2021

Water Quality Program Management Plan

U.S. ARMY CORPS OF ENGINEERS CHICAGO DISTRICT

WATER QUALITY TEAM

Contents

Executive Summary

- The purpose of this document is to comply with ER 1110-2-8154 which stipulates, “Water managers in each district must develop district-specific Water Quality Program Management Plans (WQMPs)”.
- The activities of the District’s Water Quality Program are driven by the guidance and requirements set forth in ER 1110-2-8154, titled “Water Quality and Environmental Management for Corps Civil Works Projects”.
- Water quality issues associated with the operation of water control projects led to the development of the water quality discipline within the Corps. The impacts of impounding a free-flowing waterbody can be detrimental, extensive, and enduring. It is the policy of the Corps that the environment be given equal weight, not simply consideration, in all aspects of project management and the operational decision-making process.
- The Corps’ water quality management authority is founded on the Federal Water Pollution Control Act of 1948 and its amendments. Several Corps policies support operating Corps projects in an environmentally responsible manner. These include Engineer Regulations, Engineer Manuals, and the Environmental Operating Principles.
- ER 1110-2-8154 states, “The Corps operates a water quality management program to ensure that all applicable state and federal water quality standards are met, water quality degradation of Corps resources is avoided or minimized, and project responsibilities are attained.”
- The District’s Water Quality Program’s area of responsibility includes 3 flood control reservoirs.
- The District’s Water Quality Program provides technical support on water quality issues to all District activities as requested. Routine technical assistance is provided to Water Management, Planning, and Operations.
- While water quality in the District is generally good, several water quality issues exist and need to be monitored. It is important to note that these water quality issues are like what is experienced in other non-Corps waterbodies in the area.
- It is Corps policy that a district’s Water Quality Team and Water Management Team work closely together. Activities to this end include water quality directives, regular meetings between respective Team leaders, communication, partnerships on projects, and input on plans and reports.
- Questions regarding this document should be directed to Casey Pittman.

Introduction

The U.S. Army Corps of Engineers (Corps) Chicago District (hereinafter, District) Water Quality Program's (WQP) area of responsibility includes 3 flood control reservoirs. The District also manages one other reservoir and 12 locks and dams; however, there is no water quality mission there yet. The District drains waters of Illinois, Indiana, Wisconsin, and Ohio.

The District's three reservoirs are in Indiana and are diverse in characteristics (Table 1). The land use surrounding these reservoirs is mostly agricultural, some residential, and some resource extraction. The District includes watersheds with amazing biodiversity and beautiful scenery. Great recreational opportunities exist, and the District's projects host more than 1.2 million visitors annually.

Table 1: Chicago District lake facts.

Lake	Began Operation	Surface Area (Acres)	Flood Control	Recreation	Water Quality	Water Supply	Fish & Wildlife
Mississinewa	1967	3,180	X	X	X		X
Roush, J. Edward	1969	900	X	X	X	X	
Salamonie	1966	2,665	X	X	X		X

The District's WQP is responsible for water quality issues related to all waters within the District's jurisdiction. Construction of a flood control reservoir can have major impacts to a watershed and the surrounding ecosystem. The flow of water through an impoundment continuously influences the physical, chemical, and biological conditions both upstream and downstream, which ultimately determines the ecological integrity of the aquatic environment. Due to these influences, water quality must be an integral component of all Corps civil works missions. The Corps is mandated to meet all applicable Federal and State water quality standards and stewardship responsibilities at such projects as described in Engineer Regulation (ER) 1110-2-8154. In managing the operation of flood control and navigation projects, the Corps' decisions impact whether the projects have a positive or negative impact on the environment. As stewards of the environment, the Corps has a responsibility to conserve, protect, and, where necessary, restore that portion of the environment influenced by Corps projects.

Authorities

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

- Indiana Administrative Code Title 327, Article 2 – Water Quality Standards

Key Supporting Publications

Several Corps policies support operating Corps projects in an environmentally responsible manner. These include ERs, Engineer Manuals (EMs) and the Environmental Operating Principles. Division and District documents are also important as they provide more specific goals and applications of these policies. Key documents are listed below.

- ER 1110-2-8154; Water Quality Management; 31 MAY 2018
- ER 1110-2-3600; Management of Water Control Systems; 10 OCT 2017
- ER 1110-2-240; Water Control Management; 30 MAY 2016
- The Corps' Environmental Operating Principles
- U.S. Army Corps of Engineers Great Lakes and Ohio River Division (LRD) Water Quality Program Strategic Plan; October 2015

Mission and Objectives

Water quality issues associated with the operation of water control projects led to the development of the water quality discipline within the Corps. The impacts of impounding a free-flowing waterbody can be detrimental, extensive, and enduring. It is the policy of the Corps that the environment be given equal weight, not simply consideration, in all aspects of project management and the operational decision-making process. The District's WQP satisfies this need by following the general objectives listed in ER 1110-2-8154:

1. Ensure that water quality affected by district activities and projects and their operations are suitable for designated purposes, existing water uses, and public health and safety, and that operations comply with applicable Federal, state, tribal, and local laws and regulations, while meeting the purpose and objectives of the water resource development project.
2. Establish and maintain a water quality monitoring and data evaluation program that ensures the achievement of water quality management objectives, the evaluation of project performance, an understanding of water quality and associated trends and data essential for real-time modeling systems is available.
3. In a watershed context, identify existing and potential water quality problems, develop and implement effective operational strategies per applicable Corps authority and initiate management actions that offset or mitigate those problems.
4. Integrate water quality considerations into all water control management decisions.
5. Maintain coordination and communication among division and district elements involved in water quality matters.
6. Maintain close coordination and, where possible, collaboration with all interested governmental and non-governmental entities about activities that may affect (or be affected) by water quality or water control decisions associated with the Corps projects.
7. Use an interdisciplinary team approach to develop objectives, establish priorities and execute water quality management programs and activities.
8. Develop an understanding and continuing awareness of the water quality factors and processes in the project, its watershed and in the area influenced by project operation.
9. Where degraded conditions exist, explore appropriate Corps authority or legal requirements to address the conditions and develop plans to restore or improve water quality conditions as

appropriate and feasible. These plans should be coordinated with the appropriate Federal, state, tribal, local, and other stakeholders.

10. Ensure that all Corps water resource activities result in the lowest potential negative impact to the aquatic environment and that they are managed to accentuate their potential to improve conservation and preservation of natural and cultural resources.
11. Document the water quality management activities of the Civil Works Programs and individual projects to record trends, identify problems and accomplishments, and provide information and guidance.
12. Recognize that some problems and opportunities demand rapid, timely response. Per applicable emergency delegation authorities, district water managers may be empowered in some instances to react in a time frame commensurate with the event and with best available information and judgment. Long-term situations allow for more comprehensive study and refined response.
13. Promote and develop cost-sharing partnerships for water quality monitoring and data collection activities.
14. To the greatest extent possible, incorporate ecological sustainability and consider system response in all water resource activities.
15. In a watershed context, pursue collaboration with stakeholders and support education and communication.
16. Apply, as appropriate, water quality models and/or watershed-based management tools capable of predicting changes in water quality conditions in response to project operations and other water resource management activities. Water quality models and/or watershed-based management tools must be capable of evaluating changes in water quality within an acceptable level of uncertainty.

It should be noted that budget and personnel constraints will impact the pace and level at which the general objectives listed above can be met and maintained. A robust WQP is required to adequately meet district needs and policy requirements.

Overview of the District's Water Quality Characteristics

While water quality in the District is generally good, several water quality issues are known and require monitoring. It is important to note that these water quality issues of concern are similar to those experienced in other non-Corps waterbodies in the area. Although these issues are like other nearby waterbodies, increased awareness, attention, and evaluation is typically required to understand lake dynamics and impacts to our operations and authorized purposes. This monitoring is supported by the objectives listed in ER 1110-2-8154. Examples of water quality issues include environmental flow management, mineral and resource extraction techniques, Harmful Algal Blooms (HABs), climate change, and invasive species.

Current and Emerging Water Quality Issues

Eutrophication

Eutrophication is the excessive presence of nutrients in a waterbody. Streams, rivers, and reservoirs need nutrients to support primary productivity, and ultimately, all life in the waterbody. However, an excess of nutrients is detrimental to water quality and can cause harmful and excessive algal blooms,

low dissolved oxygen, and fish kills. Eutrophication is a natural phenomenon that occurs as a lake ages, however, human disturbances (e.g. agricultural runoff, residential fertilizers, sewage, etc.) greatly accelerate the process.

Through a series of biological and chemical processes, eutrophication can result in more extreme lake stratification and greater diurnal fluctuation in dissolved oxygen concentrations. The result is less dissolved oxygen at depths, which can reduce the availability of favorable habitat for aquatic organisms. Impacts can extend to reduced recreational use (i.e. fish kills and decreased perceived aesthetic value of the waterbody) and poorer quality drinking water. Additional negative impacts include diminished biodiversity, new species invasion, and algal toxin production.

Climate Change

Climate change is a significant variation in weather patterns occurring over time. Corps policy requires that climate change adaptation be mainstreamed into all Corps activities to help enhance the resilience of the Corps built and natural water resource infrastructure and to reduce its potential vulnerabilities to the effects of climate change and variability. One characteristic of climate change is increased temperatures. The USEPA has done an extensive trend analysis on approximately 25 years of District water temperature data. Preliminary results have indicated that reservoir temperatures are increasing.

General Watershed Disturbances and Sedimentation

Resource extraction, land development, and farming are examples of watershed disturbances that may negatively impact streams. Disturbances are directly correlated with increases in specific conductance, metals, sulfates, and sedimentation that threaten biological communities and habitats. While sedimentation is naturally occurring, human activity has accelerated its prevalence, especially in reservoirs and large rivers. Sedimentation can influence nutrient transport, decrease water clarity, and alter habitat, which in turn can threaten drinking water quality, biological organisms, and recreational use opportunities.

Harmful Algal Blooms (HABs)

Freshwater HABs are significant and excessive growths of blue-green algae, also known as cyanobacteria. All freshwater lakes are inhabited by native cyanobacteria species that can produce HABs. Several of these species can at times produce toxins (called cyanotoxins) that are harmful to the nervous system (neurotoxins), the liver (hepatotoxins), and the skin (dermatoxins) of humans and other animals. In addition to cyanotoxins, HABs can be harmful to the lake ecosystem and can cause depletion of oxygen levels which can result in large fish kills.

General contributing factors that promote the formation of HABs are:

- Ample sunlight
- Warm temperatures
- Low-water or low-flow conditions
- Excessive nutrients (nitrogen and phosphorus)

Although some HABs occur during the cold seasons, they most frequently occur during the summer when temperatures are high, sunlight is ample, and the flow of incoming water is low. Also, one of the most influential factors of HAB growth is the concentration of nutrients such as nitrogen and phosphorus. Most nitrogen and phosphorus pollution (i.e. eutrophication) comes from the runoff of

agricultural fertilizer, lawn fertilizer, untreated human sewage (storm overflows) and untreated animal sewage from concentrated animal feeding operations.

In a 29 June 2012 memo from CG Margaret Burcham, LRD Corps Districts were directed to develop HAB Response Plans in order to protect the public from the potential threats posed by HABs. In accordance with the memo, these plans are coordinated with the appropriate state agencies. As states refine and revise their statewide procedures, the Water Quality Team (WQT) continues to coordinate with them in order to have a cohesive approach. The District WQT has created a HAB Response Manual for the state of Indiana to serve as reference information on HAB response. Additionally, the District WQT provides information to the Invasive Species Leadership Team (ISLT) HAB Liaison (Mark Cornish, MVR) for vertical communication regarding HAB issues.

Invasive Species

Invasive species are non-native plants, fish, and wildlife which, by their introduction, can compete with and threaten the health and existence of native species and their supporting ecosystems. Invasive species often spread and dominate in ecosystems due to the absence of natural biological controls that tend to keep native populations in balance. Asian carp, zebra mussels, quagga mussels, and Eurasian water milfoil are examples of non-native aquatic species that may need to be managed on Corps project lands and waterways.

The WQT works with the ISLT regularly by providing input to our representative and responding to data calls. The ISLT is an 18-member team that consists of one representative from each Division office and a representative from one of the District offices within each Division. Corps Headquarters (HQUSACE) proponents include representatives from Natural Resource Management and Navigation along with a technical proponent from the U.S. Army Engineer Research and Development Center (ERDC). The main objectives of the ISLT are:

- To establish a network for the exchange and sharing of information on invasive species challenges, action being taken by others, lessons learned, and best management practices.
- To develop and provide strategic recommendations on a range of invasive species issues to Corps leadership.

The District's waters are impacted by invasive species (Table 2). This table is not a comprehensive list of all invasive species.

Table 2: Select invasive species documented in District watersheds.

Lake	Asiatic Clam	Bighead Carp	Common Carp	Goldfish	Silver Carp
Mississinewa Lake		X	X		
Roush, J. Edward Lake	X	X	X	X	X
Salamonie Lake			X		

The District WQP contributes to invasive species assessments through our intensive surveys and partnerships. Fish community assessments are included in these assessments due to the conclusions regarding long-term water quality conditions one can draw from the data. These data, with other District water quality data, are transferred to the state agencies to include in their assessments. This advances the understanding of invasive species habitat and dispersal.

State Classified Impaired Waters

Some streams within the District are listed as impaired waters by the state of Indiana. The National Water Quality Inventory Report to Congress (Combined 303(d)/305(b) report) is the primary means of informing Congress and the public about general water quality conditions in the United States. These reports consist of water quality assessments submitted by states, tribes, and others and summarized by the US Environmental Protection Agency (USEPA) for Congress.

In addition to designated uses, the report calls for a listing of impaired waters (Section 303(d)). States are required to develop and implement Total Maximum Daily Loads (TMDLs) for water resources listed on their respective 303(d) lists. The 303(d) impairments for each project are listed in Table 3.

"Designated Use" is a description of the use of the water body that is impaired, while the "Cause of Impairment" is a description of the cause of impairment. This information can be found in the Assessment and Total Maximum Daily Load Tracking and Implementation System (ATTAINS) USEPA database.

The District WQP contributes to this assessment through our partnerships and coordination with state agencies. The District's water quality data are transferred to the appropriate state water quality agency for inclusion in their data framework. From there, data are assessed alongside state (and other) collected water quality data in Clean Water Act (CWA) assessments. The WQT takes special care to ensure that our data are up to the best standards for inclusion in states' CWA assessments and that data are received by the agencies in time and proper format for analysis. This is one way that the District's WQP contributes to improvements in water quality in our watersheds.

Table 3 shows the impaired designated use and cause of impairment for the projects on the Upper Wabash River, as well as the Fox River and CAWS. Note that these listings do not necessarily apply to the watershed, but rather applies to a single waterbody or multiple waterbodies within the watershed. These values are reported by the state and information can be found in the ATTAINS USEPA database.

Table 3: District reservoir project watersheds with Clean Water Act Section 303(d) listed waters.

Water Body	**Year[1]**	**Impaired Designated Use/Cause of Impairment[2]**
Mississinewa Lake	2018	Fish consumption/PCB(s) in fish tissue
Roush Lake	2018	Fish consumption/PCB(s) in fish tissue
Salamonie Lake	2018	Human health and wildlife/PCB(s) in fish tissue and bacteria and other microbes
Lake Winnebago	2020	Fish consumption/Mercury in fish tissue
Fox River	2018	Aquatic life and fish consumption/Nitrogen and Phosphorous and mercury in fish tissue

1. The year of the most recent data from the ATTAINS USEPA database.
2. "Designated Use" is a description of the use of the water body that is impaired, while the "Cause of Impairment" is a description of the cause of impairment.

Reservoir Operations and Water Quality

Corps projects and water management activities impact natural resources in a variety of ways. Corps projects and their mode of operation influence the quality of the ecosystems, the usefulness of the water resource, and the overall benefit derived from a project and/or water resource management

activity. The impacts of projects and their operation may be destructive in some cases and have the capacity to affect the environment quite distant from the project. Therefore, efforts to maintain good water quality should be made while operating water resource projects.

Impacts of Limited Selective Withdrawal Capabilities

Selective withdrawal capabilities (i.e. multi-level intakes) describe a reservoir's ability to select and release water from different depths within a reservoir. These capabilities exist and are necessary to properly maintain reservoir and tailwater water quality characteristics during operations. Mimicking a natural temperature regime in the tailwater is critical for wildlife downstream of the reservoir. Additionally, the maintenance of cold water within the reservoir is important as it is a limited resource and can serve to mitigate other water quality problems.

All these considerations derive from the fact that during the warmer season, most reservoirs undergo a process called thermal stratification. Thermal stratification results in a separation of the lake into three very distinct layers. From top to bottom, these layers are called the epilimnion, metalimnion, and hypolimnion. While this process is driven by temperature, each of these layers have unique physical, chemical, and biological characteristics.

When a reservoir has limited selective withdrawal capability, an unnatural and harmful temperature regime is created in the tailwater. Limitations in selective withdrawal capabilities will almost always result in too cold tailwater releases in the spring and summer and too warm tailwater releases in the fall. If a reservoir's selective withdrawal capabilities are inadequate, water will mostly or only be released from the hypolimnion (i.e. bottom layer) of the reservoir. Over time, this depletes the volume of cold water in the reservoir resulting in tailwaters and reservoirs that are too warm during the fall and early winter.

Inappropriate (too cold or too warm) temperature releases in the tailwater harm aquatic life in many ways. First, unnatural temperature regimes interrupt breeding queues resulting in diminishing populations. Secondly, temperature impacts an aquatic organism's growth and feeding habits. Additionally, water temperature can increase the harmfulness of certain water quality parameters on aquatic wildlife (e.g. ammonia). Lastly, the solubility of oxygen is decreased as water temperature increases.

Over the summer, a reservoir with insufficient selective withdrawal capabilities will increase in temperature. Increased temperature in the reservoir promotes algae growth. Eventually, these excessive algae blooms will die and be consumed by bacteria. The bacteria that consumes the algae will deplete oxygen levels in the reservoir potentially causing fish kills within the reservoir body as well as the tailwater. Low reservoir dissolved oxygen is experienced in all the District reservoirs and the Fox River. The occasional fish kill is documented due to this dissolved oxygen depletion.

Water Quality Criteria Exceedances

Water quality criteria define acceptable levels of contamination in the environment. The CWA directed the USEPA to develop water quality criteria for the protection of aquatic life. These criteria can be adopted as enforceable standards by states and tribes. Exceedances of water quality criteria are assessed in the District as encouraged in ER 1110-2-8154. Water quality criteria exceedances in the District are not numerous or extreme, however they have been documented as occurring within project reservoirs. Exceedances of copper, dissolved oxygen, temperature, mercury, iron, ammonia, zinc, and

pH have been documented in the District. All exceedances found are reported to the state water quality agency as well as other partners. Additionally, any exceedances found within a year will be specified and discussed in the WQP's Annual Report.

Water Quality Program Implementation Strategy

A water quality program designed to monitor status and trend data is essential to understand and effectively manage the District's water resource projects. According to ER 1110-2-240, water control management responsibilities include, "Analyzing water quality parameters necessary to evaluate proposed operations and inform water control management decisions." Therefore, it is crucial that the District's WQP be adequately staffed and funded in order to provide current information as well as track trends (i.e. increases, decreases or status quo in analyte levels). Such data can be shared with water managers, watershed interests, policy makes, and other potential stakeholders.

Monitoring and Studies

Due to the diversity in the District's water quality needs and the quantity of water managed by the District, a strong water quality program is necessary. Water quality data must be collected, analyzed, and applied to understand and manage water resources effectively. The following examples of water quality monitoring and data collection objectives are listed in ER 1110-2-8154.

1. Assess compliance with applicable Federal, state, and tribal water quality standards.
2. Provide adequate, publicly available database for understanding current water quality conditions, identifying trends, identifying problems and solutions and facilitating coordination with Federal, state, and tribal agencies regarding watershed activities influencing water quality.
3. Investigate special problems (such as harmful algal blooms (HABs), fish kills, radionuclides, or other acute or chronic conditions), and design and implement modifications to improve water management procedures.
4. Provide data to support reservoir regulation and other civil works activities, support effective management, manage water quality, and address environmental problems.
5. Provide water quality data required for real-time project operation, which may include regulatory compliance, environmental flow management and ecological sustainability.
6. Evaluate sediment physiochemical interactions with water quality conditions and their effects on overall water quality.
7. Understand, protect, and restore aquatic and riparian environments and ecosystems.
8. Through training, Community of Practice, lessons learned, and close attention to system response, develop and maintain water quality awareness to ensure sound stewardship of environmental resources.
9. Monitor recreational areas and water supplies to ensure public safety and restore integrity.
10. Ensure stormwater, erosion, and sediment control best management practices are designed, constructed, maintained, and functioning per applicable state and local requirements.
11. Collect water quality data to support studies, evaluations, and water resource modeling.
12. Consider spatial watershed relationships or conditions through both short and long-term seasonal, annual, and/or multi-annual trends in water quality.
13. Identify/modify water quality data collection requirements to meet evolving management objectives, regulatory requirements, and/or Corps policies.

14. Develop a sufficient data record to document water quality impacts or harm to project purposes and/or resources from external sources.
15. Provide timely response to incidents that could impact project operations and/or resources.

In order to meet Corps policy on water quality and environmental protection, a variety of techniques must be used. Several of these approaches are described in EM 1110-2-3600. These methods include a diverse set of water quality surveys and studies. These surveys and studies are accomplished through in-house collection, contracts, and partnerships. Stringent quality control procedures are followed on all data collection and sampling activities. At times, the types of surveys, sampling, analyses, and frequency of sampling must be altered in response to environmental events, weather, staffing levels, and budget constraints. Below is a description of the types of surveys and studies necessary to meet the District's WQP objectives.

Project Profiles

Project profiles monitor the status and progression of thermal and chemical stratification in a reservoir. Project personnel take temperature and dissolved oxygen readings approximately once every two weeks during reservoir stratification. These profiles are collected at all reservoir projects. Data include the reservoir profile as well as a tailwater reading of temperature and dissolved oxygen. Data collected from these readings are used to manage the quality of the release from the reservoir. Data from the United States Geological Survey (USGS) gages are also used, when available.

Ambient Surveys

The purpose of ambient surveys is to capture the status of water quality in the reservoir during thermal stratification. This effort is conducted through an annual sampling event. District staff travel to each of the three reservoirs to sample the reservoir body, primary inflows, and tailwater. They collect field data and grab samples for various chemical and biological (e.g. phytoplankton, zooplankton, and chlorophyll) analyses. Water quality parameters measured and tested are relatively standard; however, customized plans have been and are being developed for many reservoirs. These data are used to evaluate reservoir operations and environmental concerns, both long and short term in nature.

Intensive Surveys

Intensive Surveys are designed to more thoroughly assess water quality parameters within a watershed. These surveys are conducted on a ten-year rotation (i.e. one reservoir every three years) at each reservoir. Sample stations are sampled three times – during the spring, summer, and fall. Sample sites, additional to what would be included in ambient surveys, are added. Additional biological assessments are conducted (e.g. fish and macroinvertebrates) and additional water quality parameters may be assessed. This provides a seasonal and more in-depth picture of water quality status of a reservoir.

Emergency and Situational Response

Emergency and situational response surveys are conducted on an as-needed basis. These surveys are typically in response to an unusual environmental event (e.g. fish kills, plankton blooms, chemical spills). However, these surveys can also be in response to a rare change in operations such as periodic inspections which allow access to habitat that is typically too deep and rapid to assess. Data collected during these surveys are reviewed, imported into the LRC WQ database, and used in future assessments. Additionally, a special report or public advisory may be issued based upon data results.

Harmful Algal Bloom (HAB) Response

HAB response is a type of emergency response sampling that occurs when a HAB is suspected. All efforts are coordinated with Operations project staff and state agencies per the HAB Response Plan instructions for Indiana. These efforts occur only as needed.

Special Studies

Special studies are planned, non-routine efforts to answer questions about a reservoir and/or its watershed. These surveys are supported by ER 1110-2-8154. Types of special studies that can be conducted include, but are not limited to, modeling, greenhouse gas, sediment, bathymetry, data collection efficacy analysis, and complex HAB analyses. These studies are conducted on an as-needed basis.

Partnerships

Partnerships are critical to program success. The views of other federal, state, and local agencies must be considered when developing or revising water control plans or designing new water quality studies. Because data collection can be costly and labor-intensive, efforts to share data collection will result in a more efficient and effective water quality program. Coupling water quality data with hydrologic, climatic, and other environmental data is essential for a water management program.

The District's water quality partners include:

- United States Environmental Protection Agency
- United States Geological Service
- United States Fish and Wildlife Service
- Indiana Department of Environmental Management
- Indiana Department of Natural Resources
- The Nature Conservancy
- Salamonie Watershed Committee
- Several internal Corps entities

The District's WQT prioritizes partnerships with other water resource agencies to leverage resources, obtain expertise, and access services additional to what is available within the District. Every effort is taken to ensure that the District receives the best information and highest quality assessments that are available. Additionally, working collaboratively with partners not only leverages resources but also serves to further advance the field in general and improve water quality.

Data Management and Analysis

Water quality monitoring and data collection are essential to understand and manage the environmental resources of Corps water projects. For the District's WQP to provide benefit to the District, the program must not only collect data, but organize, preserve the quality thereof, and analyze data. Data maintenance and analysis are equally important to data collection.

When water quality data are received, they are formatted and imported into the District's live water quality database as soon as possible. All District water quality data are stored in one database located on a local server. This database is regularly backed up and secured in several locations for redundancy and protection. The District's water quality database is currently a Microsoft Excel file. To interact with the database, the WQT uses a program called Data Analysis Software for Lakes, Estuaries, and Rivers

(DASLER). DASLER is used as an interface to work with an Access database file. LRC is currently working with ERDC on developing a new database for the Upper Wabash projects.

Some data that are received (e.g. project profiles) are immediately imported, analyzed, and used to make reservoir operations. Once these operations are made, the data are still used in other analyses. For more complex analyses, graphical and statistical methods are used. Data analysis conducted in the District include status analyses, determination of existing limnologic conditions, level of attainment of existing federal and state water quality standards, and various biological assessments. Results of these assessments are shared in the District's WQP Annual Report. Future assessments include but are not limited to trend analyses, problem identification and quantification, and the application of water quality models.

The Water Resources Development Act (WRDA) of 2007 directed the Corps to make all water data accessible to the public via the internet. In 2009, the Committee on Water Quality submitted a Water Quality Data Implementation Plan to meet the requirements of WRDA 2007. The Corps is in the beginning stages of satisfying the WRDA requirement by making water quality data publicly available via Access 2 Water (A2W). Once the A2W program and process is complete, the District WQP will migrate all program data to the A2W website for public use. Currently, the public can access any data by contacting the District WQT; this information and the WQT's contact information is found on the WQT's webpage.

Planning and Reporting

The WQP will produce several plans and reports that will aid in managing the program (Table 4). Some plans and/or reports are updated annually. However, some are updated only as needed. It should be noted that keeping these documents up to date requires adequate staff.

Table 4: Description and status of Water Quality Program plan and report documents.

Document	**Update Frequency**	**Description**
Water Quality Program Management Plan	Annually	Aids in establishing program goals, objectives, and priorities for surface water quality issues within the District.
Annual Operating Plan	Annually	Lists program priorities and needs for the WQP within a specific fiscal year. A fiscal year budget summary is included.
Annual WQ Report	Annually	Detailed review and assessment of water quality activities over the previous calendar year. Findings and recommendations from this report are used to prioritize future budget requests and monitoring needs.
HAB Response Plans	As needed	Assists in protecting the public from the potential threats posed by HABs. They are coordinated with state agencies and Operations.
Exceedance Assessments	Annually	Assesses impacts of reservoir operations and policy requirements attainments. Exceedances are included in the Water Quality Program Annual Report.

State Sampling Plans	As needed	Required by IDEM for accepting data external to their agency.
Strategic Plan Implementation Record	As needed	Describes and records the implementation of the LRC WQP Strategic Plan in the District's WQP.
Water Management Annual Report (contribution)	As requested	Reviews and assesses the management of the District's multi-purpose reservoirs.
Water Management Program Management Plan (contribution)	As requested	Establishes the basis for managing the Water Management products and services conducted by the District Water Management Team
Reservoir Water Control Manuals (contribution)	As requested	For day-to-day use in water control for essentially all foreseeable conditions affecting a project or a system. Water control plans should be updated not less than once every 10 years.

Programmatic planning promotes the success of programs in many ways. Planning establishes priorities and guides the alignment of programmatic elements to meet district, regional, and national objectives. Programmatic planning ensures that programs stay on track long-term when impairments such as inadequate manpower or funding occur. Additionally, prioritization through adequate planning increases the likelihood that the best decision will be made in any given situation.

ER 1110-2-8154 recognizes that various types of reports are required to ensure that adequate information is available to HQUSACE, divisions, districts, other agencies, and the public. The ER lists several types of reports including project-specific reports, needs assessment reports, special situation reports, special study reports, and annual water quality summary reports. Reports are important as they share water quality data, interpretation, and analyses.

Risks and Challenges

With so many working parts, integration between offices and a field that involves the environment, it's no surprise that implementing a WQP carries a substantial amount of risk. Risks to the WQP can be separated into three categories – internal, external, and natural. Specific risks and impacts of each type are described below.

Internal risks include funding constraints, contracting issues, and staffing limitations. A loss of funding, staff, or contracting authority will ultimately result in a decreased ability to meet WQP objectives and maintain compliance with laws and regulations. The program serves as the only long-term, continuous water quality monitoring effort within the District. Data collection is vital for determining long-term trends relative to state water quality standards, watershed conditions, recreational conditions, and drinking water quality. Additionally, Indiana uses data to determine compliance with state water quality standards, to determine if waters require listing on impaired waters lists, and to determine if TMDL requirements are achieved.

External risks include laboratory quality assurance/quality control (QA/QC) issues, laboratory closure, and sample equipment malfunctions and repair delays. The WQT Leader is responsible for deciding how to address such issues and determining both short and long-term program impacts.

Natural risks include weather (short-term) and climate (long-term) impacts. Weather can influence scheduled sampling events and poses the most risk to events that are coordinated between multiple agencies. Climatic conditions can also impose risks to scheduled monitoring efforts. Prolonged drought conditions have the potential to reduce inflow and in-lake sample locations. Expansive floods can alter inflow sample locations and sample schedules. The WQT Leader will be responsible for determining alterations or modifications to annual sampling schedules related to such natural risks.

The WQT Leader, in consultation with the rest of the WQT and the Hydraulic and Environmental Engineering Section Chief, will determine the most effective plan to address any of the risks. When funding and staffing limitations exist, prioritizing activities can be difficult. However, this is when adequate planning is most critical.