# *1998 KENTUCKY REPORT TO CONGRESS ON WATER QUALITY*

**KENTUCKY NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET**

**DIVISION OF WATER**

**JANUARY 1999**

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## Introduction

This report was prepared by the Kentucky Division of Water (DOW) following submittal of electronic data to U. S. Environmental Protection Agency (EPA) in April 1998 to fulfill requirements of Section 305(b) of the Federal Water Pollution Control Act of 1972 (P.L. 92-500) as subsequently amended and commonly known as the Clean Water Act. Section 305(b) requires that states submit to EPA on a biennial basis a report assessing current water quality conditions. This report presents an assessment of Kentucky's water quality for the period October 1995 through September 1997. Information contained in the Background section (including the atlas) of the 1996 Kentucky Water Quality Report to Congress has not changed and can be accessed in that report.

## Data Collection

The water quality assessment of rivers and streams in this report is based on the support of designated uses in state waters depicted on U.S. Geological Survey (USGS) 1:100,000 scale topographic maps, excluding the Mississippi River. According to EPA's Reach File 3, the maps contain about 49,100 miles of streams. Approximately 9,232 miles were assessed by the DOW. The 664 miles of the Ohio River bordering Kentucky were assessed by the Ohio River Valley Water Sanitation Commission (ORSANCO).

### Ambient Monitoring Programs

**Water Quality.** Forty-four primary ambient water quality monitoring stations, characterizing approximately 1,432 stream miles, were operated by the DOW during the reporting period. (Table 1; Figure 1). For ground water, over 100 ambient monitoring sites are maintained by DOW. In addition, 13 lakes were sampled for eutrophication trends. Water quality data from nine stations operated by federal and other state agencies were used to supplement DOW water quality data (Table 2; Figure 1). Various other water quality data sources are described in a later section.

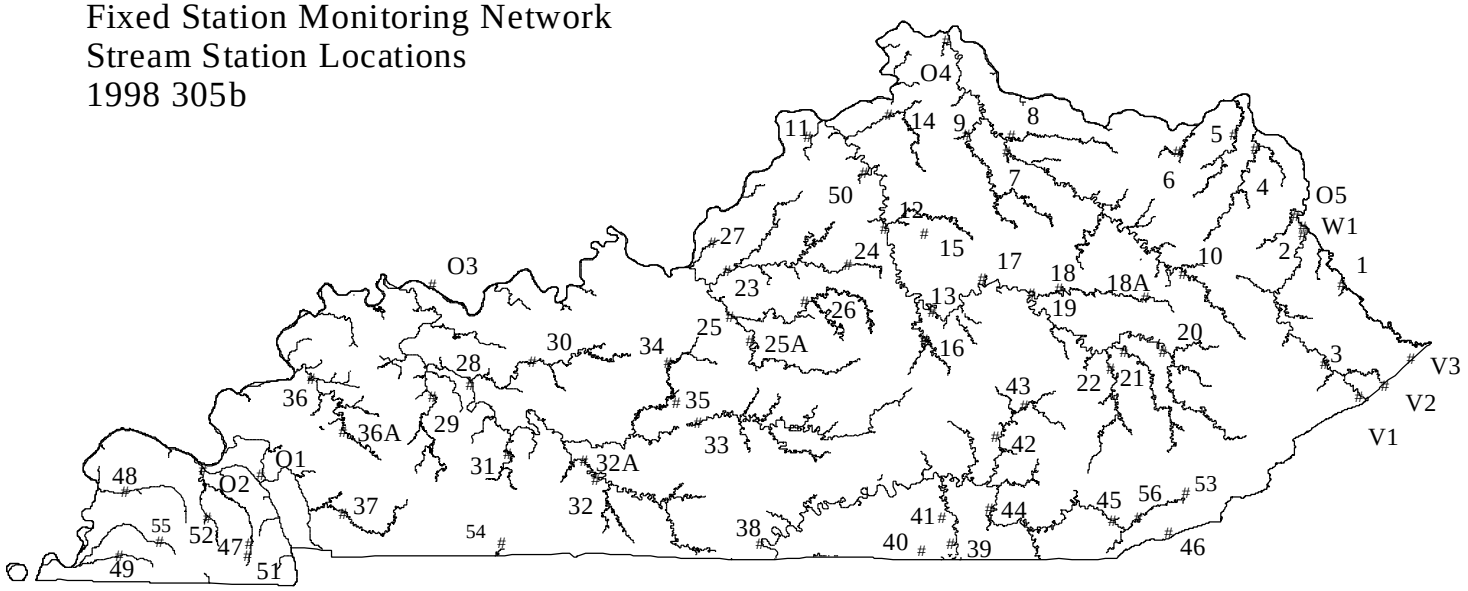
| Table 1. Kentucky Division of Water Fixed-Station Monitoring Network | | | | |
|---|---|---|---|---|
| **MAP NO.** | **STATION NAME** | **RIVER MILE** | **ROAD LOCATION** | **BIOLOGICAL SAMPLING PERFORMED 1996 - 1997** |
| 1 | Tug Fork at Kermit | 35.1 | KY 40 | X |
| 2 | Levisa Fork near Louisa | 29.6 | KY 644 | |
| 3 | Levisa Fork near Pikeville | 114.6 | KY 1426 | X |
| 4 | Little Sandy River near Argillite | 13.2 | KY 1 | |
| 5 | Tygart's Creek near Load | 28.1 | KY 7 | |
| 6 | Kinniconick Creek near Tannery | 10.4 | KY 1149 | |
| 7 | Licking River at Claysville | 78.2 | US 62 | X |
| 8 | N. Fork Licking River at Milford | 6.9 | KY 19 | X |
| 9 | S. Fork Licking River at Morgan | 11.7 | KY 1054 | X |
| 10 | Licking River at West Liberty | 226.4 | US 60 | X |
| 11 | Little KY River near Bedford | 9.4 | US 42 | |
| 12 | Kentucky River at Frankfort | 66.4 | St. Clair St. Bridge | |
| 13 | Kentucky River at High Bridge | 135.1 | | |
| 50 | Kentucky River at Lockport | 31.0 | | |
| 14 | Eagle Creek at Glencoe | 21.5 | US 127 | |
| 15 | S. Elkhorn Creek near Midway | 25.3 | Moores Mill Rd. Bridge | |
| 16 | Dix River near Danville | 34.6 | KY 52 | |
| 17 | Boone Creek at Hunt Club | 3.8 | Grimes Mill Rd. | |
| 18 | Red River at Clay City | 21.6 | KY 11/15 | |
| 19 | Kentucky R. near Trapp | 191.2 | Red River Ferry Rd. | |
| 20 | N. Fk Kentucky R. at Jackson | 304.5[c] | Old KY 30 | |
| 21 | M. Fk. Kentucky R. at Tallega | 8.3 | KY 708 | |
| 22 | S. Fk Kentucky R. at Booneville | 12.1 | KY 28 | |
| 23 | Salt River at Shepherdsville | 22.9 | KY 61 | |
| 24 | Salt River at Glensboro | 82.5 | KY 53 | |
| 25 | Rolling Fk near Lebanon Junction[d] | 12.3 | KY 434 | |
| 25A | Rolling Fk at New Haven | 38.8 | US 31E | X |
| 26 | Beech Fork near Maud | 48.1 | KY 55 | X |
| 27 | Pond Creek near Louisville | 15.5 | Manslick Rd. Bridge | |
| 28 | Green River near Livermore | | Livermore Boat Ramp | |
| 29 | Pond River near Sacramento | 12.4 | KY 85 | |
| 30 | Rough River near Dundee | 62.5 | Barrets Ford Bridge | |
| 31 | Mud River near Gus | 17.4 | KY 949 | |
| 32 | Barren River at Bowling Green[d] | 37.5 | College St. Bridge | |
| 32A | Barren River at L & D 1[c] | 14.5 | Greencastle Rd. | |
| 33 | Green River at Munfordville | 225.9 | US 31W | |

| | | | | |
|---|---|---|---|---|
| 34 | Nolin River at White Mills | 80.9 | White Mills Ridge | |
| 35 | Bacon Creek near Priceville | 7.2 | C. Avery Rd. Bridge | |
| 36 | Tradewater River near Sullivan | 15.1 | US 60/641 | |
| 36A | Tradewater River near Olney | 72.7 | KY 1220 | |
| 37 | Little River near Cadiz | 24.4 | KY 272 | X |
| 51 | Clarks River[e] | 56.7 | | X |
| 52 | West Fork Clarks River[e] | 21.0 | | X |
| 54 | Red River - Dot[e] | 58.8 | | X |
| 55 | Obion Creek - Mayfield[e] | 48.2 | | X |
| 38 | Cumberland R. at Turkey Neck[d] | 393.7 | KY 214 | |
| 39 | Big S. Fk. Cumberland R. at Blue Heron | 44.7 | Old Rail Bridge | X |
| 56 | Cumberland River @ Molus | 679.1 | | X |
| 40 | Rock Creek near Bell Farm | 17.1 | White Oak Bridge | X |
| 41 | Little South Fk. Cumberland R. near Ritner Ford | 5.4 | Freedom Church | X |
| 42 | Rockcastle River at Billows | 24.4 | Old KY 80 | X |
| 43 | Horse Lick Creek near Lamero | 7.5 | Daugherty Rd. Ford | |
| 53 | Poor Fork @ Rosspoint[e] | 695.4 | | X |
| 44 | Cumberland R. at Cumberland Falls | 562.3 | KY 90 | X |
| 45 | Cumberland R. at Pineville[d] | 654.4 | Pine St. Bridge | |
| 46 | Martins Fk near Cumberland Gap National Pk | 27.4 | Off Hwy 987 | X |
| 47 | Clarks River at Almo | 53.5 | Almo-Shiloh Rd. Bridge | |
| 48 | Mayfield Creek near Magee Springs | 10.8 | KY 121 | X |
| 49 | Bayou de Chien near Clinton | 15.1 | US 51 | X |

[a] Water quality samples collected monthly
[b] Stations not sampled in 1996-1997
[c] 49.7 miles upstream of confluence with S. Fk KY R.
[d] Water quality site only
[e] Biological site only

Figure 1.

Fixed Station Monitoring Network
Stream Station Locations
1998 305b



**Biological.** Kentucky's biological monitoring program consisted of a network of 49 stations located in 12 river basins (Table 1; Figure 1). The majority of the sites are at or near the physicochemical sampling sites. In 1993, the network was expanded to include stations on eight of the nine Kentucky Wild Rivers. Approximately one-fourth of the sites are sampled each year on a river basin approach. For instance, all stations in the Big Sandy, Licking, and Salt river basins were sampled in 1996, and all stations in the lower Cumberland, Tennessee and Mississippi river basins were sampled in 1997. Data collected from these 17 stations were used to assess warmwater aquatic habitat (WAH) use support in stream miles. The data were also used to determine potential sources of any use impairment, changes to existing water or habitat quality, background values against which future conditions can be compared, and problems with toxic and conventional pollutants, bacteriological contamination, and nuisance biological growth.

**Table 2. Water Quality Stations Maintained by Federal and Other State Agencies**

| | River Mile No. | Map |
|---|---|---|
| Ohio River Valley Water Sanitation Commission | | |
| Cumberland River at Pinckneyville | 16.0 | 01 |
| Tennessee River at Paducah | 5.0 | 02 |
| Green River near Sebree | 41.3 | 03 |
| Licking River at Covington | 4.5 | 04 |
| Big Sandy River near Louisa | 20.5 | 05 |
| Virginia Department of Environmental Quality | | |
| Russell Fork near Elkhorn City | 116.0 | V1 |
| Levisa Fork at state line | 151.5 | V2 |
| Knox Creek at state line | 7.6 | V3 |
| West Virginia Department of Natural Resources | | |
| Tug Fork at Fort Gay, WV | 0.1 | W1 |

Algal samples were collected from each biological monitoring station using both artificial substrates (for biomass estimates) and natural substrates (for algal identification and community structure evaluation). The condition of the algal community was determined by a Diatom Bioassessment Index (DBI), which includes the following metrics: total number of

diatom species, diversity, pollution tolerance index, and relative abundance of sensitive species. Relative abundance of non-diatom algae and biomass (chlorophyll *a* and ash free dry-weight) were used to arrive at the DBI.

Fish were collected for community structure evaluation at biological monitoring sites where sampling could be conducted. The condition of the fish community was determined by species richness, relative abundance, species composition, and the Index of Biotic Integrity (IBI). The IBI was used to assess biotic integrity directly by evaluation of 12 attributes, or metrics, of fish communities in streams. These community metrics include measurement of species richness and composition, trophic structure, and fish abundance and condition. The IBI was used to assign one of the following categories to a fish community: excellent, good, fair, poor, very poor, or no fish.

Macroinvertebrates are collected from both artificial substrates and all available natural habitats. A Macroinvertebrate Bioassessment Index (MBI) is calculated from several other indices, including, at a minimum: 1) taxa richness, 2) total number of individuals, 3) Hilsenhoff Biotic Index, and 4) Percent Community Similarity Index. Additional metrics are used depending on factors such as ecoregion and type of impact.

**Reference Reach Program**

The DOW began a program in 1991 to gather physical, chemical, and biological data from the state's least impacted streams. The program looks at candidate waters as representative of geographic regions of the state known as ecoregions. This program defines the physical, chemical, and biological potentials for the streams of a particular ecoregion and allows a comparison with other streams in the same ecoregion. It also helps determine the potential legitimate uses of other streams in the same region. The data from this program will provide the basis for the development of narrative and numerical biocriteria for the various ecoregions of the Commonwealth. Data on chemical water quality, sediment quality, fish tissue residue, habitat condition, and biotic conditions are collected.

Fifty-five stream sites from seven proposed ecoregions were initially sampled in the spring and fall of 1992-1993 under the Reference Reach Program. For this reporting period, 11

new sites were also sampled, resulting in a total of 689 miles that have been assessed for WAH use since 1992. Forty of these sites have been placed into the Reference Reach Program (Table 3: Figure 2). Spring and fall collections will continue in order to increase the biological data base from undisturbed streams that can be used to compare with impacted streams. At the same time, program personnel will continue to develop and refine the necessary metrics used to evaluate the relationships between biotic communities and habitat conditions in streams across Kentucky.

**Intensive Surveys**

Twenty-nine intensive surveys were conducted on 178.1 miles of streams to evaluate point source and nonpoint agricultural pollution, baseline water quality, and the status of water quality in streams assessed previously.

**Other Data Sources**

**Discharge Monitoring Data Reports.** Discharge monitoring report data, collected by KPDES permit holders, were accessed through DOW's permit compliance system database. Depending on the relative sizes of the wastewater discharge and the receiving stream and the severity of permit violations, it was often possible to assess instream uses as threatened or impaired.

**Kentucky Department of Fish and Wildlife Resources Data.** Fisheries investigation reports prepared by the Kentucky Department of Fish and Wildlife Resources (KDFWR) were used to assess WAH use for several streams. The KDFWR conducts field surveys that identify streams capable of supporting a sustainable year-round trout fishery. These data allow the DOW to classify streams as Coldwater Aquatic Habitat (CAH). Streams classified as CAH were considered to fully support the CAH use and were considered as monitored waters in the assessment.

Another source of data for the evaluated category was a list of streams recommended by the KDFWR as candidates for Outstanding Resource Waters. They were recommended because of

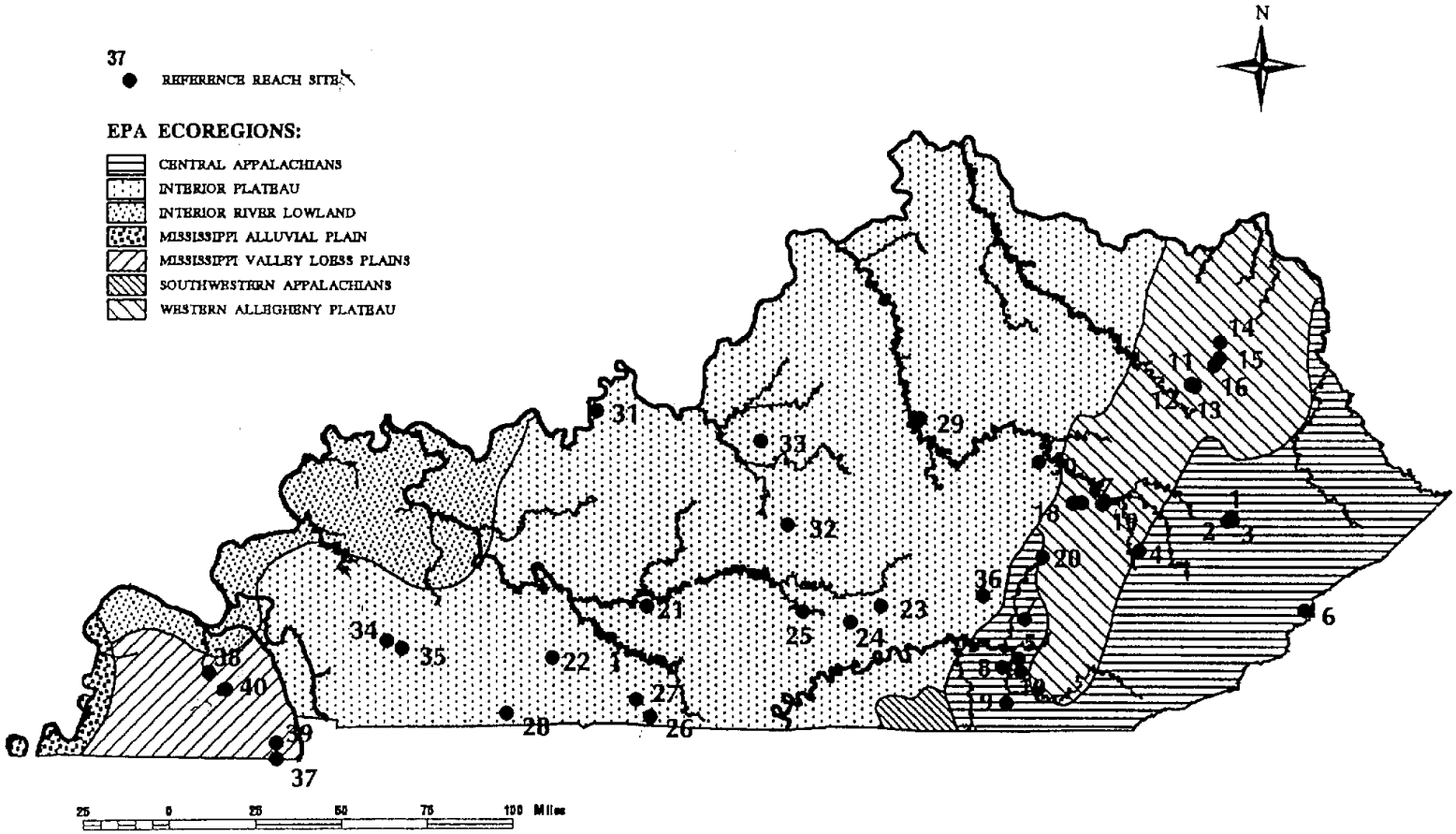
| Table 3. KENTUCKY DIVISION OF WATER REFERENCE REACH SITES | | | | |
|---|---|---|---|---|
| **Map No.** | **Station Name** | **River Mile** | **County** | **Road Location** |
| **CENTRAL APPALACHIAN ECOREGION** | | | | |
| | **Kentucky River Basin** | | | |
| 1 | Clemons Fork | 0.5 | Breathitt | Robinson Forest Rd. |
| 2 | Clemons Fork | 0.6 | Breathitt | Robinson Forest Rd. |
| 3 | Coles Fork | 0.6 | Breathitt | Robinson Forest Rd. |
| 4 | Right Fork Buffalo Creek | 1.1 | Owsley | Off Whoopflarea Rd. |
| | **Upper Cumberland River Basin** | | | |
| 5 | Bad Branch | 0.2 | Letcher | KY 932 Bridge |
| 6 | Bark Camp Creek | 2.5 | Whitley | USFS Rd. 193 |
| 7 | Cane Creek | 7.0 | Laurel | Off Middle Fork Rd. |
| 8 | Eagle Creek | 3.0 | McCreary | KY 896 Bridge |
| 9 | Marsh Creek | 12.6 | McCreary | KY 478 Bridge |
| 10 | South Fork Dog Slaughter Cr. | 3.6 | Whitley | USFS Rd. 195 |
| **WESTERN ALLEGHENY ECOREGION** | | | | |
| | **Licking River Basin** | | | |
| 11 | Bucket Branch | 0.1 | Morgan | Leisure-Paragon Rd. Br. |
| 12 | Devils Fork | 0.2 | Morgan | KY 711 Bridge |
| 13 | North Fork | 13..0 | Morgan | Off Leisure-Paragon Rd. |
| | **Little Sandy River Basin** | | | |
| 14 | Arabs Fork | 0.1 | Elliott | KY 1620 Bridge |
| 15 | Big Cane Creek | 7.9 | Elliott | Off Binion Ford Rd. |
| 16 | Laurel Creek | 7.6 | Elliott | Carter School Rd. Br. |
| | **Kentucky River Basin** | | | |
| 17 | Station Camp Creek | 19.0 | Estill | Off KY 1209 |
| 18 | South Fork Station Camp Creek | 5.3 | Jackson | KY 89 Bridge |
| 19 | Sturgeon Creek | 4.0 | Lee | Off Sturgeon Creek Rd. |
| | **Upper Cumberland River Basin** | | | |
| 20 | Horse Lick Creek | 1.9 | Jackson | Horse Lick Creek Rd. |
| **INTERIOR PLATEAU ECOREGION** | | | | |
| | **Green River Basin** | | | |
| 21 | Beaverdam Creek | 7.6 | Edmonson | KY 101-259 Bridge |
| 22 | Gasper River54 | 32.4 | Logan | Bucksville Rd. Bridge |
| 23 | Goose Creek | 5.6 | Casey | Off Brock Rd. |
| 24 | Russell Creek | 60.5 | Adair | KY Hwy. 80 |
| 25 | Russell Creek | 25.6 | Adair | Off KY 768 |
| 26 | Trammel Fork | 18.5 | Allen | Red Hill Rd. Bridge |
| 27 | Trammel Fork | 26.6 | Allen | Concord Church Rd. Br. |

| | | | | |
|---|---|---|---|---|
| | **Lower Cumberland River Basin** | | | |
| 28 | Whippoorwill Creek | 4.3 | Logan | KY 2395 Bridge |
| | **Kentucky River Basin** | | | |
| 29 | Clear Creek | 4.1 | Woodford | Hifner Mill Rd. Bridge |
| 30 | Muddy Creek | 13.4 | Madison | KY 52 Bridge |
| | **Ohio River Basin** | | | |
| 31 | Yellowbank Creek | 4.4 | Breckinridge | Cart-Manning Rd. |
| | **Salt River Basin** | | | |
| 32 | Salt Lick Creek | 5.3 | Marion | Off Salt Lick Rd. |
| 33 | Wilson Creek | 12.2 | Bullitt | Mt. Carmel Church Rd. |
| | **Tradewater Basin** | | | |
| 34 | Sandlick Creek | 6.7 | Christian | Mt. Carmel-Camp Cr. Rd. |
| 35 | Upper Tradwater River | 128.9 | Christian | T. Sparkman Rd. Bridge |
| | **Upper Cumberland River Basin** | | | |
| 36 | Buck Creek | 28.9 | Pulaski | Off Bud Rainey Rd. |
| | **MISSISSIPPI VALLEY LOESS PLAINS ECOREGION** | | | |
| | **Tennessee River Basin** | | | |
| 37 | Blood River | 15.1 | Calloway | Grubbs Lane Rd. Bridge |
| 38 | Panther Creek | 1.0 | Calloway | KY 280 Bridge |
| 39 | Panther Creek | 1.2 | Graves | KY 2580 Bridge |
| 40 | Soldiers Creek | 2.6 | Marshall | KY 58 Bridge |

their outstanding value as sport fishing streams. These streams were assessed as fully supporting warmwater aquatic habitat use if there were no data which conflicted with the assessment.

**Louisville MSD/U.S. Geological Survey.** The Louisville and Jefferson County Metropolitan Sewer District, in cooperation with the USGS, has a monitoring program for streams in Jefferson County. Twenty-six stations are monitored for a variety of parameters including fecal coliform bacteria. Macroinvertebrate and fish collections are also made. The chemical and bacteriological data from 1992 - 1997 were used for this report, and they were considered to be monitored data in the assessments.

Figure 2.


REFERENCE REACH SITES
37
REFERENCE REACH SITES
EPA ECOREGIONS:
CENTRAL APPALACHIANS
INTERIOR PLATEAU
INTERIOR RIVER LOWLAND
MISSISSIPPI ALLUVIAL PLAIN
MISSISSIPPI VALLEY LOESS PLAINS
SOUTHWESTERN APPALACHIANS
WESTERN ALLEGHENY PLATEAU
N
25 0 25 50 75 100 Miles

**Kentucky State Nature Preserves Commission.** Data from streams surveyed by the KSNPC for a special project to obtain background aquatic biota and water quality data in the oil shale region of the state was published in a 1984 report entitled Aquatic Biota and Water Quality and Quantity Survey of the Kentucky Oil Shale Region**.** Although more than ten years old, these data are still considered valid and were used in this report.

**U.S. Fish and Wildlife Service.** Field work conducted for the U.S. Fish and Wildlife Service, and verified by the KSNPC and KDFWR, identified streams in Kentucky that harbored the blackside dace, a federally threatened species of fish. This work was considered as monitored data. These streams are automatically classified as Outstanding Resource Waters and were judged to fully support the WAH use.

**U.S. Army Corps of Engineers.** The Blaine Creek watershed has been monitored by the COE-Huntington District for several years in conjunction with the Yatesville Lake project. The COE macroinvertebrate and chemical data were utilized for this report.

**U.S. Forest Service.** U.S. Forest Service data were used for several streams in the Daniel Boone National Forest.

**Lexington-Fayette Urban County Government.** The local government conducts biological and water quality monitoring of several streams in Fayette County. These data were used in assessing WAH and swimming uses for this reporting period.

## Assessment Methodology

Overall use support was assessed by following EPA guidelines that define fully supporting as fully supporting all uses for which data are available. If a segment supported one use but did not support another, it was listed as not supporting. For instance, if a segment supported a warmwater aquatic habitat use but not a primary contact recreation use, it was listed as not

supporting. A segment is listed as partially supporting if any assessed use fell into that category even if another use was fully supported. Many waterbodies were assessed for only one use because data were not available to assess other uses.

**Aquatic Life and Primary Contact Recreation Use Support**

The water quality and biological data described in the preceding pages were used to determine stream use support status. The data were categorized as "monitored" or "evaluated." Monitored data were derived from site-specific ambient surveys and were generally no more than five years old. In some instances where watershed conditions remained mostly unchanged, monitored data collected prior to 1993 were still considered valid, and streams described by those data were categorized as monitored. Evaluated data were from other sources such as questionnaires to regional field personnel or from ambient surveys that were conducted more than five years ago. The criteria for assessing these data to determine use support are explained below.

In areas where both chemical and biological data were available, the biological data were generally the determinant factor for establishing WAH use support status. This was especially true when copper, lead, or zinc criteria were contradicted by biological criteria. The DOW made this decision in recognition of the natural ability of surface waters to sequester metals, rendering them less available to aquatic life by reducing the toxic "dissolved" fraction.

**Water Quality Data.** Chemical data collected by the DOW, ORSANCO, Virginia, West Virginia, and the USGS at fixed stations were evaluated according to EPA guidelines for the preparation of this report. Water quality data were entered into EPA's national storage and retrieval (STORET) database and compared to criteria. The segment fully supported the WAH use when criteria for dissolved oxygen, un-ionized ammonia, temperature, and pH were not met in 10 percent or less of the samples collected from October 1995 through September 1997. Partial support was indicated if any one criterion for these parameters was not met 11-25 percent of the time. The segment was 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 were analyzed for violations of acute criteria listed in state water quality standards using three years of data (from October 1994 through September 1997). The segment fully supported its use if all criteria were met at stations with quarterly or less frequent sampling or if only one violation occurred at stations with monthly sampling. Partial support was indicated if any one criterion was not met more than once but in less than 10 percent of the samples. The segment was not supporting if criteria were exceeded in greater than 10 percent of the samples. The assessment criteria are closely linked to the way state water quality criteria were developed. Aquatic life are considered to be protected if, on the average, the acute criteria are not exceeded more than once every three years Fecal coliform and pH data were used to indicate the degree of support for Primary Contact Recreation (swimming) use. The swimming use was fully supported if the criterion was not met in 10 percent or less of the measurements, partially supported if the criterion was not met in 11-25 percent of the measurements, and not supported if the criterion was not met more than 25 percent of the time. Streams with pH below 6.0 units were judged to not support swimming use.

**Biological Data.** Biological data for 1996-1997 were collected from 17 fixed monitoring network stations in six river basins, 40 reference reach sites, and 29 intensive surveys. Algae, macroinvertebrates, and fish were collected, and several community structure function metrics were analyzed for each group of organisms as described earlier in this chapter. These metrics were used to determine biotic integrity and designated use support for each stream segment monitored (Table 4). Expectations for metric values are dependent upon stream size, ecoregion, and habitat quality and were applied accordingly. Bioassessments integrated data from each group of organisms, habitat data, selected physical and chemical parameters, and professional judgment of aquatic biologists.

The diatom bioassessment index classifies algal communities as excellent or good (supporting), fair (partially supporting), or poor (not supporting). For the macroinvertebrate evaluations, stream reaches were considered to fully support the WAH use if information reflected no alterations in community structure or functional compositions for the available

| Table 4. Biological Criteria for Assessment of Warmwater Aquatic Habitat (WAH) Use Support | | | |
|---|---|---|---|
| | **Fully Supporting** | **Paritally Supporting** | **Not Supporting** |
| Algae | Diatom Bioassessment Index (DBI) Classification of excellent or good, biomass similar to reference/control or STORET mean. | DBI classification of fair, increased biomass (if nutrient enriched) of filamentous green algae. | DBI classification of poor, biomass very low (toxicity), or high (organic enrichment). |
| Macroinvertebrate | Macroinvertebrate Bioassessment Index (MBI) excellent or good, high EPT, sensitive species present. | MBI classification of fair, EPT lower than expected in relation to available habitat, reduction in RA of sensitive taxa. Some alterations of functional groups evident. | MBI classification of poor, EPT low, TNI of tolerant taxa very high. Most functional groups missing from community. |
| Fish | Index of Biotic Integrity (IBI) excellent or good, presence of rare, endangered or species of special concern. | IBI fair. | IBI poor, very poor, or no fish. |

EPT=Ephemeroptera, Plecoptera, Trichoptera, RA=Relative Abundance, TNI=Total Number of Individuals

habitats and if habitat conditions were relatively undisturbed. A reach was considered partially supporting uses when information revealed that community structure was slightly altered, that functional feeding components were noticeably influenced, or if available habitats reflected some alterations and/or reductions. Reaches were considered not supporting uses if information reflected sustained alterations or deletions in community structure, taxa richness and functional feeding types, or if available habitats were severely reduced or eliminated. For fish, reaches with an IBI of excellent or good were considered to fully support uses. Reaches were assessed as partially supporting uses if they had an IBI of fair, while reaches were considered not supporting uses when the IBI category was poor, very poor, or no fish.

**Fish Consumption Use Support**

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 were 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 subpopulation 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 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 potentially greater risk, for one or more fish species; commercial fishing ban in effect.

**Drinking Water Use Support**

In 1986, amendments to the Safe Drinking Water Act (SDWA) required the U.S. Environmental Protection Agency (EPA) to set drinking water standards for 83 contaminants listed in the Act and an additional 25 contaminants every three years thereafter. EPA established a phased approach for introducing standards and requirements for testing for the first group of 83 contaminants.

Phase I - established maximum contaminant levels (MCLs) for a group of 8 volatile organic compounds.

Phase II - established MCLs for 17 pesticides, 8 inorganics, 10 volatile organics, a new MCL for PCBs (polychlorinated biphenyls), and deleted the MCL for silver.

Phase III - set criteria for radionuclides.

Phase IV - set criteria for disinfection by-products and for disinfection for groundwater.

Phase V - set drinking water standards for 5 inorganics, 3 volatile organics, 9 pesticides, and 6 other organic contaminants.

Phase II of EPA's schedule required monitoring and reporting for a large number of contaminants to be completed by 1995. Phase V established MCLs and maximum contaminant level goals (MCLGs) for a number of Phase II contaminants. (MCLs are enforceable standards considered feasible and safe. MCLGs are nonenforceable health goals that water systems should try to achieve.) Phase V also took advantage of the monitoring information provided through Phase II. These two phases required testing for the largest number of contaminants of the five phases.

Original cost estimates for each water system to do Phase II/Phase V analyses ranged from $10,000 to $12,000 a year. Because of costs and the small number of laboratories certified to do the required tests (in 1993, there were no labs fully certified for these tests in Kentucky), the Department for Environmental Protection committed its analytical laboratory, the Division of Environmental Services to carry out testing for systems that served 10,000 or fewer customers. Larger public and industrial/commercial systems were responsible for their own sampling and analysis.

The department conducted sample analyses and provided sampling containers, preservatives, supplies, and transportation costs involved in getting the samples to the lab. During 1993, DOW personnel spent 3,844 hours in various aspects of the sampling program. The project consumed almost all of the laboratory's capacity for analyzing organics. Organic analyses of other samples collected by the department were contracted to commercial laboratories.

Sampling for each system was done on a quarterly basis, and results from four consecutive quarters were used to determine compliance. Following the initial four quarters of sampling, a three-year monitoring period was established. Waivers may be granted for individual systems for various contaminants based upon initial sampling results and vulnerability of the system to those contaminants.

For purposes of assessing drinking water use, results of the Phase II/Phase V and subsequent compliance monitoring of finished water were compared to MCLs. Although not a quantitative

measurement of ambient water quality, it highlights waters in which certain pollutants are high enough to exceed drinking water criteria even after conventional treatment by the drinking water plant. Lacking instream data, which historically has been scarce in Kentucky for drinking water constituents, EPA's 1998 305(b) report guidance recommends using the finished water data for assessing drinking water use support.

## Use Support Summary

### Streams and Rivers

Aquatic life, swimming, drinking water, and fish consumption uses were assessed. Excluding the Ohio River, full support of uses occurred in 6,153 miles (67 percent), uses were not supported in 2,004 miles (21 percent), and partial use impairment was found in 1,072 miles (12 percent) of the assessed waters (Table 5.) This summary does not include ORSANCO's assessment of the mainstem of the Ohio River. ORSANCO reported that none of the 664 miles of the Ohio River bordering Kentucky fully supported swimming or fish consumption uses. For aquatic life use, 553 miles fully supported and 61 miles partially supported. Swimming use was affected mostly by combined sewer overflows. Fish consumption use was affected by limited fish consumption advisories for PCBs and chlordane in fish tissue. The Mississippi River, which forms 71 miles of Kentucky's western border, was assessed by Missouri.

Swimming use was impaired to a much greater extent than was aquatic life use (Table 6). The major causes of use nonsupport were fecal coliform bacteria contamination (pathogen indicators), which affected swimming use, and siltation and nutrients, which impaired aquatic life use (Table 7). Nonpoint sources impacted about three times as many miles as point sources. The major sources of the fecal coliform contamination were sanitary (both municipal and package wastewater treatment plants), agricultural nonpoint sources, septic tanks, and straight pipes. Sanitary wastewater facilities were also the source of the organic enrichment, while mining and agricultural nonpoint sources were the major sources of siltation (Table 8).

For the drinking water use, 68 of the 389 public water suppliers dependent on surface waters had 171 violations of maximum contaminant levels (MCL) for the period October 1, 1995 to

September 30, 1997. Violations were for total coliform, turbidity, and trihalomethanes. These problems were a result of treatment processes and do not relate to instream use impairment. Eighteen groundwater systems had 27 MCL violations for inorganics (cadmium, barium thallium, beryllium), nitrates, and total coliform.

Inadequate sewer collection systems are a major concern in many towns. Surface waters are impacted by overflows from these systems primarily during and immediately following rainfall events.

Swimming advisories were in effect in three areas of the state, and citizens have been advised not to swim in streams in and downstream of urban areas following rainfall events. Fecal coliform contamination caused swimming advisories to be re-issued for the Licking River and two tributary streams near Covington, 86 miles of the upper reaches of the North Fork Kentucky River, and the Cumberland River and several streams in the Upper Cumberland River basin in Bell and Harlan counties.

Fish consumption advisories remain in effect for the Mud River and Town Branch in Logan, Butler, and Muhlenberg counties, the West Fork of Drakes Creek in Simpson and Warren counties, Green River Lake, and Little Bayou Creek in McCracken County because of PCB contamination, and for five ponds on the West Kentucky Wildlife Management Area (McCracken County) because of mercury from unknown sources. The entire length (664 miles) of the Ohio River bordering Kentucky remains posted with fish consumption advisories because of PCB and chlordane contamination. The Ohio River advisories are specifically for the consumption of channel catfish, carp, white bass, paddlefish, and paddlefish eggs. Twenty-seven fish kills totaling about 32,304 fish were reported by the Kentucky Department of Fish and Wildlife Resources during 1996-1997, affecting 67 miles. Fish kills were most commonly attributed to nutrients and oxygen-demanding materials.

For a report of all the streams assessed, see the Division of Water's website at http://water.nr.state.ky.us/305b/data.pdf. For a map of assessed streams, see http: //water.nr.state.ky.us/305b/maps.htm.

| Table 5. Summary of Assessed Use Support[a] Miles | | | |
|---|---|---|---|
| | Assessed Basis | | |
| **Degree of Support** | **Evaluated** | **Monitored** | **Total** |
| Fully Supporting | 1773.6 | 4154.8 | 5928.4 |
| Fully Supporting but Threatened | 91.7 | 133.1 | 224.8 |
| Partially Supporting | 423.7 | 648.7 | 1072.4 |
| Miles Not Supporting | 580.6 | 1423.1 | 2003.7 |
| TOTAL | 2869.6 | 6362.5 | 9232.1 |

[a] Excludes mainstems of Ohio and Mississippi rivers; refer to ORSANCO and Missouri 305(b) reports

| Table 6. Summary of Individual Use Support Rivers and Streams | | | | | |
|---|---|---|---|---|---|
| **Use** | **Full Support** | **Threatened** | **Partial Support** | **Non Support** | **Total** |
| 1. AQUATIC LIFE | | | | | |
| Miles | 5960.2 | 263.70 | 998.20 | 1052.40 | 8,275.50 |
| Percent | 72.0 | 3.2 | 12.1 | 12.7 | 100.0 |
| 2. SWIMMABLE | | | | | |
| Miles | 538.10 | 77.40 | 503.60 | 1391.20 | 2,510.30 |
| Percent | 21.4 | 3.1 | 20.1 | 55.4 | 100.0 |
| 3. FISH CONSUMPTION | | | | | |
| Miles | 1532.10 | | 4.40 | 122.70 | 1,659.20 |
| Percent | 92.3 | | 0.3 | 7.4 | 100.0 |
| 4. DRINKING WATER | | | | | |
| SUPPLY | | | | | |
| Miles | 1425.30 | 18.00 | | | 1,443.30 |
| Percent | 98.8 | 1.2 | | | 100.0 |

| Table 7. Causes of Use Impairment Rivers and Streams | | |
|---|---|---|
| **Cause** | **Miles Affected** | **Percent** |
| Pathogens | 1617.0 | 31.0 |
| Siltation | 1136.3 | 21.8 |
| Nutrients | 576.5 | 11.1 |
| Organic Enrichment/Low DO | 474.6 | 9.1 |
| Habitat Alterations (non-flow) | 337.8 | 6.5 |
| pH | 286.2 | 5.5 |
| Suspended Solids | 189.5 | 3.6 |
| Metals | 163.3 | 3.1 |
| PCBs | 132.1 | 2.5 |
| Salinity/TDS/Chlorides | 78.0 | 1.5 |
| Oil and Grease | 42.5 | 0.8 |
| Cause Unknown | 29.2 | 0.6 |
| Flow Alterations | 26.1 | 0.5 |
| Pesticides | 22.9 | 0.4 |
| Priority Organics | 18.0 | 0.3 |
| Ammonia (unionized) | 17.4 | 0.3 |
| Noxious Aq.Plants native | 13.4 | 0.3 |
| Radiation | 13.0 | 0.2 |
| Unknown Toxicity | 11.2 | 0.2 |
| Chlorine | 8.7 | 0.2 |
| Nonpriority Organics | 8.4 | 0.2 |
| Mercury | 6.5 | 0.1 |
| Thermal Modifications | 6.5 | 0.1 |
| Turbidity | 1.4 | 0.0 |
| TOTAL | 5216.5 | 100. |

| Table 8. Sources of Use Impairment - Rivers and Streams | | | | | | |
|---|---|---|---|---|---|---|
| | Point | | Nonpoint | | Total | |
| **Source** | **Miles** | **Percent** | **Miles** | **Percent** | **Miles** | **Percent** |
| Agriculture | | | 984.3 | 28.1 | 984.30 | 19.7 |
| Resource Extraction | | | 916.8 | 26.2 | 916.80 | 18.3 |
| Municipal Point Sources | 810.7 | 65.3 | | | 810.70 | 16.2 |
| Improper Waste Disposal (includes straight pipes) | | | 590.0 | 16.8 | 590.0 | 11.8 |
| Urban Runoff/Storm Sewers | | | 450.6 | 12.9 | 450.60 | 9.0 |
| Industrial Point Sources | 276.8 | 22.3 | | | 276.80 | 5.5 |
| Source Unknown | | | | | 260.10 | 5.2 |
| Hydromodification | | | 128.2 | 3.7 | 128.20 | 2.6 |
| Habitat Modification | | | 115.3 | 3.3 | 115.30 | 2.3 |
| Collection System Failure | 113.20 | 9.1 | | | 113.20 | 2.3 |
| Grazing-Related Sources | | | 82.3 | 2.3 | 82.30 | 1.6 |
| Construction | | | 67.6 | 1.9 | 67.60 | 1.4 |
| Crop-Related Sources | | | 63.8 | 1.8 | 63.80 | 1.3 |
| Silviculture | | | 56.1 | 1.6 | 56.10 | 1.1 |
| Animal Feeding Operations | | | 41.6 | 1.2 | 41.60 | 0.8 |
| Combined Sewer Overflow | 40.4 | 3.3 | | | 40.40 | 0.8 |
| Spills | | | 6.0 | 0.2 | 6.00 | 0.1 |
| Natural Sources | | | 1.7 | 0.0 | 1.70 | 0.0 |

**Lakes**

The water quality assessment of lakes included more than 90 percent of the publicly owned lake acreage of Kentucky. Eighty-eight of 121 lakes (73 percent) fully supported their uses, 27 (23 percent) partially supported uses, and 6 (5 percent) did not support one or more uses. On an acreage basis, more than 92 percent (199,961 acres) of the 218,362 assessed acres fully supported uses, eight percent (17,849 acres) partially supported uses, and less than one percent (552 acres) did not support one or more uses (Table 9).

Nutrients were the most frequent cause of uses in lakes not being fully supported (Table 10). Agricultural runoff, land disposal, and septic tanks were the principal sources of the nutrients (Table 11). PCBs affected one lake of considerable size, resulting in a high percentage of lake

acres impacted by priority organics (Table 10). Naturally shallow lake basins, which allow the proliferation of nuisance aquatic weeds that impair secondary contact recreation, accounted for the second greatest cause of use nonsupport. Other natural conditions such as manganese releases from anoxic hypolimnetic water and nutrients in runoff from relatively undisturbed watersheds affected domestic water supply and secondary contact uses, respectively. Suspended solids from surface mining activities impaired the secondary contact recreation use in fewer eastern Kentucky reservoirs than in the previous two-year reporting period.

An analysis of lake trophic status indicated that of the 105 lakes assessed, 58 (55.2 percent) were eutrophic (including three that were hypereutrophic), 35 (33.3 percent) were mesotrophic, and 12 (11.4 percent) were oligotrophic. One-half of the lake acres assessed (108,151 acres) were eutrophic. Of the rest, 22 percent were mesotrophic and 29 percent were oligotrophic.

**Wetlands**

Wetlands are considered waters of the Commonwealth and are protected from loss and degradation primarily through the process of Water Quality Certification. The WQC process requires that new wetland impacts be mitigated at a minimum ratio of two acres restored for each one acre lost. With the exception of wetland losses due to surface coal mining in Western Kentucky, most wetland losses are small and due to development impacts in growing urban areas. In the time period 1996-1997, the historical trend toward unmitigated wetland loss was reversed.

In addition to wetland mitigation required for permitted wetland losses, a wetland mitigation "bank" was established in Nelson County. This facility is a private for-profit venture that has restored 91 acres of prior converted wetland back to wetland status in hopes of selling wetland "credits" to those in need of wetland mitigation in the future. Two more "banks" are under review at the present time. One advantage of this approach is that wetland acres are restored before losses occur. This allows the time necessary to restore the wetland functions that are lost. Wetland banking is gaining favor nationwide and is on the rise in Kentucky.

| Table 9. Summary of Lake Use Support | | |
|---|---|---|
| **Degree of Support** | **Number** | **Acres** |
| Fully Supporting | 88 | 199,961 |
| Partially Supporting | 27 | 17,849 |
| Miles Not Supporting | 6 | 552 |

| Table 10. Causes of Use Impairment Lakes | | |
|---|---|---|
| **Name** | **Acres Affected** | **Percent** |
| Priority Organics | 8210 | 43 |
| Nutrients | 7513 | 40 |
| Suspended Solids | 1940 | 10 |
| Metals | 452 | 2 |
| Shallow Lake Basin | 551 | 3 |
| Other inorganics | 135 | 1 |
| pH | 219 | 1 |

| Table 11. Sources of Impairment | | |
|---|---|---|
| **Name** | **Acres Affected** | **Percent** |
| Industrial Point Sources | 8210 | 31 |
| Source Unknown | 6743 | 26 |
| Agriculture | 5582 | 21 |
| Resource Extraction | 2294 | 9 |
| Land Disposal | 1475 | 6 |
| Natural Sources | 1418 | 5 |
| Other (Septic Tanks) | 153 | 1 |
| Municipal Point Sources | 139 | 1 |
| Contaminated Sediments | 86 | >1 |

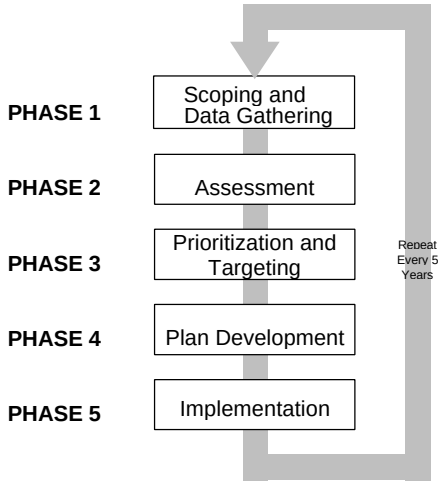
## Ground Water

The DOW continues to operate an ambient ground water monitoring network of more than 100 sites. Data analyses of nitrate and pesticides from wells in western Kentucky have been published, and work is in progress to publish more data analyses in cooperation with the Kentucky Geological Survey. The Ground Water Branch has identified the major sources of ground water contamination as animal feedlots, fertilizer and pesticide applications, underground storage tanks, landfills, surface impoundments, septic systems, mining activities, spills, and urban runoff.

## Water Pollution Control Programs

In order to better characterize the water of the state and better coordinate resources toward addressing problems, Kentucky is adopting a Watershed Management Framework. The purpose of this management framework is to use programs, people, information, and funds as efficiently as possible to protect, maintain, and restore water and land resources. This approach provides a framework, in time and place, within which participating individuals and institutions can link and support one another's efforts in watershed management.

According to the adopted Framework, the state is divided into five basin management units (see Schedule below) for the purposes of focusing management activities spatially. Activities within each unit will follow a five-year schedule, staggered by one year, so that efforts can be better focused temporally within a basin. Phases in the cycle include collecting information about water resources in the basin, identifying priority watersheds, listing the watersheds in the basin in order of priority and deciding which problems can be solved with existing funds, determining how best to solve the problems in the watershed, developing an Action Plan, and carrying out the strategies in the plan. Public participation is also encouraged throughout the process, allowing citizens and organizations to stay informed and have an active role in management of the resource.




Each basin will be phased into the Watershed Framework schedule as listed below:

- July 1997 – Kentucky River Basin
- July 1998 – Salt and Licking River Basins
- July 1999 – Cumberland, Tennessee, and Mississippi River Basins
- July 2000 – Green and Tradewater River Basins
- July 2001 – Big Sandy, Little Sandy, and Tygarts River Basins

Benefits of this approach include:

- Better coordination of resource management activities around common basin management units and schedules:
- Partnering can stretch limited dollars for implementation activities
- Better information about water resources without higher monitoring costs:
- More data as monitoring efforts are coordinated – a four-fold increase in assessment data is expected in the Kentucky River Basin in 1998
- Better data as agencies standardize methods and procedures.
- Greater opportunities for citizen involvement

The ground water program in Kentucky continues to make advances to strengthen protection strategies and to implement regulations. The Driller Certification Program and Wellhead Protection Program continue to ensure that water obtained from wells drilled in the state is safe

for all citizens. The Wellhead Protection Program was part of Kentucky's Source Water Assessment Program (SWAP) submitted to EPA in 1997. The Kentucky SWAP was the first in the nation to be submitted to EPA for approval. Programs and regulations of agencies other than the Division of Water (e.g. State Superfund and RCRA programs) are also being fully implemented (Table 12).

Water Watch, a citizens' education program, has 270 water testing teams in place, each equipped with field kits that measure dissolved oxygen, pH, temperature, nitrates, chloride, and iron. Also, 160 biological monitoring teams have been placed in the field. The Water Watch Program also supports shoreline cleanup projects, community education, and leadership training. A total of $100,000, in the form of seed grants of up to $5,000, was again provided through the Community Rivers and Streams Programs to help watershed organizations improve river and riparian management. The DOW supports these organizations with technical support and information. Also, the DOW has created an international "Sister Rivers" project to link river groups from different countries with Kentucky-based watershed organizations.

Kentucky's water pollution control programs continued to improve existing water quality and develop new approaches for controlling pollution. Permitting of combined sewer overflows (CSOs) and stormwater outfalls was initiated in the summer and fall of 1991 and proceeded throughout this 305(b) reporting period. By the end of 1997, 86 municipal and 59 industrial wastewater treatment facilities had KPDES permit requirements for whole effluent toxicity testing. The DOW conducted acute and chronic toxicity tests on 45 point source discharges in 1996 and 1997. A total of 1,589 tests were conducted by permitted facilities. One hundred and nineteen facilities (82 percent) were in compliance with their toxicity limits, and 26 facilities (18 percent) were conducting toxicity identification/reduction evaluations to reduce the toxicity of their effluents.

Pretreatment programs have been approved in 76 cities to better treat industrial wastes flowing into publicly owned treatment works. Sixty-eight of the programs are active. New programs were approved and implemented in five municipalities.

A state revolving loan fund program has continued to help meet the needs of wastewater treatment plant construction. Twenty-six municipal wastewater treatment projects were

| Table 12. Ground Water Protection Programs | | |
|---|---|---|
| **Programs or Activities** | **Implementation Status** | **Responsible State Agency** |
| Active SARA Title III Program | Continuing efforts | Department for Environmental Protection Commissioner's Office |
| Ambient ground water monitoring system | Continuing efforts | Division of Water |
| Aquifer vulnerability assessent | Completed | Division of Water |
| Aquifer mapping | Ongoing | Kentucky Geological Survey |
| Aquifer characterization | Ongoing | Kentucky Geological Survey |
| Comprehensive data management system | Fully Established | Division of Water |
| CSGWPP | Evaluating | Division of Water |
| Ground water discharge permits | Continuing efforts | Division of Water |
| Ground water Best Management Practices | Fully established | Division of Conservation |
| Ground water legislation | Fully implemented | Division of Water |
| Ground water classification | | |
| Ground water quality standards | | |
| Interagency coordination for ground water protection initiatives | Fully established | Interagency Technical Advisory Committee |
| Nonpoint source controls | Fully established | KPDES |
| Pesticide State Management Plan | Fully established | Division of Pesticides |
| Pollution Prevention Program | Continuing implementation | Division of Water |
| Resource Conservation and Recovery Act (RCRA) Primacy | Continuing efforts | Division of Waste Management |
| State RCRA Program incorporating more stringent requirements than RCRA Primacy | | |
| State septic system regulations | Fully established | Health Services Cabinet |
| Underground Storage Tank Installation Requirements | Fully established | Division of Waste Management |
| Underground Storage Tank Remediation | Fully established | PSTEAF |
| Underground Storage Tank Permit Programs | Continuing efforts | Division of Waste Management |
| Underground Injection Control Program | Fully established | EPA Region IV |
| Vulnerability assessment for drinking water wellhead protection | Completed | Division of Water |
| Well Abandonment Regulations | Continuing efforts | Division of Water |
| Wellhead Protection Program (EPA-approved) | Fully established | Division of Water |
| Well installation regulations | Continuing efforts | Division of Water |

completed in 1995-97. These projects have either replaced outdated or inadequate treatment facilities, addressed inflow/infiltration problems, or have provided a centralized collection and treatment system for the first time. Since 1989, Kentucky has received more than $202 million in capitalization grants and has added $40 million in state funds under this program.

The Kentucky Nonpoint Source (NPS) Pollution Control Program is currently providing oversight and funding (Clean Water Act Section 319[h] grants) for 70 active projects. These projects seek to reduce and control runoff pollution through watershed demonstrations, education, training, best management practice demonstration, technical assistance and enforcement. Kentucky's NPS program has received a total of more than $11 million through Section 319(h) grants from EPA since 1990.

NPS biologists continue to monitor water quality in two watersheds with NPS pollution remediation demonstration projects. The Upper Salt River/Taylorsville Lake and Fleming Creek projects both involve agricultural pollution remediation throughout the entire watershed. These are long-term studies to determine nonpoint source impacts and demonstrate water quality improvements from best management practices. Other important watershed remediation projects being implemented by NPS Program cooperator include Mammoth Cave (agriculture), Triplett Creek (on-site wastewater), Horse Lick Creek (off road vehicles), and Panther Creek (agriculture). Grant funds are also provided to support other monitoring initiatives including an expansion of DOW's surface and groundwater monitoring and stream-flow partitioning analysis of the surface water data.

Education efforts in the NPS program are producing several noteworthy achievements. Two video programs on pollution problems from nonpoint sources in Kentucky were produced under contract with Western Kentucky University. One of the videos focuses on abandoned mine lands and water quality. Funding was awarded to the American Cave and Conservation Association to assist in developing NPS-related exhibits at its American Museum of Caves and Karstlands located in Horse Cave. The DOW has contracted with the Kentucky Waterways Alliance to award small grants to local citizen waterway groups for nonpoint source education projects. The DOW also continues to provide financial support for the Kentucky Master Logger Program.

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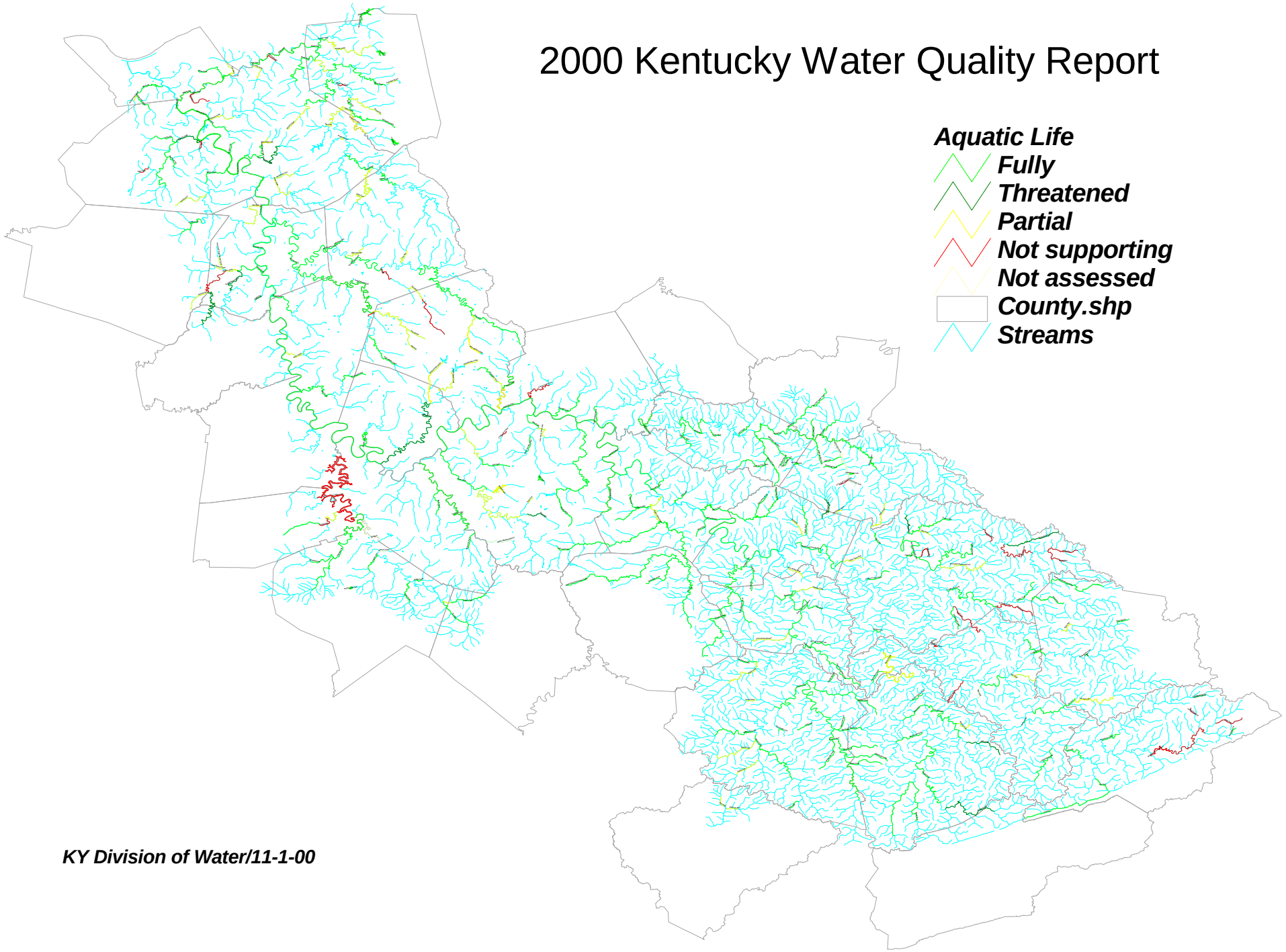


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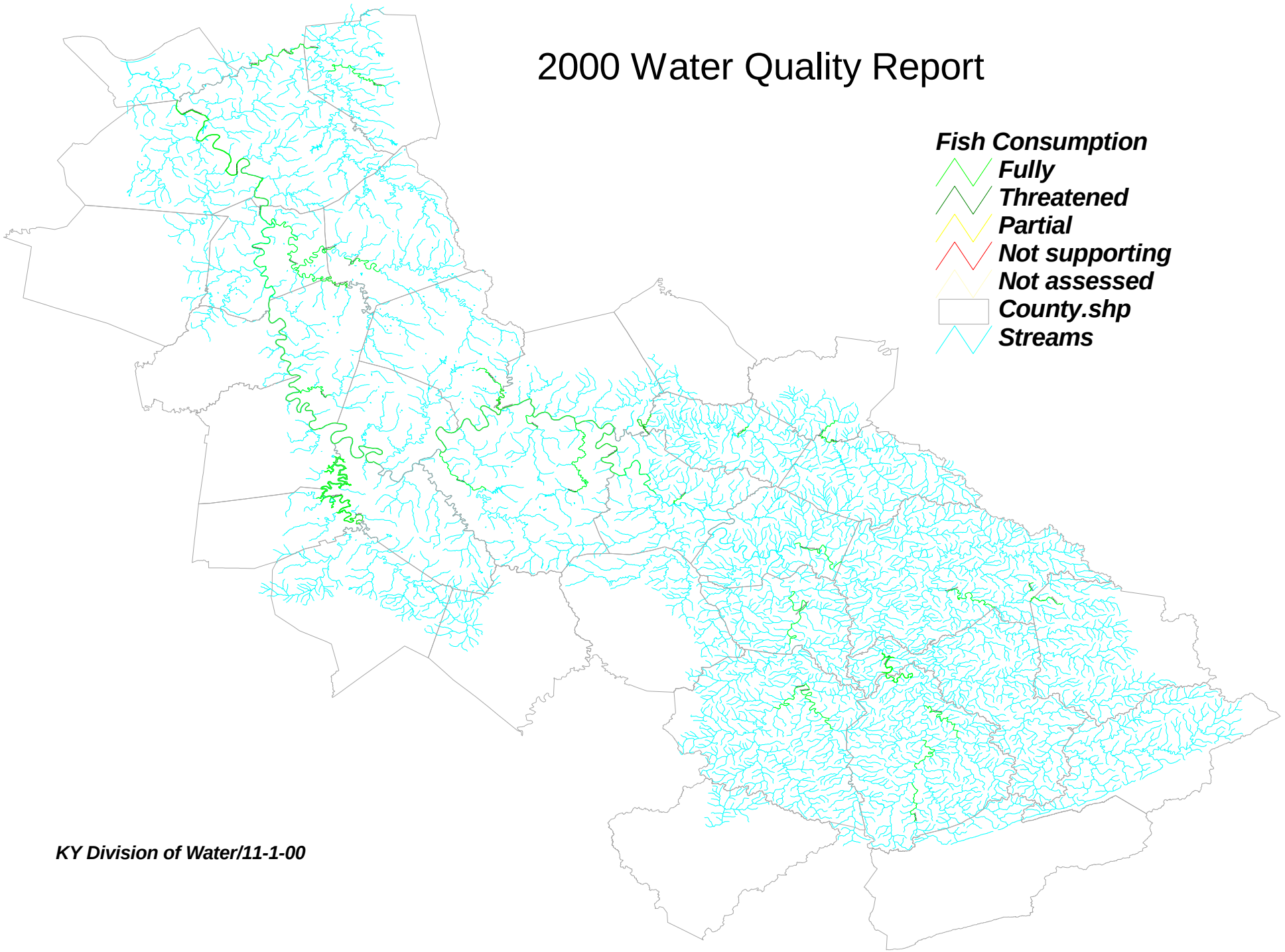


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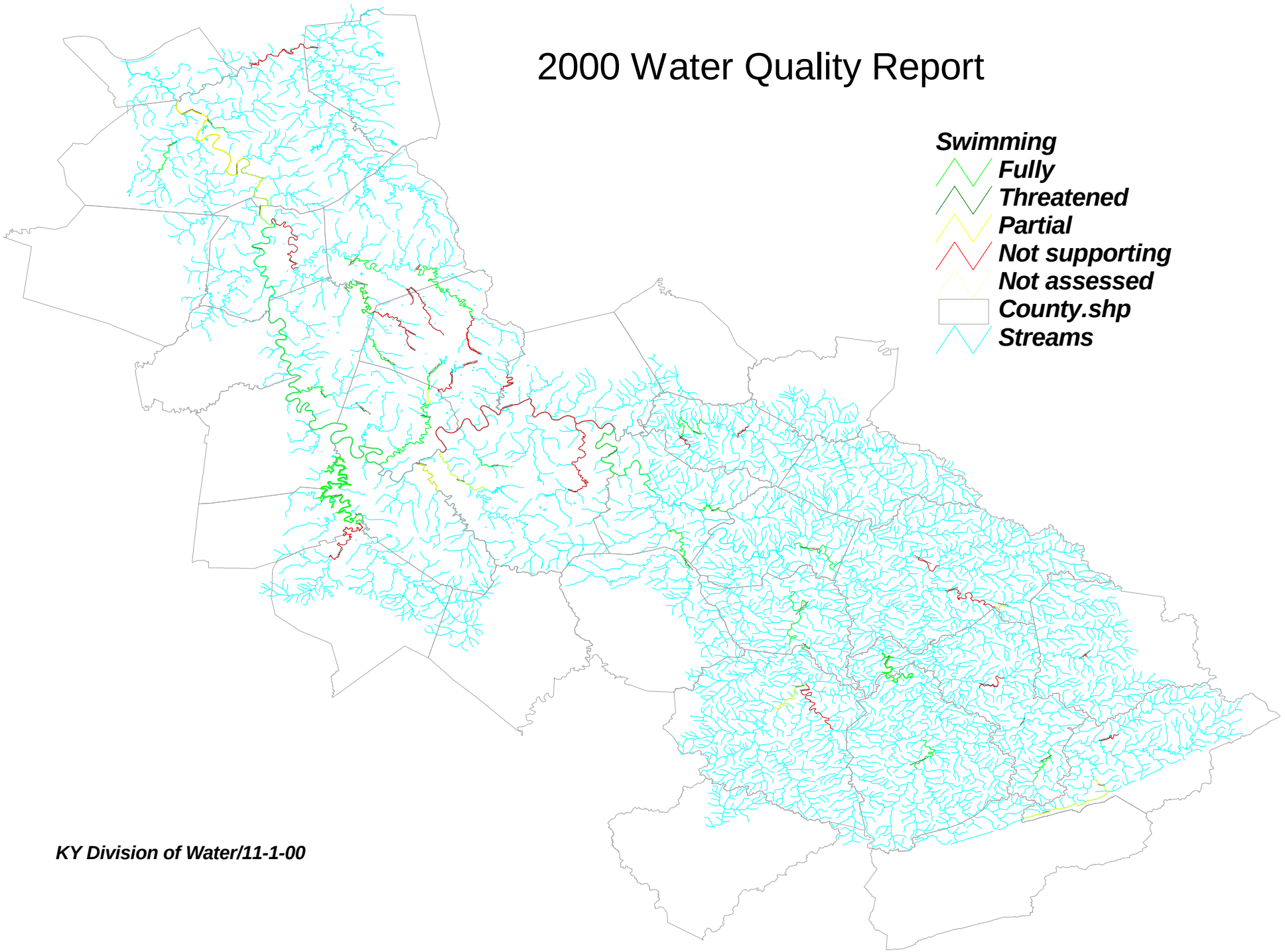


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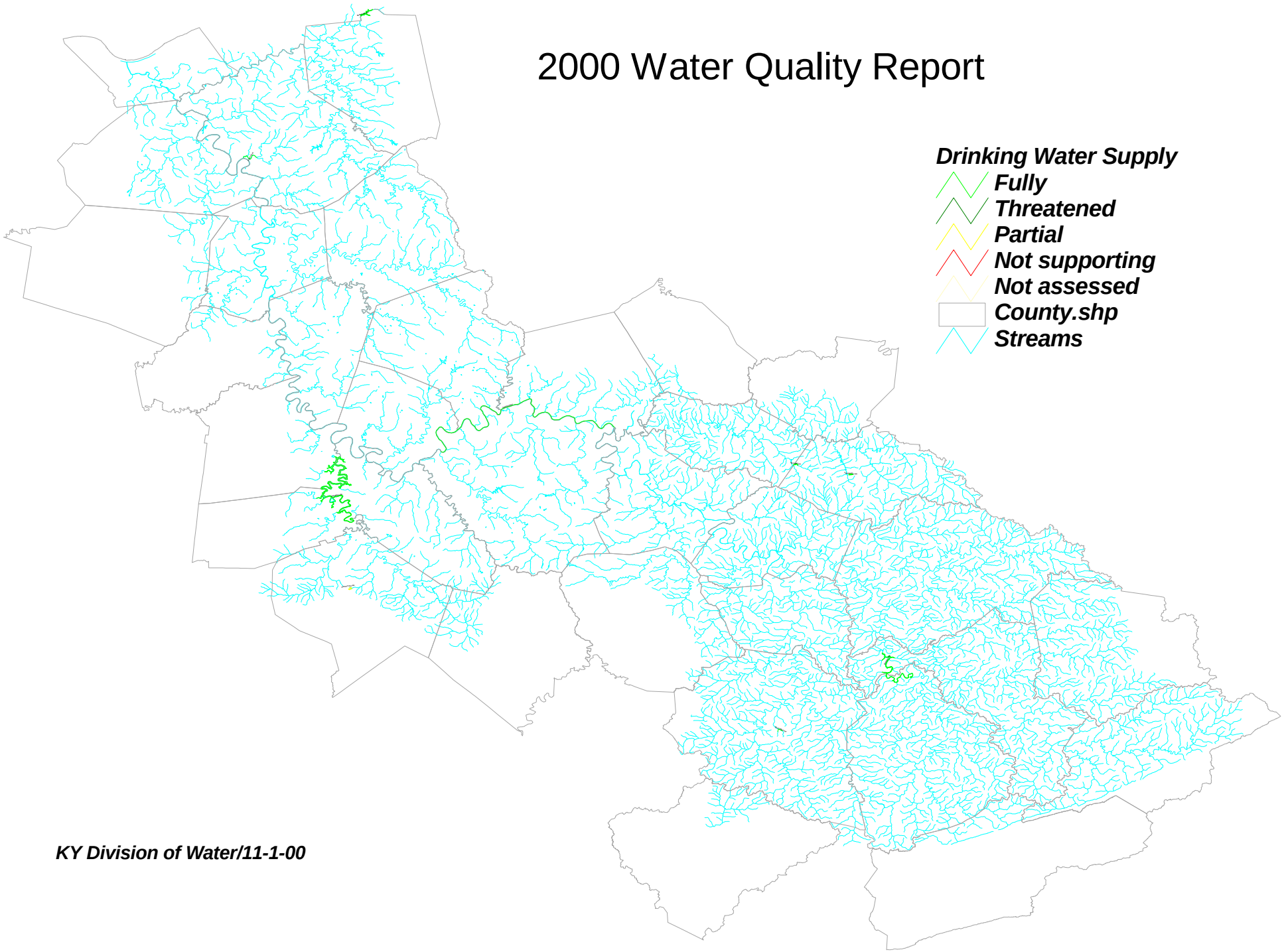


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