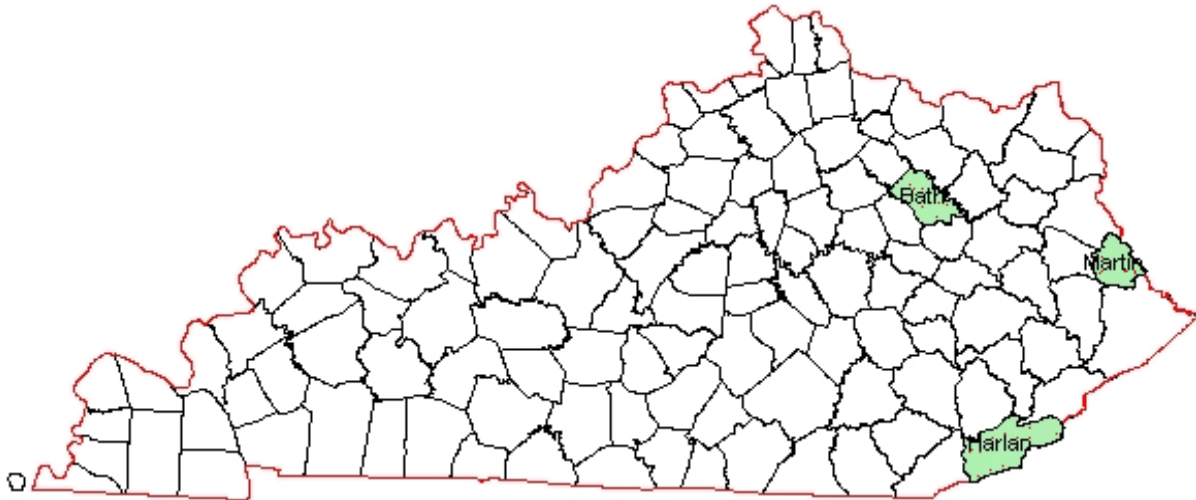


Kentucky Straight Pipes Report

Harlan, Martin, and Bath Counties



Prepared by:

**U.S. Environmental Protection Agency
Region 4**

Table of Contents

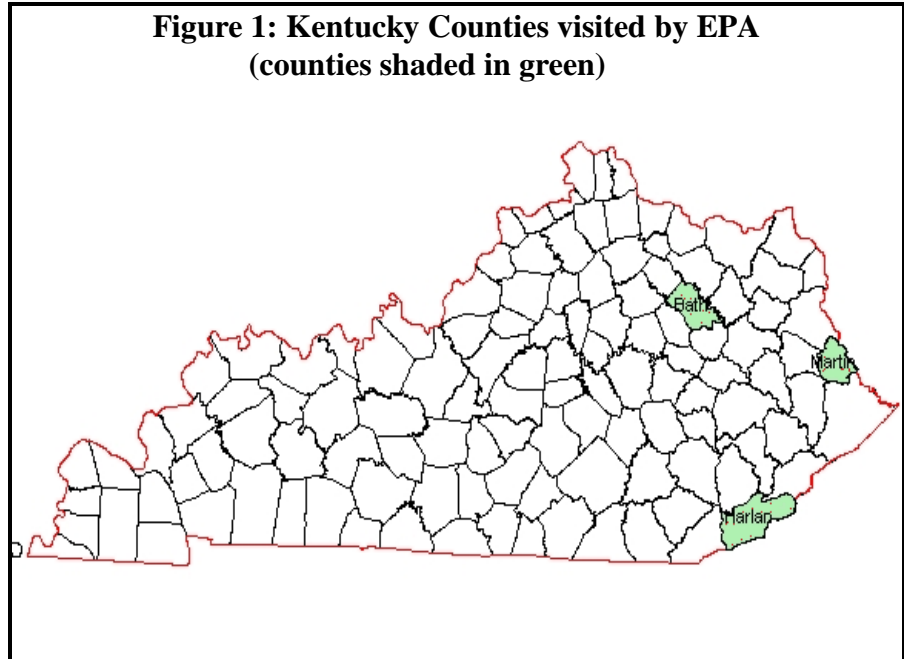
	Page
Introduction	1
Executive Summary	1
Background	2
Areas Assessed During June 2002	6
Wastewater Treatment Options	9
EPA Recommendations	12
References	14
List of EPA, State, and Local Participants	Appendix A
Summary of Photographs	Appendix B

Introduction

During June 25th-27th, 2002 representatives of the U.S. Environmental Protection Agency, Region 4, the Kentucky Division of Water, and the Kentucky Health Department toured various communities in Harlan, Martin, and Bath counties in eastern and central

Kentucky (Figure 1) to assess the extent of unpermitted sewage discharges from “straight pipes” and determine if an alternative wastewater demonstration project was feasible in addressing the water pollution issues. This report provides background on straight-pipe and other wastewater problems, summarizes the areas that were visited during the

EPA/KY site assessments, and provides a summary of the viable options to address the wastewater treatment issues. A complete listing of the EPA and State representatives who participated in the site assessment are presented in Appendix A.



Executive Summary

The poor sanitary conditions and water pollution problems EPA observed in the Kentucky counties of Harlan, Martin, Bath, and Montgomery were of the highest concern. The widespread scale of both the straight pipe issues as well as package plant wastewater problems present an environmental crisis which deserves attention from all levels of government. These conditions are unprecedented in the United States and in many cases are comparable to the water pollution problems that were prevalent in the 1950s and 1960s, prior to the Clean Water Act. At the current rate of investment in the solutions to these problems, many more generations of Kentucky citizens will continue to live under the same conditions that face many developing countries. The Commonwealth of Kentucky, however, is to be complimented on their recognition of the problem and the solutions they are currently implementing, which are outlined in this report.

Concerning the overall wastewater treatment problems, it was apparent that more than one general solution should be considered in order to meet the wastewater needs of the region. These solutions can be broken down into three categories. They are: (1) connection to an existing wastewater plant that has the capacity; (2) cluster systems; and (3) on site systems. Additionally, Kentucky should continue to investigate all sources of funding, implement reliable and proven low-tech wastewater systems as opposed to package plants, and investigate the most cost-effective means of sewerage communities where needed. EPA involvement is crucial as the estimated total cost to address this wide scale problem is over \$3 billion dollars (based on The States 1994 NEEDS Survey).

The original purpose of this project was to select a community for a pilot project which would demonstrate concepts presented in EPA's "decentralized wastewater systems" initiative. EPA believes that the Preston community in Bath County is an excellent location for a demonstration project. A strong owner/manager was present (electric coop), land is available for treatment, and the community is fairly compact. Dr. Richard Otis, a recognized national expert had been retained for his technical knowledge. The City has already purchased the land for construction of a wastewater treatment system and raised more than \$150,000 towards project costs. The project has also secured \$235,000 from EPA's 319 program, and an additional Regional Geographic Initiative grant proposal has been submitted to Region 4 for \$75,000. A contract for design of the collection system has been awarded to a local engineering firm, and development is underway. A design-build contract for the 30,000 gallon/day treatment/disposal system will be advertised and awarded by February 2003. Completion of the entire system is slated for late 2003. Efforts to develop a program for promoting the demonstration project and facilitating technology transfer to neighboring communities and local engineering firms have been initiated by East Kentucky Power Company and other partners, and will be ongoing for the next two to three years.

Background

Since the implementation of the Clean Water Act, the US-EPA in conjunction with the State Programs has been successful in identifying, permitting, and regulating most of our nations point source discharges. Additionally, the EPA has been successful in providing federal funding to construct wastewater treatment facilities to meet secondary limitations (currently over 3000 major municipal facilities of greater than 1 mgd flow in the U.S.). Although the Clean Water Act has been monumentally successful in reducing water pollution from point source discharges, many of our nations communities are still without access to adequate sewage collection, treatment, and disposal.

EPA estimates that approximately 40 percent of Kentucky households are not connected to a centralized sewer system. According to the Kentucky Division of Water's 1998 Report to Congress on Water Quality, approximately 33 percent of the rivers and streams in the state are impaired with high levels of pathogens due to improper waste disposal. The source of much of this pollution is the unpermitted discharge of untreated sewage from poorly maintained or failing septic systems. Some of these septic systems have failing drainage fields that leach septage directly into a nearby ditch or stream. Over the years, some Kentucky residents who could not afford a septic system have improvised, utilizing metal drums and even refrigerators as septic tanks. Most failing septic systems simply have a straight pipe that



Figure 2: Straight Pipe, Martin County, KY

transports raw or partially settled sewage directly into the closest ditch or stream (**Figure 2**). This problem has been severe enough that in some areas of Kentucky swimming and fishing advisories have been issued due to high fecal coliform bacteria levels. In its annual survey of waterways, the Kentucky Division of Water lists several streams in eastern Kentucky - including the North Fork of the Kentucky River, the Upper Cumberland River and a small portion of the Licking River - that could make swimmers sick.

According to a June 26th, 2002 article appearing in the Lexington Herald newspaper, it is estimated that approximately 207,000 people living in the 17-county central Kentucky area depend on failed septic systems or poorly operated package wastewater treatment plants. The number of new homes being built without centralized sewer systems is estimated at 52,000 for the 17 county central Kentucky area, and it is expected that 32 percent of the people living in the region in 2020 would still not be connected to a sewer.

Adding to the water pollution woes are poorly operated and maintained wastewater package plants. Package plants are small-scale wastewater treatment plants that are purchased and installed as a complete fabricated unit (**Figure 3**). Because the entire treatment process is housed in a single unit, package plants are cost-effective and do not require large tracts of land. They have been widely used in remote areas of Eastern and Central Kentucky to serve schools, subdivisions, rest areas, commercial establishments, and mobile home parks. It was originally held that because of the long detention time in the biological portion of the package treatment process (**Figure 4**), that the biological cell mass would consume itself, thus no sludge management and disposal was necessary. This has proven to be grossly in error, as package plants actually generate solids in the treatment process, which subsequently must be properly managed and disposed of. Thus, a package plant requires some degree of operator attendance and expertise, including careful attention to process control and adequate management of the wastewater solids. However, because many small communities lack money and trained staff, most package plants are poorly



Figure 3: Package Plant, Hindman, Kentucky

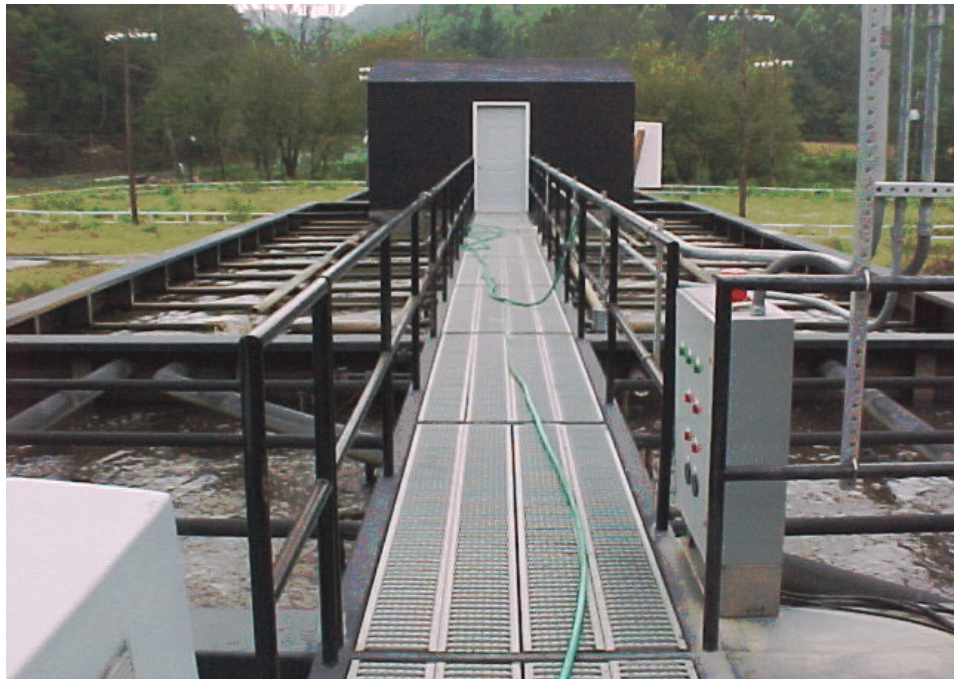


Figure 4: Aeration Tank, Hindman, Kentucky

operated or in some cases, are not operated at all. Consequently, the solids that are produced in the package plant build up and ultimately are discharged into the receiving stream. This results in high concentrations of sewage sludge, nutrients, and pathogens that contaminate the rivers and streams. Because of the large numbers of poorly operated package plants, the Kentucky Division of Water has made efforts to reduce or eliminate package plants and has moved to “Regionalize” wastewater treatment. In the 1994 report *Regionalization of Wastewater Treatment Facilities in Kentucky*, the KY-DOW concluded that the large numbers of package plants were a cause of great concern for present and future water quality in Kentucky. EPA’s experience in other Region 4 states has shown similar concern and problems with package plants. The State of Tennessee has documented numerous problems with package plants and enacted legislation in the mid-1990s that prohibited the installation of package plants for flows less than 15,000 gallons per day.

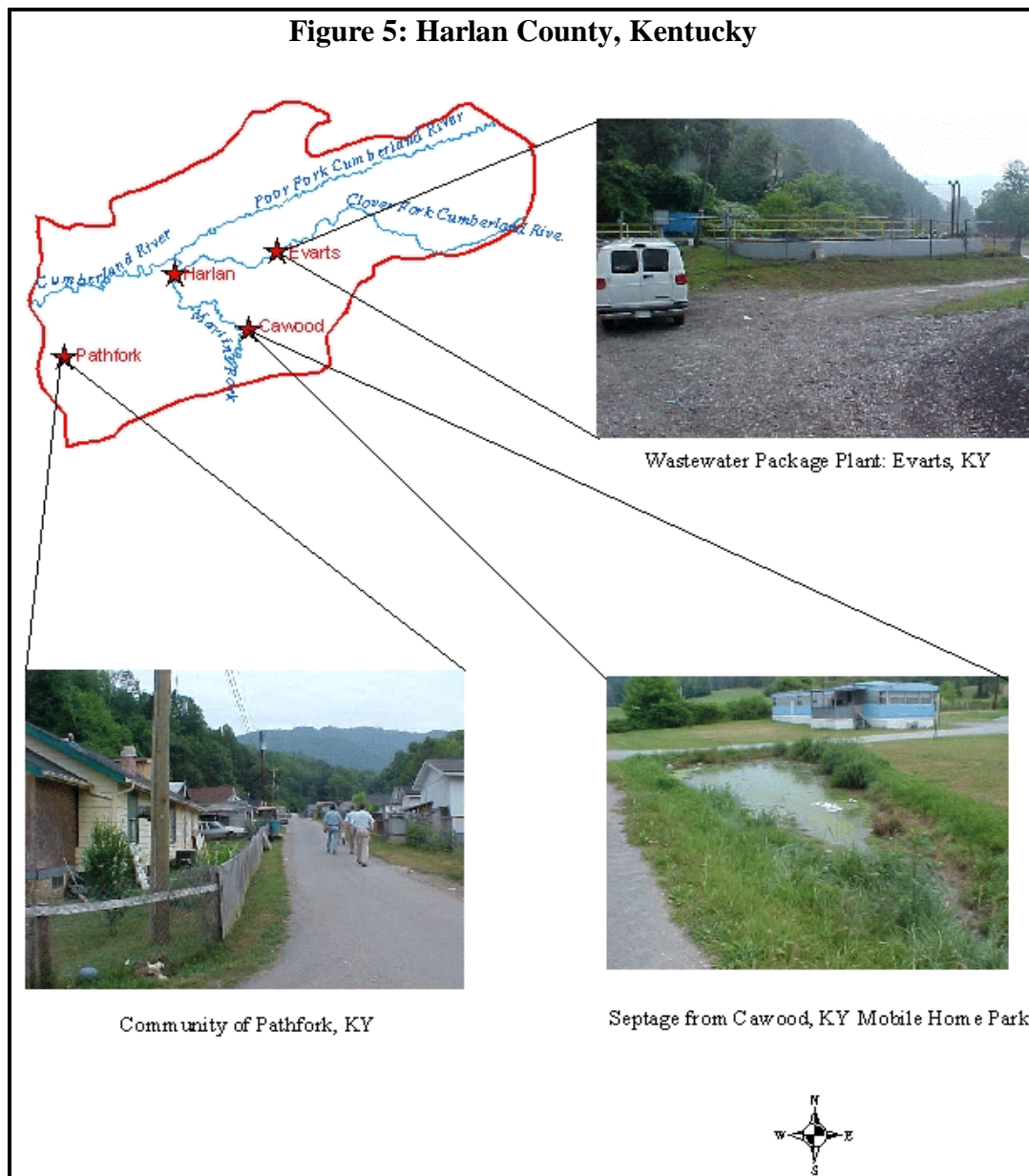
In 1997 the Commonwealth of Kentucky formed an organization known as PRIDE (Personal Responsibility In a Desired Environment). The PRIDE initiative was formed to provide the first comprehensive, region wide, state/local/federal funding to clean-up of the regions rivers and streams of sewage and garbage while ending illegal trash dumps, promoting environmental education, and renewing pride in southern and eastern Kentucky. PRIDE has provided funding for about 3,500 new septic systems in the past year with plans to replace some 14,000 more with \$9 million in federal funds earmarked for the program, according to Janet Bridges, chief financial officer for the organization. Along with the \$9 million in federal money for grants to poor homeowners, PRIDE has made \$15 million available to cities and counties to extend sewage lines into areas without service. In August 2001, the Commonwealth of Kentucky announced a “straight pipe” initiative, a program which focuses on eliminating straight pipe discharges in 40 counties of eastern and central Kentucky. It is estimated that 36,000 homes in this area have failed septic systems or straight pipe discharges.

Although PRIDE has been successful in correcting many of the regions wastewater woes, the problem of straight pipe discharges is still widespread. Many of eastern and central Kentucky’s communities need to be sewerred and equipped with an on-site wastewater treatment system or a full-scale municipal wastewater treatment plant. It is estimated that Kentucky will need over \$3 billion dollars of funding to address the wastewater problems throughout the state (States 1994 NEEDS Survey). EPA believes the cost for eastern Kentucky alone to be in the \$1 billion dollar range. Just eliminating the current straight pipe situation is estimated to cost in excess of \$300 million dollars. Thus, it is critically important that this problem receive attention from all levels of government.

Areas Assessed during June 2002

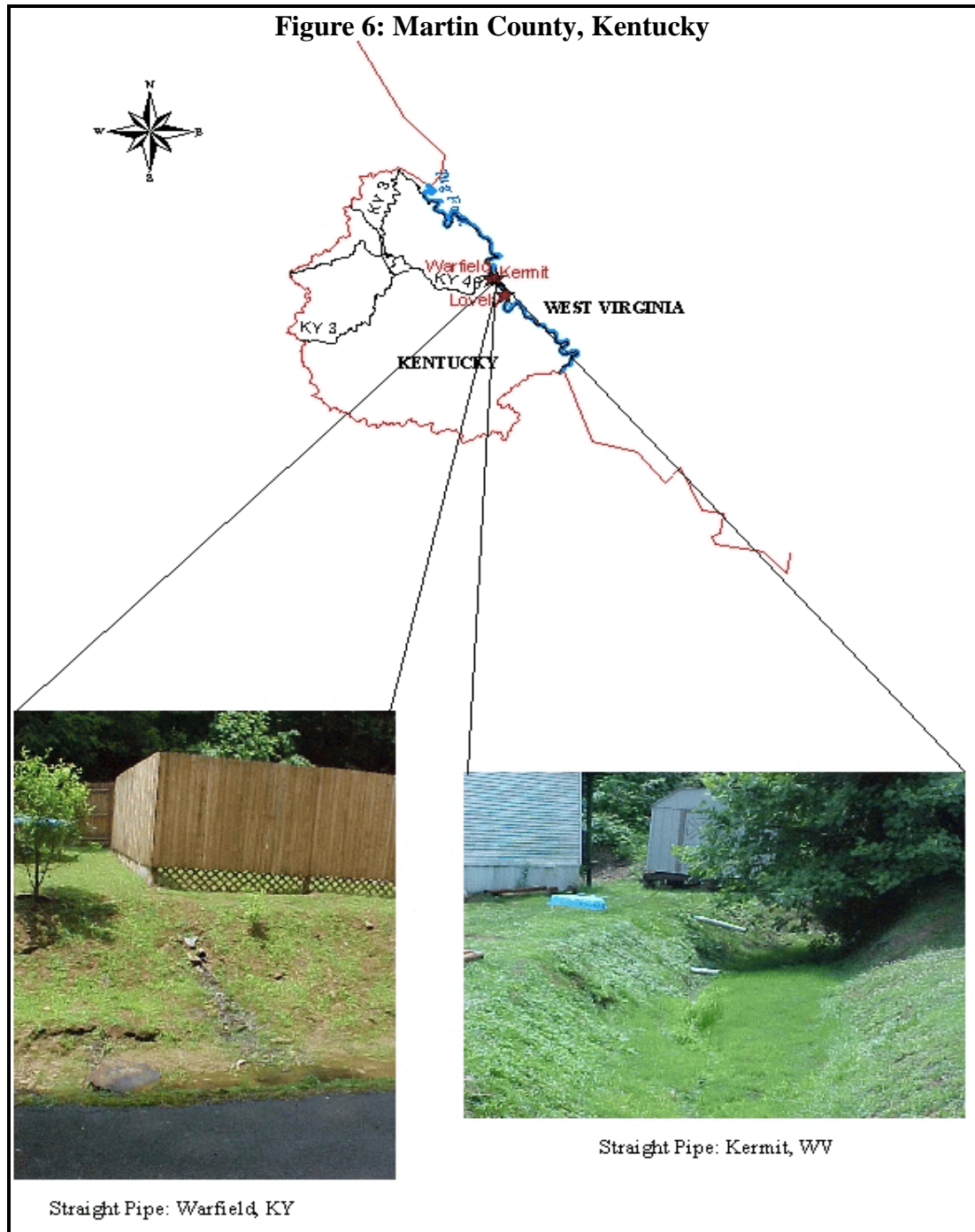
Harlan County:

Figure 5 shows the location of the communities of Path Fork, Cawood, and the Town of Evarts, Kentucky. All are located in Harlan County. This region has historically been a coal mining area located in the heart of the Cumberland mountains, which is characterized by moderate to steep hillsides and narrow valleys. Large open tracts of land are minimal, which places constraints on wastewater treatment options. Consequently, small-scale wastewater package plants are prevalent. There are 18 community water systems and 355 companies that have been issued NPDES permits to discharge wastewater, including 21 package plants. Harlan county has a population of approximately 33,202 with 15,017 housing units. Figure 5 also shows photographs from each community. A complete summary of EPA photographs is attached in Appendix A. Path Fork, Cawood, and Evarts are located along tributaries of the upper Cumberland River and each had numerous examples of “straight-pipe” discharges.



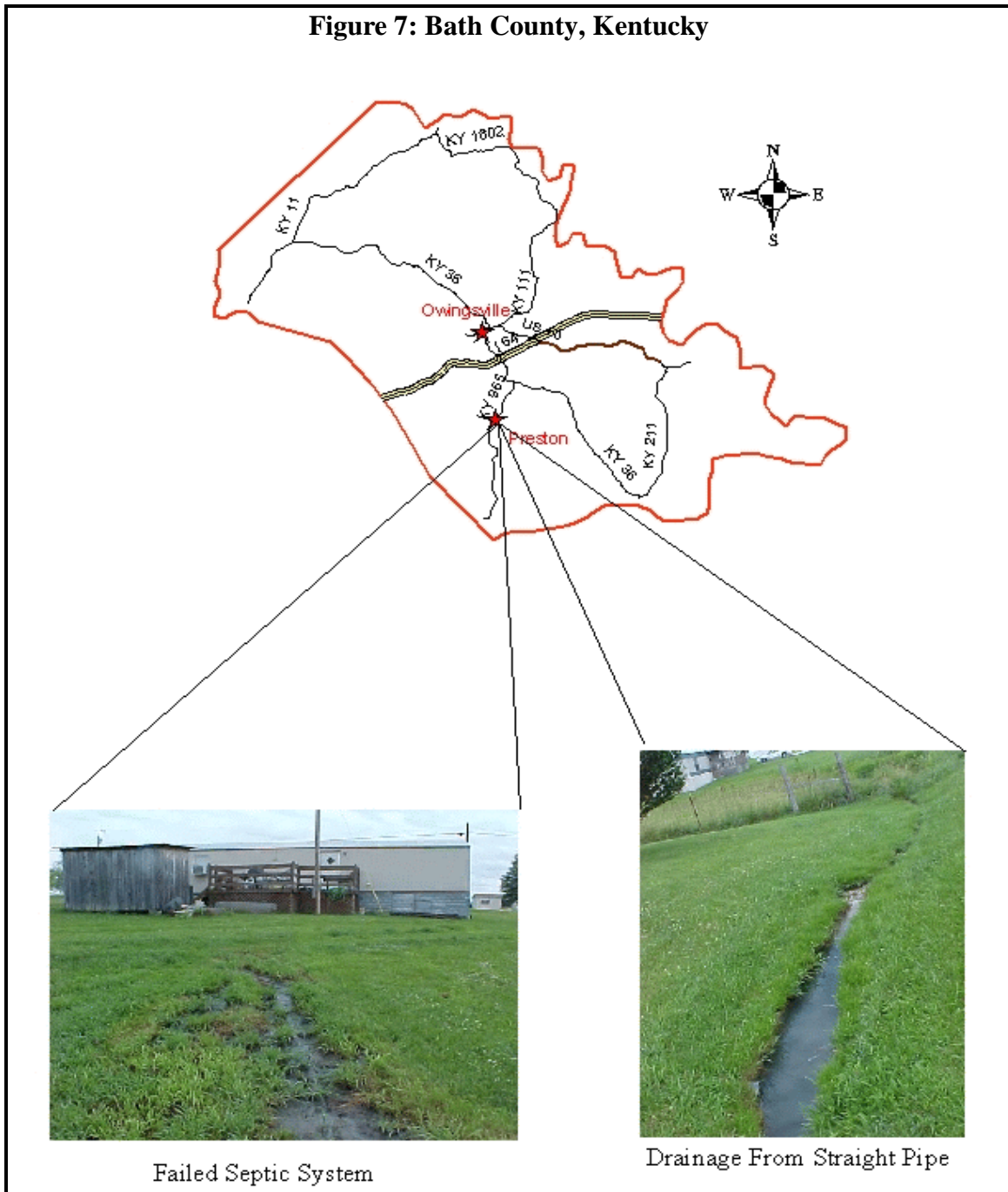
Martin County:

Figure 6 shows the communities of Warfield and Lovely Kentucky, and the Town of Kermit, West Virginia. These communities are part of the Tug Valley Sewer Authority and include more than 1300 households (estimated). The sewer authority encompasses six communities with two community drinking water systems and three schools. The communities are located along the Tug River, which flows into the Big Sandy River along the Eastern Kentucky-West Virginia border. Martin County, Kentucky has a population of 12,578. There is one community water system and 221 NPDES wastewater discharge permits, including 4 package plants.



Bath County:

The community of Preston, Kentucky is shown in Figure 7. Preston is located in Bath County in East Central Kentucky and is part of the Slate and Hinkston watersheds of the Licking River Basin. The topography in this area is not as restrictive as the mountainous region of eastern Kentucky, and consists of moderately steep and rolling hills ranging from 700 to 1300 feet above sea level. Large open tracts of land make this region feasible for lagoon type wastewater treatment systems. Bath County has a total population of 11,085 with approximately 4,994 housing units. There are 3 community water systems, 11 NPDES wastewater discharge permits, and 3 package plants.



Montgomery County

The community of Sid Caulk Lake located in Montgomery County was also visited during this assessment. Concern was expressed that septic systems at numerous homes around the lake were causing pollution problems. Examination of the bacteria data that the Health Department had gathered for this community did not indicate a problem severe enough to cause public health concerns. EPA feels that the slightly elevated bacteria levels can best be addressed by correcting problems with individual on-site systems that are not functioning adequately.

Wastewater Treatment Options

During the EPA visit, it was apparent that more than one solution should be considered in order to meet the regions' wastewater needs. These solutions can be broken down into three categories. They are: (1) connection to an existing wastewater plant that has the capacity; (2) cluster systems; and (3) on-site systems. Table 1 shows a list of projects which were financed by the U. S. Corp of Engineers in Eastern Kentucky. This data was obtained from the Kentucky PRIDE website. It is assumed that the costs presented are total cost estimates. This data was examined because it was readily available, and could give a snapshot of the cost of providing wastewater service in the area. The sample is too small, and there are too many unknowns with regards to the project data to draw any firm conclusions.

1. Connection to existing POTW

This data does support the logical conception that if an existing treatment plant is close-by and has capacity, the cheapest solution for unsewered communities is to connect to the plant. Unfortunately, this solution is not always available due to the remoteness of many communities, or the lack of capacity at a near-by treatment plant.

It is suggested that alternative, small diameter sewers which utilize septic tanks at each residence be considered for communities which are within range of a POTW. Small diameter sewers can be built for substantially less money than conventional sewers. Where conditions for installing pipe are less than favorable due to rock, poor soils, high water table, etc., the costs savings can be even more substantial compared to conventional sewers.

EPA Region 4 personnel visited a town in Tennessee which added a subdivision to the town's wastewater plant using small diameter sewers. Using attenuation in the system and the septage pumping station, they were able to pump off-peak, thus not overloading the capacity of the treatment plant.

<u>PROJECT</u>	<u>COST</u>	<u>RES</u>	<u>\$/RES</u>	<u>TYPE</u>
Means Community (Menifee County)	\$300,000	90	\$3,333	S
Burnside Collection System (Pulaski County)	\$1,100,000	287	\$3,833	S
Sally Stevens Branch (Floyd County)	\$300,000	60	\$5,000	LS & S
Corbin - Sampson Street Sewer Line Extension (Laurel County)	\$81,400	15	\$5,427	S
Royalton - Wastewater Treatment and Sewer Line Ext. (Magoffin Co)	\$1,125,000	205	\$5,488	SS
Paintsville - Greentown Sewer Line Extension (Johnson County)	\$330,000	60	\$5,500	S
City of Allen (Floyd County)	\$472,000	60	\$7,867	LS & S
Middlesborough - Chester and Parker Sewer Line Ext (Bell Co)	\$344,300	37	\$9,305	S
Mountain Water District - South Williams on Sewer (Pike County)	\$3,820,000	371	\$10,296	SS
Hardshell / Caney Creek Area (Breathitt County)	\$825,000	70	\$11,786	CS
Letcher - Cluster Treatment System (Letcher County)	\$382,800	30	\$12,760	CS
Jenkins - Forest Hills Sewer Collection (Letcher County)	\$342,100	23	\$14,874	S
North Fork Clean Water Project (Letcher County)	\$485,000	30	\$16,167	CS
Lovely (Martin County)	\$99,800	6	\$16,633	CS
Vicco - Wastewater Treatment Plant (Perry County)	\$2,454,400	132	\$18,594	TP
Elkhorn City (Pike County)	\$780,000	33	\$23,636	S
City of Whitesburg / Long Branch (Letcher County)	\$635,000	22	\$28,864	S
	\$13,876,800.00	1531	\$9,064	
CS - Cluster system				
LS & S - Lift Station & Sewer				
SS - Complete conventional sewer system				
S - Conventional Sewer				
TP - conventional treatment plant				

TABLE 1

2. Cluster Systems

A cluster system is generally considered to be a system which serves two or more households. Larger systems serve entire subdivisions. A cluster systems provides treatment close to the point of generation. Cluster systems are not new. Typically they were used for developments which were remotely located. Conventional sewers and package, activated sludge wastewater plants were the overwhelming choice of systems installed.

Package Plants have been a source of problems for state regulators. In the document, *Regionalization of Wastewater Treatment Facilities in Kentucky: Progress, Problems, & Recommendations*, written by the Kentucky Division of Water, the problems with package plants are well documented. Other Region 4 states have also documented problems with package treatment plants. The State of Tennessee documented similar problems and enacted legislation which prohibited package plants for flows less than 15,000 gallons per day. However, Tennessee State Inspectors indicated they had documentation which showed severe performance and compliance problems with many package plants, regardless of design flow. The 15,000 gpd flow rate was a political compromise.

Activated sludge is a complex wastewater treatment process which requires highly trained individuals to properly operate and maintain the system. Small communities are often unable to hire and retain operators with the skills necessary to run one of these systems. Poor operation

and maintenance has been the leading cause of the failure of these systems. Even large communities have problems with these systems.

Kentucky also noted that package plants lacked proper O&M due to poor management. The Division of Water further states in this document, "*Kentucky's DOW has endorsed a policy developed by the U.S. EPA of encouraging the consolidation of the physical operation of wastewater treatment and/or the responsibility for overseeing the service, where possible.*"

EPA's initiative on Decentralized Wastewater Systems recognizes that management of the system is usually the most important factor when failures of these systems are examined. Management entities which do not have the legal authority, financial resources, personnel resources, and the flexibility to coordinate and change, are not likely to prosper in the wastewater business.

Wastewater treatment systems have been developed over the past couple of decades which do not have the considerable O&M burden that activated sludge systems require. These systems which are described in several EPA publications, which are listed at the end of this report, are relatively simple and easy to maintain and operate when compared with activated sludge. EPA Region 4 personnel have had considerable experience with lagoon systems, intermittent sand filters, and recirculating sand filters, all of which are examples of proven and reliable low-tech wastewater systems.

3. On Site Systems

During the June 2002 EPA site assessments, several on-site systems were seen or discussed including constructed wetlands, peat systems, individual retention lagoons, and recirculating and intermittent sand filters. EPA encourages the state to evaluate the effectiveness of different onsite treatment systems. EPA's *Onsite Wastewater Treatment Systems Manual, February 2002*, should be consulted in this endeavor and presents methodology for evaluating system performance. The Kentucky concept presented in the document on regionalization which places a single responsible entity in control of all wastewater treatment, including onsite systems, in a geographical area, is an attractive idea.

However, Kentucky DOW has recognized that many topographic and geological characteristics place constraints and adversely affect the performance of septic systems. Many existing septic systems in Kentucky were installed prior to the enactment of state regulations requiring proper installation. Consequently, many of these older systems continue to cause problems.

As a component of the PRIDE initiative, PRIDE, in association with the local Area Development District (ADD) and Resource Conservation and Development District (RC&D), has established a grant program for low-income homeowners to hook onto an existing sewage treatment line or to install a septic system. To date, more than \$1,300,000 in grant funds have been awarded to homeowners in the PRIDE region. To qualify for a grant, the homeowner must meet the HUD poverty guidelines, be the deed holder, and must have existing electricity at the home.

EPA Recommendations

Recommendations for Wastewater Demonstration Project:

- The original purpose of this project was to select a community for a pilot project which would demonstrate concepts presented in EPA's "decentralized wastewater systems" initiative. EPA believes that Preston is an excellent location for a wastewater demonstration project. A strong owner/manager was present (electric coop), land was available for treatment, and the community was fairly compact. Dr. Richard Otis, a recognized national expert had been retained for his technical knowledge of small community wastewater systems.
- Some of the communities that were visited, such as the Sunshine community near Harlan, are close enough to a wastewater plant with capacity such that connecting to the existing wastewater plant would be the best solution for the community. Other communities, such as Warfield will probably be better served by a large central system.
- EPA feels that in order to have success in the decentralized arena, a strong management/owner must be identified. Although the trailer park at Crummies Creek presented an attractive project, it lacked a strong management entity. Without this necessary entity, EPA does not feel that this system would be sustainable. However, it was about the right size (20-30 trailers), was compact, and had land available for a treatment system.

Recommendations concerning "Straight Pipe" and other Wastewater Issues:

- The Kentucky Division of water should continue to implement the concepts and ideas contained in the document, *Regionalization of Wastewater Treatment Facilities in Kentucky: Progress, Problems, & Recommendations*. EPA believes this is an excellent document which lays out a good, viable plan for solving the State's wastewater problems.
- Kentucky should continue to investigate and seek all possible sources of funding. The States 1994 NEEDS Survey documented over \$3 billion dollars of wastewater funding needs in the entire state. EPA believes the cost for eastern Kentucky alone to be in the \$1 billion dollar range. Just eliminating the current straight pipe situation is estimated to cost in excess of \$300 million dollars.
- On-site systems should continue to be evaluated. All systems are not equal, and today's solution can often become tomorrow's problem. Many different systems have been tried in Kentucky. Some of the systems that EPA saw or discussed with state personnel have a questionable technical basis. An objective evaluation of these different system performances under local conditions should eliminate some systems, and provide some standardization. Care should be taken not to stifle innovation.

- For collection systems, alternative, small diameter sewers should be used wherever possible. These systems are one of the more important developments in wastewater technology in many years. Properly used, they can represent an impressive savings over conventional sewers.
- Where possible, low tech, easy-to-operate wastewater treatment plants should be strongly promoted for small communities. Package, activated sludge plants have historically been plagued with numerous problems. Systems which utilize other technologies, such as lagoon systems or intermittent sand filters, are available at lower capital cost and considerable lower O&M cost. The one disadvantage of these systems is land requirements which may be considerably larger than the land required for an activated sludge system. This will be a challenge for Eastern Kentucky, where suitable land for construction is often difficult to obtain.

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Appendix A
Listing of EPA, State, and Local Representatives

<u>Personnel</u>	<u>Organization</u>	<u>Phone Number</u>
Bruce Henry	EPA, Region 4	404/562-9754
Mike Bowden	EPA, Region 4	706/355-8734
Diana Woods	EPA, Region 4	404/562-9438
Lee Colten	KY-DOW, Frankfort	502/564-3410
Rob Miller	KY-DOW, London	606/878-0157
Ted Withrow	KY-DOW, Morehead	606/784-6635
Pamla Wood	KY-DOW, Frankfort	502/564-3410
Clark Allison	NRCS-USDA	606/789-7706
Mike Matto	Gateway District Health Department	606-674-6396
Sally Purvis	Montgomery County Health Department	606-498-0719
Celia Barker	Bath County Health Department	606-674-2371
Scott Drake	East KY Rural Electric Co-op	859-744-4812

Appendix B
Summary of EPA Photographs:



**Straight Pipe Drainage: Path Fork, Kentucky
(Harlan County)**



**Straight Pipe: Preston, Kentucky
(Bath County)**



Straight Pipe Discharge: Kermit, West Virginia



Straight Pipe Drainage: Kermit, West Virginia



Straight Pipe: Martin County



Straight Pipe Drainage: Preston, KY



Failed Septic System: Preston, KY



Infiltrator Drainage System: Preston, KY



Straight Pipe: Martin County, KY



Straight Pipe: Martin County, KY



Failed Septic System: Preston, KY



Septic drainage: Preston, KY



Straight Pipe: Martin County, KY



Straight Pipe:Martin County, KY