TETRA TECH

Master Drainage Plan

for

Hopkinsville Surface and Stormwater Utility

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101 North Main Street
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EXECUTIVE SUMMARY AND RECOMMENDATIONS

The Hopkinsville Surface and Stormwater Utility selected Tetra Tech in May 2006 to develop a Master Drainage Plan that would address drainage and flooding problems in the City of Hopkinsville. The plan consists of three elements: (1) identification of surface drainage projects to improve the existing drainage system of pipes, culverts, and channels throughout the city, (2) flood mitigation measures for the South Fork of the Little River, and (3) flood mitigation measures for the North Fork of the Little River.

The major findings are summarized below.

1. The estimated cost to address the flooding and drainage problems is shown in Table 1.

**TABLE 1 - ESTIMATED COST,
HOPKINSVILLE STORMWATER PROGRAM**

Type of Project	Estimated Cost	Estimated Federal Share	Utility Funds Needed
Surface Drainage Projects (not impacted by the river)	$8,800,000	$2,150,000	$6,650,000
South Fork Flood Mitigation (flood control facilities, home buyouts, and floodproofing)	$7,400,000	$3,700,000	$3,700,000
North Fork Flood Mitigation (increased flood storage of existing watershed lakes, home buyouts, and floodproofing)	$6,300,000	$3,150,000	$3,150,000
Total	**$22,500,000**	**$9,000,000**	**$13,500,000**

2. Thirty-two major surface drainage projects were identified and are listed in Appendix A. These projects would require detailed design by an engineer, and a contractor selected through a bidding process would construct the project. Appendix C lists these projects ranked by the number of severity points using evaluation criteria previously developed by the city. A cost/benefit analysis would be conducted at the time of preliminary design and it may be determined that it is cheaper to buy certain structures rather than construct a project to reduce flooding.

3. Approximately 72 homes and 42 commercial structures along the South Fork will flood during a 100-year storm. Properly sized flood control facilities east of the city would have a significant effect on reducing flood levels in the city and would protect approximately 69 homes and 37 commercial structures from the 100-year flood. Additional flood mitigation measures could include buyouts and floodproofing.
4. Approximately 63 homes and 23 commercial structures along the North Fork will flood during a 100-year storm. Increasing the flood storage capacity of four existing watershed lakes would protect approximately 17 homes and 9 commercial structures from the 100-year flood. Additional flood mitigation measures could include buyouts and floodproofing.

Recommendations:

1. Proceed with a bond issue to finance the design and construction of surface drainage projects and the local share of flood mitigation on the North Fork and South Fork.
2. Adopt the ranking of the surface drainage projects in Appendix C.
3. Adopt the schedule in Table 2 for design and construction of the surface drainage projects as funding allows:

TABLE 2 -
SCHEDULE OF SURFACE DRAINAGE PROJECTS

Year	Project Name	Estimated Cost
2007-2008	Woodmont, Hurst, Windsor, Apache	$2,952,000
2009	Westwood, West 15 St, 212 Country Club, Bahama, North Main, Howell, Morningside, Hillaire	$2,640,000
2010	Sanderson, Braden, Metcalfe, Donna, 510.5 Country Club, 7th Street at Greenville Rd, Evergreen Apartments, Wayne	$2,119,000
2011	East 9th, Locust Grove, Calvin Manor, Lacy, North Vine, Center St, Campbell St, Clarence, Cayce Meade, South Main near Latham, McHenry, South Virginia at Dixie	$1,059,000

4. Request federal monetary assistance for flood mitigation measures on the South Fork of the Little River, including buyouts, floodproofing, and the design and construction of a regional flood control facility and/or watershed lakes strategically placed to provide the necessary flood control.
5. Conduct an engineering feasibility study of providing flood control on the South Fork east of the city. The study should address the location and size of facilities to control flooding. This should be coordinated with the Natural Resources Conservation Service and the U.S. Army Corps of Engineers.
6. Buy out or floodproof three homes on the South Fork that cannot be protected by upstream flood control facilities.
7. Request federal assistance for flood mitigation measures on the North Fork of the Little River, including buyouts, floodproofing, and retrofitting and maintenance of the North Fork watershed lakes.
8. Utilize the services previously offered by the Natural Resources Conservation Service to evaluate the feasibility of using the North Fork watershed lakes to provide additional flood control.
9. Buy out or floodproof those homes on the North Fork that cannot be protected by additional upstream flood control. This would likely be done in phases as funding allows. The initial phase should include approximately 28 homes that flood by more than 2 feet during the 100-year flood.
10. Establish a budget for maintenance of the proposed detention facilities (constructed as part of the surface drainage projects) that become the property of the Surface and Stormwater Utility.
11. Establish a budget for maintenance of the North Fork watershed lakes that become the property of the Surface and Stormwater Utility.

The flood mitigation measures proposed in this plan will do much to improve drainage conditions and reduce the impact of flooding on the citizens of Hopkinsville. However, there is always the possibility of a storm event that exceeds the design standards of state or local government and that will result in flooding.

1.0 INTRODUCTION

The Hopkinsville Surface and Stormwater Utility selected Tetra Tech in May 2006 to develop a Master Drainage Plan that would address drainage and flooding problems in the City of Hopkinsville. The plan consists of three elements: (1) identification of surface drainage projects to improve the existing drainage system of pipes, culverts, and channels throughout the city, (2) flood mitigation measures for the South Fork of the Little River, and (3) flood mitigation measures for the North Fork of the Little River.

2.0 PROJECT APPROACH

The approach for developing the Master Drainage Plan was to use available information from previous studies and supplement it with new information obtained from public meetings conducted by the Hopkinsville Surface and Stormwater Utility in September of 2006. The findings in this report are based on information from the following sources:

- Conceptual Drainage Study of the Woodmont Subdivision, 1999, by JKS Architects and Engineers
- Municipal Drainage Projects Ranking Study, 1989, by Howard K. Bell Engineers
- Hopkinsville Stormwater Management Study, 2001, Tetra Tech
- The Little River Watershed Flood Control Advisory Committee, "Findings and Recommendations," 1998
- Citizens Committee on Flooding and Drainage, "Flooding and Drainage Report," 1999
- Meetings with Planning Commission and city staff
- Field investigations
- State of Kentucky contractor (AMEC) for floodplain map modernization
- U.S. Army Corps of Engineers Flood Reduction Study (currently in draft form)
- Six public meetings conducted in September, 2006

The Corps of Engineers collected valuable information as part of their Flood Reduction Study funded by the federal government in 2000. They provided the first floor elevation of homes and businesses along the North Fork and South Fork of the Little River. They also provided an estimated value of each structure in the floodplain. In addition, their draft report contained

conceptual design information for a regional flood control facility on the South Fork near Edwards Mill Road.

AMEC is the floodplain map modernization contractor for the state of Kentucky. They are updating the floodplain maps for Hopkinsville and Christian County. They also updated the HEC-RAS computer models for the South Fork and North Fork using new topography obtained by the Hopkinsville - Christian County Planning Commission. Tetra Tech contracted with AMEC to evaluate the effect of (1) increasing the flood storage of the North Fork watershed lakes and (2) constructing a flood control facility on the South Fork.

3.0 SURFACE DRAINAGE PROJECTS

Surface drainage projects are intended to reduce flooding and drainage problems caused by surface runoff and not influenced by backup of the river. Many of these projects will be improvements to the existing drainage system of pipes, culverts, and channels. An engineering firm would design the project, prepare construction plans, and conduct construction contract administration. A contractor would construct the project and be selected through a bidding process.

Projects were identified by reviewing past engineering reports, meetings with Planning Commission staff, conducting field investigations, and attending the public meetings in September 2006. Appendix A contains a description of each project; Appendix B contains cost estimates and maps. The cost estimates are planning level estimates and would be refined during the design phase of a project. In addition, cost/benefit analyses would be conducted to determine if it is more cost effective to purchase certain homes or businesses rather than construct the project.

Each surface drainage project was evaluated using criteria previously developed by the city. Appendix C contains the evaluation data for each project and shows the projects ranked by the number of severity points.

4.0 SOUTH FORK FLOOD MITIGATION

Using data provided by AMEC and the Corps of Engineers, the depth of first floor flooding was determined for homes and businesses along the South Fork within the city limits. The results are shown in Table 3.

TABLE 3 -
FIRST FLOOR FLOODING DEPTH ALONG THE SOUTH FORK

First Floor Flooding Depth 100-Year Flood (feet)	No. of Homes	No. of Commercial Structures
0.0-0.5	9	6
0.5-1.0	15	5
1.0-1.5	11	5
1.5-2.0	5	2
2.0-2.5	11	2
2.5-3.0	6	3
3.0-3.5	9	5
3.5-4.0	4	5
>4.0	2	9
Total	**72**	**42**

There are two approaches to reducing flooding in the city along the South Fork. Reduce the peak flow of water entering the city by constructing a flood control facility upstream, or remove the structures that flood. Tetra Tech contracted with AMEC to conduct computer simulations to determine the effect of a flood control facility near Edwards Mill Road as shown in Figure 1. Table 4 shows the reduction in flood elevation at various road crossings. The facility would reduce 100-year flood levels in the city by 2.6-4.9 feet and protect approximately 69 homes and 37 commercial structures as shown in Table 5. However, this would not protect all the homes and businesses on the South Fork that currently flood. It is possible that a combination of watershed lakes, strategically placed in the watershed, would provide additional flood control.

TABLE 4 -
EFFECT OF A SOUTH FORK FLOOD CONTROL FACILITY

Location	Potential 100-Year Flood Reduction[1] (feet)
Pennyrile Parkway	4.9
Pembroke Road (Hwy 41)	4.8
L&N Railroad	4.8
Fort Campbell Blvd	3.9
Marietta Drive	3.3
Eagle Way	3.6
Lovers Lane	3.7
Riverbend Road	2.6
Lafayette Road	2.6

[1] Based on the Corps of Engineers concept for a flood control facility near Edwards Mill Road. Results based on data provided by AMEC.

TABLE 5 -
STRUCTURES PROTECTED BY A
SOUTH FORK FLOOD CONTROL FACILITY

	No. of Existing Structures that Flood (100-Year Flood)	No. of Existing Structures That Would be Protected by Flood Control	Estimated Value of Structures Protected
Homes	72	69	$5,900,000[1]
Businesses	42	37	$10,000,000[2]
Total	**114**	**106**	**$15,900,000**

[1] From Christian County PVA , 2006
[2] From Corps of Engineers draft study (2000) plus 20% for inflation

Federal assistance is anticipated to help pay for part of the design and construction of the flood control facility. The Corps of Engineers roughly estimated the cost of the facility to be between $5,000,000 and $8,000,000. For purposes of this report, we estimated a design and construction cost of $7,000,000 for the facility and a buyout cost of $400,000 for the homes that would still flood. The buyout cost of the homes was based on assessment values from the Christian County

Property Valuation Administrator plus 30 percent for contingencies, and includes a cost for demolition and disposal of the structures.

5.0 NORTH FORK FLOOD MITIGATION

Using data provided by AMEC and the Corps of Engineers, the depth of first floor flooding was determined for homes and businesses along the North Fork within the city limits. The results are shown in Table 6.

TABLE 6 -
FIRST FLOOR FLOODING DEPTH ALONG THE NORTH FORK

First Floor Flooding Depth 100-Year Flood (feet)	No. of Homes	No. of Commercial Structures
0.0-0.5	7	5
0.5-1.0	13	4
1.0-1.5	5	2
1.5-2.0	10	3
2.0-2.5	8	2
2.5-3.0	10	4
3.0-3.5	6	2
3.5-4.0	1	0
>4.0	3	1
Total	**63**	**23**

Flood control on the North Fork is provided by four existing watershed lakes: Lake Tandy, Lake Blythe, Lake Morris, and Lake Boxley. They are shown in Figure 1. The Hopkinsville Water Environment Authority (HWEA) also uses these lakes for water supply. Additional flood control may be gained by lowering the normal pool once HWEA completes construction of a new water line to Lake Barkley. Table 7 provides water supply and flood control data for the lakes.

TABLE 7 -
WATER SUPPLY AND FLOOD STORAGE,
NORTH FORK WATERSHED LAKES

Lake	Watershed Drainage Area[1] (acres)	Existing Water Supply Volume[1] (million gallons)	Existing Flood Storage[2] above Water Supply Volume (million gallons)
Tandy	3900	176	380
Morris	4800	567	980
Boxley	6200	652	600
Blythe	2200	411	190
Total	**17,100**	**1806**	**2150**

[1] Data provided by HWEA.
[2] Volume between the current normal pool and emergency spillway. Data provided by KY Division of Water.

Tetra Tech contracted with AMEC to conduct computer simulations to determine the maximum possible effect of increasing the flood storage of the watershed lakes. They assumed the lakes would store all the runoff during a 100-year storm and that no outflow would occur from the lakes. AMEC also determined the existing flood control effect of the lakes. The results are shown in Table 8. Additional storage in the lakes could reduce 100-year flood levels in the city by 0.5-1.0 feet and protect approximately 17 homes and 9 businesses as shown in Table 9.

For purposes of estimating a budget for flood mitigation on the North Fork, we used a buyout cost of $5,300,000 for the homes that would still flood and $1,000,000 for costs associated with retrofitting and maintenance of the watershed lakes. The buyout cost of the homes was based on assessment values from the Christian County Property Valuation Administrator plus 30 percent for contingencies, and includes a cost for demolition and disposal of the structures.

TABLE 8 -
FLOOD MITIGATION EFFECT OF THE NORTH FORK WATERSHED LAKES

Location	Current 100-Year Flood Reduction[1] (feet)	Additional 100-Year Flood Reduction Possible[2] (feet)
Metcalfe Lane	6.0	0.8
L&N Railroad	6.5	0.8
Main Street	5.8	0.8
Second Street	5.1	0.8
Seventh Street	5.1	0.8
Ninth Street	5.3	0.7
North Drive	4.9	0.5
Canton Pike	4.3	0.6
Millbrooke Drive	4.1	0.7
Cox Mill Road	3.9	0.7
Eagle Way	3.9	1.0

[1] The watershed lakes as currently operated provide significant flood control for the North Fork. Without these lakes, the 100-year flood elevations would be higher by the amount shown in this column. Results based on data provided by AMEC.

[2] This analysis assumed no outflow from the lakes during the 100-year storm. Results based on data provided by AMEC.

TABLE 9 -
EFFECT OF INCREASED FLOOD STORAGE IN THE NORTH FORK WATERSHED LAKES

	No. of Existing Structures that Flood (100-year Flood)	No. of Existing Structures That Could be Protected by Additional Flood Storage	Estimated Value of Structures Protected
Homes	63	17	$1,300,000[1]
Businesses	23	9	$1,700,000[2]
Total	**86**	**26**	**$3,000,000**

[1] From Christian County PVA, 2006

[2] From Corps of Engineers draft study (2000) plus 20% for inflation

6.0 OTHER FLOOD MITIGATION MEASURES

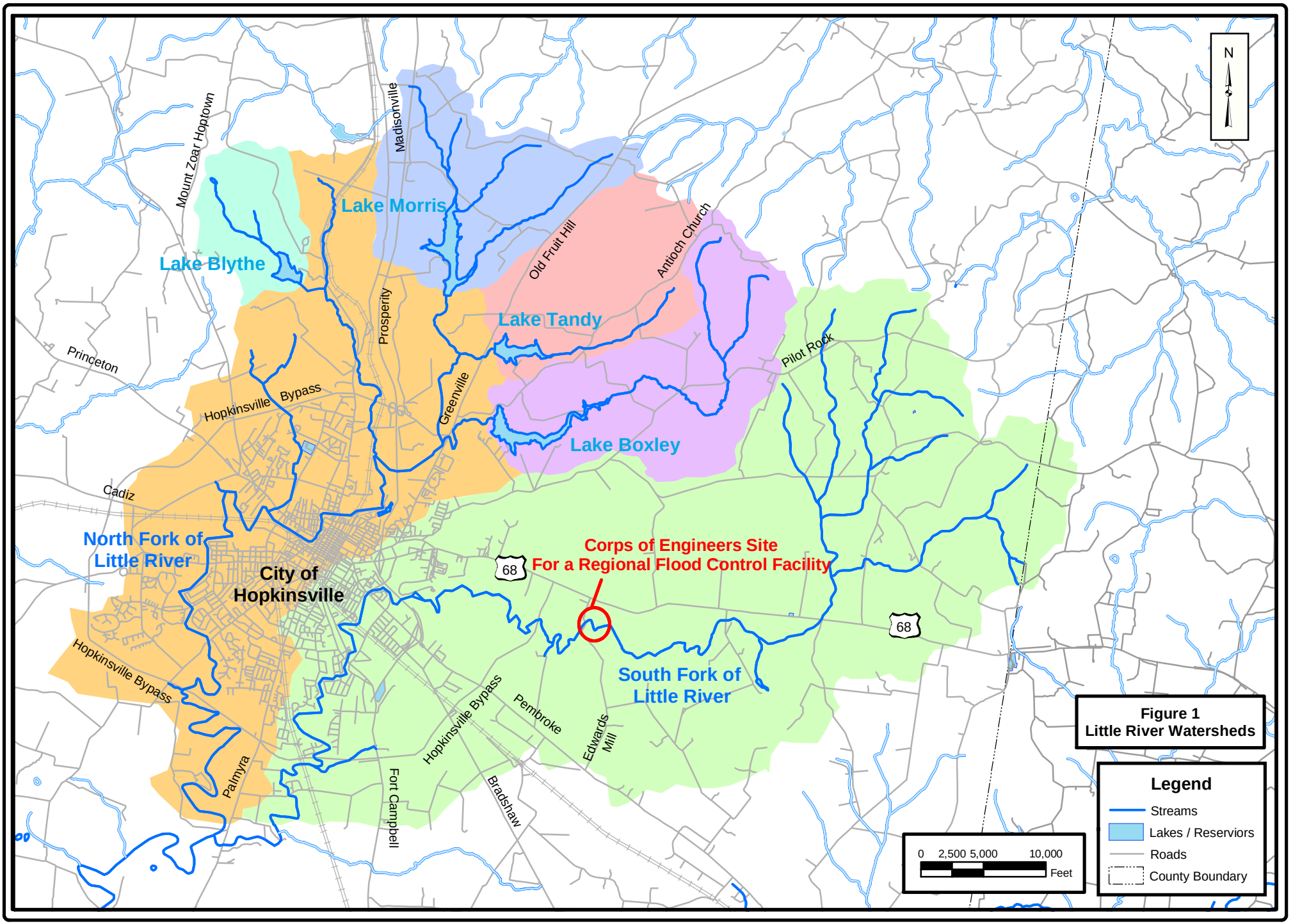
River Cleaning Program

The city has routinely cleaned the river of log jams and other debris that obstruct the flow in the river, particularly at culverts and bridges. The utility board should coordinate with the Kentucky Division of Water whenever debris is removed from the river or fill is placed in the floodplain.

Floodproofing Program

The utility board may want to consider a matching grant flood-proofing program that provides money directly to homeowners for their use in floodproofing their property. This has been used successfully in other communities. The Lexington, Kentucky, floodproofing program is included in Appendix D as an example.

FIGURE 1 – WATERSHED


N
Mount Zoar Hoptown
Madisonville
Lake Morris
Lake Blythe
Old Fruit Hill
Antioch Church
Prosperity
Lake Tandy
Princeton
Hopkinsville Bypass
Greenville
Pilot Rock
Lake Boxley
Cadiz
North Fork of Little River
City of Hopkinsville
Corps of Engineers Site For a Regional Flood Control Facility
68
68
South Fork of Little River
Hopkinsville Bypass
Palmyra
Fort Campbell
Hopkinsville Bypass
Pembroke
Edwards Mill
Bradshaw
Figure 1
Little River Watersheds
Legend
Streams
Lakes / Reservoirs
Roads
County Boundary
0 2,500 5,000 10,000
Feet

APPENDICES