencies will not participate in strategic actions involving advocacy. Unless otherwise noted, advocacy will be facilitated by ORBA in collaboration with existing interested non-federal organizations and agencies

## Plan for the Ohio River Basin

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goals directed at solving problems affecting water quantity and leveraging these strategies and goals as vital Ohio River Basin assets.

- Facilitate collaboration to pursue a focused water quantity study to follow on to the existing USACE study that specifically addresses climate change as it relates to water quantity impacts in the medium and long term (by 2040 and 2100, respectively).

**Objective 5:** By 2025, inventory drinking and wastewater system infrastructure needs for the Ohio River Basin and develop a strategy to maintain these systems Basin wide.

### *Strategic Actions:*

- Increase financial and other necessary resources through the Water Infrastructure Financing and Innovation Act (WIFIA), State Revolving Loan Fund (SRF), and other appropriate infrastructure funding mechanisms to maintain aging drinking and wastewater infrastructure systems.
- Develop and maintain data layers for inclusion in the comprehensive Ohio River Basin GIS platform to inventory drinking and wastewater system infrastructure needs for the Ohio River Basin.
- Leverage the USEPA Water and Wastewater Infrastructure Needs Assessment Survey to develop a communication strategy for the need to address these aging infrastructure assets on an Ohio River Basin-wide basis that details the urgency associated with increased infrastructure failures.

# Plan for the Ohio River Basin

## 4.2 Healthy and Productive Ecosystems

### Challenges and Opportunities:

The Ohio River Basin drains an area of approximately 200,000 square miles with 7,000 miles of waterfront along the Ohio River and its major tributaries. The Ohio River Basin is nationally and internationally renowned for its array of ecoregions with a diversity of flora and fauna that distinguishes it from other basins within the nation (Figure 11). Portions of at least 16 distinct Level III ecoregions can be identified within the Basin. A great number of aquatic species inhabit the waters of the Basin making it one of the most diverse and productive regions in the nation (Figure 12). As part of the larger Ohio River Basin watershed, the Green, Tennessee, and Cumberland River sub-basins are three of the richest ecological regions in the nation and are among the richest in terms of species diversity in the world. However, extensive human activity has led to the loss or modification of wildlife habitat that negatively impacts key ecosystem functions and imperils native wildlife populations. For example, of the 127 species of mussels once found in the Ohio River, 11 are extinct, and 46 others are classified as threatened, endangered, or a species of concern. There are an additional 625 species from other taxa within the 15 Basin states that are federally listed as threatened or endangered (USACE Comprehensive Reconnaissance Report, 2009).

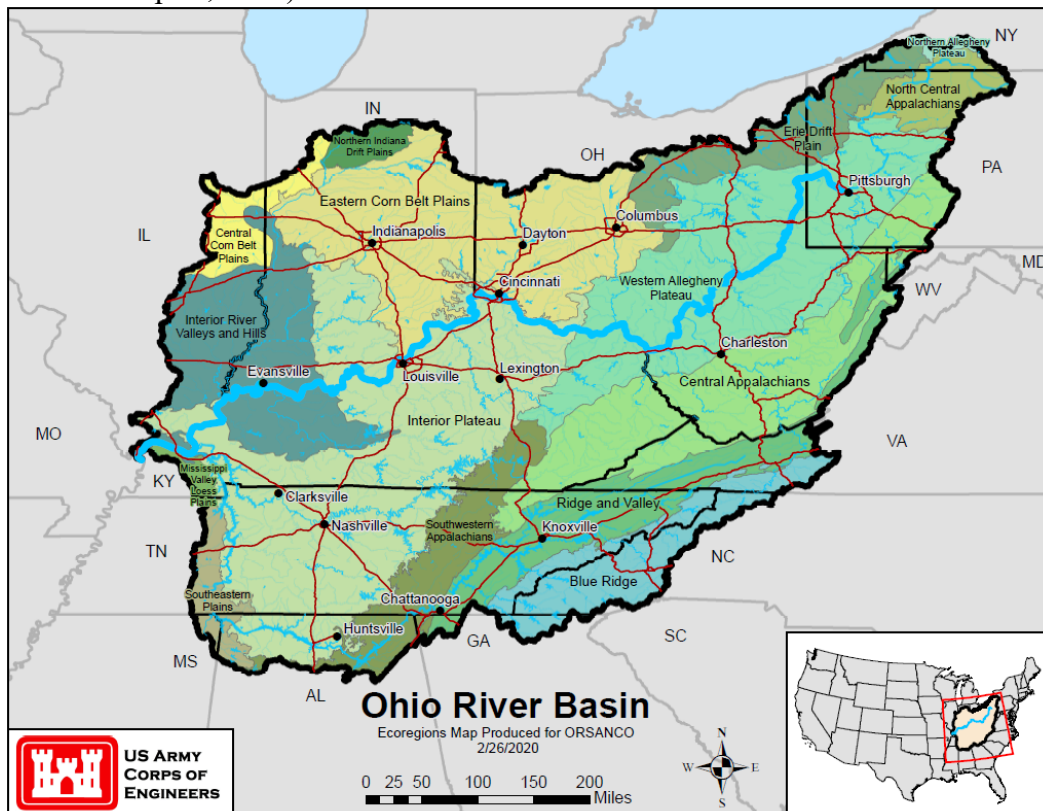


Figure 11: The Ohio River Basin has a diverse array of ecoregions.

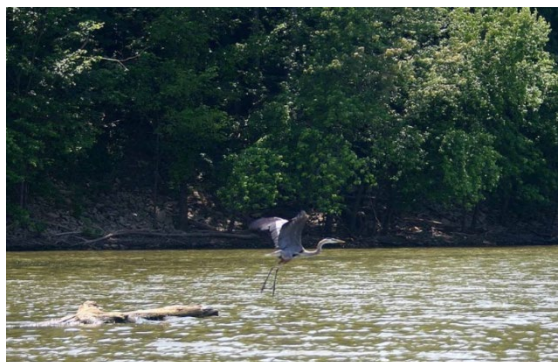
Invasive species such as Asian carp (i.e., bighead, silver, black, and grass carp), round goby, curly leaf pondweed, hydrilla, and zebra mussels, have been documented in the Ohio River Basin (Ohio State University, 2018) and have potential to cause lasting environmental and economic

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damage. Whether introduced accidentally or intentionally, invasive species often grow faster, mature earlier, disperse readily, and have few natural predators. When established, they can threaten ecological stability, outcompete native species, reduce biodiversity, degrade water quality, or otherwise negatively affect commercial, agricultural, or recreational activities.

Soil health has a profound impact on ecosystems as well as water quality and overall Basin stability. Improving soil health is the most effective way to decrease run off by improving water infiltration into the soil further improving moisture and nutrient retention for healthy crop growth (NRCS, 2020).



**Objective 1:** By 2022, Basin states and the U.S. EPA, ORSANCO, conservation organizations, federal agencies, and other stakeholders will develop a plan for Ohio River Basin restoration through the identification and protection of at-risk ecosystems and the threats to them such as acid mine drainage or emerging toxic contamination. Examples of at-risk ecosystems include wetlands and riparian zones, habitat for threatened or endangered species, and other areas of ecological significance.

### *Strategic Actions:*

- Facilitate collaboration and resource coordination among the Ohio River Basin Fish Habitat Partnership, the Southeast Aquatic Resources Partnership, The Nature Conservancy, the National Wildlife Federation, and other stakeholders to further cooperative development of strategic aquatic restoration and protection opportunities. (See Appendix 1). Examples of projects include aquatic ecosystem restoration.
- In coordination with U.S. EPA, states, and local organizations, encourage and advocate for funding for regional programs that restore, protect and manage valuable habitat and water resources through implementation of the Ohio River Basin Fish Habitat Partnership strategy (USACE 2009; USFW Landscape Priorities; ORBFHP 2013) (See Appendix 1). Examples of projects include aquatic ecosystem restoration.

**Objective 2:** By 2025, secure funding to initiate a federal geographic program for the restoration of the Ohio River Basin that is appropriate to the need identified by the states,

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federal agencies including the U.S. EPA, ORSANCO, conservation organizations, and other stakeholders.

### *Strategic Actions:*

- Taking guidance from similar federally-funded geographic restoration initiatives (i.e., the Great Lakes Restoration Initiative, Chesapeake Bay Program, and Columbia River Restoration Program), establish a novel Basin restoration initiative through efforts that seek to find and gather support for a legislative champion(s), develop formal governance procedures, define formal restoration goals and milestones, and establish advisory committees and advocacy groups that, together with public outreach efforts, build a diverse coalition that works to protect and restore the Ohio River Basin.
- In collaboration with the states and interested water resource groups, pursue investment in a robust restoration economy that restores floodplains and connectivity, protects existing high quality habitat, restores and protects native aquatic populations, strategically leverages water resources to strengthen local economies, and positions the Ohio River Basin as an attractive site to draw and retain workforce (USFW Landscape Priorities; ORBFHP 2013; USACE/ORBA 2017).
- Facilitate Basin-wide collaboration that expands upon the NRCS's existing Mississippi River Basin Healthy Watersheds Initiative, among agricultural organizations and agencies to define and pursue a large-scale, healthy soil initiative to protect farmlands and improve water quality, water retention, erosion control, and fish and wildlife habitat.

Objective 3: In collaboration with state and federal agencies and other stakeholders, develop and implement strategies to eradicate, control, and manage invasive species within the Ohio River Basin. Management and control strategies should be comprehensive in application and proactive in nature by utilizing sound scientific data designed to analyze and assess risk, develop and utilize effective control methods, limit dispersal, reduce the effects of invasive species, and focus conservation efforts on high-priority ecosystems within the Basin. Management and control efforts should also include the public sector via the development and implementation of education and outreach programs designed to increase the understanding of the potential ecological, economic, and social impacts of invasive species within the Basin.

### *Strategic Actions:*

- Advocate for existing entities, i.e., Aquatic Nuisance Species (ANS) Task Force, to develop and implement a Basin-specific program designed to coordinate efforts to monitor, control, and study invasive species.
- Advocate for full funding of Asian Carp National Plan with full funding for Ohio River Basin by 2021 (inclusive of the Tennessee and Cumberland Rivers)(USACE 2009; MICRA, 2018)



### 4.3 Knowledge and Education to Inform Decisions

#### Challenges and Opportunities:

Technical problems are those for which optimal solutions can be pursued. Selection of efficient and effective solutions depends on the quality and availability of knowledge at the time the decision is made. Performing and reporting on research related to priorities of the Basin and providing effective formal and informal education for the public and for decision-makers will provide timely, state-of-the-art knowledge to inform decisions.

Research is needed to inform technical problems in each of the other goals of this strategy (Figure 13). Examples of needed research and education include:



*Figure 13: USACE Louisville District representatives conduct a wetland delineation at the Kentucky Army National Guard Wendell H. Ford Regional Training Center, Greenville, Ky.*

- For informing river navigation decisions - the economic value of water uses in the Basin, and the dams and reservoirs that ensure the adequacy of the water;
- For ecosystem restoration and protection decisions - the impacts of hydromodification leading to erosion, flooding and habitat loss and identification of effective and efficient means of preventing and reversing impacts of invasive species;
- For abundant clean water - efficient and effective means of preventing loss of irreplaceable soils and excess nutrients from impacting waterbodies through runoff;
- For nature-based recreation – application of methods of assessing the benefits and costs of river recreation to the local economy as well as the benefits and costs of low head dam removal;
- And for flood risk reduction - modeling of the flood protection projects and reservoirs of the Basin as a system to understand interactive impacts on flooding.

Collaboration among organizations involved with relevant research and partnerships with decision makers addressing Basin-wide priorities is needed to ensure that research and education receives focus and funding necessary to solve technical challenges and inform decisions. The sharing of research and data is also vital to prevent the duplication of efforts, resulting in efficient and thorough data collection.

Public education plays a major role in the success of the Basin. Conveying the unique history and attributes of the Basin to the public at large, particularly children, increases pride and fosters stewardship of natural lands. While this is a powerful tool to improve the Basin, it can also be taken a step farther to include the public in research. Volunteer surveys and citizen science such as bird counts provide valuable data and encourage the public to invest in their natural surroundings.

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Objective 1: Regularly facilitate collaboration among stakeholders to identify and prioritize Ohio River Basin challenges that need to be addressed through research and/or education.

*Strategic Actions:*

- Hold an annual symposium for Basin stakeholders to present Ohio River Basin challenges that need to be addressed through research and/or education.
- Encourage communities to host an Ohio River discussion series where river scientists and enthusiasts can share their knowledge and passion for the river with the general public.

Objective 2: By 2021, establish coalitions to address Basin-wide research needs and map out an Ohio River research investment strategy that can be funded and implemented.

*Strategic Actions:*

- Facilitate collaboration and pursue funding to establish a comprehensive Long Term Ecological Research (LTER) program at Basin scale with broad participation of both research institutions and comprehensive colleges and universities.
- Facilitate regional forums and collaboratives working to develop effective invasive species prevention and control in support of the Asian Carp National Plan and other invasive species initiatives of the Ecological Restoration Goal.
- Create a research agenda that can be distributed to university research centers that examines the intersection of ecosystem health with community health that can help identify challenges to vulnerable communities and solutions that can be adopted.
- Develop and implement educational trainings geared toward increasing awareness of strategic Goals 1 – 5 (See Appendix 1). Examples of projects include Silver Jackets Education Initiatives.

Objective 3: By 2025, create a Basin-wide communication/marketing plan that will unify the Basin, educate the public on the value of natural resources and increase pride in the Ohio River Basin.

*Strategic Actions:*

- Encourage research, disseminate information, and collaborate with regional leaders to quantify the economic value of the Ohio River Basin water resources, the return on investments in environmental restoration and water-related infrastructure, the ecosystem benefits and services generated by the waters of the ORB and the quantitative value of ORB nature based recreation; advocate for funding to support the development of science-based tools and practical applications that quantify the value of the ORB.
- Identify similar program elements within the work of student education organizations in the Ohio River Basin. Pursue opportunities for groups to collaborate on education/curriculum development in order to capitalize on existing educational resources, and identify Ohio River/water resource issues that could be better addressed through education and communication programs.

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- Promote water wealth for development by showing value of water to businesses, recreation, and culture in the Basin through a detailed water budget and a study or Supplemental Environmental Project to document economic impacts of river usage including recreation projects.
- Pursue collaboration and funding to develop a branding, outreach, and marketing campaign for the Ohio River Basin to increase pride of place and to increase tourism, so that the Ohio River Basin is as well-known as Florida Everglades.
- Identify and promote existing citizen science activities and volunteer opportunities in the Ohio River Basin, such as bird counts, water quality monitoring, and clean-up days.
- Identify and develop collaborative approaches to deliver Ohio River Basin education opportunities to underserved geographical areas within the Basin.
- Create outdoor education spaces in conjunction with restoration projects along the Ohio River and its tributaries, including interpretive signage where appropriate.
- Pursue funding to support interdisciplinary approaches to increase citizen engagement in the Ohio River (See Appendix 1). Examples of projects include Silver Jackets Education Initiatives, Watershed Assessment Studies, River Feasibility Studies and Planning Assistance to States Studies.



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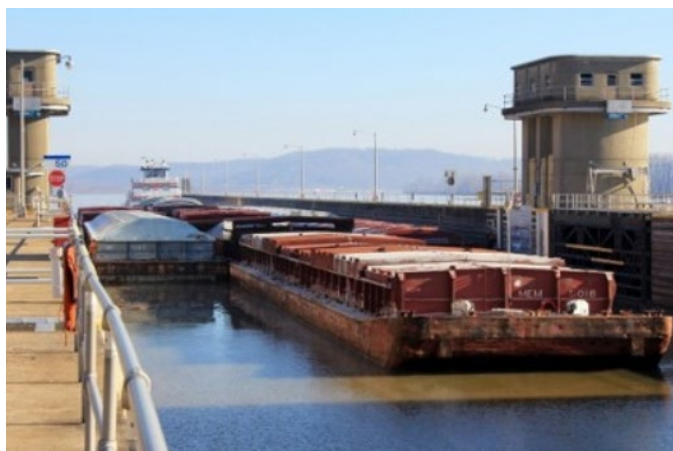
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### 4.4 Nation's Most Valuable River Transportation and Commerce Corridor

#### Challenges and Opportunities:

As part of the nation's Inland Waterway System, commercial navigation in the Ohio River provides an economical method of transporting commodities and bulk goods (Figure 14). Roughly 214 million tons of grain, steel, chemicals, petroleum, construction materials such as rock or sand, and coal are transported on Basin rivers annually. A typical 15 barge tow obviates the need for approximately 1,000 tractor trailers on Basin roads (USACE, 2009). Electricity production from scores of power plants along the river and the businesses and communities that utilize the electricity rely on the efficient barge transport of coal.

The historic development of the Basin was directly attributable to the rivers and natural resources of the Ohio River Basin. With the changing characteristics of the region's economic drivers, regional approaches to development will be critical for providing jobs and raising incomes throughout the Basin. The region is considered "water rich", meaning industries requiring consumptive or non-consumptive water use can locate and grow here. The Basin includes 53 navigation dams, including but not limited to 20 on the Ohio River itself, nine on Monongahela, nine on the Tennessee and two on the Green (USACE, 2018). The Basin's river navigation system and ports have substantial capacity to accommodate industries that would benefit from efficient river transport. With the major influence these industries have on the health of the Basin, it is important to consider the need to attract industries that will work to protect the waters and natural resources in the Basin. There is an urgent need to shift industry toward clean, renewable energy that minimizes negative impacts on the environment while creating jobs and growing the economy.



*Figure 14: A barge moves through the chamber at Cannelton Locks and Dam on the Ohio River near Cannelton, Indiana.*

With the average USACE navigation project being more than 70 years old (USACE, 2017), much of the lock and dam infrastructure is beyond its design life, and substantial maintenance, repair, and replacement is needed to ensure reliable river navigation. The Inland Waterways Users Board recently completed its annual Report to Congress that provides a comprehensive strategy for maintaining the nation's waterways infrastructure, including the infrastructure of the Ohio River Basin navigation system (IWUB, 2019). While this goal focuses on transportation, maintaining pool levels

sufficient for river navigation also provides water for drinking, industrial use, and ecological flows.

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Objective 1: By 2025, the inland waterways infrastructure is efficiently funded to consistently maintain authorized river pools and the economical transportation of goods on the inland waterways.

### *Strategic Actions:*

- Advocate for consideration of all (national and regional) benefits in valuation for USACE projects. All benefits to be advocated are value of water supply, hydrological impacts, ecosystem services, recreation, national security, system infrastructure, and resource resilience. Currently, the primary direct navigation benefits of a water resource project are defined as the product of the savings to shippers using the waterway and the estimated traffic that would use the waterway.
- Advocate for greater use of the integration and maintenance of publicly accessible, comprehensive data on usage of locks and dams including all vessels and tonnage that from the Institute of Water Resources and Lock Performance Monitoring System and data at the Waterborne Commerce Statistics Center. <https://www.iwr.usace.army.mil/About/Technical-Centers/WCSC-Waterborne-Commerce-Statistics-Center/>
- In collaboration with Waterways Council, Inc. and other stakeholders, advocate for priorities that apply to the Ohio River Basin identified in the most current Inland Waterways Users Board recommendations (IWUB 2019). (See Appendix 1). Examples of projects include Freight and Analysis Studies, Major Rehabilitation Studies and 216 studies.

Objective 2: By 2025, compared to 2019, the five-year growth trend of water-dependent industry, recreation, and commerce has increased.

### *Strategic Actions:*

- Facilitate and endorse regional collaboration by governments, industry, and non-governmental organizations (NGOs) to improve regional economic performance and competitiveness by creating an attractive land portfolio that addresses stream-side brownfields; strengthens water-related infrastructure; and develops a cooperative approach to attract industries that would use water resources, ports and terminals, and barge transportation.
- Advocate to update the Ohio River Basin Comprehensive Reconnaissance Report (2009) as a baseline and establish a five-year Basin growth trend of water-dependent industry, recreation, and commerce.
- Advocate for a study on the removal and reuse/repurposing of outdated infrastructure such as abandoned rail lines to allow for waterfront development.

# Plan for the Ohio River Basin

## 4.5 Reliable Flood Control and Risk Reduction

### Challenges and Opportunities:

Efforts to reduce flood risk in the Ohio River Basin began with land owners in the 1800's. Federal interest began with the River and Harbor Act of 1917. In an effort to monitor water levels throughout the Basin, an extensive stream gage network is operated by USGS, USACE, National Weather Service (NWS), and other Federal and state agencies. The NWS's Integrated Flood Observing and Warning System is an initiative that receives data from more than 1,000 stream gages to provide flood warning and forecasting information. The USGS maintains approximately 318 gages within the Ohio River Basin reporting on a number of water quantity and quality parameters. While these programs exist to provide adequate warning to the public, there is room for improvement in order to reach more people and do so in a more efficient and effective way in order to prevent damages and loss of life. The 2009 USACE Ohio River Basin reconnaissance report (USACE, 2009) stated:

“The current Ohio River Basin system consists of 83 reservoirs (including 5 single- purpose reservoirs), 95-plus major local protection projects, and numerous small flood control projects. Although these projects were justified economically and analyzed for effectiveness in reducing flood damages, they were not regarded as components of a system during their individual formulation. Recent flood events in January 2005 and May 2008 have highlighted some of the deficiencies in the existing infrastructure. For example, during the January 2005 flood in the Muskingum basin, 13 reservoirs reached record pools, and emergency repairs were required at several projects to prevent catastrophic failures. Record floods in the White River sub-basin in May 2008 and additional flood records in the region in 2011, 2018, and 2019 highlight the need for flood risk reduction measures in the highly populated areas throughout the Ohio River Basin.”(See Flood Event Map, Figure 15)

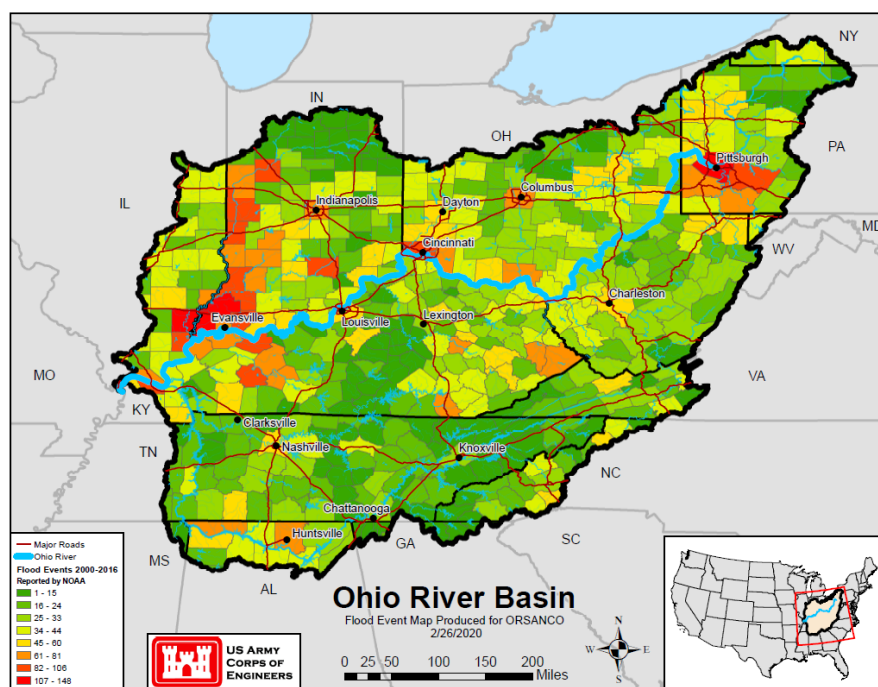


Figure 15: Flood event map for the Ohio River Basin.



*Figure 16: The crew at Lock and Dam 53 on the Ohio River Covers the power house windows with plywood to keep drift from breaking them as the river rises in April 2011.*

Almost 200 of the Basin's reservoirs and local flood protection projects are about 80 years old. Issues with aging structures as well as degradation from natural events, such as erosion of earthen dams, need to be considered in work to maintain and update flood infrastructure. Coupled with this concern, precipitation and flooding patterns may be shifting due to climate change, as has been observed anecdotally, but also as reported in the Climate Preparedness and Resilience Community of

Practice's Recent US Climate Change and Hydrology Literature synthesis for the Ohio River region (USACE, 2020). With more than ten billion dollars invested in infrastructure and half a million lives protected by this infrastructure, it is important to ensure on-going effectiveness. The high damage risks combined with the observed extreme flood events are changing the thought process relative to developing floodplains and unintended creation of potential damage areas. Engineering best practices and new technology are also improving the understanding of the aging structure's integrity. Risk analysis methods continue to evolve in identifying existence of dangerous conditions and prioritizing limited repair and maintenance dollars. Watershed management practices can indirectly affect the performance and integrity of a flood control structure; sediment and runoff balances can affect available channel area to pass flow, reduce available storage volumes for peak flow reduction, or conversely lead to undermining of critical infrastructure. Yet watershed management regulation is largely within the purview of entities other than those maintaining and operating the infrastructure (Figure 16).

The USACE's Flood Risk Management Program (FRMP) was established in May 2016 and is made up of 19 relevant sub-programs or agency bodies which all have avenues or expertise pertaining to reducing flood risk. Relevant programs include the Continuing Authorities Program (CAP), Floodplain Management Services Program (FPMS), Rehabilitation Program (see PL 84-99 [33 USC 701n]), the Silver Jackets Program, the Engineer Research and Development Center (ERDC), Hydrologic Engineering Center (HEC), and the National Nonstructural Committee, and Specifically Authorized Projects (Investigations) from Congress.



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Objective 1: By 2025, prepare a Basin-wide investment plan that addresses high flood risk areas, including areas where dams and local protection projects exist.

*Strategic Actions:*

- Advocate for the preparation of a Basin-wide reinvestment plan that addresses the existing Corps-designed and constructed flood risk management structures including both single-purpose dams, multi-purpose reservoirs and local protection projects operated by third parties (USACE 2009).
- Examine high risk areas that may benefit from a feasibility study and structural or non-structural measures, with an emphasis on wetlands and floodplains that could reduce risk within those areas.
- Advocate for the divestiture of un-needed infrastructure (dams and levees) and potentially target for green spaces and ecosystem restoration efforts. Whenever possible, seek ways to incorporate innovative, forward thinking solutions such as green infrastructure (e.g., bio swales, green roofs, man-made wetlands, and native planting efforts) that work with nature and are better designed to handle changing climate patterns. (See Appendix 1). Examples of projects include Silver Jackets Green Infrastructure, Continuing Authority 205 projects, Dam Removal Projects, River Feasibility Studies, System Analysis and River Feasibility PAS Studies and FPMS Studies.

Objective 2: By 2025 USACE, USGS and NWS jointly prepare a Basin-wide plan to update and expand components of an adequate flood warning system incorporating climate change considerations.

*Strategic Actions:*

- Advocate for operation and maintenance financial support to update and expand components of the current flood warning systems, such as stream gages and other early warning systems.
- Advocate for agencies and stakeholders, to incorporate climate change considerations into flood frequency estimates and related outreach efforts (USACE 2009).
- Advocate for the update of the USACE climate change adaptation report by 2025.

Objective 3: Hold regular collaborative stakeholder meetings to discuss and identify opportunities and issues with flood risk management and increase overall communication between Flood Response Groups.

*Strategic Actions:*

- Encourage the Basin-wide Silver Jacket collaboration to pursue funding for a future PAS study, which would provide county Emergency Management Agencies below dams and other flood prone areas with best practices and template warning messages to ensure timely evacuations following flood warnings.
- Encourage Silver Jackets to facilitate a multi-state, collaborative approach to flood risk management that accounts for downstream impacts of rain events and explore and promote

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projects that consider sustainable flood risk management opportunities such as wetland restoration and removal of impervious surfaces.

- Encourage Basin-wide Silver Jackets workshops to identify collaborative opportunities for flood risk management and to share information on flood risk and flood control methods with focus on pre-disaster mitigation through non-structural methods.
- Create a centralized location for stakeholders to share data that is developed for flood related purposes.
- Advocate for Silver Jackets to encourage pre-disaster mitigation through FEMA and promote non-structural measures for flood risk management such as Basin-wide riparian tree planting and other green infrastructure, buy-outs and controlled development within the flood plain.
- Encourage USACE to develop a briefing that can be shared throughout the Basin so that Silver Jackets coordinators can educate stakeholders and the public on other USACE programs that may be beneficial to them, including Floodplain Management Services, Section 205 flood risk management projects and major flood risk management projects.

### 4.6 World-class Nature-based Recreation Opportunities



Figure 17: Children explore the East Fork of the Little Miami River below the W.H. Harsha Dam, Batavia, Ohio, during the Great Outdoor Fun Weekend Sept. 26, 2015.

#### Challenges and Opportunities:

The natural resources of the Basin contribute significantly to the economic value of the region. The streams, rivers, mountains, and forests attract outdoor recreation and potential for growth of related tourist attractions and hospitality industries, as seen in the Riverlife waterfront redevelopment in Pittsburgh, PA. The Ohio River Basin, with its diverse ecosystems and natural amenities, offers a broad range of outdoor recreation opportunities, many world class. These opportunities range from paddling Class V rapids of the Upper Gauley River, biking along the Little Miami Scenic River, rock climbing in the Red River Gorge in Kentucky, or fishing for trout in the headwaters in Pennsylvania, Kentucky, Tennessee, West Virginia, and Ohio. Recreational opportunities on the main stem include fishing, to short/extended paddlesport/power boat river trips or cruising on one of the several passenger vessels operating on the Ohio. Smaller tributaries and creeks throughout the Basin provide opportunity for recreation such as kayaking and paddle boarding, hiking, and birdwatching (Figure 17).

These activities that are dependent on functioning ecosystems also generate economic benefits. Small businesses play a role in these benefits as well as larger corporations. Summarizing data from the Outdoor Industry Association 2017 National Recreation Economy Report for the five states that are primarily in the Basin - Indiana, Kentucky, Ohio, Tennessee, and West Virginia - outdoor recreation generates \$83.4 billion in annual consumer spending, 757,000 direct jobs, \$23.8 billion in wages, and more than \$5.4 billion in state and local tax revenue (Table 3). Because of the fragmented nature of the recreation industry, it is often overlooked as an important potential engine of economic growth (Outdoor Industry Association).

State	Direct Jobs	Consumer Spending (Billions)	Wages and Salaries (Billions)	State and Local Tax Revenue
Indiana	143,000	\$15.7	\$4.3	\$1.1 billion
Kentucky	120,000	\$12.8	\$3.6	\$756 million
Ohio	215,000	\$24.3	\$7.0	\$1.5 billion
Tennessee	188,000	\$21.6	\$6.5	\$1.4 billion
West Virginia	91,000	\$9.0	\$2.4	\$660 million

Table 3: Economic benefits of outdoor recreation by state.

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Access to nature is known to improve health and quality of life (APHA, 2013). The lives and health of millions can be improved by ensuring that all people, including those that are underserved such as low income and minority groups, have safe access to the river and its surrounding natural areas. In order to accomplish this, there is need for clear, comprehensive communication to the public on nature opportunities and events in the Basin, recreational safety issues, and the importance of the protection of our waters and lands.

The Ohio, Tennessee, and Cumberland Rivers provide a large variety of options when it comes to recreation such as fishing and boating, trails and bike paths, nature viewing, or camping. These large rivers are recreational assets, but the tributaries, lakes, and reservoirs also offer access both to exciting whitewater and to calmer waters that can be used more easily by paddlers and kayakers (Figure 18). Creating an integrated recreational system that links the main stem of the Ohio with these tributaries and lakes allows work on a Basin-wide scale, while at the same time, emphasizing how the river reaches beyond its banks thereby enabling more people from the entire Basin to be connected to the waterways.



*Figure 18: In 2013, the annual Louisville Mayor's Hike, Bike, and Paddle event hosted more than 200 kayakers, canoeists, and other boaters. Part of the 4.5 mile journey from Louisville's waterfront to New Albany, Indiana took the group through the locks at McAlpine.*

**Objective 1:** From 2021 - 2025, grow the Basin's outdoor recreation economy at a rate that exceeds the national average.

### *Strategic Actions:*

- Facilitate collaboration and advocate for funding to establish multipurpose terrestrial and water trails (i.e. Greenways and Blueways) along the Ohio River interconnecting with Tennessee RiverLine and tributary trails, and increase access in underserved areas, to promote nature-based recreation, corresponding economic growth, providing diverse recreation options for different types of users.



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- Identify and encourage collaboration among water trail organizations to engage relevant river cities, agencies, businesses, associations, and NGOs on approaches and plans to promote outdoor recreation with particular emphasis on reaching new participants, including providing easy opportunities to “try out” activities such as boating or camping.
- Encourage Mayors along rivers to collaborate on the local or regional strategies that are being pursued in their area, in order to create a more comprehensive and coordinated approach.
- Collaborate with USACE to identify existing operating, abandoned or vacant federal and state lock houses and grounds that could be used or expanded for river access, camping and day use educational activities (See Appendix 1). Example projects include park restoration plans, local recreation plans and use of water quality data monitoring to enhance boater experience.
- Advocate for policies and funding supportive of fishing, hunting, and paddle sport education to expand nature-based recreation and economic growth, and to encourage the stewardship of natural resources that make such recreation possible.
- Pursue funding and an organizational structure for a comprehensive water trail on the Ohio River and its tributaries.

Objective 2: By 2025, create a Basin-wide communication plan for recreation that encompasses recreation safety as well as the benefits to public health and quality of life.

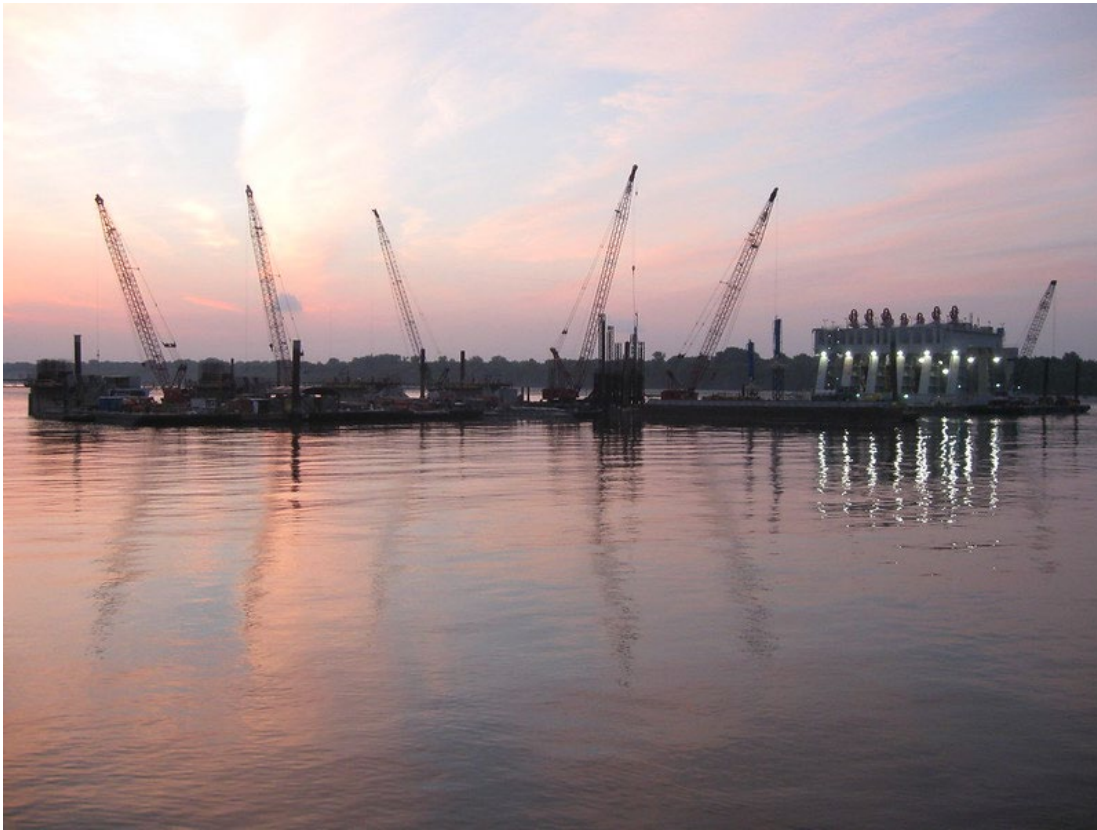
### *Strategic Actions:*

- Pursue funding for expansion of geographic coverage and marketing of the Ohio Kentucky Indiana Regional Council of Governments GIS-based Digital Guide to the Ohio for the Ohio River Basin recreation opportunities and amenities that includes comprehensive information about real time river stage/current, boat ramps, marinas, fuel docks, pump out stations, campgrounds, bike trails, historical points of interest, river safety, AIS barge location tracking, difficulty levels, average trip times between destinations, etc.
- Facilitate Basin-wide collaboration to coordinate outreach to the general public to share information on existing trails, events, points of interest, and safety related to outdoor recreation and ensure inclusion of historically vulnerable populations and non-English speaking people.
- Although not the primary reason for dam removal, advocate for funding to locate and safely remove low head dams throughout the Basin to restore historical flow and ecological function, to reduce danger to boaters, and improve recreational access and connectivity.

### **5.0 Conclusion**

Throughout this study, it has been a goal to reach out and get thoughtful input from various organizations working throughout the Basin to improve water quality, transportation and economy, ecological well-being, and other aspects of watershed health. The planning process for this study began with discussions to create a comprehensive list of existing Basin wide and multi-state collaborations to secure their priorities. Through an extensive year-long outreach effort that included both remote and in-person meetings as well as the collection of relevant documents, the objectives and strategies of this study were created.

The goals of this study set the long range aspirations of a collective group of stakeholders actively working to improve the Basin. The objectives aim to set clear, measurable and attainable priorities while the strategic actions can be executed by members of the Basin collaborative in order to achieve the objectives. It is the hope that completing these projects is a step toward a healthy, productive Ohio River Basin.



*Figure 19: The final construction phase begins at Olmsted Lock and Dam on the Ohio River (2014).*

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## Appendix 1: Potential Supporting Projects by Goal

### **Abundant Clean Water**

- Patoka Lake Water Control Manual Update (USACE- Louisville District)
- USACE- Pittsburgh District has developed a Systems Analysis PAS scope
  - Will evaluate how changes in precipitation due to climate variability affect the reservoir and local protection projects in the Allegheny River watershed. This could also be scoped and used to ensure our water management system will be able to continue to enable clean and abundant to support vital ecosystem services (drinking water, recreation, navigation, etc.).
- USACE- Pittsburgh District has scoped out an Integrated Water Resource Management Framework and Plan PAS with Southwestern PA Commission
  - Will assist 11 counties in Southwestern PA in developing and implementing IWRMPs. This potential PAS has been scoped but not submitted for funding.
- Section 340 (Southern WV), Section 531 (Southeastern KY), Section 571 (Central WV), and Section 594 (Ohio) Environmental Infrastructure Programs - various projects that have not yet been funded (USACE- Huntington District/various partners)
- South Charleston Wastewater Treatment Plant Section 14 - South Charleston, WV (USACE- Huntington District/City of South Charleston Sanitary Board)
- Newark Sewage Infrastructure Section 14 - Newark, OH (USACE- Huntington District/City of Newark)

### **Healthy and Productive Ecosystems**

- Town Branch Urban Ecosystem Restoration CAP 206 - Lexington KY (USACE- Louisville District)
- Blue River Ecosystem Restoration Study (USACE- Louisville District)
- Mahoning River Section 206 Aquatic Ecosystem Restoration (USACE-Pittsburgh District).
  - This project will remove low head dams within the Mahoning River to provide for better ecosystem connectivity.
- Poland Municipal Forest Section 206 Aquatic Ecosystem Restoration (USACE- Pittsburgh District).
  - This project will evaluate bank erosion within a managed municipal forest, and how such erosion deleteriously impacts the ecosystem. Awaiting a letter of intent from the local sponsor.
- Johnstown Section 1135 Aquatic Ecosystem Restoration (USACE- Pittsburgh District).
  - This project will provide for improvement of natural aquatic habitat within portions of the Corps local protection project, which essentially sterilized the habitat in the Little Conemaugh, Stoneycreek, and Conemaugh Rivers.
- Chautauqua Lake Aquatic Ecosystem Restoration General Investigation (USACE- Pittsburgh District).

## Plan for the Ohio River Basin

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- This authorized project will mitigate harmful algal blooms and aquatic invasive species in Chautauqua Lake, and will seek to leverage ERDC's HABITATs pilot project occurring this year.
- USACE- Pittsburgh District has developed a Systems Analysis PAS scope
  - This project will evaluate how changes in precipitation due to climate variability affect the reservoir and local protection projects in the Allegheny River watershed. This could also be scoped and used to see how changes in flow could impact environmental flows and water quality.
- Removal of White's Mill Low-Head Dam CAP Section 206 - Athens, OH (USACE- Huntington District/City of Athens)
- Town of Boone Section 206 - Boone, NC (USACE- Huntington District/City of Boone)

### **Knowledge and Education to Inform Decisions**

- Emerald Ash Borer Multi State Impacts Planning Assistance to States (USACE- Louisville District)
- IN Stream Education Initiative (IN Silver Jackets)
- Leveraging Higher Education Capstone Programs to Help Address Local Water Resource Issues (USACE- Pittsburgh District)
  - Partnerships between Universities and USACE could be a great way to reach smaller communities throughout the Ohio River Basin.
- Kanawha River Basin Feasibility Study - WV/VA/NC (USACE- Huntington District/State of WV)
- Tuscarawas River Basin Feasibility Study - east central OH (USACE- Huntington District/TBD)
- South Fork Licking River Section 729 Initial Watershed Assessment - Hebron, OH (USACE- Huntington District/South Licking Watershed Association);

### **Nation's Most Valuable River Transportation and Commerce Corridor**

- Kentucky Riverports Highway & Rail Freight Analysis Study (KYDOT)
- Remote Lock Operations 216 study (USACE- Pittsburgh District).
  - LRP has submitted a work plan request for a Section 216 study to look at the viability of instituting remote lock operations along the Ohio River mainstem and tributaries.
- Mahoning River Section 208 Clearing and Snagging (USACE- Pittsburgh District).
  - While there are no commercial locks on the Mahoning River, it is still considered navigable, and this project will remove debris and snags from the river.
- Winfield Lock & Dam Major Rehabilitation - Winfield, WV (USACE- Huntington District)
- Greenup Lock & Dam Major Rehabilitation Report - Greenup, KY (USACE- Huntington District)

# Plan for the Ohio River Basin

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## **Reliable Flood Risk Reduction**

- City of Salem Flood Risk Management CAP 205 (USACE- Louisville District)
- KY Green Infrastructure (KY Silver Jackets)
- Dam Removal - Green L&D #5 (USACE- Louisville District/FWS)
- USACE- Pittsburgh District has developed a Systems Analysis PAS scope
  - Will evaluate how changes in precipitation due to climate variability affect the reservoir and local protection projects in the Allegheny River watershed. Part of this analysis is evaluating current capacity and level of protection.
- FPMS - FRM Planning for Sharpsburg, PA
- Ridgway, PA Section 205 (USACE- Pittsburgh District)
- Indiana County Act 167 Phase II PAS (USACE- Pittsburgh District).
  - Act 167 is a PA state mandate that requires counties to consider effects of development on watersheds as opposed to strict municipal boundaries.
- USACE- Pittsburgh District has developed several PAS/FPMS scopes that look at hydraulics and hydrology models for waterways
  - North Huntingdon Floodplain Management Study FPMS
  - Cranberry Township, Venango County, PA Floodplain Management Study PAS
  - Bullskin Township, Fayette County, PA Floodplain Management Study PAS
  - Boardman Township, Mahoning County, OH Floodplain Management Study PAS
- Watershed Study in Plum Run Watershed near Oakmont, PA Sect 729 or PAS (USACE- Pittsburgh District)
- Kanawha River Basin Feasibility Study - WV/VA/NC (USACE- Huntington District/State of WV)
- Town of Boone/Three Creeks Section 205 - Boone, NC (USACE- Huntington District/City of Boone)
- Peak Creek Section 205 - Pulaski, VA (USACE- Huntington District/Pulaski County/Town of Pulaski)

## **World-class Nature-based Recreation Opportunities**

- Chickasaw Park CAP 14 - An Olmsted Park (USACE- Louisville District)
- Westpoint Multipurpose Recreation Plan (John Muir Trail) PAS (USACE- Louisville District)
- HAB Alert System for USACE Reservoirs (USACE- Pittsburgh District)
  - Develop a model and subsequent alert system that could help predict when HABs will occur based on incoming stream flow, air and water temperature, etc. This could be useful to the recreation industry, as well as USACE and other management agencies that could help control HABs before they start.

### Appendix 2: Guiding Ideals for Ohio River Basin

Throughout the planning process, there were many ideas that were not incorporated directly into the strategies of this document. While these are not explicitly mentioned in the strategies of the plan, many of the priorities mentioned here were included in the study.

- The public and governments have pride of place in the Ohio River watershed that inspires a broad stewardship ethic and support for the natural resources of the Basin that, in turn, helps attract and retain a talented workforce.
- Broad stakeholder collaboration results in a holistic and sustainable systems approach; This will be communicated in a unified voice, to further policies and funding for advancing progress on all Basin-wide priorities to protect ecosystems and improve economic vitality.
- The high quality of waters of the Ohio River Basin provide safe drinking water after reasonable treatment, accessible recreational waters, and productive fisheries free of consumption advisories.
- Diverse and healthy aquatic and riparian ecosystems are sustainable and possess intrinsic social, environmental, and economic value.
- The inland waterways infrastructure is developed and maintained to support recreational boating and efficient commercial navigation/intermodal transportation, and grows the economies enabled by these uses of water resources (understood to include water quality and quantity) consistent with sustaining healthy ecosystems.
- The establishment and spread of invasive species and recurrent/persistent harmful algal blooms are prevented.
- Development and transmission of credible knowledge, including consideration of impacts on economically or socially disadvantaged groups, underpins wise decisions impacting water resource use in the Basin including the drinking water, waste water, agriculture, energy, recreation, fishing, river navigation, and manufacturing industries, as well as the ecosystems, that depend on them.
- Appreciation and recognition for the Basin's value and role in history, from its sacredness to indigenous peoples through today's quality of life enabled by our system of streams and rivers.

## **Appendix 3: Key Organizations, Collaborations, and States of the Basin**

### **Federal Agencies:**

National Oceanic and Atmospheric Administration/National Integrated Drought Information System (NIDIS)  
National Oceanic and Atmospheric Administration/National Weather Service  
US Army Corps of Engineers (4 districts)  
US Department of Agriculture  
US Environmental Protection Agency (3 regions)  
US Fish and Wildlife Service  
US Forest Service  
US Geological Survey - Ohio-Kentucky-Indiana Water Science Center  
Tennessee Valley Authority

### **States and Commissions:**

ORSANCO including its member states (Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia, West Virginia);  
Appalachian Regional Commission; and  
other states of the Basin inclusive of Alabama, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee.

### **Major River Cities:**

Cincinnati, Huntington, Louisville, Nashville, and Pittsburgh

### **Multi-state Collaborations:**

Big Sandy Watershed Watch  
Central Ohio River Business Association  
KYOVA Interstate Planning Commission  
Living Lands and Waters  
Mississippi River/Gulf of Mexico Hypoxia Task Force  
Ohio River Basin Alliance  
Ohio River Basin Fish Habitat Partnership (ORBFHP)  
Ohio River Fisheries Management Team (ORFMT)  
Ohio River Recreation Trail  
Ohio - Kentucky - Indiana Regional Council of Governments  
National Association of Conservation Districts (NACD)  
Silver Jackets  
Southeast Aquatic Resources Partnership  
Tennessee-Cumberland Waterways Council  
Upper Ohio River Users Group  
Waterways Council, Inc.



### **Non-governmental Organizations (NGOs):**

Cumberland River Compact  
Eastern Brook Trout Joint Venture  
Electric Power Research Institute  
National Association of Conservation Districts  
National Wildlife Federation  
Ohio River Basin Consortium for Research and Education (ORBCRE)  
Ohio River Foundation  
Ohio River Trails Team Working Group  
ORSANCO Power Industry Committee  
ORSANCO Publicly Owned Wastewater Treatment Works Advisory Committee  
ORSANCO Watershed Advisory Committee Members  
The Nature Conservancy

### **Academic and Educational Organizations:**

Carnegie Melon University  
Discovery Riverworks  
Foundation for Ohio River Education  
Marshall University  
Northern Kentucky University  
Ohio State University  
Ohio University  
Thomas More University/Center for Ohio River Research & Education  
University of Cincinnati  
University of Louisville  
University of Pennsylvania  
University of Tennessee

### **Tribal Organizations Contacted:**

(See mailing list in Appendix 4)

### **Appendix 4: Tribal Coordination**

The Corps coordinated with Tribal Nations on this study on January 23, 2020. Letters describing the study project goals were sent to 63 tribes (see mailing list). As of February 19, 2020; the following Tribal Nations have stated they would like to be included in future consultation regarding the project: Eastern Shawnee, Miami Tribe of Oklahoma, and Pokagon Band of Potawatomi. The Sac and Fox Nation of Oklahoma do not wish to be consulted regarding the project. However the Sac and Fox Nation of Oklahoma would like to be informed in the unlikelihood of an inadvertent discovery of human remains or cultural resources that may occur during the project. Lastly, the Oneida Indian Nation, does not wish to be a participating party for the project. Tribal consultation is still on-going.

# Plan for the Ohio River Basin

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## Sample Tribal Letter:



**DEPARTMENT OF THE ARMY**  
U.S. ARMY CORPS OF ENGINEERS, LOUISVILLE DISTRICT  
600 DR. MARTIN LUTHER KING JR PL  
LOUISVILLE, KY 40202

January 23, 2020

Planning, Programs and  
Project Management Division  
Planning Branch

The Honorable <Name of Tribal Chair>  
<Name of Tribe>  
Address  
City, State

Dear:

The U.S. Army Corps of Engineers, Louisville District (Corps) is informing your tribe about a Planning Assistance of State (PAS) program of the Ohio River Valley Water Sanitation Commission (ORSANCO). The intent of the PAS study is to develop a strategic document for the development, utilization, and conservation of the water and related resources of drainage basins, watersheds or ecosystems, including plans to address water resource challenges. The area of interest includes the entire Ohio River Basin extending from Pittsburgh, Pennsylvania to Cairo, Illinois. (Figure 1). The authority to conduct the study is Section 22 of the Water Resources Development Act of 1974, as amended (WRDA 1974). This project is a cooperative effort between the Corps and ORSANCO to reach out to stakeholders to receive input on strategies to improve the basin. This PAS study is centered on the following goals:

1. Nation's Most Valuable River Transportation and Commerce Corridor: Provide for safe, efficient and dependable commercial navigation within the Ohio River Basin to ensure a competitive advantage for our goods in global and regional markets; sustain a water use system to efficiently and effectively support agricultural, industrial, and energy productivity.
2. Healthy and Productive Ecosystems: conserve, enhance and restore ecosystems within the Ohio River Basin to support natural habitats and fish and wildlife resources that depend on them.
3. Abundant Clean Water: ensure the quality and quantity of water in the Ohio River Basin is adequate to support the economic, social and environmental functions that are dependent on it.
4. World-class Nature-based Recreation Opportunities: enrich the quality of life for people and recreation-based economies by maintain and enhancing riverine, lake and wetland-associated recreation within the Ohio River Basin.

## Plan for the Ohio River Basin

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5. **Reliable Flood Control and Risk Reduction:** provide reliable flood protection and risk reduction through well-managed and maintained infrastructure, including appropriate floodplain connections for water conveyance and ecosystem benefits, and management of surface and storm water runoff to better protect life, property and economics.
6. **Knowledge and Education to Inform Decisions:** ensure that research and education adequately informs Ohio River Basin-wide economic, social, and environmental decisions; enhance the profile of education organizations in the Basins and synergize efforts to garner effective public involvement in the stewardship and management of the Basin's resources.

While there are no physical ORSANCO projects associated with this effort occurring along the Ohio River at this time, we invite your tribe to be a participating party as this PAS study progresses and request that your tribe provides a written response indicating your interest in being a participating party. Any information that you can provide will assist in our efforts to protect tribal resources that could be impacted by the study recommendations. Please be assured that we will remain sensitive to any concerns you may have regarding the confidentiality of this information.

If you have any questions or require any additional information, please contact me by telephone at 502-315-7468, or by email at [jennifer.m.guffey@usace.army.mil](mailto:jennifer.m.guffey@usace.army.mil). Please provide a response within 30 calendar days of receiving the document.

Sincerely,

Jennifer Guffey  
Archaeologist and Tribal Liaison  
Planning Branch

Enclosures:

1. Figure 1

# Plan for the Ohio River Basin

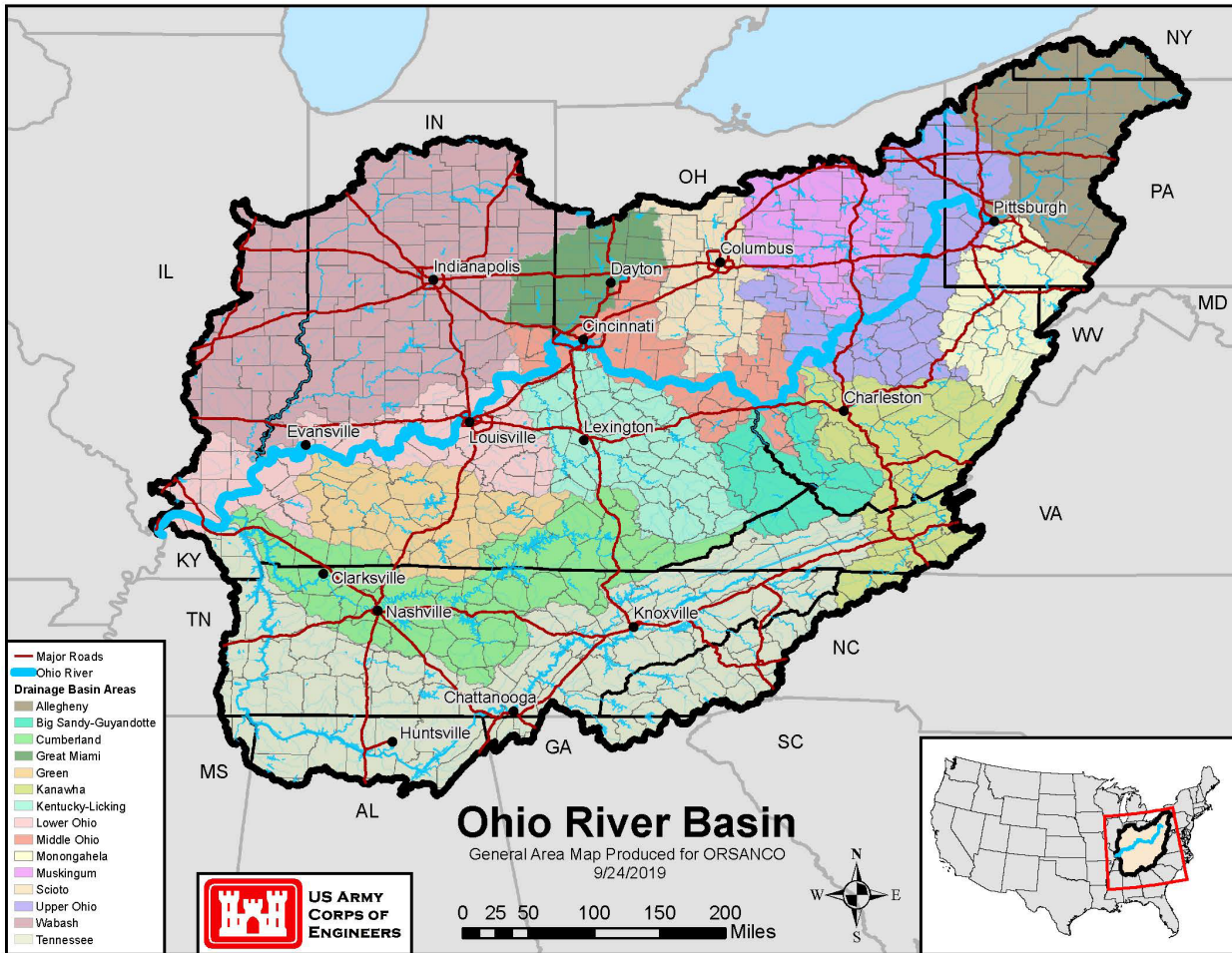


Figure 1: Ohio River Basin Study Area



## Tribal List:

Shawnee Tribe of Indians  
Shawnee Tribe of Oklahoma  
Cherokee Nations of Oklahoma  
Peoria Tribe of Oklahoma  
Tonawanda Seneca Nation  
Seneca Nation of Indians of New York  
Eastern Shawnee Tribe of Oklahoma  
Eastern Band of Cherokee Indians  
United Keetoowah Band of Indians In Oklahoma  
Osage Nation of Oklahoma  
Tuscarora Nation of New York  
St. Regis Mohawk Tribe  
Onondaga Nation of New York  
Oneida Nation of Wisconsin  
Delaware Nation of Oklahoma  
Bad River Band of Lake Superior Chippewa  
Prairie Band of Potawatomi  
Pokagon Band of Potawatomi  
Miami Tribe of Oklahoma  
Bios Forte Band of Chippewa  
Forest County Potawatomi  
Oneida Nation of New York  
Cayuga Nation of New York  
Citizen Potawatomi Nation  
Gun Lake Tribe  
Delaware Tribe of Indians Oklahoma  
Nottawaseppi Huron Band of Potawatomi  
Fond du lac Band of Lake Superior  
Grand Portage Band of Lake Superior of Chippewa  
Grand Traverse Band of Ottawa and Chippewa  
Hannahville Indian Community  
Kickapoo Tribe of Kansas  
Kickapoo Traditional Tribe of Texas  
Lac du Flambeau of Lake Superior  
Leech Lake Band of Ojibwe  
Little Traverse Bay Band of Odawa  
Ottawa Tribe of Oklahoma  
Seneca-Cayuga of Oklahoma  
Keweenaw Bay Indian Community  
Kickapoo Tribe of Oklahoma  
Lac Courte Oreilles Band of Chippewa  
Lac Vieux Desert Band of Lake Superior  
Little River Band of Ottawa  
Mille Lacs Band of Ojibwe

Red Cliff Band of Lake Superior Chippewa  
Red Lake Chippewa  
Sac and Fox Nation of Oklahoma  
Sault Ste Marie Tribe of Chippewa  
St. Croix Chippewa Community  
Choctaw Nations of Oklahoma  
Quapaw Tribe  
Alabama Coushatta Tribe of Texas  
Alabama Quassart Tribal Town  
Sac and Fox Nation of Missouri in Kansas and Nebraska  
Sac and Fox Tribe of Mississippi in Iowa  
Sokaogon Chippewa  
Turtle Mountain Band of Chippewa  
Chickasaw Nations  
Saginaw Chippewa Indian Tribe of Michigan  
Muscogee Creek Nation  
Kialegee Tribal Town  
Thlopthlocco Tribal Town