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Kentucky River Basin: Unified Long-Range Water Resources Plan. Executive Summary

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Kentucky River Basin:

Unified Long-Range Water Resources Plan

Executive Summary

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Prepared for:
The Kentucky River Authority

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2.0 OVERVIEW OF THE KENTUCKY RIVER AUTHORITY

The Kentucky River Authority was formed by the Kentucky General Assembly in 1986 to assume operation of the Kentucky River Locks and Dams 5 through 14 from the United States Army Corps of Engineers. After the drought of 1988, the Authority was given the added responsibilities of protecting and improving the waters of the Kentucky River through environmental management of the entire watershed.

Specifically, the mission of the Kentucky River Authority is to maintain and manage the water resources of the Kentucky River Basin; provide a clean water supply for the citizens of the Basin; provide leadership and a common forum for all stakeholders in the Basin; and promote the highest and best recreational uses of the water resources in the Basin. With regard to water supply, the KRA engages in planning, stream flow monitoring, capital facility improvements, technical assistance and providing recommendations for alternative water sources. Within the category of water quality, the KRA's activities relate to support for volunteer monitoring through the Kentucky River Watershed Watch; watershed management; a Kentucky River headwaters initiative; and solid waste clean-ups. In order to develop recreational activities on the Kentucky River, the KRA facilitates lock operations, boat ramp construction, park development and provision of public information.

Legislative authorization for the Authority's programs is contained in KRS 151.700-798 and 420 KAR 1:010-050. The Authority's programs can be generally categorized as relating to water supply, water quality and recreation. As part of the Authority's water supply responsibilities, the Authority was mandated by regulatory statute 420 KAR 1:030, Section 4 to develop a Unified Long-Range Water Resources Plan for the Kentucky River Basin. The statute directs the Kentucky River Authority to develop this plan, which shall at a minimum address the following components:

- 1.) Acquisition and utilization of the Kentucky River Lock and Dam system
- 2.) Construction, acquisition and control of projects and facilities
- 3.) Commercial and recreational navigation on the Kentucky River
- 4.) Storm-water management
- 5.) Physical, chemical and biological conditions
- 6.) Protection of public health
- 7.) Improvement of fisheries
- 8.) Means of controlling water quality
- 9.) Abatement of water pollution
- 10.) Control of run-off, erosion, and agricultural and urban non-point source pollution
- 11.) Land management to prevent and to control erosion and to improve water quality
- 12.) Integration of county long-range water resource plans
- 13.) Regulation of flows and allocation of supplies
- 14.) Control of withdrawals and diversions of surface water and ground water
- 15.) Basin-wide and specific local land and water conservation measures and practices
- 16.) Floodplain protection and flood damage reduction
- 17.) Recreational opportunities and recreational areas
- 18.) Generation of hydroelectric power

19.) Economic development

This report addresses each of these components individually along with reference to other related reports where applicable. Together they make up a comprehensive set of documents that comprise the ULRWRP for the Kentucky River Authority.

3.0 ASSOCIATED REPORTS

Where applicable, each of the requirements listed for the Unified Long Range Water Resources Plan have been addressed through one or more additional reports that make up a library of documents that compose the ULRWRP (see Figure 2). These reports include: 1) *Historic Water Supply Plans of the Kentucky River Basin*; 2) *Kentucky River Authority Capital Construction Plan*; 3) *Kentucky Water Shortage Response Plan*; 4) *Kentucky River Authority Valve Operating Plan*; 5) *Kentucky River Basin Management Plan*; 6) *County Water Management Planning for the Kentucky River Basin*; and 7) *Volunteer Assessment of the Kentucky River Basin*. A brief overview of each report is provided in the following sections where the applicable component of the ULRWRP addressed by the report is identified by [#].

Historic Water Supply Plans of the Kentucky River Basin	Kentucky River Authority Capital Construction Plan	Kentucky Water Shortage Response Plan	Kentucky River Authority Valve Operating Plan	Kentucky River Basin Management Plan	County Water Management Planning for the Kentucky River Basin	Volunteer Assessment of the Kentucky River Basin
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Figure 3.1 Library of Documents that make up the ULRWRP

3.1 Historic Water Supply Plans of the Kentucky River Basin (KWRI, 2003) [1,2,13,15,19]

The document entitled, *Historic Water Supply Plans of the Kentucky River Basin*, was developed specifically for this ULRWRP by the Kentucky Water Research Institute at the University of Kentucky. It provides summaries of the numerous reports written about the water resources of the Kentucky River. Many of these reports were written upon the request of a local, state or federal agency, or were required by state or federal legislation. Thus, they are categorized by the agency or organization sponsoring the specific study.

The reports written about the Kentucky River basin cover a variety of topics, but focus primarily on water supply issues and the potential for developing additional supplies in the basin. Many proposals are offered for ways to increase storage in the mainstem pools of the river, as well as for potential reservoir sites in the river’s tributaries. The summary table at the conclusion of this report lists historically proposed water supply alternatives, along with a notation of which projects were actually completed. For those supply alternatives not completed, an attempt is made to explain why it was not pursued.

3.2 Kentucky River Authority Capital Construction Plan (KRA, June 2001) [1,2,3,17,19]

The KRA Capital Construction Plan was initially developed in 2000 and updated in 2001 for the 2002-2008 biennia. It provides an overview of the Authority's activities as they relate to each of three major categories—water supply, water quality and recreation. The prioritization of projects in the capital plan expands on the "Kentucky River Water Storage Enhancements" project, authorized by the General Assembly in 2000. This project encompasses several sub-projects, including the sequential renovation and modification of Lock and Dam 10, Lock and Dam 9 and Lock and Dam 11. These sub-projects will increase the capacities of Pools 9, 10 and 11 in order to achieve a target of a minimum of an additional three billion gallons of water storage for Kentucky River Basin communities. In addition to detailing the purpose and status of these individual sub-projects, the plan provides financial summaries of their costs and funding sources.

3.3 Kentucky Water Shortage Response Plan (KDOW, 1988) [13,14,15]

The Kentucky River Authority is currently pursuing the development of an operational model for the Kentucky River, along with an associated drought management plan. Until their completions, the KRA has adopted the Kentucky Water Shortage Response Plan to assist local communities in the decision-making process during water shortages. Through recommendations in the response plan, the Kentucky Division of Water intends to help communities avoid the social and economic repercussions that can occur with a drought emergency.

The response plan describes a procedure for all local water managers and city officials to use in monitoring and managing water supplies and the demand on those supplies. The original plan was used by many local water management officials during the droughts of 1986 and 1987 and was subsequently revised based on suggestions stemming from these experiences.

As described by the plan, the state's Drought Notification System establishes two levels of awareness for a water shortage, a Water Shortage Watch and a Water Shortage Warning. The announcement of either the watch or warning is accompanied by the geographic area affected, and, in certain instances, the supply sources affected. On the local level, officials should determine the severity of the shortage and declare an Advisory Phase, Alert Phase, Emergency Phase or Rationing Phase—each of which is tied to specified conservation and related activities.

Other topics addressed in the response plan include: evaluation of vulnerability to water shortages, determination of ability to meet demand, public information and education strategies, water conservation measures, recommendations for appointing local water shortage management task forces, sample ordinances and by-laws, considerations for alternate sources, water quality concerns and pricing strategies.

3.4 Kentucky River Authority Valve Operating Plan (KRA, April 1999) [1,8,13,14,15]

The Kentucky River Authority is currently pursuing the development of an operational model for the Kentucky River, along with an associated drought management plan. In the interim, the River Authority has developed a Valve Operating Plan. The KRA's Valve Operating Plan was developed by staff consultants of the KRA using the KYBASIN planning model developed under a separate contract with the Kentucky Water Research Institute. The KRA's Valve Operating Plan details a system of regulating the flow of the Kentucky River during times of drought to make efficient use of the water stored behind the dams. This level of water use accounts for minimum environmental flows, as well as equitable water supply to all mainstem users.

The valves in the dams and lock gates along the river can be used to pass water from upstream to downstream pools. In this way, water stored in the pools below the dam crests is allowed to flow downstream. This method of transferring water is only necessary when the natural flow in the river is less than the needed withdrawal amounts, as may occur during a drought.

The plan is tied to specified low flow conditions, or "triggers," on the river between Locks and Dams 4 through 14. When these trigger flows occur, allowable water withdrawals are reduced and the valves are adjusted to enable predetermined flows. The plan details specific valve flows and allowable withdrawals for increasingly severe low flow conditions.

3.5 Kentucky River Basin Management Plan (KWRI, April 2002) [4,5,6,7,8,9,10,11]

The *Kentucky River Basin Management Plan* was prepared for the KRA by the University of Kentucky – Kentucky Water Resources Research Institute. It is a product of the activities associated with the first cycle of the Kentucky Watershed Management Framework, a dynamic, flexible structure for coordinating watershed management across Kentucky. Through this framework, watershed data are analyzed at five-year intervals, and watershed planning is expanded and improved in each cycle. Existing state and local programs are connected through the geographic focus of the watershed, promoting comprehensive efforts mobilized around managing these watersheds.

The Kentucky Watershed Framework Process is organized around five state management units, which encompass the 12 river basins in the state. (See Figure 3.2) The Kentucky River Basin is classified as one of the five management units and was the first to be assessed under a revolving five-year cycle. During this cycle, participants engage in monitoring and data collection (year one); watershed assessment (year two); watershed prioritization and ranking (year three); plan development and stakeholder involvement (year four); and implementation and evaluation (year five). Further details about the Kentucky Watershed Framework Process can be found at the internet address <http://kywatersheds.org>.

The Management Plan presents information and priorities identified in the first Kentucky River basin cycle (1997 – 2002), and sets forth priorities for activities during the second cycle. The document is divided into two major sections, entitled *Management Plans* and *Watershed Summaries by Region*. The first section provides Watershed Management Plans for the three priority watersheds identified in the basin—the Red River Gorge Watershed, the South Elkhorn

Creek Watershed and the Eagle Creek Mouth Watershed. This section also summarizes Program Management Plans, which describe how activities of partner agencies will be coordinated during the second basin cycle scheduled to take place from July 2002 to July 2007. The *Watershed Summaries* describe relevant conditions in each of the basin's 97 watersheds, providing descriptive information (geography, waterways, land and water use and agency data assessment), results of framework rankings, highlights of critical issues and activities, diagrams of the watershed's position in the basin and related maps. The Management Plan can be viewed in its entirety at the website address <http://www.uky.edu/WaterResources/Watershed>.

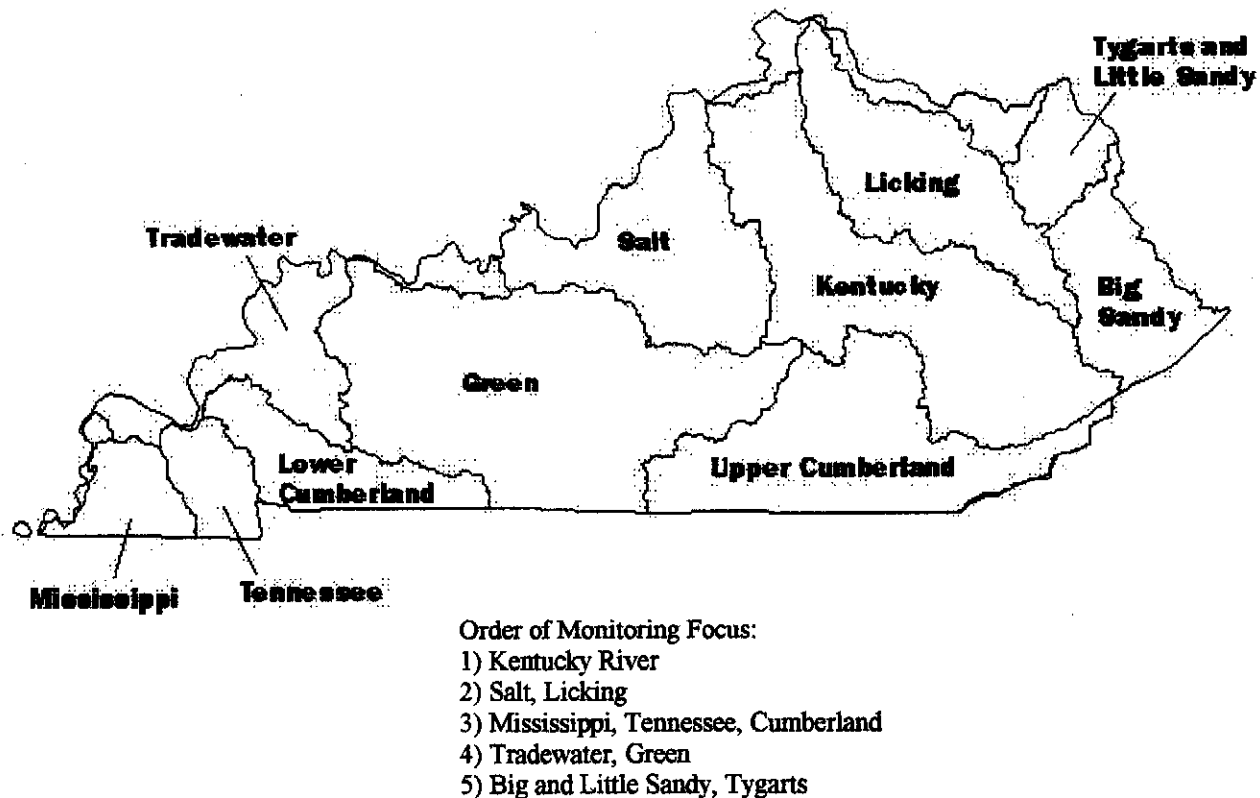


Figure 3.2 River Basin Management Units as part of the Kentucky Watershed Management Framework Process

3.6 County Water Management Planning for the Kentucky River Basin (KWRI, 2003) [12,13,14,15]

In 1990, the Kentucky General Assembly passed KRS151.114-.118, mandating that long-range county water supply plans be developed by July 15, 1998, according to guidelines to be developed by the Kentucky Division of Water. This report summarizes the resulting county water supply plans for all public water suppliers utilizing water sources located within the Kentucky River Basin.

Thirty-two public water suppliers in 25 counties utilize water supply sources in the Kentucky River basin. Eleven suppliers use the main stem of the Kentucky River as their source, 10

suppliers withdraw from tributaries of the Kentucky River, 13 utilize reservoirs in the basin and four suppliers withdraw from groundwater wells. (Some suppliers use more than one source, resulting in more than 32 sources.)

Elements assessed in the summary document include the county suppliers, their sources and treatment capacities; population projections and expected increases in water demand; water availability; supply adequacy assessment and any needed alternative supply sources; and cost estimates for future infrastructure needs. A separate table provides a discussion of the 14 Kentucky River Basin suppliers found to be drought vulnerable and the primary supply alternative being considered by each.

3.7 Volunteer Assessment of the Kentucky River Basin (KWRI, 2002) [5,6,8,9,10]

The Kentucky River Authority provides annual funding to the Kentucky River Watershed Watch to conduct annual synoptic sampling of streams throughout the river basin. This volunteer sampling effort is coordinated on an annual basis by the University of Kentucky – Kentucky Water Resources Research Institute, which produces an annual report of the sampling results. The most recent report was completed in 2002 and is published on the internet at <http://www.uky.edu/WaterResources>. Sampling parameters assessed in the report include temperature, dissolved oxygen, conductivity, pH, fecal coliform, nutrients, herbicides and metals.

4.0 DETAILED DISCUSSION OF THE COMPONENTS OF THE ULRWRP

As previously noted, regulatory statute KAR 1:030, Section 4, requires that the Kentucky River Authority develop a comprehensive Unified Long Range Water Resources Plan that addresses each of the items identified in Section II. The following provides a specific discussion of how each requirement is addressed.

4.1 Acquisition and utilization of the Kentucky River Lock and Dam system

This ULRWRP requirement is largely met through the KRA's *Capital Construction Plan*. The *Capital Construction Plan* explains the ownership and operation status of the fourteen Locks and Dams on the Kentucky River (see Figure 4.1). The U.S. Army Corps of Engineers currently maintains *ownership* of all lock and dam systems on the river except Lock and Dam 10, which is owned by the state of Kentucky. The KRA is working with the Corps of Engineers to transfer Locks and Dams 5 through 14 to the state and will assume responsibility for their long-term operation and maintenance. The KRA is also cooperating with local governments and citizen groups to convert the adjacent lock master properties into recreational areas. In addition, due to the minimal use of Locks 1 through 4, the Corps plans to transfer title of these additional facilities to the KRA. These facilities were added to KRA's lease in March 2002. Actual title transfer will occur following a minimum 5-year disposition period, during which the Kentucky Natural Resources and Environmental Protection Cabinet must sign-off on the transfer and any required environmental cleanup must be completed.

In 1986, the Kentucky River Authority was established to take over *operation* of the Kentucky River Locks and Dams 5 through 14 from the Corps of Engineers. In 2002, Locks and Dams 1 -4 were added to KRA's operations responsibilities. Lock operating personnel operate the release valves; monitor and maintain the equipment, buildings and grounds associated with the locks; and provide field contact with the general public.

Rather than being used to enable navigation, the lock and dam system on the Kentucky River is predominantly used as a means of water storage for supplying communities along the river. The report, *Historic Water Supply Plans of the Kentucky River Basin*, details historically proposed methods of maximizing Kentucky River water supply through utilization and management of the lock and dam system. Some examples of recommended actions include low-level valve releases, raising dam heights, addition of crest gates to the dams and piping water from Pool 6 to Pool 9 of the river. The KRA's *Valve Operating Plan* explains existing procedures for using low-level valves in the Locks and Dams to release water downstream during extreme low flow conditions.

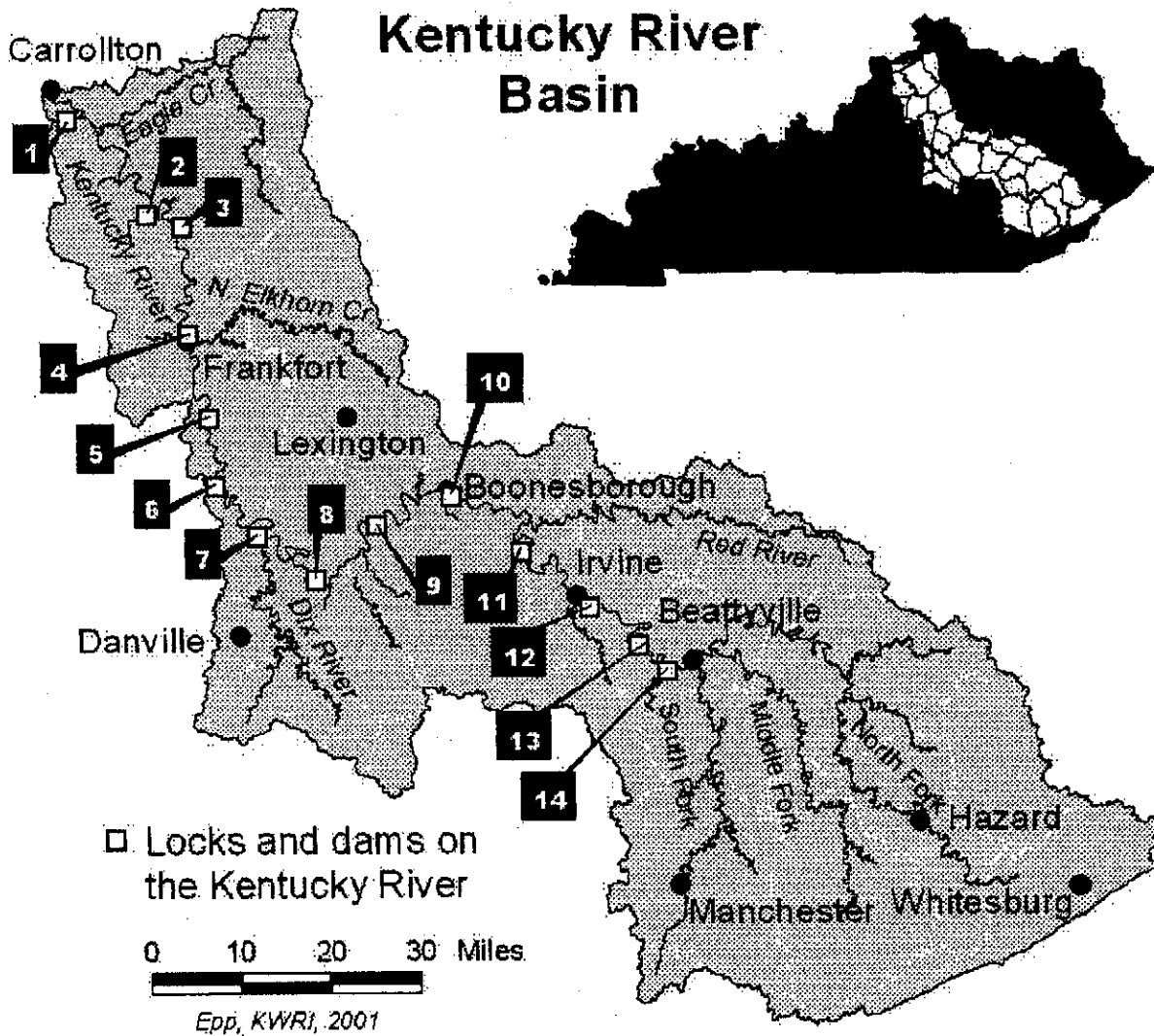


Figure 4.1 Location of Locks and Dams on the Kentucky River

4.2 Construction, acquisition, operation and control of projects and facilities

The long range plan for modifications to the existing locks and dams is provided in the KRA’s *Capital Construction Plan*. In general, the plan calls for the expansion and execution of the previously authorized “Kentucky River Water Storage Enhancements Project.” This plan details sub-projects aimed at the renovation and modification of Locks and Dams 9 through 11. The goal of these subprojects is to achieve a target of a minimum of three billion gallons of additional water storage in Pools 9 – 11, thereby alleviating a portion of the region’s water supply deficit predicted for times of drought.

On December 11, 2002, the KRA voted to pursue raising Dam 10 by either four feet or six feet. By raising the dam, an additional 1.0 to 1.6 billion gallons of storage capacity will be created in Pool 10. In addition, the construction of the new, higher dam just upstream of the existing dam would eliminate the function of Lock 10. If the function of this lock is later considered a priority and funds to repair it are available, the new dam can be modified to enable this. Construction of the new Dam 10 is expected to occur during the 2006-2008 construction seasons, and \$24 million in funding has already been earmarked for the project. Through an 80/20 cost-share arrangement with the federal government, the KRA must pay 20% of the \$24 million or total project cost, whichever is less.

Since its inception, the KRA has worked to ensure that Locks and Dams 9 and 11-14 have functioning low-level release valves to enable water releases during low flow periods. In order to transfer water through Lock 10, valves in the lock gates are opened. The current Dam 10 project includes plans to install a new low level valve for the facility.

The most recent KRA construction projects occurred in fall 2001 when concrete bulkheads were constructed in the lock chambers of Locks 8 and 9 and a new low level valve was installed in Lock 9. Minor work was completed in fall 2002 on the far abutment at Dam 8 to reduce leakage around the dam.

Additionally, maintenance needs are being pursued at Lock and Dam 10. The Louisville District of the Army Corps of Engineers is performing a detailed evaluation that will result in recommendations for the near-term stabilization of the existing structure. The proposed project includes actions to stabilize the main dam, the land lock wall and the miter gates at Lock and Dam 10. The repairs are expected to cost approximately \$1 million and will not substantially alter the function of the existing lock and dam. The \$1 million cost will be deducted from the \$24 million allocated for the replacement and raising of Dam 10.

4.3 Commercial and recreational navigation on the Kentucky River

This ULRWRP requirement is largely met through the KRA's *Capital Construction Plan* and its annual Lock Schedule. The lock and dam system on the Kentucky River was built in the late 1800's and early 1900's to enable commercial traffic on the Kentucky River from the mouth at the Ohio River to Beattyville. Coal was expected to be the principal commercial cargo on the river, but the completion of railroads into the Eastern Kentucky coal region diminished this use. Although very little commercial traffic ever materialized on the Kentucky River, the U.S. Army Corps of Engineers continued to operate the locks until the mid 1980's.

At that point, the KRA assumed operation of locks 5 - 14 for summer, weekend traffic only. As of August 1, 2002, the KRA also assumed operation of Locks 1 through 4 from the Corps of Engineers. In the recent past, there has been minimal use of the locks, mainly the commercial transport of sand and gravel from the Ohio River to Frankfort through Locks 1 - 4 and some recreational traffic through the remaining locks. (For example, before its closure in 2000 due to mechanical problems, Lock 10 was used during the summer of 1999 by 196 individual boats, which locked through 580 times.)

Locks 5 – 14 are now closed to traffic. The temporary closure of additional lockage facilities is likely, due to the continued deterioration of the remaining locks in operation; their potential for causing loss of water supply; and the high cost of refurbishing them. The following table outlines the 2003 dates of operations for all 14 Kentucky River locks.

Table 4.1: Kentucky River Lock and Dam Schedule

Lock	Operator	Status	Schedule
Lock 1	KRA*	Open	5/26 – 9/28, Friday – Sunday and July 7 th and Sept. 1 st
Lock 2	KRA*	Open	5/26 – 9/28, Friday – Sunday and July 7 th and Sept. 1 st
Lock 3	KRA*	Open	5/26 – 9/28, Friday – Sunday and July 7 th and Sept. 1 st
Lock 4	KRA*	Open	5/26 – 9/28, Friday – Sunday and July 7 th and Sept. 1 st
Lock 5	KRA	Closed	N/A
Lock 6	KRA	Closed	N/A
Lock 7	KRA	Closed	N/A
Lock 8	KRA	Closed	N/A
Lock 9	KRA	Closed	N/A
Lock 10	KRA	Closed	N/A
Lock 11	KRA	Closed	N/A
Lock 12	KRA	Closed	N/A
Lock 13	KRA	Closed	N/A
Lock 14	KRA	Closed	N/A

* Locks 1-4 were operated by the U.S. Army Corps of Engineers until August 1, 2002.

The *Capital Construction Plan* offers description of the use of locks and dams to enable the minimal amount of commercial and recreational navigation still occurring on the Kentucky River. In addition, the U.S. Army Corps of Engineers’ website provides details about their operations at [http:// www.lrl.usace.army.mil/optm/](http://www.lrl.usace.army.mil/optm/).

4.4 Storm water management

This ULRWRP requirement is largely met through the *Kentucky River Basin Management Plan* in cooperation with the Kentucky Division of Water’s oversight of the KPDES (Kentucky Pollutant Discharge Elimination System) Program. Three types of storm water discharges are regulated—those stemming from construction activities, industrial activities and municipal separate storm sewer systems (MS4s). Most storm water discharges are considered point sources and require coverage by a National Pollutant Discharge Elimination System (NPDES) permit, or KPDES permit, as issued by the Kentucky Division of Water.

In 1990, the U.S. Environmental Protection Agency (EPA) developed Phase I of the NPDES Storm Water Program in order to address sources of storm water runoff that had the greatest

potential to negatively impact water quality. Under Phase I, EPA requires NPDES permit coverage for storm water discharges from "medium" and "large" municipal separate storm sewer systems located in incorporated places or counties with populations of 100,000 or more, as well as eleven categories of industrial activity; one of which is construction activity that disturbs five or more acres of land.

The Phase II Final Rule, published in the Federal Register on December 8, 1999, requires NPDES permit coverage for storm water discharges from certain regulated "small" municipal separate storm sewer systems, and construction activity disturbing between 1 and 5 acres of land (i.e., small construction activities). Operators of Phase II-regulated small MS4s and small construction activity are required to apply for NPDES permit coverage by March 10, 2003.

Thus, KPDES permits will be required for all sites in the basin falling within categories outlined by both Phase I and Phase II stormwater regulations as of March 2003. In the Kentucky River Basin, the Phase I rule previously required such a permit for Lexington's storm sewer system. With the Phase II rule coming into effect, the Kentucky River Basin cities of Danville, Frankfort, Georgetown, Nicholasville, Richmond and Winchester will also be required to have plans in place for their storm sewer systems. Phase II cities were either automatically designated by the EPA according to population, or the Kentucky Division of Water designated them due to concerns about a combined sewer system or storm sewer overflow, TMDL-listed streams or karst areas.

The *Kentucky River Basin Management Plan* includes stormwater management as an action item for each of the basin's three priority watersheds—the Red River Gorge Watershed, South Elkhorn Creek Watershed and Eagle Creek Mouth Watershed:

Red River Gorge Watershed – There is an identified need to evaluate the effects of stormwater runoff from Campton into Swift Camp Creek, including sewage during rain events. In order to address nonpoint source stormwater impacts, the plan includes a recommendation to restore riparian vegetation (utilizing opportunities for grant assistance) and educate local citizens about problems and solutions.

South Elkhorn Creek Watershed – One of the top priorities is to reduce the pollution from urban stormwater runoff. A suggested strategy is to adopt new approaches to planning new development and designing drainage systems. All watershed counties are encouraged to advocate best construction practices for minimizing runoff during storm events. Other suggestions are the restoration of riparian habitat and educational outreach to raise public awareness about problems and solutions. Fayette County's Division of Engineering plans to begin inspecting stormwater and other KPDES permit holders, watershed by watershed, in a new initiative to encourage full compliance. The Division would also like to compile a map of watershed hotspots for water pollution and ensure that hotspot facilities hold correct permits. Further, Fayette County is beginning to install drain markers indicating the receiving stream for each street drain.

Eagle Creek Mouth Watershed – This is a largely agricultural watershed, but it is likely to experience development in the near future. There are stormwater concerns about

nutrient and sediment runoff from agricultural land and sediment runoff from construction activities. One priority is to promote practices for construction and land management that can prevent soil erosion and subsequent degradation of streams. There is also concern that existing stormwater retention requirements are not adequate for the development that is currently occurring and is expected to occur. Construction BMPs are strongly encouraged.

In addition, stormwater has the potential to create flooding problems for communities located along the Kentucky River and its tributaries. Ways in which the Kentucky River is managed to mitigate flooding impacts are described in topic #16 of this section, which covers "floodplain protection and flood damage reduction."

4.5 Physical, chemical and biological conditions

This ULRWRP requirement is largely met through the *Kentucky River Basin Management Plan* and associated activities of the Kentucky Watershed Framework Process, as well as monitoring and assessment by Kentucky River Watershed Watch. The Kentucky River Authority currently serves as the basin coordinator for the Kentucky River as part of the Kentucky Watershed Framework Process. This Framework is a dynamic structure for coordinating watershed management across Kentucky. It serves as a means for coordinating and integrating the programs, tools, and resources of multiple stakeholder groups to better protect, maintain, and restore the ecological structure and function of watersheds and support the sustainable uses of watersheds.

The Kentucky Watershed Framework Process is organized around five state management units, which encompass the 12 river basins in the state. The Kentucky River Basin is classified as one of the five management units and was the first to be assessed under a revolving five-year cycle (See Figure 4.2). During this cycle, participants engage in monitoring and data collection (year one); watershed assessment (year two); watershed prioritization and ranking (year three); plan development and stakeholder involvement (year four); and implementation and evaluation (year five). Further details about the Kentucky Watershed Framework Process can be found at the internet address <http://kywatersheds.org>.

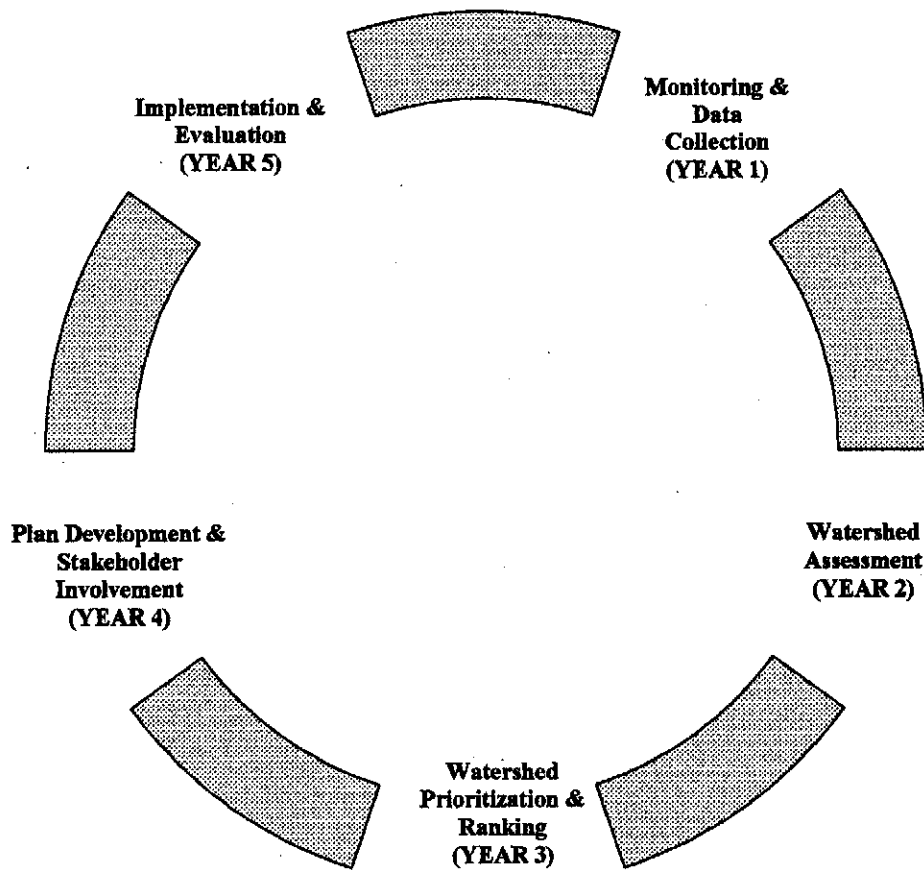


Figure 4.2 Kentucky Watershed Management Framework Cycle

One of the key components of the Watershed Framework Process is the assessment of physical, chemical and biological conditions of the river basin. In addition to annual ambient monitoring by the Kentucky Division of Water, intense focused monitoring is accomplished every five years through a comprehensive and coordinated monitoring program involving several state and federal agencies. The agencies and organizations involved with the Kentucky River Basin monitoring effort include:

- Kentucky Division of Water
- Kentucky Department of Fish and Wildlife Resources
- Kentucky Division of Forestry
- Kentucky Division of Pesticides
- Kentucky Division of Conservation
- Kentucky State Nature Preserves Commission
- Kentucky Division of Waste Management
- Kentucky Transportation Cabinet
- Kentucky River Authority
- Kentucky Geological Survey
- Kentucky Water Resources Research Institute

Kentucky Department for Surface Mining Reclamation and Enforcement
U.S. Army Corps of Engineers
U.S. Geological Survey
Natural Resources Conservation Service
Ohio River Valley Water Sanitation Commission (ORSANCO)
U.S. Forest Service
U.S. Fish and Wildlife Service
Kentucky River Watershed Watch
University of Louisville, Institute for Environment & Sustainable Development
East Kentucky Power Company
Eastern Kentucky University
Morehead State University
Lexington-Fayette Urban County Government
Northern Kentucky Sanitation District #1

The monitoring results, along with other data, are compiled and evaluated as part of the Framework Process and result in the development of a comprehensive basin management report. The first *Kentucky River Basin Management Plan* was completed in 2002 and is described in further detail at the beginning of this report. The watershed summaries in the *Kentucky River Basin Management Plan* include a section on “agency data assessment,” which describes water quality conditions in assessed segments of the watershed. Where applicable, it also lists impaired streams, types of stream impairment and potential sources of the pollutant. The table in Appendix B of the *Management Plan* indicates impairments by watershed (e.g., failure to fully support aquatic life use, primary contact recreation and secondary contact recreation), as well as the status of Total Maximum Daily Load (TMDL) development for impaired streams.

In addition to serving as the basis for the *Kentucky River Basin Management Plan*, results from the sampling effort help support the development of the Kentucky 305(b) Report and the associated 303(d) list of impaired streams. Section 305(b) of the Clean Water Act requires each state to submit a biennial report of the water quality status of its streams, rivers and lakes. The overall intent of the Clean Water Act is to ensure that the nation’s waters are “fishable and swimmable,” and the 305(b) report assesses whether state waters attain this goal. Section 303(d) of the Clean Water Act requires that the Kentucky Division of Water prepare a prioritized list of streams and lakes in Kentucky that do not fully support their designated uses. The list provides information as to what pollutants and sources are the causes of the non-supported use. Further details about each of these reports, as well as the most recent versions for Kentucky, can be found on the Kentucky Division of Water’s website at [http:// water.nr.state.ky.us/dow/dwhome.htm](http://water.nr.state.ky.us/dow/dwhome.htm). The map shown in Figure 4.3 indicates which Kentucky River Basin streams fully support, partially support, or do not support their designated uses, according to Kentucky’s 2002 305b report.

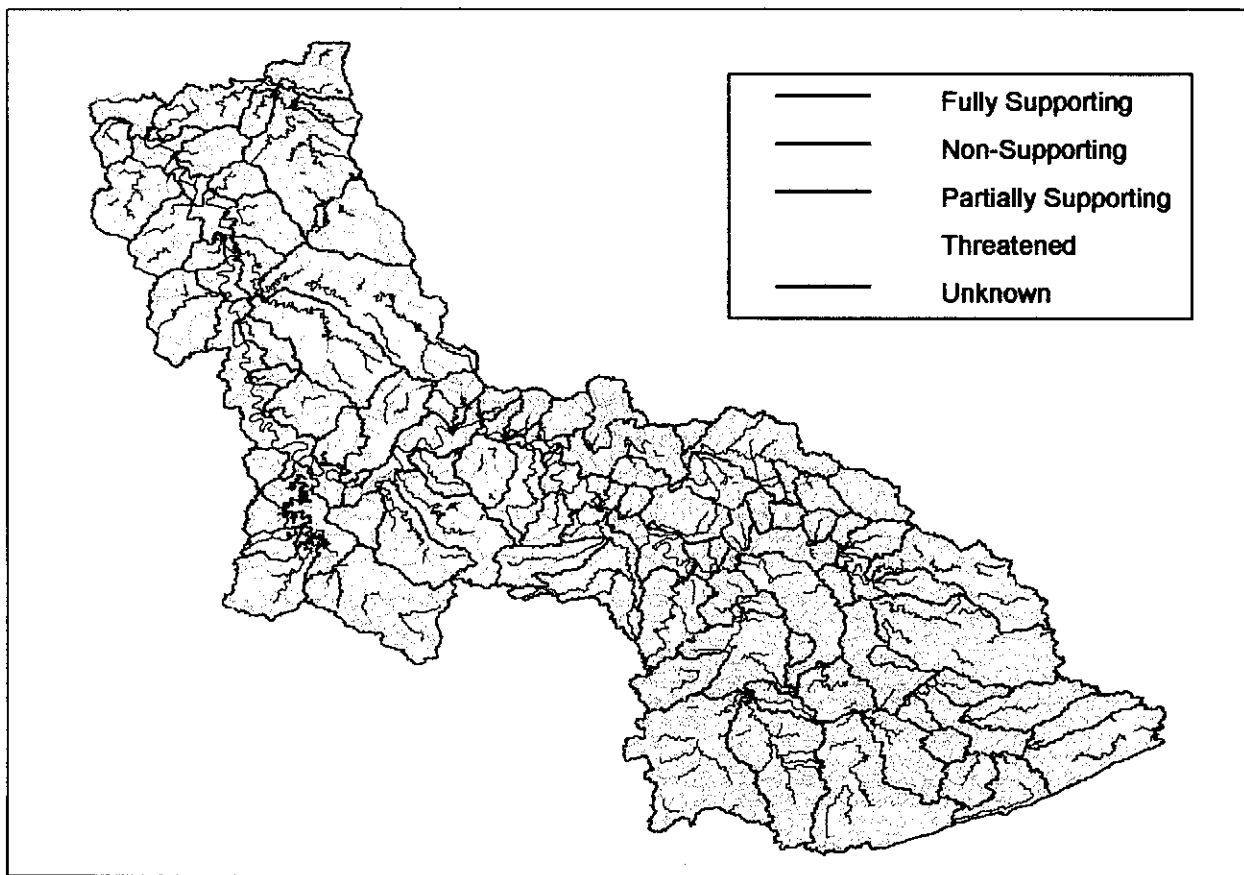


Figure 4.3 Map of Impaired Streams in the Kentucky River Basin

As part of the *Kentucky River Basin Management Plan*, three priority watersheds were identified for improvement in the basin. These were the South Elkhorn Creek watershed, the Red River Gorge watershed and Eagle Creek Mouth watershed. Selection of these three watersheds resulted from a two-stage process, as outlined by the Kentucky Watershed Management Framework. First, a quantitative ranking was made that evaluated the need for action in each watershed. Second, a series of regional meetings was held to gain additional input from local people and organizations and to gauge the level of interest in taking action in particular watersheds. These three watersheds are areas where there is both the need and the readiness to organize task forces. As part of its ongoing responsibilities as the Basin Coordinator in the Kentucky River Basin, the Kentucky River Authority continues to work with the Division of Water and representatives in these basins to implement the recommendations of the Kentucky River Basin Management Plan. This includes efforts to secure external funding in support of related watershed management activities.

The Kentucky River Authority provides annual funding to the Kentucky River Watershed Watch to conduct annual synoptic sampling of streams throughout the river basin. This volunteer sampling effort is coordinated on an annual basis by the University of Kentucky – Kentucky Water Resources Research Institute, which produces an annual report of the sampling results. The most recent report was completed in 2002 and is published on the internet at <http://www.uky.edu/WaterResources>. Sampling parameters assessed in the report include

temperature, dissolved oxygen, conductivity, pH, fecal coliform, nutrients, herbicides and metals. Based on the findings of the 2002 report, ten of the most impacted streams are listed in Table 4.2.

Table 4.2: 2002 KRWV Ten Most Impacted Streams

Stream	County	Pollutants
Ten Mile Creek	Grant	High conductivity/sulfate
Dreaming Creek	Madison	High metals, nitrogen, phosphorus
Town Branch/Wolf Run	Fayette	High nitrogen, phosphorus, fecals
South Fork Elkhorn Creek	Fayette, Woodford, Scott	High metals, nitrogen, phosphorus
Clarks Run	Boyle	High metals, nitrogen, fecals
Muddy Creek	Madison	High metals, fecals
West Hickman Creek	Jessamine	High fecals
Jessamine Creek	Jessamine	High fecals
Silver Creek	Madison	High fecals
Clear Creek	Woodford	High fecals

Continued synoptic sampling and the development of Citizen Action Plans were recommended for these impacted streams.

4.6 Protection of public health

This ULRWRP requirement is largely met through the *Kentucky River Basin Management Plan*, KRA’s continued funding of volunteer sampling efforts through the Kentucky River Watershed Watch, and the coordination of oversight activities with the Kentucky Division of Water through the Kentucky Watershed Management Framework. Under specifications of the Clean Water Act, the U.S. Environmental Protection Agency requires that states designate appropriate water body uses to be achieved and protected. The Kentucky Division of Water lists water bodies (i.e., rivers, streams and lakes) according to specific uses in its water quality standards regulations. Once a designated use is assigned, water quality criteria protect the use in the form of associated numeric pollutant concentrations and narrative requirements. In addition, an antidegradation policy maintains and protects existing uses.

In order to protect public health, the designated uses of domestic water supply, primary contact recreation and secondary contact recreation are assigned to appropriate waters in the state. Kentucky Statute, 401 KAR 5:002 defines these uses as follows:

“Domestic water supply” refers to “surface waters that with conventional treatment are suitable for human consumption through a public water system, culinary purposes, or for use in any food or beverage processing industry; and meet state and federal regulations under the Safe Drinking Water Act.”

“Primary contact recreation waters” refer to “waters suitable for full body contact recreation during the season of May 1 through October 31.”

“Secondary contact recreation waters” refer to “waters suitable for partial body contact recreation with minimal threat to public health due to water quality.”

The Kentucky DOW’s 305b report assesses water bodies for the designated use of primary contact recreation, but does not separately assess for secondary contact recreation. Likewise, it assesses water bodies for aquatic life criteria, rather than domestic water supply designation. The primary contact recreation and aquatic life designations are each more stringent and satisfaction of criteria for each of these would satisfy those of secondary contact and domestic water supply, respectively.

Once a water body is identified as *not* supporting its designated use and is included on the 303d list, an effort is made to identify the cause and source of the impairment. This process takes place through the development of Total Maximum Daily Loads (TMDLs) for impaired streams. TMDLs establish the total amount of a particular constituent that a waterbody may receive without violating associated water quality standards. Further description of the TMDL development process is provided in topic #8.

In addition to the state’s 305(b) and 303(d) reports, the watershed summaries contained in the *Kentucky River Basin Management Plan* include discussion about the ability of Kentucky River Basin watershed streams to meet water quality criteria for their designated uses. Assessments for each stream segment demonstrate whether it supports, partially supports, or does not support the assigned use. The table in Appendix B of the *Management Plan* lists impairments by watershed, as well as the status of TMDL development for impaired streams.

4.6.1 Safe Drinking Water

Under the provisions of the Safe Drinking Water Act, the EPA has set legally enforceable standards for more than 80 contaminants that may occur in drinking water and pose a risk to human health. Drinking water standards apply to public water systems that provide water for human consumption through at least 15 service connections, or regularly serve at least 25 individuals. The Drinking Water Branch of the Kentucky Division of Water is responsible for ensuring that the state’s public water supplies meet the standards set forth by the EPA, referred to as maximum contaminant levels (or MCLs).

The Groundwater Branch of the Division of Water is also involved in ensuring the quality of public drinking water supplies through its Wellhead Protection Plan Program (WHPP). The WHPP protects groundwater quality by managing potential contaminant sources within a designated recharge area around a public well or spring.

In addition, the state of Kentucky instituted a Source Water Assessment and Protection Program in 1990. The regulation requires the delineation of source water watersheds and recharge areas for each public water supply source, a contaminant source inventory with relative susceptibility (risk) assessment and recommendations for protection. The state is working with water suppliers to systematically assess every source of drinking water and to identify potential sources of contaminants. (Further details about the state’s SWAPP are available at

<http://water.nr.state.ky.us/dow/swap/>, and individual county source water assessments are provided in their respective county water supply plans.)

4.6.2 Recreation

Fecal coliform and pH data are used to indicate the degree of support for Primary Contact Recreation (swimming) use. The swimming use is considered fully supported if the criteria are met in 90 percent or more of the measurements, partially supported if the criteria are met in 75-89 percent of the measurements, and not supported if the criteria are met less than 75 percent of the time. In Kentucky's 2002 303(d) report, 47 streams in the Kentucky River Basin were identified as *not* fully supporting the designated use of primary contact recreation.

The Kentucky Division of Water and the Cabinet for Health Services have continuing swimming advisories in different areas of the state. Kentuckians should avoid swimming and other recreational contact with waters in these areas because of the presence of high levels of fecal coliform bacteria. This type of bacteria, present in human and animal waste, indicates the presence of untreated or inadequately treated sewage. Fecal bacteria create a potential for acquiring infectious diseases, particularly diarrheal illnesses. In the Kentucky River Basin, a swimming advisory remains in effect for the North Fork of the Kentucky River upstream of Chavies. Numerous illegal straight pipe discharges of sewage contribute to water quality problems along this section of the river. However, water quality has continued to improve and is approaching an acceptable level for swimming in some stretches of the river.

4.6.3 Fish consumption

Fish consumption is a category that, in conjunction with aquatic life use, assesses attainment of the fishable goal of the Clean Water Act. Assessment of the fishable goal was separated into these two categories in 1992 because a fish consumption advisory does not preclude attainment of the aquatic life use and vice versa. Separating fish consumption and aquatic life uses gives a clearer picture of actual water quality conditions. The following criteria are used to assess support for the fish consumption use:

Fully Supporting: No fish advisories or bans in effect.

Partially Supporting: "Restricted consumption" fish advisory or ban in effect for general population or a sub-population that could be at potentially greater risk (e.g., pregnant women, children). Restricted consumption is defined as limits on the number of meals consumed per unit of time for one or more fish species.

Not Supporting: "No consumption" fish advisory or ban in effect for general population, or a subpopulation that could be at greater risk, for one or more fish species; commercial fishing ban in effect.

A statewide fish consumption advisory was issued on April 11, 2000 due to low levels of organic mercury found in samples of fish from Kentucky waters. Women of childbearing age and children six years and younger were advised to eat no more than one meal per week of freshwater

fish from Kentucky rivers, streams and lakes. The fish tissue concentration triggering the statewide advisory was 0.12 ppm. However, the EPA has since issued a draft mercury water quality criterion of 0.3 ppm methylmercury concentration in fish tissue. The state has therefore been advised to list the waters as threatened, rather than impaired, based on fish tissue concentrations of methylmercury.

4.7 Improvement of fisheries

This ULRWRP requirement is largely met through the *Kentucky River Basin Management Plan*, along with the coordination of oversight activities of the Kentucky Division of Water and the Kentucky Department of Fish and Wildlife Resources. The *Management Plan* notes whether or not a watershed meets water quality standards to support aquatic life use, including that of fisheries. Aquatic life use is evaluated using both water quality and biological data. In areas where both types of data are available, the biological data are generally the determinant factor for establishing warm water aquatic habitat use status.

The Kentucky Division of Water has established physical and chemical parameters to determine aquatic life use support status. A stream is designated as fully supporting this use when criteria for dissolved oxygen, unionized ammonia, temperature and pH were not met in 10 percent or less of the water samples collected. Partial support is indicated if any one criterion for these parameters was not met 11 – 25 percent of the time. The segment is not supporting if any one of these criteria was not met more than 25 percent of the time. Data for mercury, cadmium, copper, lead and zinc are also analyzed for violations of acute criteria in state water quality standards.

When a water body is found to be in nonsupport of the aquatic life use, an effort is made to determine the cause and source of the impairment. Most waters not supporting aquatic life use are identified through biological monitoring, and causes are determined by observations and professional judgment of the field biologists. Sources are more difficult to determine and are more fully identified through the TMDL development process when site-specific sampling is conducted and a more comprehensive study of the region's activities and land uses is conducted.

In the 2002 303(d) listing for Kentucky, 98 streams in the Kentucky River Basin were listed as being impaired for the designated aquatic life use. Probable causes of these impairments included flow alteration, habitat alteration, low pH, nutrients, organic enrichment/low dissolved oxygen, pathogens, pesticides, siltation, total dissolved solids and turbidity. Suspected sources were agriculture, collection system failure, construction, habitat modification, hydromodification, land disposal, municipal point sources, resource extraction, silviculture and urban runoff/storm sewers.

In addition to these aquatic life assessment approaches, the Kentucky Department of Fish and Wildlife Resources assists with fisheries improvement in the Kentucky River Basin by providing technical and financial assistance for private landowners to improve aquatic habitat. The Department plans to focus their assistance on watersheds that fail to support the aquatic life use. Biologists will work with interested individuals, businesses or groups on properties of five acres or more. In addition to providing on-site technical assistance for localized instream habitat improvement or restoration, they will explore potential funding mechanisms, such as the Habitat Improvement Program (HIP). The HIP is available through the Department of Fish and Wildlife

Resources to furnish reimbursement funding for targeted and approvable projects. The HIP can also provide a link to available funds and assistance offered by other state, federal and private agencies.

Additionally, the Kentucky Department of Fish and Wildlife Resources operates one fish hatchery in the basin and conducts some fish stocking in the river. The Peter W. Pfeiffer Creek Hatchery is located on Elkhorn Creek near Frankfort. The Department stocks muskellunge in the mainstem of the Kentucky River, as well as the North Fork, South Fork and Buck Creek Reservoir. Some muskellunge stocked in Buck Creek Reservoir escape to the Middle Fork. Additionally, walleye pike are stocked in all three forks of the Kentucky River.

4.8 Means of controlling water quality

This ULRWRP requirement is largely met through the *Kentucky River Basin Management Plan*, along with the coordination of oversight activities of the Kentucky Division of Water. In its mandate to provide a clean water supply to citizens of the basin, the Kentucky River Authority is also responsible for addressing water quality issues. In accordance, the KRA is given the authority to jointly review applications for relevant permits under review by the Kentucky Natural Resources and Environmental Protection Cabinet. (See 420 KAR 1:030.)

The federal Clean Water Act includes several measures for controlling the nation's water quality. It provides the basic structure for regulating pollutant discharges into water bodies. In doing so, it provides the USEPA with the authority to regulate wastewater discharges from industrial sources. According to the Clean Water Act, any point source discharge to navigable waters requires a NPDES (National Pollutant Discharge Elimination System) permit. In addition, Phase I and Phase II of the NPDES Storm Water Program require permits for storm water discharges from "medium," "large" and certain "small" municipal separate storm sewer systems. Phases I and II of this program also require permits for several categories of industrial activity, including construction activity that disturbs one acre and greater.

In addition to establishing a permitting process, the Clean Water Act outlines an assessment process for the nation's waters. Section 305(b) of the Act requires each state to submit a biennial report of the water quality status of its streams, rivers and lakes. The overall intent of the Act is to ensure that the nation's waters are "fishable and swimmable," and the 305(b) report assesses whether state waters attain this goal. Section 303(d) of the Clean Water Act requires that the state prepare a prioritized list of streams and lakes that do not fully support predetermined designated uses (e.g., drinking water supplies, aquatic life, and primary and secondary contact recreation). The 303(d) list provides information on what pollutants and sources are the causes of the non-supported use. Once a water body is listed, the state is further required to develop a total maximum daily load (TMDL) for the stream or lake. The TMDL establishes the total amount of a particular constituent that a water body may receive without violating associated water quality standards. When this load is exceeded, the state must develop a load reduction and allocation strategy that will enable standards to be met.

The schedules for Kentucky's 305(b), 303(d), KPDES and TMDL programs are being phased to correspond with the Kentucky Watershed Management Framework. Thus, the stream

assessments contained in the 305(b) and 303(d) reports will focus on the basins that have most recently been monitored. KPDES permits will be issued basin-wide in year five of the rotating basin management cycle for a given basin. And, TMDLs will be calculated for first-priority watersheds and then second-priority watersheds within a given basin in the second and third years of the basin cycle. Over time, reassessment of the impaired streams will reveal the effects of any TMDL and other water quality management approaches.

In addition to the monitoring, assessment and permitting programs overseen by the Kentucky Division of Water, the U.S. Army Corps of Engineers operates Buckhorn Lake and Carr Fork Lake to augment low flows in the Kentucky River, thereby controlling water quality through the dilution of pollutants. Releases from Buckhorn Lake enter the Middle Fork of the Kentucky River, and releases from Carr Fork Lake augment flows in the North Fork of the Kentucky River. Releases from the low-level valves in the Lock & Dam system on the mainstem of the Kentucky River can also be used to supplement flows for water quality purposes. The Kentucky River Authority's *Valve Operating Plan* prescribes minimum flows during a drought for the purpose of maintaining water quality, as well as maintaining drinking water supplies. KRA lock operators are responsible for adhering to this plan, when necessary.

The Groundwater Branch of the Kentucky Division of Water oversees a Groundwater Protection Plan program to improve groundwater quality and prevent degradation of groundwater resources. The program is designed to achieve this goal through the development and implementation of best management practices to attain groundwater pollution prevention. Program staff conduct inspections of facilities within selected Wellhead Protection Areas, as approved by the Division of Water. Currently, there are few public water systems in the Kentucky River Basin that have an approved Wellhead Protection Plan or Groundwater Protection Plan. The basin suppliers for Georgetown, Manchester and Hindman and the Fleming-Neon Water Company utilize groundwater sources to provide public water.

4.9 Abatement of water pollution

This ULWRP requirement is largely met through the *Kentucky River Basin Management Plan*, along with the coordination of oversight activities of the Kentucky Division of Water and other related federal and state agencies. The watershed rankings in Appendix A of the *Kentucky River Basin Management Plan* prioritize watersheds for restoration or protection efforts based on need and feasibility. This section also contains information related to source water protection zones for public water supplies, which should reduce contamination of water supplies. Additionally, the plan offers several alternative actions for reducing water pollution through the priority watershed restoration projects.

Trash and debris accumulate along the banks of the Kentucky River and its tributaries due to spring flooding events, illegal dumping and general littering. Since its initiation in 1991 by the Kentucky River Authority, the Kentucky River Sweep has been an annual event where volunteers gather to remove trash from the river. In 2002, thirty-four Kentucky counties participated in the River Sweep, with volunteers covering nearly 119 miles of the river and collecting 99 tons of trash.

In addition to solid waste pollution of the Kentucky River, various water quality pollutants threaten the cleanliness of the river. In concert with the Watershed Framework Process, various state and federal programs have been developed to assist in the abatement of these types of water pollution. A listing of such programs follows.

4.9.1 State Revolving Loan Fund

Kentucky's state revolving fund for municipal wastewater treatment facilities has been a key element in initiating various construction projects to resolve existing point source problems and provide additional water treatment capacity. This program is administered through the Kentucky Division of Water.

4.9.2 Special Federal Appropriations

The U.S. Environmental Protection Agency designates funding for numerous water quality projects through agency appropriations bills. These projects include extensions of wastewater collection lines and upgrades or expansions of existing wastewater treatment plants to better serve the local communities. This program is administered through the Kentucky Division of Water. Year 2002 funding appropriations are listed in Table 4.3.

Table 4.3: 2002 EPA Funding Appropriations for Kentucky River Basin Water Projects

Recipient	Funding Amount	Funding purpose
Bluegrass PRIDE of KY	\$470,500	Cleanup of Bluegrass Rivers & Streams
City of Irvine	\$194,000	Sewer Rehabilitation in Estill County
City of Lawrenceburg	\$291,000	Water & Wastewater Infrastructure
City of Owenton	\$242,500	Extension of sanitary wastewater collection system
TOTAL	\$1,198,000	

4.9.3 Corps of Engineers 531 Program

Under Section 531 of the 1996 Water Resources Development Act, the U.S. Army Corps of Engineers is authorized to establish a program for providing environmental assistance to non-Federal, publicly owned interests in Southern and Eastern Kentucky. Assistance may be in the form of design and construction of water-related environmental infrastructure and resource protection and development projects, including projects for wastewater treatment and related facilities, water supply and related facilities, and surface water resource protection and development. All projects are cost shared at 75-percent Federal and 25-percent non-Federal from the local sponsor. Congress originally authorized \$10 million to carry out this program. Kentucky River Basin counties eligible for this assistance include Bell, Breathitt, Clay, Harlan, Jackson, Knott, Knox, Lee, Leslie, Letcher, Menifee, Morgan, Owsley, Perry, Rockcastle, and Wolfe counties.

4.9.4 East Kentucky PRIDE (Personal Responsibility in a Desirable Environment) Program

The PRIDE initiative was first announced by U.S. Congressman Harold "Hal" Rogers and Natural Resources and Environmental Protection Cabinet Secretary James Bickford in 1997. PRIDE is the first comprehensive, region-wide, local/state/federal cooperative effort designed to address the challenge of cleaning up southeastern Kentucky's rivers and streams. Since its initiation, the program has been responsible for the funding of numerous projects in the 40-county PRIDE region, many of which focus on the elimination of straight pipes and the upgrading of wastewater treatment plants. PRIDE counties in the Kentucky River Basin are: Bell, Breathitt, Casey, Clay, Estill, Garrard, Harlan, Jackson, Jessamine, Knott, Lee, Leslie, Letcher, Lincoln, Menifee, Morgan, Owsley, Perry, Rockcastle and Wolfe Counties.

Funding sources for PRIDE projects include the U.S. Department of Commerce and the National Oceanic and Atmospheric Administration, U.S. Environmental Protection Agency, and the U.S. Army Corps of Engineers. PRIDE funds have been used to support such initiatives as the community grant program, environmental educational grant program, and septic system loan program. In April of 1999, the Kentucky Water Research Institute was contracted to perform comprehensive monitoring and assessment of activities supported by the PRIDE program. The results of this ongoing assessment are available on the internet at <http://pride.uky.edu>.

4.9.5 Bluegrass PRIDE

The Bluegrass PRIDE Program was initiated in November 2001 by U.S. Congressman Ernie Fletcher to promote environmental awareness and educational programs in central Kentucky communities and schools, while tackling straight pipe, illegal dump, and other environmental clean-up projects. In 2001, Congressman Ernie Fletcher secured two federal grants for PRIDE, totaling nearly \$1 million.

4.10 Control of run-off, erosion and agricultural and urban non-point source pollution

This ULRWRP requirement is largely met through the *Kentucky River Basin Management Plan*, along with the coordination of oversight activities of the Kentucky Division of Water and other related federal and state agencies. Nonpoint source pollution has been identified as the leading remaining cause of water quality impairment. It results when water from rainfall or snowfall runs over the land, carrying natural or human-made pollutants and depositing them into a waterbody. Examples of nonpoint source pollutants that may be transported in this way include sediments, oil and grease, fertilizers, herbicides and insecticides, salts from irrigation ditches, acid mine drainage, and bacteria and nutrients from livestock and faulty septic systems.

The watershed summaries in the *Kentucky River Basin Management Plan* evaluate the potential for agricultural erosion from cultivated fields. Additionally, the watershed plans for the three priority watersheds in the basin provide discussion of nonpoint source impacts and recommended actions to minimize them. As the Kentucky River Basin Coordinator, the KRA is jointly responsible for facilitating these recommendations for controlling nonpoint source pollution. Other programs that address these issues are summarized as follows:

4.10.1 Kentucky TMDL Program

Kentucky's TMDL program has been developed to meet the requirements of Section 303(d) of the Clean Water Act. The TMDL program is designed to establish the Total Maximum Daily Load (TMDL) of a particular constituent that a stream may receive without violating the associated water quality standard. Where the existing load exceeds the TMDL, the state is required to develop a load reduction and allocation strategy that will meet the TMDL requirement.

The schedule for conducting TMDLs is based upon Kentucky's Watershed Management Framework approach. Waterbodies are prioritized based upon the type, extent, and intensity of impairment. Waterbodies within Kentucky for the most part share similar uses. They are assessed for support of warm water aquatic habitat and primary and secondary contact recreation criteria by default. Additionally, a waterbody is assessed for drinking water use if a drinking water intake exists in that waterbody. All waters listed as "not supporting" are given first priority in TMDL development for their particular basin. All "partial support" waterbodies are given a second priority ranking. Waters are further prioritized within each river basin management unit, factoring in the use impaired, risk, and extent of public concern. Appendix A of the *Kentucky River Basin Management Plan* provides details about this process for ranking streams in the basin.

4.10.2 Kentucky Watershed Management Framework

The Kentucky Division of Water works with numerous federal, state, local and private organizations to coordinate watershed management in the Kentucky River Basin, as well as across the entire state of Kentucky. Watershed management refers to a holistic approach to examining the interconnected issues of land use, water quality and water quantity as delineated by the natural boundaries of water flow, termed watersheds. This approach enables a geographic focus for existing state and local programs, promoting comprehensive efforts that are mobilized around managing these watersheds.

Through the Framework, watershed data are analyzed at five-year intervals, resulting in watershed planning that is expanded and improved in each cycle. The Kentucky River Authority was responsible for the preparation of the *Kentucky River Basin Management Plan* resulting from the first cycle of the watershed management program. Completed in 2002, this plan includes a detailed description of the involvement of participating organizations; summaries of the 97 individual watersheds identified in the Kentucky River Basin; and management recommendations for the three selected priority watersheds.

4.10.3 Clean Water Action Plan

In February 1998, President Bill Clinton released his Clean Water Action Plan with the broad vision of watershed restoration and protection through cooperative approaches. Its purpose is to identify priority restoration watersheds in each state and develop detailed restoration action plans.

Of the five watersheds selected for Kentucky in 1998, the Dix River falls within the Kentucky River Basin.

4.10.4 Agriculture Water Quality Act

Agricultural and forestry practices pose a significant nonpoint source threat to Kentucky waters. Due to this threat, the Agriculture Water Quality Act was passed by the Kentucky General Assembly in 1994. The main goal of the Act is to protect surface and groundwater resources from pollution resulting from agriculture and silviculture activities and help restore waters that currently fail to meet designated uses. The Agriculture Water Quality Act requires all landusers with ten or more acres to develop and implement a farm water quality plan based upon guidance from a Statewide Water Quality Plan. Landusers must select applicable best management practices (BMPs) to be included in their individual plan from the Statewide Water Quality Plan. As of October 2001, landusers were to have put the selected BMPs in place.

4.10.5 Conservation Reserve Program

The Conservation Reserve Program is administered by the Farm Service Agency, and the Natural Resources Conservation Service provides technical assistance. The CRP aims to reduce soil erosion and sedimentation in streams and lakes, among other objectives. This program encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as native grasses, wildlife plantings, trees, filter strips or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover. Additional state programs encourage the use of forestry BMPs to minimize nonpoint source impacts. These state programs include the Kentucky Forest Stewardship Program and the Kentucky Master Logger Program.

4.10.6 Stormwater Permit Program

Urban stormwater runoff is another major contributor of nonpoint source pollutants. As discussed in Section 4.4, the state's KPDES Program requires permits for municipal separate storm sewer systems and operators of both large and small construction sites to discharge storm water. Applications for KPDES permits are also subject to review by the Kentucky River Authority, according to 420 KAR 1:030. Upon review, the KRA may provide comments to the DOW on whether applications comply with the statutory requirements of the KRA (KRS 151.700 - 151.730) and regulatory requirements for strip mining activities (405 KAR Chapter 1).

4.10.7 Soil Erosion and Water Quality Cost Share Program

The Kentucky Division of Conservation under the Natural Resources Department administers the State Cost Share Program, which provides financial assistance to individuals to implement best management practices on farms or in forest operations to improve water quality. Any person engaged in agricultural or silvicultural operations is eligible to apply through the local conservation district, which will oversee the installation of BMPs.

4.10.8 EQIP Program

The United States Department of Agriculture's Environmental Quality Incentives Program (EQIP) was developed in 1996 to target federal funds for agricultural related conservation measures. Under EQIP, the USDA can provide cost-share assistance to family-sized farms and ranches for up to 75 percent of the costs of certain environmental practices. Potential funding exists for water quality improvement measures, such as grassed waterways, filter strips, manure management facilities, capping abandoned wells and wildlife enhancement.

4.10.9 Kentucky 319 Program

The Kentucky Division of Water serves as the lead agency for this program, which involves the input and cooperation of numerous federal, state, local and university organizations. Currently, Section 319(h) grant funds are targeted to non-point source pollution control activities associated with 303(d)-listed waters. The U.S. EPA has provided 319 funds for educational projects, technical assistance, watershed projects, demonstration projects, financial assistance, training, and/or enforcement.

4.11 Land management to prevent and to control erosion and to improve water quality

This ULRWRP requirement is largely met through the *Kentucky River Basin Management Plan*, along with the coordination of oversight activities of the Kentucky Division of Water and other related federal and state agencies. For instance, the preservation of riparian buffers and wetland areas along streams and rivers significantly reduces erosion and related nonpoint source impacts to water quality. The federal Farm Bill program, conservation easements, state and local stream buffer requirements, and forestry restrictions are examples of measures being used to protect riparian zones.

The *Kentucky Forest Practice Guidelines for Water Quality Management* was developed out of a requirement by Section 319 of the Clean Water Act to develop management programs for sources of nonpoint source pollution from various land use activities. This document provides a description of the most feasible ways of managing silvicultural activities, including timber harvesting, to prevent nonpoint source impacts to water quality.

As required by the *Kentucky Agricultural Statewide Water Quality Plan*, any person owning ten or more contiguous acres of land being used for agriculture or silviculture must have an individual water quality plan. The Statewide Plan outlines ten silvicultural BMPs that are to be included in individual plans, as appropriate. Further, the landowner is required to ensure that BMPs are implemented in operations on the property, effectively mandating the use of BMPs defined in the plan. Among the forestry BMPs outlined in the Statewide Plan is the practice of maintaining streamside management zones adjacent to intermittent and perennial streams. In order to minimize disturbance to these zones, this BMP specifies the minimum distance between the water body and the construction of any roads, trails and landings. The plan also provides information about the percentage and size of trees that may be removed from these zones.

Development and associated construction practices also have the potential to create significant erosion problems in a watershed. In addition to the KPDES Phase I and II Storm Water regulations described under topic #4 of this section, construction impacts are addressed through local ordinances in some Kentucky cities and towns. For instance, the Lexington-Fayette Urban County Government has an ordinance (Article 20 of the LFUCG Zoning Ordinance) requiring the preparation of an erosion and sediment control plan for all construction projects that disturb other than a single individual residential lot. (Erosion control refers to efforts to maintain soil on the site, and sediment control refers to efforts to keep eroded material from leaving the site.) These plans are to incorporate required non-structural and structural practices. Non-structural practices include floodplain avoidance, stream buffer zones, reduced exposure time, limits on maximum disturbed area and embankment slope minimization. Structural practices for soil stabilization include mulch, temporary seed, permanent seed, sod, road/parking stabilization, construction entrance, dust control, etc. Structural practices for sediment control include check dams, sediment traps, sediment ponds, silt fences, storm drain inlet protection, filter strips and stream crossings. The approval of the plan leads to the issuing of a permit for constructing the detailed practices, which remains in effect throughout the entire construction project.

Another land management issue affecting water quality is that of septic system location. Improperly sited septic systems can result in nutrient and pathogen contamination of nearby groundwater and surface waters. In addition to local health department regulations on siting septic systems, the state of Kentucky now requires inspected, approved site-based septic systems before electrical service is connected at new residences.

The *Kentucky River Basin Management Plan* includes erosion control measures as action items for the basin's three priority watersheds—the Red River Gorge Watershed, South Elkhorn Creek Watershed and Eagle Creek Mouth Watershed. As with other management recommendations included in the plan, the Kentucky River Authority is jointly responsible for facilitating recommended measures for erosion control.

4.12 Integration of county long-range water resource plans

This ULRWRP requirement is met through *A Summary of County Water Management Plans in the Kentucky River Basin*. All water management plans for counties with suppliers utilizing Kentucky River Basin sources are summarized and described in this document. A summary at the beginning of the document provides a comprehensive overview of the individual county plans.

During the drought of 1988, several communities throughout the state experienced difficulties in providing adequate supplies of potable water to their citizens. In response to this emergency situation, Governor Wallace Wilkinson issued an Executive Order to create a Water Supply Task Force. In 1989, the task force released its recommendations, one of which was a requirement for water suppliers to develop Water Supply Plans.

In 1990, the General Assembly passed KRS151.114-.118, mandating that long-range county water supply plans be developed by July 15, 1998, according to guidelines to be developed by the Kentucky Division of Water. County Water Supply Plans have subsequently been developed for

every county in the state by the Area Development Districts, members of the different Water Supply Planning Councils, and the elected and appointed officials of each county.

Thirty-two public water suppliers in 25 counties utilize water supply sources in the Kentucky River basin. Eleven suppliers use the main stem of the Kentucky River as their source, 10 suppliers withdraw from tributaries of the Kentucky River, 13 utilize reservoirs in the basin and four suppliers withdraw from groundwater wells.

Fourteen of the basin suppliers in 12 different counties are classified as drought-vulnerable systems (Classes B and C), implying that alternative supply sources must be sought for these systems. Six suppliers have been declared Class C systems, meaning that they are likely to experience a shortage during a drought. Eight suppliers in the Kentucky River Basin are categorized as Class B systems, meaning that they have the potential for a water shortage during a drought. Due to the difficulty in estimating the vulnerability of two suppliers (Fleming-Neon and Hindman), they were not assessed. See Table 4.4 below for a listing of suppliers and their respective drought vulnerability classification.

Table 4.4: Drought Vulnerability of Kentucky River Basin Water Suppliers

Public Water Supplier	Drought Vulnerability Classification
Beattyville Water Works	A
Beech Fork Water District	B
Berea College Water Utility	B
Blackey Water System	B
Blue Grass Army Depot	B
Booneville Water and Sewer	C
Bullock Pen Water District	A
Campton Water Works	C
City of Blackey	A
Danville Water Works	A
Department of Corrections, Northpoint Training Center	A
Department of Parks, Natural Bridge	A
Fleming-Neon Water System	Not Assessed
Frankfort Electric and Water Plant Board	A
Georgetown Municipal Water and Sewer	C
Harrodsburg Municipal Water Works	A
Hazard Water Department	C
Hindman Municipal Water Works	Not Assessed
Hyden-Leslie County Water Works	B
Irvine Municipal Utilities	A
Jackson Municipal Water Works	A
Kentucky-American Water Company	C
Lancaster Municipal Water Works	A
Lawrenceburg Municipal Water Works	A
Manchester Water Works	C
Nicholasville Water Works	A
Owenton Water Works	B
Richmond Water, Gas and Sewage	A
Stanford Water Works	B
Versailles Municipal Water Works	A
Whitesburg Municipal Water Works	B
Wilmore Utilities System	A
Winchester Municipal Utilities	A

According to the report by the Water Resource Development Commission, *Water Resource Development: A Strategic Plan*, publicly-owned water suppliers in the Kentucky River Basin are predicted to require an estimated \$182 million in infrastructure funding between 2000 and 2005. Between 2006 and 2020, funding needs are expected to be approximately \$254.5 million. These estimates are based on locally identified needs to expand, upgrade and replace infrastructure, as well as estimates of funding needed to meet the requirements of the Safe Drinking Water Act. Clay, Letcher and Madison Counties have the highest estimated infrastructure expenses for the

20-year planning period. Infrastructure funding needs for the privately owned supplier, Kentucky-American Water Company in Fayette County, were provided separately. These estimates significantly increase the estimated infrastructure expenses, more than doubling projections for 2006-2020.

4.13 Regulation of flows and allocation of supplies

This ULRWRP requirement is currently met through the *KRA Valve Operating Plan, A Summary of County Water Management Plans* and the *Kentucky Water Shortage Response Plan*.

Water supplies are allocated by the Kentucky Division of Water through the issuance of water withdrawal permits. Each withdrawal permit specifies allowable daily withdrawal rates based on calculations of water availability at the source. The Kentucky Division of Water's permitting criteria allow up to ten percent of available water under normal conditions to be withdrawn by a single permittee. For streams and rivers, "available water under normal conditions" is defined as ten percent of the lowest monthly mean flow, which typically occurs during September or October.

During drought condition, flows in the mainstem of the Kentucky River can be controlled by the Kentucky River Authority through low-level valves in the dams. Dam releases by the U.S. Army Corps of Engineers at Buckhorn Lake and Carr Fork Lake may supplement flows in the Middle Fork and North Fork of the Kentucky River, respectively. Dam releases by Kentucky Utilities at Dix Dam may supplement flows in the Kentucky River above Lock 7.

The *Kentucky Water Shortage Response Plan* explains procedures for allocating limited water supplies during a drought situation. The regulation of flows and allocation of supplies during a drought is further described in the KRA's *Valve Operating Plan*.

The Kentucky River Authority is currently pursuing the development of a real-time operational model for use in regulation of flows and allocation of supplies during drought conditions. Once developed, the model should provide an efficient tool for use in evaluating the impacts of potential management decisions.

4.14 Control of withdrawals and diversions of surface water and ground water

This ULRWRP requirement is largely met through *A Summary of County Water Management Plans for the Kentucky River Basin*, the *KRA Valve Operating Plan* and the *Kentucky Water Shortage Response Plan*, in coordination with activities of the Kentucky Division of Water. In addition, the River Authority is currently in the process of developing a new operational model for the Kentucky River that will enable real-time value operating and withdrawal decisions in response to ongoing drought situations.

The Water Resources Branch of the Division of Water is responsible for issuing water withdrawal and diversion permits to applicants. Each withdrawal permit specifies allowable daily withdrawal rates based on calculations of water availability at the source. Permitting criteria allow up to ten

percent of available water under normal conditions to be withdrawn. "Available" water under normal conditions is defined as ten percent of the average flow during the month of lowest average monthly flow, which typically occurs during September or October. The following table provides a summary of surface water withdrawals by public suppliers in the Kentucky River Basin.

Table 4.5: Water Withdrawal Permits for Sources Located in the Kentucky River Mainstem and Headwaters

Permitter	Supply Source	Withdrawal Amount*
Frankfort Electric & Water Plant	Pool 4	14.0 – 15.0 mgd
Capitol Powerhouse	Pool 4	2.25 – 4.5 mgd
Lawrenceburg Water & Sewer	Pool 5	2.5 mgd
Versailles Municipal Water	Pool 5	3.0 – 4.0 mgd
Austin-Nichols Distilling	Pool 5	1.44 mgd
Hanson Aggregates Midwest	Pool 5	0.120 – 0.320 mgd
Wilmore Municipal	Pool 6	1.0 mgd
Harrodsburg Municipal	Pool 7	3.2 mgd
Lancaster Municipal	Pool 8	1.2 – 1.7 mgd
Nicholasville Municipal	Pool 8	2.0 – 3.0 mgd
Kentucky-American Water Company	Pool 9	60.0 – 63.0 mgd
Winchester Municipal Utilities	Pool 10	15.0 mgd
East Kentucky Power Cooperative	Pool 10	0.072 – 0.144 mgd
Richmond Water, Gas & Sewer	Pool 11	9.0 mgd
Irvine Municipal	Pool 11	2.0 mgd
Beattyville Water Works	Pool 14	0.605 – 0.750 mgd
Danville Water Works	Herrington Lake	5.0 mgd
Northpoint Training Center	Herrington Lake	0.3 mgd
Old Bridge Golf Course	Herrington Lake	0.75 – 0.175 mgd
Andover Golf and Country Club	Jacobson Reservoir	0.02 – 0.100 mgd
Dept. of Parks	Mill Creek Lake	0.03 – 0.07 mgd
Whitesburg Municipal Water Works	North Fork	0.412 – 0.435 mgd
Leeco Coal	Carr Fork of North Fork	0.100 mgd
Hazard Water Department	North Fork	3.75 mgd
Jackson Municipal Water Works	North Fork	1.5 mgd
Cockrell Fork Mining	North Fork	0.05 mgd
Whitaker Coal	North Fork	1.0 mgd
Leeco Coal	Middle Fork	0.310 mgd
Blue Diamond Coal	Beech Fork of Middle Fork	0.013 mgd
Booneville Water and Sewer District	South Fork	0.355 – 0.360 mgd
Mountain Clay	South Fork	0.042 mgd
Manchester Water Works	Goose Creek of South Fork	2.5 mgd

* Permitted withdrawal amount may vary by season.

Water withdrawal regulations, and most withdrawal permits, state that withdrawals must be reduced when flows approach the 7-day, 10-year (7Q10) low flow level. The 7Q10 flow is the lowest 7-day flow that occurs on the average once every ten years. According to the Kentucky Division of Water, when 7Q10 flows are experienced for four consecutive days, withdrawals must cease. This minimum stream flow requirement can be waived by the regulatory authority in

the case of a governor’s declaration of a “water emergency,” as occurred in 1988. Estimated 7Q10 flows for the Kentucky River at lock and dam locations are listed below.

Table 4.6: 7Q10 Values at Kentucky River Locks and Dams

Kentucky River Lock and Dam #	7Q10 Value
1	130.5 MGD / 202 cfs
2	130.5 MGD / 202 cfs
3	126 MGD / 195 cfs
4	113 MGD / 175 cfs
5	89.8 MGD / 139 cfs
6	87.9 MGD / 136 cfs
7	86.6 MGD / 134 cfs
8	82.7 MGD / 128 cfs
9	77.5 MGD / 120 cfs
10	77.5 MGD / 120 cfs
11	58.8 MGD / 91 cfs
12	53 MGD / 82 cfs
13	51.1 MGD / 79 cfs
14	48.5 MGD / 75 cfs

Some withdrawal permits include incremental reduction schedules that are tied to decreases in streamflow. Water withdrawal permit preconditions are described in the individual county plan summaries contained in *A Summary of County Water Management Plans for the Kentucky River Basin*.

During a severe drought, it is expected that the KRA will work closely with the Kentucky Division of Water to coordinate the implementation of the guidelines of both *the Kentucky Water Shortage Response Plan* and the KRA’s *Valve Operating Plan*. It is anticipated that these activities will be further enhanced through the use of the proposed new operational model for the Kentucky River.

Agricultural water users are not required to obtain a water withdrawal permit or submit daily pumping rates. Thus, this use is a largely unknown competing factor in most parts of the Kentucky River Basin. In a severe drought, agricultural usage could significantly affect reservoir, and possible Kentucky River, supplies.

Agricultural demand has been estimated in two studies of water demand in the Kentucky River Basin, as shown in Table 4.7. The 1990 study by Harza Engineering Company (“Phase I Interim Report: Water Demands and Water Supply Yield and Deficit”) and a 1996 study by the Kentucky Water Resources Research Institute provide such estimates.

In the Harza study, the irrigation rates were determined based on information provided by the Division of Water. The DOW provided a range of irrigation discharge rates and actual and potential irrigation areas determined from aerial surveys. Harza utilized a mid-range withdrawal

rate of 900 gallons per minute for 12 hours a day from May through October in order to serve both actual and potential irrigation areas. These rates were not altered for future years due to the uncertainty of the original estimates.

The KWRI study employed an empirical method which divided agricultural demand into two types of usage; irrigation and livestock. Irrigation demand was determined by multiplying the daily demand per acre by the total area of irrigated land. Livestock demand was estimated using state animal inventory and average daily animal consumption rates. A “maximum” estimate of water needed to satisfy all agricultural demands in the basin was found to be 76 mgd. A “most likely” daily demand considered the economic feasibility of supplying the water, taking into account the likelihood that farmers will cease irrigation when costs exceed anticipated income. This more realistic estimate resulted in a daily demand of 11 mgd. The most likely estimate was further refined based on the presence of hilly terrain in the lower basin where most of the irrigable lands are located. This resulted in a final estimate of 7 mgd, to be distributed evenly in Pools 2 – 8 for the summer months of May through September. No estimate was made for agricultural demand from Kentucky River tributaries or subsequent effects on inflows to the major pools of the river.

Table 4.7: Estimates of Irrigation Water Demand in the Kentucky River Basin

Pool #	Harza study	KWRI study
1	N/A	N/A
2	N/A	1.0 mgd (May – Sept.)
3	N/A	1.0 mgd (May – Sept.)
4	9.2 mgd	1.0 mgd (May – Sept.)
5	0 mgd	1.0 mgd (May – Sept.)
6	0.3 mgd	1.0 mgd (May – Sept.)
7	0 mgd	1.0 mgd (May – Sept.)
8	0.7 mgd	1.0 mgd (May – Sept.)
9	0 mgd	N/A
10	1.9 mgd	N/A
11	5.2 mgd	N/A
12	3.2 mgd	N/A
13	0 mgd	N/A
14	0.7 mgd	N/A

Additionally, the Kentucky River Authority assesses Tier I and Tier II user fees for withdrawals of surface water and groundwater from the Kentucky River basin. The revenue from these fees is used to fund the management and oversight activities charged to the KRA. Tier I fees are required from all those withdrawing water from the Kentucky River basin. Mainstem withdrawers pay both Tier I and Tier II fees. Agricultural users and those withdrawing less than 10,000 gpd are exempt from the fees. Currently, 21 entities pay Tier II fees, and 57 entities pay Tier I fees. These 78 entities are listed in Table 4.8 along with their respective tier classification; with the 33 which are public water suppliers listed first.

The Tier fees are based on a rate per gross withdrawal of 1,000 gallons of water and are paid quarterly to the KRA. As of June 2003, the Tier I rate is \$0.028 / 1,000 gallons of water withdrawn, and the Tier II rate is \$0.016 / 1,000 gallons. Thus, Tier II users pay a combined total of \$0.044 / 1,000 gallons withdrawn.

Table 4.8: KRA Tier Classification for Water Suppliers in the Kentucky River Basin

Water Supplier	Tier #
Beattyville Water Works	I
Beech Fork Water District	I
Berea College Water Utility	I
Blue Grass Army Depot	I
Booneville Water and Sewer	I
Bullock Pen Water District	I
Campton Water Works	I
City of Blackey	I
Danville Water Works	I
Department of Corrections, Northpoint Training Center	I
Department of Parks, Natural Bridge	I
Elk Lake Water Company	I
Fleming-Neon Water System	I
Frankfort Electric and Water Plant Board	II
Georgetown Municipal Water and Sewer	I
Harrodsburg Municipal Water Works	II
Hazard Water Department	I
Hindman Municipal Water Works	I
Hyden-Leslie County Water Works	I
Irvine Municipal Utilities	II
Jackson Municipal Water Works	I
Kentucky-American Water Company	II
Lancaster Municipal Water Works	II
Lawrenceburg Municipal Water Works	II
Manchester Water Works	I
Nicholasville Water Works	II
Owenton Water Works	I
Richmond Water, Gas and Sewage	II
Stanford Water Works	I
Versailles Municipal Water Works	II
Whitesburg Municipal Water Works	I
Wilmore Utilities System	II
Winchester Municipal Utilities	II
Addington Mining Co.	I
Allen Co.	II
Andover Golf and Country Club	I
Arlington Association	I

Austin-Nichols Distilling Co., Inc.	II
Bear Branch Coal Company	I
BFI Waste Systems	I
Bledsoe Coal Company	I
Water Supplier	Tier #
Blue Diamond Coal Company	I
Buffalo Trace (Leestown Company, Inc.)	II
Bull Run LLC	II
Canewood Golf Course/Barlow Homes	I
Champions Golf Club	I
Coastal Coal (Enterprise Coal Co., Inc.)	I
Connemara Golf Course	I
Cook & Sons Mining	I
Danville Country Club	I
Dept. of Facilities Mgt. – Capital Powerhouse	II
Dept. of Fish & Wildlife Hatchery	I
Diamond May Coal Company	I
East Kentucky Power Cooperative	II
Frankfort Country Club	I
Georgetown College	I
High Point Golf Club	I
Highbridge Spring Water	I
Jamestown Village Inc.	I
Kearney Hills Golf Course	I
Kentucky Criterion Coal Co.	I
Kentucky Processing	II
Kentucky Utilities	II
Leeco, Inc.	I
Links and Duckers Lake	I
Liter's Quarry	II
Lone Oak Country Club	I
Longview Country Club	I
Old Bridge Golf Club	I
Perry Park Golf (Glenwood Hall Country Club)	I
Pine Mountain Settlement School	I
Players Club of Lexington	I
Shamrock Coal Co, Inc.	I
Spring Lake Country Club	I
Straight Creek Coal	I
U.S. Filter Enviro-Power	I
Wilson Landscaping and Garden	I
Woodford Hills Country Club	II

4.15 Basin-wide and specific local land and water conservation measures and practices

4.15.1 Land Conservation

The land conservation component of this ULRWRP is met through the *Kentucky River Basin Watershed Management Plan* and a variety of public and private preservation programs. The water conservation component is largely met through the *Kentucky Water Shortage Response Plan*, the KRA's *Valve Operating Plan* and *A Summary of County Water Management Plans for the Kentucky River Basin*.

The preservation or restoration of riparian buffers along the Kentucky River and its tributaries is critical to protecting instream water quality. These vegetation buffers reduce erosion of the stream banks and trap sediment runoff from the surrounding watershed. Various cost-share programs have been developed to assist with landowner restoration and maintenance of riparian buffers. These include the Kentucky 319 Program, Kentucky's Soil Erosion and Water Quality Cost Share Program and the USDA's EQIP Program.

The KRA works with the Nature Conservancy and others to protect ecologically significant land within the Kentucky River Basin. The Palisades Region of the Kentucky River is a major focus of land conservation efforts. This area contains the dolomitic limestone cliffs that formed along the river and its tributaries between Frankfort and Clays Ferry, to the west of Lexington. The river began cutting through these limestone cliffs between 400,000 and 1 million years ago.

The Nature Conservancy is engaged in a focused effort to protect the Palisades, particularly the 26-mile stretch of the Kentucky River between Camp Nelson and Mundy's landing. The Kentucky State Nature Preserves Commission, Kentucky Department of Fish and Wildlife Resources, and the National Fish and Wildlife Foundation are also working cooperatively to ensure protection of the Palisades. Once sites are identified for protection through land purchase, conservation easements or other measures, the KRA contributes informational assistance to participating organizations. A map of land currently protected or proposed for protection in the Palisades region is provided in Table 4.4.

Dedicated as the Kentucky River Authority Palisades State Nature Preserve in December 1996, the preserve was renamed the Tom Dorman State Nature Preserve in 1999 to honor the former director and chairman of the KRA. The preserve protects 565 acres along the Kentucky River in Garrard and Jessamine Counties and includes 220-foot palisades along the river and several rare plants that grow on the thin soils on the limestone cliffs.

Some of the most dramatic cliffs are found in the area surrounding the Jim Beam Nature Preserve, around Camp Nelson and High Bridge in Jessamine County. The preserve is at the center of the Inner Bluegrass Region, where the Kentucky River cuts down into the oldest rocks exposed in the state: the High Bridge Formation of Middle Ordovician age (440-450 million years ago). The Sally Brown Nature Preserve in Garrard County, the Crutcher Nature Preserve in Garrard and Jessamine Counties and the Earl D. Wallace Nature Preserve also protect acreage in the Palisades Region of the Kentucky River.

The Kentucky State Nature Preserves Commission owns several preserves throughout the Kentucky River Basin, including the Tom Dorman, Floracliff, Bad Branch, Blanton Forest, and Natural Bridge State Park State Nature Preserves and the Lower Howard's Creek Heritage Park and State Nature Preserve. The Commission plans to target future land conservation efforts around megasites, such as the Pallisades, Pine Mountain, and South Fork Kentucky River, as well as smaller sites scattered throughout the basin.

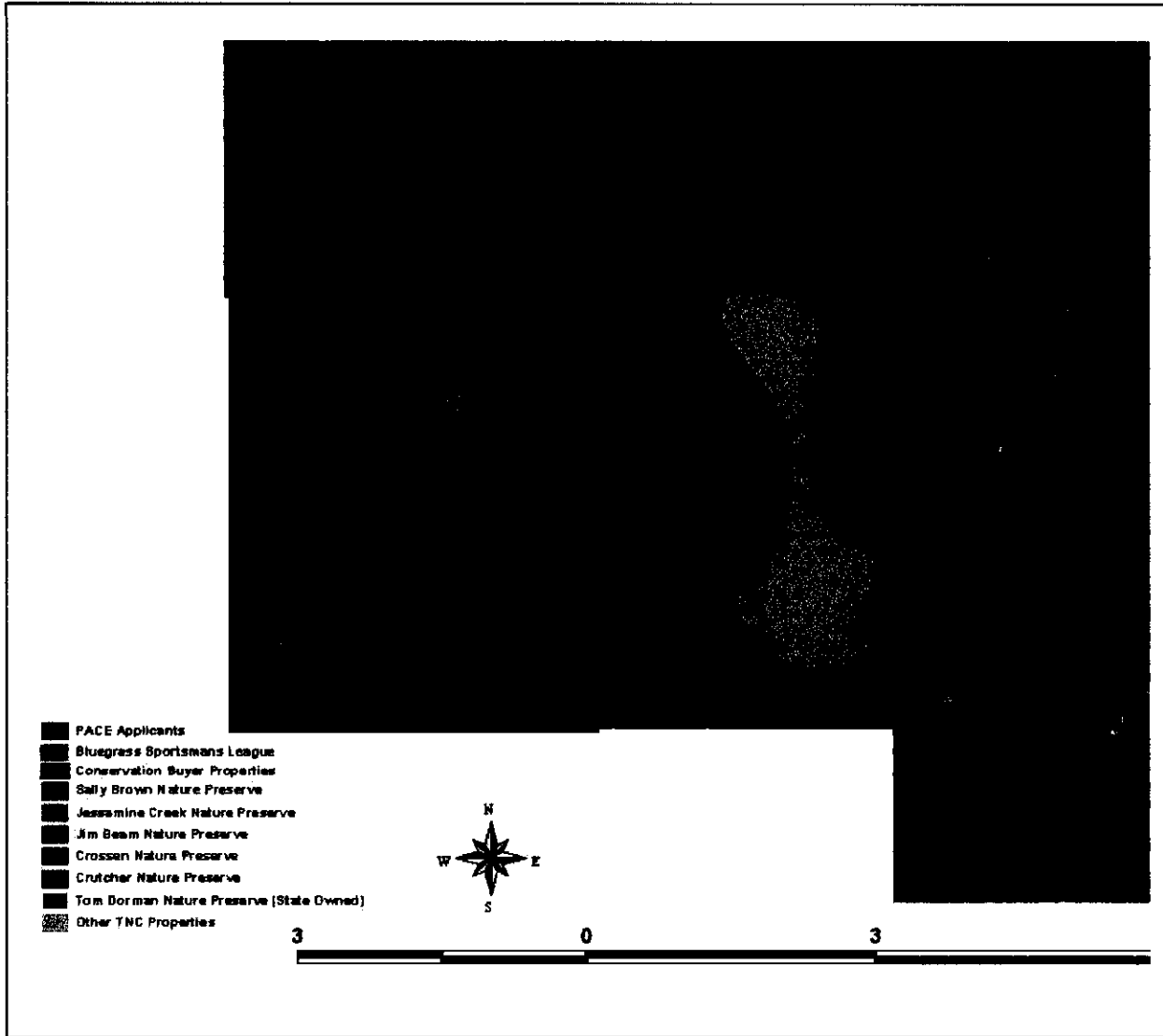


Figure 4.4 Nature Preserves Located in the Kentucky River Palisades

4.15.2 Water Conservation

With regard to water conservation, general drought response measures are described in the *Kentucky Water Shortage Response Plan*. The *Valve Operating Plan* specifies operating procedures to maximize storage and use of Kentucky River water supplies during low flow conditions. And, where applicable, individual county water conservation measures are described

in each of the county plan summaries in *A Summary of County Water Management Plans for the Kentucky River Basin*.

The Kentucky River Authority is able to administer and fund leak detection services in order to reduce “unaccounted for” water losses in the treatment and distribution systems of public suppliers. (See 420 KAR 1:030, Section 7.) The Kentucky Rural Water Association also offers ongoing assistance to those suppliers wishing to detect and reduce losses. In the past, the KRA and KRWA have jointly engaged in efforts to study and control losses by suppliers in the Kentucky River Basin. In keeping with the Kentucky Public Service Commission directive outlined in the county water supply plans, all public water suppliers should maintain or reduce water leakage losses to 15%. In the *Summary of County Water Management Plans*, the following water suppliers were noted as having leakage rates greater than 15% in a 2000 study.

Table 4.9: Estimated System Leakage Rates for Kentucky River Basin Water Suppliers

Supplier	Estimated Leakage Rate (from 2000)
Alton Water District (Anderson County)	11.9%
Blackey Water System (Letcher Co.)	11%
Beattyville Water Works (Lee Co.)	27%
Berea College Water Utilities (Madison Co.)	13.4%
Booneville Water and Sewer (Owsley Co.)	15%
Bullock Pen Water District (Boone Co.)	5.5%
Burgin Municipal Water Department (Mercer Co.)	0%
Campton Water Works (Wolfe Co.)	30%
City of Crab Orchard (Lincoln Co.)	16%
City of Clay City (Powell Co.)	8.5%
Danville City Water Works (Boyle Co.)	12.7%
East Clark County Water District (Clark Co.)	8.4%
Elkhorn Water District (Franklin Co.)	9.8%
Estill County Water District (Estill Co.)	0%
Farmdale Water District (Franklin Co.)	13.1%
Fleming-Neon Water Company (Letcher Co.)	39%
Frankfort Water Plant Board (Franklin Co.)	13.3%
Garrard County Water Association (Garrard Co.)	20.8%
Georgetown Municipal Water Service (Scott Co.)	14%
Harrodsburg Municipal Water Department (Mercer Co.)	22.3%
Hazard Water Department (Perry Co.)	19%
Hindman Water Department (Knott Co.)	20%
Hyden-Leslie County Water District (Leslie Co.)	36%
Irvine Municipal Utilities (Estill Co.)	7.4%
Jackson Municipal Water Works (Breathitt Co.)	25%
Jenkins Water Works (Letcher Co.)	59%
Jessamine County Water District (Jessamine Co.)	5.4%
Jessamine-S. Elkhorn Water District (Jessamine Co.)	10.8%

Supplier	Estimated Leakage Rate (from 2000)
Junction City Utilities (Boyle Co.)	18.4%
Kentucky-American Water Company (Fayette Co.)	10.5%
Kirksville Water Association (Madison County)	4.2%
Knott County Water and Sewer District (Knott Co.)	25%
Lake Village Water Association (Mercer Co.)	19.3%
Lancaster Municipal Water Works (Garrard Co.)	12.7%
Lawrenceburg Water & Sewer Department (Anderson Co.)	8.6%
Madison County Utilities District (Madison Co.)	15.9%
Manchester Water Works (Clay Co.)	15%
McKinney Water District (Lincoln Co.)	14.7%
Midway Municipal Water Works (Woodford Co.)	14.6%
Nicholasville Municipal (Jessamine Co.)	10.9%
North Mercer Water District (Mercer Co.)	12%
North Shelby Water Company (Estill Co.)	17.9%
North Shelby Water Company (Franklin Co.)	3.1%
Northeast Woodford County Water District (Woodford Co.)	5.6%
Owenton Water Works (Owen Co.)	5%
Peaks Mill Water District (Franklin Co.)	19.1%
Perryville Utilities (Boyle Co.)	13.2%
Powell's Valley Water District (Powell Co.)	11.3%
Richmond Utilities (Madison Co.)	10.9%
South Anderson Water District (Anderson Co.)	15.4%
South Woodford Water District (Woodford Co.)	19.3%
Southern Madison Water District (Madison Co.)	9.4%
Southside Water Association (Lee Co.)	9%
Spears Water Company (Jessamine Co.)	14.7%
Stanford Municipal Water Works (Lincoln Co.)	15%
Tri-Village Water District (Owen Co.)	7%
U.S. 60 Water District (Estill Co.)	25.4%
U.S. 60 Water District (Franklin Co.)	1.4%
Vicco Water Supply (Perry Co.)	38%
Western Rockcastle Water Association (Lincoln Co.)	7.3%
Whitesburg Municipal Water Works (Letcher Co.)	30%
Wilmore Municipal (Jessamine Co.)	1%
Winchester Municipal Utilities (Clark Co.)	8.5%

4.16 Floodplain protection and flood damage reduction

This ULRWRP requirement is largely met through the joint activities of the Kentucky Division of Water and the U.S. Army Corps of Engineers. Floodplain management involves a variety of corrective and preventative measures for reducing flood damage, including zoning, subdivision,

or building requirements, and special-purpose floodplain ordinances. Prior to the creation of the National Flood Insurance Program by the Federal Emergency Management Agency, floodplain management as a practice was not well established - only a few states and a few hundred communities throughout the country actually regulated floodplain development. A community's agreement to adopt and enforce floodplain management ordinances, particularly with respect to new construction, is an important element in making flood insurance available to home and businesses owners.

In Kentucky, the Floodplain Management Section of the Division of Water has primary responsibility for the approval or denial of proposed construction and other activities in the 100-year floodplain for all streams in the state. Typical activities permitted are dams, bridges, culverts, residential and commercial buildings, placement of fill, stream alterations or relocations, small impoundments, and water and wastewater treatment plants. In order to further protect communities along the river from flood damages, floodwalls or levees have been constructed at Frankfort and Hazard. The Corps of Engineers utilizes Buckhorn Lake and Carr Fork Lake for flood control purposes. Buckhorn Lake is located on the Middle Fork of the Kentucky River in Perry and Leslie Counties. This project became operational in 1961 and it is estimated that it has prevented more than \$38 million in flood damages. Carr Fork Lake was authorized for construction in 1962 for flood protection purposes. Completed in 1976, the 710-acre lake is located in southeastern Kentucky, about 16 miles from Hazard and 18 miles from Whitesburg. The dam is located 8.8 miles above the mouth of Carr Fork, a tributary of the North Fork of the Kentucky River. It was estimated that the lake had assisted in reducing flood damages by \$59.9 million through fiscal year 1998.

In some cases, the Kentucky River Authority has provided support for local flood impact studies for local communities. For example, Hazard is currently considering raising the height of its low level dam on the North Fork Kentucky River to ensure an adequate water supply for its planned increase in water treatment plant capacity. A hydraulic modeling study was completed by the Kentucky Water Research Institute (under contract with the KRA) to determine the effects of raising the dam's crest level on the 100-year, 50-year and 10-year flood profiles. Using the modeling tool HEC-RAS, water surface profiles were computed at increased crest-levels of up to 8 feet. The highest increase in water surface elevation corresponding to an 8 foot increase in crest level for the 100-year flood discharge was 2.7 inches, which occurred within 100 yards upstream of the dam. Although FEMA guidelines suggest that construction within the 100-year floodplain should not increase the 100-year floodplain elevations above preexisting elevations, the U.K. study recommended that the city of Hazard apply for a waiver on the basis that the increase in water surface elevations would be negligibly small. (University of Kentucky Department of Civil Engineering, "Impact on Raising Crest-Level of the Dam on North Fork Kentucky River in the Vicinity of Hazard Raw-Water Intake Tower," November 2001)

4.17 Recreational opportunities and recreational areas

This ULRWRP requirement is largely met through the KRA's *Capital Construction Plan*, as well as the activities of numerous boating-related enterprises, the Kentucky State Nature Preserves Commission and The Nature Conservancy. The Kentucky River Authority is helping to create a Kentucky River Park system with funds provided by the Economic Development Cabinet, the

Heritage Conservation Fund, ISTEPA and other non-fee sources. Areas at Boonesborough, Frankfort, Irvine, and High Bridge in Jessamine County will involve historic renovation of existing structures and educational and tourism opportunities for the general public. Additional natural area protection efforts along the palisades section of the basin are also underway.

The Boonesborough site includes beach improvements and the renovation of the lockmaster houses into a Kentucky River Museum containing exhibits and historic information about the river and the lock and dam system. The Frankfort River View Park will be located near Lock and Dam #4, and contain information on the historical importance of the river for commercial navigation and tourism. Trails and fishing areas will also provide an opportunity to enjoy the river's recreational benefits first-hand. At Irvine, the lockmaster houses will be rebuilt as a community center. Property at High Bridge was purchased in 1996 and includes an overlook of the confluence of the Dix and Kentucky Rivers. Jessamine County and the Kentucky River Authority renovated a historic pavilion on this site for use as a public park.

Dedicated as the Kentucky River Authority Palisades State Nature Preserve in December 1996, the preserve was renamed the Tom Dorman State Nature Preserve in 1999 to honor the former director and chairman of the KRA. The preserve protects 565 acres along the Kentucky River in Garrard and Jessamine Counties. It includes 220-foot palisades along the river and several rare plants that grow on the thin soils on the limestone cliffs. A two-mile trail on the Garrard County tract provides access to hiking, nature study and birdwatching opportunities within the Kentucky River palisades. The Jessamine County tract is open by appointment only with the permission of the Kentucky State Nature Preserves Commission.

The KRA's *Capital Construction Plan* lists park development efforts at High Bridge in Jessamine County and the Tom Dorman Nature Preserve in Jessamine and Garrard Counties. It also mentions the completion of the museum of river history and improvement of the beach at Boonesborough State Park. Additionally, the KRA has funded the construction of four boat ramps along the Kentucky River with the overall goal of providing free access to the river. The boat ramps are located at Twin Eagle Creek in Pool 2 (Owen County); KY 39 in Pool 8 (Jessamine County); Poosey Ridge Ramp in Pool 8 (Madison County); and Lock 13 Ramp in Pool 12 (Lee County). The ramps were installed by the Kentucky Department of Fish and Wildlife and county governments. In 2002, the KRA also funded the rehabilitation of a boat ramp in Irvine in Pool 11 (Estill County).

Additional recreational opportunities in the Kentucky River basin include hiking, birding and geological study at preserves owned and managed by The Nature Conservancy and the Kentucky State Nature Preserves Commission. Private canoeing ventures also operate at certain locations on Elkhorn Creek, South Elkhorn Creek, North Elkhorn Creek, the Forks of Elkhorn and the mainstem of the Kentucky River. Table 4.10 contains contact information for locks, boat ramps and recreational facilities along the Kentucky River.

Table 4.10: Contact Information for Kentucky River Basin Recreational Sites

Recreational Site / Organization	Phone Number / Internet Address
Lock 1 (Carroll Co.)	(502)732-5741
Twin Eagle Creek Ramp (Pool 1, Carroll Co.)	N/A
Lockport Ramp (Pool 1, Henry Co.)	N/A
Lock 2 (Henry Co.)	(502)845-4511
Six Mile Creek Ramp (Pool 2, Henry Co.)	N/A
Lock 3 (Henry Co.)	(502)845-5116
Still Waters Boat Ramp (Pool 3, Franklin Co.)	(502)223-8896
Steele Branch Ramp (Pool 3, Franklin Co.)	N/A
Kentucky River Campgrounds (Pool 3, Franklin Co.)	(502)227-2465
Lock 4 (Franklin Co.)	(502)223-8338
Bellpoint Boat Dock (Pool 4, Franklin Co.)	(502)223-1253
Frankfort Riverview Park (Pool 4, Franklin Co.)	(502)875-8575
Benson Creek Marina (Pool 4, Franklin Co.)	(502)695-9238
Frankfort Boat Club Dock (Pool 4, Franklin Co.)	(502)227-9481
River Bend Dock (Pool 4, Franklin Co.)	(502)223-6943
Lock 5 (Anderson Co.)	(502)839-6609
Fint's Ramp (Pool 5, Anderson Co.)	N/A
Onan's Ramp (Pool 5, Anderson Co.)	N/A
Lock 6 (Woodford Co.)	(859)873-3464
Oregan's Road Ramp (Pool 6, Mercer Co.)	N/A
Cummins Ferry Ramp (Pool 6, Woodford Co.)	N/A
Cummins Ferry Marina (Pool 6, Mercer Co.)	(859)865-2003
Wards Landing (Pool 6, Mercer Co.)	(859)734-2875
Pallisades Adventures (Pool 6, Mercer)	N/A
Lock 7 (Jessamine Co.)	(859)858-4188
Shakertown Village (Pool 7, Mercer Co.)	(800)734-5611
Shaker Landing Dixie Belle (Pool 7, Mercer Co.)	(800)734-5611
High Bridge (Pool 7, Jessamine Co.)	(859)885-4500 or http://www.jessamineco.com/tourism/highbridge.htm
Camp Nelson (Pool 7, Garrard Co.)	(859)548-2113
Lock 8 (Jessamine Co.)	(859)887-2511
KY 39 Ramp (Pool 8, Jessamine Co.)	N/A
Hunter's Ferry (Pool 8, Garrard Co.)	N/A
Poosey Ridge Ramp (Pool 8, Madison Co.)	N/A
Riverfront Boat Dock (Pool 8, Jessamine Co.)	N/A
Lock 9 (Jessamine Co.)	(859)272-3835
Clays Ferry Boat Dock (Pool 9, Fayette Co.)	N/A
River View Marina (Pool 9, Clark Co.)	(859)527-3800
Boonesborough State Park (Pool 9, Madison Co.)	(859)527-3146
Lock 10 (Madison Co.)	(859)527-3356
Davis Boat Dock (Pool 10, Clark Co.)	(859)527-3146
Happy Hour Boat Dock (Pool 10, Clark Co.)	N/A
Gibson's Red River Ramp (Pool 10, Estill Co.)	(859)745-1603
Lock 11 (Estill Co.)	N/A
Irvine Ramp and Howell Rest (Pool 11, Estill Co.)	(606)723-6400
Lock 12 (Estill Co.)	N/A
Ravena American Legion (Pool 12, Estill Co.)	N/A
Lock 13 Ramp (Pool 12, Lee Co.)	N/A
Lock 13 (Lee Co.)	N/A

Recreational Site / Organization	Phone Number / Internet Address
Lock 14 (Lee Co.)	N/A
Beattyville Ramp (Pool 14, Lee Co.)	N/A
Perry Col Park Ramp (Pool 14, Perry Co.)	N/A
Kentucky River Authority	(502)564-2866 or http://kra.state.ky.us
Kentucky State Nature Preserves Commission	(502)573-2886 or http://www.kynaturepreserves.org
The Nature Conservancy	(859)259-9655 or http://www.tnc.org
Kentucky Outdoor Center	(502)695-4480
Canoe Kentucky	(502) 227-4492 or 1-800-K-CANOE-1 or http://www.canoeky.com
Red River Outdoors	(606)663-9701 or www.redriveroutdoors.com

4.18 Generation of hydroelectric power

Currently, the only significant hydroelectric power in the basin is at Lock and Dam 7 and at Dix Dam. Both facilities are operated by Kentucky Utilities. When the Dix Dam Hydro Plant was originally constructed on the banks of Lake Herrington in the 1920’s, it was expected to supply electricity to K.U.’s service area into the 21st century. It is now operated only when heavy rainfall results in above normal lake elevations, and is thereby used to control lake levels. Fossil-fueled generating units and six combustion turbines serve as the primary source of power at K.U.’s Dix Dam generating station. In addition to Dix Dam, Lock 7 on the Kentucky River began operation in 1927, providing two megawatts of hydroelectric generation. In total, the hydropower units at Dix Dam and Lock and Dam 7 are currently used to generate eight to nine megawatts of electricity per year.

In September 2002, the Universal Electric Power Corporation filed an application for a preliminary permit with the Federal Energy Regulatory Commission. The applicant proposed a hydroelectric project at Lock and Dam 4 in Franklin County. This project would utilize the existing dam managed by the U.S. Army Corps of Engineers and would have an average annual generation of 15 GWh. A 60-day public comment period followed the hydroelectric application filing (12/13/02 – 2/11/03). If issued, a preliminary permit does not authorize construction. Rather, work proposed under the preliminary permit includes economic analysis, preparation of preliminary engineering plans and a study of environmental impacts. Based on the findings of these studies, the applicant can determine whether or not to pursue an application to construct and operate the project.

4.19 Economic development

The water resources provided by the Kentucky River will play a significant role in the future economic development of central Kentucky, as well as the entire Kentucky River Basin. The Kentucky River Authority works to support such economic development by providing a safe and reliable water supply for the region by continued maintenance and augmentation of storage on the Kentucky River.

Economic development in Kentucky is largely coordinated through several Area Development Districts that encompass various parts of the river basin. The Area Development Districts, or

ADDs, are composed of different sets of counties that are grouped together on the basis of geography and common economic interests. Locally-elected officials and citizen members comprise the ADD Boards of Directors. The ADD staffs are made up of professionals with a wide range of backgrounds in such areas as economic development, human services, management and planning. By sharing the expertise found on the ADD staffs, local governments are collectively able to afford the professional staff that many counties and cities could not afford by themselves. ADDs are a means by which local elected officials and citizens unite to provide for the planned growth of their area.

As shown in Figure 4.4, the majority of the Bluegrass and Kentucky River ADDs fall within the Kentucky River Basin, as well as smaller portions of KIPDA, the Northern Kentucky ADD, Gateway ADD, Cumberland Valley ADD and the Lake Cumberland ADD. Contact information for each of these ADDs is contained in Table 4.11.

The Bluegrass Area Development District is coordinating efforts by the Bluegrass Water Supply Consortium to address the potable water needs of central Kentucky. In addition to developing a treated water transmission grid for participating suppliers, the BWSC is working to identify an alternative source of water to meet demand during periods of water shortage. Participants in the Consortium include the Lexington-Fayette Urban County Government; Kentucky-American Water Company; Nicholasville Utilities; Winchester Municipal Utilities; Georgetown Municipal Water and Sewer Service; Frankfort Electric and Water Plant Board; Shelbyville Municipal Water and Sewer Commission; Mount Sterling Water and Sewer Commission; Berea College Utilities; and the cities of Cynthiana, Harrodsburg, Danville, Lancaster, Lawrenceburg, Paris, Versailles and Wilmore. BWSC participants expect to reach a consensus on a supply alternative by late spring to summer of 2003. Relief from the region's drought supply deficit should then begin to occur within three years in the form of system interconnections through the "grid" and/or access to an additional water supply source. At its fourth workshop, Consortium participants narrowed supplemental supply alternatives to eight options, with the top three options being a new water treatment plant at or below Pool 3 of the Kentucky River; a treated water pipeline to the Louisville Water Company; and a treated water pipeline to the Cincinnati Water Works.

In 1996, the Water Resource Development Commission was directed to prepare a strategic plan for developing water resources in Kentucky, with the goal of providing the best available water and sewer service to every Kentuckian by 2020. Economic development in the basin will be furthered through improved water service and other basic infrastructure needs. *Water Resource Development: A Strategic Plan* assesses all water systems in the Kentucky River Basin (as well as in the remainder of the state) and provides recommendations for improving the level of water service. The strategic plan is posted on the internet at http://wrisc.state.ky.us/wrisc_plan/.

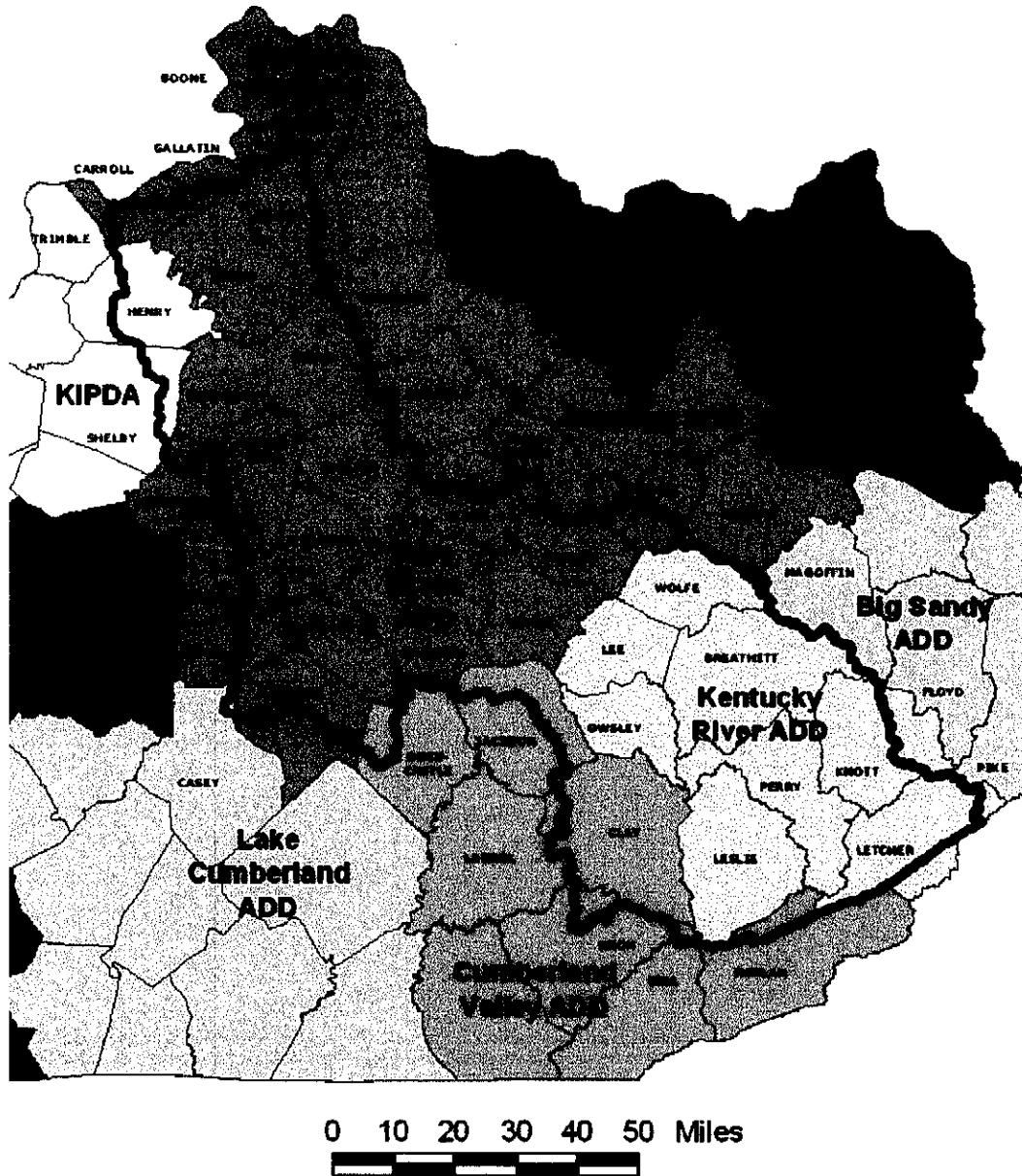


Figure 4.5: Map of Kentucky River Basin Area Development Districts

Table 4.11 Contact Information for Area Development Districts in the Kentucky River Basin

Area Development District (ADD)	Contact Information
Bluegrass ADD	699 Perimeter Drive; Lexington, KY 40517; Phone: (859) 269-8021; Fax: (859) 269-7917; bgadd@bgadd.org
Cumberland Valley ADD	342 Old Whitley Road; P.O. Box 1740; London, KY 40743-1740; Phone: (606) 864-7391; Fax: (606) 878-7361; cvadd@cvadd.org
Gateway ADD	Corner Main & Slate Streets; P.O. Box 1070; Owingsville, KY 40360; Phone: (606) 674-6355; Fax: (606) 674-6658; gailkwgadd@kih.net
Kentucky River ADD	381 Perry County Park Road; Hazard, KY 41701; Phone: (606) 436-3158; Fax: (606) 436-2144; kradd@mis.net
KIPDA	11520 Commonwealth Drive; Louisville, KY 40299; Phone: (502) 266-6084; Fax: (502) 266-5047; E-mail: kipda@iglou.com
Lake Cumberland ADD	Lakeway Drive; P.O. Box 1570; Russell Springs, KY 42642; Phone: (270) 866-4200; Fax: (270) 866-2044; cindil.alexander@mail.state.ky.us
Northern Kentucky ADD	16 Spiral Drive; P.O. Box 668 Florence, KY 41022-0668; Phone: (859) 283-1885; Fax: (859) 283-8178; nkadd@AOL.com

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

In its oversight role for the Kentucky River Basin, the KRA is expected to maintain and manage the water resources of the Kentucky River Basin; provide a clean water supply for the citizens of the Basin; provide leadership and a common forum for all stakeholders in the Basin; and promote the highest and best recreational uses of the water resources in the Basin. The following are recommendations for the KRA to satisfy these goals.

5.1 Water Supply

The KRA should continue its efforts to maintain the Kentucky River lock and dam system as the basis of water supply for basin communities.

It appears as if most communities that currently rely on water supply sources within the mainstem of the Kentucky River will continue to utilize the river as their major source. Thus, the lock and dam system, which creates water storage pools along the river, will be critical to ensuring the availability of these supplies. The KRA is the lead agency for pursuing and coordinating the maintenance and upgrades necessary for the optimum function of the locks and dams. Thus, these communities will look to the agency for assistance. And, the KRA will be expected to acquire the necessary political and financial support for lock and dam construction activities.

The KRA should encourage and assist with regional solutions to ensuring adequate water supplies.

The County Water Management Plans, as well as various other reports, predict water shortages for several basin communities in the event of a drought. Regional efforts are being pursued by groups of these communities to eliminate the threat of a water supply shortage. For instance, the Bluegrass Water Supply Consortium is an alliance of water utilities and government agencies that are working to address the potable water needs of central Kentucky. Likewise, the Carr Creek Water Commission is working toward the construction of a water treatment plant on Carr Creek Lake to serve communities in Knott, Letcher and Perry Counties. It is possible that the KRA will need to provide informational and administrative assistance to ensure the success of these efforts. The implementation of the KRA's Long-Range Capital Construction Plan should help to ensure future water supplies.

The KRA should promote programs that encourage conservation measures for maximizing water resources.

In its mission to maintain and manage the water resources of the Kentucky River, the KRA has a responsibility to ensure the most efficient use of these waters. Suggested measures include the KRA's participation in maintenance to reduce leakage losses through the locks and dams; programs that reduce system leakage in distribution lines; and education about consumer water conservation. In addition, during drought conditions, the KRA has the responsibility to assist with the implementation of basin community Water Shortage Response Plans.

5.2 Water Quality and Watershed Management

The KRA should continue to participate in cooperative efforts to implement watershed solutions.

In its role as Basin Coordinator of the Kentucky River and its mission to provide a clean water supply for citizens of the basin, the KRA has the ability to encourage and assist with local efforts to improve water quality. During the first Kentucky River Basin cycle of the Kentucky Watershed Management Framework, three priority watersheds were identified in the basin: the Eagle Creek Mouth Watershed, Red River Gorge Watershed and South Elkhorn Creek Watershed. Individual watershed management plans were subsequently written for each of these three watersheds and local task forces were organized. The KRA possesses knowledge and authority that could be critical to ensuring the success of water quality improvements recommended in the management plans. The KRA should work with grass-roots, volunteer organizations to help implement these plans.

The KRA should continue to support volunteer sampling efforts in the Kentucky River Basin.

The KRA has provided continuing support for volunteer sampling in the basin since 1997. These efforts have helped to identify new and continuing water quality impairments throughout the basin and have served as a basis for targeting problem areas.

The KRA should continue to work with other organizations to reduce fecal pollution from septic systems and failing wastewater treatment systems.

Fecal contamination represents a significant threat to water quality in the basin. Failing septic systems and wastewater treatment systems are the sources of much of this contamination. Fecal pollution also results from livestock operations in the basin. The KRA should join in efforts to limit fecal contributions from human sources and livestock operations along Kentucky River Basin waterways.

5.3 Recreational Opportunities

The KRA should continue to develop recreational sites in the Kentucky River Basin.

Existing recreational resources in the basin include boat ramps, hiking trails, riverside pavilions, picnic sites and informational displays. The Kentucky River Palisades region represents a unique attraction for tourism in the region and should be promoted as such. To accomplish this goal, the KRA should continue to work with other organizations, such as the Nature Conservancy and the Kentucky State Nature Preserves Commission, to preserve land in the Palisades region for present and future generations to enjoy.

5.4 Economic Development

The KRA can assist in economic development in the basin by continuing to ensure a clean water supply source for communities.

The region's water supply can be ensured by the KRA's Lock and Dam maintenance program, along with any recommended modifications to this system to increase needed water storage on the river. Further, by participating in the Kentucky Watershed Management Framework, the annual Kentucky River Sweep and other water quality efforts, the KRA will play a role in guaranteeing a safe raw water source for drinking water supplies.

The KRA can further encourage tourism by helping to ensure the cleanliness of Kentucky River Basin waters and continued development of recreational facilities.

By improving the water quality in the river, the KRA will enhance the appeal of recreational activities on the Kentucky River, such as boating, fishing, swimming, and a general appreciation of the aesthetic beauty of the river.