Illinois
Environmental
Protection Agency

Bureau of Water
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August 2003

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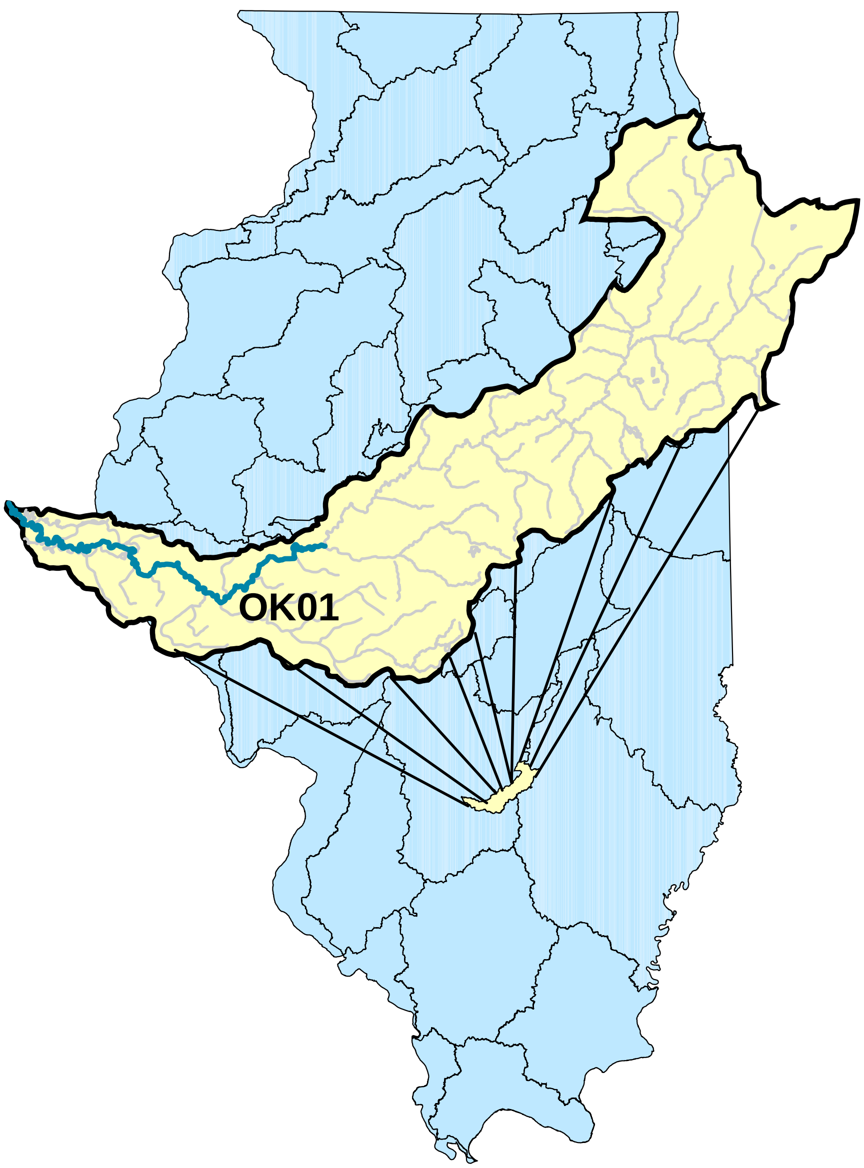
EAST FORK KASKASKIA RIVER TMDL REPORT



EAST FORK KASKASKIA RIVER (ILOK01)
TMDL AND IMPLEMENTATION PLAN

Prepared for

Illinois Environmental Protection Agency

By

MWH
Chicago, Illinois

August 2003

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF: WW-16J

AUG 01 2003

Ms. Marcia T. Willhite
Bureau of Water
IEPA
1021 North Grand Avenue East
Springfield, IL 62794-9276

Dear Ms. Willhite:

The United States Environmental Protection Agency (U.S. EPA) has reviewed the final Total Maximum Daily Load (TMDL) for the East Fork of the Kaskaskia River, including supporting documentation and follow up information. IEPA's submitted TMDL addresses a Total Suspended Solids (TSS) load that partially impairs the Aquatic Life Use Support (ALUS) in approximately 17 miles of the river (ILOK01). Based on this review, U.S. EPA has determined that Illinois' TMDL for TSS meets the requirements of Section 303(d) of the Clean Water Act (CWA) and U.S. EPA's implementing regulations at 40 C.F.R. Part 130. Therefore, U.S. EPA hereby approves Illinois' TMDL for this partially impaired reach of the East Fork Kaskaskia River. The statutory and regulatory requirements, and U.S. EPA's review of Illinois' compliance with each requirement, are described in the enclosed decision document.

We wish to acknowledge Illinois' effort in this submitted TMDL, and look forward to future TMDL submissions by the State of Illinois. If you have any questions, please contact Mr. Kevin Pierard, Chief of the Watersheds and Wetlands Branch at 312-886-4448.

Sincerely yours,

for Jo Lynn Traub
Director, Water Division

Enclosure

EXECUTIVE SUMMARY

A Total Maximum Daily Load (TMDL) for siltation is required for target watershed ILOK01, the East Fork Kaskaskia River watershed (Exhibit 2). This report presents an estimate of current siltation in the target watershed, accounting for critical periods, seasonal variability and uncertainty, and presents an Implementation Plan for the TMDL.

A TMDL is required for ILOK01 because of a determination that aquatic life use support (ALUS) is impaired in waterbody OK 01 (IEPA 1998). In its 1998 development of a list of waters requiring TMDLs, the IEPA identified nutrients and siltation as the causes of impairment. Since that time, the Illinois EPA has updated its guidelines for determining use impairment (IEPA 2000a). Upon applying the new guidelines (IEPA 2000a) to OK 01, we found that a TMDL was required for siltation, but not for nutrients.

The ALUS stream assessment guidelines for siltation involve both a water column indicator (total suspended solids concentration) and a substrate indicator (>34 percent silt or mud). If total suspended solids concentration (TSS) exceeds 116 mg/L in more than one sample in three years, or, if physical habitat transect data shows the substrate to be predominately silt in over 34 percent of the surveyed area, ALUS is considered to be impaired by siltation. In OK 01, IEPA field crews found the proportion of substrate that is silt or mud to be 13.8 percent, indicating full ALUS. However, maximum TSS concentration in the three most recent years of data was 224 mg/L, exceeding the TSS target of 116 mg/L, indicating it is a cause of ALUS impairment.

For this reason, we have taken TSS concentration as a surrogate indicator of siltation in this waterbody, and developed a TMDL on that basis. Sediment sources in the watershed were identified and a model developed to link those sources to loadings to the East Fork Kaskaskia River watershed. The model examined loadings for nine different storm events. For this watershed, sediment eroded from agricultural fields and transported by storm runoff is the source of TSS causing water quality impairments. The model results indicate that TSS concentrations need to be reduced 19 to 62 percent, depending on storm intensity and duration, to comply with the TSS endpoint of 116 mg/L.

Sediment load from the targeted subwatershed OK 01 increases stream TSS concentration by approximately 5 percent. Therefore, even major improvements in preventing TSS from entering the East Fork Kaskaskia River from subwatershed OK 01 will have negligible improvement in water quality and the implementation plan will need to also include upstream subwatersheds.

Six control options were examined to determine their feasibility for meeting the TSS endpoint concentration of <116 mg/L for a three-year storm. These control options included:

1) Changing agricultural land use in all 11 subwatersheds,
2) Changing agricultural land use in subwatershed OK 01,
3) Selectively changing land use based on soil type in all 11 subwatersheds,
4) Increasing conservation tillage,
5) Installing conservation buffers along the East Fork Kaskaskia River and tributary streams in its watershed, and
6) Contour strip cropping to reduce the slope length of farmed fields.

All six options were evaluated to determine if they could meet the TMDL and their costs were estimated. Scenarios 1, 4, and 5, if implemented alone, would meet the TSS TMDL goal. The Implementation Plan recommends a mixture of scenarios 1, 4, 5, and 6 to meet the water quality target and to provide for reasonable assurance of its implementability. Individual farm conservation plans will need to be prepared, or may need to be revised, to finance and implement the BMPs. These farm conservation plans will provide for a higher resolution than this TMDL development. Implementing the TMDL is estimated to have average initial costs of $1.7 million and recurring costs of $2.1 million annually, depending upon the final mix of BMPs selected by landowners and local agricultural agents.

Concentrated animal feeding operations (CAFOs) were not addressed in this TMDL because they were not identified as a contributor to the pollutant for which this TMDL was developed.

Phase II Storm Water Regulations were not addressed in this TMDL because municipal separate storm sewer systems (MS4s) were not identified as a contributor to the pollutant for which this TMDL was developed.

DEVELOPMENT OF TMDLS AND IMPLEMENTATION PLANS FOR THE EAST FORK KASKASKIA RIVER WATERSHED

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LIST OF ACRONYMS

ALUS	AQUATIC LIFE USE SUPPORT
AWQMN	AMBIENT WATER QUALITY MONITORING NETWORK
BMP	BEST MANAGEMENT PRACTICE
CCC	COMMODITY CREDIT CORPORATION
CREP	CONSERVATION RESERVE ENHANCEMENT PROGRAM
CRP	CONSERVATION RESERVE PROGRAM
DOA	ILLINOIS DEPARTMENT OF AGRICULTURE
DNR	ILLINOIS DEPARTMENT OF NATURAL RESOURCES
EQIP	ENVIRONMENTAL QUALITY INCENTIVE PROGRAM
FSA	FARM SERVICE AGENCY
IEPA	ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
MOS	MARGIN OF SAFETY
NPDES	NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
NRCS	NATURAL RESOURCES CONSERVATION SERVICE
RUSLE	REVISED UNIVERSAL SOIL LOSS EQUATION
STORET	STORAGE AND RETREIVAL DATABASE
SWCD	SOIL AND WATER CONSERVATION DISTRICT

TMDL	TOTAL MAXIMUM DAILY LOAD
TSS	TOTAL SUSPENDED SOLIDS
WHIP	WILDLIFE HABITAT INCENTIVES PROGRAM
USDA	UNITED STATES DEPARTMENT OF AGRICULTURE
USEPA	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
USLE	UNIVERSAL SOIL LOSS EQUATION

UNITS OF MEASUREMENT

AC	ACRE
CM	CENTIMETER
D	DAY
FT	FOOT
HA	HECTARE
HR	HOUR
IN	INCH
KG	KILOGRAM
L	LITER
LB	POUND
M	METER
MG	MILLIGRAM
MGD	MILLION GALLONS PER DAY
YR	YEAR

FOREWORD

Authorization

The development of the TMDL for the East Fork Kaskaskia River was authorized under Agency contract number FWD-0302, as amended, between Harza Engineering Company, Inc. and the Illinois Environmental Protection Agency.

Scope

The scope of work for this contract included meeting the following objectives:

- Identifying water quality targets for the target watershed, ILOK01, East Fork Kaskaskia River
- Estimating waste loads, loads, seasonal variation, and a margin of safety for pollutants impairing the target waterbody
- Preparation of a TMDL implementation plan to bring the target waterbody into compliance with the water quality target

Acknowledgments

Harza acknowledges the valuable contributions of the Illinois EPA staff to this study, including Mr. Gary Eicken, Mr. Lalit Sinha, Mr. Bruce Yurdin, Mr. David Muir, Mr. Bob Hite, Mr. Jeff White and others. The study was performed by Mr. Douglas Mulvey and Ms. Beth Padera. Mr. David Pott was Harza's Project Manager.

1.0 INTRODUCTION

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies that are not meeting applicable water quality standards/guidelines or designated uses under technology-based controls. TMDLs specify the maximum amount of a pollutant which a waterbody can assimilate and still meet water quality standards. Based upon a calculation of total load of a specific pollutant that can be assimilated, TMDLs allocate pollutant loads to sources (individual point sources and nonpoint sources) and a margin of safety (MOS). This study will determine allowable limits for pollutant loadings to meet water quality standards/guidelines and designated uses in waterbody segment OK 01, East Fork Kaskaskia River. Pollutant load reductions will be allocated among sources and provide a scientific basis for restoring surface water quality in this waterbody. In this way, the TMDL process links the development and implementation of control actions to attain and maintain water quality standards and designated uses.

1.1 GOALS OF THE TMDL PROGRAM

The TMDL process links both point and nonpoint pollution sources as they contribute to water use impairment. The goals of the TMDL program include establishing allowable pollutant loadings or other quantifiable parameters for a waterbody, providing states a tool for implementing water quality-based controls, and offering a forum for public participation on watershed issues. Key principles of the TMDL development process include making restoration of impaired waters a high priority, communication with the public, stakeholder involvement and federal government support (USEPA 1998). By following the TMDL process, states can establish water quality-based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources. The objective of the process is the restoration of a waterbody to meet water quality standards/guidelines and support designated uses.

1.2 APPROACH TO TMDL DEVELOPMENT

Harza is following a technical approach to developing this TMDL that is consistent with the 1998 Report of the Federal Advisory Committee on the TMDL Program and US

EPA's protocol for developing sediment TMDLs (USEPA 1998, 1999). The general components of this approach include:

- Problem Identification
- Identification of Water Quality Indicators and Target Values
- Source Assessment
- Linkage between Water Quality Targets and Sources
- Load Allocations
- Implementation Plans

Exhibit 1 illustrates the interrelationships between these and other activities that Harza and the Illinois Environmental Protection Agency (Illinois EPA) have undertaken, or will be undertaking, to develop and implement the TMDL and to restore the targeted waterbody to meet water quality criteria and designated uses.

1.3 SOURCES OF INFORMATION

Table 1 lists data, by source, that were obtained and reviewed in preparation of this TMDL. These and other references have complete citations at the end of this report.

Table 1

DATA SOURCES, EAST FORK KASKASKIA RIVER WATERSHED (ILOK01)

Data	Source
Land Use/Land Cover	Critical Trends Assessment Land Cover Database of Illinois, 1991-1995, Illinois Natural History Survey, Illinois State Geological Survey, Illinois Department of Natural Resources, March 1996.
Soils	Soil Geographic (STATSGO) Database, U.S. Department of Agriculture, Natural Resources Conservation Service, 1994.
NPDES Permit Conditions and Excursion Data, PCS Query	IEPA NPDES permit electronic files, Envirofacts Data Warehouse, Water Discharge Permits available at http://www.epa.gov/enviro/html/pcs/pcs_query_java.html
STORET data	Hardcopy format from IEPA. Also available from USEPA at http://www.epa.gov/storet

Table 1

DATA SOURCES, EAST FORK KASKASKIA RIVER WATERSHED (ILOK01)

Data	Source
Stream discharge	htpp://waterdata.usgs.gov/nwis-w/il
Watershed boundaries	Provided by the IEPA, headquarters
GIS Coverages of County Boundaries, Highways, Towns, and River Reaches	Illinois Natural Resources Geospatial Data Clearinghouse http://www.isgs.uiuc.edu/nsdihome/isgsindex.html
GIS USGS Quad Map coverages	http://www.isgs.uiuc.edu/nsdihome/isgsindex.html
Biotic Integrity and Habitat Survey results	IEPA (2000b)
General watershed information	Clinton, Marion and Fayette County NRCS offices
USDA programs and data	http://www.usda.gov
Climate data	Illinois State Water Survey's *Rainfall Frequency Atlas of the Midwest*, Bulletin 71 (Huff and Angel 1992)
Population forecast data	South Central Illinois Regional Planning & Development Commission
Conservation tillage data	Transect data provided by the Illinois Department of Agriculture

1.4 ORGANIZATION OF THE REPORT

This report documents the TMDL and implementation plan to reduce siltation in the East Fork Kaskaskia River. Chapter 1 is an introduction. Chapter 2 summarizes the targeted watershed condition and identifies the water quality problem. Chapter 3 identifies water quality indicators and TMDL target values. Chapter 4 is a source assessment and Chapter 5 links sources and the water quality target. Chapter 6 presents the TMDL calculation and allocation scenarios. Chapter 7 is the implementation plan. Data and model results are printed as appendices.

2.0 PROBLEM IDENTIFICATION

The objective of this chapter of the report is to document the nature of water quality in the target waterbody using available data, and to assess the watershed with respect to land use, soil characteristics, and topography.

2.1 DESCRIPTION OF THE WATERSHED

The watershed targeted for TMDL development is the East Fork Kaskaskia River (ILOK01). The targeted waterbody segment is OK 01. The segment begins at its mouth at Carlyle Lake and extends approximately 17.13 miles upstream to the confluence of the East Fork Kaskaskia River with Jims Creek.

This area is located in Clinton, Fayette, and Marion counties. Exhibit 2 is a location map. Exhibit 3 is a map showing 11 subwatersheds, including the targeted segment OK 01. According to the GIS files representing watershed boundaries (provided by the Bureau of Water), the drainage area of ILOK01 and upstream subwatersheds is 81,060 acres.

Two waterbody segments of the East Fork Kaskaskia River are upstream of OK 01: OK 02 and OK 03. The watershed is largely rural agriculture, but does include the towns of Alma, Kinmundy, and Farina. The watershed is in the Southern Till Plains Natural Division of Illinois. The topography of this Division (including the targeted watershed) is typically gently rolling hills, originally vegetated with post oak flatwood forests and mesic tall-grass prairies. Upland soils tend to be derived from loess, whereas alluvium soils occupy the lowlands (Miles 1996).

2.1.1 Stream Classifications and Uses

Title 35 of the Illinois Administrative Code, Subtitle C, Part 303, contains water use designations which determine for a given body of water which set of water quality standards (found in Part 302) applies. Unless expressly stated, water bodies designated for specific uses must meet the most restrictive water quality standards for any specified use, in addition to meeting the general standards of Part 302. There are no specially designated uses for ILOK01, and therefore, the river must meet the most restrictive water quality standards in Part 302. Uses of the ILOK01 waterbody segments include aquatic life use support (ALUS) and public water supply (Table 2).

Table 2

ILOK01 USE DESIGNATION AND USE SUPPORT STATUS
(Source: IEPA 1998)

Designated Uses	Use Support Status
Overall Use	Partial Support/Minor Impairment
Fish Consumption	Unknown
Aquatic Life	Partial Support/Minor Impairment
Public Water Supply	Full Support

2.1.2 Water Quality Standards

Water quality standards are levels of individual constituents or water quality characteristics, or descriptions of conditions of a water body that, if met, will generally protect the designated uses of the water. Standards are promulgated by states to protect designated uses of water. Narrative water quality standards describe conditions necessary for the water body to attain its designated use. Often expressed as "free from" certain characteristics, narrative criteria can be the basis for controlling nuisance conditions such as floating debris, objectionable deposits or offensive odors. Narrative standards are often used to supplement numeric standards.

Numeric water quality standards are concentrations, toxicity units, or other numbers deemed necessary to protect designated uses. Numeric standards define the relationship between pollutant concentrations and environmental and human health effects. Illinois has narrative and numeric standards that form the basis for the state's NPDES water quality-based permit limits for point source discharges. Numeric standards can also be the water quality endpoints used for TMDLs.

Applicable water quality standards for East Fork Kaskaskia River are found in Title 35 of the Illinois Administrative Code. Subtitle C, Subpart B, contains the General Use Water Quality Standards which must be met in waters of the state for which there is no specific designation. The General Use Standards are written to protect aquatic life, wildlife, agricultural use, secondary contact use, most industrial uses, and aesthetics. Primary contact uses are protected for all general use waters whose physical configuration (*i.e.* depth) permits such use.

Subpart B does not contain general use standards, numeric or narrative, applicable to ILOK01 for nutrients, siltation, or total suspended solids. The basis for the 303(d) listing is taken from the narrative standard, Section 302.203, which states that waters are to be free from sludge or bottom deposits, plant or algal growth, color or turbidity of other than natural origin.

Illinois water quality standards are written to apply at all times when flows are equal to or greater than the minimum mean seven consecutive day drought flow with a 10-year return frequency (7Q10) (Title 35 IAC 302.103).

2.1.3 305(b)-Identified Causes of Non-Attainment

Illinois' 1998 submittal of its 303(d) list catalogs the causes of waterbody impairment to the East Fork Kaskaskia River, ILOK01, as slight nutrient (nitrate nitrogen and phosphorus) and suspended solids loadings and slight siltation (Table 3). The source of these loadings is identified as non-irrigated crop production (IEPA 1998).

Table 3

CAUSES AND SOURCES OF WATER USE IMPAIRMENTS IN ILOK01
(Source: IEPA 1998)

Use/Impairment Status	Cause & Severity	Sources & Significance
Overall / minor Fish consumption / unknown Aquatic life / minor Swimming / unknown Public Water Supply / none	Nutrients (nitrate & phosphorus)– slight Siltation – slight Suspended solids – slight	Agriculture – moderate Non-irrigated crop production – moderate

2.1.4 Institutions

Institutions identified to date that are, or potentially are, involved in watershed management in the target watershed include:

- Natural Resources Conservation Service, USDA
- Clinton County Soil and Water Conservation District
- Marion County Soil and Water Conservation District
- Fayette County Soil and Water Conservation District
- Illinois EPA
- Illinois Department of Agriculture
- Mid-Kaskaskia River Basin Coalition (Vandalia, Ill.)
- Southwestern Illinois Resource Conservation & Development, Inc. (Mascoutah, Ill.)
- Post Oak Flats Resource Conservation & Development, Inc. (Salem, Ill.)
- Lake Carlyle Planning Committee (anon. undated)

2.2 DATA-BASED CHARACTERIZATION OF THE WATERSHED

Harza reviewed the available data to characterize the spatial and temporal extent of the watershed's water quality problems that prevent attainment of designated uses. Data sources reviewed and discussed below include hydrology, soils, land use, water quality, and stream habitat and aquatic life data.

2.2.1 Hydrology

Streamflow data for watershed ILOK01 are available from a gage on the East Fork Kaskaskia River near Sandoval, Ill. (05592900). The gage is located on the left bank at U.S. Highway 51, at river mile 9.9. The drainage area of this gage is reported by the USGS to be 113 square miles (72,320 acres). There are daily discharge records from October 1979 to present (Exhibit 4). The daily records through September 1998 were reviewed to find the maximum yearly flows (Table 4).

Table 4

MAXIMUM DAILY DISCHARGES IN THE EAST FORK KASKASKIA RIVER NEAR SANDOVAL, IL
(Source: USGS gage 05592900)

Year	Flow (cfs)	Year	Flow (cfs)	Year	Flow (cfs)
1979	286	1986	2,330	1993	6,260
1980	1,520	1987	2,860	1994	4,720
1981	740	1988	4,100	1995	6,450
1982	3,000	1989	2,430	1996	4,260
1983	2,860	1990	7,660	1997	2,800
1984	3,290	1991	1,510	1998	1,570
1985	5,640	1992	1,580		

Using the maximum daily discharge values (Table 4), return periods for given floods were calculated using the Weibull formula (Chow *et al*. 1988). From these data, selected return periods and corresponding discharges are presented in Table 5. Exhibit 5 is a flow duration curve, indicating median flows around 8 ft^3/s.

Table 5

ESTIMATED DISCHARGES FOR SELECT RETURN PERIODS IN EAST FORK KASKASKIA RIVER, NEAR SANDOVAL, IL

Return Period (years)	Flow (cfs)
1	750
2	2,900
3	3,800
5	4,900
10	6,400

2.2.2 Soils

The Southern Till Plain is entirely covered by fertile Illinoian glacial till, originally vegetated by mesic tallgrass prairie and post oak flatwood forest. Exhibit 6 presents the four major soil associations found in the watershed. The GIS files for Exhibit 6 have been obtained from the national STATSGO database. Soil associations in the watershed include the Bluford-Ava-Hickory Association (IL038) and the Cisne-Hoyleton-Darmstadt Association (IL006). Table 6 presents a summary of soil association type and abundance in the 11 subwatersheds. Each soil type of the association is discussed below.

Table 6

SOILS IN THE EAST FORK KASKASKIA RIVER WATERSHED (acres)
(Source: STATSGO)

Subwatershed	Bluford-Ava-Hickory (IL038)	Cisne-Hoyleton-Darmstadt (IL006)
OK01	10,044	3,077
OK02	12,423	5,902
OK03	4,307	7,371
OKB	4,921	3,423
OKBA	1,040	1,047
OKC	3,839	1,914
OKCA	782	947
OKD	650	0
OKE	2,926	9,010
OKF	132	3,879
OKG	1,528	1,897
Total	42,592	38,467

Miles (1996) describes the Bluford-Ava-Hickory Association as being nearly level to very steep, somewhat poorly drained, very slowly to moderately permeable soils. This association is on side slopes along drainages and on broad ridge tops. It was originally deciduous forests. Slopes vary widely, ranging from one to 45 percent.

The Cisne-Hoyleton-Darmstadt Association is not recognized as a distinct soil association by Miles (1996). This association is found in nearly level to gently sloping, poorly drained areas. These are the prairie soils; they are found on broad till plains, with slopes up to 7 percent.

Both of these soil associations are considered by Miles to be well suited or moderately well suited to cultivated crops.

The following soil descriptions have been taken from the USDA-NRCS Soil Survey Division, Official Soil Series Description Data Access website.

Ava Series. The Ava series consists of moderately well drained soils on convex ridges and side slopes of drainage ways on till plains. They formed in loess and the underlying silty or loamy deposits that overlie a strongly developed paleosol. They have a bisequal profile that is moderately deep to a fragipan and very deep to bedrock. Ava soils are moderately permeable in the upper part of the solum, and very slowly permeable in the fragipan horizon. Slope ranges from 0 to 18 percent.

Bluford Series. The Bluford series consists of very deep, somewhat poorly drained soils on hill slopes and knolls. They formed in loess and the underlying silty or loamy sediments. Permeability is low. Slopes range from 0 to 7 percent.

Cisne Series. The Cisne series consists of very deep, poorly drained, very slowly permeable soils on till plains. They formed in loess and the underlying gritty loess or pedisediment. Slopes range from 0 to 2 percent.

Darmstadt Series. The Darmstadt series consists of very deep, somewhat poorly drained, very slowly permeable soils formed in loess, or in loess and the underlying silty pedisediment on till plains. These soils contain a concentration of exchangeable sodium in the subsoil. Slopes range from 0 to 10 percent.

Hickory Series. The Hickory series consists of very deep, well-drained, moderately permeable soils on dissected till plains. They formed in till that can be capped with up to 20 inches of loess. Slope ranges from 5 to 70 percent.

Hoyleton Series. The Hoyleton series consists of deep, somewhat poorly drained, slowly permeable soils on low convex ridges on uplands. They formed in loess and the underlying silty or loamy deposits which overlie a strongly weathered paleosol in the Illinoian till. Slopes range from 0 to 7 percent.

2.2.3 Land Use and Cover

The Southern Till Plain is entirely covered by fertile Illinoian glacial till, originally covered by mesic tallgrass prairie and post oak flatwood forest. Today it is largely used for crop production (Table 7). Exhibit 7 is a map of land use in the watershed and Exhibit 8 contains detailed acreage figures of each land use type in each soil association.

Table 7

EAST FORK KASKASKIA WATERSHED LAND USE
(Source: Illinois Natural History Survey, *et al*. 1996)

Land Use Type	Area (ac)	Proportion
Urban	588	0.7%
Agriculture	41,737	51.5%
Grassland	21,569	26.6%
Forest	13,088	16.2%
Water	78	0.1%
Wetland	4,000	4.9%
Total	81,060	**100%**

2.2.4 Water Quality

There is an ambient water quality monitoring network station (AWQMN) in the targeted waterbody segment, OK 01. The station is located at the Highway 51 bridge, near Sandoval, Ill. Sampling is performed nine times each year and tests are performed on a variety of constituents. The Illinois EPA provided us with data from STORET for this site representing the period January 1991 through December 1998 (Appendix A). This period includes the years used as the basis for the 1998 303(d) listing. Exhibit 9 is a statistical summary of water quality data from OK 01 relevant to the causes of stream use impairment, including the relative exceedances of general use water quality standards. Below we discuss each water quality parameter separately.

Phosphorus. Total and dissolved phosphorus were measured at OK 01 72 times between January 1991 and December 1998 (Exhibits 9, 10). Over this period, total and dissolved phosphorus concentrations averaged 0.26 and 0.11 mg/L, respectively (N=72 samples). The minimum concentration of total phosphorus over the monitoring period was 0.06 mg/L.

Exhibit 11 plots phosphorus concentrations as a function of discharge. There is a weak but statistically significant correlation ($P<0.05$) between total phosphorus and discharge, supporting the transport of nutrients to the river with storm runoff.

Phosphorus has been listed by the IEPA as a cause of water quality impairment at ILOK01 (IEPA 1998). The current 305(b) assessment guideline for total phosphorus at AWQMN stations indicates use impairment if concentrations exceed 0.61 mg/L in at least one sample in three years (IEPA 2000a). During the most recent three-year period for which we have data available (January 1996 through December 1998), total phosphorus never exceeded 0.48 mg/L. During the preceding five-year period (January 1991 through November 1995), total phosphorus exceeded the 0.61 mg/L guideline on three occasions. While this may reflect improved watershed management practices, there may also be other factors, such as weather, that contribute to improved water quality.

Nitrogen. Various forms of nitrogen were also monitored during the same time period at OK 01 (Exhibits 9, 12). Nitrate+nitrite averaged 0.52 mg/L and reached a maximum of 5.4 mg/L (N=72 samples). Ammonia nitrogen averaged 0.25 mg/L (maximum = 4.7 mg/L). Total Kjeldahl nitrogen (TKN) averaged 0.93 mg/L (maximum = 3.2 mg/L). In our eight-year database, nitrogen concentrations at OK 01 are not significantly correlated to discharge ($P>0.05$).

General use ammonia-nitrogen standards (35 IAC 302.212) were never exceeded at OK 01 during the eight-year period for which we have data. There are no general use water quality standards for nitrate, nitrite or TKN. Nitrate-nitrogen has, however, been listed by the IEPA as a cause of water quality impairment at ILOK01 (IEPA 1998). The current 305(b) assessment guideline for nitrate nitrogen at AWQMN stations indicates use impairment if concentrations exceed 7.8 mg/L in at least one sample in three years (IEPA

2000a). During the eight-year period for which we have data, nitrate+nitrite nitrogen never exceeded this criterion. Therefore, application of the Agency's current 305(b) guidelines as indicators of impairment and 303(d) listing would support the delisting of nitrate-nitrogen as a cause of impairment at ILOK01.

Suspended Solids and Turbidity. Total suspended solids (TSS) and turbidity were also monitored at OK 01. TSS averaged 41 mg/L, ranging from 3 to 335 mg/L (N=72 samples). Turbidity averaged 21 FTU, ranging from 1 to 160 (Exhibits 9, 13). There is a statistically significant correlation R^2=0.617 ($P < 0.001$) between discharge and TSS, supporting the erosion and transport of solids to the river during storm events (Exhibit 11).

There are no numerical general use water quality standards for TSS or turbidity. Nevertheless, suspended solids, and the related indicator, siltation, are listed by the IEPA as potential causes of water quality impairment at ILOK01 (IEPA 1998). The current 305(b) assessment guidelines for TSS and siltation at AWQMN stations are based on TSS, and indicate use impairment if concentrations exceed 116 mg/L in at least one sample in three years (IEPA 2000a). During the most recent three-year period for which we have data available (January 1996 through December 1998), TSS exceeded this guideline on one occasion. In the five years preceding this (January 1991 through November 1995), TSS exceeded 116 mg/L on four other occasions. Therefore, application of the Agency's current 305(b) guidelines as indicators of impairment and 303(d) listing would support the preparation of a TMDL for TSS in this watershed.

2.2.5 Other Data Describing Use Attainment

The Illinois EPA performed an intensive survey of watershed ILOK01 as part of their basinwide assessment of use support in August 1997 (IEPA 2000b). Those data were collected at the OK 01 AWQMN station at US 51 near Sandoval, Ill. (five miles south of Patoka).

The Macroinvertebrate Biotic Index (MBI) estimated by the Agency from these data was 5.7 (Table 8). Taxa abundance and pollution tolerance values from this survey are tabulated below. In 1983, the Agency estimated an MBI of 6.0 at the same location. MBI and pollution tolerance values are inversely related to water quality conditions. That is, MBI increases as water quality is degraded. The MBI is used to make judgments on the biological effects of pollutant discharges.

For perspective, the current Agency 305(b) assessment criterion for full ALUS is MBI ≤ 5.9. An MBI > 8.9 indicates nonsupport and values between 5.9 and 8.9 generally indicate partial support. Therefore, the MBI scores would imply that water quality at OK 01 has improved since 1983 and fully supports aquatic life use.

Table 8
MACROINVERTEBRATES FOUND AT OK 01 ON AUGUST 4, 1997
(Source: BIOS database)

Scientific Name	Common Name	Abundance	Pollution Tolerance
Oligochaeta	oligochaetes	12	10.0
Glossiphoniidae		1	8.0
Hyalella azteca	tiny olive scud	1	5.0
Orconectes virilis		4	5.0
Baetis	small minnow mayfly	31	4.0
Centroptilum	small minnow mayfly	7	2.0
Stenacron	flatheaded mayfly	49	4.0
Caenis	small squaregill mayfly	72	6.0
Aeschna	blue darner	1	4.0
Corduliidae	green-eyed skimmers	1	4.5
Argia	narrowwinged damselfly	5	5.0
Enallagma	bluets	2	6.0
Ischnura	forktail	40	6.0
Sialis	alderfly	6	4.0
Cheumatopsyche	netspinning caddis	94	6.0
Helichus	longtoed water beetle	1	4.0
Dubiraphia		6	5.0
Stenelmis	riffle beetle	30	7.0
Simulium	black fly	15	6.0
Thienemannimyia		5	6.0
Rheocricotopus		1	6.0
Cryptochironomus	midge	2	8.0
Polypedilum		45	6.0
Saetheria		1	6.0
Tribelos		7	5.0
Tanytarsus		1	7.0
Physella	snail	4	9.0
Ferrissia	snail	5	7.0
Sphaerium	snail	1	5.0
Macroinvertebrate Biotic Index = 5.7			

Fish data for ILOK01 from the 1997 survey are also available (Table 9). The fish community was sampled during summer. The adjusted Index of Biotic Integrity (IBI) estimated from these data was 36.0. None of the species collected is currently listed by the state or federal government as being threatened or endangered.

For perspective, the current Agency 305(b) assessment guideline for full ALUS is an IBI greater than 41. An IBI less than 20 indicates nonsupport and values between 20 and 41 generally indicate partial support. Therefore, in 1997, the IBI score would suggest partial use support in OK 01.

Table 9

FISHES COLLECTED IN SEGMENT OK 01 ON AUGUST 4, 1997
(Source: IEPA 2000b)

Scientific Name	Common Name	Abundance
Cyprinella lutrensis	red shiner	3
Notropis umbratilis	redfin shiner	2
Pimephales notatus	bluntnose minnow	2
Semotilus atromaculatus	creek chub	11
Minytrema melanops	spotted sucker	1
Ictalurus natalis	yellow bullhead	5
Noturus gyrinus	tadpole madtom	1
Fundulus notatus	blackstripe topminnow	15
Lepomis cyanellus	green sunfish	3
Lepomis megalotis	longear sunfish	1
Micropterus salmoides	largemouth bass	2
Etheostoma aspirigene	mud darter	3
Etheostoma nigrum	johnny darter	15
Aplodinotus grunniens	freshwater drum	1
	Adjusted IBI = 36.0	

The Agency performed a survey of physical habitat in segment OK 01 as well. The study reach was a 480-ft wooded reach of floodplain. More than 80 percent of the study reach was classified as pool. The dominant substrate is medium gravel, but there were also significant areas of claypan, mud, detritus, and sand. Table 10 reports physical habitat data recorded for OK 01.

Table 10

SUBSTRATE (%) IN OK 01
(Source: BIOS database)

Date Sampled	**8/4/97**
Mud	13.8
Sand	10.1
Fine Gravel	8.2
Medium Gravel	19.5
Coarse Gravel	6.9
Small Cobble	2.5
Large Cobble	1.9
Boulder	1.3
Bedrock	0
Claypan	15.7
Detritus	10.1
Vegetation	1.9
Logs	8.2

3.0 IDENTIFICATION OF WATER QUALITY TARGETS

Water quality target values, or endpoints, are used as the basis for TMDL development. Often the target will be the numeric water quality standard for the pollutant of concern. In Illinois, many TMDLs must be developed for parameters that do not have numeric standards, including TMDLs for the East Fork Kaskaskia River watershed. The narrative standard must be interpreted to develop a quantifiable target value on which to base the TMDL.

The state's current approach to developing TMDLs in the absence of numerical water quality standards utilizes the Illinois EPA's 305(b) assessment guidelines (IEPA 2000a). These guidelines are currently the basis identifying impaired segments and impairment causes. For certain parameters, narrative expressions of the assessment guidelines are required. Some of these occur as a result of narrative water quality standards. Others are a combination of metrics developed by the state or USEPA in the overall monitoring strategy for the assessment of ALUS in lakes and streams. ALUS is one of several use support categories against which data are assessed to determine attainment of a particular use (fish consumption, shellfish, swimming, secondary contact and drinking water are the other categories). As indicated in Table 3, ALUS is impaired in OK 01 and nutrients (nitrate nitrogen and phosphorus) and siltation have been identified as the causes. This identification was, however, based upon Illinois EPA's 305(b) guidelines preceding those adopted for 2000 (IEPA 2000a). In this chapter, we apply the 2000 305(b) guidelines to confirm waterbody designated use support, causes of impairment, and to develop TMDL endpoints, or target values.

For parameters such as nutrients, suspended solids and siltation that have no numeric water quality standards, a statistical value equivalent to the 85^{th} percentile (statewide mean plus one standard deviation) is used as the threshold for determining full ALUS under the 305(b) assessment program. This statistical value is calculated from available AWQMN data from 1978 through 1996. At AWQMN sites, one exceedance of this statistic over three years triggers the identification of that water quality constituent as a cause of use impairment (IEPA 2000a).

In the case of segment OK 01, the East Fork Kaskaskia River, TMDL development has been identified in the 1998 303(d) list for nitrate, phosphorus, TSS and siltation (IEPA 1998).

3.1 Nutrients

Our analysis of available AWQMN data and comparison of current 305(b) assessment guidelines indicates that TMDLs are not required for nutrients at this time (Table 11). The maximum total phosphorus concentration in the three most recent years for which we have AWQMN data was 0.48 mg/L. Under the 2000 305(b) guidelines, phosphorus cannot be listed as a cause of impairment if concentrations are less than 0.61 mg/L.

The maximum concentration of nitrate nitrogen in the three most recent years for which we have AWQMN data was 2.2 mg/L. Under the 2000 305(b) guidelines, nitrate N cannot be listed as a cause of impairment if concentrations are less than 7.8 mg/L. The maximum concentration of ammonia nitrogen in the three most recent years for which we have data was 2.1 mg/L. While this level of ammonia nitrogen is less than the general use water quality standard at 35 IAC 302.212, it exceeds the nutrient 305(b) guideline of 0.41 mg/L for ammonia nitrogen. Ammonia nitrogen is not listed as a cause of impairment at this time, but future 305(b) assessments will reconsider listing it as a cause of impairment in OK 01.

Table 11

NUTRIENT TMDL DEVELOPMENT RECOMMENDATIONS
FOR EAST FORK KASKASKIA RIVER, ILOK01

Impairment Cause	Basis	Recommendation
Nitrate	No exceedance of current 305(b) listing criterion	Delist as a cause of impairment
Phosphorus	No exceedance of current 305(b) listing criterion	Delist as a cause of impairment

3.2 Siltation

The 2000 305(b) assessment guidelines for siltation involve both a water column indicator (total suspended solids concentration) and a substrate indicator (>34 percent silt). If total suspended solids concentration (TSS) exceeds 116 mg/L in more than one sample in three years, or, if physical habitat transect data shows the substrate to be predominately silt in over 34 percent of the surveyed area, ALUS is considered to be impaired by siltation and the waterbody is placed on the 303(d) List.

Table 10 contains the latest stream habitat survey information. The proportion of substrate that is silt or mud was 13.8 percent, indicating full ALUS. However, maximum TSS concentration in the three most recent years for which we have AWQMN data was 224 mg/L. Under the 2000 305(b) guidelines, TSS is listed as a cause of impairment if concentrations exceed 116 mg/L in more than one sample in three years.

Table 12

SILTATION TMDL DEVELOPMENT RECOMMENDATIONS FOR EAST FORK KASKASKIA RIVER, ILOK01

Impairment Cause	Basis	Recommendation
Siltation	No exceedance of current 305(b) listing criterion for substrate condition	Focus on water column indictor
Total Suspended Solids	One exceedance of 305(b) listing criterion	Use 305(b) criterion as water quality target for TMDL

4.0 SOURCE ASSESSMENT

This chapter presents a pollutant source assessment. The objective of a source assessment is to identify and quantify significant sources of the pollutant causing ALUS impairment.

4.1 Watershed Waste Loads

Within the target subwatershed, OK 01, there are no permitted point sources of suspended solids. Upstream, there are three small aerated lagoon wastewater treatment plants (WWTP) that serve the villages of St. Peter, Kinmundy, and Farina (Exhibit 14). These are located in subwatersheds OKE, OKF, and OK 03, respectively. Each of these point sources are regulated by a National Pollutant Discharge Elimination System (NPDES) permit that limits daily maximum TSS discharges to 45 mg/L and average monthly concentrations to 37 mg/L. TSS concentrations in subwatershed OK 01 are a flow related event (*i.e*., as flow increases, TSS concentration increases). Daily maximum permitted TSS waste loads for these three permitted facilities are shown below, together with the number of TSS effluent violations that are recorded recently. When compared with nonpoint source loads from a 1-year storm, the point source loads contribute less than 0.008 percent of the total TSS loads in the watershed, and less in comparison to a 3-year storm. While the Farina WWTP clearly exceeds its TSS limits regularly and should be examined for possible upgrading, these point sources are negligible compared with nonpoint sources.

Table 13

WASTEWATER TREATMENT FACILITY INFORMATION
(Source: USEPA Permit Compliance System)

Facility	WWTP Capacity	Subwatershed	Average TSS Load (lbs/d)	Maximum TSS Load (lbs/d)	No. Exceedances Between 11/97 & 11/00
St. Peter	0.04 MGD	OKE	52	64	12 (out of 37)
Kinmundy	0.15 MGD	OKF	136	166	0 (out of 35)
Farina	0.1 MGD	OK 03	81	98	31 (out of 37)

4.2 Watershed Pollutant Loads

Pollutant loads to surface water can originate from several sources. The primary mechanism for transport of suspended solids to local streams is surface runoff. Illinois EPA (1998) identified nonpoint sources of pollutants impairing ILOK01 as coming from non-irrigated rowcrop production. Land use data indicates 51 percent of the watershed is used for agriculture. In this area of Illinois, rowcrop production is primarily corn and soybeans, although some small grains are farmed (INHS *et al.* 1996). Another 27 percent of the land area is grassland, a large measure of which is pasture, another possible source of nonpoint source pollution.

In addition to sheet and rill erosion from fields, probable sources of suspended solids include gully erosion, and stream bed and bank erosion; no data are currently available to assess the significance of these sources. We recommend that the Agency obtain data sufficient to estimate gully, bank, and stream bed erosion.

4.2.1 Model Selection

Quantitative assessment of nonpoint loads will be performed using a model. Application of a watershed and/or water quality model is typically required as part of TMDL development, in order to define allowable loads that will lead to attainment of water quality standards and designated uses. For this TMDL, the modeling objectives include:

1. Consistency with other applications
2. Acceptability to Stakeholders
3. Model Constituents. TMDL development in this targeted watershed is limited to total suspended solids, an indictor of siltation.
4. Spatial Scale
5. Time Scale
6. Forecasting Capability. The watershed/water quality model must be suitable for forecasting the effects of different levels of treatment processes and watershed management practices on water quality.
7. Model Reliability

U.S. EPA's (1997) *Compendium of Tools for Watershed Assessment and TMDL Development* divides watershed models into three categories:

1. Simple methods (*e.g.,* EPA Simple Method)
2. Mid-range models (*e.g*., Generalized Watershed Loading Functions)
3. Detailed models (*e.g*., Hydrologic Simulation Program - HSPF)

The simple models typically predict annual loadings of pollutants to a waterbody, based upon empirical loading factors corresponding to watershed characteristics. Mid-range models are also typically based on empirical loading factors, but can provide greater temporal resolution (i.e., continuous simulation) and include site-specific runoff concentration data. Detailed models take a rigorous mechanistic approach to calculate loads, and predict pollutant accumulation and washoff rates, fate, and transport. Model selection should consider:

- Site specific characteristics
- Management objectives
- Available resources

Site-specific features of relevance for selecting a watershed model include the constituents of interest (solids) and the nature of land use (mixture of urban, agriculture, grassland, and forest). Additional objectives relevant to model selection include predicting loads during specific events, such as the 1-in-10-year storm. Available resources include field data for the waterbody and the time available to devote to the assessments. Limited watershed data exist.

The effort to appropriately apply a rigorous watershed model would require several years of data collection and analysis. Because of the desire to have a management tool developed in a short time frame and with relatively limited data, it was recognized that a high level of complexity for the watershed model would not be suitable for this study. Simple and mid-range methods were considered for the TMDLs. The available watershed models are summarized in Exhibit 15.

The EPA screening procedures (Mills *et al*. 1985) are recommended as an appropriate simple modeling approach for simulating TSS loads in ILOK01. This approach predicts siltation effects using the Universal Soil Loss Equation (USLE) and runoff curve number procedure. The AGNPS model was also considered, but would require the additional use of screening procedures for the urban loads. Other models that were considered are listed below, with the reason(s) they were discounted.

Model	Reason for Rejection
Simple Method	Urban areas only
Regression	Mainly for urban areas
SLOSS-PHOSPH	Annual loads only, not event-based; no urban capabilities
Watershed	Annual loads only, not event-based
FHWA	Designed for highways; no sediment capability
WMM	Annual loads only, no erosion/sediment capability
SITEMAP	Designed for retention basins/wetlands; no sediment capability
GWLF	Continuous simulation only, no single event capability
P8-UCM	Urban only
Auto-QI	Continuous simulation only; no rural capabilities
AGNPS	Agricultural/rural only (no urban)
SLAMM	Continuous simulation only; no rural capabilities

U.S. EPA's (1997) *Compendium of Tools for Watershed Assessment and TMDL Development* recognizes limitations of the EPA screening procedures and other models. The simplicity of the EPA screening procedures approach offers advantages over more complex computational procedures in cases where data and resources are limiting. As elaborated upon by Freedman (2002), a model need only be sufficiently accurate to support a decision, in our case, to estimate the TMDL. Ideally, complex models provide more accuracy and reliability, but inadequate resources necessitate shortcuts, compromises, poor attention to detail, and limited analyses, often leading to an increase in uncertainty in model predictions (Freedman 2002).

The set of water quality models considered were those described in USEPA (1997). This document lists 20 receiving water models, divided into hydrodynamic, steady-state, and dynamic categories. Based on the desire for event-based evaluations identified in the management objectives, as well as resource constraints, candidate models were limited to the steady-state water quality models. Complex dynamic models provide much finer temporal and spatial resolution and simulate more parameters than required by the management objectives. The cost for this resolution is more complicated model set-up and more detailed model inputs. For these reasons, the dynamic models were not considered suitable for this project. The basic features of the steady-state models are summarized in Exhibit 16.

Limiting the steady-state models under consideration to those suitable for the site-specific characteristics (siltation assessment in rivers and streams) results in the following list of models:

- EPA Screening Procedures
- QUAL2E

The EPA Screening Procedures are simplified methodologies that allow preliminary assessment of conventional and toxic pollutants in rivers, impoundments, and estuaries. QUAL2E (Brown and Barnwell 1987) is a one-dimensional water quality model that assumes steady-state flow but allows simulation of diurnal variations for dissolved oxygen modeling. Given that siltation is the only constituent undergoing TMDL development in ILOK01, the Screening Procedures are sufficient for the evaluation. Use of a more rigorous model such as QUAL2E is unnecessary and does not significantly increase the accuracy or decrease the uncertainty of model predictions.

4.2.2 Selection of Critical Periods

The traditional procedure for water quality modeling on a watershed basis consists of either a continuous simulation or "critical condition" approach. Continuous simulation provides rigorous results, but is often too data and resource intensive to apply on a watershed basis. Statistically-selected critical environmental conditions (e.g. drought stream flows, design storms) are more easily applied. In this method, water quality evaluations are targeted to protect water quality during some critical period (typically low flow for point sources and high rainfall for nonpoint sources), under the assumption that these controls will be sufficient for most other periods.

For this TMDL, data are too sparse to set up continuous model simulations. We therefore relied on modeling a set of critical conditions. Two high flow events are to be analyzed. A storm with a recurrence interval of 1-in-3 years will be the basis for the TMDL due to its relationship to the 305(b) assessment guideline used as our endpoint. As part of our uncertainty analysis, we have also opted to evaluate a storm with a recurrence interval of 10 years. Further to uncertainty analysis, three different storm durations are being evaluated: 12-hour duration, 24-hour duration and 72-hour duration. The 305(b) assessment guidelines reflect a time scale of once in three years for exceedances at AWQMN stations. Low flow conditions will not be modeled because the point sources are not expected to contribute significantly to siltation in the impaired segment.

4.2.3 Watershed Model Development

Sediment loadings to the East Fork Kaskaskia River were computed for the study area using the EPA's Simple Method for Watershed Sediment Yield. This technique uses data for rainfall, land uses, and soil types in the subwatersheds to estimate soil erosion (Mills *et al.* 1985). The subwatershed sediment yield, Y, due to surface erosion is estimated as:

$$Y = s_d \sum_k X_k A_k \qquad \text{Equation (1)}$$

where

- Y = sediment yield (tons)
- X_k = erosion from subwatershed k (tons/ha)
- A_k = area of subwatershed k (ha)
- s_d = subwatershed sediment delivery ratio

The s_d factor accounts for the attenuation of sediment through deposition and filtering as it travels from source areas to the watershed outlet. Erosion, X, from each subwatershed was estimated using the Universal Soil Loss Equation (USLE), an empirical equation designed to predict average soil loss from source areas (Equation 2).

$$X = 1.29(E)(K)(ls)(C)(P) \qquad \text{Equation (2)}$$

where

X = soil loss (tons/ha)
E[1] = rainfall/runoff erosivity index (100 m-ton-cm/ha-hr)
K = soil erodibility (tons/ha per unit of E)
ls = topographic factor
C = cover/management factor
P = supporting practice factor

The Revised Universal Soil Loss Equation or RUSLE is a similar tool used to estimate soil loss. We contacted the developers of RUSLE and were advised that it should not be used to estimate erosion due to individual storms nor from a particular year of weather and related factors (NRCS no date 2). Soil loss estimates from USLE are consistent with those calculated by the RUSLE when comparing 206 natural runoff plots representing a broad range of conditions (Rapp *et al.* 2001).

The erosivity term, E, reflects rainfall intensity, among other things. Expected magnitudes of single-storm erosivity indices are presented in Wischmeier and Smith (1978). Erosivity values for the East Fork Kaskaskia River watershed were interpolated between two stations in Illinois (Cairo and Springfield). For a 1-year storm, the erosivity is 65 (10^2 m-ton-cm/ha-hr) in this area. For the 3-year storm, the erosivity is 118 (10^2 m-ton-cm/ha-hr). For the 10-year storm, the erosivity is 199 (10^2 m-ton-cm/ha-hr).

We consulted with the Marion County Soil and Water Conservation District for selection of K, ls, and C values. Soil erodibility, or "K," values are a function of soil texture and organic content. The topographic factor, ls, is related to slope angle and slope length. Soil type was identified for each subwatershed using the STATSGO database. Corresponding K and ls values are tabulated in Table 14 derived from information provided by the Marion County SWCD. No information on K or ls values is available at the soil association level. Therefore, k and ls values for each soil type in a soil association are calculated based on a weighting formula that accounts for the relative amount of each soil type in Marion County.

[1] E is also identified as R in some publications

Table 14

SOIL ERODIBILITY "K" AND TOPOGRAPHIC FACTOR "ls"
(Sources: STATSGO Database and Marion County SWCD)

Soil Type	Soil ID	K Value	ls Value
Cisne-Hoyleton-Darmstadt	IL 006	0.41	0.35
Bluford-Ava-Hickory	IL 038	0.37	1.43

The cover/management, or C, factor is a measure of the protection of the soil surface by plant canopy, crops, and mulches. A C value of 1.0 corresponds to no protection, while a value of 0.0 corresponds to total protection. Published C values were selected from Wischmeier and Smith (1978) based on the land use type. No published values for urban lands are available. Urban areas tend to be hardened and stabilized; the practice in the industry is to set the C value equal to zero (Wischmeier and Smith 1978). Since the watershed is less than 0.6 percent urban, this does not significantly increase uncertainty. The Marion County SWCD provided C factors for agricultural lands (Table 15). These row-crop agriculture C factors reflect a corn-soybean crop rotation, which predominates in this watershed (Marion County SWCD).

Table 15

AGRICULTURAL C FACTORS
(Source: Marion County SWCD)

Land Cover	C Factor
Row Crop Agriculture (Conventional Tillage)	0.27
Row Crop Agriculture (Conservation Tillage)	0.14
Grassland/Conservation Reserve Program	0.02

The East Fork Kaskaskia River watershed includes 81,060 acres in Clinton, Marion, and Fayette counties (Table 16).

Table 16

WATERSHED AREA BY COUNTY
(Source: Watershed Delineation GIS provided by IEPA)

County	Watershed Area (acres)	Percent of Watershed
Clinton	5,430	6.7
Marion	59,175	73
Fayette	16,455	20.3
Total	81,060	100

Data on conventional tillage (0-30 percent residue) versus conservation tillage (>30 percent residue) is not available on a subwatershed basis. It is available at the county level from the Statewide Soil Conservation Transect Survey that was conducted in the spring and early summer of 2000. The Transect Survey indicates the status of soil conservation efforts. Survey teams in each county collect information on tillage systems and crop residue amounts at over 50,000 points across the state. Tables 17, 18, and 19 show the distribution of conventional and conservation tillage and crop residues for Marion, Fayette, and Clinton counties for 1995 and 2000. We opted to utilize the 1995 data from these tables to develop the watershed loadings model so that crop residue information was consistent with the dates for the land use/land cover and water quality data.

Table 17

MARION COUNTY TILLAGE AND RESIDUE INFORMATION (acres)
(Source: Transect Data, Illinois Department of Agriculture)

Tillage System	Corn	Soybeans	Small grains	Residue Level	Corn	Soybeans	Small grains
1995 Tillage				**1995 Crop Residues**			
Conventional	23,959	28,678	22,507	**0-15%**	23,959	29,041	22,507
Reduced-till	2,178	27,226	6,171	**16-30%**	2,178	26,863	6,171
Mulch-till	0	2,178	2,904	**>30%**	10,527	33,034	9,801
No-till	10,527	30,856	6,897	**NA**	0	0	0
N/A	0	0	0	**Unknown**	0	0	0
Unknown	0	0	0				
Total	36,664	88,937	38,479		36,664	88,937	38,479
2000 Tillage				**2000 Crop Residues**			
Conventional	42,270	24,544	9,545	**0-15%**	41,815	24,544	9,545
Reduced-till	5,909	18,635	455	**16-30%**	5,909	18,635	455
Mulch-till	2,727	7,727	2,273	**>30%**	24,998	55,905	11,817
No-till	21,817	48,179	9,545	**NA**	0	0	0
N/A	0	0	0	**Unknown**	0	0	0
Unknown	0	0	0				
Total	72,722	99,084	21,817		72,722	99,084	21,817

Table 18

FAYETTE COUNTY TILLAGE AND RESIDUE INFORMATION

(Source: Transect Data, Illinois Department of Agriculture)

Tillage System	Corn	Soybeans	Small grains	Residue Level	Corn	Soybeans	Small grains
1995 Tillage				**1995 Crop Residues**			
Conventional	49,847	33,800	0	**0-15%**	49,847	34,141	0
Reduced-till	10,242	27,655	44,384	**16-30%**	10,242	27,313	44,725
Mulch-till	6,828	21,851	10,584	**>30%**	13,998	49,164	11,950
No-till	7,170	26,972	1,366	**NA**	0	0	0
N/A	0	0	0	**Unknown**	0	0	0
Unknown	0	341	341				
Total	74,087	110,618	56,675		74,087	110,618	56,675
2000 Tillage				**2000 Crop Residues**			
Conventional	79,045	39,314	1,255	**0-15%**	79,882	39,314	1,255
Reduced-till	2,928	6,692	1,673	**16-30%**	2,928	6,692	1,673
Mulch-till	4,182	39,314	18,402	**>30%**	15,893	97,029	33,040
No-till	11,710	57,716	14,638	**NA**	0	0	0
N/A	0	0	0	**Unknown**	0	0	0
Unknown	836	0	0				
Total	98,702	143,034	35,968		98,702	143,034	35,968

Table 19

CLINTON COUNTY TILLAGE AND RESIDUE INFORMATION
(Source: Transect Data, Illinois Department of Agriculture)

Tillage System	Corn	Soybeans	Small grains	Residue Level	Corn	Soybeans	Small grains
1995 Tillage				**1995 Crop Residues**			
Conventional	13,858	10,505	7,823	**0-15%**	13,858	10,505	7,823
Reduced-till	25,928	24,364	11,623	**16-30%**	26,152	25,481	12,741
Mulch-till	15,423	14,529	9,388	**>30%**	26,152	32,187	27,940
No-till	10,952	18,776	19,446	**NA**	0	0	0
N/A	0	0	224	**Unknown**	0	0	0
Unknown	0	0	0				
Total	66,162	68,173	48,504		66,162	68,173	48,504
2000 Tillage				**2000 Crop Residues**			
Conventional	55,695	26,271	3,503	**0-15%**	55,695	25,921	3,503
Reduced-till	4,904	3,853	0	**16-30%**	5,254	4,203	0
Mulch-till	12,960	16,814	30,124	**>30%**	27,672	53,243	47,638
No-till	15,062	36,429	17,514	**NA**	0	0	0
N/A	0	0	0	**Unknown**	0	0	0
Unknown	0	0	0				
Total	88,621	83,367	51,141		88,621	83,367	51,141

Table 20 summarizes tillage systems and crop residue on the fields for the years 1995 and 2000.

Table 20

SUMMARY OF CONVENTIONAL AND CONSERVATION TILLAGE
(Source: Transect Data, Illinois USDA)

County	2000		1995	
	Conventional Tillage (%)	Conservation Tillage (%)	Conventional Tillage (%)	Conservation Tillage (%)
Clinton	53.0	47.0	56.6	43.4
Fayette	53.3	46.7	65.8	34.1
Marion	52.9	47.1	65.3	34.7

We calculated an overall watershed weighted C factor for agricultural row crop land from these estimates of cover factors for conventional and conservation tillage (Table 15), the area of watershed in each county (Table 16), and the number of acres of conventional and conservation tillage in each county (Tables 17 through 20). We used 1995 crop residue and land use conditions. The weighted C factor for agriculture-row crop is 0.22. Table 21 presents the cover factors for all land use/land cover types in the watershed. The Marion County SWCD provided fall and spring average C factors for agricultural row crop land. As acres in the spring are subsequently planted, and fall acres are not, C factors are higher in fall than in spring.

Table 21

C VALUES FOR LAND USES IN THE TARGET WATERSHED – FALL SEASON
(Source: Wischmeier and Smith, 1978, except as noted in text)

Land Use	**C Value**
Urban - High Density	0
Urban – Medium Density	0
Agriculture - Row Crop	0.22
Agriculture - Small Grains	0.055
Agriculture - Orchards/Nurseries	0.055
Urban Grassland	0.055
Rural Grassland	0.02
Forested - Deciduous: Closed Canopy	0.004
Forested - Deciduous: Open Canopy	0.004
Water	0
Shallow Marsh/Wet Meadow	0.055
Deep Marsh	0.055
Forested Wetland	0.004
Shallow Water Wetland	0.055

Table 22

AVERAGE SUBWATERSHED C FACTORS – FALL SEASON

Subwatershed	Average C Factor
OK 01	0.104
OK 02	0.074
OK 03	0.149
OKB	0.101
OKBA	0.136
OKC	0.069
OKCA	0.058
OKD	0.068
OKE	0.164
OKF	0.148
OKG	0.070

The supporting practice factor P is a measure of the effect of traditional soil conservation practices on erosion from agricultural fields. Watershed-wide information on conservation practices has been difficult to obtain. The data we have been able to collect on conservation practices have been incorporated into the cover factor, as discussed above. Our approach is to set P equal to 1.0, corresponding to no conservation practices, and serving as a “worst case” scenario.

Soil loss estimates for 1-, 3- and 10-year storms using the above described techniques are presented in Table 23. Computation details for each subwatershed are reprinted in Appendix B. These data reflect the fall season, which is the season with the highest relative soil loss. Table 24 provides estimates of areal soil loss. Subwatershed OK 01 has the highest areal soil loss followed by subwatersheds OKD, OKBA, OK 03, and OKE.

Table 23
SUBWATERSHED SOIL LOSS (in tons) – FALL SEASON

Subwatershed	Area (acres)	1-Year Storm	3-Year Storm	10-Year Storm
OK 01	13,121	6,894	12,516	21,107
OK 02	18,325	6,344	11,518	19,424
OK 03	11,677	5,121	9,297	15,678
OKB	8,344	3,015	5,474	9,232
OKBA	2,087	962	1,747	2,946
OKC	5,754	1,872	3,398	5,731
OKCA	1,729	265	482	813
OKD	650	310	562	948
OKE	11,937	5,016	9,105	15,356
OKF	4,011	967	1,755	2,959
OKG	3,425	868	1,576	2,657
Total	81,060	31,634	57,430	96,851

Table 24
SUBWATERSHED AREAL SOIL LOSS (in tons/acre) – FALL SEASON

Subwatershed	Area (acres)	1-Year Storm	3-Year Storm	10-Year Storm
OK 01	13,121	0.525	0.954	1.609
OK 02	18,325	0.346	0.629	1.060
OK 03	11,677	0.439	0.796	1.343
OKB	8,344	0.361	0.656	1.106
OKBA	2,087	0.461	0.837	1.412
OKC	5,754	0.325	0.591	0.996
OKCA	1,729	0.153	0.279	0.470
OKD	650	0.476	0.865	1.458
OKE	11,937	0.420	0.763	1.286
OKF	4,011	0.241	0.437	0.738
OKG	3,425	0.253	0.460	0.738

5.0 WATER QUALITY ANALYSIS

Chapter 5 discusses the development and calibration of a water quality model for the target waterbody, a prerequisite for developing the TMDL.

5.1 Water Quality Model Development

For each subwatershed, total runoff volume was calculated using the Soil Conservation Service[2] (SCS) Rainfall-Runoff Method (SCS 1972). The volume of runoff (Q) depends on the volume of precipitation (P) and the volume of storage (S) that is available for retention. A certain volume of precipitation at the beginning of a storm, the initial abstraction (I_a), will not appear as runoff. The SCS Method involves the following equation to calculate runoff:

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S} \qquad \text{Equation (3)}$$

Initial abstraction (I_a) is a function of land use, treatment, and condition; interception; infiltration; depression storage; and antecedent soil moisture (SCS 1972). An empirical equation was developed by the SCS for estimating I_a:

$$I_a = 0.2S \qquad \text{Equation (4)}$$

where:

$$S = \frac{1000}{CN} - 10 \qquad \text{Equation (5)}$$

Runoff curve numbers (CN) are provided by the SCS Method for different land uses and cover types; separate values are provided for four hydrologic soil groups. Published curve number values were selected from McCuen (1982) based on land use type, antecedent soil moisture condition II (average soil moisture conditions), and hydrologic soil group classification C (indicative of the watershed). Table 25 presents the CN values chosen to represent the target watershed, ILOK01.

[2] Now known as the Natural Resources Conservation Service

Table 25

SUMMARY OF CURVE NUMBERS BASED ON LAND USE TYPE
(Source: McCuen 1982)

Land Use	Curve Number	Basis of Estimate
Urban-High Density	83	¼ acre residential lot
Urban-Medium Density	80	½ acre residential lot
Agriculture-Row Crop	85	Cultivated land without conservation treatment
Agriculture-Small Grains	83	Small grain, straight row, good condition
Agriculture-Orchards/Nurseries	71	Meadow
Urban Grassland	74	Open spaces, good condition
Rural Grassland	79	Open spaces, fair condition
Forested-Deciduous: Closed Canopy	70	Woods, good condition
Forested-Deciduous: Open Canopy	73	Woods, fair condition
Water	0	
Shallow Marsh/ Wet Meadow	86	Pasture, poor condition
Deep Marsh	0	
Forested Wetland	77	Woods, poor condition
Shallow Water Wetland	0	

Combining Equations 3 and 4 results in the following equation used to calculate runoff volume:

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)} \qquad \text{Equation (6)}$$

One-, 3- and 10-year event storm precipitation data for multiple storm durations are presented in Table 26. These data, for Zone 9 in Illinois, are applicable for the East Fork Kaskaskia River watershed.

Table 26

RAINFALL (INCHES) FOR MULTIPLE RETURN PERIODS AND DURATIONS
(Source: Huff and Angel 1992)

Duration	**1 yr**	**2 yr**	**3 yr[1]**	**5 yr**	**10 yr**	**25 yr**	**50 yr**	**100 yr**
10 days	4.75	5.74	6.18	7.09	8.07	9.54	10.68	11.79
5 days	3.75	4.48	4.89	5.57	6.5	7.91	9.16	10.57
3 days	3.27	3.92	4.3	4.92	5.75	7.05	8.23	9.4
2 days	3	3.6	3.95	4.52	5.28	6.48	7.58	8.62
24 hours	2.62	3.16	3.47	4	4.62	5.79	6.71	7.73
18 hours	2.41	2.91	3.19	3.68	4.25	5.33	6.17	7.11
12 hours	2.28	2.75	3.02	3.48	4.02	5.04	5.84	6.72
6 hours	1.97	2.37	2.6	3	3.47	4.34	5.03	5.8
3 hours	1.68	2.02	2.22	2.56	2.96	3.71	4.29	4.95
2 hours	1.55	1.85	1.92	2.36	2.72	3.41	3.96	4.56
1 hours	1.23	1.49	1.63	1.88	2.2	2.72	3.15	3.63
30 min.	0.97	1.17	1.28	1.47	1.73	2.14	2.48	2.86
15 min.	0.71	0.85	0.94	1.08	1.25	1.56	1.81	2.09
10 min.	0.58	0.7	0.77	0.88	1.02	1.27	1.48	1.7
5 min.	0.32	0.38	0.42	0.48	0.55	0.69	0.81	0.93

1 Note: Data for the three-year return period were interpolated.

Runoff varies not only with the amount of precipitation but with the duration of the storm. To account for this, our water quality model includes an analysis of the effect of storm duration on pollutant loads and concentrations. To aid selection of storm duration for this TMDL, we examined the work of Huff (1967). This researcher investigated time distributions for 261 storms over the 12-year period 1955-1966 from a 400-square-mile network of 49 recording rain gages in east-central Illinois. Among the 261 storms, 42 percent had durations less than or equal to 12 hours, 33 percent lasted from 12.1 to 24 hours, and 25 percent had durations exceeding 24 hours. The analysis included the effect on water quality of storm durations of 12 hours, 24 hours, and 72 hours. Hence, we are examining the water quality conditions of nine hydrologic events (Table 27).

Table 27

RAINFALL (INCHES) FOR SELECT RETURN PERIODS
(Source: Huff and Angel, 1992)

Return Period (years)	Precipitation (inches)		
	12-hr duration	24-hr duration	72-hr duration
1	2.28	2.62	3.27
3	3.02	3.47	4.3
10	4.02	4.62	5.75

Given the precipitation shown in Table 27, we used Equation 6 to derive runoff volumes for these nine storms for each subwatershed (Table 28).

Table 28

SUMMARY OF RUNOFF VOLUMES

Subwatershed	Discharge (ac-ft)								
	1-Year Return Period			3-Year Return Period			10-Year Return Period		
	12 hr	24 hr	72 hr	12 hr	24 hr	72 hr	12 hr	24 hr	72 hr
OK 01	803	1,056	1,582	1,374	1,753	2,494	2,239	2,791	3,875
OK 02	1,017	1,354	2,061	1,780	2,291	3,298	2,951	3,703	5,187
OK 03	839	1,083	1,582	1,386	1,742	2,432	2,195	2,706	3,700
OKB	488	645	974	844	1,081	1,546	1,386	1,733	2,416
OKBA	137	179	265	231	293	413	372	461	636
OKC	295	397	611	526	682	991	884	1,115	1,574
OKCA	92	123	188	162	209	303	271	341	480
OKD	35	47	72	62	80	115	103	130	182
OKE	896	1,150	1,669	1,465	1,835	2,548	2,304	2,831	3,855
OKF	291	375	547	479	602	840	758	934	1,276
OKG	177	238	367	316	409	593	529	668	941

5.2 Model Calibration

TSS concentration in our analysis is computed as the quotient of sediment yield (mass) and runoff volume. For this analysis, sediment yield, per Equation 1, can be calibrated using an empirical model specific for ILOK01. A 24-hour, 1-year event was selected for calibration of this water quality predictor because the available dataset had a maximum measured flow of 1,260 cfs, lower than the estimated 3-year event. Return periods of various storm events, and their corresponding discharges, were presented in Table 5. In analyzing water quality data, we found a statistically significant correlation between TSS concentrations and discharge (*Q*) at OK 01 (R^2=0.611, P<0.001). The regression allows TSS concentration, *C*, to be estimated (Equation 7). The standard error associated with this estimate is ± 39.7.

$$C = 0.247Q + 26.9 \qquad \text{Equation (7)}$$

Using Equation 7, TSS concentration during a 24-hr, 1-year storm flow is estimated to be 210 mg/L ± 40 mg/L.

There are two variables in the EPA screening procedures that were used to calibrate the empirical model to measured data. These two variables were the topographic factor (ls) in estimating soil loss (Equation 2), and the sediment delivery ratio (S_d) used to estimate sediment yield (Equation 1). The length slope varies widely, depending on soil type, as shown in Table 29. The sediment delivery ratio is a simple function of watershed drainage area. The ls and S_d values were calibrated for the 24-hour 1-year storm flow to match a TSS concentration at OK 01 of 210 mg/L. Calibrated values for ls and S_d are tabulated below (Tables 29 and 30). Using these values of ls and S_d, the calibrated model was then used to estimate TSS concentrations for other storm frequencies and durations.

Table 29

LENGTH SLOPE (ls) CALIBRATION VARIABLES

Soil Type	Soil ID	ls Range	Weighted ls	Calibrated ls
Cisne-Hoyleton-Darmstadt	IL006	0.12-2.2	0.35	0.12
Bluford-Ava-Hickory	IL038	0.13-12.5	1.43	0.5

Table 30

SEDIMENT DELIVERY RATIO CALIBRATION
(Source of initial values: Wischemeir and Smith 1978)

Sediment Delivery Ratio (S_d)	Initial Value	Calibrated Value
OK 01	0.19	0.057
OK 02	0.19	0.057
OK 03	0.18	0.054
OKB	0.20	0.075
OKBA	0.25	0.060
OKC	0.24	0.093
OKCA	0.31	0.072
OKD	0.35	0.105
OKE	0.17	0.051
OKF	0.22	0.066
OKG	0.20	0.060

Multiplying the subwatershed soil losses (Table 23) by the sediment delivery ratios provides an estimate of sediment yield (Table 31), that is, the quantity of sediment delivered to the stream.

Table 31

SUBWATERSHED SEDIMENT YIELDS (in tons) – FALL SEASON

Subwatershed	Area (acres)	1-Year Storm	3-Year Storm	10-Year Storm
OK 01	13,121	393	713	1,203
OK 02	18,325	362	656	1,107
OK 03	11,677	277	502	847
OKB	8,344	181	328	554
OKBA	2,087	72	131	221
OKC	5,754	135	245	413
OKCA	1,729	25	45	76
OKD	650	33	59	100
OKE	11,937	256	464	783
OKF	4,011	64	116	195
OKG	3,425	52	95	159
Totals	81,060	1,850	3,354	5,658

Estimates of areal sediment yield for each subwatershed are presented in Table 32. The highest areal sediment yield is predicted for OKD, followed by OKBA and OK 01. Computational details for these estimates are reprinted in Appendix B.

Table 32

SUBWATERSHED AREAL SEDIMENT YIELDS (in tons/acre)
– FALL SEASON

Subwatershed	Area (acres)	1-Year Storm	3-Year Storm	10-Year Storm
OK 01	13,121	0.030	0.054	0.092
OK 02	18,325	0.020	0.036	0.060
OK 03	11,677	0.024	0.043	0.073
OKB	8,344	0.022	0.039	0.066
OKBA	2,087	0.035	0.063	0.106
OKC	5,754	0.023	0.043	0.072
OKCA	1,729	0.014	0.026	0.044
OKD	650	0.050	0.091	0.153
OKE	11,937	0.021	0.039	0.066
OKF	4,011	0.016	0.029	0.049
OKG	3,425	0.015	0.028	0.047

5.3 Water Quality Model Results

The reader is referred to Appendices B and C for computational details on runoff, sediment yield and TSS concentrations for each subwatershed for various storm return periods. TSS concentrations for each subwatershed, computed as the quotient of sediment yield (mass) and runoff volume, are shown in Table 33. These values reflect only a specific subwatershed (*i.e.* TSS concentrations in Table 33 are not cumulative). The concentration of TSS at any point must be estimated as the flow-weighted mean of the concentrations of upstream contributing areas.

Table 33

MODELED SUBWATERSHED TSS CONCENTRATIONS

Subwatershed	TSS Concentration (mg/L)								
	1-Year Return Period			3-Year Return Period			10-Year Return Period		
	12 hr	24 hr	72 hr	12 hr	24 hr	72 hr	12 hr	24 hr	72 hr
OK 01	397	302	201	421	330	232	436	349	252
OK 02	288	217	142	299	232	161	305	242	173
OK 03	267	207	142	294	234	167	313	254	186
OKB	301	227	151	315	246	172	324	259	186
OKBA	426	327	221	460	363	257	482	388	282
OKC	370	276	179	377	291	200	379	300	213
OKCA	219	163	106	224	173	120	226	180	128
OKD	749	561	367	772	598	415	782	622	443
OKE	231	180	124	257	205	148	276	224	165
OKF	178	138	95	196	157	112	209	170	124
OKG	238	177	115	243	187	129	244	194	137

The concentration of TSS entering subwatershed OK 01 was calculated as the flow-weighted mean of the concentrations of the upstream subwatersheds. Results are given in Table 34. The average TSS concentration for a 3-year, 24-hour storm at sample location OK 01 is approximately 232 mg/L. Additional data are presented for eight other storms in Table 34.

Table 34

ESTIMATED TSS CONCENTRATIONS (mg/L) AT OK 01

Duration	1-Yr Return Period	3-Yr Return Period	10-Yr Return Period
12 hr	276	295	307
24 hr	211	232	247
72 hr	142	164	178

Because of the large flow during these storms, the computations are based on all eroded material being transported down the river with no significant deposition during the storm. Deposition would occur after the storm peak, with declining stream discharge and velocities.

Known point sources are the three small aerated lagoons located in the upper reaches of the watersheds, which are controlled by a NPDES permit. Maximum TSS waste loads for these facilities are found in Table 13. When compared with sediment loads from a 1-year storm, the point sources contribute less than 0.009 percent of the total TSS load in the watershed and these point sources are negligible when compared with agricultural runoff.

5.4 Seasonal Variations

The EPA screening procedures siltation model is based upon several factors that vary seasonally. Among the seasonally variable factors are C, the cover factor, and E, the rainfall/erosivity index. The cover factor**,** C, is the ratio of soil loss under the conditions in question to that which would occur under continuously bare soil. Clearly C will vary during the growing season as foliage develops and is harvested or dies back, and soil roughness, moisture and plant residue changes. During summer, foliage flourishes and is most dense. During summer, the plants intercept the highest proportion of precipitation and seasonally protect soil to a greater extent than other seasons. During winter, the soil is typically frozen, snow covered, or precipitation is snow, so winter is not particularly the season most susceptible to soil erosion. Spring and fall therefore tend to be the seasons most sensitive to erosion, as fields tend to be newly plowed or harvested. The Marion County SWCD provided fall (Tables 21 and 22) and spring (Table 35) average C factors for agricultural row crop land. The fall C factors are higher because of the tendency of farmers to turn ground after a crop has been harvested. Following spring tillage, the land is subsequently planted, and C factors are lower.

Table 35

C VALUES FOR LAND USES IN ILOK01 – SPRING SEASON

Land Use	C Value
Urban - High Density	0
Urban – Medium Density	0
Agriculture - Row Crop	0.19
Agriculture - Small Grains	0.055
Agriculture - Orchards/Nurseries	0.055
Urban Grassland	0.055
Rural Grassland	0.02
Forested - Deciduous: Closed Canopy	0.004
Forested - Deciduous: Open Canopy	0.004
Water	0
Shallow Marsh/Wet Meadow	0.055
Deep Marsh	0.055
Forested Wetland	0.004
Shallow Water Wetland	0.055

Rain in ILOK01 is not particularly seasonal. Huff and Angel (1992) examined seasonal distribution of rainfall by examining the records of 275 weather stations in Midwestern states. Table 36 compares seasonal statistics for precipitation in Illinois and Indiana. While winter is notably the driest season, and summer the wettest, rain is fairly evenly distributed among spring and fall (Table 36). Huff and Angel's seasonal rainfall frequency curves for the weather station nearest the target watershed (Rockville, IN) show nearly identical precipitation amounts for spring and fall storms of similar recurrence intervals. About two-thirds of the most severe 1-day storms occur in summer. The erosive effects of these severe storms are mitigated by dense vegetative cover on the land.

Table 36

SEASONAL RAINFALL DISTRIBUTION
(Source: Huff and Angel, 1992)

Season	Annual Contribution		Top-Ranked 1-Day Storms	
	Illinois Average	Indiana Average	Illinois	Indiana
Winter	16.7%	18.8%	3.3%	2.4%
Spring	29.1%	28.9%	20.0%	17.1%
Summer	29.8%	29.1%	65.0%	63.4%
Autumn	24.3%	24.3%	11.7%	17.1%

5.5 Background Concentrations

Background is defined as those loads that represent a baseline or minimum level of water pollution which are natural and can not be eliminated by local or area-wide water quality management (Mills *et. al.* 1985). Background concentrations of suspended sediment for southern Illinois are between 20 and 50 mg/L (McElroy *et al.* 1976). Comparing these background TSS concentrations with the 3- and 10-year storm TSS concentrations estimated by the model suggests that background concentrations account for between 7 percent and 30 percent of the estimated TSS concentration.

5.6 Uncertainty

We have attempted to minimize uncertainty in this modeling task by modeling multiple storm event durations and frequencies, comparison of our results with the scientific literature and making conservative assumptions across all parameters. Uncertainty in these findings originated from the following:

- Empirical equations used to estimate runoff and sediment yield
- Model prediction is outside of the range of available calibration data
- Empirical calibration regression with a standard error of ±40 mg/L (about 20 percent)

- Hydrologic parameter estimation, such as curve numbers, vegetative cover factors, etc.
- Use of specific storm return periods and durations to represent the range of critical periods
- Lack of data to accurately estimate the 1-year flow in the East Fork Kaskaskia River
- Lack of watershed specific information regarding the significance of gully erosion, streambed erosion and bank erosion

Our evaluations included an analysis of variable storm duration and return period (Table 34). In comparison to the TMDL design storm (24-hr, 1-in-3 year event) the more intense 12-hour storm increases TSS concentrations about 27 percent, and the less intense 72-hour storm decreases TSS concentrations by about 29 percent. The ten-year storm results in TSS concentrations 4 to 8 percent higher than three-year storms of similar duration, and 11 to 25 percent higher than one-year storms.

TMDL allocations include a margin of safety (MOS), a factor that intends to account for, among other things, uncertainties associated with modeling and measurements. The MOS is discussed in the following chapter.

6.0 TMDL

The pollutant allocation, or TMDL, is composed of the sum of waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, natural background levels, and a margin of safety (MOS). The MOS is required to account for major uncertainties concerning the relationship between pollutant loads and instream water quality, and for urban growth and development. There is also a factor reflecting seasonal variations (SV) in the TMDL equation:

$$TMDL = \sum WLAs + \sum LAs + MOS + SV \qquad \text{Equation (8)}$$

In ILOK01, pollutant allocation is required to identify the maximum allowable loads from nonpoint sources that are necessary to meet the water quality endpoint. For this TMDL, the endpoint is the 305(b) assessment guidelines for siltation (IEPA 2000a): TSS concentration less than 116 mg/L, and, less than 34 percent of substrate being silt/mud. OK 01 meets the second of these guidelines, but fails the first, as described in Chapter 4.

Discharges from all studied storm events yield TSS concentrations greater than the target concentration of 116 mg/L once in three years. In order for TSS concentrations in the subwatershed OK 01 to be within the target concentrations of 116 mg/L, loads need to be reduced by:

- 18 to 58 percent, depending on storm duration, for 1-year return periods
- 29 to 61 percent, depending on duration, for 3-year return periods
- 35 to 62 percent, depending on duration, for 10-year return periods

The water quality model developed for this target watershed predicts TSS concentrations for the fall season. Fall is expected to have TSS concentrations approximately 10 percent higher than in spring. Therefore, the results presented are for a worst-case scenario. Additionally, background concentrations account for 15 percent of the TSS concentration. As shown in the subwatershed TSS concentration estimates (Table 33), TSS entering subwatershed OK 01 already exceed the TSS target concentration. TSS loads from subwatershed OK 01 increase TSS concentrations by approximately 5 percent.

The modeling results presented in Chapter 5 indicate that the entire East Fork Kaskaskia River watershed contributes a considerable amount of TSS to OK 01. Without addressing upstream TSS loads in larger storm events, it is not possible to lower TSS concentrations at OK 01 below the target concentration of 116 mg/L, as concentrations entering the subwatershed already exceed this value. Therefore, TMDL allocation will need to consider upstream sediment loadings.

For comparison, Table 37 presents results for TSS predictions if upstream contributing subwatersheds were in compliance with the 116 mg/L guideline.

Table 37

ESTIMATED TSS CONCENTRATIONS AT STATION OK 01 IF UPSTREAM CONTRIBUTING AREAS WERE MEETING TSS ENDPOINT

Storm Duration	TSS Concentration (mg/L)		
	1-yr Storm	3-yr Storm	10-yr Storm
12-hr	180	192	199
24-hr	137	151	160
72-hr	92	106	116

However, the compliance point for this TMDL is sampling station OK 01 and upstream contributing areas will need to be taken into consideration. Table 38 presents the TSS concentrations from nonpoint sources expected at sample station OK 01, as taken from Table 34, together with the required reductions in TSS concentrations in order to meet the water quality target concentration of 116 mg/L.

Table 38

ESTIMATED TSS CONCENTRATIONS AND REQUIRED REDUCTIONS AT STATION OK 01 DURING FALL

Storm Duration	TSS Concentration (mg/L)		
	1-yr Storm	3-yr Storm	10-yr Storm
12-hr	276 (58%)	295 (61%)	307 (62%)
24-hr	211 (45%)	232 (50%)	247 (53%)
72-hr	142 (18%)	164 (29%)	178 (35%)

Note: Values in parentheses represent the required reductions in TSS concentrations in order to meet the TMDL endpoint of 116 mg/L for that specific storm. Reductions assume upstream subwatersheds contribute TSS as described in Table 33.

Three small aerated lagoons located outside of the OK 01 watershed are regulated by NPDES permits that limit maximum daily effluent TSS concentrations to 45 mg/L. As discussed earlier, these waste loads are negligible compared to the loads associated with total nonpoint sources during events when the water quality endpoint is exceeded.

6.1 MOS / ALLOWANCE FOR INCREASE IN POLLUTANT LOADS

The Margin of Safety, MOS, can be incorporated into conservative assumptions (implicitly) or added as a separate, quantitative component (explicitly) of the TMDL (USEPA 1991). The MOS for this TMDL has been implicitly accounted for in conservative modeling approaches, including:

- The model accounts for 100 percent of sediment entering to be transported through the system (i.e., no deposition occurs).
- Use of the worst case season for allocation scenarios. The post-harvest fall season fields contain little vegetative cover to protect the soil and is the most likely time for large soil erosion events. This brings conservatism to the TSS estimates.
- Use of 1995 land use and conservation practice data that does not account for approximately five years of BMP implementation on agricultural land.

- Use of historical water quality data for model development and calibration that likewise does not account for agricultural BMPs installed after December 1998.

This implicit MOS is exemplified in our development of the watershed model using 1995 land cover and conservation tillage data. The most recent land cover data available reflects 1995 conditions, and we have therefore constructed and calibrated the model for that dataset. While we expect little changes in land cover between 1995 and 2001, agricultural conservation practices have been implemented across ILOK01, per conversations with representatives of Marion County SWCD, NRCS, and Illinois Department of Agriculture. Tables 17 through 20 provide general data on conservation tillage practices. In Marion County, where most of ILOK01 is located, conservation tillage which leaves 30 percent or more plant residue on the fields was practiced on 35 percent of cropland in 1995, and 47 percent of cropland in 2000. Additionally, investments in other conservation measures have also been made between 1995 and 2000, most notably in conservation buffers (personal communication, Illinois DOA). Quantitative data on these investments currently are not kept in an electronic form that can be used to refine watershed models without major expenditures. By this example, and the other factors listed above, the TMDL has an implicit MOS.

The EPA screening procedures approach is limited by the Universal Soil Loss Equation's prediction of sheet and rill erosion from fields. Other probable sources of suspended solids include gully erosion, and stream bed and bank erosion; no site-specific data are currently available to assess the significance of these sources. We have recommended that the Agency obtain data sufficient to estimate gully, bank, and stream bed erosion in ILOK01. The Carlyle Lake Watershed Plan provided estimates of these sediment sources, but did not support the computations with references for their data, evidence of calibration, evaluation of uncertainty, or field surveys (anonymous undated). We have found no other studies of these sources for the target watershed. The Carlyle Lake Watershed Plan reports that gully erosion in the East Fork Kaskaskia River watershed (ILOK01) is 108,992 tons annually, but the authors provide no basis for this figure. The Carlyle Lake Watershed Plan also estimated that bank erosion contributes about 23 percent of the total sediment loading to Carlyle Lake, a watershed of over one million acres. While bank erosion was not estimated for each tributary, that plan indicated that most of the bank erosion in the Carlyle Lake watershed comes from the Kaskaskia River, downstream of Lake Shelbyville. The Carlyle Lake Watershed Plan derived bank erosion estimates from a review of aerial photographs and an assumed loading of 2,000 tons per mile of unprotected stream bank. Relatively large portions of Kaskaskia River stream banks in Fayette County are bare (29 percent), while significantly lesser portions of stream channels in Clinton County are bare (8 percent). Further, the regulated flows on the Kaskaskia River (from Lake Shelbyville) exacerbate bank erosion in comparison to natural flow regimes on the East Fork Kaskaskia River. Based upon these findings, we judge that the EPA screening procedures sediment yield model, as calibrated to instream suspended solids concentrations, adequately represents siltation processes in the East Fork Kaskaskia River. The sediment delivery ratio effectively accounts for all sources of erosion: sheet, rill, gully and bank erosion.

TMDLs need to include an allowance for future growth to account for reasonably foreseeable increases in pollutant loads. We requested growth data from the South Central Illinois Regional Planning & Development Commission (SCIRP&DC). The SCRIP&DC indicated that the population will decrease by 7 percent from 2000 to 2020 for Marion County and 9 percent for Fayette County. Our calculations accounted for zero changes in land use (i.e. no agriculture land will be converted to grassland). Therefore, no foreseeable increase in TSS loading is expected.

6.2 Total Maximum Daily Load

As presented above, the WLA, SV and the MOS terms in Equation 8 are negligible or implicitly included in our analysis. The WLA from the three small aerated lagoons is negligible, given the insignificance of these waste loads during high flows. The SV and MOS are implicitly included in our TMDL by the modeling of worst-case conditions. Therefore, the solution of the TMDL for this target watershed reduces to:

$$TMDL = \sum LAs \leq 116 \frac{mg}{L} \qquad \text{Equation (9)}$$

Equation 9 is the design condition for the watershed implementation plan and evaluation of pollutant load reduction alternatives.

6.3 Pollutant Reduction Options

The goal of pollutant allocation is to reduce sediment loading to the stream such that there are no TSS concentrations greater than 116 mg/L in a 3-year storm or less. Herein we evaluate alternatives to accomplish this. Regardless of the options evaluated below, the implementation includes a recommendation for the IEPA to embark upon a field program to assess the significance of, and need for remediation of, gully erosion, and stream bed and bank erosion in ILOK01.

The alternatives focus on reducing erosion of agricultural row crop land, a source of siltation in OK 01. Current agricultural land use is broken down in Table 39. Sediment yield from row crop agricultural land is approximately 10 times greater than for grassland during any storm return period (Table 40). Additionally, soil association IL038 (Bluford-Ava-Hickory) is responsible for almost five times more soil loss per unit area than does IL006 (Cisne-Hoyleton-Darmstadt), the other soil association in the watershed. This is due to the slope length (ls) factor being more than four times greater in IL038 soils (Table 14).

Table 39

EXISTING ROW CROP AND GRASSLAND LAND USE

Subwatershed	Existing Row Crops (acres)	Existing Rural Grassland (acres)
OK 01	5,669	3,249
OK 02	5,187	6,245
OK 03	7,376	2,437
OKBA	1,230	338
OKB	3,488	2,050
OKCA	339	648
OKC	1,535	1,883
OKD	162	224
OKE	8,542	1,906
OKF	2,507	1,070
OKG	928	1,065
Total	36,963	21,115

Table 40

ESTIMATED SOIL LOSS
FOR SELECTED LAND USE AND SOIL TYPES

Soil Type	Land Use	Soil Loss(m-tons/ha)		
		1- year storm	3- year storm	10-year storm
IL038	Agriculture-Row Crop	3.79	6.87	11.59
IL038	Rural Grassland	0.34	0.62	1.05
IL006	Agriculture-Row Crop	0.84	1.52	2.56
IL006	Rural Grassland	0.08	0.14	0.23

Several options were explored to determine their feasibility for implementation and meeting the water quality endpoint. These include:

1. Changing land use in all 11 subwatersheds of the overall East Fork Kaskaskia River watershed,

2. Changing land use in the target subwatershed, OK 01,

3. Selectively changing land use based on soil type in all 11 subwatersheds of the overall East Fork Kaskaskia River watershed,

4. Increasing conservation tillage on row crops in the watershed,

5. Installing conservation buffers along the East Fork Kaskaskia River and tributary streams in its watershed (Reach File Version 3 (RF3) stream sections), and,

6. Implementing BMPs specifically directed at reducing slope length on IL038 soils being farmed with row crops.

The TMDL implementation plan must be sufficiently flexible to allow landowners and local agricultural extension agents to make the final decisions for their fields. The objective of this feasibility evaluation is not to specify control options, rather, to identify general success factors and costs related to each of these six options. Conservation plans will ultimately need to be prepared at the farm level, with areal soil loss estimates evaluated for consistency with this TMDL.

6.3.1 Option 1

Under Option 1, row crop agricultural land use/cover would be modified to rural grassland. This would be independent of soil type (i.e., land cover is adjusted an equal percentage for all soil types) equally in all 11 subwatersheds. By altering the cover factors in the calibrated model to reflect changed land use, we estimated the percent of row crop land requiring conversion to grassland in order to meet the TSS target concentration of 116 mg/L in OK 01 (Table 41). For the TMDL design storm (3-yr recurrence, 24-hour duration), 63 percent of all row crop land in the watershed, or about 23,250 acres of corn/soybean fields would require conversion to grassland. This would more than double the area of rural grassland in the East Fork Kaskaskia River watershed. Table 41 shows the effect of varying storm magnitudes and durations on land use area changes required to meet the TMDL endpoint under this option. Between 8,500 acres for lesser storms, and 29,000 acres for the higher magnitude storms (12-hr, 10-yr) would need to be converted.

Table 41

ROW CROP LAND TO BE CONVERTED TO GRASSLAND TO MEET WATER QUALITY TARGET

Recurrence	Duration	Row Crops to be Converted (%)
1-Year Events	12-hour	72
	24-hour	56
	72-hour	23
3-Year Events	12-hour	76
	24-hour	63
	72-hour	37
10-Year Events	12-hour	78
	24-hour	66
	72-hour	44

6.3.2 Option 2

Option 2 is not predicted to satisfy the TMDL. This option converts a percentage of agricultural row crop land to rural grassland in subwatershed OK 01, rather than the entire watershed. This conversion would be independent of existing soil type (i.e., land is adjusted an equal percentage for all soil types). Again, we can alter the cover factors in the USLE model to reflect changes in land use.

Option 2 does not lead to attainment of the water quality goal of 116 mg/L (Table 42). Even if all row crop lands in subwatershed OK 01 are converted to rural grassland, TSS concentrations can only be reduced about 17 percent. Upstream subwatersheds are providing more of a sediment load than land use conversions in subwatershed OK 01 can offset. Table 42 provides estimates of TSS concentrations at OK 01 under Option 2.

Table 42

TSS CONCENTRATIONS EXITING SUBWATERSHED OK 01 UNDER OPTION 2

Storm Duration	Storm Frequency		
	1-Year	3-Year	10-Year
12-hour	244	261	271
24-hour	186	205	218
72-hour	125	144	157

6.3.3 Option 3

Under Option 3, areas of soil association IL038 (Bluford-Ava-Hickory) being farmed for row crops would be converted to rural grassland. Option 3 envisions applying this conversion selectively to soil association IL038, the more erosive soils, throughout the watershed. There are 12,921 acres of row crops in soil association IL038. Option 3 assumes an equal modification in agricultural land use (percentage wise) for all 11 subwatersheds (i.e., if 10 percent of row crops is changed to rural grassland in subwatershed OK 01, then 10 percent is also changed in the remaining 10 subwatersheds). Modifying the USLE cover factors from row crop land to grassland allows us to estimate the benefits of this approach.

Table 43 indicates the relative area of row crop land to be converted to rural grassland to meet the water quality target concentration for 1-, 3- and 10-year storms. For the 24-hour, 3-year storm, if all row crops on IL038 soils in the East Fork Kaskaskia River watershed are converted to grassland, the TMDL endpoint would be met. Option 3 does not meet the TSS endpoint for larger, more intense storms, although it does for the smaller, less intensive storms.

Table 43

ROW CROPS IN EAST FORK KASKASKIA WATERSHED TO BE CONVERTED TO GRASSLAND UNDER OPTION 3

Recurrence	Duration	Percent Row Crops to be Converted
1-Year Events	12-hour	109
	24-hour	85
	72-hour	35
3-Year Events	12-hour	114
	24-hour	94
	72-hour	55
10-Year Events	12-hour	117
	24-hour	100
	72-hour	66

6.3.4 Option 4

Option 4 focuses on the use of conservation tillage practices. Leaving all or part of the previous crop's residue on the soil surface has three primary effects that reduce sheet and rill erosion. Plant residue reduces the splash effect of rainfall, reduces surface runoff, and increases infiltration. For surface residue to achieve erosion benefits, the residue needs to be evenly distributed over the field. (NRCS 1999). Conservation tillage systems are estimated to reduce sediment loading by as much as 75 percent (NCSU Water Quality

Group 2000). This corresponds to a residue cover of approximately 40 percent (Table 44).

Table 44

EFFECT OF RESIDUE COVER ON REDUCING SHEET AND RILL EROSION COMPARED TO CONVENTIONAL TILLAGE WITHOUT RESIDUE
(Source: NRCS 1999)

Residue cover %	Erosion Reduction %
10	30
20	50
30	65
40	75
50	83
60	88
70	91
80	94

We obtained information on local crop rotation and tillage practices from the Marion County SWCD. We evaluated each by applying the erosion reduction rates from Table 44 to the sediment yield estimates in our watershed siltation model. Table 45 presents the reduction in TSS concentration at OK 01 for 100 percent implementation of each of these techniques across all 11 subwatersheds. Table 45 indicates C factors and predicted TSS reductions associated with crop rotations and tillage systems. According to the Marion County SWCD, corn and soybean rotations are used on 80 percent of the fields.

Table 45

CONSERVATION TILLAGE TECHNIQUES AND EXPECTED WATER QUALITY BENEFITS

Tillage Technique	C Factor [3]	Reduction in TSS
Corn and Soybean Rotations		
No-till corn; mulch till soybeans, 30% residue	0.10	48%
No-till corn and soybeans, 60% residue	0.08	56%
No-till soybeans, 60% residue; mulch till corn, 20% residue	0.10	48%
No-till continuous, 70% residue	0.04	72%
Corn, Soybean, and Wheat Rotations		
No-till corn; mulch till soybeans and wheat, 30% residue	0.08	56%
No-till corn and soybeans, mulch till wheat, 60% residue	0.06	64%
No-till soybeans and wheat, 60% residue; mulch till corn, 20% residue	0.06	64%
No-till continuous, 70% residue	0.02	80%
Corn, Soybean, Wheat and Meadow Rotations		
No-till corn; mulch till soybeans and wheat, 30% residue	0.07	60%
No-till corn and soybeans, mulch till wheat, 60% residue	0.04	72%
No-till soybeans and wheat, 60% residue; mulch till corn, 20% residue	0.04	72%
No-till continuous, 70% residue	0.02	80%

[3] **Provided by Marion Co. SWCD**

A reduction of TSS concentration of 50 percent is required to meet the 3-year, 24-hour storm TMDL endpoint. A reduction in TSS concentration of up to 62 percent is required to meet the TMDL objective for the 10-year, 12-hour storm. As presented in Table 45, only continuous no-till farming practices that leave 70 percent residual achieve the TMDL goal on land in corn-soybean rotations, which is the dominate practice in Marion County. This will require nearly 90 percent adoption of no-till practices when farming a corn and soybean rotation.

6.3.5 Option 5

Option 5 is an analysis of the widespread implementation of conservation buffers. Conservation buffers are areas or strips of land with permanent vegetation maintained to control pollutants and manage other environmental problems. Conservation buffers are strategically located on the landscape, and include a variety of practices: field borders, alley cropping, grassed waterways and filter strips, contour buffer strips, and riparian forest buffers. There are many effective applications of buffers, and combinations of buffers, that could be developed for the East Fork Kaskaskia River watershed. Option 5 specifically evaluates the use of riparian forest buffer strips to meet the TMDL goal, but riparian buffers are most effective as part of a comprehensive conservation plan that includes additional practices. A comprehensive conservation plan, based upon landowner acceptance and needs, is the most pragmatic approach to meeting the TMDL requirement.

Grasses and trees are better vegetation types than shrubs for filtering sediment and stabilizing banks (Tjaden and Weber 1997).

The literature reports a wide range of effectiveness of buffer strips at reducing TSS concentrations in streams. Sediment trapping efficiency varies with vegetation type, stem density, ponded depth, backwater length, flow rate, sediment size and other factors (NCRS 1999). The state of Michigan specifies minimum riparian buffer width of 100 feet (MDEQ 1997). NRCS defines riparian buffers as minimally 50 feet wide (Palone and Todd 1997). Thirty-foot wide grass buffer strips have been shown to reduce TSS concentrations by 80 percent (Dillaha *et al.* 1989 and Magette *et al.* 1987).

The RF3 stream reach files in the GIS indicate that there are a total of 1,052,472 feet of streams in the East Fork Kaskaskia River watershed. Of these, about half pass through agricultural or rural grass lands, the balance being in forested areas or wetlands. If 50-

foot buffer strips are applied on both sides of all streams to achieve an 80 percent reduction in loadings, 1,235 acres of land will need to be used as riparian buffer strips and the TMDL goal can be achieved (Table 46). For cost estimating purposes, we have assumed that an additional 10 percent of land area will require riparian buffers. This essentially supplements the MOS in the TMDL for this option. The 10 percent additional area accounts for assumed uncertainties in the land use and RF3 GIS file spatial resolution.

Modeling results are shown in Table 47. Option 5 will bring the targeted watershed below the TMDL TSS endpoint, and return the stream to full use support.

Table 46

STREAM LENGTH THROUGH AGRICULTURAL LANDS AND REQUIRED RIPARIAN BUFFER AREAS

Subwatershed	Agriculture (ft)	Grassland (ft)	Total (ft)	Area (ac)	Area with 10% MOS
OK 01	13,085	61,844	74,929	172	189
OK 02	45,810	75,789	121,599	279	307
OK 03	43,624	37,978	81,602	187	206
OKB	9,545	41,626	51,171	117	129
OKBA	10,818	5,142	15,960	37	40
OKC	5,335	15,783	21,118	48	53
OKCA	2,660	7,630	10,290	24	26
OKD	389	3,235	3,624	8	9
OKE	56,772	42,893	99,665	229	252
OKF	19,320	30,425	49,745	114	126
OKG	1,245	6,896	8,141	19	21
Total	208,603	329,242	537,845	1,235	1,358

Table 47

ESTIMATED TSS CONCENTRATIONS AT OK 01 – OPTION 5

Event Durations	TSS Concentration (mg/L)		
	1-yr Storm	3-yr Storm	10-yr Storm
12-hr	55	59	61
24-hr	42	46	49
72-hr	28	33	36

6.3.6 Option 6

Option 6 analyzes the effectiveness of Best Management Practices (BMPs) specifically directed at reducing slope length on Bluford-Ava-Hickory soils (IL038 soil association) being farmed with row crops. These include:

- Terraces
- Contour buffer strips or contour stripcropping

The effectiveness of such practices at conserving soil is typically evaluated by including recommended P factors less than unity in the USLE. For contour stripcropping, P factors range from 0.25 to 0.7, depending upon crop rotation, strip width, and slope length (NRCS 1981). Terrace P factors are usually greater than 0.6, and, vary with the specifics of the field (NRCS 1989).

The Bluford-Ava-Hickory soils (IL038) occur on side slopes along drainages and on broad ridgetops. IL038 slopes vary widely, ranging from one to 45 percent. The general value of this option to meeting the TMDL objective is shown below. We applied a P factor of 0.5 to all row crop lands in the watershed in IL038 soils. This factor, taken from the NRCS Conservation Practice Standard for contour stripcropping, reflects strip widths of 100 feet, maximum slope lengths of 600 feet, 3 percent to 5 percent slopes, for alternate strips of row crops and small grains. We judged this a conservative P factor for the area and conditions. Table 48 displays the estimates of TSS concentrations expected under this option, indicating Option 6 only provides a sufficient level of protection for the less intensive storms being evaluated, that is, those of a 72-hour duration.

Table 48

ESTIMATED TSS CONCENTRATIONS AT OK 01 – OPTION 6

Event Durations	TSS Concentration (mg/L)		
	1-yr Storm	3-yr Storm	10-yr Storm
12-hr	181	194	202
24-hr	139	152	162
72-hr	93	107	117

6.3.7 Summary

This section has evaluated options for reducing sediment loading to the stream such that there are no TSS concentrations greater than 116 mg/L under nine different storms durations or intensities. We recommend the IEPA assess the significance of, and need for remediation of, gully erosion, and stream bed and bank erosion in ILOK01 as part of this TMDL program.

Tillage of the IL038 soil association leads to impaired waterbody uses. BMPs that are 50 percent effective at reducing soil loss on these soils (*i.e.* setting P factor = 0.5) are insufficient to bring OK 01 into compliance with the TMDL goal. Converting all IL038 crop land in the East Fork Kaskaskia River watershed to grassland, evaluated as Option 3, is necessary. But, this is not a realistic expectation, given rural socioeconomic conditions in southern Illinois. Therefore, we recommend that a combination of these options be employed, at the local level, for meeting the TMDL goal:

- Land use changes, converting IL038 crop land to grass land (Options 1, 2, & 3)
- Conservation tillage on all crop land (Option 4)
- Riparian buffers (Option 5)
- Targeting of IL038 crop lands for contour stripcropping and /or terracing (Option 6)

Comprehensively applied to the watershed, these practices will be sufficient to bring OK 01 into compliance with the TMDL goal. Individual farm conservation plans will need to be prepared, or may need to be revised, to finance and implement the BMPs. These farm conservation plans provide for a higher resolution of watershed resources, greater than this TMDL modeling effort, prepared using the best available existing data, is able to reach.

An example of such an approach is analyzed below, in a stepwise implementation of three options that, in combination, bring TSS concentrations into compliance with the TMDL. For this example implementation plan we have used three options, which will cumulatively reduce TSS concentrations below the target of 116 mg/L. Options used include:

- Option 3: Conversion of 15 percent of row crop agricultural land in soil association IL038 to rural grassland
- Option 4: Conversion of 50 percent of row crop land to no-till corn and soybean rotation with 60 percent crop residue (C factor = 0.08)
- Option 5: 40 percent installation of riparian buffer strips on both sides of RF3 stream reaches.

Table 49 shows the acres affected and estimated water quality improvement associated with this implementation plan. The estimated costs of this example are provided in the following chapter.

Table 49

EXAMPLE TMDL IMPLEMENTATION PLAN

Option	Description	Affected Area	3-yr 24-hr Storm	
			TSS (mg/L)	% Reduction
0	No action	0	232	0
3	IL038 land use changes	1,938 ac	214	8
4	Conservation tillage	17,513 ac	161	31
5	Riparian buffers	494 ac	110	53
Overall		19,945 ac	110	53

7.0 IMPLEMENTATION PLAN

TMDL implementation plans require the following elements:

1) Control actions,
2) Time line,
3) Reasonable assurance,
4) Legal authority,
5) Time required to attain water quality standards,
6) Monitoring plan,
7) Milestones for attaining water quality standards, and
8) Revision procedures.

Control actions are evaluated in the previous section. The remaining items are presented in this chapter.

The control options presented in the previous chapter will remediate ALUS in OK 01 and should bring the waterbody into compliance with the TMDL endpoint. Monitoring for refinement of the source loads is also recommended as part of the implementation plan. Bed erosion, bank erosion, and gully erosion contribute to the total TSS load, but data are not available to link these sources to instream water quality.

7.1 Reasonable Assurance

Reasonable assurances provide a level of confidence that the waste load allocations and load allocations in TMDLs will be implemented by federal, state, or local authorities and/or by voluntary action. Reasonable assurance for reductions in nonpoint source loadings may be non-regulatory, regulatory, or incentive-based, and consistent with applicable laws and regulations. For non-enforceable, nonpoint source control activities assurances include:

- Demonstration of adequate funding,
- Process by which agreements/arrangements between appropriate parties (e.g. governmental bodies, private landowners) will be reached,
- Assessment of the future of government programs which contribute to implementation actions, and
- Demonstration of anticipated effectiveness of the actions.

7.2 Legal Authority

Because neither Illinois EPA, county SWCDs, nor other governmental entities have direct authority over the identified nonpoint sources, it will be important to coordinate activities with entities that have programs in place to implement the nonpoint source actions. Reasonable assurances for nonpoint source control implementation can be strengthened by signing agreements with land owners, non-governmental organization and local agricultural interest groups.

7.3 Assistance Programs

This section presents information concerning programs that provide technical and financial assistance and encourage land stewardship. This information is summarized from the USDA website, www.usda.gov, unless otherwise noted.

7.3.1 Environmental Quality Incentives Program (EQIP)

Under EQIP, technical assistance, cost share, incentive payments, and educational help are provided to farm operators who enter into five to 10 year contracts with USDA. EQIP replaces and combines the functions of previous USDA programs This program provides assistance both within and outside designated priority areas, with half of the resources targeted to livestock-related natural resource concerns and the remainder set aside for other significant conservation priorities.

The Natural Resources Conservation Service (NRCS) and the Farm Service Agency (FSA), both part of the USDA, administer the EQIP. Participants, in cooperation with the local soil and water conservation district, develop a conservation plan for the farm that serves as the basis for the EQIP contract. The Commodity Credit Corporation (CCC) provides cost-share or incentive payments to apply the conservation practices and land use conversions within a specified timeframe. Eligibility requires that the participant:

1. Be in compliance with highly erodible land and wetlands conservation provisions
2. Have control of the land for the term of the contract
3. Submit an acceptable farm conservation plan to NRCS, approved by the SWCD, and in compliance with the terms and conditions of the program, and
4. Supply information as required by CCC to determine eligibility for the program.

Public or private land can be enrolled in the EQIP, including crop land, pasture, forest land, and other land on which crops or livestock are produced, including land the NRCS has determined poses a serious threat to soil, water, or related natural resources.

EQIP provides cost-sharing up to 75 percent for certain conservation practices, such as grassed waterways, filter strips, and other practices important to improving and maintaining the health of natural resources in the area. Total EQIP cost-share and incentive payments are limited to $10,000 per person per year and $50,000 for the length of the contract.

7.3.2 Wildlife Habitat Incentives Program (WHIP)

WHIP is a voluntary program for landowners who want to develop and improve fish and wildlife habitat on private land. It provides technical assistance and cost sharing for practice installation. WHIP participants who own or control land agree to prepare and implement a wildlife habitat development plan. NRCS helps participants prepare a wildlife habitat development plan in consultation with the SWCD. The plan describes the landowner's goals for improving wildlife habitat and lists practices and schedules for the life of the agreement. This plan may or may not be part of a larger conservation plan that addresses other resource needs such as water quality and soil erosion.

USDA and the WHIP participant sign a 5 to 10 year cost-share agreement. Under the agreement:

- The landowner agrees to install and maintain the WHIP practices and allow NRCS access to monitor the effectiveness of the practices.
- USDA agrees to provide technical assistance and pay up to 75 percent of the cost of installing the wildlife habitat practices.
- Cost-share payments may be used to establish new practices or replace practices that fail for reasons beyond the landowner's control.

All lands are eligible for WHIP, except:

- Federal land
- Land currently enrolled in the Water Bank Program, Conservation Reserve Program, Wetlands Reserve Program, or other similar programs
- Land subject to an Emergency Watershed Protection Program floodplain easement
- Land where USDA determines that impacts from onsite or offsite conditions make the success of habitat improvement unlikely.

Forested riparian buffers, for example, would be eligible for WHIP assistance.

7.3.3 Wetland Reserve Program (WRP)

This voluntary program helps landowners protect, restore, and enhance wetlands on private property. It provides an opportunity for landowners to receive financial incentives to restore wetlands in exchange for retiring marginal agricultural land. The NRCS administers the program in consultation with the FSA and other agencies. Funding for WRP comes from the CCC.

The landowner and NRCS jointly develop a plan for the restoration and maintenance of the wetland. The WRP offers landowners three options: permanent easements, 30-year easements, and restoration cost-share agreements of a minimum 10-year duration.

- Permanent Easement. This is a conservation easement in perpetuity. Easement payment will be the lesser of: the agricultural value of the land, an established payment cap, or an amount offered by the landowner. In addition to paying for the easement, USDA pays 100 percent of the costs of restoring the wetland.

- 30-Year Easement. This is a conservation easement lasting 30 years. Easement payments are 75 percent of what would be paid for a permanent easement. USDA also pays 75 percent of restoration costs.
- Restoration Cost-Share Agreement. This is an agreement (generally for a minimum of 10 years in duration) to re-establish degraded or lost wetland habitat. USDA pays 75 percent of the cost of the restoration activity. This does not place an easement on the property. The landowner provides the restoration site without reimbursement.

Since 1994, Illinois has enrolled over 32,000 acres in WRP. The program's successes have created enormous landowner interest. Illinois has a backlog of eligible applicants for this program. Landowners have expressed various reasons for their interest in the program, but most landowners appreciate the program providing financial compensation for removing their high-risk acreage from agriculture production. WRP funds are subsequently used to reduce debt or invest in more productive land.

Among other areas of the state, WRP easements have also been clustered along the Kaskaskia River, particularly in the Carlyle Lake watershed in Fayette County (NRCS 2000b).

7.3.4 Forest Legacy Program (FLP)

The FLP is a federal program administered by the USDA Forest Service. FLP supports state efforts to protect environmentally sensitive forest lands. The program is designed to encourage the protection of privately owned forest lands. FLP is a voluntary program, and focuses on the acquisition of partial interests in privately owned forest lands. FLP encourages and supports acquisition of conservation easements, legally binding agreements transferring a negotiated set of property rights from one party to another, without removing the property from private ownership. Most FLP conservation easements restrict development, require sustainable forestry practices, and protect other values.

Participation in FLP is limited to private forest landowners. To qualify, landowners are required to prepare a multiple resource management plan as part of the conservation easement acquisition. The federal government may fund up to 75 percent of program costs, with at least 25 percent coming from private, state or local sources. Through the end of 2000, only 83 acres of land in Illinois had been enrolled in the FLP (Forest Service 2000). This program is not likely a source of financial assistance for creating new riparian forest buffers, but can be utilized to support protection of existing forested areas.

7.3.5 Small Watershed Program

The Watershed Protection and Flood Prevention Program, also known as the Small Watershed Program, or "PL 566 Program," provides technical and financial assistance to address resource and related economic problems on a watershed basis. This program is administered by the NRCS. Projects related to watershed protection, flood prevention, water supply, water quality, erosion and sediment control, wetland creation and restoration, fish and wildlife habitat enhancement, and public recreation are eligible for assistance. Technical and financial assistance is also available for planning and installation of works of improvement to protect, develop, and use land and water resources in small watersheds.

Eligibility for assistance extends to any local or state agency, county, municipality, town or township, SWCD, flood prevention/flood control district, or other unit of government with the authority and capacity to carry out, operate, and maintain installed works of improvement. Projects are limited to watersheds smaller than 250,000 acres, indicating that the East Fork Kaskaskia River is eligible for this program.

This program provides technical assistance and cost sharing (amount varies) for implementation of NRCS-authorized watershed plans, including technical assistance on watershed surveys and planning. Although projects vary significantly in scope and complexity, typical projects entail $3.5 million to $5 million in federal financial assistance. Funding nationally for this program has decreased in recent years, and about $100 million annually is currently appropriated, of which about $50 million is available for financial assistance.

7.3.6 Conservation Reserve Program (CRP) and Conservation Reserve Enhancement Program (CREP)

These programs are a state-federal partnership that targets specific water quality, soil erosion and wildlife habitat issues related to agriculture. Financial incentives encourage farmers to voluntarily enroll in contracts of 10 to 15 years in duration to remove highly erodible lands from agricultural production.

CRP is voluntary. Participants receive an annual rent and half the cost of establishing a conserving land cover in exchange for retiring highly erodible and/or environmentally sensitive land. Approximately 65 percent of cultivated cropland in the United States is eligible for this program (USDA ERS 1997). Limited opportunities now remain for new acreage to be enrolled in the CRP, with relatively little program acreage expiring though 2002. In addition to the regular, periodic CRP signups, USDA conducts a continuous signup of acreage dedicated to specific conservation practices, such as filter strips, riparian buffers, grassed waterways, field windbreaks, shelter belts, living snow fences, shallow water areas for wildlife and well-head protection areas. These practices involve relatively small parcels of land, but are expected to provide disproportionate environmental benefits. Under the continuous signup, if land is suitable for the above practices and the landowner agrees to the annual payment rate, which is based on soil type, the offer is considered immediately accepted under the continuous signup for contracts of up to 15 years. On top of the annual payment, there is a yearly bonus of 20 percent for filter strips, riparian buffers, grassed waterways and field windbreaks.

USDA announced new incentives for participants in continuous signup including a one-time "signing bonus," additional cost-share assistance and new payment rates for marginal pasture lands. CREP is a new program; it is essentially an enhanced version of the CRP. In Illinois, CREP targets the Illinois River watershed. This is outside our area of concern and therefore the new program is not applicable (NRCS 1998).

7.3.7 Conservation 2000

Conservation 2000 is state program. It is a multi-million dollar initiative designed to take a broad-based, long-term ecosystem approach to conserving, restoring, and managing Illinois' natural lands, soils, and water resources. It currently expires in 2009.

The Conservation 2000 Program funds nine programs across three state agencies:

- Illinois Department of Natural Resources
    - Ecosystems Program
    - Review of Illinois Water Law
    - Ecosystem Monitoring Program
    - Natural Resources Information Network
- Illinois Environmental Protection Agency
    - Illinois Clean Lakes Program
- Illinois Department of Agriculture
    - Conservation Practices Cost-Share Program
    - Sustainable Agriculture Grants Program
    - SWCD Program Development
    - Expansion Grants
    - Streambank Stabilization and Restoration Program

Several of these are watershed conservation efforts. They are discussed below.

The Illinois Clean Lakes Program is modeled after its federal counterpart (Section 314 of the Clean Water Act). The Illinois Clean Lakes Program includes the following funding components:

- Priority Lake and Watershed Implementation Program
- Illinois Clean Lakes Phases I, II and III Projects
- Volunteer and Ambient Lakes Monitoring
- Lake Education Assistance Program

The Sustainable Agriculture Grants Program funds sustainable agriculture research, education and demonstration through conferences, training, on-farm research and educational outreach. Sustainable agriculture is a system of farming designed to balance environmental and economic concerns. Practices are aimed at maintaining producers' profitability while conserving soil, protecting water resources and controlling pests through means that are not harmful to natural systems, farmers or consumers. Organizations and individuals may apply for sustainable agriculture grants provided they can demonstrate an understanding of sustainable agriculture systems and the ability to complete the project in a timely and professional manner.

The Conservation Practices Cost-Share Program subsidizes landowner implementation of conservation practices, such as terraces, filter strips and grass waterways, that are aimed at reducing soil loss on crop land. To qualify for the program, land upon which the owner plans to install a conservation practice must be experiencing erosion at rates greater than one and one-half times the tolerable soil loss level. Landowners must cooperate with their SWCD, including developing a conservation plan. The SWCD sets maximum cost-share rates for each approved practice, up to a maximum of 60 percent. Maximum cost-share payments may also be established for each project. Cost-share payments are based on locally established average costs for similar conservation practices. Conservation practices selected for cost-share assistance include those listed below.

- Contour farming establishment
- Contour stripcropping or contour buffer strip establishment
- Cover and green manure crops
- Critical area planting
- Diversion
- Field border strips
- Filter strips
- Grade stabilization structures
- Grassed waterway
- No-till planting systems
- Pasture and hayfield planting
- Terraces
- Water and sediment control basins

Recipients of cost-share monies must agree to continue or maintain structural conservation practices and possibly some management practices for at least 10 years.

The Streambank Stabilization and Restoration Program is designed to demonstrate effective, inexpensive vegetative and bio-engineering techniques for limiting streambank erosion. Program monies fund demonstration projects at suitable locations statewide and provide cost-share assistance to landowners with severely eroding streambanks. Both cost-share assistance and demonstration project funding are available under this program. Eligibility for participating in this program includes a requirement that sites meet assessment and selection criteria established for successful streambank stabilization using vegetative or other bio-engineering techniques. Proposals must be sponsored by the local SWCD and recipients must agree to maintain streambank stabilization practices for at least 10 years.

The Soil and Water Conservation District Grants Program provides assistance to Illinois' SWCDs to help offset operating expenses.

7.3.8 Section 319

Section 319 of the Clean Water Act authorizes the federal Nonpoint Source Management Program. This program is administered by the Illinois EPA. Under Section 319, states receive grant money which support a wide variety of activities including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific nonpoint source implementation projects. Fiscal year 2001 included $9.6 million in the Illinois EPA's budget for Section 319 grants. Grant funds are supplemented with 40 percent funding provided by the local sponsor (grantee). The development and implementation of nonpoint source TMDLs can be funded under Section 319.

7.3.9 Summary of Financing Sources

The matrix below summarizes the eligibility of nonpoint source control options described in Chapter 6. Planning assistance and riparian buffers have the most opportunities for obtaining federal or state financial assistance at some level, but all are eligible for one or more programs.

	Crop Land to Grass Land Conversion	Adoption of Conservation Tillage Practices	Implementation of Riparian Forest Buffers	Implementation of Contour Stripcropping/Terracing	Conservation Planning Assistance
Environmental Quality Incentives Program	●	●	●	●	●
Wildlife Habitat Incentives Program			●		●
Wetland Reserve Program			●		●
Forest Legacy Program			●		●
Small Watershed Program	●	●	●	●	●
Conservation Reserve Program	●				●
Conservation Reserve Enhancement					
Conservation 2000	●	●	●	●	●
CWA Section 319	●	●	●	●	●

7.4 Costs

TMDL implementation costs have been estimated using historical average costs and an estimated combination of BMPs.

7.4.1 Unit Costs

The average CRP rental rate in Marion County (majority of the watershed) is $75 per acre based on data collected from 1987 until 2001 (NRCS no date 3). In addition, a one time sign-up bonus of $100 to $150 per acre is also being paid for the land enrolled in the continuous sign-up program (USDA 2000). The cost to establish permanent vegetative cover is $69 to $270 per acre, of which the USDA cost shares 50 percent for the continuous sign-up program (USDA ERS 2000). Therefore, an average rental rate of $75 per acre, a one time sign-up bonus of $125 per acre, and an average installation cost of $85 (50 percent cost share of the average installation cost) is used as the financial commitments in these calculations. Landowners' loss of cropland income is estimated to be $150 per acre.

The two biggest economic factors that may cause producers to consider conservation tillage systems are labor and equipment savings (NRCS 1999). When conservation tillage systems are applied, there are fewer trips made compared to conventional or intensive tillage systems, resulting in fuel savings, less equipment and equipment repairs, and less labor. Operational savings may be substantial because of reduced field operations. If a producer is able to convert to a complete no-till system, then most primary and secondary machinery is not needed. Depending on the size of the operation, less horsepower and fewer tractors may be required, which can substantially reduce operation costs. In addition, less maintenance is needed since the machinery is not being operated as many hours each year. As tillage is decreased, herbicides are more important for weed control. In a 1997 nationwide survey of growers, the NRCS found that operation costs were rarely an impediment to implementing conservation tillage practices (cited in NRCS 1999). More common reasons stated in that survey were the expense of equipment changes and weed problems. As illustrated in Table 50, operating costs may be less under no-till systems than conventional tillage system. Costs for procuring the equipment, however, can be challenging for some operators.

Table 50

**OPERATING COSTS ($/acre) FOR
CONVENTIONAL TILLAGE VERSUS NO-TILL**
(adapted from NRCS 1999)

Crops	Conventional Tillage	No-till System	Increase/decrease
	Corn		
Operating/machinery	17	5	–12
Material	100	95	–5
Other	5	5	0
Total	122	105	-17
	Soybeans		
Operating/machinery	14	6	–8
Material	55	83	28
Other	3	4	1
Total	72	93	21
	Wheat		
Operating/machinery	12	6	–6
Material	38	49	11
Other	3	3	0
Total	53	58	5

Riparian forest buffer unit costs were taken from NRCS (2000a) and Palone and Todd (1997). NRCS estimates that riparian forest buffers developed to their specifications, that is, planted with mixed hardwood seedlings (110 trees/ac), cost about $450/ac. Additionally, under the Continuous Conservation Reserve Program (CRP), the landowner is generally offered an annual rental payment based on local cash rent, a one time signing bonus and a 90% cost share for riparian forest buffers and filter strips.

NRCS contour stripcropping (Practice 585, NRCS 1981) is estimated to cost $30/ac in payments, which are limited to the first year of this practice (NRCS 2000a). Our costs are based on negligible farm income from stripcropped lands.

These unit costs are the basis for programmatic level estimates for the target watershed TMDL implementation.

7.4.2 Program Costs

It is the philosophy and intent of the Illinois EPA to maximize voluntary adoption of the implementation options described in Chapter 6. Program budgets for TMDL implementation must therefore be sufficiently flexible to allow for a range of BMPs and controls costs. It is unrealistic to expect one of the six options to be wholly adopted throughout the watershed. Table 51 provides costs that assume a single option is adopted for the entire watershed. Table 51 is based upon the unit costs presented in Section 7.4.1.

Table 51

ESTIMATED PROGRAM COSTS
(million dollars)

Option	Acres Impacted	Public Costs			Landowner Costs		Summary	
		Rent [4]	Sign-up	Installation Cost Share	Loss of Income[4]	Installation	Initial	Annual[4]
1	25,000	$1.88	$3.13	NA[5]	$3.75	$2.12	$5.25	$5.63
2	5,670	$0.43	$.71	NA	$0.85	$0.48	$1.19	$1.28
3	12,759	$0.96	$1.59	NA	$1.91	$1.08	$2.67	$2.87
4	36,964	NA[5]	NA	NA	NA	NA	NA	NA
5	1,360	$0.10	$0.41	$0.46	$0.20	$0.15	$1.02	$0.71
6	12,759	NA	$0.38	NA	$1.91	NA	$0.38	$1.91

The costs in Table 51 are the basis for development of a range of TMDL implementation costs. Options 1, 4, 5, and 6 are most reasonable options for agricultural BMPs, and, in combination, provide technically and socioeconomically reasonable methods for meeting the TMDL goal. If these four options are implemented at an equal portion of the total (*i.e.* 25 percent of TMDL implementation costs are devoted to each Option), initial and annual costs would be $1.7 million and $2.1 million, respectively.

[4] Cost is per year.
[5] NA – Not Applicable. Government programs do not provide funding.

The example implementation plan in Table 49 included three TSS control options, or BMPs. That example is estimated to have initial costs of $770,000 and recurring costs of $550,000 annually (Table 52).

Table 52

ESTIMATED COSTS OF THE EXAMPLE IMPLEMENTATION PLAN ILLUSTRATED IN TABLE 49
(million dollars)

Option	Acres Impacted	Public Costs			Landowner Costs		Summary	
		Rent	Sign-up	Installation Cost Share	Loss of Income	Installation	Initial	Annual
3	1,938	$0.15	$0.24	NA	$0.29	$0.16	$0.40	$0.44
4	17,513	NA	NA	NA	NA	NA	NA	NA
5	494	$0.04	$0.15	$0.17	$0.07	$0.05	$0.37	$0.11
Total	19,945	$0.19	$0.39	$0.17	$0.36	$0.21	$0.77	$0.55

7.5 Monitoring

The Implementation Plan requires that the TMDL establish a schedule that includes a monitoring or modeling plan to measure the effectiveness of source control measures. The Illinois EPA continues to monitor the East Fork Kaskaskia River at sample station OK 01 as part of their ambient water quality monitoring network station (AWQMN) sampling from which data is collected nine times a year. The continued collection of this data will allow the Implementation Plan effectiveness to be calculated.

As indicated earlier, no data are currently available to allow an estimate of gully erosion, bank erosion or stream bed erosion. Depending upon the nature and magnitude of these sources, the Implementation Plan made require revision. We recommend that the Illinois EPA make this monitoring a priority for ILOK01, as well as other target watersheds impaired by siltation.

7.6 Implementation Schedule, Milestones and Revisions

The July 13, 2000, TMDL rules, currently under deferral, state that "implementation will be as expeditious as practicable for waterbodies impaired only by sources which are not subject to NPDES permits, including nonpoint sources" (Federal Register 2000). Specifically, the July 13, 2000, rules establish a goal of five years for implementing management measures or control actions to achieve load allocations, and a goal of 10 years for attaining water quality standards. Meeting this schedule successfully will require the following:

- Local development of farm conservation plans
- Aggressive preparation of these plans and public education about agricultural conservation
- Local, state and federal funding support for planning, implementation, and monitoring

We recommend that farm conservation plans be completed within the first 18 months. The IEPA will make sufficient grant funding available to the SWCDs to support conservation planning and implementation, contingent upon adequate federal support. Plans will be prepared and implemented on a priority basis, according to the areal soil loss rate for the subwatershed (Table 53).

Table 53

SUBWATERSHED PRIORITIES FOR CONSERVATION PLANNING AND IMPLEMENTATION
(from Table 24)

Subwatershed	Areal Soil Loss Rate	Priority
OK 01	0.95 t/ac/yr	1
OKD	0.86 t/ac/yr	2
OKBA	0.84 t/ac/yr	3
OK 03	0.80 t/ac/yr	4
OKE	0.76 t/ac/yr	5
OKB	0.66 t/ac/yr	6
OK 02	0.63 t/ac/yr	7
OKC	0.59 t/ac/yr	8
OKG	0.46 t/ac/yr	9
OKF	0.44 t/ac/yr	10
OKCA	0.28 t/ac/yr	11

The time required for stream segment OK 01 to meet the water quality target for siltation is dependent on voluntary farmer participation in existing government programs such as EQIP and Conservation 2000. The suggested control measures can be implemented expeditiously. These programs are supported by adequate funding, indicating a reasonable assurance that they will be implemented. Additionally, the NRCS funds, recommends, and supports these programs providing the legal authority for these actions.

While monitoring and recording of water quality is adequate through the AWQMN, farm conservation plans and BMP implementation are not currently recorded electronically, making rapid integration with watershed assessments cumbersome and inefficient. Development of a GIS-based recording system at the SWCD level would greatly facilitate watershed assessments and determination of linkages between land treatment and water quality. Revisions and updates to modeling and the TMDL can be incorporated as new data are obtained.

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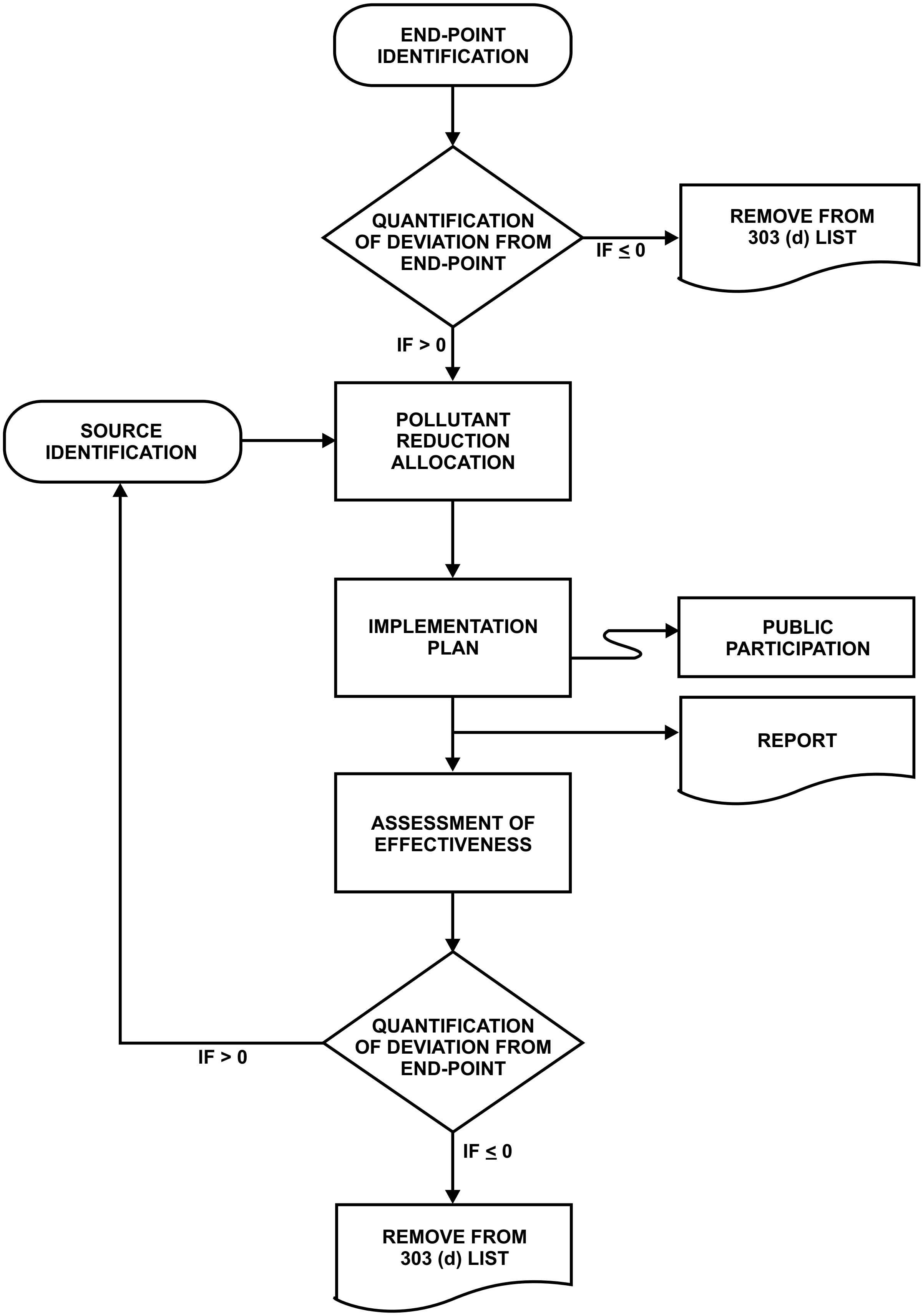
EXHIBITS

EXHIBITS

EXHIBIT 1



SOURCE: Modified From EPA 100-R-98-006, July 1998.

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HIERARCHAL APPROACH TO TMDL DEVELOPMENT

DEVELOPMENT OF TMDL'S AND IMPLEMENTATION PLANS FOR TARGET WATERSHEDS

Watershed ILOK01: East Fork Kaskaskia

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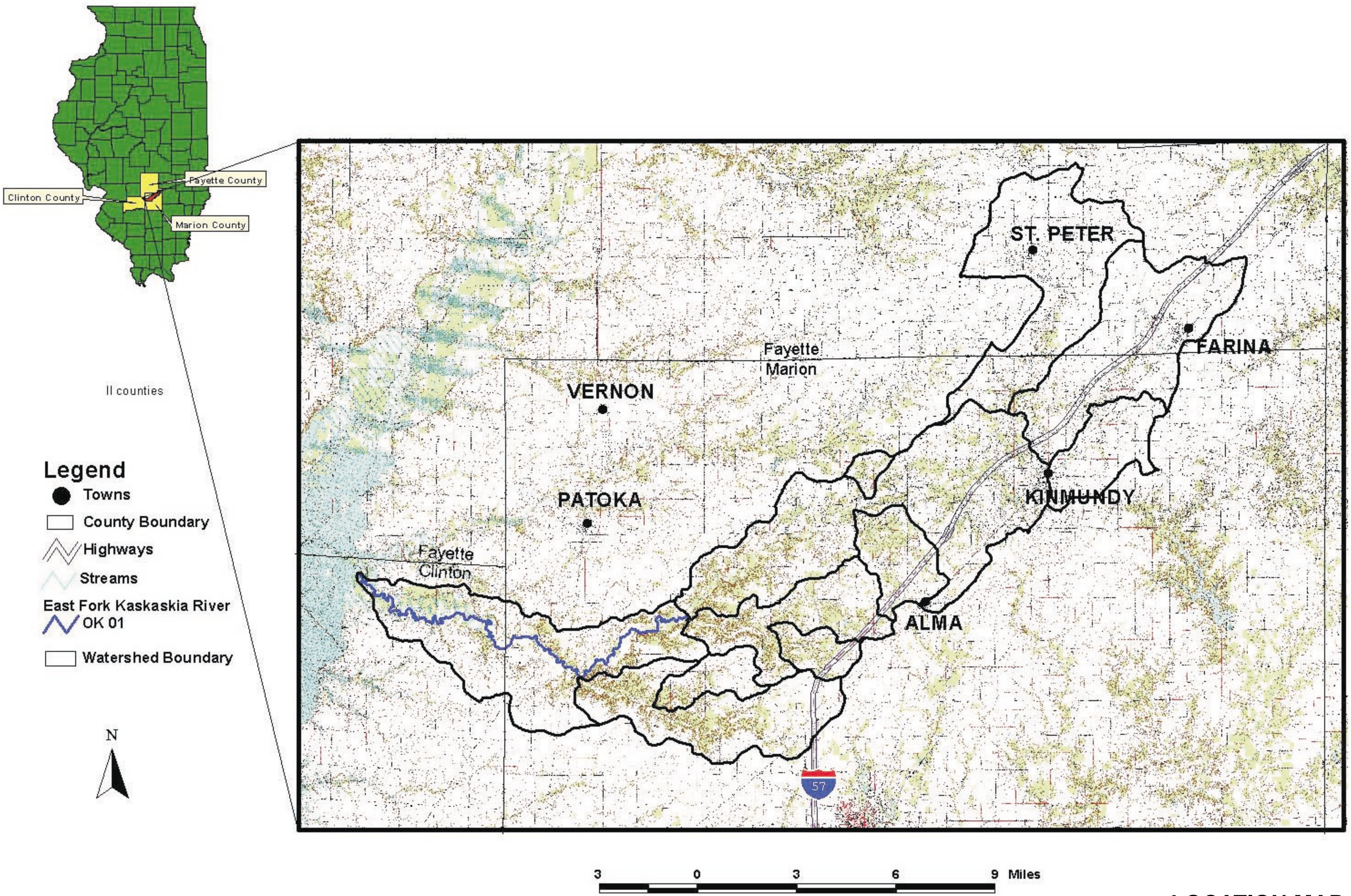

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LOCATION MAP
DEVELOPMENT OF TMDL'S AND IMPLEMENTATION PLANS
FOR TARGET WATERSHEDS
Watershed ILOK01: East Fork Kaskaskia River

EXHIBIT 2

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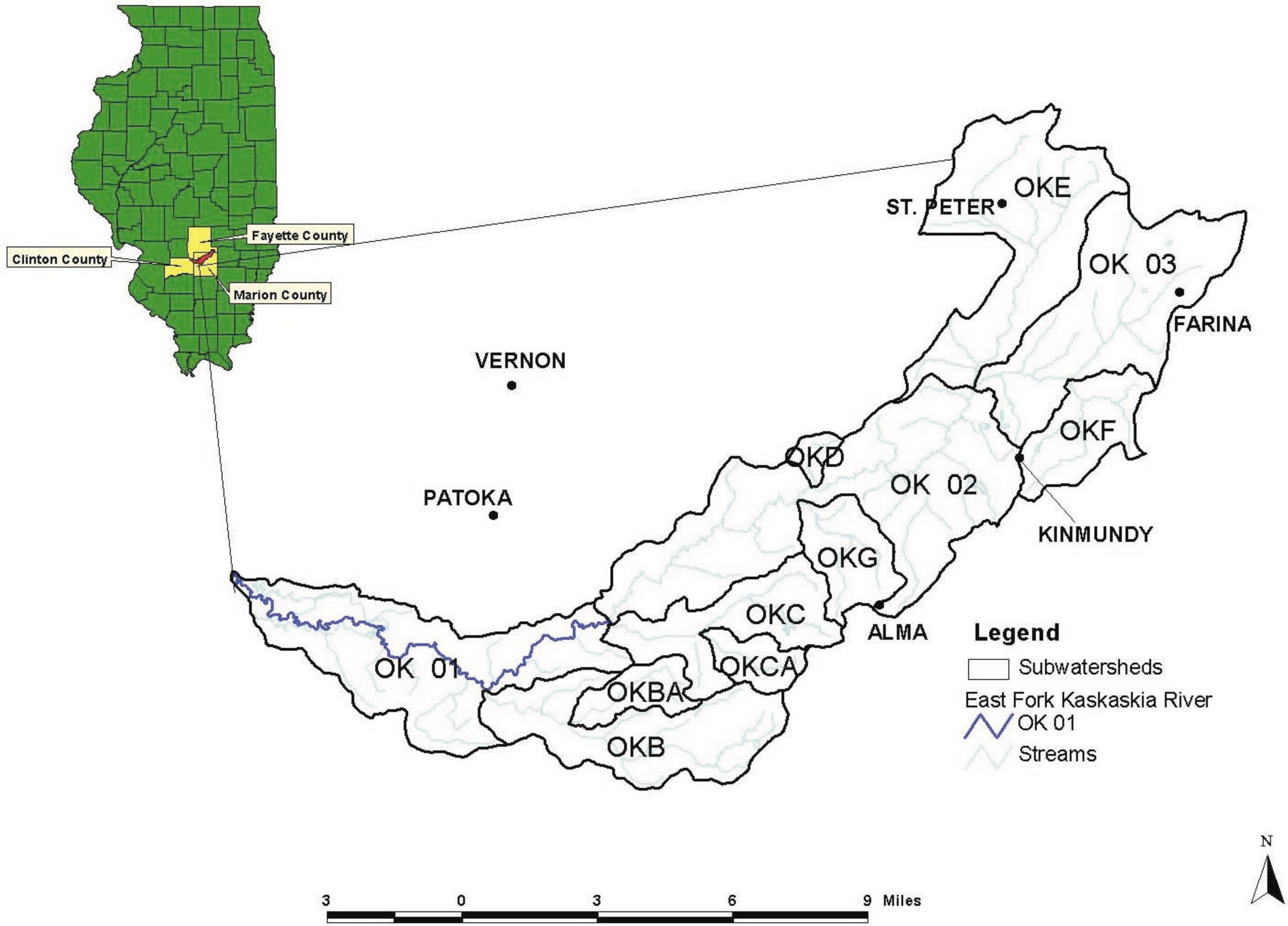

SUBWATERSHEDS

DEVELOPMENT OF TMDL'S AND IMPLEMENTATION PLANS
FOR TARGET WATERSHEDS
Watershed ILOK01: East Fork Kaskaskia River

EXHIBIT 3

MWH
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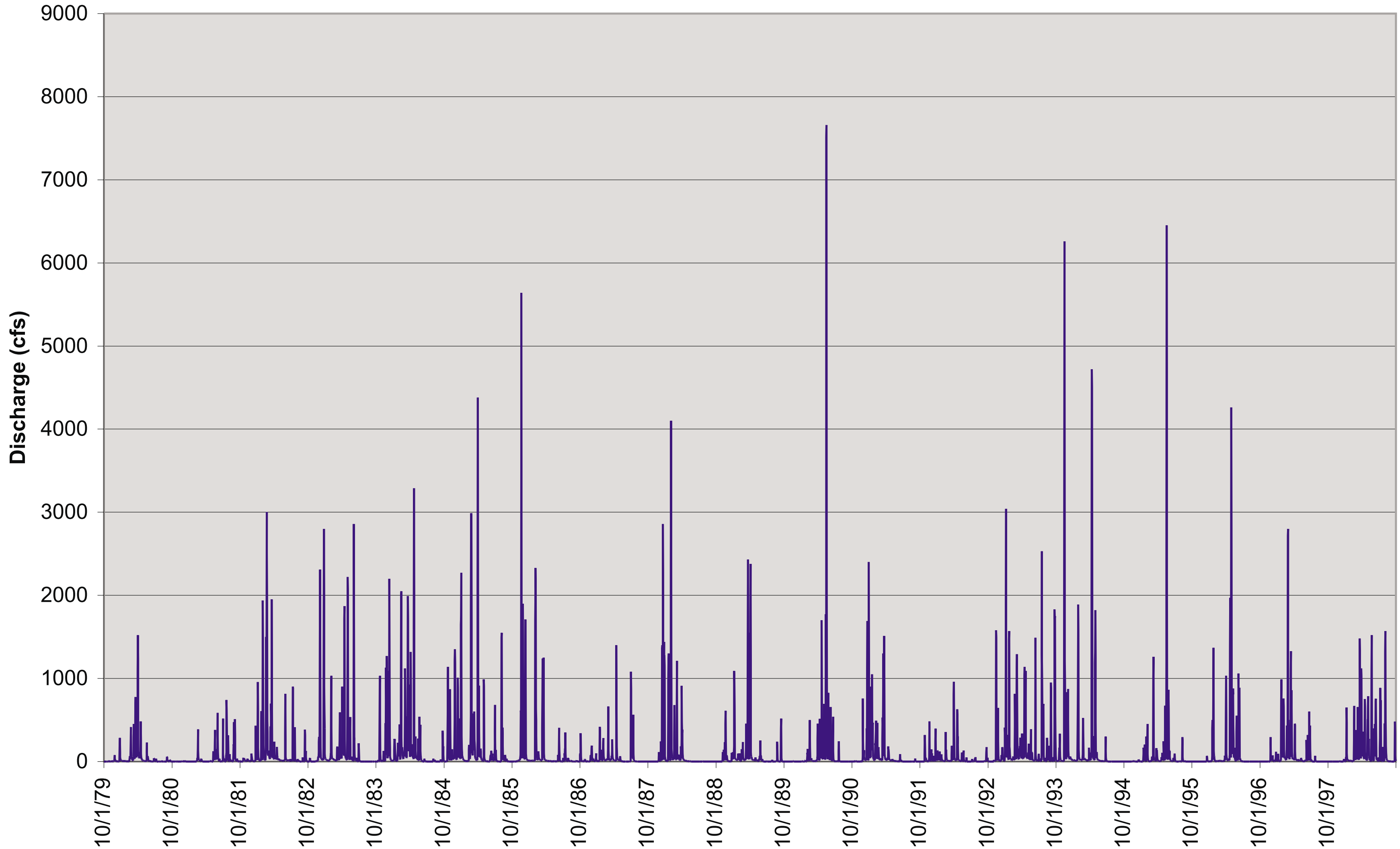

EAST FORK KASKASKIA DISCHARGE NEAR SANDOVAL, IL
DEVELOPMENT OF TMDL'S AND IMPLEMENTATION PLANS
FOR TARGET WATERSHEDS
Watershed ILOK01: East Fork Kaskaskia River

EXHIBIT 4

MWH
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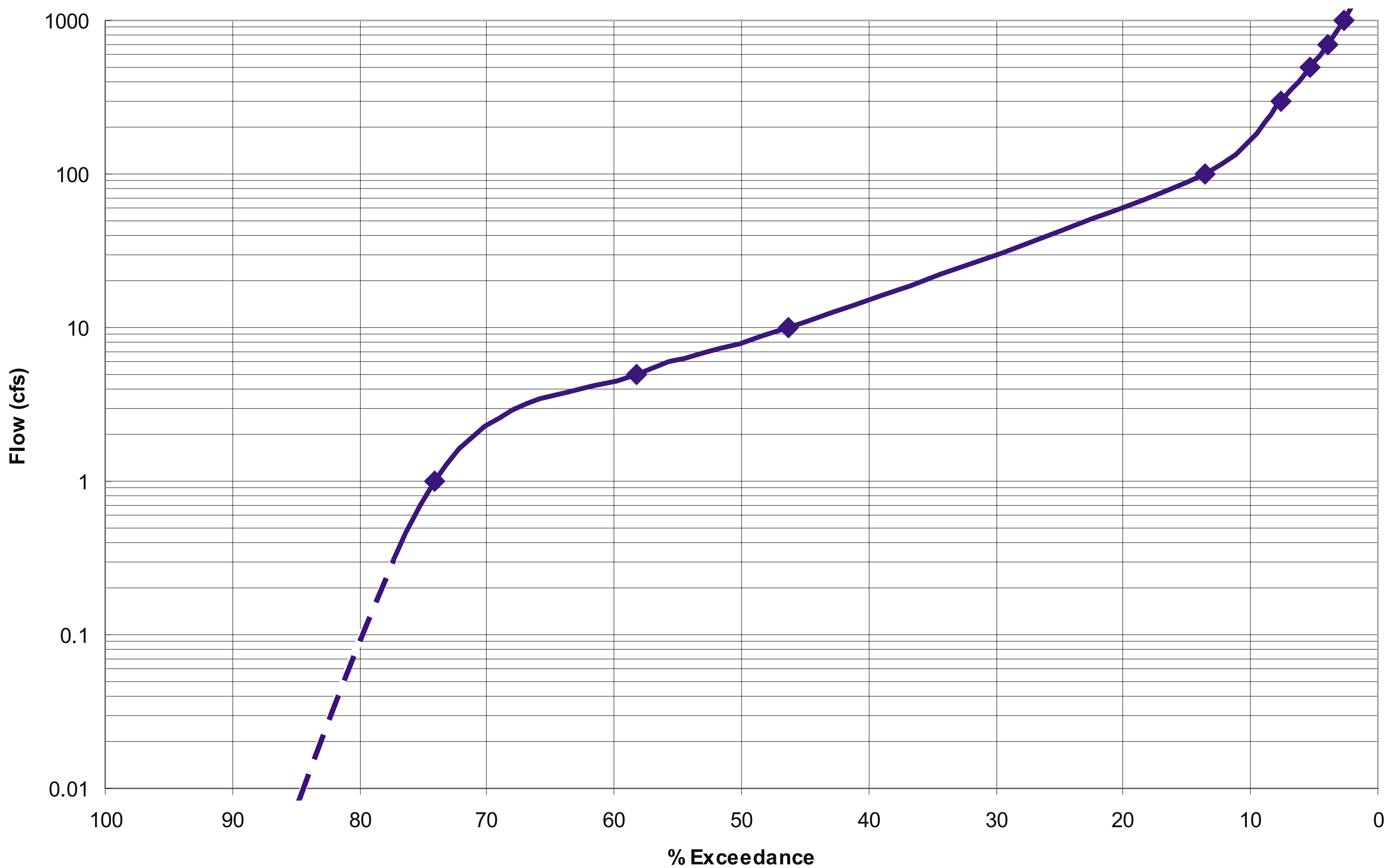

FLOW DURATION CURVE:
EAST FORK KASKASKIA RIVER NEAR SANDOVAL, IL
DEVELOPMENT OF TMDL'S AND IMPLEMENTATION PLANS
FOR TARGET WATERSHEDS
Watershed ILOK01: East Fork Kaskaskia River

EXHIBIT 5

MWH
MONTGOMERY WATSON HARZA

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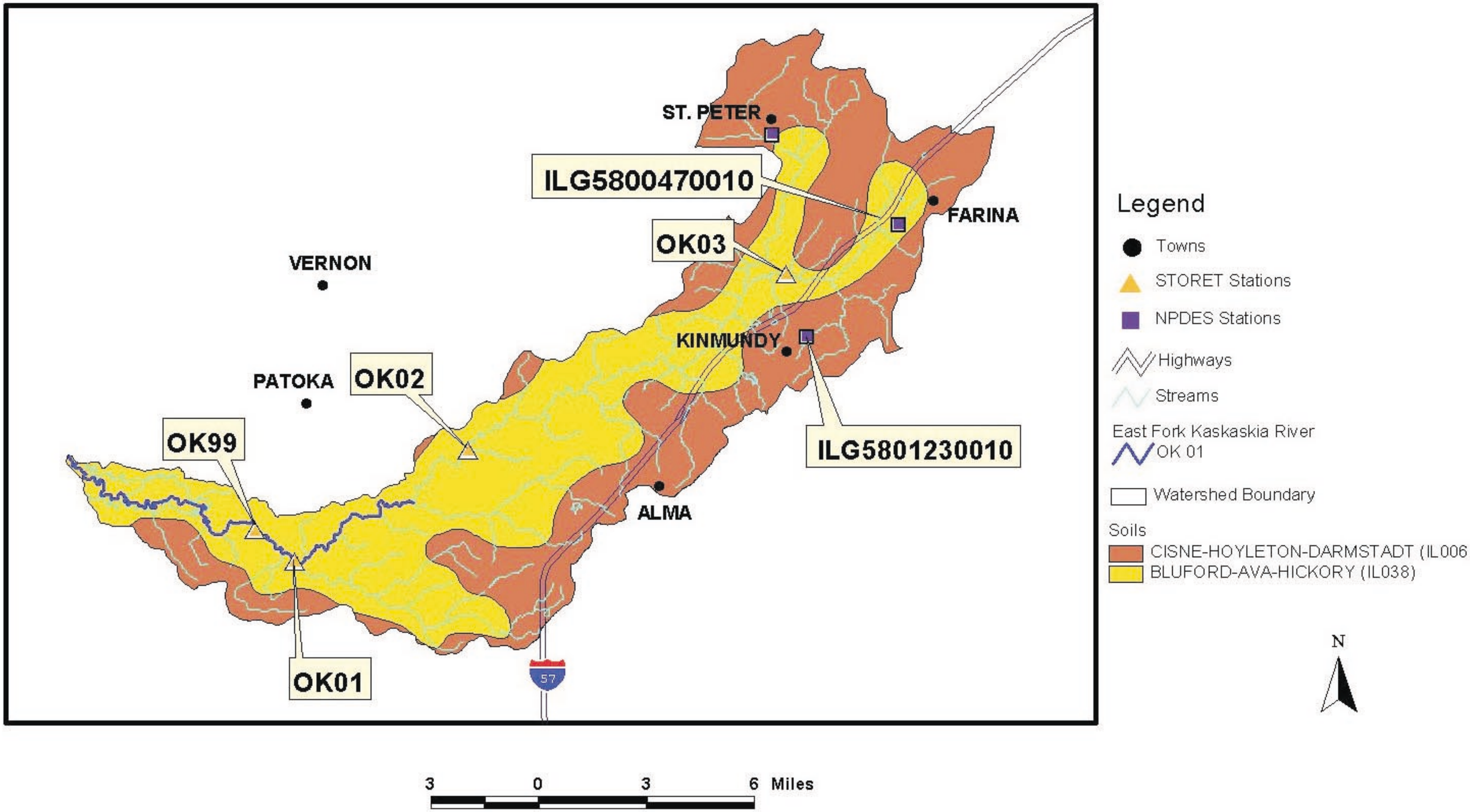

MWH
MONTGOMERY WATSON HARZA

SOIL MAP
DEVELOPMENT OF TMDL'S AND IMPLEMENTATION PLANS FOR TARGET WATERSHEDS
Watershed ILOK01: East Fork Kaskaskia River

EXHIBIT 6

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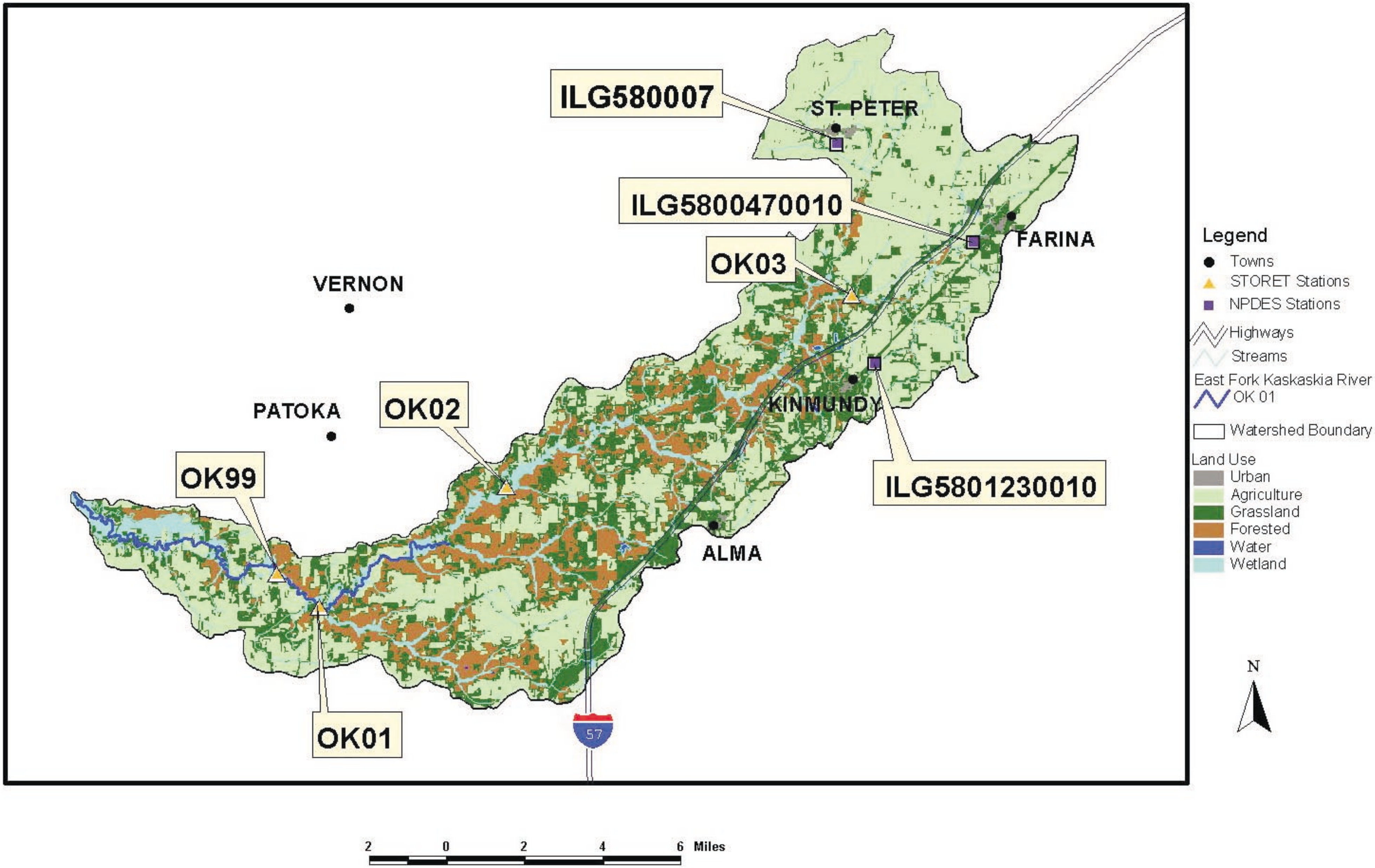


MWH
MONTGOMERY WATSON HARZA

LAND USE MAP
DEVELOPMENT OF TMDL'S AND IMPLEMENTATION PLANS
FOR TARGET WATERSHEDS
Watershed ILOK01: East Fork Kaskaskia River

EXHIBIT 7

EXHIBIT 8

LAND USE AREAS

	OK 01			OK 02			OK 03			OKBA			OKB			OKCA		
Land Use/Land Cover	**IL0038**	**IL0006**	**Total**	**IL0038**	**IL0006**	**Total**	**IL0038**	**IL0006**	**Total**	**IL0038**	**IL0006**	**Total**	**IL0038**	**IL0006**	**Total**	**IL0038**	**IL0006**	**Total**
Urban - High Density	3.5	3.6	7.1	14.7	30.7	45.4	58.0	26.8	84.9	0.7	-	0.7	-	8.1	8.1	-	-	-
Urban - Medium Density	-	-	-	-	104.7	104.7	63.4	18.5	81.9	-	-	-	-	-	-	-	-	-
Agriculture - Row Crop	3,574.3	2,094.4	5,668.7	2,928.7	2,258.3	5,187.0	1,752.4	5,623.6	7,376.0	373.1	856.6	1,229.7	1,231.3	2,256.7	3,488.0	46.4	292.6	339.1
Agriculture - Small Grains	379.3	264.0	643.2	603.5	440.1	1,043.6	551.2	482.7	1,033.9	52.3	46.9	99.1	238.3	152.4	390.6	22.9	157.8	180.7
Agriculture - Orchards/Nurseries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Urban Grassland	-	-	-	-	218.6	218.6	78.6	15.6	94.2	-	-	-	-	-	-	-	-	-
Rural Grassland	2,613.5	635.6	3,249.1	4,110.3	2,134.4	6,244.7	1,284.6	1,152.4	2,437.1	211.3	126.9	338.2	1,203.1	846.5	2,049.6	382.3	265.7	648.0
Forested - Deciduous: Closed Canopy	1,708.4	75.2	1,783.7	3,613.2	655.8	4,269.0	368.9	28.5	397.4	342.4	16.6	359.0	1,919.1	144.6	2,063.7	292.1	231.0	523.1
Forested - Deciduous: Open Canopy	-	-	-	-	-	-	5.4	-	5.4	-	-	-	-	-	-	-	-	-
Water	2.6	-	2.6	10.6	21.6	32.1	2.7	16.4	19.1	-	-	-	3.7	-	3.7	-	-	-
Shallow Marsh/Wet Meadow	94.7	-	94.7	59.2	-	59.2	25.3	-	25.3	-	-	-	-	3.7	3.7	-	-	-
Deep Marsh	2.7	-	2.7	1.3	-	1.3	-	-	-	-	-	-	-	-	-	-	-	-
Forested Wetland	1,588.1	2.6	1,590.7	1,053.6	28.2	1,081.7	82.3	-	82.3	56.5	-	56.5	316.4	-	316.4	35.3	-	35.3
Shallow Water Wetland	76.5	2.0	78.6	27.9	9.9	37.8	33.7	6.1	39.9	3.3	-	3.3	8.8	11.0	19.8	3.2	-	3.2
Total	10,043.7	3,077.5	13,121.2	12,422.9	5,902.2	18,325.1	4,306.7	7,370.7	11,677.4	1,039.6	1,047.0	2,086.6	4,920.8	3,422.9	8,343.8	782.3	947.1	1,729.4

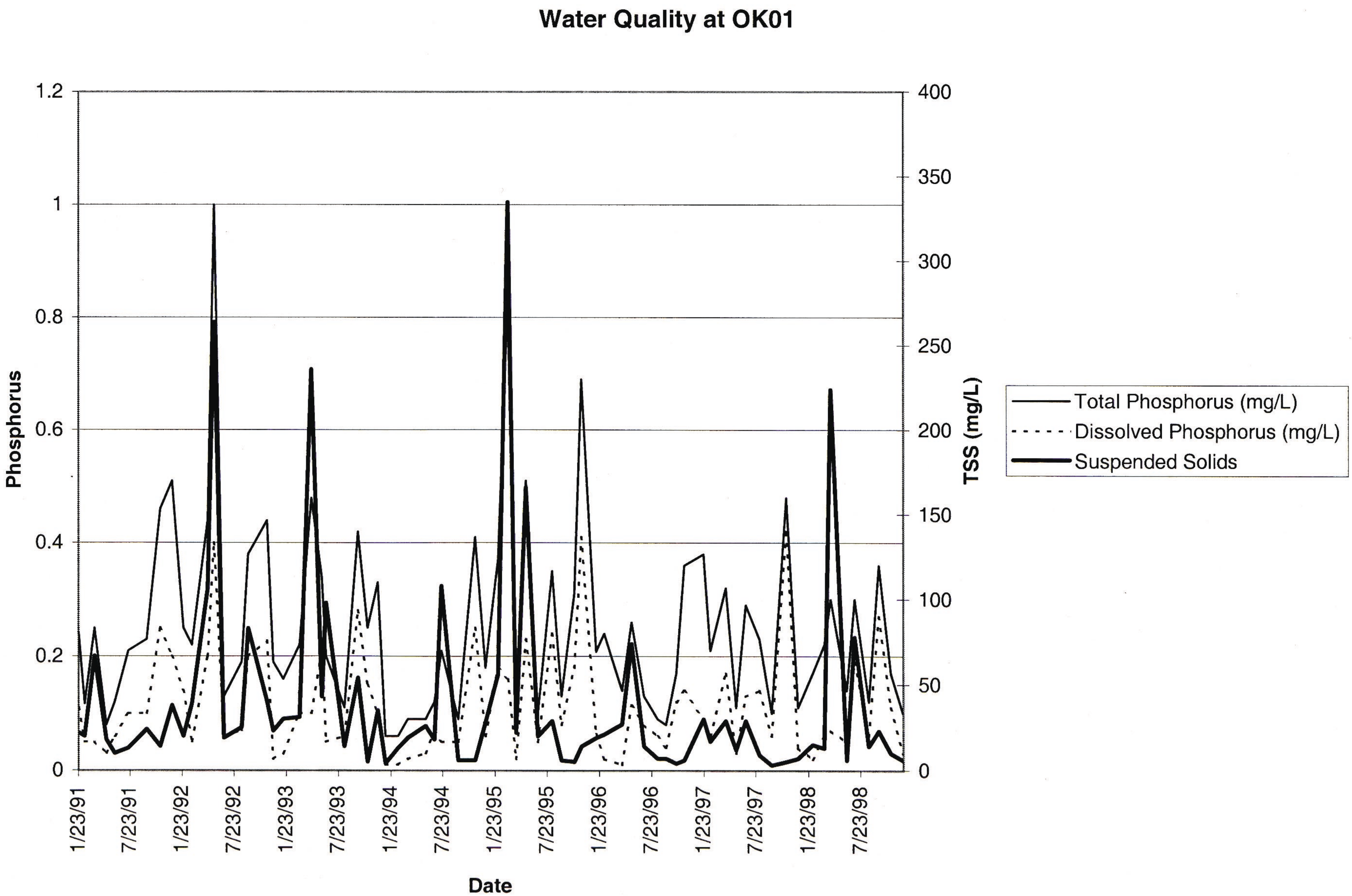
	OKC			OKD			OKE			OKF			OKG			Watershed Totals		
Land Use/Land Cover	**IL0038**	**IL0006**	**Total**	**IL0038**	**IL0006**	**Total**	**IL0038**	**IL0006**	**Total**	**IL0038**	**IL0006**	**Total**	**IL0038**	**IL0006**	**Total**	**IL0038**	**IL0006**	**Total**
Urban - High Density	2.4	-	2.4	-	-	-	-	43.9	43.9	0.7	5.3	6.0	-	12.0	12.0	80.0	130.5	210.5
Urban - Medium Density	-	-	-	-	-	-	0.8	127.5	128.3	-	31.2	31.2	-	31.9	31.9	64.2	313.8	378.0
Agriculture - Row Crop	896.5	638.1	1,534.6	161.8	-	161.8	1,560.5	6,981.1	8,541.6	34.8	2,472.7	2,507.4	361.0	566.5	927.6	12,920.9	24,040.7	36,961.6
Agriculture - Small Grains	90.2	96.1	186.3	63.1	-	63.1	133.4	600.9	734.2	15.4	273.8	289.2	27.6	37.3	64.9	2,177.2	2,551.8	4,729.0
Agriculture - Orchards/Nurseries	-	-	-	-	-	-	-	-	-	-	-	-	-	46.0	46.0	-	46.0	46.0
Urban Grassland	-	-	-	-	-	-	1.0	36.8	37.8	-	43.3	43.3	-	60.8	60.8	79.6	375.1	454.6
Rural Grassland	1,213.9	668.9	1,882.7	223.8	-	223.8	776.1	1,130.2	1,906.3	67.7	1,002.1	1,069.8	386.0	679.5	1,065.5	12,472.8	8,642.1	21,114.8
Forested - Deciduous: Closed Canopy	1,471.7	459.6	1,931.2	190.7	-	190.7	377.2	70.9	448.1	7.4	41.1	48.6	636.7	430.7	1,067.4	10,928.1	2,154.0	13,082.1
Forested - Deciduous: Open Canopy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.4	-	5.4
Water	-	20.0	20.0	-	-	-	-	-	-	-	-	-	-	-	-	19.6	58.0	77.6
Shallow Marsh/Wet Meadow	-	-	-	0.7	-	0.7	-	-	-	-	-	-	-	-	-	179.8	3.7	183.5
Deep Marsh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.0	-	4.0
Forested Wetland	161.1	23.5	184.6	8.4	-	8.4	73.8	15.7	89.5	-	-	-	112.7	23.8	136.5	3,488.1	93.8	3,581.9
Shallow Water Wetland	3.4	8.3	11.7	1.7	-	1.7	3.7	3.4	7.2	6.1	9.5	15.7	3.6	8.3	12.0	172.2	58.7	230.9
Total	3,839.2			650.3	-	650.3	2,926.5	9,010.4	11,936.8		3,879.0	4,011.3	1,527.7	1,897.0	3,424.7	42,592	38,468	81,060

Exhibit 9

WATER QUALITY STATISTICS FOR SEGMENT OK01
JANUARY, 1991 THROUGH DECEMBER, 1998

(Source: STORET)

	N	Mean	Maximum	Minimum	Variance	Standard Deviation	No. Exceedances of G.U. Standard
Water Temperature (C)	72	12.8	26	-3	73	8.57	
Discharge (cfs)	70	63	1,260	0.00	40,013	200	
Turbidity (FTU)	72	21	160	1.1	966	31	
Conductivity (umho/cm)	72	506	915	141	35071	187	
DO (mg/L)	71	7.5	13.6	2	10.3	3.21	22
COD (mg/L)	25	26	58	11	136	11.7	
pH	71	7.41	8.5	6.3	0.16	0.40	
Total Suspended Solids (mg/L)	72	41	335	3	3916	63	
Ammonia N (mg/L)	72	0.25	4.7	0.005	0.36	0.60	
Unionized Ammonia N (mg/L)	72	0	0.022	0.00003	0.00001	0.0035	
Total Kjeldahl N (mg/L)	71	0.93	3.2	0.13	0.26	0.51	
Nitrate+Nitrite N (mg/L)	72	0.52	5.4	0.005	0.61	0.78	
Total Phosphorus (mg/L)	72	0.26	1	0.06	0.03	0.18	
Dissolved Phosphorus (mg/L)	72	0.11	0.42	0.01	0.009	0.10	

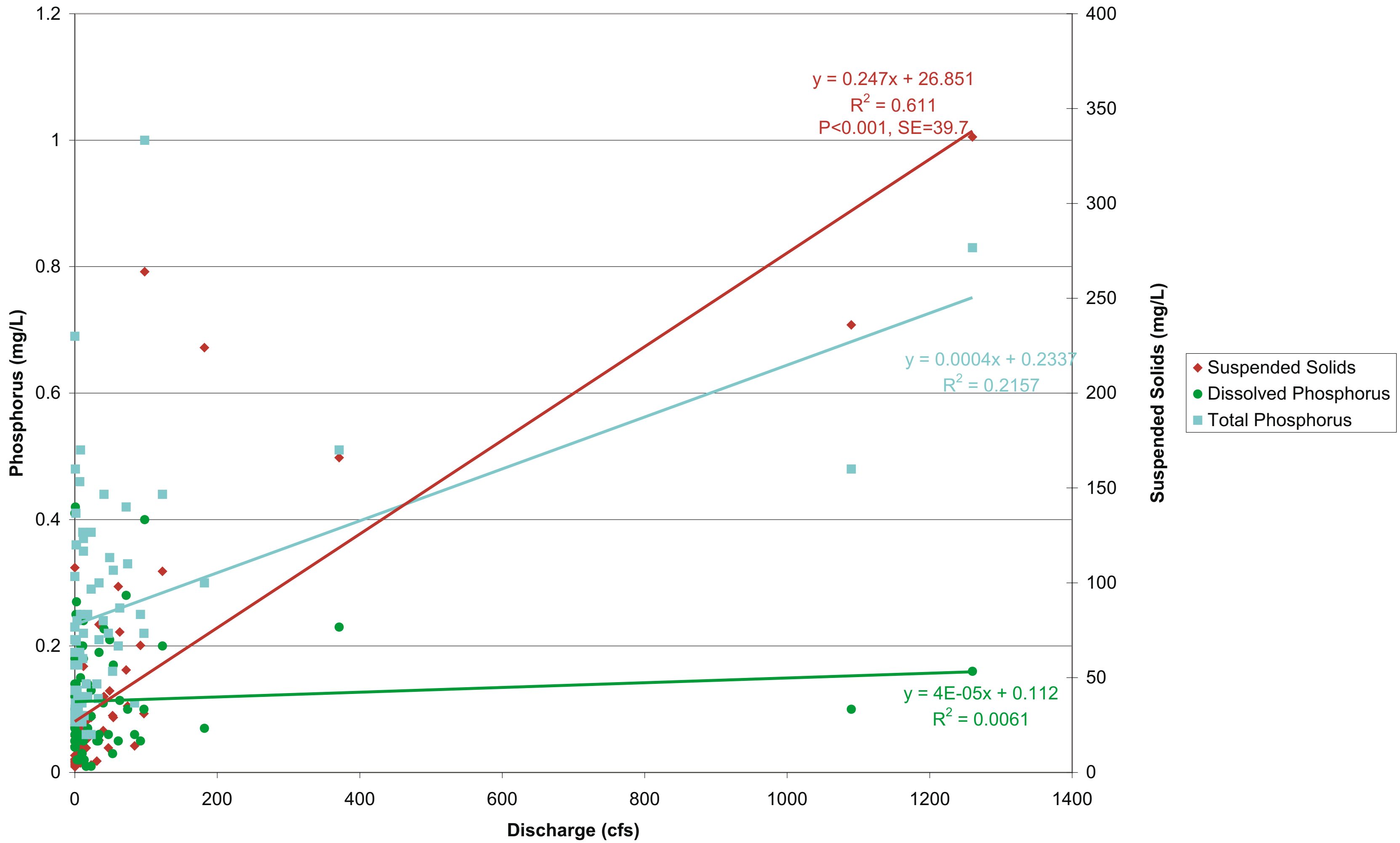


MWH
MONTGOMERY WATSON HARZA

WATER QUALITY AT OK01
DEVELOPMENT OF TMDL'S AND IMPLEMENTATION PLANS
FOR TARGET WATERSHEDS
Watershed ILOK01: East Fork Kaskaskia River

EXHIBIT 10

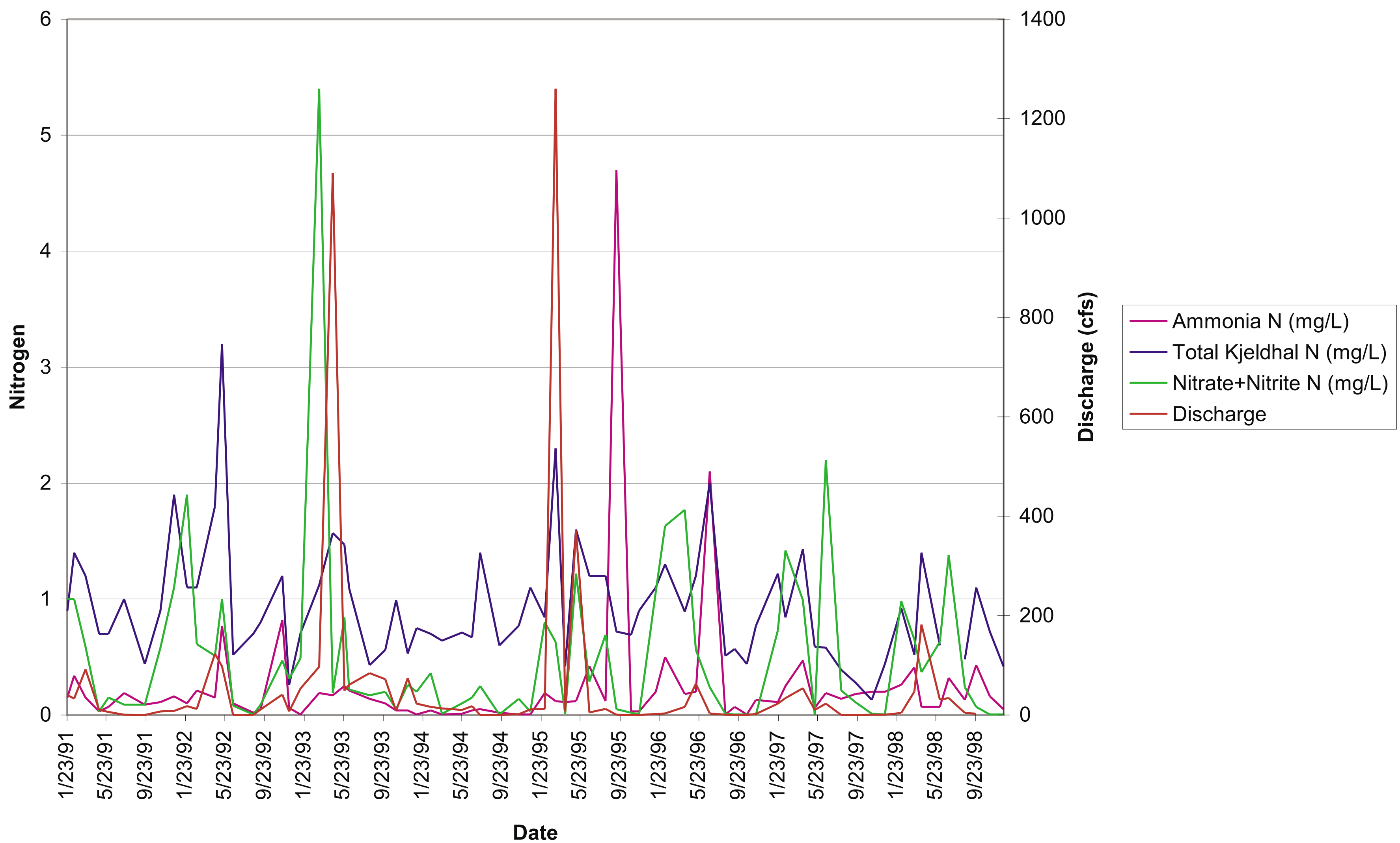
o:/NPDES/kaskaskia/exhibits1.cdr



MWH
MONTGOMERY WATSON HARZA

WATER QUALITY-DISCHARGE RELATIONSHIPS
DEVELOPMENT OF TMDL'S AND IMPLEMENTATION PLANS
FOR TARGET WATERSHEDS
Watershed ILOK01: East Fork Kaskaskia River

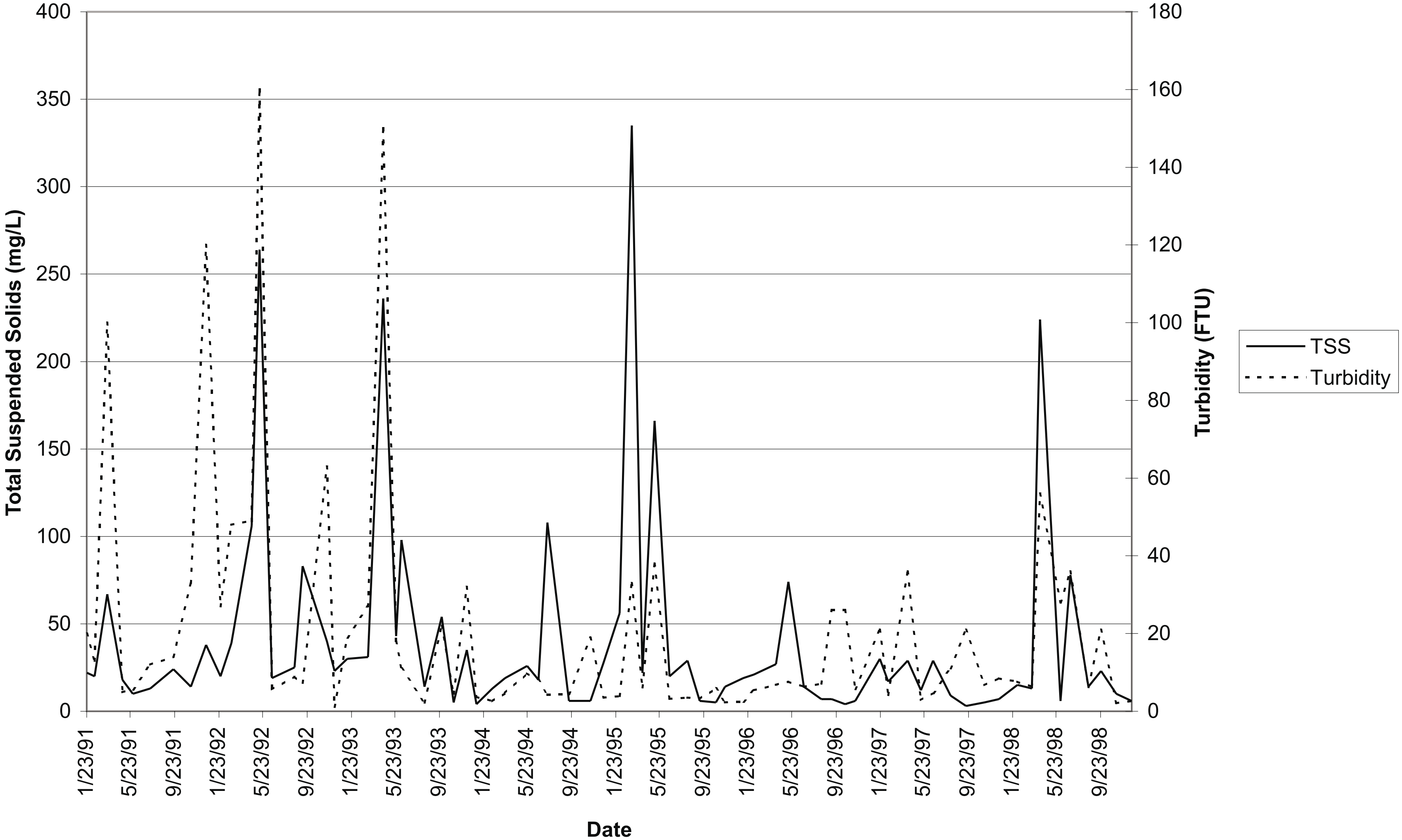
EXHIBIT 11



MWH
MONTGOMERY WATSON HARZA

WATER QUALITY AT OK01
DEVELOPMENT OF TMDL'S AND IMPLEMENTATION PLANS
FOR TARGET WATERSHEDS
Watershed ILOK01: East Fork Kaskaskia River

EXHIBIT 12

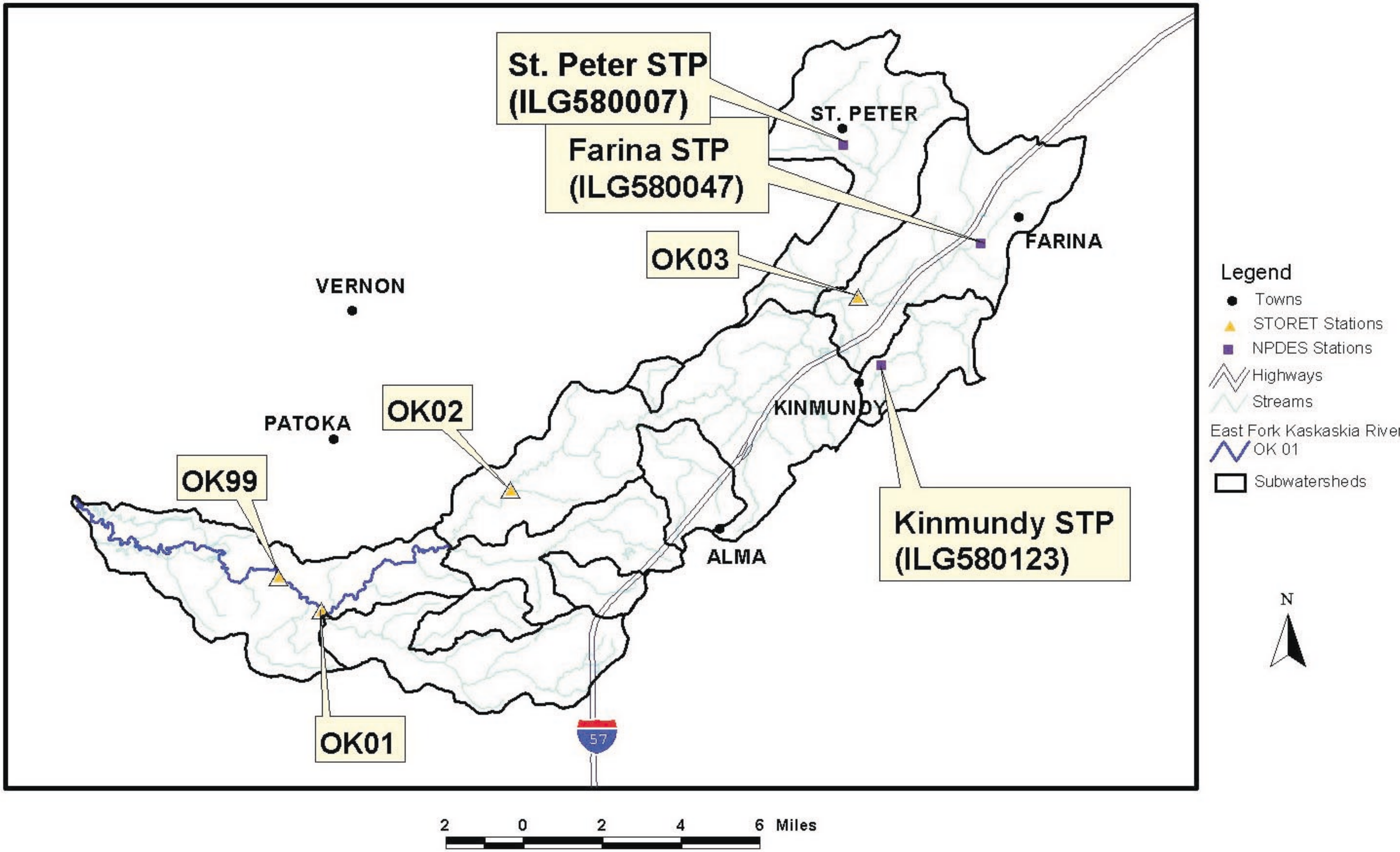


MWH
MONTGOMERY WATSON HARZA

WATER QUALITY AT OK01
DEVELOPMENT OF TMDL'S AND IMPLEMENTATION PLANS
FOR TARGET WATERSHEDS
Watershed ILOK01: East Fork Kaskaskia River

EXHIBIT 13

o:/NPDES/kaskaskia/exhibits1.cdr



MWH
MONTGOMERY WATSON HARZA

POLLUTANT SOURCES
DEVELOPMENT OF TMDL'S AND IMPLEMENTATION PLANS
FOR TARGET WATERSHEDS
Watershed ILOK01: East Fork Kaskaskia River

EXHIBIT 14

EXHIBIT 15

COMPARISON OF SELECTED CAPABILITIES OF SIMPLE AND MID-RANGE WATERSHED MODELS

(after EPA, 1997)

Criteria		EPA Screening	Simple Method	Regression Method	SLOSS-PHOSPH	Watershed	FHWA	WMM	SITEMAP	GWLF	P8-UCM	Auto-QI	AGNPS	SLAMM
Land Uses	Urban	3	2	2		2	3	1	1	1	1	1	-	1
	Rural	2	-	3	2	2	3	1	1	1	-	-	1	-
	Point Sources	-	-	-	-	3	-	3	2	2	1	-	1	1
Time Scale	Annual	3	1	1	1	1	1	1	-	-	-	-	-	-
	Single Event	3	3	3	-	-	3	-	3	-	1	-	1	-
	Continuous	-	-	-	-	-	-	-	1	1	1	1	-	1
Pollutant Loading	Sediment	2	2	2	2	2	-	-	-	1	1	1	1	1
	Nutrients	2	2	2	2	2	2	2	1	1	1	1	1	1
	Others	3	2	2	-	2	2	2	-	-	1	1	-	1

1 = High 2 = Medium 3 = Low - = Not incorporated

EXHIBIT 16

COMPARISON OF CAPABILITIES OF STEADY STATE WATER QUALITY MODELS

(After EPA 1997)

		EPA Screening	EUTROMOD	PHOSMOD	BATHTUB	QUAL2E	EXAMSII	TOXMOD	SMPTOX4	TPM	DECAL
Water Body Type	Rivers/Streams	1	-	-	-	1	1	-	1	-	-
	Lakes/Reservoirs	1	1	1	1	3	-	1	-	-	-
Physical Processes	Advection	1	-	-	1	1	1	-	1	1	1
	Dispersion	1	-	-	1	1	1	-	1	1	1
Particle Fate		3	3	3	3	-	3	3	1	1	1
Eutrophication		1	1	1	1	1	-	-	-	1	-
Chemical Fate		1	-	-	3	3	1	1	1	3	1

1 = High 2 = Medium 3 = Low - = Not incorporated

APPENDICES

APPENDIX A – WATER QUALITY DATA

This appendix contains water quality data provided by the Illinois EPA Bureau of Water.

Segment	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01
Date	23-Jan-91	13-Feb-91	20-Mar-91	1-May-91	30-May-91	17-Jul-91	19-Sep-91	6-Nov-91	18-Dec-91	27-Jan-92	26-Feb-92	22-Apr-92	14-May-92	17-Jun-92	18-Aug-92	10-Sep-92	16-Nov-92	7-Dec-92	11-Jan-93	9-Mar-93	20-Apr-93	26-May-93	10-Jun-93
Water Temperature (C)	-3	5.3	9.8	17.2	24.9	22.8	16.0	3.7	1.3	0.7	5.7	14.5	17.8	25.4	20.1	20.4	4.6	1.3	0.2	5.6	13.3	17.5	21.9
Discharge (cfs)	40	33	92	10	6	0.3	0	7	8	18	12	123	98	0.2	0	11	41	6.9	53	97	1090	49	61
Turbidity (FTU)	20.0	13.0	100.0	4.9	5.6	12.0	14.0	33.0	120.0	27.0	48.0	49.0	160.0	5.6	8.9	7.3	63.0	1.1	19	27	150	18	11
Conductivity (umho/cm)	319	556	357	691	677	385	224	315	402	415	583	358	262	723	248	231	279	588	472	364	186	141	555
DO (mg/L)	11.7	13.6	9.9	7.5	3.5	4	5.1	10.6	12.3	13.6		8.4	6.0	4.1	4.6	5.7	10.8	11.9	12.6	10.9	8.3	7.2	6.9
BOD (mg/L)																							
COD (mg/L)	15.0	17.0	28.0	17.0	19.0	23.0	24.0	34.0	37.0	24.0	25.0	47.0	45.0	18.0	18.0	29.0	33.0	15.0	16.0	20.0	58.0	11.0	19.0
pH	7.2	7.4	7.3	7	7.4	7.6	7.4	7.8	7.6	7.8		7.3	7.2	7.3	7.5	7.2	7.3	7.5	7.5	7.7	7.5	7.4	7.5
Total Suspended Solids (mg/L)	22	20	67	18	10	13	24	14	38	20	39	106	264	19	25	83	40	23	30	31	236	43	98
Ammonia N (mg/L)	0.15	0.34	0.15	0.03	0.07	0.19	0.09	0.11	0.16	0.1	0.21	0.15	0.77	0.1	0.02	0.05	0.82	0.06	0.005	0.19	0.17	0.25	0.21
Unionized Ammonia N (mg/L)	0.0002	0.001	0.0005	0.0001	0.001	0.004	0.0007	0.0008	0.0006	0.0005	0.002	0.0008	0.004	0.001	0.0002	0.0003	0.002	0.0002	0.00003	0.001	0.001	0.002	0.003
Total Kjeldhal N (mg/L)	0.9	1.4	1.2	0.7	0.7	1	0.44	0.90	1.9	1.1	1.1	1.80	3.2	0.52	0.7	0.8	1.2	0.259	0.704	1.119	1.57	1.47	1.09
Nitrate+Nitrite N (mg/L)	1	1	0.6	0.03	0.15	0.09	0.09	0.58	1.1	1.9	0.61	0.51	1.0	0.08	0.005	0.09	0.47	0.31	0.49	5.4	0.19	0.84	0.22
Total Phosphorus (mg/L)	0.24	0.117	0.25	0.08	0.12	0.21	0.23	0.46	0.51	0.25	0.22	0.44	1.00	0.13	0.19	0.38	0.44	0.19	0.16	0.22	0.48	0.34	0.2
Dissolved Phosphorus (mg/L)	0.11	0.05	0.05	0.03	0.06	0.1	0.1	0.25	0.2	0.14	0.05	0.20	0.40	0.06	0.07	0.20	0.227	0.02	0.03	0.10	0.10	0.21	0.05

Segment	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01
Date	12-Aug-93	29-Sep-93	1-Nov-93	7-Dec-93	3-Jan-94	16-Feb-94	23-Mar-94	23-May-94	23-Jun-94	18-Jul-94	15-Sep-94	14-Nov-94	20-Dec-94	2-Feb-95	8-Mar-95	6-Apr-95	10-May-95	20-Jun-95	9-Aug-95	11-Sep-95	26-Oct-95	20-Nov-95	10-Jan-96
Water Temperature (C)	23.3	14	5.4	5	0.5	2	12.3	21	26	24.1	21.3	13.6	4.5	2.4	3.7	11	18	23	25.2	19.1	11.4	7.1	1
Discharge (cfs)	84	72	8	74	23	16	13	10	18	0.1	0.09	1.6	11	12	1260	7	371	5	12	0.4	0.00	0.01	2
Turbidity (FTU)	2.2	22	4.5	32	3.7	2.6	4.7	9.8	8.1	4.3	4.4	19	3.5	3.9	33	6.1	38	3.2	3.5	3.2	5.9	2.3	2.5
Conductivity (umho/cm)	472	335	615	425	821	755	865	715	770	399	532	512	785	416	183	772	270	580	369	458	504	478	591
DO (mg/L)	4.9	8.1	4.7	10.8	12.4	12.8	9.3	7.4	4.4	3.6	4.5	3.8	9.9	12.6	11.2	11.8	6.4	4.5	4.4	4.2	2	4.3	6.5
BOD (mg/L)																							
COD (mg/L)	19.0	38.0																					
pH	7.8	7.0	7.6	7.4	7.6	7.9	8.4	7.6	7.6	7.9	7.9	7.9	7.6	7.5	7.3	7.8	7.0	7.3	6.9	7.1	6.7	7.0	7.5
Total Suspended Solids (mg/L)	14	54	5	35	4	13	19	26	18	108	6	6	28	56	335	22	166	20	29	6	5	14	19
Ammonia N (mg/L)	0.14	0.1	0.04	0.04	0.005	0.04	0.005	0.01	0.04	0.05	0.02	0.005	0.005	0.19	0.12	0.11	0.12	0.42	0.12	4.7	0.03	0.03	0.2
Unionized Ammonia N (mg/L)	0.004	0.0003	0.0002	0.0001	0.00003	0.0003	0.0005	0.0002	0.0009	0.002	0.0007	0.0002	0.00005	0.0006	0.0003	0.001	0.0004	0.004	0.0005	0.022	0.00003	0.00004	0.0006
Total Kjeldhal N (mg/L)	0.43	0.56	0.99	0.53	0.75	0.7	0.64	0.71	0.67	1.4	0.6	0.77	1.1	0.84	2.3	0.42	1.6	1.2	1.2	0.72	0.69	0.9	1.1
Nitrate+Nitrite N (mg/L)	0.17	0.2	0.05	0.26	0.2	0.36	0.01	0.1	0.15	0.25	0.005	0.14	0.03	0.8	0.63	0.01	1.22	0.29	0.69	0.05	0.02	0.005	1.06
Total Phosphorus (mg/L)	0.11	0.42	0.25	0.33	0.06	0.06	0.09	0.09	0.12	0.21	0.09	0.41	0.18	0.37	0.83	0.08	0.51	0.1	0.35	0.13	0.31	0.69	0.208
Dissolved Phosphorus (mg/L)	0.06	0.28	0.15	0.1	0.01	0.01	0.02	0.03	0.07	0.05	0.05	0.25	0.06	0.18	0.16	0.02	0.23	0.05	0.24	0.08	0.18	0.41	0.064

Segment	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01	OK01
Date	8-Feb-96	9-Apr-96	13-May-96	25-Jun-96	12-Aug-96	10-Sep-96	17-Oct-96	14-Nov-96	21-Jan-97	13-Feb-97	8-Apr-97	14-May-97	17-Jun-97	4-Aug-97	16-Sep-97	6-Nov-97	16-Dec-97	5-Feb-98	17-Mar-98	8-Apr-98	4-Jun-98	1-Jul-98	20-Aug-98
Water Temperature (C)	9	9	11	19	23	24	23	1	1	2	12	15.5	21	24	20	8	3	4.3	8	15.8	19.6	25	24.8
Discharge (cfs)	3	16	63	3	0.4	0.00	0.05	2	23	34	54	10	23	0.07	0.2	0.66	0.50	4.30	47	182	31	34	4.2
Turbidity (FTU)	5.4	6.8	7.6	6.3	7.1	26	26	5.7	21	4.2	36	2.9	4.7	11	21	6.7	8.5	7.6	6.3	56	28	36	6.2
Conductivity (umho/cm)	679	616	420	508	643	597	584	507	900	560	388	670	457	291	364	378	860	915	603	403	514	425	536
DO (mg/L)	9	10.1	8.4	5.2	6	7.9	4.1	4.0	7.5	12.6	8.8	7.8	5.9	3.8	2.9	2.4	6.5	12.5	10	7.9	6	4.1	5.5
BOD (mg/L)																							
COD (mg/L)																							
pH	6.3	7	7.5	7.2	7.7	7.6	6.9	7.1	6.7	8.5	7.3	8.3	7.3	7.2	7.3	6.9	7.4	7.8	8.2	7.1	7.4	7.3	7.1
Total Suspended Solids (mg/L)	21	27	74	14	7	7	4	6	30	17	29	12	29	9	3	5	7	15	13	224	6	78	14
Ammonia N (mg/L)	0.5	0.18	0.2	2.1	0.005	0.07	0.005	0.13	0.11	0.25	0.47	0.06	0.19	0.14	0.18	0.2	0.2	0.26	0.41	0.07	0.07	0.32	0.13
Unionized Ammonia N (mg/L)	0.0001	0.0003	0.002	0.017	0.0002	0.001	0.00003	0.0002	0.00005	0.007	0.002	0.003	0.002	0.001	0.001	0.0003	0.0005	0.002	0.01	0.0003	0.0008	0.004	0.0009
Total Kjeldhal N (mg/L)	1.3	0.89	1.2	2	0.51	0.57	0.44	0.77	1.22	0.84	1.43	0.59	0.58	0.39	0.28	0.13	0.44	0.92	0.52	1.4	0.6		0.48
Nitrate+Nitrite N (mg/L)	1.63	1.77	0.56	0.24	0.01	0.005	0.005	0.005	0.73	1.42	0.99	0.005	2.2	0.21	0.11	0.01	0.005	0.98	0.65	0.37	0.63	1.38	0.24
Total Phosphorus (mg/L)	0.24	0.14	0.26	0.13	0.09	0.08	0.17	0.36	0.38	0.21	0.32	0.11	0.29	0.23	0.1	0.48	0.11	0.17	0.22	0.3	0.14	0.3	0.12
Dissolved Phosphorus (mg/L)	0.02	0.01	0.114	0.08	0.06	0.04	0.12	0.14	0.089	0.06	0.17	0.03	0.13	0.14	0.06	0.42	0.04	0.02	0.06	0.07	0.05	0.19	0.06

ILOK01 Water Quality Data

Segment	OK01	OK01	OK01
Date	24-Sep-98	5-Nov-98	17-Dec-98
Water Temperature (C)	18.4	10.1	5.9
Discharge (cfs)	2.3	#N/A	#N/A
Turbidity (FTU)	21	2.1	2.6
Conductivity (umho/cm)	288	578	766
DO (mg/L)	4.2	6.8	9.2
BOD (mg/L)			
COD (mg/L)			
pH	7.3	6.7	7.3
Total Suspended Solids (mg/L)	23	10	6
Ammonia N (mg/L)	0.43	0.16	0.05
Unionized Ammonia N (mg/L)	0.003	0.0002	0.0001
Total Kjeldhal N (mg/L)	1.1	0.72	0.42
Nitrate+Nitrite N (mg/L)	0.07	0.005	0.005
Total Phosphorus (mg/L)	0.36	0.17	0.1
Dissolved Phosphorus (mg/L)	0.27	0.11	0.03

APPENDIX B – WATERSHED MODEL

The Illinois EPA Bureau of Water has been provided with the GIS and spreadsheets used to calculate sediment loadings to the East Fork Kaskaskia River watershed. The spreadsheets are reprinted in this appendix.

East Fork Kaskaskia Watershed
Summary Sheet - Fall
Sediment Loading to Stream (Soil Loss multiplied by Delivery Ratio)

Subwatershed	Area (acres)	Sediment Yield (tons) 3-Year Storm	tons sediment/acre 3-Year Storm	Sediment Yield (tons) 10-Year Storm	tons sediment/acre 10-Year Storm	Sediment Yield (tons) 1-Year Storm	tons sediment/acre 1-Year Storm
OK01	13121	713	0.054	1203	0.092	393	0.030
OK02	18325	656	0.036	1107	0.060	362	0.020
OK03	11677	502	0.043	847	0.073	277	0.024
OKB	8344	328	0.039	554	0.066	181	0.022
OKBA	2087	131	0.063	221	0.106	72	0.035
OKC	5754	245	0.043	413	0.072	135	0.023
OKCA	1729	45	0.026	76	0.044	25	0.014
OKD	650	59	0.091	100	0.153	33	0.050
OKF	4011	116	0.029	195	0.049	64	0.016
OKG	3425	95	0.028	159	0.047	52	0.015
OKE	11937	464	0.039	783	0.066	256	0.021
Total	**81060**	**3355**		**5657**		**1848**	

Soil Loss Calculated from USLE

Subwatershed	Area (acres)	Soil Loss (tons) 3-Year Storm	tons sediment/acre 3-Year Storm	Soil Loss (tons) 10-Year Storm	tons sediment/acre 10-Year Storm	Soil Loss (tons) 1-Year Storm	tons sediment/acre 1-Year Storm
OK01	13121	12516	0.954	21107	1.609	6894	0.525
OK02	18325	11518	0.629	19424	1.060	6344	0.346
OK03	11677	9297	0.796	15678	1.343	5121	0.439
OKB	8344	5474	0.656	9232	1.106	3015	0.361
OKBA	2087	1747	0.837	2946	1.412	962	0.461
OKC	5754	3398	0.591	5731	0.996	1872	0.325
OKCA	1729	482	0.279	813	0.470	265	0.153
OKD	650	562	0.865	948	1.458	310	0.476
OKF	4011	1755	0.437	2959	0.738	967	0.241
OKG	3425	1576	0.460	2657	0.776	868	0.253
OKE	11937	9105	0.763	15356	1.286	5016	0.420
Total	**81060**	**57429**		**96851**		**31635**	

This sheet calculates the overall weighted C factors for each subwatershed

		C Factor	**OK01**	**OK02**	**OK03**	**OKB**	**OKBA**	**OKC**	**OKCA**	**OKD**	**OKE**	**OKF**	**OKG**
IL038	Urban - High Density	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Urban - Medium Density	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Agriculture - Row Crop	0.22	0.060	0.035	0.033	0.032	0.039	0.034	0.006	0.055	0.029	0.002	0.023
	Agriculture - Small Grains	0.055	0.002	0.002	0.003	0.002	0.001	0.001	0.001	0.005	0.001	0.000	0.000
	Agriculture - Orchards/Nurseries	0.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Urban Grassland	0.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Rural Grassland	0.02	0.004	0.004	0.002	0.003	0.002	0.004	0.004	0.007	0.001	0.000	0.002
	Forested - Deciduous: Closed Canopy	0.004	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.001
	Forested - Deciduous: Open Canopy	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Water	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Shallow Marsh/Wet Meadow	0.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Deep Marsh	0.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Forested Wetland	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Shallow Water Wetland	0.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IL006	Urban - High Density	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Urban - Medium Density	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Agriculture - Row Crop	0.22	0.035	0.027	0.106	0.060	0.090	0.024	0.037	0.000	0.129	0.136	0.036
	Agriculture - Small Grains	0.055	0.001	0.001	0.002	0.001	0.001	0.001	0.005	0.000	0.003	0.004	0.001
	Agriculture - Orchards/Nurseries	0.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
	Urban Grassland	0.055	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
	Rural Grassland	0.02	0.001	0.002	0.002	0.002	0.001	0.002	0.003	0.000	0.002	0.005	0.004
	Forested - Deciduous: Closed Canopy	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001
	Forested - Deciduous: Open Canopy	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Water	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Shallow Marsh/Wet Meadow	0.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Deep Marsh	0.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Forested Wetland	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Shallow Water Wetland	0.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Weighted C Factor		**0.104**	**0.074**	**0.149**	**0.101**	**0.136**	**0.069**	**0.058**	**0.068**	**0.164**	**0.148**	**0.070**

Universal Soil Loss Equation
1-year storm

Soil Type	Land Use	X (ton/ha)	E (10^2 m-ton-cm/ha-hr)	k (ton/ha per unit of E)	ls	C	P
IL038	Urban - High Density	0.00	65	0.41	0.50	0	1
	Urban - Medium Density	0.00	65	0.41	0.50	0	1
	Agriculture - Row Crop	3.79	65	0.41	0.50	0.22	1
	Agriculture - Small Grains	0.95	65	0.41	0.50	0.055	1
	Agriculture - Orchards/Nurseries	0.95	65	0.41	0.50	0.055	1
	Urban Grassland	0.95	65	0.41	0.50	0.055	1
	Rural Grassland	0.34	65	0.41	0.50	0.02	1
	Forested - Deciduous: Closed Canopy	0.07	65	0.41	0.50	0.004	1
	Forested - Deciduous: Open Canopy	0.07	65	0.41	0.50	0.004	1
	Water	0.00	65	0.41	0.50	0	1
	Shallow Marsh/Wet Meadow	0.95	65	0.41	0.50	0.055	1
	Deep Marsh	0.95	65	0.41	0.50	0.055	1
	Forested Wetland	0.07	65	0.41	0.50	0.004	1
	Shallow Water Wetland	0.95	65	0.41	0.50	0.055	1
IL006	Urban - High Density	0.00	65	0.37	0.12	0	1
	Urban - Medium Density	0.00	65	0.37	0.12	0	1
	Agriculture - Row Crop	0.84	65	0.37	0.12	0.22	1
	Agriculture - Small Grains	0.21	65	0.37	0.12	0.055	1
	Agriculture - Orchards/Nurseries	0.21	65	0.37	0.12	0.055	1
	Urban Grassland	0.21	65	0.37	0.12	0.055	1
	Rural Grassland	0.08	65	0.37	0.12	0.02	1
	Forested - Deciduous: Closed Canopy	0.02	65	0.37	0.12	0.004	1
	Forested - Deciduous: Open Canopy	0.02	65	0.37	0.12	0.004	1
	Water	0.00	65	0.37	0.12	0	1
	Shallow Marsh/Wet Meadow	0.21	65	0.37	0.12	0.055	1
	Deep Marsh	0.21	65	0.37	0.12	0.055	1
	Forested Wetland	0.02	65	0.37	0.12	0.004	1
	Shallow Water Wetland	0.21	65	0.37	0.12	0.055	1

East Fork - OK02
Sediment Yield - 3 yr storm

	Sediment Yield (tons)
	656

Soils	**Land Use**	**Xk**	**Ak(acres)**	**Ak (ha)**	**Xk*Ak**	**sd**
IL038	Urban - High Density	0.00	15	6	0	0.057
	Urban - Medium Density	0.00	0	0	0	
	Agriculture - Row Crop	6.87	2929	1,185	8,145	
	Agriculture - Small Grains	1.72	604	244	420	
	Agriculture - Orchards/Nurseries	1.72	0	0	0	
	Urban Grassland	1.72	0	0	0	
	Rural Grassland	0.62	4110	1,663	1,039	
	Forested - Deciduous: Closed Canopy	0.12	3613	1,462	183	
	Forested - Deciduous: Open Canopy	0.12	0	0	0	
	Water	0.00	11	4	0	
	Shallow Marsh/Wet Meadow	1.72	59	24	41	
	Deep Marsh	1.72	1	1	1	
	Forested Wetland	0.12	1054	426	53	
	Shallow Water Wetland	1.72	28	11	19	
IL006	Urban - High Density	0.00	31	12	0	
	Urban - Medium Density	0.00	105	42	0	
	Agriculture - Row Crop	1.52	2258	914	1,387	
	Agriculture - Small Grains	0.38	440	178	68	
	Agriculture - Orchards/Nurseries	0.38	0	0	0	
	Urban Grassland	0.38	219	88	34	
	Rural Grassland	0.14	2134	864	119	
	Forested - Deciduous: Closed Canopy	0.03	656	265	7	
	Forested - Deciduous: Open Canopy	0.03	0	0	0	
	Water	0.00	22	9	0	
	Shallow Marsh/Wet Meadow	0.38	0	0	0	
	Deep Marsh	0.38	0	0	0	
	Forested Wetland	0.03	28	11	0	
	Shallow Water Wetland	0.38	10	4	2	
			18325	7416	11,518	

Sd = Sediment Delivery Ratio (based on watershed size of 18,326 acres and Figure III-13)

East Fork - OK03
Sediment Yield - 10 yr storm

Sediment Yield (tons)
847

Soils	**Land Use**	**Xk**	**Ak(acres)**	**Ak (ha)**	**Xk*Ak**	**sd**
IL038	Urban - High Density	0.00	58	23	0	0.054
	Urban - Medium Density	0.00	63	26	0	
	Agriculture - Row Crop	11.59	1752	709	8,219	
	Agriculture - Small Grains	2.90	551	223	646	
	Agriculture - Orchards/Nurseries	2.90	0	0	0	
	Urban Grassland	2.90	79	32	92	
	Rural Grassland	1.05	1285	520	548	
	Forested - Deciduous: Closed Canopy	0.21	369	149	31	
	Forested - Deciduous: Open Canopy	0.21	5	2	0	
	Water	0.00	3	1	0	
	Shallow Marsh/Wet Meadow	2.90	25	10	30	
	Deep Marsh	2.90	0	0	0	
	Forested Wetland	0.21	82	33	7	
	Shallow Water Wetland	2.90	34	14	40	
IL006	Urban - High Density	0.00	27	11	0	
	Urban - Medium Density	0.00	18	7	0	
	Agriculture - Row Crop	2.56	5624	2,276	5,826	
	Agriculture - Small Grains	0.64	483	195	125	
	Agriculture - Orchards/Nurseries	0.64	0	0	0	
	Urban Grassland	0.64	16	6	4	
	Rural Grassland	0.23	1152	466	109	
	Forested - Deciduous: Closed Canopy	0.05	28	12	1	
	Forested - Deciduous: Open Canopy	0.05	0	0	0	
	Water	0.00	16	7	0	
	Shallow Marsh/Wet Meadow	0.64	0	0	0	
	Deep Marsh	0.64	0	0	0	
	Forested Wetland	0.05	0	0	0	
	Shallow Water Wetland	0.64	6	2	2	
			11677	4726	15,678	

Sd = Sediment Delivery Ratio (based on watershed size of 11,677 acres and Figure III-13)

Universal Soil Loss Equation
1-in-10 year storm

Soil Type	Land Use	X (ton/ha)	E (10^2 m-ton-cm/ha-hr)	k (ton/ha per unit of E)	ls	C	P
IL038	Urban - High Density	0.00	199.00	0.41	0.50	0	1
	Urban - Medium Density	0.00	199.00	0.41	0.50	0	1
	Agriculture - Row Crop	11.59	199.00	0.41	0.50	0.22	1
	Agriculture - Small Grains	2.90	199.00	0.41	0.50	0.055	1
	Agriculture - Orchards/Nurseries	2.90	199.00	0.41	0.50	0.055	1
	Urban Grassland	2.90	199.00	0.41	0.50	0.055	1
	Rural Grassland	1.05	199.00	0.41	0.50	0.02	1
	Forested - Deciduous: Closed Canopy	0.21	199.00	0.41	0.50	0.004	1
	Forested - Deciduous: Open Canopy	0.21	199.00	0.41	0.50	0.004	1
	Water	0.00	199.00	0.41	0.50	0	1
	Shallow Marsh/Wet Meadow	2.90	199.00	0.41	0.50	0.055	1
	Deep Marsh	2.90	199.00	0.41	0.50	0.055	1
	Forested Wetland	0.21	199.00	0.41	0.50	0.004	1
	Shallow Water Wetland	2.90	199.00	0.41	0.50	0.055	1
IL006	Urban - High Density	0.00	199.00	0.37	0.12	0	1
	Urban - Medium Density	0.00	199.00	0.37	0.12	0	1
	Agriculture - Row Crop	2.56	199.00	0.37	0.12	0.22	1
	Agriculture - Small Grains	0.64	199.00	0.37	0.12	0.055	1
	Agriculture - Orchards/Nurseries	0.64	199.00	0.37	0.12	0.055	1
	Urban Grassland	0.64	199.00	0.37	0.12	0.055	1
	Rural Grassland	0.23	199.00	0.37	0.12	0.02	1
	Forested - Deciduous: Closed Canopy	0.05	199.00	0.37	0.12	0.004	1
	Forested - Deciduous: Open Canopy	0.05	199.00	0.37	0.12	0.004	1
	Water	0.00	199.00	0.37	0.12	0	1
	Shallow Marsh/Wet Meadow	0.64	199.00	0.37	0.12	0.055	1
	Deep Marsh	0.64	199.00	0.37	0.12	0.055	1
	Forested Wetland	0.05	199.00	0.37	0.12	0.004	1
	Shallow Water Wetland	0.64	199.00	0.37	0.12	0.055	1

Universal Soil Loss Equation
1-in-10 year storm

Soil Type	Land Use	X (ton/ha)	E (10^2 m-ton-cm/ha-hr)	k (ton/ha per unit of E)	ls	C	P
IL038	Urban - High Density	0.00	199.00	0.43	0.50	0	1
	Urban - Medium Density	0.00	199.00	0.43	0.50	0	1
	Agriculture - Row Crop	12.15	199.00	0.43	0.50	0.22	1
	Agriculture - Small Grains	3.04	199.00	0.43	0.50	0.055	1
	Agriculture - Orchards/Nurseries	3.04	199.00	0.43	0.50	0.055	1
	Urban Grassland	3.04	199.00	0.43	0.50	0.055	1
	Rural Grassland	1.10	199.00	0.43	0.50	0.02	1
	Forested - Deciduous: Closed Canopy	0.22	199.00	0.43	0.50	0.004	1
	Forested - Deciduous: Open Canopy	0.22	199.00	0.43	0.50	0.004	1
	Water	0.00	199.00	0.43	0.50	0	1
	Shallow Marsh/Wet Meadow	3.04	199.00	0.43	0.50	0.055	1
	Deep Marsh	3.04	199.00	0.43	0.50	0.055	1
	Forested Wetland	0.22	199.00	0.43	0.50	0.004	1
	Shallow Water Wetland	3.04	199.00	0.43	0.50	0.055	1
IL006	Urban - High Density	0.00	199.00	0.37	0.12	0	1
	Urban - Medium Density	0.00	199.00	0.37	0.12	0	1
	Agriculture - Row Crop	2.56	199.00	0.37	0.12	0.22	1
	Agriculture - Small Grains	0.64	199.00	0.37	0.12	0.055	1
	Agriculture - Orchards/Nurseries	0.64	199.00	0.37	0.12	0.055	1
	Urban Grassland	0.64	199.00	0.37	0.12	0.055	1
	Rural Grassland	0.23	199.00	0.37	0.12	0.02	1
	Forested - Deciduous: Closed Canopy	0.05	199.00	0.37	0.12	0.004	1
	Forested - Deciduous: Open Canopy	0.05	199.00	0.37	0.12	0.004	1
	Water	0.00	199.00	0.37	0.12	0	1
	Shallow Marsh/Wet Meadow	0.64	199.00	0.37	0.12	0.055	1
	Deep Marsh	0.64	199.00	0.37	0.12	0.055	1
	Forested Wetland	0.05	199.00	0.37	0.12	0.004	1
	Shallow Water Wetland	0.64	199.00	0.37	0.12	0.055	1

Universal Soil Loss Equation
1-in-10 year storm

Soil Type	Land Use	X (ton/ha)	E (10^2 m-ton-cm/ha-hr)	k (ton/ha per unit of E)	ls	C	P
IL038	Urban - High Density	0.00	199.00	0.41	0.50	0	1
	Urban - Medium Density	0.00	199.00	0.41	0.50	0	1
	Agriculture - Row Crop	11.59	199.00	0.41	0.50	0.22	1
	Agriculture - Small Grains	2.90	199.00	0.41	0.50	0.055	1
	Agriculture - Orchards/Nurseries	2.90	199.00	0.41	0.50	0.055	1
	Urban Grassland	2.90	199.00	0.41	0.50	0.055	1
	Rural Grassland	1.05	199.00	0.41	0.50	0.02	1
	Forested - Deciduous: Closed Canopy	0.21	199.00	0.41	0.50	0.004	1
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	Shallow Marsh/Wet Meadow	2.90	199.00	0.41	0.50	0.055	1
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1-in-10 year storm

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APPENDIX C – WATER QUALITY MODEL

The Illinois EPA Bureau of Water has been provided with the spreadsheets used to calculate water quality in the East Fork Kaskaskia River from the information reprinted in Appendix B. The water quality model spreadsheets are reprinted in this appendix.

Landuse	Area (sf)	Area (acres)	Percentage	Curve Number[1]	Weighted Curve Number
Urban - High Density[2]		44	0	83	0.31
Urban - Medium Density[3]		128	1	80	0.86
Agriculture - Row Crop[4]		8542	72	85	60.82
Agriculture - Small Grains[5]		734	6	83	5.11
Agriculture - Orchards/Nurseries[6]		0	0	71	0.00
Urban Grassland[7]		38	0	74	0.23
Rural Grassland[8]		1906	16	79	12.62
Forested - Deciduous: Closed Canopy[9]		448	4	70	2.63
Forested - Deciduous: Open Canopy[10]		0	0	73	0.00
Water		0	0	0	0.00
Shallow Marsh/Wet Meadow[11]		0	0	86	0.00
Deep Marsh		0	0	0	0.00
Forested Wetland[12]		89	1	77	0.58
Shallow Water Wetland		7	0	0	0.00
		11937	**100**		**83**

[1] Assumes Group C soils:clay loams, shallow sandy loams, soils low in organic content, and soil usually high in clay.
[2] Assumes 1/4 acre residential lots
[3] Assumes 1/2 acre residential lots
[4] Assumes Cultivated Land withou conservation treatment
[5] Assumes Small grain, straight row, good condition
[6] Assumes Meadow
[7] Assumes Open Spaces, good condition
[8] Assumes Open Spaces, fair condition
[9] Assumes Woods, good condition
[10] Assumes Woods, fair condition
[11] Assumes Pasture, poor condition
[12] Assumes Woods, poor condition

Excess Precipitation Calculations (P_e) (inches)

S 2.026622463

Duration	1 yr	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr	3 yr
10 d	2.96	3.87	5.13	6.06	7.48	8.58	9.66	4.27
5 d	2.08	2.72	3.71	4.57	5.91	7.11	8.47	3.09
72 h	1.68	2.23	3.12	3.88	5.09	6.21	7.34	2.56
48 h	1.46	1.95	2.76	3.44	4.56	5.59	6.59	2.26
24 h	1.16	1.59	2.30	2.85	3.91	4.77	5.74	1.84
18 h	1.00	1.38	2.02	2.52	3.49	4.27	5.15	1.61
12 h	0.90	1.26	1.85	2.32	3.22	3.96	4.78	1.47
6 h	0.68	0.97	1.46	1.84	2.60	3.22	3.92	1.14
3 h	0.49	0.72	1.11	1.42	2.05	2.55	3.14	0.86
2 h	0.41	0.60	0.96	1.23	1.79	2.26	2.79	0.65
1 h	0.24	0.38	0.62	0.84	1.23	1.58	1.98	0.46
30 m	0.12	0.21	0.37	0.52	0.80	1.05	1.34	0.26
15 m	0.04	0.08	0.17	0.25	0.42	0.58	0.76	0.11
10 m	0.01	0.04	0.09	0.14	0.26	0.37	0.50	0.06
5 m	0.00	0.00	0.00	0.01	0.04	0.07	0.11	0.00

Runoff Volume (ac-ft)

Duration	1 yr	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr	3 yr
10 d	2947.10	3845.65	5102.53	6029.95	7436.69	8536.77	9613.43	4252.03
5 d	2071.75	2706.90	3689.66	4549.71	5877.87	7071.59	8430.34	3072.58
72 h	1668.92	2217.52	3099.54	3854.84	5064.91	6182.26	7302.08	2548.20
48 h	1449.14	1944.39	2742.33	3425.06	4531.06	5564.98	6554.41	2243.39
24 h	1150.35	1578.71	2286.60	2831.14	3891.64	4745.92	5707.07	1835.05
18 h	991.63	1377.17	2012.16	2504.34	3470.54	4242.76	5121.35	1603.23
12 h	896.09	1251.02	1843.43	2303.92	3207.66	3937.68	4755.28	1465.22
6 h	678.12	962.00	1449.14	1835.05	2583.36	3198.63	3900.85	1135.02
3 h	489.58	712.23	1104.49	1417.07	2037.66	2539.42	3126.53	852.76
2 h	410.99	598.08	954.62	1227.63	1784.94	2252.02	2777.81	644.44
1 h	237.26	376.15	617.83	838.43	1227.63	1570.56	1969.76	458.87
30 m	122.40	208.38	364.76	520.85	795.81	1043.97	1337.50	262.31
15 m	39.61	79.59	167.62	247.18	416.89	572.01	760.70	111.03
10 m	13.79	37.21	89.61	142.29	257.23	370.44	502.02	55.32
5 m	3.73	0.32	2.64	9.59	34.88	67.00	107.33	0.10

Sediment Load Calculations

1 year sediment loading (tons)	256
3 year sediment loading (tons)	464
10 year sediment loading (tons)	783

TSS (mg/L)

	Return Period		
Duration	3 yr	10 yr	1 yr
12 hr	256.94	275.58	231.43
24 hr	205.16	224.26	180.28
72 hr	147.74	164.70	124.26

APPENDIX D - RESPONSIVENESS SUMMARY

This responsiveness summary responds to substantive questions and comments received during the public comment period from December 28, 2002, through February 28, 2003 (postmarked) including those from the January 28 public hearing.

EAST FORK KASKASKIA RIVER TMDL

APPENDIX D

RESPONSIVENESS SUMMARY

TABLE OF CONTENTS

LLINOIS ENVIRONMENTAL PROTECTION AGENCY
(Illinois EPA)

IN THE MATTER OF:

EAST FORK KASKASKIA RIVER IN JEFFERSON COUNTY
TOTAL MAXIMUM DAILY LOAD DLC# 697-02

RESPONSIVENESS SUMMARY

This responsiveness summary responds to substantive questions and comments received during the public comment period from December 28, 2002, through February 28, 2003 (postmarked) including those from the January 28 public hearing.

WHAT IS A TMDL?

A Total Maximum Daily Load (TMDL) is the sum of the allowable amount of a single pollutant that a water body can receive from all contributing sources and still meet water quality standards or designated uses. The East Fork Kaskaskia River TMDL report contains a plan detailing the actions necessary to reduce pollutant loads to East Fork Kaskaskia River and ensure compliance with applicable water quality standards. The Illinois EPA implements the TMDL program in accordance with Section 303(d) of the federal Clean Water Act and the regulations thereunder.

BACKGROUND

The watershed targeted for TMDL development is the East Fork Kaskaskia River (ILOK01). The targeted waterbody segment is OK 01. The segment begins at its mouth at Carlyle Lake and extends approximately 17.13 miles upstream to the confluence of the East Fork Kaskaskia River with Jims Creek. This area is located in Clinton, Fayette, and Marion counties. The drainage area of ILOK01 and upstream subwatersheds is 81,060 acres. The watershed is largely rural agriculture, but does include the towns of Alma, Kinmundy, and Farina. A TMDL is required for ILOK01 because of a determination that aquatic life use support (ALUS) is impaired in waterbody OK 01. The cause of impairment is siltation. The source of these loadings is identified as non-irrigated crop production. The Illinois EPA contracted Montgomery Watson Harza, Chicago, Illinois, to prepare a TMDL report for Illinois EPA on this waterbody.

PUBLIC MEETINGS/ HEARING

A public meeting was held in the Salem City Hall on November 27, 2000. A public hearing on the proposed plan was held on Wednesday, January 28, 2003 in at the Marion County Public Service Building, 200 East Swartz, Salem, Illinois. Twenty-one persons attended the hearing. The hearing record remained open until midnight February 28, 2003. A total of 5 exhibits were received either during the hearing or within the public comment period. A court reporter prepared a transcript of the public hearing. The Illinois EPA provided public notice for the hearing by placing boxed display ads in the *Salem Times-Commoner* on December 27, 2002 and on January 3 and 10, 2003. Notices were also placed in the *Farina News* on December 26, 2002, and on January 2 and 9, 2003. These three notices gave the date, time, location, and purpose of the hearing. The notices also provided references to obtain additional information about this specific site, the TMDL Program, and other related issues, as well as the name, address, and phone number of the IEPA hearing officer. Over 90 individuals and organizations were also sent the public notice by first class mail. The mailing list is contained in the Agency file DLC # IEPA/BOW/03-007. The Draft TMDL Report was available for review on the Agency's web page at http://www.epa.state.il.us/water/tmdl/tmdl-reports.html The report is also available by mail upon request.

QUESTIONS AND COMMENTS

1. What is the basis for the 116 mg/L Total Suspended Solids (TSS) Standard? How long has that number been used?

   The 116 mg/L is a guideline we use, not a state water quality standard. For parameters such as suspended solids that have no water quality standards, a statistical value (i.e., 85th percentile) is used as the threshold for identifying potential causes of impairment. For suspended solids, this percentile value is calculated from all available Ambient Water Quality Monitoring Network (AWQMN) data from Water Years 1978 through 1996 and approximately 30,000 samples. One exceedance of the threshold statistical value at an Intensive Basins Survey (IBS) or Facility Related Stream Survey (FRSS) site, or one exceedance over three years at an AWQMN station, qualifies that parameter as a potential cause of impairment.

   The TSS guideline has been in use for approximately four years. It was developed to address consistency issues in the surface water monitoring program. Before adoption of the guideline, biologists depended on best professional judgment in the field. This guideline ensures that all streams are measured consistently against the same statistically derived guideline.

2. What is the cost of getting the Best Management Practices (BMPs) that were recommended in the report implemented? Who will be responsible for maintaining it and where is the money going to come from?

   The costs will vary depending on the number and size of the BMPs installed. Controls for non-point source pollution are voluntary. The Agency only has regulatory authority over permitted point sources, such as the three wastewater treatment plants in the watershed. Government assistance programs such as the Conservation Reserve Program (CRP), Conservation Practices Plan (CPP) and Section 319 are detailed in the Implementation plan of the TMDL. Combined, these programs have about $1 million available for cost share programs. A percentage of CPP money will be targeted to TMDL watersheds to fund nutrient management plans. Using money from these programs, it would be up to the landowners, local stakeholders and watershed groups to take the initiative in implementing these BMPs and maintaining them.

3. Will the Agency (IEPA) determine what we can and cannot do? Will there be a timeline indicating when we have to meet certain levels?

   Since all recommendations are made on a voluntary basis, there will be no timelines or levels to meet. However, the Agency encourages watershed groups and landowners to consult the TMDL during the planning process and to set implementation and water quality goals as part of their overall watershed management plan.

4. How does the sampling process go? Is sampling done during major storm events? What can we expect in the future with respect to sampling?
Illinois EPA does not sample the streams specifically during storm events. Intensive basin surveys are done at times of low flow because that is the period of time when the highest amounts of stress and water quality problems are exhibited in the stream.

With respect to future monitoring, the East Fork Kaskaskia watershed will be included in the regular Illinois EPA surface water monitoring schedule. On the present schedule, the watershed will be sampled approximately once every five years. Up to this point TMDL watersheds have not been given a higher priority over other watersheds in the surface water monitoring program, although the Agency is looking into this issue.

5. The model used data from '96 and '98 and soil calculations were made using the Universal Soil Loss Equation (USLE). Will we see an updated model with more recent data and soil calculations using the Revised Soil Loss Equation (RUSLE)?

At the time of TMDL development, '96 and '98 data were the most recent available. The water quality model was used to determine a Total Maximum Daily Load and load allocations for the report. The Agency will continue to monitor progress of OK 01 and if more recent information indicates the segment is no longer impaired, it will be removed from the next 303(d) List. However, we do not plan on running the model again with more recent data. On a watershed level, Illinois EPA feels that USLE is sufficient in arriving at reasonable soil loss calculations. RUSLE is believed to yield more accurate estimates on a field-by-field basis. Since TMDLs consider the entire watershed and the water quality models are designed to run USLE, the Agency does not plan to use RUSLE for further calculations.

6. Within the draft TMDL, I believe there are five or six references to the issue of gully, ephemeral, and stream bank erosion, but there was no survey of that erosion done. Levels of erosion are estimated in the 30-50% range. How does that affect the solutions you proposed in the TMDL implementation plan? Are you going to determine those levels before finalizing the plan?

No readily available data exists regarding gully, ephemeral and stream bank sources of erosion, and we had no means of conducting a stream bank erosion survey under the contract established with our contractor. This TMDL was developed with readily available data. The report recommends embarking upon a field assessment of, and the need for remediation of gully, streambed and stream bank erosion. The implementation plan in the report is limited to sheet and rill erosion and its reduction. Illinois EPA will not be determining the levels of erosion from gully, stream bank or streambed prior to the completion of this report. It is our recommendation that a locally lead group, possibly with Illinois EPA or other technical and financial assistance, complete a study to determine the contribution of sediment from these sources prior to any implementation efforts to determine if these areas should be addressed in advance of any upland treatment.

7. Will the Agency be doing more studies on the stream bank and streambed?

   At this time, we have no additional studies planned. It is Illinois EPA's recommendation that the stakeholders in the watershed and technical resource agencies conduct such a survey to help determine and prioritized what practices need to be applied and where.

8. So, theoretically, if there were some scattered high sources within the watershed such as hog lots and oil brine damaged areas, this plan really overlooks those sources as contributors to the overall impairment.

   The plan developed for this TMDL does not get into the specifics of exactly where the problems are, nor does it detail exactly where practices should be installed. It is our recommendation that a local watershed planning group be developed and that the implementation plan in this TMDL be further evaluated and improved upon by the local citizens that know the watershed. Additional information should be collected to help the local planning group refine the plan so the appropriate actions can be taken in the watershed.

9. On December 20, 2002, USEPA announced its plans to withdraw the final rule regarding the TMDL program. How does that affect this TMDL?

   It should not affect this TMDL at all. In December 2002 USEPA proposed to withdraw a TMDL rule that was published in July of 2000. The July 2000 rule was never enacted. Congress added a "rider" to an appropriations bill that prohibited EPA from spending FY2000 and FY2001 money to implement the July 2000 rule. Since that time, USEPA has been rewriting what it now calls the "Watershed Rule" to replace the July 2000 rule. However, since the July 2000 rule was adopted, USEPA had to formally withdraw it before they could propose the new "Watershed Rule." The regulations that currently apply are those that were issued in 1985 and amended in 1992 (40 CFR Part 130, section 130.7). This TMDL was written under the 1992 rules and if finalized, will not have to be changed when new rules are published.

10. So, its possible new regulations issued soon could affect this plan?

    This TMDL should be finalized before new rules are published and thus it will not be affected.

11. If you have data from the 70's through the present, why do you look at a set period rather than establish a trend line for all of your data to show whether perhaps a watershed is improving or becoming worse over a period of time?

    We looked at the most recent five-year data available to us for this segment of stream. Our goal was to establish whether or not there was impairment in this segment. We

did not look at trends in water quality. The condition of the stream in the 1970's has no bearing on whether or not the stream is presently impaired.

12. It appears that the stream was not listed as impaired because TSS exceeded 116 mg/L. It was listed as impaired because the IBI score or the MBI score, which is a measure of the aquatic life, were above or below; is that not correct?

    Yes that is correct. The segment was listed due to low Index of Biotic Integrity (IBI) scores. The cause for this impairment was attributed to siltation. TSS is used as a water quality indicator of the amount of siltation in the stream.

13. Was the river listed because of the aquatic indexes or because of the TSS readings?

    The segment was listed because of aquatic indexes. Please see the response to question 12.

14. To what extent have you talked with the local soil and water conservation districts (SWCDs) about involvement in helping implement the TMDL? If you haven't yet established a dialogue, how do you plan on doing that?

    Our contractor contacted the local SWCDs and the National Resources Conservation Service (NRCS) to obtain information needed for the water quality model and land use. We take the Public Hearing as an opportunity to begin a dialogue with local stakeholders and ask for their advice and assistance in implementation of the TMDL.

15. We have reviewed the draft TMDL for the East Fork of the Kaskaskia River and believe that this TMDL, as written, will not ensure the necessary improvements in water quality. The use of a statistically derived water quality endpoint for total suspended solids (TSS) and the application of that endpoint in a once in a three-year period are not scientifically defensible. In addition, the use of this approach is contrary to the Agency's policy that was revised after the public hearing on the Cedar Creek TMDL.

    As the Agency strives to satisfy requirements in Section 303(d) and 305(b) of the Clean Water Act, we must attempt to quantify biological and chemical processes that are not fully understood. The Agency uses several methods of rationale in its attempt to analyze the health of our state's waterways and to adopt standards and guidelines protective of designated uses. As mentioned above, the TSS guideline was developed using a large amount of statewide water quality data. The Agency feels the TSS guideline is an acceptable endpoint in determining designated use impairment and stands by this TMDL as an accurate analysis of watershed dynamics and the first step in improving water quality in the East Fork Kaskaskia River watershed.

    Development of the TMDL for the East Fork Kaskaskia River was initiated prior to our policy change for developing TMDLs on only those pollutants with numeric standards. Therefore, since this report was nearly complete at the time we made this policy change, it was finalized under the same program policies that were established

at the time it was begun. Given that the proposed implementation plan is dependent on voluntary practices within the watershed, including the gathering of additional information, we do not believe this TMDL mandates unscientific or unsupportable approaches to water quality.

16. The draft TMDL does not show a cause-and-effect relationship between any exceedance of the water quality endpoint of 116 mg/L TSS once in any 3-year period and an impairment of aquatic life. We do not believe that TSS concentrations greater than 116 mg/L can be properly determined to be the cause of water quality impairment in a small subset of streams in Illinois when that same concentration does not cause water quality impairments in other similar streams. The mean TSS concentration in many streams in western Illinois is greater than 116 mg/L, but the Agency has not determined that those waterbodies are impaired. We also note that the Agency's report on baseline loadings of nitrogen, phosphorus and sediments from Illinois watersheds (Short, 1999) indicates that the statewide mean for TSS is greater than 116 mg/L in May through July and that the 75th percentile exceeds 116 mg/L in June and July (Figure 3-17, p. 41).

    The Agency realizes that chemical and biological processes in surface waters vary significantly from region to region. Determining impairment of a stream involves assessing the chemical, biological and physical characteristics. The TSS guideline of 116 mg/L was not used to determine impairment of the stream, but was only used as the guideline for determining the cause of the impairment once the stream is identified as impaired.

    Due to the analytical nature of TMDLs, however, an established guideline or numerical limit is necessary as an endpoint or goal for pollutant reduction. The Illinois EPA has made every effort to use sound science in determining an appropriate endpoint. The Agency stands by the current TSS guideline as a general indicator of the cause of impairment throughout the state.

17. As pointed out by the U.S. Environmental Protection Agency in a recent guidance document, the occurrence of a potential stressor at equal or greater concentrations at reference (not impaired) sites is a basis for eliminating the potential cause from consideration as a cause of water quality impairment in the subject waterbody. Also, based on information available at the IEPA website, it has been our understanding that the Agency would no longer use the 85th percentile value or the once-in-three years occurrence in developing TMDLs.

    Development of TMDLs for the East Fork Kaskaskia River was initiated prior to this policy change (also see response to question #15). Therefore, since this report was nearly complete at the time we made this policy change, it was finalized under the same program policies that were established at the time it was begun. Future TMDLs will follow the policy you discuss.

18. While we do not have a significant disagreement with the use of arbitrary values for TSS, siltation or nutrients in the 305(b) report for the purpose of identifying potential causes of

water quality impairments, we do not believe that those values should be used as de facto water quality standards in determining the maximum allowable load of a constituent for TMDLs. The Department is concerned about the way in which the statistically based water quality endpoint for TSS is used in the draft TMDL for the East Fork of the Kaskaskia River. This value is not justified in terms of impairments to designated uses and results in unrealistic proposals for changing agricultural practices. As a consequence of these unrealistic and, we believe, inappropriate endpoints, the entire TMDL process in Illinois is likely to lose credibility.

The Illinois EPA makes all recommendations for control of non-point sources of pollution on a voluntary basis. We believe the 116 mg/L TSS guideline is reasonable and appropriate for its function as a water quality endpoint for the purposes of this TMDL (refer to responses for questions #15 and #17).

19. If the draft TMDL for the East Fork of the Kaskaskia River represents another change in Agency policy, the Department recommends that the Agency immediately address the appropriateness of the water quality endpoints being used in developing TMDLs. While we are aware of the Agency's current efforts to convene the Illinois Nutrient Standards Work Group (INSW) to develop water quality standards for nutrients in response to USEPA's proposed water quality criteria, we all recognize that completion of that process will take several years at a minimum. We would also recommend that the Agency add sediment-related water quality parameters (TSS, siltation and turbidity; USEPA's nutrient criteria proposal includes turbidity) to the charge to the INSW or form another technical working group to address the development of appropriate water quality endpoints or standards for those parameters.

Your suggestions are noted. We believe the appropriate approach for nutrient standards development is now underway, in part through the INSW. We intend to address TSS and other endpoints as described in the 2002 303(d) List. Thank you for your comments.

20. The universal soil loss equation is primarily intended to estimate annual soil loss. There is certainly a need to determine daily loads from critical storm events because they are critical to stream health. However, please provide additional justification that this equation has been properly modified for use estimating individual events. References to specific literature that includes findings that this use of the USLE is appropriate would be helpful.

The Universal Soil Loss Equation (USLE) predicts the long term average annual rate of erosion on a field slope based on rainfall pattern, soil type, topography, crop system and management practices. Five major factors are used to calculate the soil loss for a given site. Each factor is the numerical estimate of a specific condition that affects the severity of soil erosion at a particular location. The erosion values reflected by these factors can vary considerably due to varying weather conditions.

This TMDL used the USEPA's Screening Procedures to develop load estimates. The Screening Procedure, detailed in Mills *et al.* (1985), includes two modifications to

adapt the USLE to individual storm events. The erosivity term, E, reflects rainfall intensity, among other things. Expected magnitudes of single-storm erosivity indices are presented in Wischmeier and Smith (1978). Erosivity values for the East Fork Kaskaskia River watershed were interpolated between two stations in Illinois (Cairo and Springfield). For a 1-year storm, the erosivity is 65 (10^2 m-ton-cm/ha-hr) in this area. For the 3-year storm, the erosivity is 118 (10^2 m-ton-cm/ha-hr). For the 10-year storm, the erosivity is 199 (10^2 m-ton-cm/ha-hr). The Screening Procedure also includes estimates of the volume of runoff for specific storm events, which are part of calculating the loads. In this TMDL, runoff volume was estimated for several specific storm events (see Section 5.1 in the report).

21. The document should better justify that water quality throughout the watershed is protected by the TMDL, not just at the sampling point. It is not clear whether the models, particularly the EPA Screening Procedures, used to determine appropriate loading from each subwatershed set pollution concentration constraints at various points along the stream network. If so, please specify where those points are. If not, please provide other demonstration that water quality requirements are met throughout the watershed.

    The TMDL was developed for OK 01, an ambient water quality sampling station. The TMDL was not developed for all locations. The TMDL establishes a load to the stream as a whole from the watershed, thus the reason for using a watershed approach to address the pollutant(s) of concern. While models may allow one to determine which sub-watersheds may be contributing a load, or at least demonstrate which sub-watershed(s) may be a larger contributor than another (see Table 33, for example), the TMDL does not set pollutant limits at various points along a stream. Knowing which sub-watershed(s) may be the major contributor(s) is beneficial in determining/prioritizing where to target implementation efforts.

22. The document recommended removing all the other parameters that were identified in the 1998 303(d) list. However, these parameters were not proposed for removal from the list in 2002. Please clarify the intent of the Agency with regard to delisting, including any new information that was not considered in the 2002 listing decision.

    The causes of impairment listed on the 1998 303(d) List were identified using different criteria than the criteria used in the development of the TMDL. In 1999, Illinois EPA revised the criteria used to determine causes of impairment. These new criteria were not available at the time the 1998 List was developed.

    The first step in the TMDL process is to determine the appropriate causes and sources of the impairment. Based on a re-evaluation of the causes attributable to the impairment using the new criteria, it was determined that those previously identified were no longer accurate. These causes were not proposed for removal from the 2002 List because we list and de-list water bodies, not causes.

23. Dissolved oxygen (DO) violations occurred for 22 of the 71 samples collected at the monitoring station. These violations occur regularly for most summer sampling events as

shown in the data provided in Appendix A of the report. There is clearly a low flow, summer month DO problem. While addressing the DO problem was not the intent of this TMDL analysis, the discussion of water quality in section 2.2.4 should mention this problem. Because this impairment seems to be the most substantial deviation from water quality standards, IEPA should clarify why this impairment was not identified in 1998.

We have reviewed the DO data for this segment. The DO impairment cited in this question was verified. We will re-evaluate this segment for DO impairment the next time this area is targeted for TMDL development.

24. While the document indicates that there are no point sources currently contributing TSS to the impaired segment, the allocation to point sources (the waste load allocation) should be specified. If the TMDL equation contains no allocation for point source loads, the WLA implicitly is zero. Therefore, IEPA will be required to deny issuance of NPDES permits and deny coverage under general permits, to any applicant that proposes to discharge suspended solids.

    A TMDL is developed to address existing sources in a watershed. A TMDL cannot predict, nor will we attempt to predict future point sources. Should a discharger apply for an NPDES permit, Illinois EPA will address the issue in the permit limits allowed.

25. The margin of safety (MOS) is inadequate. The document indicates that it is implicit through conservative assumptions including the assumption that no deposition of sediment occurs, the critical season is modeled, recent conservation practices are not included, and pre-BMP water quality data is used for calibration. However, these do not lead to conservative results with an adequate MOS for the following reasons: (1) In a healthy river system, there is no net deposition of sediment; a healthy river is defined as one that moves sediment such that it neither accumulates nor erodes over time. (2) Because water quality standards must be met, even during critical conditions, regulations require that the TMDL be based on critical conditions; this should not also be considered a credit in the MOS. (3 and 4) Because recent conservation practices are not included in the model, it is only appropriate that water quality that occurred prior to implementation of such practices be used in the calibration. Calibrating the model using water quality data that did not match practices modeled would lead to bad calibration. Therefore, the MOS should be redefined with solid justification that the magnitude of the MOS takes into account all uncertainty in the development process.

    We selected a simple model and an implicit approach to MOS because we have insufficient data on the system to use more complex models or to develop scientifically defensible explicit MOS factors. This TMDL includes recommendations for future monitoring and for adaptive management, which provides the necessary assurance for eventual success.

26. We feel that the information on total suspended solids (TSS) and the use of corresponding endpoints is not scientifically valid. The draft TMDL does not prove a cause/effect

connection between any elevated TSS and impairment to aquatic life. We are concerned with the way in which the statistically based water quality endpoint for TSS is used. We question the connection between this information and impairments to designated uses. We are concerned that this will eventually result in unrealistic proposals for changing agricultural practices in the watershed.

Please see response to comment #16

27. A concern is that the Illinois EPA had previously indicated that constituents without water quality standards would be listed for causing impairment but that TMDLs would not include numeric reductions and allocations of these constituents. The draft TMDL for the Kaskaskia contains a reduction of potential causes for which there are no water quality standards. This uses a de facto water quality standard to determine an allowable load of constituent for TMDLs. This is a reversal of Illinois EPA's previous statement that TMDLs would not be developed for constituents that do not have water quality standards.

    Development of the TMDL for the East Fork Kaskaskia River was initiated prior to this policy change. Therefore, since this report was nearly complete at the time we made this policy change, it was finalized under the same program policies that were established at the time it was begun. Future TMDLs will follow the policy you discuss.

28. Another concern we have had with this process is the lack of communication between the contractor and local groups and agencies in the watershed. Sound communication among local agencies and the contractor is vital to the development of a plan that will actually work, have credibility and eventually improve water quality. We strongly urge the Agency to increase communication in the TMDL process.

    The Agency feels that communication with local stakeholders is a crucial part of making the TMDL process successful. We will continue to make communication a high priority and encourage our contractors to foster a good relationship with local groups and stakeholders.

29. The analysis and plan assume sheet and rill erosion from cropland is the only source for siltation in the East Fork Kaskaskia River. However, throughout the plan (Sections 4.2, 6.1, 6.3, et al.), the developer acknowledges the absence of quantitative data on other forms of erosion. These include gully, ephemeral, stream bank and streambed erosion. Under scenarios where these alternate forms of erosion provide a significant contribution (>30%) to siltation in the East Fork Kaskaskia River, the proposed plan may be unable to achieve the planned results. Additionally, the plan overlooks the potential impacts of certain non-cropland activities in the watershed. These included oil brine damage areas, ATV trails, borrow areas and livestock lots. Further assessments on the alternate forms of erosion and the impact of non-cropland areas should be completed prior to finalization of the plan.

    Please see response to Comment #6.

30. Fayette County SWCD is omitted in Section 2.1.4 Institutions.

    Fayette County SWCD will be added to the list in the Final Draft.

31. Further clarification is needed for the discussion of "C" factors on pages 34 and 47. Fall tillage (fall "C" factors) reduces residue cover after harvest and leaves soils more susceptible to erosion than spring tillage (spring "C" factors). Spring tillage leaves the crop residue cover undistributed through fall and winter months. Consequently, "C" factors for fall tilled land are higher than for spring tilled land to reflect the higher erosion potential.

    Thank you for your comment and clarification. It is for the reasons you mention that this TMDL was developed using fall "C" factors so that we were representing worse case conditions.

32. Bluford, Ava and Hickory soils (IL038 soil association) are not generally suited to the use of strip cropping, contour farming and terrace practices. These soils tend to occur on dissected landscapes and short side slopes on the Illinoian till plain. In addition, these practices do not lend themselves well to modern farming operations because they often create point rows and overlap areas. Most large farming operations within the East Fork Kaskaskia River watershed utilize planter's widths of at least 30 feet.

    Thank you for this information.

33. We concur with the recommendation on page 67 to develop individual conservation plans. The recommendation on page 83 to develop plans within the first 18 months is unrealistic and unachievable. Adequate resources are not available locally to complete this task. The current 60/40 grants being made available to local soil and water conservation districts by IEPA do not recognize the lack of local resources. For local soil and water conservation districts to adequately address conservation planning in the East Fork Kaskaskia River watershed, additional funding will be needed.

    Thank you for your comment.

34. On page 79 is a discussion of issues and trends in the use of conservation and no till farming practices. Locally, landowners and operators have reduced the use of no till farming practices particularly for corn and milo. This is due to perceived or actual yield decreases when compared to other tillage systems. Agronomist and other crop professionals now recognize these losses are the result of poor or inadequate plant populations. Reduced plant populations are most often related to wet soils in the spring.

    Thank you for your comment.

35. Incentive payments are offered for riparian buffers and filter strips under the Continuous CRP not the EQIP program (page 80). Incentive payments range from $100 to $150 per acre in Illinois.

Thank you for pointing out this error in the report. It has been corrected.

36. Local NRCS and SWCD personnel have worked with landowners and operators to plan and install conservation buffers since 1996. More than 4,000 acres of filter strips and riparian buffers have been installed throughout Marion County. Similar applications in Fayette and Clinton County have occurred as well. Prior to adoption of the final TMDL plan, IEPA should make an accurate assessment of conservation buffers already established in the East Fork Kaskaskia River watershed.

    Illinois EPA encourages stakeholders in the watershed to use the recommendations in the TMDL as a guide in their watershed planning. The Agency does not have the resources to conduct in-depth investigations of conservation practices in the watershed. Landowners and local watershed groups know the land best and are best qualified to direct the recommendations detailed in the TMDL to the areas where they are needed most.

37. The recommendation for development of GIS based recording system is excellent. Full utilization of a GIS based system will require the development of a digital soils layer. The development of a digital soils layer by the USDA-NRCS currently requires a local one-third match. Economic conditions within Marion County will not allow the completion of a soil survey digitization project in the foreseeable future. Therefore, IEPA may wish to contract for digitization of the soils within the East Fork Kaskaskia River watershed by NRCS or another qualified contractor.

    Thank you for your comment.

38. In T*he Carlyle Lake Watershed Plan*, page 60 under "Technical Committee Recommendations for Action Items", item #2 calls for construction of water and sediment detention basins. This is an instrumental and critical part of the plan. The private landscape is the primary site now for flood control and sediment retention. The problem is real. The Public will eventually dictate how much sediment and other water contaminants will be allowed into the public waters.

    Thank you for your Comment

39. If you want the Private landowner to be concerned with water quality, *put water on the private landscape*. I have yet to see a single landowner with a lake or pond that isn't acutely aware of what drains into it. Most landowner's will avoid sending excess sediments into their own ponds and lakes. Secondly, I beg anyone to find a single study that shows water leaving a lake, pond, or sediment control structure; not cleaner than the water that entered. Even Lakes Shelbyville and Carlyle accomplish this. These structures can function as wetlands, by providing a stable source of water for gradual movement into water tables beneath them.

    Thank you for your comment.

40. Build lakes, ponds, and retention sites throughout the watershed. Cost share with landowners on a per acre-foot of storage basis, maybe with 40% of typical construction costs on a 10-acre feet storage facility, less on smaller facilities. (This would have to be evaluated and developed in detail, so as to put a true cost/ benefit ratio) The dam construction should allow for at least some seasonal storage, (freeboard storage). This would allow flood retention and yet provide gradual release into streams.

Thank you for your comment.

41. I feel confidant that as more private bodies of water are developed, private landowners will more readily adapt environmental practices such as nutrient management (through activities such as strip-till) and reduced tillage; to keep their own reservoirs from being damaged. Controlled construction of Lakes and ponds can enhance forested sites. If forested habitat is removed, mitigate with the private landowner to establish new-forested habitat. Two acres new for every one acre lost, wouldn't be unreasonable to most landowners**.**

Thank you for your comment.

GLOSSARY AND ACRONYMS

ALUS	Aquatic Life Use Support.
AWQMN	Ambient Water Quality Network
BMPs	Best Management Practices. These are practices that have been determined to be effective and practical means of preventing or reducing pollution from nonpoint sources.
CPP	Conservation Practices Program
CRP	Conservation Reserve Program
FY2000	Fiscal Year 2000
IBI	Index of Biological Integrity. Primary purpose is to assess the biological integrity of a habitat using samples of living organisms and to evaluate the consequences of human actions on biological systems. Developed for use in managing aquatic resources (e.g., to establish use designations for water bodies, biological water quality standards, or goals for restoration).
IBS	Intensive Basin Survey
IEPA	The Illinois Environmental Protection Agency (also referred to as the Agency or Illinois EPA)
NRCS	Natural Resources Conservation Service
NVSS	Non-volatile suspended solids
RUSLE	Revised Universal Soil Loss Equation
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids. Solids in water that can be trapped by a filter. TSS can include a wide variety of material, such as silt, decaying plant and animal matter, industrial wastes, and sewage. High concentrations of suspended solids can cause many problems for stream health and aquatic life.
USEPA	United States Environmental Protection Agency
USLE	Universal Soil Loss Equation. A method of estimating the average soil loss from sheet and rill erosion that might be expected to occur over an extended period under specified conditions of soils, vegetation, climate, cultural operation, and conservation measures.

DISTRIBUTION OF RESPONSIVENESS SUMMARY

Copies of this responsiveness summary were mailed in March 2003, to all who registered at the hearing, to all who sent in written comments and to anyone who requested a copy. Additional copies of this responsiveness summary are available from Bill Hammel, Illinois EPA Office of Community Relations, phone 217-524-7342 or e-mail Bill.Hammel@epa.state.il.us.

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Questions regarding the public hearing record and access to the exhibits should be directed to Hearing Officer Sanjay Sofat, 217-782-5544.

The public hearing notice, the hearing transcript and the responsiveness summary are available on the Illinois EPA website: www.epa.state.il.us

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EAST FORK KASKASKIA RIVER TMDL

APPENDIX D

RESPONSIVENESS SUMMARY

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LLINOIS ENVIRONMENTAL PROTECTION AGENCY
(Illinois EPA)

IN THE MATTER OF:

EAST FORK KASKASKIA RIVER IN JEFFERSON COUNTY
TOTAL MAXIMUM DAILY LOAD DLC# 697-02

RESPONSIVENESS SUMMARY

This responsiveness summary responds to substantive questions and comments received during the public comment period from December 28, 2002, through February 28, 2003 (postmarked) including those from the January 28 public hearing.

WHAT IS A TMDL?

A Total Maximum Daily Load (TMDL) is the sum of the allowable amount of a single pollutant that a water body can receive from all contributing sources and still meet water quality standards or designated uses. The East Fork Kaskaskia River TMDL report contains a plan detailing the actions necessary to reduce pollutant loads to East Fork Kaskaskia River and ensure compliance with applicable water quality standards. The Illinois EPA implements the TMDL program in accordance with Section 303(d) of the federal Clean Water Act and the regulations thereunder.

BACKGROUND

The watershed targeted for TMDL development is the East Fork Kaskaskia River (ILOK01). The targeted waterbody segment is OK 01. The segment begins at its mouth at Carlyle Lake and extends approximately 17.13 miles upstream to the confluence of the East Fork Kaskaskia River with Jims Creek. This area is located in Clinton, Fayette, and Marion counties. The drainage area of ILOK01 and upstream subwatersheds is 81,060 acres. The watershed is largely rural agriculture, but does include the towns of Alma, Kinmundy, and Farina. A TMDL is required for ILOK01 because of a determination that aquatic life use support (ALUS) is impaired in waterbody OK 01. The cause of impairment is siltation. The source of these loadings is identified as non-irrigated crop production. The Illinois EPA contracted Montgomery Watson Harza, Chicago, Illinois, to prepare a TMDL report for Illinois EPA on this waterbody.

PUBLIC MEETINGS/ HEARING

A public meeting was held in the Salem City Hall on November 27, 2000. A public hearing on the proposed plan was held on Wednesday, January 28, 2003 in at the Marion County Public Service Building, 200 East Swartz, Salem, Illinois. Twenty-one persons attended the hearing. The hearing record remained open until midnight February 28, 2003. A total of 5 exhibits were received either during the hearing or within the public comment period. A court reporter prepared a transcript of the public hearing. The Illinois EPA provided public notice for the hearing by placing boxed display ads in the *Salem Times-Commoner* on December 27, 2002 and on January 3 and 10, 2003. Notices were also placed in the *Farina News* on December 26, 2002, and on January 2 and 9, 2003. These three notices gave the date, time, location, and purpose of the hearing. The notices also provided references to obtain additional information about this specific site, the TMDL Program, and other related issues, as well as the name, address, and phone number of the IEPA hearing officer. Over 90 individuals and organizations were also sent the public notice by first class mail. The mailing list is contained in the Agency file DLC # IEPA/BOW/03-007. The Draft TMDL Report was available for review on the Agency's web page at http://www.epa.state.il.us/water/tmdl/tmdl-reports.html The report is also available by mail upon request.

QUESTIONS AND COMMENTS

1. What is the basis for the 116 mg/L Total Suspended Solids (TSS) Standard? How long has that number been used?

   The 116 mg/L is a guideline we use, not a state water quality standard. For parameters such as suspended solids that have no water quality standards, a statistical value (i.e., 85th percentile) is used as the threshold for identifying potential causes of impairment. For suspended solids, this percentile value is calculated from all available Ambient Water Quality Monitoring Network (AWQMN) data from Water Years 1978 through 1996 and approximately 30,000 samples. One exceedance of the threshold statistical value at an Intensive Basins Survey (IBS) or Facility Related Stream Survey (FRSS) site, or one exceedance over three years at an AWQMN station, qualifies that parameter as a potential cause of impairment.

   The TSS guideline has been in use for approximately four years. It was developed to address consistency issues in the surface water monitoring program. Before adoption of the guideline, biologists depended on best professional judgment in the field. This guideline ensures that all streams are measured consistently against the same statistically derived guideline.

2. What is the cost of getting the Best Management Practices (BMPs) that were recommended in the report implemented? Who will be responsible for maintaining it and where is the money going to come from?

   The costs will vary depending on the number and size of the BMPs installed. Controls for non-point source pollution are voluntary. The Agency only has regulatory authority over permitted point sources, such as the three wastewater treatment plants in the watershed. Government assistance programs such as the Conservation Reserve Program (CRP), Conservation Practices Plan (CPP) and Section 319 are detailed in the Implementation plan of the TMDL. Combined, these programs have about $1 million available for cost share programs. A percentage of CPP money will be targeted to TMDL watersheds to fund nutrient management plans. Using money from these programs, it would be up to the landowners, local stakeholders and watershed groups to take the initiative in implementing these BMPs and maintaining them.

3. Will the Agency (IEPA) determine what we can and cannot do? Will there be a timeline indicating when we have to meet certain levels?

   Since all recommendations are made on a voluntary basis, there will be no timelines or levels to meet. However, the Agency encourages watershed groups and landowners to consult the TMDL during the planning process and to set implementation and water quality goals as part of their overall watershed management plan.

4. How does the sampling process go? Is sampling done during major storm events? What can we expect in the future with respect to sampling?
Illinois EPA does not sample the streams specifically during storm events. Intensive basin surveys are done at times of low flow because that is the period of time when the highest amounts of stress and water quality problems are exhibited in the stream.

   With respect to future monitoring, the East Fork Kaskaskia watershed will be included in the regular Illinois EPA surface water monitoring schedule. On the present schedule, the watershed will be sampled approximately once every five years. Up to this point TMDL watersheds have not been given a higher priority over other watersheds in the surface water monitoring program, although the Agency is looking into this issue.

5. The model used data from '96 and '98 and soil calculations were made using the Universal Soil Loss Equation (USLE). Will we see an updated model with more recent data and soil calculations using the Revised Soil Loss Equation (RUSLE)?

   At the time of TMDL development, '96 and '98 data were the most recent available. The water quality model was used to determine a Total Maximum Daily Load and load allocations for the report. The Agency will continue to monitor progress of OK 01 and if more recent information indicates the segment is no longer impaired, it will be removed from the next 303(d) List. However, we do not plan on running the model again with more recent data. On a watershed level, Illinois EPA feels that USLE is sufficient in arriving at reasonable soil loss calculations. RUSLE is believed to yield more accurate estimates on a field-by-field basis. Since TMDLs consider the entire watershed and the water quality models are designed to run USLE, the Agency does not plan to use RUSLE for further calculations.

6. Within the draft TMDL, I believe there are five or six references to the issue of gully, ephemeral, and stream bank erosion, but there was no survey of that erosion done. Levels of erosion are estimated in the 30-50% range. How does that affect the solutions you proposed in the TMDL implementation plan? Are you going to determine those levels before finalizing the plan?

   No readily available data exists regarding gully, ephemeral and stream bank sources of erosion, and we had no means of conducting a stream bank erosion survey under the contract established with our contractor. This TMDL was developed with readily available data. The report recommends embarking upon a field assessment of, and the need for remediation of gully, streambed and stream bank erosion. The implementation plan in the report is limited to sheet and rill erosion and its reduction. Illinois EPA will not be determining the levels of erosion from gully, stream bank or streambed prior to the completion of this report. It is our recommendation that a locally lead group, possibly with Illinois EPA or other technical and financial assistance, complete a study to determine the contribution of sediment from these sources prior to any implementation efforts to determine if these areas should be addressed in advance of any upland treatment.

7. Will the Agency be doing more studies on the stream bank and streambed?

   At this time, we have no additional studies planned. It is Illinois EPA's recommendation that the stakeholders in the watershed and technical resource agencies conduct such a survey to help determine and prioritized what practices need to be applied and where.

8. So, theoretically, if there were some scattered high sources within the watershed such as hog lots and oil brine damaged areas, this plan really overlooks those sources as contributors to the overall impairment.

   The plan developed for this TMDL does not get into the specifics of exactly where the problems are, nor does it detail exactly where practices should be installed. It is our recommendation that a local watershed planning group be developed and that the implementation plan in this TMDL be further evaluated and improved upon by the local citizens that know the watershed. Additional information should be collected to help the local planning group refine the plan so the appropriate actions can be taken in the watershed.

9. On December 20, 2002, USEPA announced its plans to withdraw the final rule regarding the TMDL program. How does that affect this TMDL?

   It should not affect this TMDL at all. In December 2002 USEPA proposed to withdraw a TMDL rule that was published in July of 2000. The July 2000 rule was never enacted. Congress added a "rider" to an appropriations bill that prohibited EPA from spending FY2000 and FY2001 money to implement the July 2000 rule. Since that time, USEPA has been rewriting what it now calls the "Watershed Rule" to replace the July 2000 rule. However, since the July 2000 rule was adopted, USEPA had to formally withdraw it before they could propose the new "Watershed Rule." The regulations that currently apply are those that were issued in 1985 and amended in 1992 (40 CFR Part 130, section 130.7). This TMDL was written under the 1992 rules and if finalized, will not have to be changed when new rules are published.

10. So, its possible new regulations issued soon could affect this plan?

    This TMDL should be finalized before new rules are published and thus it will not be affected.

11. If you have data from the 70's through the present, why do you look at a set period rather than establish a trend line for all of your data to show whether perhaps a watershed is improving or becoming worse over a period of time?

    We looked at the most recent five-year data available to us for this segment of stream. Our goal was to establish whether or not there was impairment in this segment. We

did not look at trends in water quality. The condition of the stream in the 1970's has no bearing on whether or not the stream is presently impaired.

12. It appears that the stream was not listed as impaired because TSS exceeded 116 mg/L. It was listed as impaired because the IBI score or the MBI score, which is a measure of the aquatic life, were above or below; is that not correct?

    Yes that is correct. The segment was listed due to low Index of Biotic Integrity (IBI) scores. The cause for this impairment was attributed to siltation. TSS is used as a water quality indicator of the amount of siltation in the stream.

13. Was the river listed because of the aquatic indexes or because of the TSS readings?

    The segment was listed because of aquatic indexes. Please see the response to question 12.

14. To what extent have you talked with the local soil and water conservation districts (SWCDs) about involvement in helping implement the TMDL? If you haven't yet established a dialogue, how do you plan on doing that?

    Our contractor contacted the local SWCDs and the National Resources Conservation Service (NRCS) to obtain information needed for the water quality model and land use. We take the Public Hearing as an opportunity to begin a dialogue with local stakeholders and ask for their advice and assistance in implementation of the TMDL.

15. We have reviewed the draft TMDL for the East Fork of the Kaskaskia River and believe that this TMDL, as written, will not ensure the necessary improvements in water quality. The use of a statistically derived water quality endpoint for total suspended solids (TSS) and the application of that endpoint in a once in a three-year period are not scientifically defensible. In addition, the use of this approach is contrary to the Agency's policy that was revised after the public hearing on the Cedar Creek TMDL.

    As the Agency strives to satisfy requirements in Section 303(d) and 305(b) of the Clean Water Act, we must attempt to quantify biological and chemical processes that are not fully understood. The Agency uses several methods of rationale in its attempt to analyze the health of our state's waterways and to adopt standards and guidelines protective of designated uses. As mentioned above, the TSS guideline was developed using a large amount of statewide water quality data. The Agency feels the TSS guideline is an acceptable endpoint in determining designated use impairment and stands by this TMDL as an accurate analysis of watershed dynamics and the first step in improving water quality in the East Fork Kaskaskia River watershed.

    Development of the TMDL for the East Fork Kaskaskia River was initiated prior to our policy change for developing TMDLs on only those pollutants with numeric standards. Therefore, since this report was nearly complete at the time we made this policy change, it was finalized under the same program policies that were established

at the time it was begun. Given that the proposed implementation plan is dependent on voluntary practices within the watershed, including the gathering of additional information, we do not believe this TMDL mandates unscientific or unsupportable approaches to water quality.

16. The draft TMDL does not show a cause-and-effect relationship between any exceedance of the water quality endpoint of 116 mg/L TSS once in any 3-year period and an impairment of aquatic life. We do not believe that TSS concentrations greater than 116 mg/L can be properly determined to be the cause of water quality impairment in a small subset of streams in Illinois when that same concentration does not cause water quality impairments in other similar streams. The mean TSS concentration in many streams in western Illinois is greater than 116 mg/L, but the Agency has not determined that those waterbodies are impaired. We also note that the Agency's report on baseline loadings of nitrogen, phosphorus and sediments from Illinois watersheds (Short, 1999) indicates that the statewide mean for TSS is greater than 116 mg/L in May through July and that the 75th percentile exceeds 116 mg/L in June and July (Figure 3-17, p. 41).

    The Agency realizes that chemical and biological processes in surface waters vary significantly from region to region. Determining impairment of a stream involves assessing the chemical, biological and physical characteristics. The TSS guideline of 116 mg/L was not used to determine impairment of the stream, but was only used as the guideline for determining the <u>cause</u> of the impairment once the stream is identified as impaired.

    Due to the analytical nature of TMDLs, however, an established guideline or numerical limit is necessary as an endpoint or goal for pollutant reduction. The Illinois EPA has made every effort to use sound science in determining an appropriate endpoint. The Agency stands by the current TSS guideline as a general indicator of the cause of impairment throughout the state.

17. As pointed out by the U.S. Environmental Protection Agency in a recent guidance document, the occurrence of a potential stressor at equal or greater concentrations at reference (not impaired) sites is a basis for eliminating the potential cause from consideration as a cause of water quality impairment in the subject waterbody. Also, based on information available at the IEPA website, it has been our understanding that the Agency would no longer use the 85th percentile value or the once-in-three years occurrence in developing TMDLs.

    Development of TMDLs for the East Fork Kaskaskia River was initiated prior to this policy change (also see response to question #15). Therefore, since this report was nearly complete at the time we made this policy change, it was finalized under the same program policies that were established at the time it was begun. Future TMDLs will follow the policy you discuss.

18. While we do not have a significant disagreement with the use of arbitrary values for TSS, siltation or nutrients in the 305(b) report for the purpose of identifying potential causes of

water quality impairments, we do not believe that those values should be used as de facto water quality standards in determining the maximum allowable load of a constituent for TMDLs. The Department is concerned about the way in which the statistically based water quality endpoint for TSS is used in the draft TMDL for the East Fork of the Kaskaskia River. This value is not justified in terms of impairments to designated uses and results in unrealistic proposals for changing agricultural practices. As a consequence of these unrealistic and, we believe, inappropriate endpoints, the entire TMDL process in Illinois is likely to lose credibility.

The Illinois EPA makes all recommendations for control of non-point sources of pollution on a voluntary basis. We believe the 116 mg/L TSS guideline is reasonable and appropriate for its function as a water quality endpoint for the purposes of this TMDL (refer to responses for questions #15 and #17).

19. If the draft TMDL for the East Fork of the Kaskaskia River represents another change in Agency policy, the Department recommends that the Agency immediately address the appropriateness of the water quality endpoints being used in developing TMDLs. While we are aware of the Agency's current efforts to convene the Illinois Nutrient Standards Work Group (INSW) to develop water quality standards for nutrients in response to USEPA's proposed water quality criteria, we all recognize that completion of that process will take several years at a minimum. We would also recommend that the Agency add sediment-related water quality parameters (TSS, siltation and turbidity; USEPA's nutrient criteria proposal includes turbidity) to the charge to the INSW or form another technical working group to address the development of appropriate water quality endpoints or standards for those parameters.

    Your suggestions are noted. We believe the appropriate approach for nutrient standards development is now underway, in part through the INSW. We intend to address TSS and other endpoints as described in the 2002 303(d) List. Thank you for your comments.

20. The universal soil loss equation is primarily intended to estimate annual soil loss. There is certainly a need to determine daily loads from critical storm events because they are critical to stream health. However, please provide additional justification that this equation has been properly modified for use estimating individual events. References to specific literature that includes findings that this use of the USLE is appropriate would be helpful.

    The Universal Soil Loss Equation (USLE) predicts the long term average annual rate of erosion on a field slope based on rainfall pattern, soil type, topography, crop system and management practices. Five major factors are used to calculate the soil loss for a given site. Each factor is the numerical estimate of a specific condition that affects the severity of soil erosion at a particular location. The erosion values reflected by these factors can vary considerably due to varying weather conditions.

    This TMDL used the USEPA's Screening Procedures to develop load estimates. The Screening Procedure, detailed in Mills *et al.* (1985), includes two modifications to

adapt the USLE to individual storm events. The erosivity term, E, reflects rainfall intensity, among other things. Expected magnitudes of single-storm erosivity indices are presented in Wischmeier and Smith (1978). Erosivity values for the East Fork Kaskaskia River watershed were interpolated between two stations in Illinois (Cairo and Springfield). For a 1-year storm, the erosivity is 65 (10^2 m-ton-cm/ha-hr) in this area. For the 3-year storm, the erosivity is 118 (10^2 m-ton-cm/ha-hr). For the 10-year storm, the erosivity is 199 (10^2 m-ton-cm/ha-hr). The Screening Procedure also includes estimates of the volume of runoff for specific storm events, which are part of calculating the loads. In this TMDL, runoff volume was estimated for several specific storm events (see Section 5.1 in the report).

21. The document should better justify that water quality throughout the watershed is protected by the TMDL, not just at the sampling point. It is not clear whether the models, particularly the EPA Screening Procedures, used to determine appropriate loading from each subwatershed set pollution concentration constraints at various points along the stream network. If so, please specify where those points are. If not, please provide other demonstration that water quality requirements are met throughout the watershed.

    The TMDL was developed for OK 01, an ambient water quality sampling station. The TMDL was not developed for all locations. The TMDL establishes a load to the stream as a whole from the watershed, thus the reason for using a watershed approach to address the pollutant(s) of concern. While models may allow one to determine which sub-watersheds may be contributing a load, or at least demonstrate which sub-watershed(s) may be a larger contributor than another (see Table 33, for example), the TMDL does not set pollutant limits at various points along a stream. Knowing which sub-watershed(s) may be the major contributor(s) is beneficial in determining/prioritizing where to target implementation efforts.

22. The document recommended removing all the other parameters that were identified in the 1998 303(d) list. However, these parameters were not proposed for removal from the list in 2002. Please clarify the intent of the Agency with regard to delisting, including any new information that was not considered in the 2002 listing decision.

    The causes of impairment listed on the 1998 303(d) List were identified using different criteria than the criteria used in the development of the TMDL. In 1999, Illinois EPA revised the criteria used to determine causes of impairment. These new criteria were not available at the time the 1998 List was developed.

    The first step in the TMDL process is to determine the appropriate causes and sources of the impairment. Based on a re-evaluation of the causes attributable to the impairment using the new criteria, it was determined that those previously identified were no longer accurate. These causes were not proposed for removal from the 2002 List because we list and de-list water bodies, not causes.

23. Dissolved oxygen (DO) violations occurred for 22 of the 71 samples collected at the monitoring station. These violations occur regularly for most summer sampling events as

shown in the data provided in Appendix A of the report. There is clearly a low flow, summer month DO problem. While addressing the DO problem was not the intent of this TMDL analysis, the discussion of water quality in section 2.2.4 should mention this problem. Because this impairment seems to be the most substantial deviation from water quality standards, IEPA should clarify why this impairment was not identified in 1998.

We have reviewed the DO data for this segment. The DO impairment cited in this question was verified. We will re-evaluate this segment for DO impairment the next time this area is targeted for TMDL development.

24. While the document indicates that there are no point sources currently contributing TSS to the impaired segment, the allocation to point sources (the waste load allocation) should be specified. If the TMDL equation contains no allocation for point source loads, the WLA implicitly is zero. Therefore, IEPA will be required to deny issuance of NPDES permits and deny coverage under general permits, to any applicant that proposes to discharge suspended solids.

A TMDL is developed to address existing sources in a watershed. A TMDL cannot predict, nor will we attempt to predict future point sources. Should a discharger apply for an NPDES permit, Illinois EPA will address the issue in the permit limits allowed.

25. The margin of safety (MOS) is inadequate. The document indicates that it is implicit through conservative assumptions including the assumption that no deposition of sediment occurs, the critical season is modeled, recent conservation practices are not included, and pre-BMP water quality data is used for calibration. However, these do not lead to conservative results with an adequate MOS for the following reasons: (1) In a healthy river system, there is no net deposition of sediment; a healthy river is defined as one that moves sediment such that it neither accumulates nor erodes over time. (2) Because water quality standards must be met, even during critical conditions, regulations require that the TMDL be based on critical conditions; this should not also be considered a credit in the MOS. (3 and 4) Because recent conservation practices are not included in the model, it is only appropriate that water quality that occurred prior to implementation of such practices be used in the calibration. Calibrating the model using water quality data that did not match practices modeled would lead to bad calibration. Therefore, the MOS should be redefined with solid justification that the magnitude of the MOS takes into account all uncertainty in the development process.

We selected a simple model and an implicit approach to MOS because we have insufficient data on the system to use more complex models or to develop scientifically defensible explicit MOS factors. This TMDL includes recommendations for future monitoring and for adaptive management, which provides the necessary assurance for eventual success.

26. We feel that the information on total suspended solids (TSS) and the use of corresponding endpoints is not scientifically valid. The draft TMDL does not prove a cause/effect

connection between any elevated TSS and impairment to aquatic life. We are concerned with the way in which the statistically based water quality endpoint for TSS is used. We question the connection between this information and impairments to designated uses. We are concerned that this will eventually result in unrealistic proposals for changing agricultural practices in the watershed.

Please see response to comment #16

27. A concern is that the Illinois EPA had previously indicated that constituents without water quality standards would be listed for causing impairment but that TMDLs would not include numeric reductions and allocations of these constituents. The draft TMDL for the Kaskaskia contains a reduction of potential causes for which there are no water quality standards. This uses a de facto water quality standard to determine an allowable load of constituent for TMDLs. This is a reversal of Illinois EPA's previous statement that TMDLs would not be developed for constituents that do not have water quality standards.

    Development of the TMDL for the East Fork Kaskaskia River was initiated prior to this policy change. Therefore, since this report was nearly complete at the time we made this policy change, it was finalized under the same program policies that were established at the time it was begun. Future TMDLs will follow the policy you discuss.

28. Another concern we have had with this process is the lack of communication between the contractor and local groups and agencies in the watershed. Sound communication among local agencies and the contractor is vital to the development of a plan that will actually work, have credibility and eventually improve water quality. We strongly urge the Agency to increase communication in the TMDL process.

    The Agency feels that communication with local stakeholders is a crucial part of making the TMDL process successful. We will continue to make communication a high priority and encourage our contractors to foster a good relationship with local groups and stakeholders.

29. The analysis and plan assume sheet and rill erosion from cropland is the only source for siltation in the East Fork Kaskaskia River. However, throughout the plan (Sections 4.2, 6.1, 6.3, et al.), the developer acknowledges the absence of quantitative data on other forms of erosion. These include gully, ephemeral, stream bank and streambed erosion. Under scenarios where these alternate forms of erosion provide a significant contribution (>30%) to siltation in the East Fork Kaskaskia River, the proposed plan may be unable to achieve the planned results. Additionally, the plan overlooks the potential impacts of certain non-cropland activities in the watershed. These included oil brine damage areas, ATV trails, borrow areas and livestock lots. Further assessments on the alternate forms of erosion and the impact of non-cropland areas should be completed prior to finalization of the plan.

    Please see response to Comment #6.

30. Fayette County SWCD is omitted in Section 2.1.4 Institutions.

    Fayette County SWCD will be added to the list in the Final Draft.

31. Further clarification is needed for the discussion of "C" factors on pages 34 and 47. Fall tillage (fall "C" factors) reduces residue cover after harvest and leaves soils more susceptible to erosion than spring tillage (spring "C" factors). Spring tillage leaves the crop residue cover undistributed through fall and winter months. Consequently, "C" factors for fall tilled land are higher than for spring tilled land to reflect the higher erosion potential.

    Thank you for your comment and clarification. It is for the reasons you mention that this TMDL was developed using fall "C" factors so that we were representing worse case conditions.

32. Bluford, Ava and Hickory soils (IL038 soil association) are not generally suited to the use of strip cropping, contour farming and terrace practices. These soils tend to occur on dissected landscapes and short side slopes on the Illinoian till plain. In addition, these practices do not lend themselves well to modern farming operations because they often create point rows and overlap areas. Most large farming operations within the East Fork Kaskaskia River watershed utilize planter's widths of at least 30 feet.

    Thank you for this information.

33. We concur with the recommendation on page 67 to develop individual conservation plans. The recommendation on page 83 to develop plans within the first 18 months is unrealistic and unachievable. Adequate resources are not available locally to complete this task. The current 60/40 grants being made available to local soil and water conservation districts by IEPA do not recognize the lack of local resources. For local soil and water conservation districts to adequately address conservation planning in the East Fork Kaskaskia River watershed, additional funding will be needed.

    Thank you for your comment.

34. On page 79 is a discussion of issues and trends in the use of conservation and no till farming practices. Locally, landowners and operators have reduced the use of no till farming practices particularly for corn and milo. This is due to perceived or actual yield decreases when compared to other tillage systems. Agronomist and other crop professionals now recognize these losses are the result of poor or inadequate plant populations. Reduced plant populations are most often related to wet soils in the spring.

    Thank you for your comment.

35. Incentive payments are offered for riparian buffers and filter strips under the Continuous CRP not the EQIP program (page 80). Incentive payments range from $100 to $150 per acre in Illinois.

Thank you for pointing out this error in the report. It has been corrected.

36. Local NRCS and SWCD personnel have worked with landowners and operators to plan and install conservation buffers since 1996. More than 4,000 acres of filter strips and riparian buffers have been installed throughout Marion County. Similar applications in Fayette and Clinton County have occurred as well. Prior to adoption of the final TMDL plan, IEPA should make an accurate assessment of conservation buffers already established in the East Fork Kaskaskia River watershed.

    Illinois EPA encourages stakeholders in the watershed to use the recommendations in the TMDL as a guide in their watershed planning. The Agency does not have the resources to conduct in-depth investigations of conservation practices in the watershed. Landowners and local watershed groups know the land best and are best qualified to direct the recommendations detailed in the TMDL to the areas where they are needed most.

37. The recommendation for development of GIS based recording system is excellent. Full utilization of a GIS based system will require the development of a digital soils layer. The development of a digital soils layer by the USDA-NRCS currently requires a local one-third match. Economic conditions within Marion County will not allow the completion of a soil survey digitization project in the foreseeable future. Therefore, IEPA may wish to contract for digitization of the soils within the East Fork Kaskaskia River watershed by NRCS or another qualified contractor.

    Thank you for your comment.

38. In T*he Carlyle Lake Watershed Plan*, page 60 under "Technical Committee Recommendations for Action Items", item #2 calls for construction of water and sediment detention basins. This is an instrumental and critical part of the plan. The private landscape is the primary site now for flood control and sediment retention. The problem is real. The Public will eventually dictate how much sediment and other water contaminants will be allowed into the public waters.

    Thank you for your Comment

39. If you want the Private landowner to be concerned with water quality, *<u>put water on the private landscape</u>*. I have yet to see a single landowner with a lake or pond that isn't acutely aware of what drains into it. Most landowner's will avoid sending excess sediments into their own ponds and lakes. Secondly, I beg anyone to find a single study that shows water leaving a lake, pond, or sediment control structure; not cleaner than the water that entered. Even Lakes Shelbyville and Carlyle accomplish this. These structures can function as wetlands, by providing a stable source of water for gradual movement into water tables beneath them.

    Thank you for your comment.

40. Build lakes, ponds, and retention sites throughout the watershed. Cost share with landowners on a per acre-foot of storage basis, maybe with 40% of typical construction costs on a 10-acre feet storage facility, less on smaller facilities. (This would have to be evaluated and developed in detail, so as to put a true cost/ benefit ratio) The dam construction should allow for at least some seasonal storage, (freeboard storage). This would allow flood retention and yet provide gradual release into streams.

    Thank you for your comment.

41. I feel confidant that as more private bodies of water are developed, private landowners will more readily adapt environmental practices such as nutrient management (through activities such as strip-till) and reduced tillage; to keep their own reservoirs from being damaged. Controlled construction of Lakes and ponds can enhance forested sites. If forested habitat is removed, mitigate with the private landowner to establish new-forested habitat. Two acres new for every one acre lost, wouldn't be unreasonable to most landowners**.**

    Thank you for your comment.

GLOSSARY AND ACRONYMS

ALUS Aquatic Life Use Support.

AWQMN Ambient Water Quality Network

BMPs Best Management Practices. These are practices that have been determined to be effective and practical means of preventing or reducing pollution from nonpoint sources.

CPP Conservation Practices Program

CRP Conservation Reserve Program

FY2000 Fiscal Year 2000

IBI Index of Biological Integrity. Primary purpose is to assess the biological integrity of a habitat using samples of living organisms and to evaluate the consequences of human actions on biological systems. Developed for use in managing aquatic resources (e.g., to establish use designations for water bodies, biological water quality standards, or goals for restoration).

IBS Intensive Basin Survey

IEPA The Illinois Environmental Protection Agency (also referred to as the Agency or Illinois EPA)

NRCS Natural Resources Conservation Service

NVSS Non-volatile suspended solids

RUSLE Revised Universal Soil Loss Equation

TMDL Total Maximum Daily Load

TSS Total Suspended Solids. Solids in water that can be trapped by a filter. TSS can include a wide variety of material, such as silt, decaying plant and animal matter, industrial wastes, and sewage. High concentrations of suspended solids can cause many problems for stream health and aquatic life.

USEPA United States Environmental Protection Agency

USLE Universal Soil Loss Equation. A method of estimating the average soil loss from sheet and rill erosion that might be expected to occur over an extended period under specified conditions of soils, vegetation, climate, cultural operation, and conservation measures.

DISTRIBUTION OF RESPONSIVENESS SUMMARY

Additional copies of this responsiveness summary are available from Bill Hammel, Illinois EPA Office of Community Relations, phone 217-524-7342 or e-mail Bill.Hammel@epa.state.il.us.

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