Final Report

Total Maximum Daily Loads for the East Branch of the DuPage River, Illinois

Submitted to

Illinois Environmental Protection Agency

P.O. Box 19276
1021 North Grand Avenue East
Springfield, IL 62794-9276

October 2004

Prepared by

CH2MHILL

CH2M HILL Inc.
727 North First Street
Suite 400
St. Louis, Mo 63102-2542

In association with

Applied Environmental Engineering, LLC and
AQUA TERRA Consultants

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

REPLY TO THE ATTENTION OF:
WW-16J

29 SEP 2004

Marcia Willhite, Chief
Bureau of Water
IEPA
P.O. Box 19276
1021 North Grand Avenue East
Springfield, Illinois 62794-9276

Dear Ms. Willhite:

The United States Environmental Protection Agency (U.S. EPA) has conducted a complete review of the final Total Maximum Daily Loads (TMDL) for chlorides, carbonaceous biochemical oxygen demand (CBOD) and ammonia-N, including supporting documentation, for three segments of the East Branch DuPage River, located in DuPage and Will Counties, Illinois. Based on this review, U.S. EPA has determined that Illinois' TMDLs for these pollutants for these waterbodies meet 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, by this letter, U.S. EPA hereby approves 8 TMDLs for the East Branch DuPage 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 these submitted TMDLs, and look forward to future quality TMDL submissions by the State of Illinois. If you have any questions, please contact Mr. Kevin Pierard, Chief of the Wetlands and Watersheds Branch, at 312-886-4448.

Sincerely yours,

Jo Lynn Traub
Director, Water Division

Enclosure

Executive Summary

This report presents the development of total maximum daily loads (TMDLs) for the East Branch of the DuPage River ("East Branch") in DuPage and Will Counties, Illinois. The East Branch flows together with the Des Plains River in urban Chicago, Illinois. The 1998 303(d) List identified the East Branch as impaired for nutrients, siltation, salinity/TDS/chlorides, suspended solids, low dissolved oxygen, habitat alterations and noxious aquatic plants. The 2000 305(b) Report updated these potential causes of impairment to be nutrients, siltation, salinity/TDS/chlorides, suspended solids, habitat alterations, flow alterations, excessive algal growth/chlorophyll-a and low dissolved oxygen. The Illinois Environmental Protection Agency ("the Agency") has adopted a policy of developing TMDLs only on potential causes of impairment that have a water quality standard, which in this case, were chlorides and low dissolved oxygen (DO). This document describes and presents the methods and procedures used to develop a chloride and DO TMDLfor the East Branch. The East Branch watershed covers about 79.3 square miles of northeastern Illinois. The watershed is located in the Des Plains hydrologic unit code (HUC 07120004). Approximately 40 percent of the land use in the watershed is residential. Approximately 16 percent of the total watershed area is impervious surfaces. There are eight wastewater treatment plants in the watershed.

The U.S. Environmental Protection Agency's (USEPA's) Hydrologic Simulation Program Fortran (HSPF) watershed model, the Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) analysis system, and the in-stream water quality model QUAL2E were used to characterize the watershed and evaluate TMDL allocations. Spatial data (land use and cover, hydrographic and topographic data), monitoring data (water quality, flow, and weather information), and pollutant source data were used to develop input parameters for the watershed models.

The watershed models were calibrated using information from two U.S. Geological Survey (USGS) gauges, one at Downers Grove (USGS Gauge ID 05540160) and one at Bolingbrook (USGS Gauge ID 05540250), which were located inside the watershed.

TMDLs are sums of the individual waste allocations (WLAs) for point sources, load allocations (LAs) for both nonpoint sources and natural background, and a margin of safety (MOS). This definition is denoted by the following equation:

$$\text{TMDL} = \Sigma \text{ WLAs} + \Sigma \text{ LAs} + \text{MOS}$$

Each TMDL developed for the East Branch watershed was developed to achieve full compliance with Illinois water quality standards for each pollutant.

The chloride TMDL will require a 33 percent reduction in overall chloride application to the East Branch watershed. Table E-1 summarizes the chloride TMDL.

TABLE E-1
Chloride TMDL for the Mouth of East Branch DuPage River

	WLA[a]	MS4 WLA[b]	MOS	TMDL
Chloride (lb/yr)	6.83E+07	1.05E+07	Implicit	7.88E+07

[a]WLA based on permitted design flow and concentration of 400 mg/L
[b]Represents a 33% Reduction in NPS Load

Three allocation scenarios were developed for the DO TMDL. In the first scenario, point sources will have to reduce their permitted load of $CBOD_5$ and ammonia nitrogen. The scenario is based on achieving $CBOD_5$ limits of 8 mg/L and ammonia limits of 1 mg/L. In the second allocation scenario, point sources remain at their current monthly average permit limits, but either the dam in Reach 3 must be removed or the water behind the dam in Reach 3 must be artificially reaerated in order to achieve the water quality target. Table E-2 summarizes the DO TMDL.

TABLE E-2
Summary of East Branch DO TMDL

Pollutant	Load Allocation (lb/day)	Wasteload Allocation (lb/day)	Margin of Safety	TMDL (lb/day)	Observed Load (lb/day)[a]	Percent Reduction Needed from Observed Load
Allocation Scenario 1						
5-day carbon. biochemical oxygen demand	NA	2384	Implicit	2384	268	0
Ammonia nitrogen	NA	298	Implicit	298	273	0
Allocation Scenario 2						
5-day carbon. biochemical oxygen demand	NA	2980	Implicit	2980	268	0
Ammonia nitrogen	NA	447	Implicit	447	273	0

[a] Current observed loads based on effluent data from June 24-25, 1997 IEPA dataset
WLA based only on Bloomingdale, Glendale Heights, Glenbard, and Downers Grove facilities as remaining facilities discharge downstream of the impaired segment

There were no Confined Animal Feeding Operations (CAFOs) identified in this watershed. CAFOs were not identified as contributors of chloride or low dissolved oxygen, the pollutants for which this TMDL was developed, and will not be addressed in this TMDL.

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Acronyms and Abbreviations

AGWRC	basic groundwater recession (HSPF model parameter)
AS	acute standard
BASINS	Better Assessment Science Integrating Point and Nonpoint Sources database
BMP	best management practices
BOD	biochemical oxygen demand
CBOD	carbonaceous biochemical oxygen demand
cfs	cubic feet per second
CS	chronic standard
CSO	combined sewer overflow
CWA	Clean Water Act
DCDS	DEC Stormwater Management Division
DEC	DuPage County Department of Environmental Concerns
DEEPFR	fraction of groundwater inflow to deep recharge
DEM	digital elevation models
DMR	discharge monitoring report
DO	dissolved oxygen
DP	dissolved phosphorus
DRG	digital raster graphic
EIA	effective impervious area
FRSS	facility-related stream surveys
GIS	geographic information system
GU	general use
HSPEXP	an expert system for hydrologic calibration
HSPF	Hydrologic Simulation Program Fortran
HUC	hydrologic unit code
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
IRC	interflow recession parameter
LA	load allocation
LZETP	lower zone evapotranspiration parameter
LZSN	lower zone nominal soils moisture
mg/L	milligram per liter
MOS	margin of safety
MWRDGC	Metropolitan Water Reclamation District of Greater Chicago
NCDC	National Climatic Data Center
NIPC	Northeastern Illinois Planning Commission
NOAA	National Oceanographic and Atmospheric Administration
NVSS	nonvolatile suspended solids
PCS	permit compliance system
PET	potential evapotranspiration
PETMAX	air temperature below which evapotranspiration is reduced
PETMIN	air temperature below which evapotranspiration is set to 0

PRISM	parameter-elevation regressions on independent slopes model
QUAL2E	a stream water quality model
R^2	coefficient of determination
RF3	Reach File version 3
SOD	sediment oxygen demand
SSO	sanitary sewer overflow
STP	sewage treatment plant
TCU	transportation land use (NIPC classification)
TDS	total dissolved solids
TMDL	total maximum daily loads
TP	total phosphorus
TSNOW	a model parameter
TSS	total suspended solid
UCI	user control input
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UZSN	upper zone nominal soils moisture
VSS	volatile suspended solid
WDM	watershed data management
WLA	waste load allocation
WQS	water quality standard
WTC	wastewater treatment plant
WRF	water reclamation facility
WWTP	wastewater treatment plant

1 Introduction

1.1 Background

Section 303(d) of the Federal Clean Water Act (CWA) and the U.S. Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (40 CFR Part 130) require states to identify water bodies that do not meet water quality standards (WQSs) applicable to their designated use classifications and to develop total maximum daily loads (TMDLs) for these water bodies. The TMDL process establishes the allowable pollutant loads or other quantifiable parameters for a water body based on the relationship between pollutant sources and in-stream conditions. By following the TMDL process, states can establish water quality–based controls to reduce pollution from point and nonpoint sources and restore and maintain the water quality (USEPA, 1991).

Located in DuPage and Will Counties, Illinois, the East Branch of the DuPage River ("East Branch") and its tributaries were placed on the Illinois 303(d) list (1998) of impaired waters for several pollutants, including conductivity, chloride, and dissolved oxygen (DO). TMDLs for all pollutants causing applicable WQS violation were established for each identified water body.

This document presents the TMDLs and describes the methods and procedures used to develop the TMDLs for impaired segments in the East Branch watershed.

1.2 Organization of the Report

This report is organized to provide a structured description of TMDL endpoints, watershed characterization and source assessment, the assessment of water quality and TMDL approach, a summary of modeling approach and assumptions, and a summary of all recommended allocation scenarios. It builds upon a series of technical memoranda that has been submitted throughout the East Branch TMDL development process. Comments on the technical memoranda have been incorporated into this report.

2 Target Identification/Determination of TMDL Endpoints

The 1998 Illinois Section 303(d) List identified the East Branch of the DuPage River as impaired for nutrients, siltation, salinity/TDS/chlorides, suspended solids, low dissolved oxygen, habitat alterations and noxious aquatic plants. The 2000 305(b) Report updated these potential causes of impairment to be nutrients, siltation, salinity/TDS/chlorides, suspended solids, habitat alterations, flow alterations, excessive algal growth/chlorophyll-a and low dissolved oxygen.

In developing the 2002 Illinois Section 303(d) List, the Illinois EPA revised its prioritization method that accounts for severity of pollution and the uses to be made of such waters. Prioritization was done on a watershed basis. For a detailed explanation refer to the Illinois 2002 Section 303(d) list, available at: http://www.epa.state.il.us/water/watershed/reports/303d-report/index.html. Under this new prioritization process, emphasis is given to those parameters with numeric WQS. These are identified in Table 2-1 and Figure 2-1. As a result of prioritization, this study focused on chloride and dissolved oxygen, which have a numeric WQS.

The IEPA is aware of the other parameters previously listed and those parameters will be given attention through methods other than a TMDL and hence no further discussion of those will be provided in this document. Pending development of appropriate water quality standards as may be proposed by the Agency and adopted by the Pollution Control Board, Illinois EPA will continue to work toward improving water quality throughout the state by promoting and administering existing programs and working to innovate and create new methods of treating potential causes of impairment.

According to Illinois waterbody use classifications, the East Branch is designated for general use (GU). Based on this classification, TMDLs were developed for chloride and DO and were designed to meet applicable WQSs.

The first part of this section outlines the different segments and the pollutants of concern for East Branch. The second part outlines the TMDL endpoints selected for each pollutant listed for East Branch under the Illinois 303(d) list.

2.1 Impaired East Branch Segments

Three segments of East Branch do not meet Illinois WQSs. Table 2-1 presents a complete list of all segments and causes of impairments associated with numeric WQS. Figure 2-1 shows the location of the impaired segments in East Branch DuPage River.

TABLE 2-1
Segments of the East Branch of the DuPage River That This TMDL Report Addresses and Identified Potential Causes of Impairment

Segment	TDS/ Conductivity	Chloride	DO
GBL 05	X	X	X
GBL 10		X	X
GBL 08			X

TDS, total dissolved solids.

2.2 Applicable Water Quality Standards and Total Maximum Daily Load Endpoints

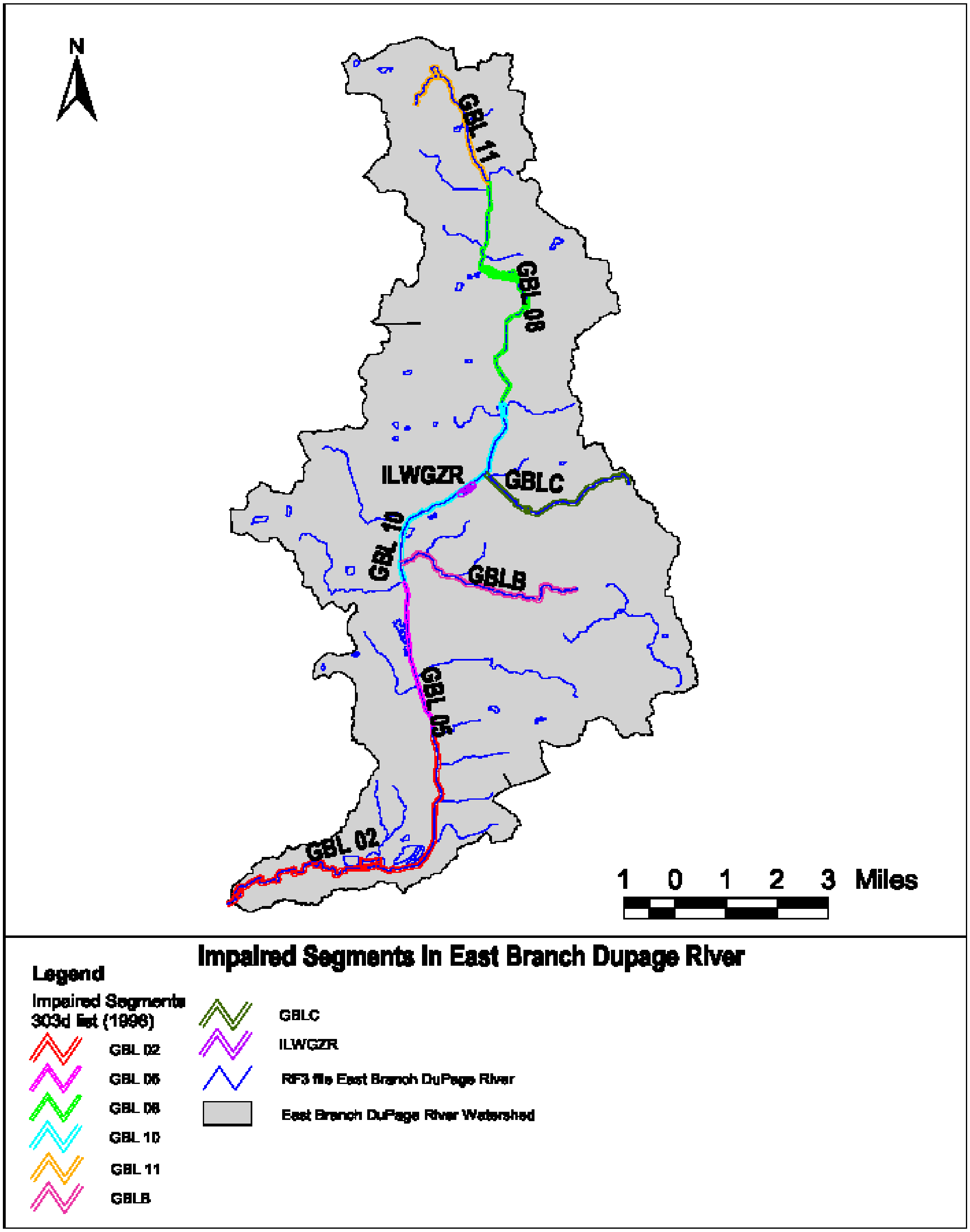
The applicable WQS was the chosen endpoint for the TMDL. Table 2-2 shows a list of pollutants, WQS, and potential endpoints addressed in this report.

TABLE 2-2
Pollutants, Water Quality Standards, and TMDL Endpoints

Parameter	Water Quality Standard	Total Maximum Daily Load Endpoints
Conductivity	TDS—1,000 mg/L, equivalent to 1,667 μmho/cm of conductivity	General-use standard for chloride of 500 mg/L
Chloride	500 mg/L	Water quality standard
Dissolved oxygen	Not less than 5 mg/L at any time or not less than 6 mg/L for 16 of 24 consecutive hours	Not less than 5 mg/L at any time or not less than 6 mg/L for 16 of 24 consecutive hours

mg/L, milligrams per liter
TDS, total dissolved solids

FIGURE 2-1
Impaired Segments in the East Branch of the DuPage River



3 Watershed Characterization and Source Assessment

This section describes the data acquired and the watershed characterization conducted to develop the East Branch TMDLs. The available historical data for each 303(d)-listed pollutant are presented and discussed and followed by an assessment of available data for watershed modeling.

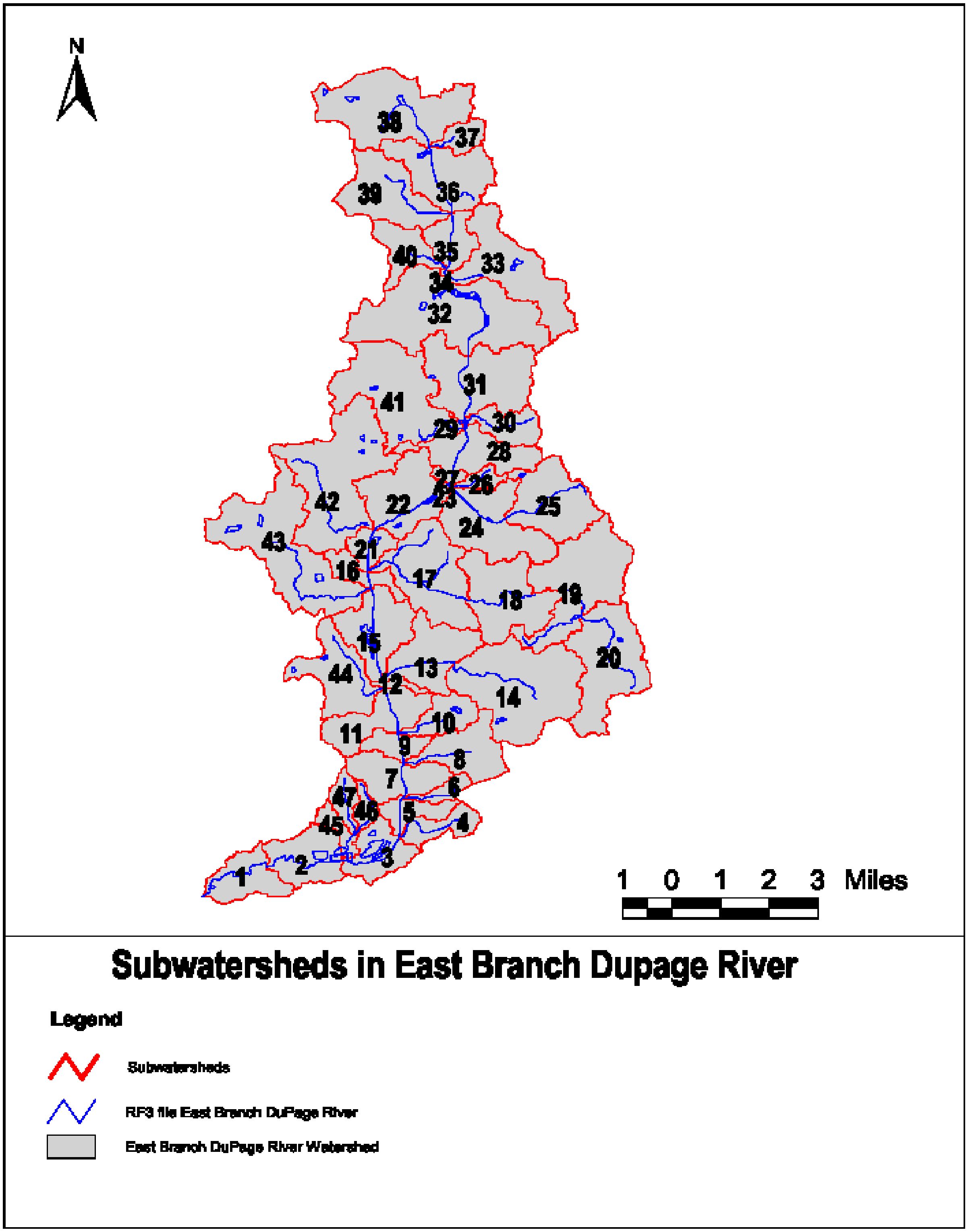
3.1 Watershed Description and Background Information

The East Branch watershed encompasses about 79.3 square miles of northeastern Illinois. The DuPage County Department of Environmental Concerns (DEC) Stormwater Management Division (DCDS) developed subwatershed boundaries for its stormwater management program. The boundaries take into account areas in DuPage County that are drained by storm sewer systems, with sometimes nontopographically based drainage characteristics. The subwatershed areas range from 0.2 to 2,109 acres and average 119 acres. Because of the watershed's complex nature, existing subwatershed delineations that include storm sewer areas were used wherever possible in the TMDL modeling process. Figure 3-1 shows the subwatersheds in the East Branch watershed.

The Illinois Environmental Protection Agency (IEPA) also provided 14-digit Hydrologic Unit Code (HUC) watershed boundaries for the entire East Branch watershed. For areas in DuPage County, these boundaries were checked against the DCDS data. For areas outside DuPage County, the 14-digit HUC boundaries were verified using U.S. Geological Survey (USGS) 1:240,000-scale digital elevation models (DEMs) to match the Reach File version 3 (RF3) stream segments. RF3 is the most detailed stream network data layer available from the Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) data set and is identical to the National Hydrography Data (NHD) for the East Branch of the DuPage River. The HUC watershed boundaries were not detailed enough to use for East Branch subwatershed data in this report, but they were investigated and compared with the other data sources.

Topographic data were obtained in a digital format from the USGS and the DCDS. USGS topographical mapping was downloaded from the Illinois Geographic Information Council Website as a digital raster graphic (DRG) file. The topographic data were used to confirm drainage patterns established by the state 14-digit HUC and DCDS subwatershed delineation. No significant differences were found between the DRGs and DEMs. Therefore, only the DEMs from the USGS were used in the final data selection and subwatershed delineation.

FIGURE 3-1
Subwatersheds in the East Branch of the DuPage River



3.2 Land Use

Land use data were obtained from the DCDS, the Northeastern Illinois Planning Commission (NIPC), and BASINS.

The DCDS land use data were defined for a higher resolution than NIPC data but were not available for areas outside DuPage County. The NIPC data covered the entire study area with adequate detail for characterizing nonpoint sources of pollution and for modeling. BASINS land use data were out of date and did not provide the necessary detail for modeling. A data set showing forested areas was obtained from the Illinois Department of Natural Resources (IDNR). In the NIPC data, forested areas were classified under open space. To identify what portions of the open space were forested areas, the IDNR forest coverage was overlaid with the NIPC data to produce the final land use coverage for use in modeling. In addition, the category called "vacant excluding wetlands" in the geographic information system (GIS) layer was combined with the open space category for modeling purposes.

Figure 3-2 shows the East Branch watershed land use. The watershed consists primarily of developed areas. According to the land use data obtained from NIPC, only 3 percent of the East Branch watershed is agricultural; approximately 40.3 percent is residential. Table 3-1 shows a complete list of land use categories. Therefore, nonpoint source pollution from agricultural activities would be low for most listed pollutants when compared with the amount of pollution from other land uses. Nonpoint source loads from residential areas may contribute significantly to some pollutant loads.

Land use data were used to characterize nonpoint source pollution sources in the watershed and to complete the load allocation (LA) portion of the TMDL. The East Branch watershed was listed for several pollutants that are transported by stormwater runoff. These include total dissolved solids (TDS)/conductivity, chloride, and oxygen-demanding materials that affect DO. During modeling, these pollutants were linked to contributing types of land use (see Section 6).

3.3 Hydrographic Data

To model the stream network in a watershed, the selected models (Hydrologic Simulation Program Fortran (HSPF) and QUAL2E) required the stream network to be broken into reaches representing the stream characteristics. Flows and pollutants were routed through these reaches using trapezoidal channel geometry. Stream reach data were available from DuPage County and BASINS data sets.

The DCDS provided hydrographic data that were compared with RF3 data in USEPA's BASINS 2.1 model. Both data sets had identical basic reach information. The DCDS data included smaller and isolated water bodies, but the stream network connectivity was poor. The RF3 data included all the connected streams in the watersheds and additional attribute information that were required to set up the model. Therefore, the RF3 data were used to develop the TMDLs. Appendix A includes a detailed summary of the reaches used for modeling.

FIGURE 3-2
Land Use in the East Branch of the DuPage River

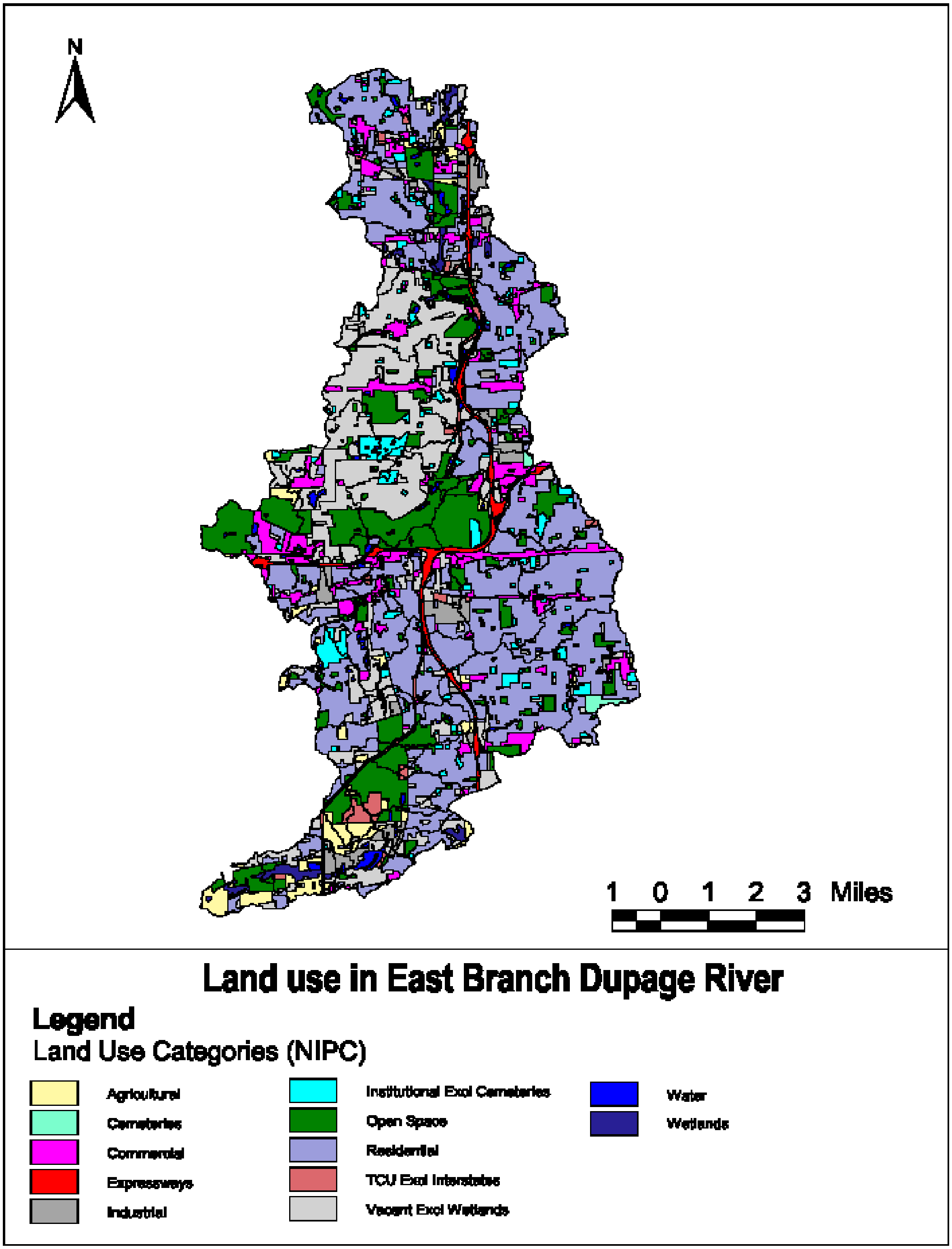


TABLE 3-1
NIPC and IDNR Land Use Distribution in the East Branch of the DuPage River

Land Use	ID	Area (Acres)		
		Impervious	Pervious	Total
Cemeteries and vacant land	1		10,715.34	10,715.34
Commercial	2	3,113.35	549.42	3,662.77
Forest	3		2,389.19	2,389.19
Industrial	4	1,303.18	229.99	1,533.17
Institutional	5	572.97	1,339.27	1,912.24
Open space	6		5,461.34	5,461.34
Residential	7	1,615.07	18,573.45	20,188.52
TCU excluding Interstates	8	541.17	360.80	901.97
Expressways	9	606.39	404.25	1,010.64
Wetlands	10		686.54	686.54
Agricultural	11		1,520.81	1,520.81

TCU, transportation land use.

3.4 Meteorological Data

Weather data were needed to calibrate hydrologic and water quality models and were used by the models to generate runoff volumes. The modeled runoff volumes were routed to determine streamflow values that were compared with data from several streamflow gauges in the East Branch watershed (see Section 3.5). Model input parameters were adjusted using this comparison of observed and modeled values.

NIPC provided National Climatic Data Center (NCDC) and other weather data in a Watershed Data Management (WDM) file format. Table 3-2 shows the data included in the WDM files. NIPC obtained precipitation data primarily from the NCDC and from a gauge at Argonne National Laboratory. Daily precipitation data were disaggregated using nearby hourly recording gauges. The Wheaton weather station, located in the East Branch watershed, was used to obtain necessary weather data for TMDL development because it had the most long-term hourly data. Figure 3-3 shows the location of each station from which precipitation data were collected for East Branch.

In addition to precipitation data, NIPC provided potential evapotranspiration (PET), cloud cover, solar radiation, air temperature, dew point, temperature, and wind movement data in a WDM format. Most of these data came from the NCDC.

The spatial variability of rainfall throughout the study area was verified using annual rainfall data found at Oregon State University's software system Website (http://www.ocs.orst.edu/prism/). The Parameter-Elevation Regressions on Independent Slopes Model (PRISM) on the Website uses point data and a DEM to generate gridded estimates of climate parameters, including precipitation. The annual precipitation for Illinois was downloaded from this site. Review of the data shown in Figure 3-4 indicated that there were no significant spatial variations in rainfall patterns across the study area that would require special consideration. The average annual precipitation value at Wheaton (36.5 in.) for the 30-year period used for developing the PRISM data (1961–1990), corresponds to the average annual value from PRISM.

TABLE 3-2
Weather Data Provided in NIPC WDM Files

Start Date	End Date	Station ID	Source of Data	Data Type and Interval
01/01/1948	07/31/1996	Chicago O'Hare WSE ARP R	NCDC	Hourly precipitation
01/01/1948	09/30/1999	Chicago Midway AP 3 SW	NCDC	Hourly precipitation
06/30/1948	09/30/1988	McHenry WG Stratton L&D	NCDC	Hourly precipitation
09/30/1948	07/31/1996	Aurora	NCDC	Daily data distributed to hourly using Argonne data
01/01/1948	12/31/1999	Wheaton 3 SE	NCDC	Daily data distributed to hourly using Argonne data
09/30/1948	07/31/1996	Elgin	NCDC	Daily data distributed to hourly using Argonne data
12/04/1996	12/31/2000	Elmhurst	USGS	5-minute precipitation data aggregated to hourly
01/01/1948	07/31/1996	Argonne	NCDC	Adjusted Argonne precipitation

For detailed description of data, refer to *Application Guide for the Hydrologic Modeling in DuPage County Using Hydrologic Simulation Program - Fortran (HSPF): Model Organization and Use, Data Collection and Processing, Calibration* (May 1996). Tom Price, Northeastern Illinois Planning Commission.

Hourly data from Wheaton were used for meteorological data such as solar radiation, wind speed, cloud cover, temperature, and dew point temperatures for the entire East Branch watershed.

Pan-evaporation data were obtained from the Midwestern Regional Climate Data Center (National Oceanographic and Atmospheric Administration (NOAA)) for the Urbana weather station in Champaign County. To adjust these to East Branch watershed conditions, the NOAA pan-evaporation charts were used to calculate a ratio of annual pan-evaporation from Urbana to East Branch. The data from Urbana were multiplied by this ratio to obtain a pan-evaporation time series for the East Branch watershed. The pan-evaporation was assumed to be equivalent to PET. To obtain the actual evapotranspiration from the PET, the NOAA pan-coefficient was applied (National Weather Service, 1982c). Evapotranspiration data packaged with the USEPA's BASINS software were significantly higher than the values reported by NOAA.

FIGURE 3-3
Weather Stations with Precipitation Data

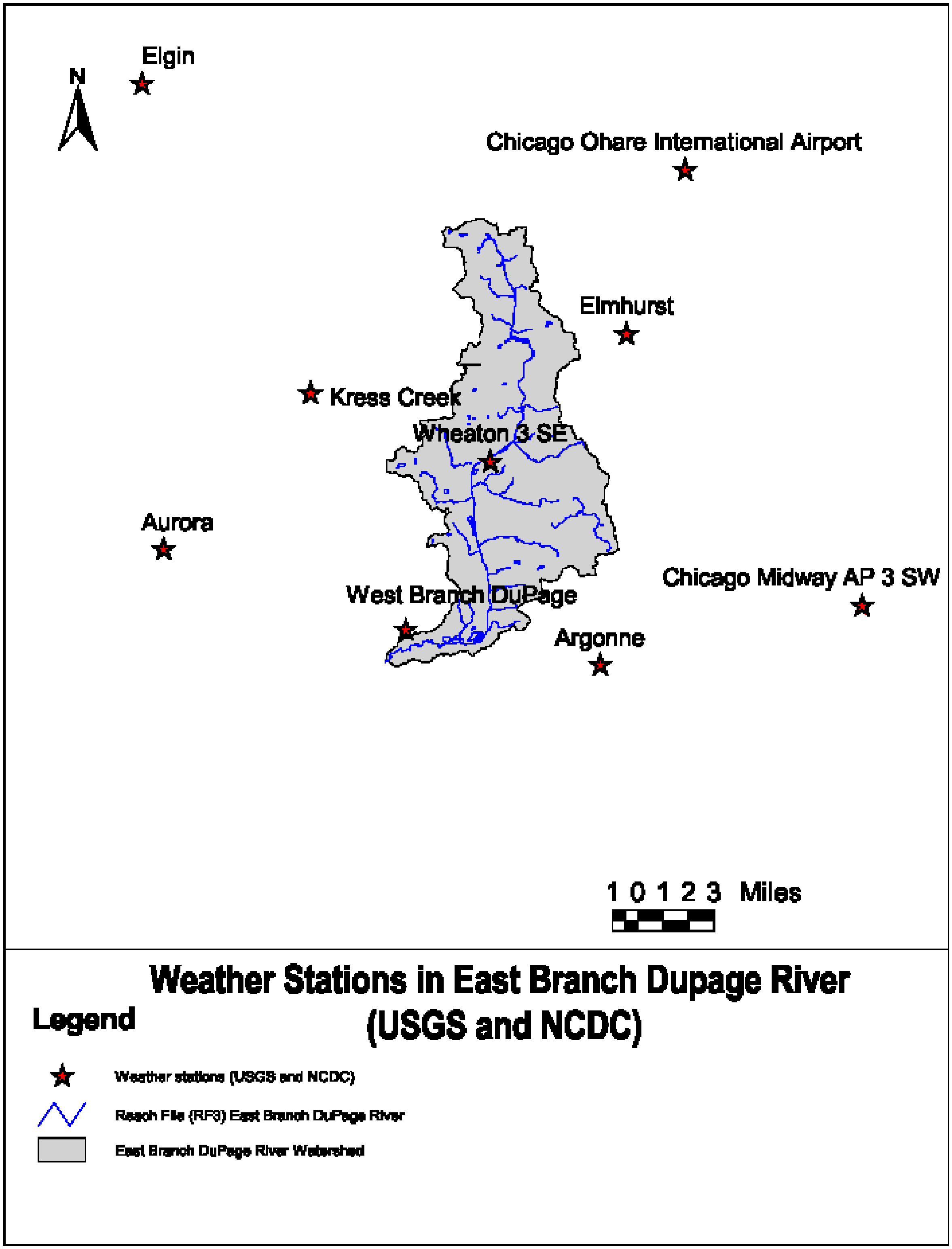
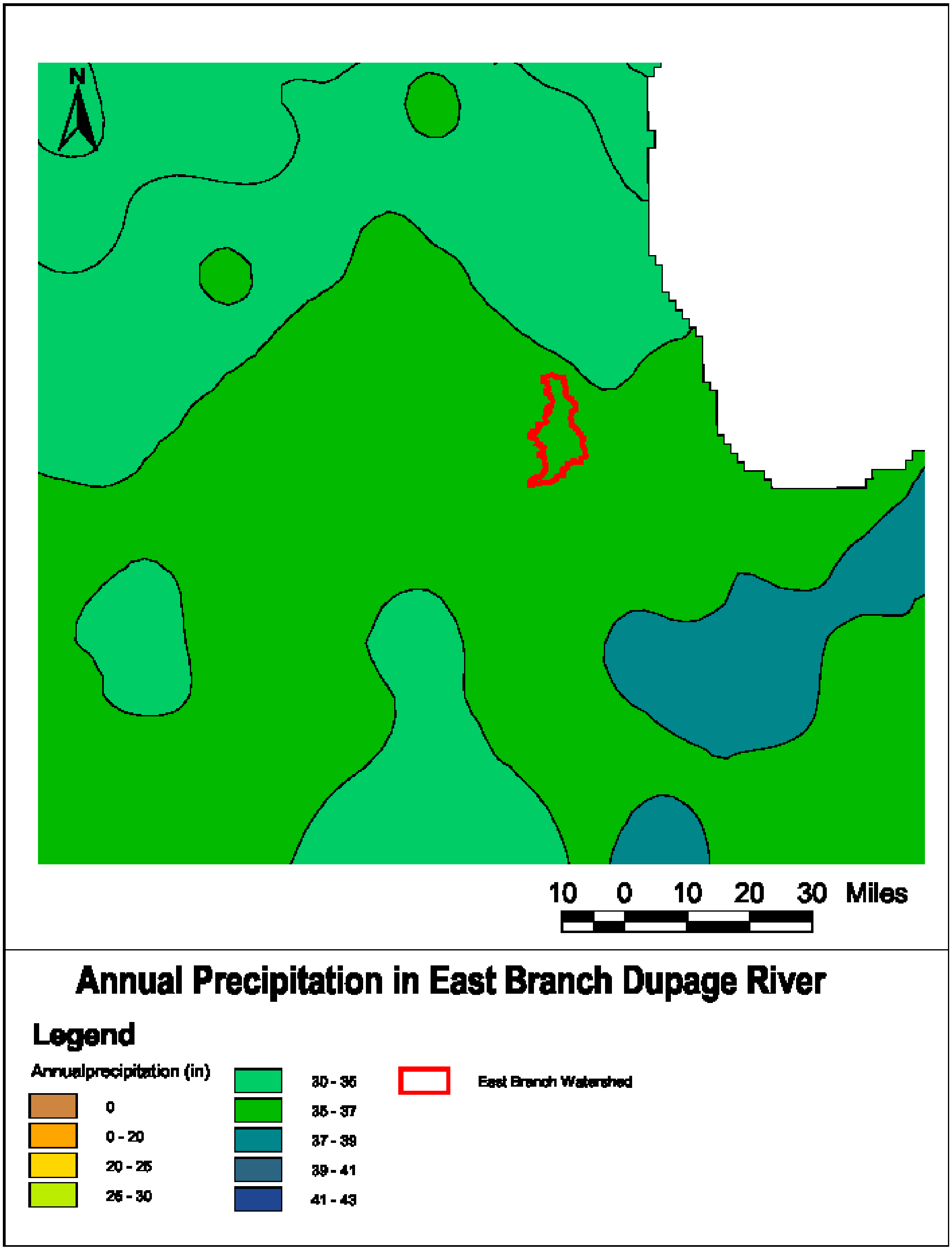


FIGURE 3-4
Annual Precipitation



3.5 Streamflow Data

Streamflow data are needed to calibrate hydrologic and water quality models. As mentioned earlier, first the weather data are used to generate the runoff volumes from the watershed. Modeled runoff volumes are routed to determine streamflow values that are compared with data from several streamflow gauges located in the East Branch watershed. The USGS gauge station cover provided in EPA's BASINS 2.1 model was used to determine the location of gauges. Figure 3-5 shows the location of all USGS gauge stations in East Branch.

From all the USGS flow gauges in East Branch, only two contained the long-term data needed for model calibration: Downers Grove (USGS Gauge ID 05540160), in the upper portion of the watershed, and Bolingbrook (USGS Gauge ID 05540250), in the lower portion of the watershed. Therefore, these two stations were used for model calibration. Figure 3-6 shows the location of the two gauges in the East Branch watershed.

3.6 Point Sources

Point source discharge data are needed to complete the waste load allocation (WLA) portion of the TMDL. All point source data were obtained from the IEPA and the Permit Compliance System (PCS) database of EPA.

The IEPA provided effluent concentrations, flow rates, and permit limits for NPDES permitted point sources from the discharge monitoring report (DMR) system. In addition, IEPA provided locations of point sources. The geographic information provided by IEPA and the BASINS 2.1 permit compliance system (PCS) GIS data were used to locate point sources in the East Branch watershed; Figure 3-7 shows the point source locations. Only point sources with a significant flow rate were considered in the modeling efforts; this included all WWTP and other major point sources. Table 3-3 lists the point sources and notes which ones were included in the modeling analyses.

Glenbard-Lombard is a wet weather discharge. Including it in the HSPF model would have double-counted the stormwater - the model would have accounted for it in both the discharge and in the nonpoint source runoff. Stone Barber is a quarry, and its flow is accounted for through groundwater runoff; its discharge will not contain high amounts of chlorides.

For the QUAL2E model, Glenbard-Lombard was not discharging during the calibration study. Since it is a wet weather discharge, it is unlikely that it would discharge during low flow conditions, the conditions upon which the DO TMDL is based. Stone Barber does not contain oxygen-consuming waste, and its flow is accounted for in the incremental inflow rates.

FIGURE 3-5
Location of USGS Gauges in the East Branch of the DuPage River Watershed

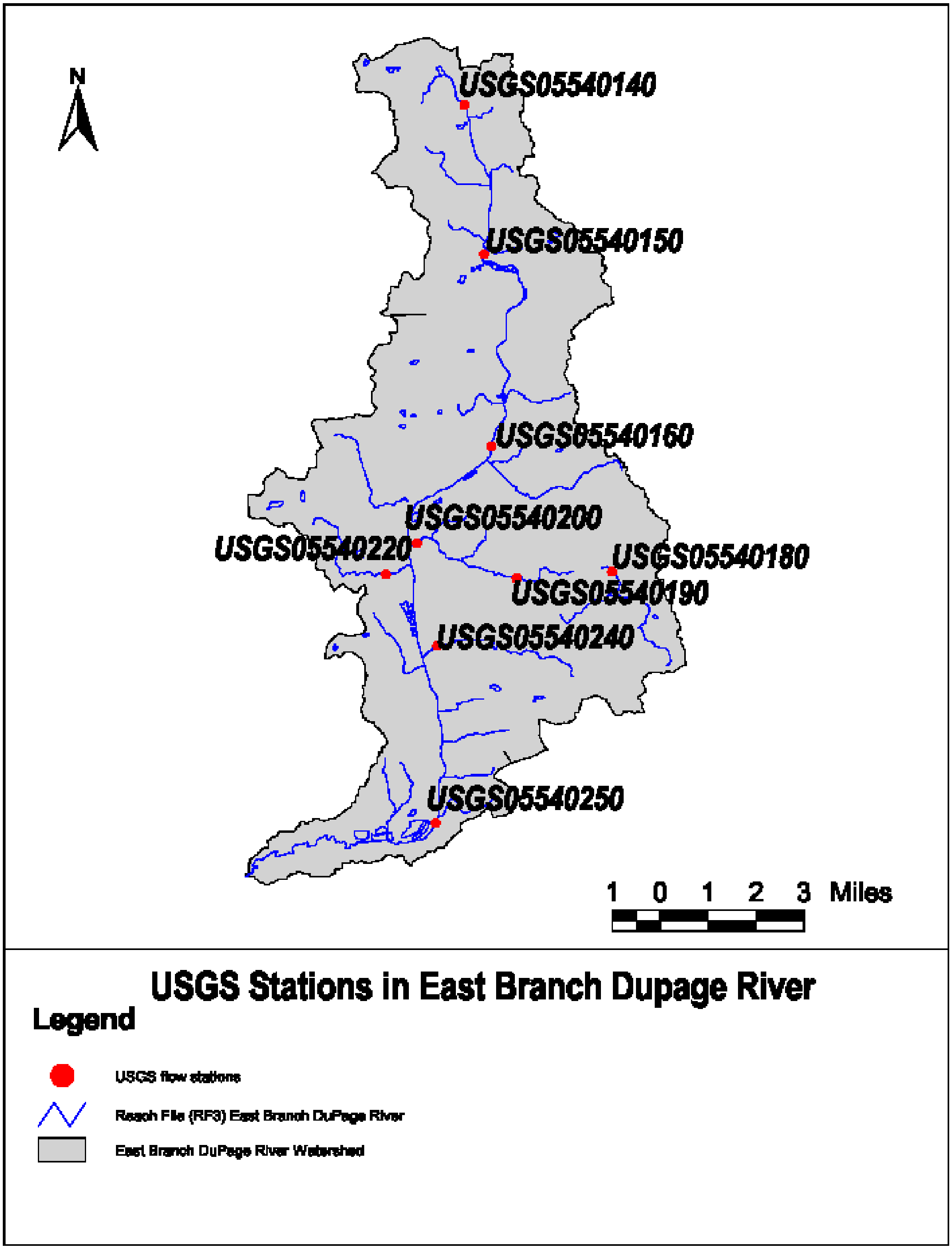


FIGURE 3-6
Location of USGS Gauges Used for Hydrologic Calibration

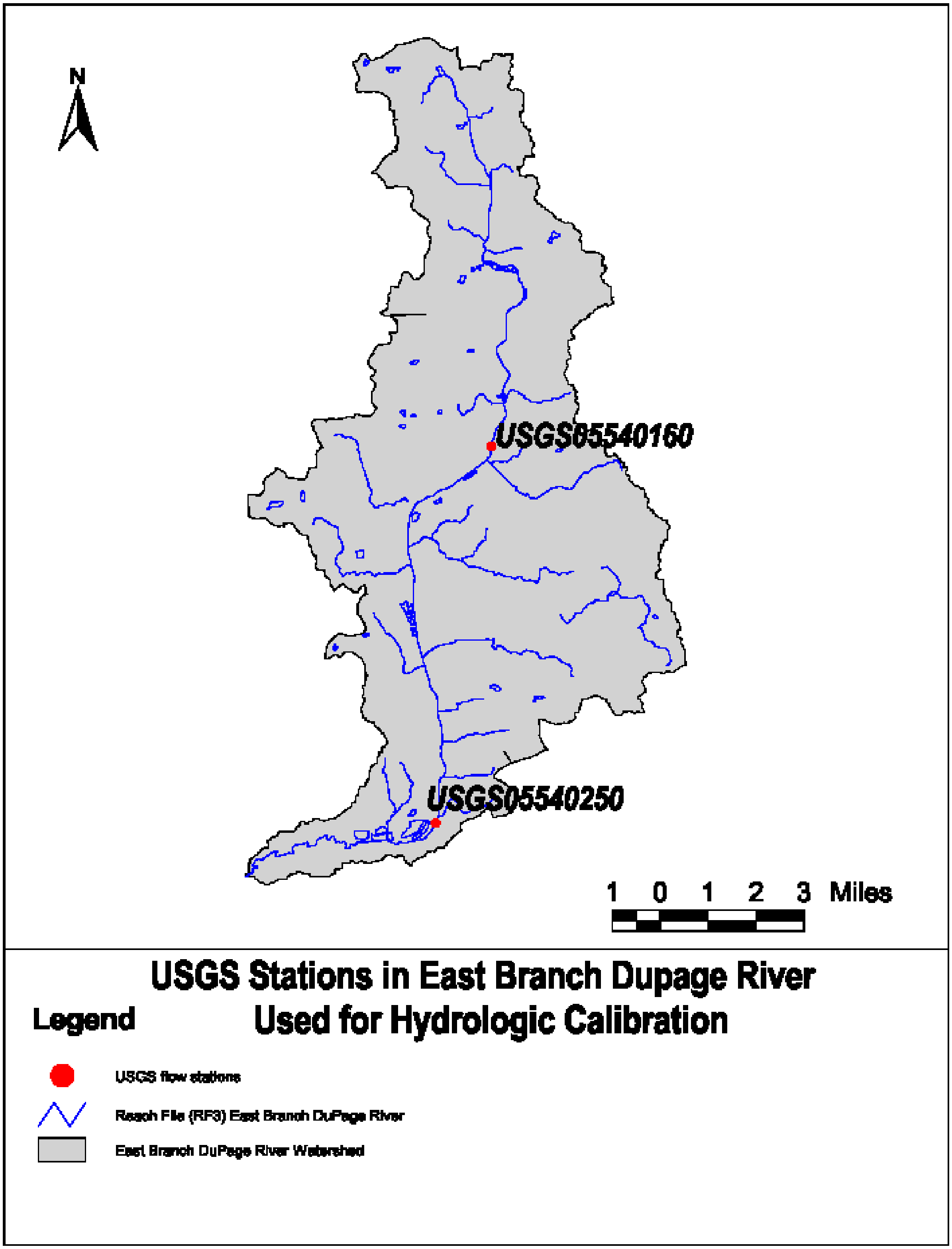
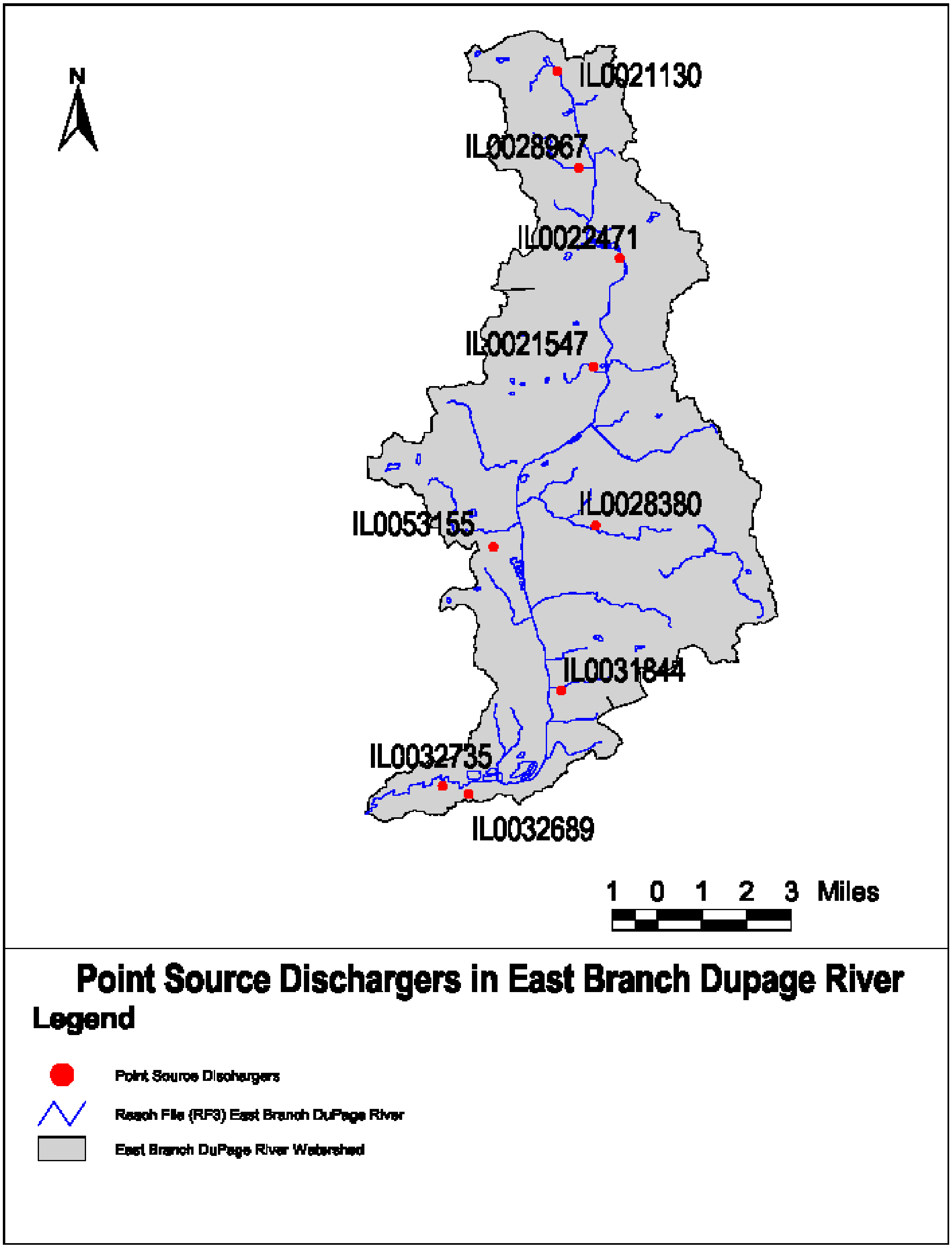


FIGURE 3-7
Point source Dischargers in the East Branch of the DuPage River



3.7 Nonpoint Sources

3.7.1 Sewered and Unsewered Areas

Three impaired segments of East Branch were listed for not meeting DO water quality standards. No combined sewer or sanitary sewer data were available to suggest that significant biochemical oxygen demand (BOD) load to the East Branch reaches originates from combined sewers or leaky sanitary sewers. The sewer network data obtained from DCDS show that several sewer (possibly storm sewer) pipes terminate at East Branch. Storm sewer outfalls at these locations may transport nonpoint source BOD load associated with urban runoff.

TABLE 3-3
Point Source Dischargers in East Branch DuPage River Watershed

Name	NPDES	County	Subwatershed ID[a]	Included in the Models?[b]
Elmhurst Chicago Stone-Barber	IL0053155	Will	15	No
Glenbard WW Auth-Lombard	IL0022471	DuPage	32	No
Citizens Utility Company #2 STP	IL0032735	Will	2	Yes
DuPage County Woodridge STP	IL0031844	DuPage	8	Yes
Bolingbrook STP #1	IL0032689	Will	2	Yes
Downers Grove SD WTC	IL0028380	DuPage	17	Yes
Glendale Heights STP	IL0028967	DuPage	39	Yes
Glenbard WW Auth-Glenbard	IL0021547	DuPage	41	Yes
Bloomingdale-Reeves WRF	IL0021130	DuPage	38	Yes

[a]Indicates which subwatershed in East Branch the point source is located.
[b]"Yes" indicates that the point source is being considered in the watershed modeling for TMDL development.

STP, sewage treatment plant.

3.7.2 Best Management Practices

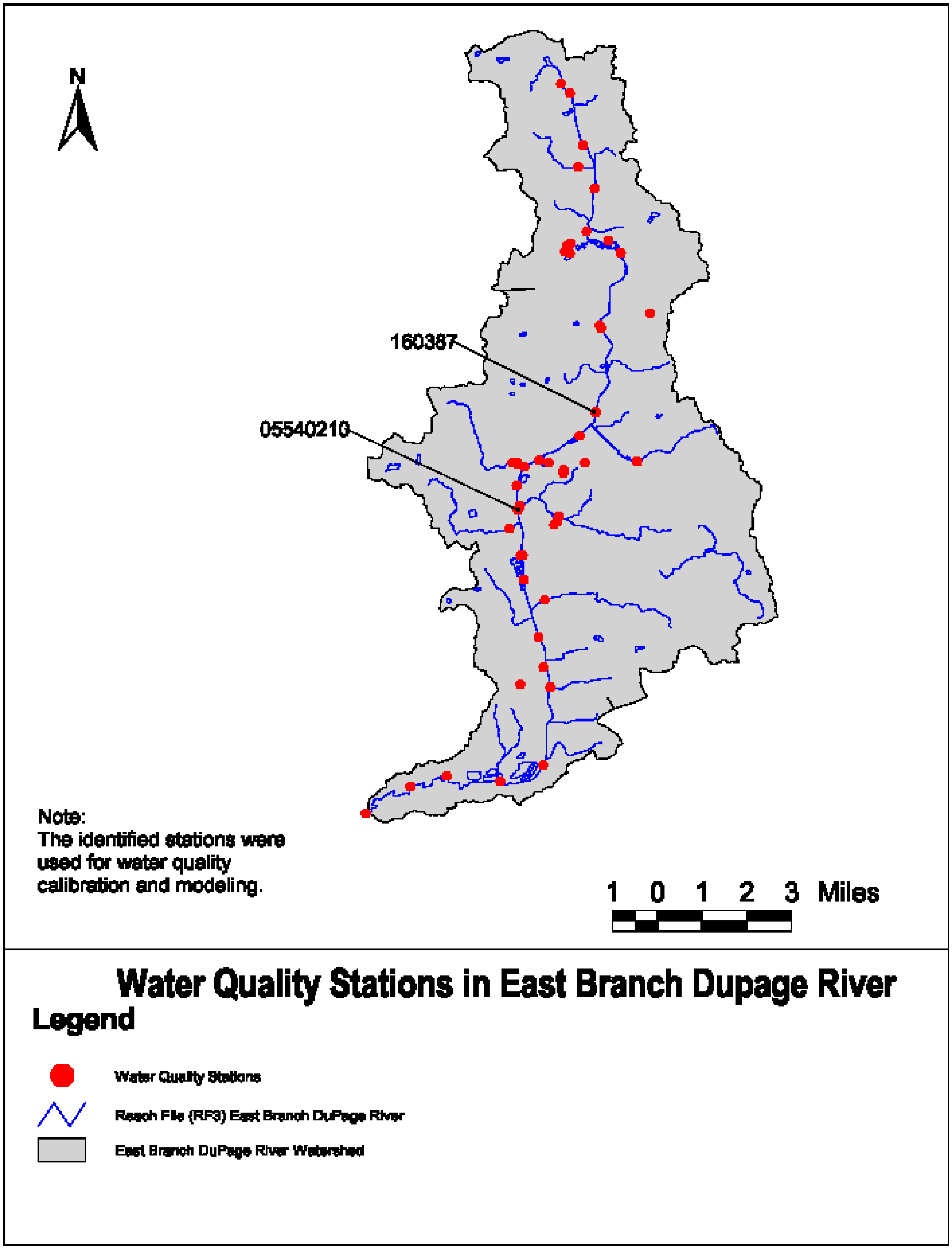
Existing best management practices (BMP) data were requested from the DCDS and NIPC. Although no detailed information for these facilities was available from either agency, review of the DuPage County Countywide Stormwater and Floodplain Ordinance (September 1994) revealed that the ordinance promotes the application of BMPs to new development through riparian buffer zones, erosion control plans, detention basins, etc.

No BMPs were included specifically in the modeling because no detailed information could be obtained about BMP locations.

3.8 Water Quality Data

Water quality data were obtained from two sources. Water quality data through December 1998 were available from STORET (http://www.epa.gov/storet), a national database maintained and operated by USEPA. The IEPA provided in-stream water quality data for 1997 intensive sampling events and monitoring data from 1999. The data from both sources were carefully reviewed to determine the basis for development of the 1998 303(d) list, to select appropriate modeling approaches, and to identify water quality stations for model calibration. Figure 3-8 shows the location of all water quality stations in the East Branch watershed.

FIGURE 3-8
Location of Water Quality Stations in the East Branch of the DuPage River



4 Assessment of Water Quality Data and TMDL Approach

This section summarizes each pollutant on the East Branch watershed list of impairments and assesses the length of record and frequency of observations. Selected modeling approaches were affected by the availability of data regarding frequency, and the amount of data varied for the different pollutants. For each pollutant, the following is provided: a cause for listing, an assessment of the potential sources, and a selected TMDL approach based on the cause and assessment. Details of the TMDL modeling are provided in Section 5.

4.1 Period of Assessment for Water Quality Data

Water quality in a water body may be impaired by pollutants from point and nonpoint sources. Generally, it is during dry weather periods when direct discharge (i.e., point sources) is the primary source of the impairment. However, impairments during wet weather events may be caused by nonpoint sources or both point and nonpoint sources. Therefore, an analysis of long-term water quality is essential for a better understanding of the sources that violate WQSs and to help select a correct approach for developing a TMDL. IEPA uses monitoring data from the most recent 5 years to prepare the 303(d) list of impairments. Water quality data for East Branch were available to the end of 1999; therefore data collected between 1995 and 1999 were used to develop the TMDLs for East Branch and its tributaries.

4.2 Total Dissolved Solids/Conductivity

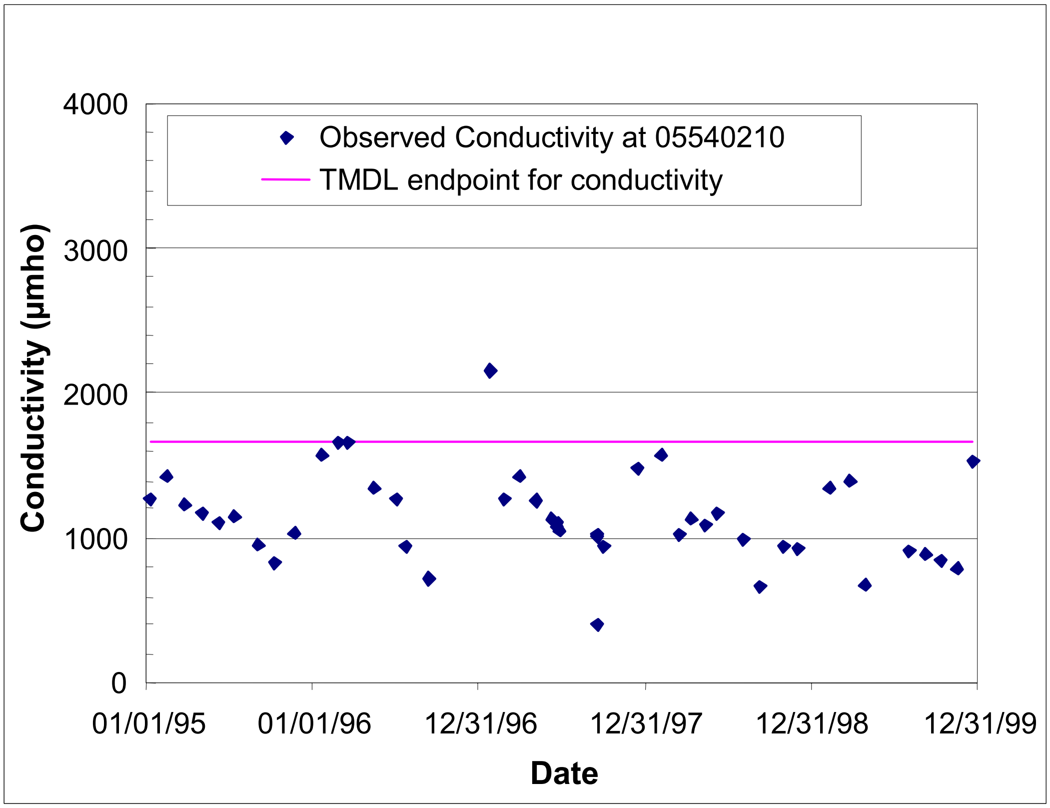
East Branch segment GBL 05 is listed for TDS/conductivity impairments. Long-term TDS and conductivity data are available at the Illinois ambient water quality station at the Route 34 Bridge at Lisle (“Lisle”; station ID 05540210). Another Illinois water quality station, near Route 56 at Downers Groove (station ID 160387), recorded eight conductivity data in summer 1997. Due to lack of sufficient data, this station was not included in the development of the conductivity TMDL.

According to the Illinois GU WQS, TDS concentrations (STORET parameter code 70300) shall not exceed 1,000 mg/L. Conductivity is directly proportional to the TDS concentration. Although there is no GU WQS for conductivity, a conductivity value of 1,667 μS/cm corresponds to 1,000 mg/L of TDS (305(b) guideline). Therefore, an exceedance of 1,667 μS/cm of conductivity is considered indicative of potential exceedance of the 1,000-mg/L TDS standard.

Only conductivity data were analyzed to investigate TDS/conductivity impairments because substantially more data were available for conductivity than for TDS.

A plot (Figures 4-1) of water quality data collected at the Lisle station shows that conductivity exceeded the 1,667-µS/cm endpoint once during the 1995–1999 period. Conductivity generally follows an annual cycle, with elevated values in winter and lower values in late summer or early fall. Figure 4-1 shows conductivity data collected between 1995 and 1999 and the annual cycles.

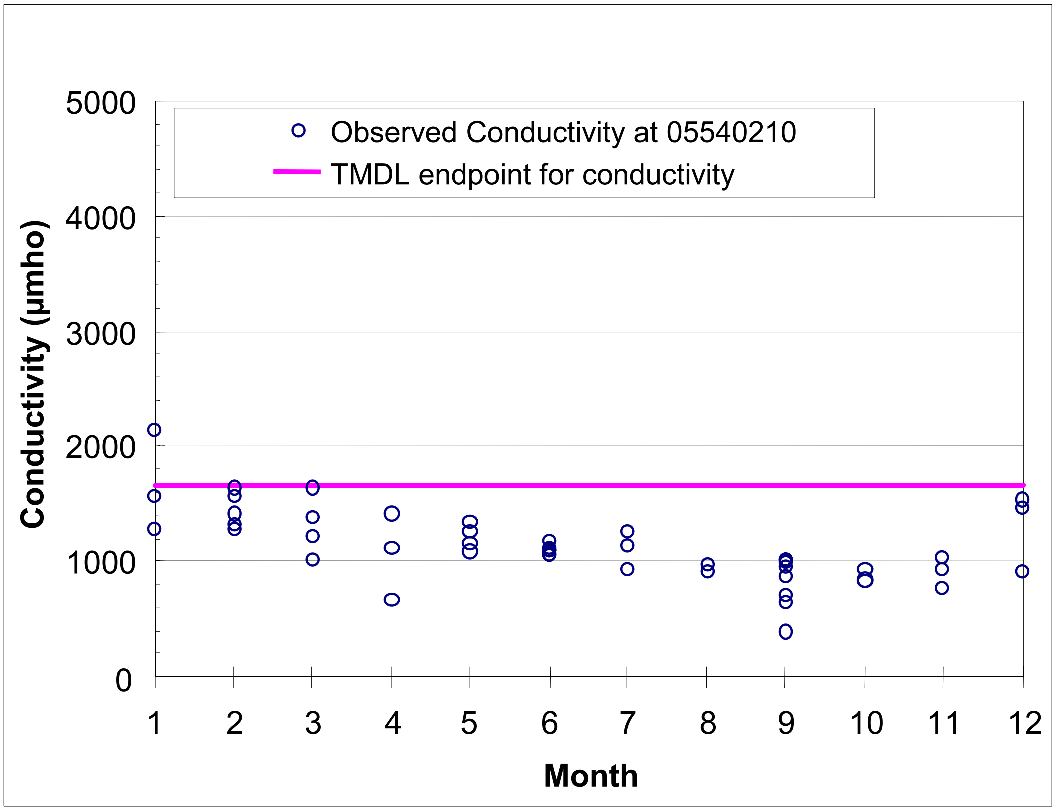
FIGURE 4-1
Plot of the East Branch of the DuPage River (Lisle station 05540210) Conductivity Data by Date



Generally, many dissolved anions and cations contribute to TDS/conductivity in surface water. Most anions and cations are naturally occurring substances. Dissolution of minerals as water flows in contact with soil and precipitation containing atmospheric constituents contribute to naturally occurring TDS/conductivity. Anthropogenic sources such as road salt application and fertilizer application and point sources may increase the concentration of TDS/conductivity.

An investigation of seasonal patterns and of the correlation between chloride and conductivity showed that conductivity is generally higher from December through April (the time of year subject to conductivity impairment) than from May through November (Figure 4-2). Chloride is the major TDS component in winter months; snowmelt runoff in the winter includes chloride from roadway deicing activities, and high TDS/conductivity is caused by road salt application and is directly proportional to chloride concentration. In East Branch, conductivity is closely correlated to observed chloride concentration. To verify that chloride is a major component of TDS/conductivity, a regression analysis of the two constituents was performed.

FIGURE 4-2
Observed Conductivity at the East Branch of the DuPage River by Month



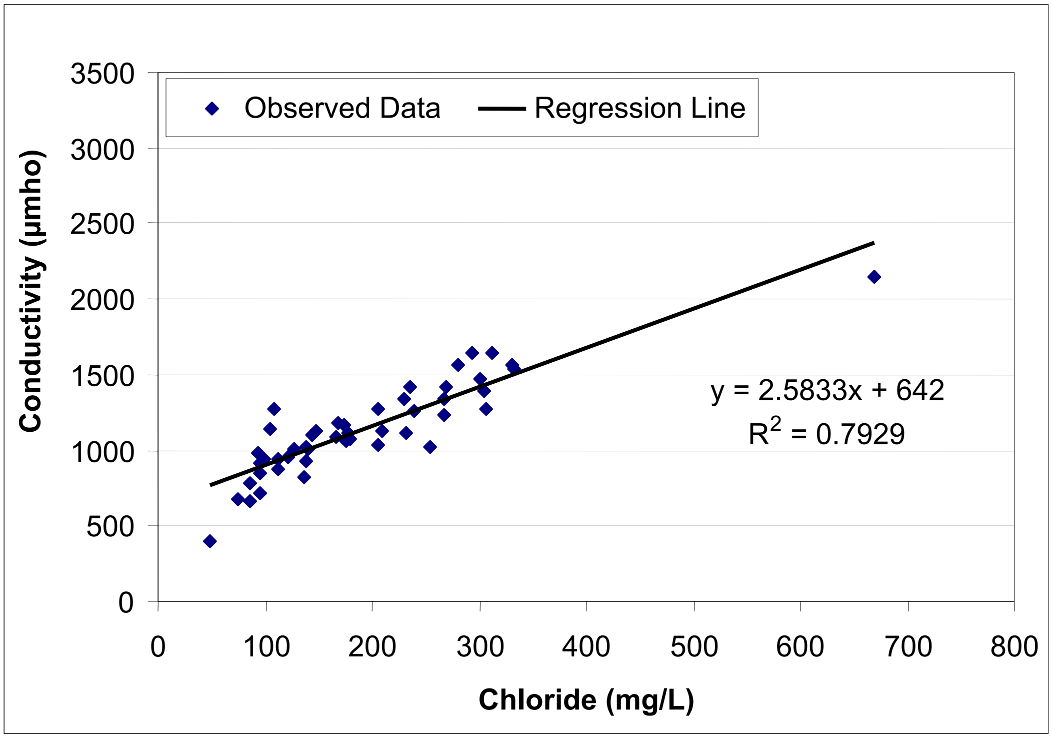
The relationship between conductivity and chloride in East Branch is given by:

Conductivity (µmho) = 642 + 2.58 × Chloride (mg/L)
$R^2 = 0.79$

Figure 4-3 shows this relationship graphically. The strong correlation between chloride and conductivity (i.e., high R^2 values) indicates that the variation in conductivity levels can be explained by chloride concentrations. Also, chloride and conductivity are high during winter months and concurrent with snowmelt runoff, suggesting that chloride from roadway deicing activities is the major component of TDS. Additionally, depending on the composition of road salt, other dissolved constituents such as sodium and calcium can be present in water as part of the TDS.

Based on the analysis presented in this section, the TDS/conductivity considerations should be addressed through the evaluation and development of chloride TMDLs.

FIGURE 4-3
Relationship between Conductivity and Chloride in the East Branch of the DuPage River



4.3 Chloride

4.3.1 Historic Data and Causes for Listing

Segments GBL 05 and GBL 10 of East Branch DuPage River are listed for chloride impairment. Long-term total chloride data are available at the ambient water quality station (station id 05540210) at route 34 Bridge at Lisle. According to the Illinois GU WQS, chloride concentration (STORET parameter code 00940) shall not exceed 500 mg/L.

Segment GBL 05 is listed for TDS/conductivity impairment and has been discussed in the previous section. Chloride constitutes a significant part of TDS/conductivity and provides a means to control exceedances of the TDS/conductivity standard, which would result in use impairment.

Water quality data collected between 1995 and 1999 at the Lisle water quality station show that there was one exceedance (Figure 4-4) of the chloride standard, on January 22, 1997. The observed chloride concentration was 669 mg/L. In addition to Figure 4-4, a plot of observed chloride concentration by month in Figure 4-5 shows higher chloride concentrations during winter months. Therefore, elevated chloride concentrations are believed to be associated with road salt application.

FIGURE 4-4
East Branch DuPage River (Lisle station 05540210) Chloride Concentrations by Sample Date and Water Quality Standard

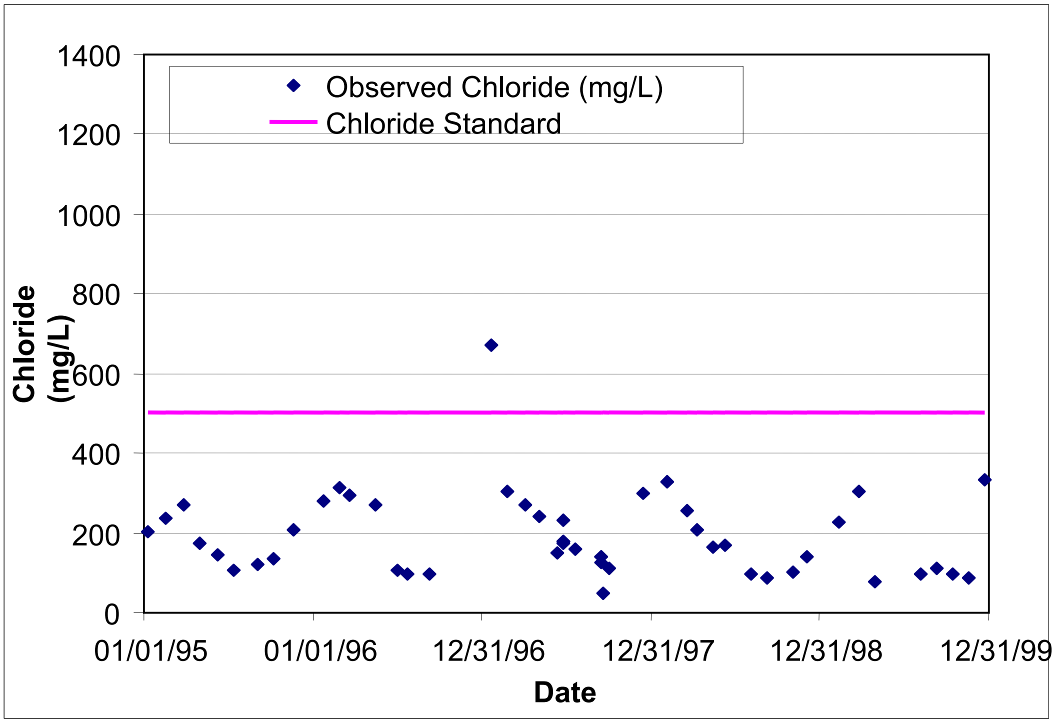
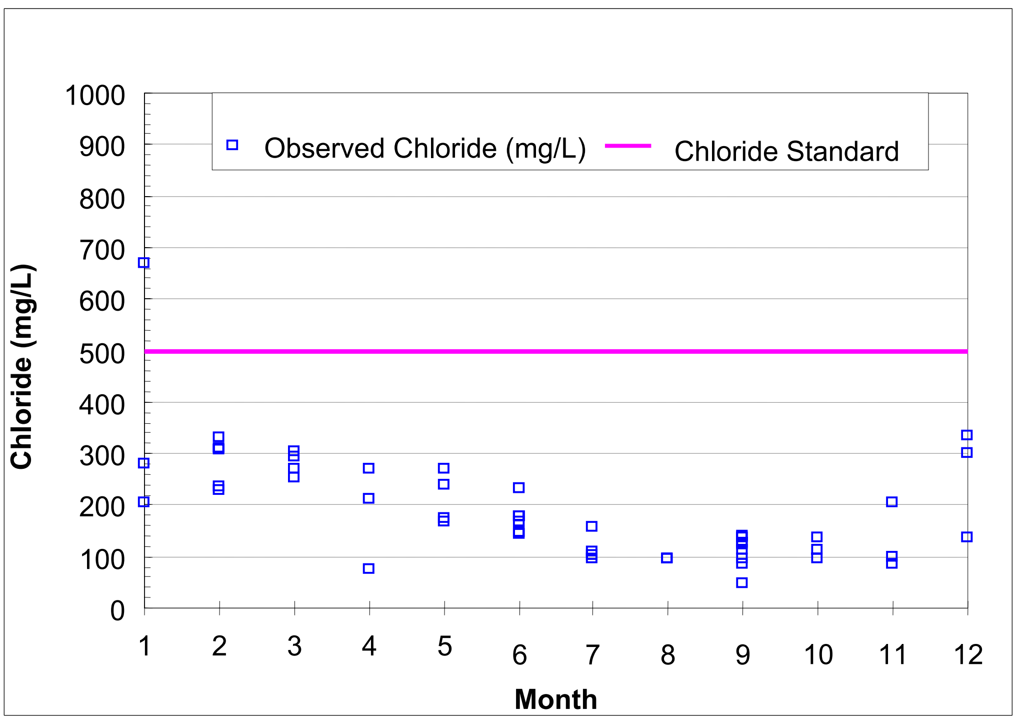


FIGURE 4-5
Chloride Concentrations in East Branch DuPage River by Sample Month and the Water Quality Standard



4.3.2 TMDL Approach

Chloride was modeled for the East Branch segments using HSPF. Road salt application information was incorporated in the model for calibration. Model calibration and validation were performed using chloride data collected at the Lisle station.

4.4 Dissolved Oxygen

4.4.1 Historic Data/Causes for Listing

East Branch segments GBL 05, GBL 10, and GBL 08 are listed for DO impairment. Long-term in-stream DO data are available at the East Branch water quality station at Lisle (station 05540210). Also, intensive diel sampling data from summer 1997 are available at many sites along the main-stem segments.

Illinois WQSs state that the DO (STORET number 00300) shall not be less than 6.0 mg/L during at least 16 hours of any 24-hour period, and not less than 5.0 mg/L at any time. Two STORET parameters (00300 and 00299) represent DO (in milligrams per liter). Parameter 00299 specifically designates measurements of DO by probe in the field. Available data show that the number of DO measurements by probe is significantly larger than the number of DO measurements in laboratory (parameter 00300). All DO data, both parameters 00299 and 00300, were included in analysis and the TMDL development.

DO data collected at various East Branch locations can be divided into one of two groups for analyzing the problem. The first group includes six weekly samples collected from the East Branch DuPage River monitoring site at Lisle (station 05540210). The second group includes data from two extensive diel data-collection efforts: on June 24 and 25, 1997, and September 16 and 17, 1997. All of the above data were collected by IEPA. DO and other water quality data were collected at 6-hour intervals from many sites along the main stem, including point source effluents. These data provide information about the extent of diurnal variation of DO along the river during the warm and dry summer period. Generally, the DO problem is critical under warm and dry summer conditions.

Except for one sample (collected during the diel survey on June 24, 1997, at 2:00 p.m.), six weekly samples collected at the Lisle water quality station for the period 1995–1999 do not exhibit any excursion below the 5-mg/L standard. Also, except for one sample, all DO measurements, including the diel survey data collected on June 24 and 25 and September 16 and 17, 1997, were consistently above the 16-hour average standard (6 mg/L) at the same location. Long-term DO data from the Lisle station are presented in Figure 4-6. Diel data collected on June 24 and 25, 1997, from all East Branch sites are presented in Figure 4-7. Generally, low DO concentrations were observed during summer months. Therefore, the summer low-flow condition was used for TMDL development.

High benthic oxygen demand, point source discharge, and eutrophication that occur because of excessive nutrients are possible causes of the DO problem in the East Branch watershed. Eutrophication leads to high concentrations of algae, which in turn deplete nighttime oxygen levels via respiration. Urban stormwater runoff is a potential source of BOD that settles as bottom deposit and depletes DO in the water column above. Discharge at the storm sewer outfalls during small storms may contribute to low DO concentrations by transporting oxygen-demanding materials and low-DO water. Stormwater runoff includes pet and other animal waste with high nutrient concentrations as well as other organic deposits (e.g., leaf litter). Also, WWTP effluents can deplete DO through BOD and ammonia loads. However, according to the DMR data and the IEPA monitoring data from 1997, WWTPs in the East Branch watershed generally discharged CBOD concentrations well below their permit limits. Also, ammonia concentrations from Bloomingdale STP and Glendale Heights STP were significantly lower than the permit limits. Potential sources contributing to the DO excursions are listed in Table 4-1.

FIGURE 4-6
Monthly DO Data at the Lisle Water Quality Station (05540210) by Sample Date and the Water Quality Standards for DO

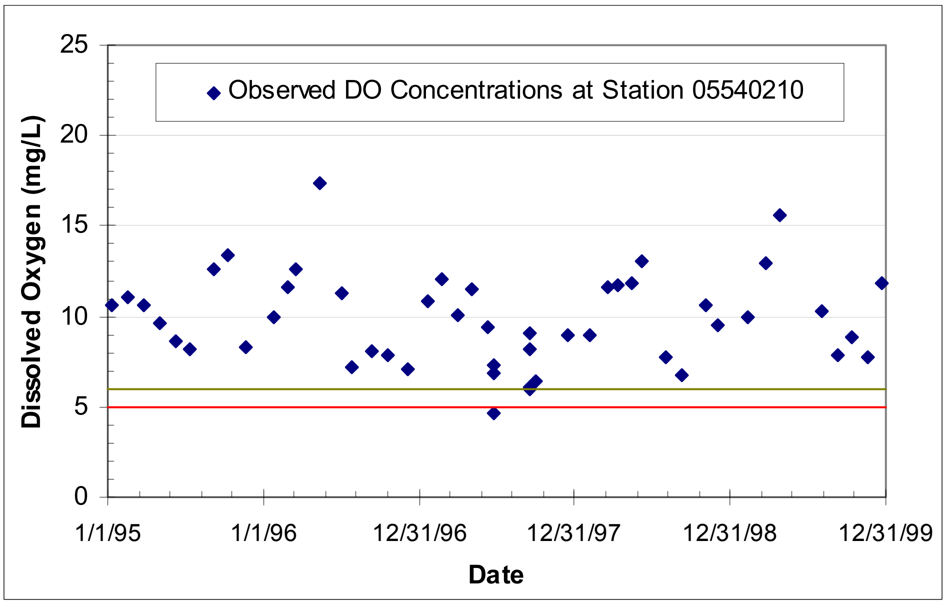
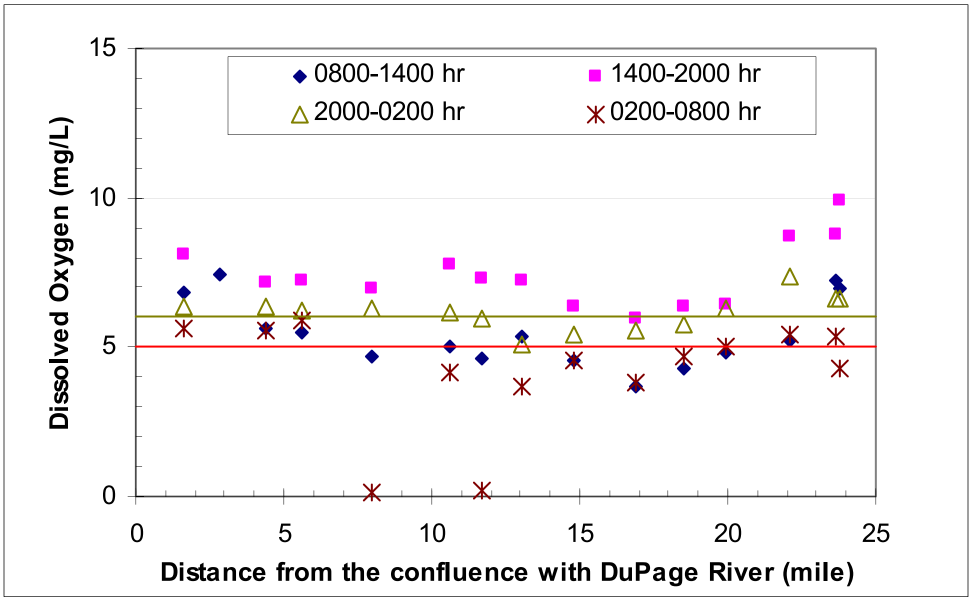


TABLE 4-1
Causes for Low Dissolved Oxygen

Water Body Segment	Source
GBL 05	Municipal point sources—Downer's Grove SD WTC Urban runoff/ storm sewer
GBL 08	Municipal point sources—Bloomingdale Reeves WRF and Glendale Heights STP Upstream impoundments—Churchill Woods Forest Preserve Lake Urban runoff / storm sewer
GBL 10	Municipal point sources—Glenbard WW Authority, Glenbard STP Urban runoff/ storm sewers

FIGURE 4-7
Diel Data Collected at Many East Branch of the DuPage River Sites on June 24–25, 1997, and the Water Quality Standards for DO



The analysis of East Branch DO and its potential sources provided key information necessary to identify the modeling needs and selecting an appropriate model. DO TMDL evaluations for East Branch will be developed using the QUAL2E model. The DO problem has been characterized as one associated with low- to medium-flow conditions in the summer months. The QUAL2E model can adequately simulate DO and other water quality constituents (e.g., BOD, nutrient) contributing to DO problems under a given flow condition. After being calibrated using diel sampling data, the model will be used to develop the DO TMDL using a critical low-flow condition.

4.5 Summary

Table 4-2 summarizes all the pollutants listed on the 303(d) list for East Branch. Also listed are any WQS/TMDL endpoints, other supporting data, and potential sources.

TABLE 4-2
Summary of Available Data, Water Quality Standards, and Potential Sources

Parameter	Water Quality Standard/ TMDL Endpoints	Data Supports Impairment	Potential Sources	Resolutions/ Comments
Conductivity	TDS—1,000 mg/L, equivalent to 1,667 µmho/cm	Directly related to TDS and chloride standards	Urban runoff/storm sewers	Will be addressed by the chloride TMDL
Chloride	500 mg/L	Exceedances warrant further evaluation and potential TMDL development	Road deicing applications	
Dissolved oxygen	Not less than 5 mg/L at any time or not less than 6 mg/L for 16 hours out of 24	Yes	Urban runoff/storm sewers, contaminated sediments, waterfowl, municipal point sources	

5 Modeling Approach and Assumptions

This section describes the detailed approach and assumptions used to characterize the pollutant sources for modeling and to develop the model input for TMDL analysis in the East Branch watershed. The first section outlines the procedure used to select the necessary models and tools to perform the TMDL analysis required. A section on the hydrologic calibration follows, and the water quality calibrations for the pollutants of concern are presented.

5.1 Selection of Models and Tools

Two models were considered for use: HSPF and QUAL2E. HSPF is a continuous watershed model with stream-modeling capabilities, whereas QUAL2E is a steady-state stream water quality model.

HSPF can model a wide variety of water quality constituents, including conservative substances (e.g., chloride), sediment, and nutrients from various sources, including land uses. HSPF is also a continuous simulation model that can handle long-term simulations, which are needed for nonpoint source load allocations during TMDL development.

QUAL2E allows more-detailed segmentation of reaches than HSPF and is a stream-only model (it does not model watershed processes). QUAL2E applies a finite-difference solution to the advective-dispersive mass transport and reaction equations and simulates up to 15 water quality constituents in a channel network. QUAL2E is a steady-state model best suited to simulate specific flow conditions, such as low-flow periods.

The HSPF model was used to develop the conductivity and chloride TMDLs, and the QUAL2E model was used to develop the DO TMDL after the data presented in the previous chapter was analyzed.

5.2 Modeling Chloride Using HSPF

5.2.1 Hydrologic Calibration for HSPF General Background Information

There are two long-term USGS flow gauges in the watershed. The upstream gauge, at Downers Grove (USGS gauge ID 05540160), has a drainage area of 26.6 square miles, according to the USGS. The downstream gauge, at Bolingbrook (USGS gauge ID 05540250), has a drainage area of 75.8 square miles, according to the USGS.

The delineated subbasins for East Branch as described in Section 3.1 were used to calculate contributing areas for each flow gauge. These subbasins indicate about 2 percent more area at the top gauge than that reported by the USGS, and about 2.5 percent less area at the bottom gauge than that reported by the USGS. These differences are within a range deemed acceptable for modeling.

The following sections detail the various data coverage processed for use in hydrologic calibration of HSPF. For details on any of the calibration outputs and plots of simulated and observed flow, refer to Appendix B.

5.2.2 Land Use Data for Hydrologic Calibration

From the discussion of available land use data in Section 3.2, the classifications from Table 3-1 were used to determine the percentage of each land use category in the drainage areas for the two flow gauges. The land use breakdown for each flow gauge is shown in Table 5-1.

TABLE 5-1
Land Use Summary for Each Flow Gauges

Land Use	Area above Downers Grove, %	Area above Bolingbrook, %	Effective Impervious Area, %
Cemeteries and vacant	28.8	21.6	0.0
Commercial	8.2	7.8	85.0
Forest	2.9	4.8	0.0
Industrial	4.0	2.8	85.0
Institutional	4.3	4.1	30.0
Open space	9.0	10.9	0.0
Residential	35.9	42.2	10.0
TCU, excluding interstates	1.7	1.5	60.0
Expressways	2.2	2.2	60.0
Wetlands	2.2	1.0	0.0
Agricultural	1.0	1.4	0.0

The effective impervious area (EIA) percentages reflect only the estimated runoff from impervious areas that are directly connected to stormwater conveyance systems (e.g., stream channels, storm sewers) with no opportunity for infiltration. EIA values differ from total impervious area values because runoff from some impervious areas, including many rooftops, may flow onto pervious areas. These values were extracted from the 1996 report *Application Guide for Hydrologic Modeling in DuPage County Using Hydrologic Simulation Program – FORTRAN (HSPF)* (Price, 1996).

5.2.3 Meteorological Data for Hydrologic Calibration

From the meteorological data discussed in Section 3.4, one time series, the Wheaton time series, was created to use for model simulation, with data from 1991 to 1999. The time series was divided into two sets, one for model calibration and one for model validation. Since the two East Branch USGS gauges (Downers Grove and Bolingbrook) began recording in 1989, it follows that the calibration period must have been within the span of 1989 to 1999. The first 5 years of the weather data set, 1991–1995, were chosen for hydrologic calibration. The following years, 1996–1999, were used for model validation.

5.2.4 Point Source Data for Hydrologic Calibration

Point source discharges from wastewater treatment plants make up a significant portion of the flow in the East Branch during low-flow periods. This point is illustrated by examining a long-term flow gauge operated by DuPage County on the DuPage River at Maple Avenue (the period of record of the USGS gauges in the East Branch is not long enough to illustrate this point). During the 10-year period from 1959 to 1968, the mean of the 10-percent lowest flows is about 5 cubic feet per second (cfs). At the same location during the 10-year period 1979 to 1988, the mean of the 10-percent lowest flows is about 17.5 cfs. This increase can be attributed to point sources that began discharging into the river during this period.

Point sources contribute heavily to flow at both USGS gauges. According to the point source data as discussed in Section 3.6, there are nine point source discharges in this watershed, and the combined average monthly point source discharge above the USGS gauge at Bolingbrook is about 68 cfs. However, during the 10-year period 1990 to 1999, the average of the 10-percent lowest flows at the USGS gauge at Bolingbrook is only about 33 cfs.

Hydrologic Calibration of HSPF Model for DuPage County (Price, 1994) provides an explanation for the large difference between the point source discharge data and the observed low flows at the USGS gauges. The explanation for this discrepancy is related to stormwater infiltrating the sanitary sewer system, where runoff enters the sanitary sewer system through manholes and through joints in the sewer pipe.

This study on the DuPage River assumes that the average discharge during the driest month of that study period was wastewater only and did not include any runoff. The study concludes that 30.8 cfs is the average point source discharge into the DuPage River at the outlet of that study area at Maple Avenue (compared with 56 cfs reflected in the discharge data). That comes to roughly 55 percent of the discharge that actually is the wastewater component.

Using the assumption in that report, 55 percent of the 68 cfs at the Bolingbrook gauge, or about 37.4 cfs, is assumed to be the wastewater component of the point source discharges. But at the Bolingbrook gauge, the average of the 10-percent lowest flows during the 10-year period 1990 to 1999 is only about 32.8 cfs. It is possible that the wastewater component of the treatment plant discharges is lower than 55 percent below the Maple Avenue gauge.

There is no long-term USGS gauge in the East Branch watershed that shows what flows might have been before the area was developed, but in the neighboring Salt Creek watershed, at a USGS gauge at Western Springs, the 10-percent lowest flows during the 10-year period from 1945 to 1954 (the earliest records at that gauge) average about 3.2 cfs. Assuming that these watersheds are hydrologically similar and factoring the predevelopment flow proportionally by respective areas, about 2.1 cfs would have been the 10-percent low flow during the same period. Thus it could be assumed that the difference between the 10-year flows between the 1940s and the 1990s, about 30.7 cfs, is the actual point source contribution at the Bolingbrook gauge.

The 30.7-cfs value was weighted among the point sources by average flow and input as a constant value at each point source over the calibration period. Using this method, water balances within 5 percent of observed data are obtained at the two USGS gauges on the East Branch DuPage River. Obviously, this point source contribution is subject to significant uncertainty, and better data would represent these contributions more precisely.

5.2.5 Initial Parameters for Hydrologic Calibration

The initial parameter values for this calibration were obtained from *Hydrologic Calibration of HSPF Model for DuPage County* (Price, 1994). The land uses referenced in this report include agricultural, forest, grassland, and impervious land. Since these land uses do not correspond directly with the land uses modeled in this study, some assumptions and estimates were made in determining the initial parameter set. Price's agricultural parameters were used in this study for the agricultural land use, and the forest parameters were used for the forest areas in this study. Price's grassland parameters were used for every other category, with the exception of wetlands. Since Price did not parameterize wetlands, the initial wetland parameters were adjusted from Price's grassland values based on experience with wetlands in other watersheds.

Some of these initial parameters were changed to reflect the variation in land uses across the watershed, where the initial parameter set used the same value for all land uses. An example of this type of change can be observed from the lower zone nominal soils moisture (LZSN) values. Whereas Price (1994) uses the same LZSN value for all land uses, LZSN was changed to be higher for forest than for urban land uses.

F-tables contain rating curve (stage-discharge relationship) information for stream and lake segments in the model. One F-table was developed for each stream segment in a subwatershed. F-tables were developed using rating curves prepared by USGS at the gauge locations, available cross-sectional information, and drainage areas. Rating curve data at the USGS gauge locations were obtained from the USGS Website. Stream cross-sectional information was estimated at different locations during a field reconnaissance in April 2000. Drainage areas were calculated based on GIS data.

A spreadsheet was set up to combine all this information and calculate different F-table components. The spreadsheet also checked input values resulting in unacceptable F-table components (e.g., negative outflow) and compared F-table components for reaches with similar drainage areas. Thus any discrepancies in the F-tables were eliminated.

5.2.6 General Comments about the Hydrologic Calibration

Snow was calibrated based upon the measured daily snow pack depth observations at O'Hare Airport. For snow calibration, TSNOW (a model parameter) was increased slightly so that all major snow events observed at O'Hare were simulated as snow. The snow simulations show a fair agreement with the snow depth observations (Figure B-1, Appendix B). The calibration shows some day-to-day differences between simulated and observed values, but this is a common occurrence in snow simulations. These differences can be attributed to the distance between the watershed and the O'Hare meteorological station, and it is common to have significant variations in observed snow measurements within a watershed (AQUA TERRA Consultants and HydroQual, Inc., 2000).

The hydrologic calibration process was greatly facilitated with the use of the HSPEXP, an expert system for hydrologic calibration specifically designed for use with HSPF and developed under contract for the USGS (Lumb, McCammon, and Kittle, 1994). This package gives calibration advice such as which model parameters to adjust and/or inputs to check, based on predetermined rules, and allows the user to modify the HSPF user control input (UCI) files, make model runs, examine statistics, and generate a variety of plots. HSPEXP still has some limitations, such as "how much" to change a parameter and relative differences among land uses, which required professional modeling experience and judgment.

The statistics computed by HSPEXP include errors in total runoff volume, in the 50-percent lowest flows, in the 10-percent highest flows, in the storm peaks, in seasonal volume, and in summer storm volume. The storm events are chosen by the user, and up to 36 storms can be used in figuring the storm error term.

During the hydrologic calibration process, a few parameters were changed from the initial set based upon experience and advice from HSPEXP. These changes include lowered UZSN, lowered PETMIN and PETMAX, lowered interception storage, and adjusted LZETP.

The total runoff volume errors at the two calibration locations are 5 percent or less, which indicates very good agreement. Table 5-2 compares observed and simulated annual flows with correlation coefficients.

TABLE 5-2
Hydrologic Calibration Summary

Station	Mean Observed Annual Flow (in.)	Mean Simulated Annual Flow (in.)	R Daily	R Monthly
Downers Grove	24.3	23.7	0.77	0.89
Bolingbrook	20.7	21.1	0.85	0.90

Most of the calibration statistics computed by HSPEXP indicate a very good calibration. The exceptions are related to the storm events at the upper gauge, and seasonal volume error at the lower gauge, but even these errors are nearly within the ranges deemed acceptable according to the criteria defined in HSPEXP. These errors may be explained by the highly localized nature of summer thunderstorms in this region (see Tables B-1 and B-2 in Appendix B).

The flow duration curves show very good agreement overall. However, the low-flow ends of the plots show some oversimulation (see Figures B-2 through B-5 in Appendix B). This error may be explained by the nature of the point source input data. These data were provided as monthly averages, whereas the observed streamflow data are mean daily. These monthly point source data do not reflect short-term reductions in treatment plant discharges, such as those that might be associated with treatment plant cleaning or maintenance, yet these short-term reductions in flow are seen in the observed data. More-refined point source discharge data would be needed to model these low-flow conditions more adequately.

Scatter plots of observed versus simulated flow at the two calibration locations show correlation coefficients of 0.77 to 0.85 for the daily data and 0.89 to 0.90 for the monthly flows (see Figures B-6 and B-7 in Appendix B).

5.2.7 East Branch Validation Summary

To validate the results of the hydrology calibration, HSPF was run for East Branch for the period January 1996 through September 1999. Table 5-3 includes statistical summaries of the calibration and validation results.

TABLE 5-3
Summary of Hydrologic Calibration and Validation—Annual Flow and Correlation Coefficients

	Calibration Period (1991–1995)					Validation Period (Jan. 1996 through Sept. 1999)				
Station	Mean Observed Annual Flow (in.)	Mean Simulated Annual Flow (in.)	% Diff	R-Squared Daily	R-Squared Monthly	Mean Observed Annual Flow (in.)	Mean Simulated Annual Flow (in.)	% Diff	R-Squared Daily	R-Squared Monthly
Downers Grove	24.3	23.7	-2.5	0.59	0.890 0.79	27.7	24.7	-10.8	0.50	0.890 0.50
Bolingbrook	20.7	21.1	1.9	0.72	0.81	23.4	22.2	-5.1	0.66	0.67

For a hydrology calibration, the percent difference between simulated and observed flows often is used as a measure of the accuracy of the calibration. A difference of less than 10 percent is considered a very good calibration, whereas a difference of 10 to 15 percent is considered good. Differences between 15 and 25 percent are considered fair (Donigian, 2000)

Table 5-3 shows differences between simulated and observed flows of less than 5 percent for the calibration, indicating a very good calibration. For the validation period, the differences are in the range of 5 percent, also indicating a very good calibration, with the exception of the Downer's Grove station, which shows a good calibration.

R^2, the coefficient of determination, is sometimes used as a statistical measure of the quality of a calibration. When analyzing daily values, an R^2 value of 0.8 to 0.9 is considered to be very good, 0.7 to 0.8 is considered good, and 0.6 to 0.7 is considered fair. When analyzing monthly values, an R^2 value of 0.85 or higher is considered very good, 0.75 to 0.85 is considered good, and 0.65 to 0.75 is considered fair (A. Donigian, personal communication, 2001).

For the hydrology calibration, the daily R^2 values indicate a range from fair to good, whereas the monthly values indicate a range from fair to very good. For the validation, the daily R^2 values indicate a range from poor to fair, whereas the monthly values indicate a range from poor to fair. The poor values tend to be more toward the upper portions of the watershed, which are more influenced by the heavy point source discharges during low-flow periods.

The validation period included several extreme events, including a July 1996 rainfall event of over 9 inches. Such extreme events may be affecting the quality of the validation results. The fact that the validation period was shorter than the calibration period can bias the validation statistics by magnifying the effect of extreme events. Further parameter changes could result in improved results for the validation period.

Since point sources are responsible for a large portion of flow during low-flow periods, the quality of the point source data is likely leading to error in the calibration and validation. Since the point source discharge data were provided as monthly values, daily point source discharge variation is not reflected in the simulation, and the effect of this monthly data would be felt the strongest during low-flow periods.

5.2.8 Water Quality Calibration for Chloride

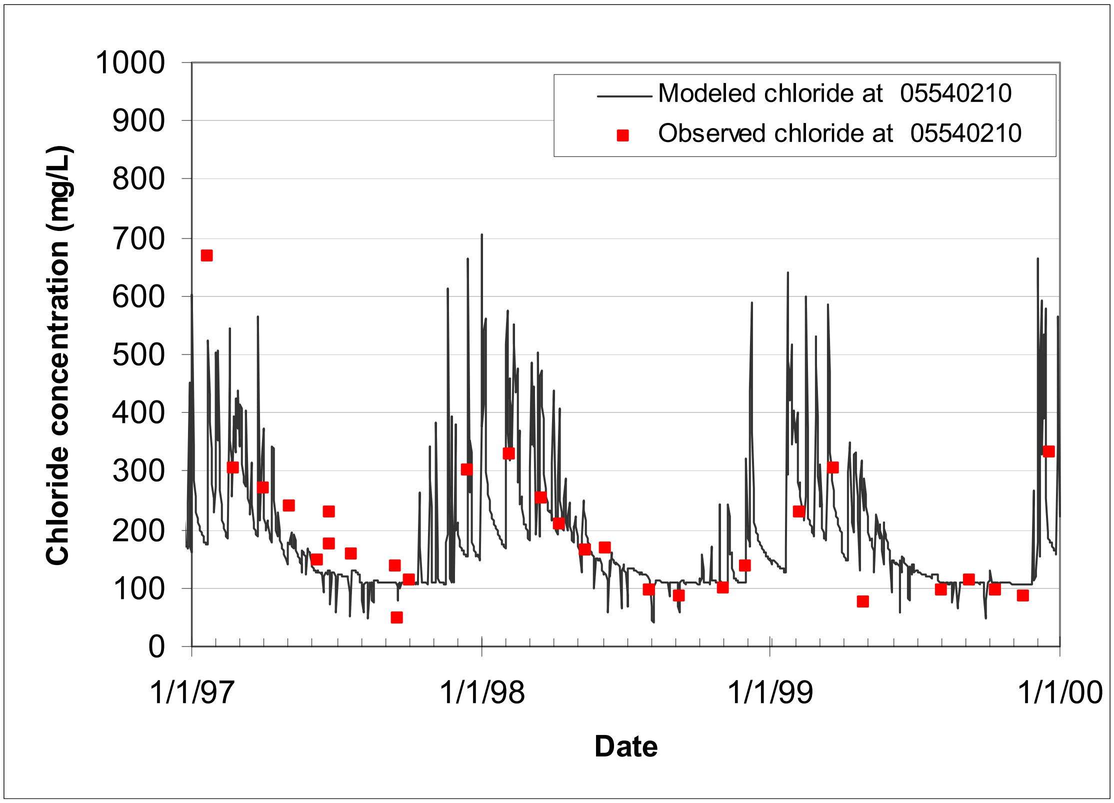
The Lisle water quality–monitoring station (05540210) on the East Branch was selected as a good source (see the water quality data discussion in Section 4.3) of long-term water quality data (Figure 3-9).

The primary source of chloride is road salt applications during winter months. HSPF was selected as the model for simulating snow accumulation, snowmelt, and chloride concentrations in runoff. The hydrologic calibration phase included the calibration of the model for snow. The chloride simulation option was added to the hydrologically calibrated model using the general quality modules. The general quality modules simulate surface runoff of chloride using buildup (or accumulation) and wash-off functions. A thorough analysis was performed to determine the chloride buildup rates on pervious and impervious land segments in different watersheds.

A GIS coverage of road data was obtained from Environmental Systems Research Institute, Inc. (http://www.esri.com/data/online/tiger/index.html). The data, whose origin was the U.S. Bureau of the Census TIGER/Line® 1995 Data, provided a detailed road network in all the subwatersheds. Miles of roads in each subwatershed were calculated and used as a basis for estimating the amount of road salt applied to each subwatershed. The average number of snowfalls and the monthly distribution were estimated using historic precipitation and air temperature data. On an average, 14 snowfall events occurred in the area (consecutive days of snowfall were treated as one event). It was assumed that 5.6 tons of salt were applied to every mile (3.5 tons/km) of road lane. This rate is consistent with road salt application rates found in the literature for other major cities (Novotny et al., 1999) in the region. Daily accumulation rates were calculated based on the acres of pervious and impervious expressways; transportation land use (TCU) excluding interstates, residential, commercial, industrial and institutional land uses in each subwatershed; and the average number of snowfall events per month. The average concentration of chloride in groundwater wells in the East Branch watershed was 106 mg/L. Six groundwater quality samples collected between 1993 and 1998 included chloride measurements. The average groundwater concentration was incorporated in the model to account for the background concentration.

Model calibration results at the Lisle water quality station are shown in Figure 5-1. The model successfully simulated chloride concentrations over a 3-year period (1997–1999) and captured the variability of chloride concentration in different seasons of the year. Figure 5-1 shows observed data and model results from January 1, 1997, to December 31, 1999. The model is considered adequately calibrated for developing TMDL allocations for chloride.

FIGURE 5-1
Water Quality Calibration of Chloride at the East Branch of the DuPage River Site (Lisle station 05540210)



5.3 Modeling Dissolved Oxygen Using QUAL2E

This section analyzes the water quality problems associated with low-flow conditions in order to develop the DO TMDL for the East Branch watershed. The QUAL2E model was used to simulate DO, BOD, and nutrients under steady-state conditions.

East Branch, as represented in the model, begins at the Glen Ellyn Road bridge immediately upstream of the Bloomingdale-Reeves WRF discharge location and ends at the confluence with the West Branch of the DuPage River. The river is 23.8 miles long, with 17.3 miles located in DuPage County and 6.5 miles in Will County, Illinois. Tributaries to the East Branch include Lacey Creek, Armitage Ditch, St. Joseph Creek, and Prentiss Creek. None of the tributaries were included in the reach network of the model. East Branch drains a 79.3-square-mile watershed and receives effluents discharged from seven wastewater treatment plants.

Two sets of extensive monitoring data were collected on June 24–25 and September 16–17, 1997 (Appendix D). Water quality–sampling stations included in-stream locations as well as point source effluents. Two flow gauges located on the main stem of East Branch provided the flow data for the model. These gauges are Downers Grove (05540160), in the upper portion of the watershed, and Bolingbrook (05540250), in the lower portion of the watershed. Locations and descriptions of East Branch water quality–sampling stations, wastewater treatment plants, and flow gauges are listed in Table 5-4.

TABLE 5-4
Summary of Water Quality Sampling Stations during 1997 Diel Study, Wastewater Treatment Plants, and Flow Gauges in the East Branchof the DuPage River

Station ID	River Mile	Description
GBL 14	23.80	Upstream of Bloomingdale STP at Glen Ellyn Road
GBL-B-E	23.70	Bloomingdale STP
GBL 11	23.67	Downstream of Bloomingdale STP at Army Trail Road
GBL 15	22.07	Fullerton Ave. in Glendale Heights
GBLG 01	21.50	Armitage Ditch upstream of Glendale HTS. STP
GBLG-GH-E	21.50	Glendale Heights STP
GBL 16	19.95	St. Charles Rd. in Glen Ellyn
GBL 17	18.50	Hill Ave. in Lombard
GBL 08	16.92	Roosevelt Rd. (RT. 36) in Glen Ellyn
GBL-GB-E	15.90	Glenbard STP - Glenbard
05540160	14.90	USGS flow gauge near Downers Grove
GBL 09	14.78	Butterfield Rd. (Rt. 56)
GBL 13	13.06	Rt. 53 in Lisle Morton Arboretum
GBLB 01	11.90	Ogden Ave. (Rt. 34) in Lisle St. Joseph Creek
GBL 10	11.66	Ogden Ave (Rt. 34) in Lisle
GBL-DG-E	11.50	Downers Grove SD STP
GBL 05	10.64	Maple Ave. in Lisle
GBL 12	7.99	75th Street near Woodridge
GBLD-W-E	7.39	Woodridge STP
05540250	5.70	USGS flow gauge near Bolingbrook
GBL 19	5.59	Royce Rd. in Bolingbrook
GBL-BB-E	5.50	Bolingbrook #1 STP
GBL 13	4.39	Hidden Lakes off Boughton Road
GBL-HL-E	4.37	Hidden Lakes fishing pond discharge

TABLE 5-4
Summary of Water Quality Sampling Stations during 1997 Diel Study, Wastewater Treatment Plants, and Flow Gauges in the East Branchof the DuPage River

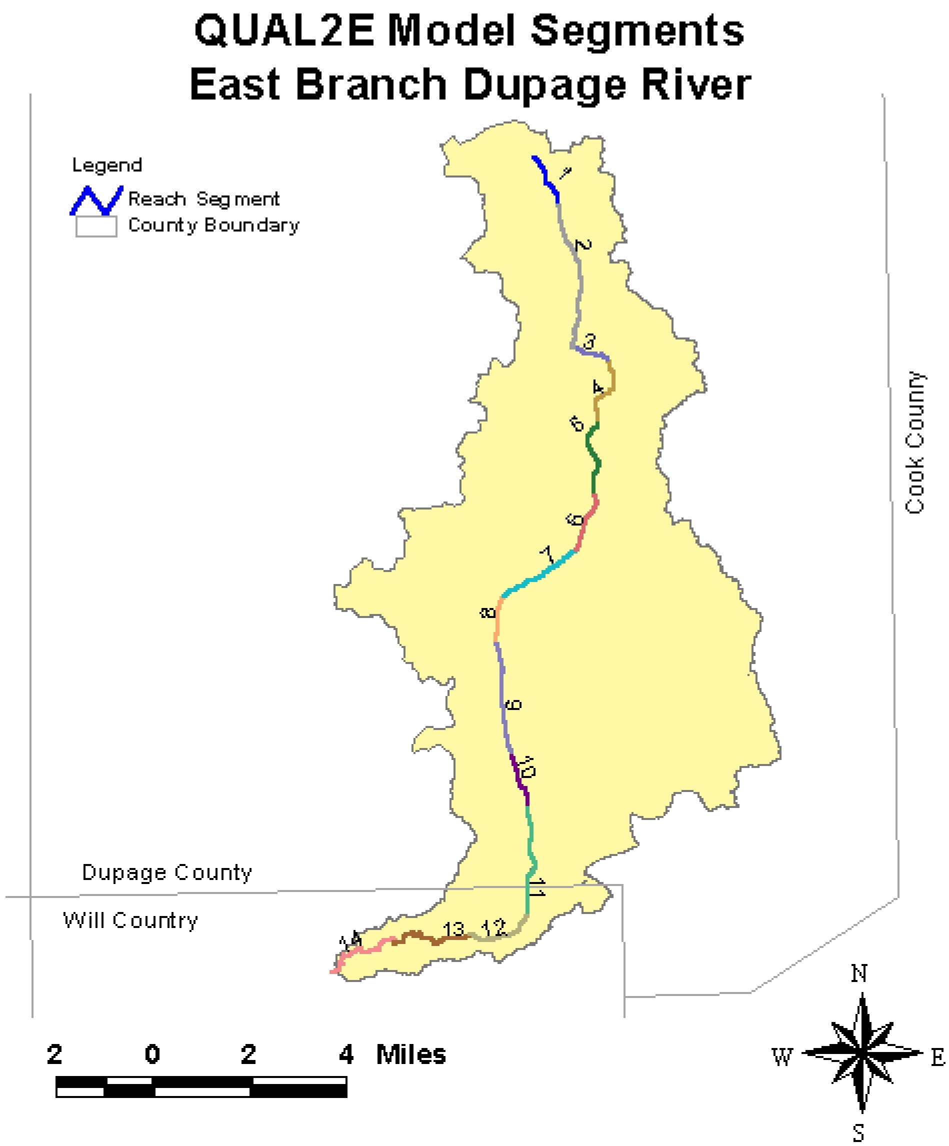
Station ID	River Mile	Description
GBL-EC-E	4.35	Quarry discharge downstream Hidden Lake
GBL 20	2.85	Upstream of Citizen's Utilities W.S. #2 STP
GBL-CU-E	2.40	Citizen's W.S. #2 STP
GBL 02	1.60	Washington Street near Naperville

The East Branch was segmented into 14 reaches in the model as shown in Figure 5-2 and listed in Table 5-5. Changes in the stream's physical characteristics (e.g., wide reach) were the primary basis of segmentation. Each reach was divided into smaller computational elements. Each computational element was 0.2 mile long. The model assumes that each computational element is completely mixed and generates output for each computational element. Thus the model provides output that varies within a reach as well as among reaches. However, model input and kinetic coefficients can vary by reach only. Locations of point sources are specified in the model by reach number and element number.

TABLE 5-5
Segmentation of East Branch DuPage River as Represented in QUAL2E

Reach ID	Length (miles)	Upstream River Mile	Downstream River Mile
1	0.6	24.0	23.4
2	2.2	23.4	21.2
3	1.4	21.2	19.8
4	2.2	19.8	17.6
5	1.4	17.6	16.2
6	2.4	16.2	13.8
7	0.8	13.8	13.0
8	2.0	13.0	11.0
9	1.4	11.0	9.6
10	1.8	9.6	7.8
11	2.6	7.8	5.2
12	1.2	5.2	4.0
13	1.8	4.0	2.2
14	2.2	2.2	0.0

FIGURE 5-2
Segmentation of the East Branch of the DuPage River as Represented in QUAL2E



There are two East Branch hydraulic structures. The upstream structure is located at the Crescent Boulevard bridge (River mile 19.4) and maintains the pool of water in the lake in Churchill Woods Forest Preserve. The downstream dam is located at the Seven Bridges Golf Course upstream of Prentiss Creek confluence with East Branch (river mile 9.5).

Seven wastewater treatment plants discharge to East Branch. Bloomingdale and Glendale Heights STPs are located upstream of the lake at Churchill Woods Forest Preserve. Glenbard STP at Glenbard is located downstream of the lake and upstream of the USGS flow gauge near Downers Grove (05540160). Downers Grove SD and Woodridge STPs discharge between the USGS flow gauges near Downers Grove and Bolingbrook (05540250). Bolingbrook #1 STP and Citizen #2 STP discharge downstream of the Bolingbrook gauge. Woodridge, Bolingbrook, and Citizen #2 STPs all discharge to Segment GBL 02 which is not listed for DO impairment. Current permit limits of all wastewater treatment plants for CBOD5 and ammonia are listed in Table 5-6.

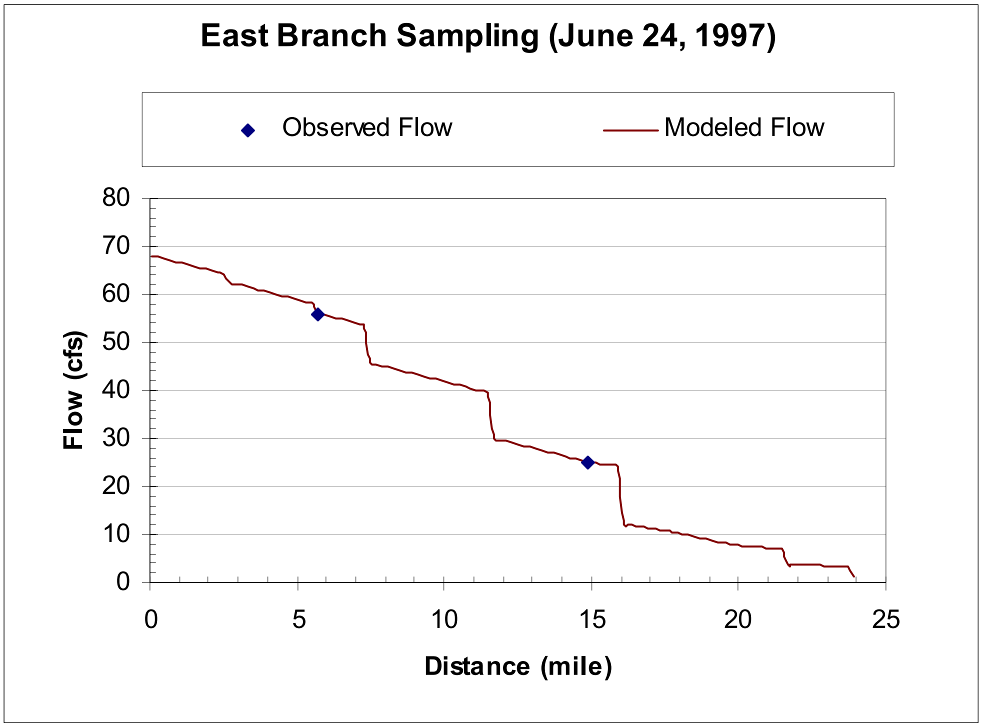
TABLE 5-6
Current CBOD5 and Ammonia-N Permit Limits of the Wastewater Treatment Plants

Point Source	Daily Max CBOD5 (mg/L)	Monthly Avg CBOD5 (mg/L)	Daily Max Ammonia-N (mg/L)	Monthly Avg Ammonia-N (mg/L)
Bloomingdale-Reeves WRF	20	10	3.0	1.5
Glenbard WW Auth-Glenbard	20	10	3.0	1.5
Downers Grove SD WTC	20	10	3.0	1.5
Glendale Heights STP	20	10	3.0	1.5
DuPage County Woodridge STP	20	10	3.0	1.5
Bolingbrook STP #1	40	20	3.0	1.5
Citizens Utility Company #2 STP	40	20	3.0	1.5

The modeling for TMDL development involved a two-step process. First, the model was set up and calibrated using June 24–25, 1997 diel survey data. Second, the calibrated model was used to develop TMDL allocation scenarios.

QUAL2E was set up to simulate flow, CBOD5, ammonia nitrogen, nitrite nitrogen, nitrate nitrogen, and DO. The stream cross-section was assumed to be trapezoidal, and hydraulic input data were estimated based on Reach File version 1 data in BASINS, field reconnaissance, and drainage areas. The slope of each reach was estimated using contour lines in USGS 7.5-min quadrangle maps. Literature values (Chow, 1959) and other studies in the surrounding areas (e.g., USGS, 1996) were used to estimate Manning's roughness coefficients. Monthly average discharges of point sources were obtained from June 1997 DMR data and incorporated in the model. Incremental flows were estimated using observed flow data at the gauges and discharge monitoring data (DMR) for point sources. Model and observed flows at USGS gauges are shown in Figure 5-3.

FIGURE 5-3
Modeled and observed flows at East Branch DuPage River on June 24, 1997



Water quality calibration of QUAL2E included comparing observed and simulated ammonia nitrogen, CBOD5, and DO data in order to adjust model parameters. Concentrations of ammonia, CBOD5, and DO in point source effluents were obtained from samples collected on June 24 and 25, 1997, and incorporated in the model. Table 5-7 lists measured effluent concentrations. Ammonia concentrations in effluents of Bloomingdale STP and Glendale Heights STP were low and well below the permit limits, but monitoring data suggested that there was a gradual increase in ammonia concentration upstream of Glenbard STP. No monitoring data were available for organic nitrogen. The model was set up using 0.9 mg/L of organic nitrogen and 1.5 mg/L of ammonia nitrogen concentrations in incremental flow for model segments (reaches) 2 through 5. Organic nitrogen and ammonia nitrogen concentrations of 0.3 mg/L and 0.15 mg/L were used for incremental flows in reaches 6 through 14. The in-stream ammonia concentration in East Branch increased significantly at river mile 15.9 by the Glenbard STP discharge. Ammonia concentrations in the Glenbard's effluent varied between 2.4 and 3.5 mg/L, with all samples exceeding the monthly average permit limit and two of four samples exceeding the daily maximum permit limit. In-stream concentration decreased steadily downstream of Glenbard STP. Also the fluctuation of ammonia load from the Glenbard STP caused a significant variation of in-stream ammonia concentrations between river miles 10 and 16.9 with time.

Model calibration for ammonia resulted in ammonia oxidation rates of 1.0 day^{-1} for reaches 6 through 14 and 0.3 day^{-1} for reaches 1 through 5. The values are within the range found in the literature. EPA (1985, Rates, Constants, and Kinetics Formulations in Surface Water Quality Modeling, EPA/600/3-85/040) reported that average ammonia oxidation rates varied between 0.1 day^{-1} and 5.7 day^{-1} in streams and rivers. Observed and modeled ammonia concentrations on June 24–25, 1997 are presented in Figure 5-4. Model results matched the average ammonia concentration very well.

TABLE 5-7
Observed Concentrations of DO, CBOD5 and Ammonia Nitrogen in Point Source Effluents on June 24–25, 1997

Point Sources	Sampling Station	Dissolved Oxygen (mg/L)				CBOD5 (mg/L)				Ammonia (mg/L)			
		A	B	C	D	A	B	C	D	A	B	C	D
Bloomingdale STP	GBL-B-E	7.40	6.76	6.4	6.04	1	1	1	2	0.67	0.27	0.39	0.46
Glendale Heights STP	GBLG-GH-E	7.54	7.93	6.8	6.36	1	1	1	1	0.18	0.15	0.19	0.19
Glenbard STP	GBL-GB-E	7.04	7.37	7.2	6.48	1	<1	1	1	2.40	2.50	3.50	3.50
Downers Grove SD STP	GBL-DG-E	7.28	7.41	7.0	7.66	<1	<1	1	1	1.70	0.94	0.94	1.40
Woodridge STP	GBLD-W-E	8.33	8.52	8.1	7.22	2	2	3	3	0.19	0.32	0.18	0.18
Bolingbrook #1 STP	GBL-BB-E	7.83	8.25	8.0	12.41	<1	<1	1	1	0.17	0.13	0.17	0.16
Citizen's W.S. #2 STP	GBL-CU-E	6.7	7.53	7.3	7.31	<1	2	2	2	0.15	0.24	0.28	0.18

Column headings:

A, morning
B, afternoon
C, evening/night
D, late night/dawn

Observed data collected from water quality stations located upstream of river mile 16.9 showed CBOD5 concentrations generally ranging from 2 to 3 mg/L. However, CBOD5 in Bloomingdale STP and Glendale Heights STP effluents and at the water quality monitoring station immediately downstream of Glendale Heights STP was 1 mg/L or less. An increase in CBOD5 between river miles 16.9 and 20 indicated a high nonpoint source contribution. An average CBOD5 concentration of 6 mg/L in incremental flow of reaches 2 through 5 was determined through model calibration. A BOD decay rate of 0.14 day^{-1} was used in all reaches. This rate is consistent with the range of BOD decay rates (0.113 to 0.156 day^{-1}) found in the Salt Creek model (USGS, 1996). Figure 5-5 shows modeled and observed CBOD5 concentrations at East Branch on June 24 and 25 1997.

FIGURE 5-4
Modeled and Observed Ammonia Concentrations at the East Branch of the DuPage River on June 24-25 1997

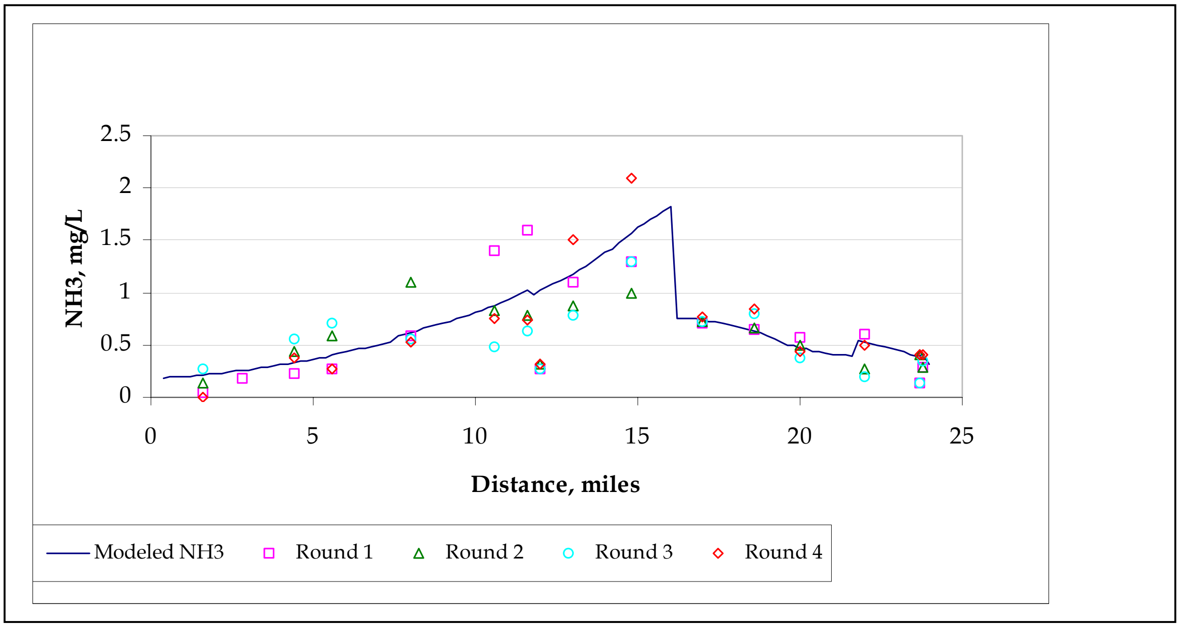
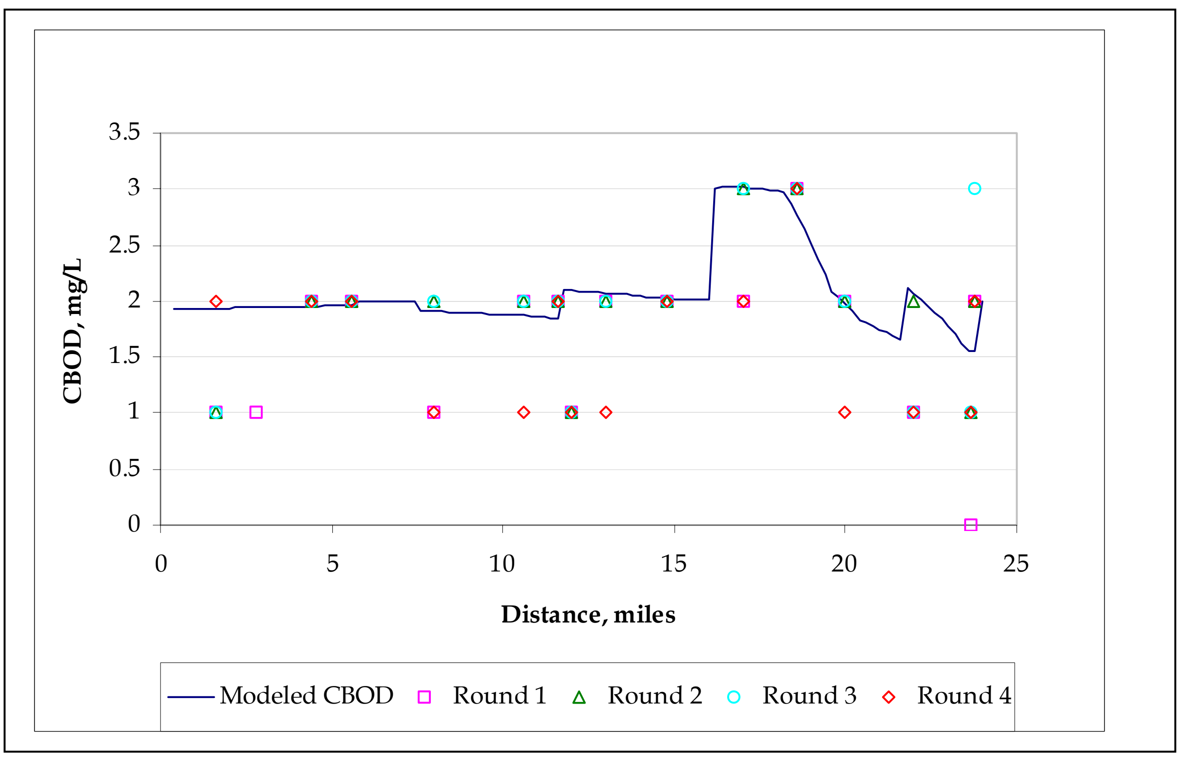


FIGURE 5-5
Modeled and Observed CBOD5 Concentrations at the East Branch of the DuPage River on June 24–25, 1997



Dissolved oxygen in East Branch DuPage River was simulated as a function of biological oxidation of CBOD, exertion of sediment oxygen demand (SOD), oxidation of ammonia, atmospheric reaeration and direct input (e.g., DO concentrations in effluents). Algae were not simulated. The rate constants for processes related to oxidation of ammonia and CBOD were determined through the calibration of the model for ammonia and CBOD, and discussed earlier. SOD is caused by the oxidation of organic and other particulate material deposited in the streambed. Discharge of high BOD and solids from point and nonpoint sources may result in high SOD. Unlike the Salt Creek model, there were no measured SOD values available in East Branch DuPage River. Measured and calibrated SOD values in the Salt Creek model ranged from 0.115 to 0.228 g/ft^2-day and from 0.04 to 0.45 g/ft^2-day, respectively. Except for reach 3 (representing the lake in Churchill Woods Forest Preserve), SOD values ranged from 0.05 to 0.2 g/ft^2-day. SOD in reach 3 was 0.025 g/ft^2-day. There was no measurement of atmospheric reaeration rates available in East Branch DuPage River. Reaeration rates were initially estimated based on the Salt Creek model and updated through model calibration. The calibrated East Branch DuPage River model used 2 day^{-1} and 3 day^{-1} as reaeration rate coefficients in reaches 1 through 5 and reaches 6 through 14, respectively.

Figure 5-6 shows the observed DO concentrations at approximately 6-hour intervals. The horizontal axis in the plot shows the distance upstream from the confluence of the East Branch DuPage River with the West Branch DuPage River. A set of circles at a given distance represents the observed concentrations at different times of the day. Generally predawn and morning DO concentrations at all sampling locations upstream of river mile 7.5 were less than 5 mg/L. On the contrary, all afternoon samples were above 6 mg/L. Algal production of DO through photosynthesis reaches the maximum in the afternoon and elevates in-stream DO concentrations. Two predawn samples recorded 0.23 mg/L and 0.12 mg/L of DO at Ogden Avenue in Lisle and 75th Street near Woodridge, respectively. These observations were not consistent with DO concentrations measured upstream and downstream of these water quality–monitoring stations. Average DO concentration was less than 5 mg/L between river miles 16 and 17.4, and less than 6 mg/L between river miles 9.6 and 19.8. Model results matched average observed DO concentrations very well.

Various components of the DO mass balance (i.e., CBOD decay, exertion of sediment oxygen demand (SOD), and reaeration) were analyzed using the model results. Relative contributions and magnitudes of DO mass balance components were plotted in Figure 5-7 to determine the primary causes of DO sag at different locations and find the best remediation measures. The most important source of DO was the reaeration, and the most important sink was SOD at the critical sections upstream of Glebard STP outfall. SOD (on a mg/L-day basis) was relatively high in the lake in Churchill Woods Forest Preserve, perhaps due to low velocity that causes high settling rates of organic debris from nonpoint source and BOD-rich suspended solids from point sources. The ammonia oxidation rate was also important which indicates that ammonia is an important parameter to control.

FIGURE 5-6
Modeled and Observed East Branch DO concentrations on June 24–25, 1997

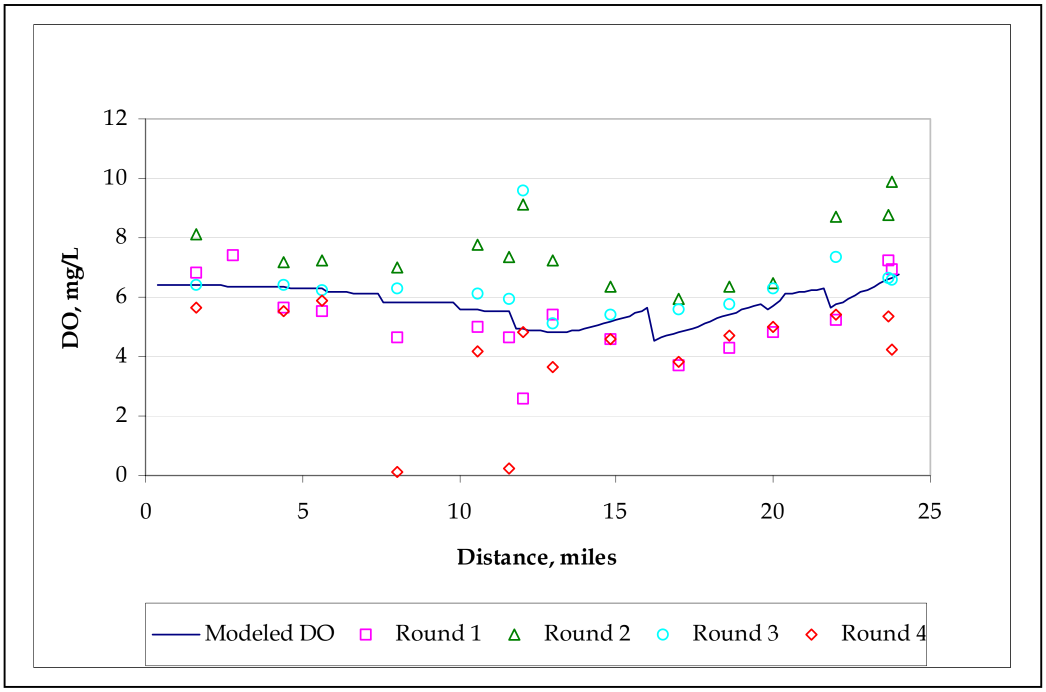
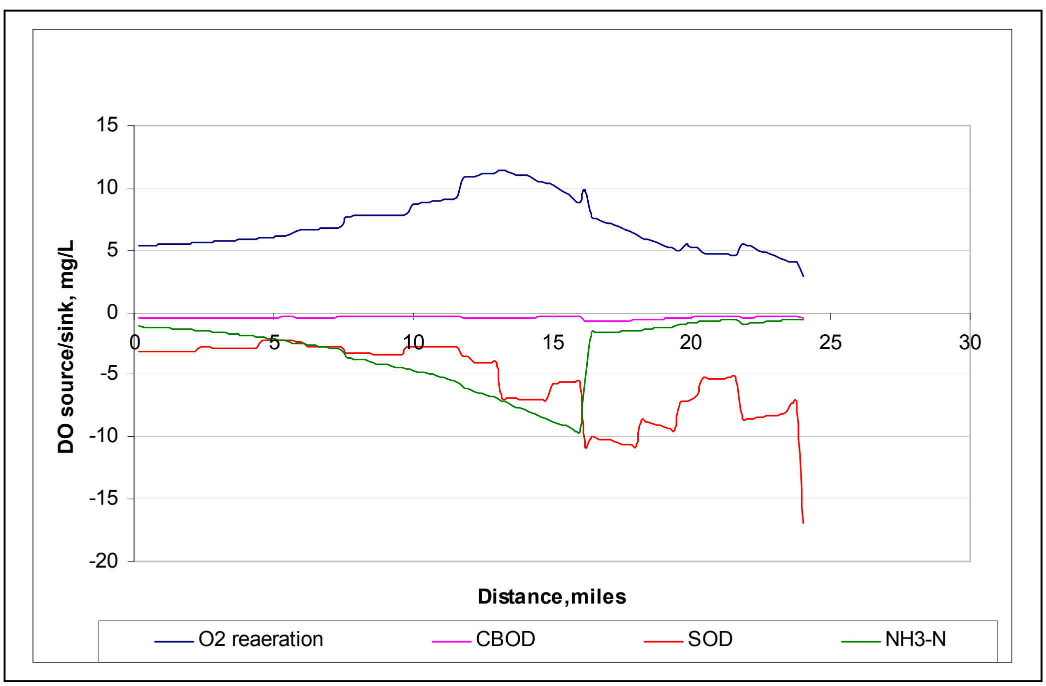


FIGURE 5-7
Components of the DO Mass Balance Based on the Model Results for June 24–25, 1997



6 TMDL Allocation

6.1 Approach and Methodology

TMDLs are the sum of the individual WLAs for point sources, LAs for both nonpoint sources and natural background, and a margin of safety (MOS). This definition is denoted by the following equation:

$$\text{TMDL} = \Sigma \text{ WLAs} + \Sigma \text{ LAs} + \text{MOS}$$

Developing a TMDL is an iterative process that involves modeling and generating allocation scenarios that meet water quality targets. East Branch TMDLs were developed using the calibrated models presented in Section 5. Each scenario was carefully evaluated, and the TMDLs are presented in the following sections. Seasonal variability of pollutant concentrations and flow were considered explicitly in the model through continuous simulation and time-varying input variables or through determining critical conditions, as discussed in Section 5. Separate TMDLs were developed using approaches appropriate for the listed pollutants. The following sections present the TMDLs for each cause of impairment.

Section 303(d) of the CWA requires TMDLs to include "a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." There are two methods for incorporating the MOS (USEPA, 1991):

- Implicitly incorporate the MOS using conservative model assumptions to develop allocations
- Explicitly specify a portion of the total TMDL as the MOS; use the remainder for allocations

An implicit MOS was used in the development of the TMDLs presented in this report.

6.2 Future Growth

Future growth may have an impact on TMDL allocation scenarios in two ways:

- Modified point source loads
- Modified nonpoint source loads

A change in point source loads may occur due to an increase (or decrease when there is a declining population) in population densities in existing clusters or development of new clusters. The summer low-flow condition was found to be the critical condition for the DO impairment. Therefore, point source contribution has the most significant impact on in-stream DO concentration. Change of population served by the point sources will affect the point source discharge. An analysis of projected population data (NIPC, 2002) shows that the population of DuPage County will have increased by 26 percent from 1990 to 2020. Accordingly, all point source discharges under the summer low-flow condition were increased by 26 percent and the DO was simulated using the QUAL2E model. A comparison of the model result for increased point source discharge with that of existing point source discharge shows slightly improved in-stream DO concentration.

Future growth will also affect nonpoint source pollution by changing land use coverage in the watersheds. For example, agricultural areas converted to residential land will have an impact on water quality in the impaired segments. The chloride and conductivity TMDL allocations require consideration of land use changes, especially conversion to roads. Increased chloride load due to future growth in the watersheds was estimated assuming that all agricultural areas in the existing GIS coverage of land use would be converted to residential areas. Using GIS data of current road density it was estimated that up to 15 miles of new roads might be constructed in the process of land use change. The new land use data was incorporated in developing TMDL allocations for chloride.

6.3 Conductivity/Total Dissolved Solids and Chloride

The chloride TMDL addresses issues involving the conductivity/TDS and the chloride exceedances in the East Branch watershed. A strong correlation was found between conductivity and chloride (Section 4.2). Road salt application for deicing contributes chloride loads to surface waters. All the simulated chloride standard exceedances as well as the one observed violation occurred during winter months. The HSPF model was used to simulate the chloride load from the watershed and to develop TMDL allocation scenarios. The model setup and calibration procedures are described in Section 5.2. The calibrated model was used to estimate the annual chloride load under existing conditions.

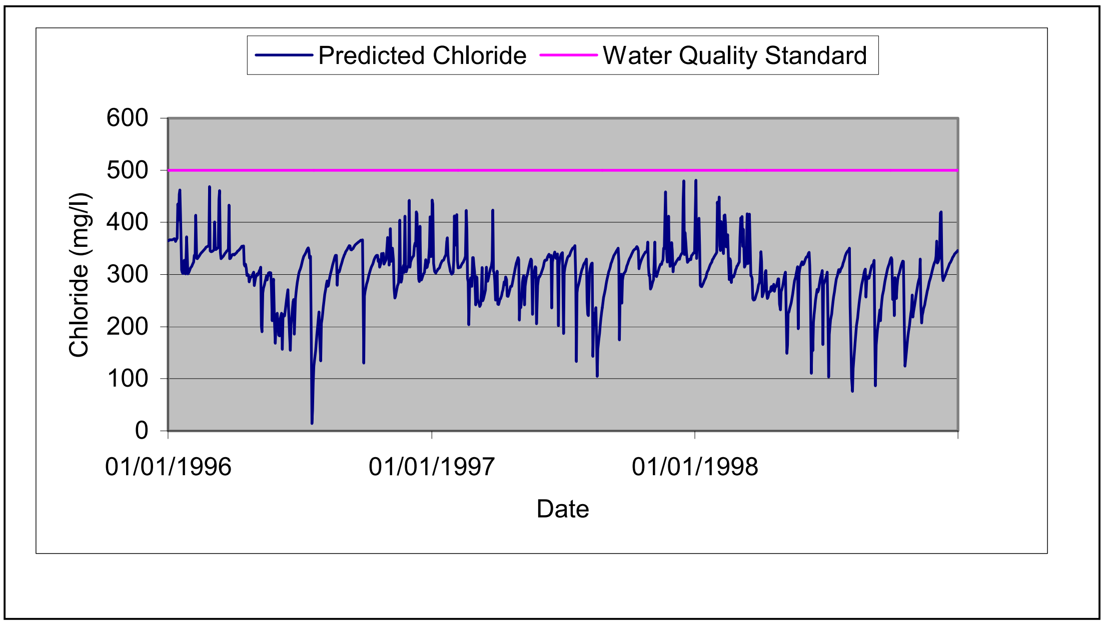
6.3.1 Critical Condition

Section 303(d) of the CWA and the USEPA's regulations at 40 CFR 130.7 require the consideration of seasonal variation of conditions affecting the constituent of concern and the inclusion of a MOS in the development of a TMDL. For the East Branch chloride TMDL, long-term-monitoring data and continuous-modeling results were used to determine seasonal variation of chloride concentration. The TMDL was developed based on the critical conditions in the winter months. Runoff and interflow generated from precipitation and snowmelt are the primary modes of transport of chloride from land surface to water bodies. A reasonable approach for TMDL allocation calculations requires using an average year (neither a dry nor a wet year) for modeling. Annual streamflow data from between 1991 and 1998 were compared to determine an average flow year to avoid using an extremely wet or dry year. Streamflows in 1996 and 1997 were representative of average weather conditions. The 3-year period between January 1, 1996, and December 31, 1998, which includes average weather conditions, was selected for TMDL scenario development.

6.3.2 Margin of Safety

An implicit MOS was incorporated in data analysis, modeling, and calculation of the TMDL allocations. Continuous modeling of hydrology and water quality provided in-stream chloride concentrations that allowed direct comparison of model results with observed data and seasonal variation of chloride concentrations. Direct comparison of model results with observed data shows the ability of the model to simulate seasonal variability and the extent of violation of the chloride standard under different scenarios. Hydrologic modeling included continuous snow simulation, providing runoff from snowmelt. The snow simulation capability was critical in determining the chloride load generated from road salt application for deicing. Using 5 years of chloride data and 5 years of model output for model calibration and 3 years of model output for the TMDL allocation provided a conservative approach for TMDL load calculations by ensuring a lower possibility of violation of the WQS. For example, if the 1997 data were used for TMDL allocation, Figure 6-1 suggests that a smaller reduction in chloride may be needed to meet the water quality standard. Additionally, a background chloride concentration (106 mg/L) was incorporated in the model by specifying shallow groundwater concentrations based on observed data from groundwater wells in the surrounding areas. Finally, the allocation approach in which loads were reduced to allow no exceedances of the standard over the three year period was very conservative.

FIGURE 6-1
Modeled Chloride Concentrations at the East Branch of the DuPage River at 05540210 for the TMDL Allocation Scenario



6.3.3 Chloride Exceedances

The WQS is expressed as a concentration of chloride (500 mg/L). The HSPF model was set up to output total annual load and daily average concentration of chloride. The model was run iteratively, reducing the overall winter season chloride load from salt application to determine percentage reductions in nonpoint source chloride contribution that would result in reasonable point source allocations. A 33 percent reduction in nonpoint source chloride was selected. The number of exceedances over the 3-year critical condition period used for TMDL development (1996-1998) was determined. Table 6-1 summarizes this information for various point source discharge concentrations.

TABLE 6-1
Chloride Exceedance Summary by Point Source Discharge Concentration (1996-1998) for 33 Percent Reduction in NPS Loads; Point sources Input at Permitted Design Flows

	100 mg/L	300 mg/L	400 mg/L	500 mg/L
No. Predicted Model Exceedances at 05540210 (Segment 16)	0	0	0	9
Percent Exceedances at 05540210 (Segment 16)	0	0	0	0.27%

Point source loads of chloride were incorporated in the model as direct input. Table 6-2 summarizes the chloride data collected at the WWTPs during the September 1997 diel survey. The concentrations ranged from 90 mg/L to 555 mg/L. Based on the results in Table 6-1, and the effluent data summarized in Table 6-2, an effluent chloride concentration of 400 mg/L was applied for the TMDL. Further information is provided in the Point Source Load section (6.3.4.2).

TABLE 6-2
Chloride Concentration in Selected WWTP Effluents

Point Source	Observed Chloride Concentration (mg/L) on September 16, 1997
Woodridge STP	159
Downers Grove SD STP	135
Bloomingdale STP	113
Glendale Heights STP	90
Glenbard STP	122
Bolingbrook #1 STP	555
Citizen's W.S. #2 STP	432

6.3.4 Chloride Allocations

The TMDL process requires that the allowable load be allocated among point and nonpoint sources. A review of the available data and modeling results indicates that the chloride exceedances of 500 mg/L or more occur during the deicing season. The primary contributor to the exceedances is application of road salt for snow and ice control purposes.

As stated above, the model was run iteratively to determine an allocation scenario that meets the chloride standard at nearly all times. Figure 6-1 shows the allocation results for station 05540210. The chloride standard is included in the plots to easily compare the modeled chloride concentrations with the standard. Since salt application for deicing is the major source of chloride leading to standard exceedance, the chloride TMDL indicates the need for salt application chloride reduction.

6.3.4.1 Nonpoint Source Load

The chloride TMDL describes load allocations (LAs; i.e., NPS allocations) as being applicable to stormwater sources of chloride, such as road salting activities. However, due to regulatory approaches, stormwater in municipal separate storm sewer systems (MS4s) is regulated as a point source instead of a non-point source. Consequently, the MS4 chloride load will be handled as a WLA and not as a LA. Additional discussion on MS4s and LA versus WLA is contained in Section 7 *Implementation Plan*.

Because Phase II of the NPDES stormwater program will apply to most or all of the municipalities in the watershed (see Appendix G for the list of stormwater permittees), as well as to the roads owned and operated by the state and the Toll way Authority, it is anticipated that stormwater-related allocations will actually be implemented as point source controls, as described in recent USEPA guidance and as governed by the Illinois Environmental Protection Agency (IEPA) General Permit for Stormwater Discharges. Consequently, chloride from road deicing materials is not included as a nonpoint source load allocation (LA). Instead, the load from road salt is listed as a waste load allocation (WLA) for MS4s and there is no nonpoint source load for this TMDL.

6.3.4.2 MS4 Load

The chloride WLA from deicing materials was determined by taking the average road salt application in tons applied per lane-mile that was used in the HSPF model calibration (5.6 tons/lane-mile - year). TIGER data obtained from NIPC were used to estimate the miles of road in the East Branch watershed; the number of lanes on each road was estimated by road type, and lane miles were then calculated. An additional 15 miles of roadway was added to account for the future growth described in Section 6.2. The current chloride application (lb/yr) was estimated based on the lane miles and current salt application rates. A 33 percent reduction results in an application rate of 10,500,000 pounds of chloride per year (equivalent to 17,400,000 pounds of road salt per year).

The MS4 waste load allocation was based upon an analysis of road lane-miles within the watershed and is represented as a reduction in salt applied for deicing purposes since that is the most direct measurement of chloride applied to the watershed. A combination of measuring chloride applied and instream chloride concentrations should provide a strong gauge for meeting water quality standards.

6.3.4.3 Point Source Load

The NPDES facilities that have permitted design flow capacities were included in the model at their permitted design flows. In addition, Elmhurst Stone Barber and Glenbard-Lombard were assigned an allocation based on flows outlined in Table 6-3. Table 6-3 summarizes the NPDES facilities and flow rates assumed for the TMDL.

TABLE 6-3
Point Source Flows and Concentrations Used in TMDL WLA

Point Source	Flow (MGD)	Chloride Conc (mg/L)	WLA (lb/yr)
Bloomingdale	3.45	400	4,200,858
Glendale Heights	5.26	400	6,404,786
Glenbard	16.02	400	19,506,593
Downers Grove	11	400	13,394,040
Dupage County - Woodridge	12	400	14,611,680
Bolingbrook	2.04	400	2,483,986
Citizens Utility #2	3	400	3,652,920
Elmhurst	1.03	400	1,257,076
Lombard	2.28	400	2,771,506
Total			68,283,444

Including the point sources at the permitted design flow results in a reasonable WLA for the point sources as it allows for additional growth. Basing the WLA on a concentration of 400 mg/L protects the water quality standard for chloride.

6.3.4.4 TMDL

Based on the load calculations described above, a TMDL was calculated for East Branch. In order to account for all point and nonpoint sources, the TMDL was calculated at the mouth of the creek.

The WLA value in Table 6-4 represents a lumped WLA for all point source discharges and a separate WLA is calculated for MS4 permittees.. The WLA could be broken down in WLAs specific to each point source based on the information presented in Table 6-3. At this time, however, IEPA intends to implement the WLA as a lumped value. As long as point sources collectively meet the lumped WLA, they will be considered compliant with the TMDL. This will allow greater flexibility which is appropriate given that there is limited point source data, and the concentration used to calculate the TMDL is lower than the standard. The TMDL allocation requires a 33 percent reduction in nonpoint source loading based on road salt application.

TABLE 6-4
Chloride TMDL for the Mouth of East Branch DuPage River

	WLA[a]	MS4 WLA[b]	MOS	TMDL
Chloride (lb/yr)	6.83E+07	1.05E+07	Implicit	7.88E+07

[a]WLA based on permitted design flow and concentration of 400 mg/L
[b]Represents a 33% Reduction in NPS Load

6.3.5 Implementation Considerations

As discussed above, the allocation scenario for chloride assumes that the WQS must be met at all times and would be accomplished by reduction in the overall annual road salt application mass to achieve that end. This is a very conservative approach and should be further evaluated before the TMDL is finalized or implemented. The exceedances, both monitored and modeled, are infrequent (less than 10 percent of the time). For example, USEPA guidance recommends that water bodies should be considered impaired only if exceedances occur more than a given percent of time, depending on pollutant type, data distribution, etc. (see USEPA July 2002 Consolidated Assessment and Listing Methodology guidance). In addition, it may be possible to identify though additional monitoring and/or modeling what specific hydrologic and salt application conditions lead to elevated in-stream chloride concentrations. It may be possible to target control actions specific to these conditions that would not necessitate an overall annual salt application reduction of the magnitude indicated above.

It should also be noted that the TMDL is based on a reduction of road salt application from current rates. The current application rates were estimated based on literature and used in the HSPF calibration model. Actual road salt application rates should be monitored by those entities which apply road salt in the East Branch watershed to ensure the baseline application rate used in the TMDL approximates current loads.

6.4 Dissolved Oxygen

This section presents the TMDL allocations for pollutants causing the DO excursions in East Branch. The USEPA's QUAL2E model was used to determine the pollutant loads from point and nonpoint sources that ensured the WQS would be met. Analysis of DO data in Section 4.4 showed that the DO standard was not met under low-flow conditions in the summer months. The QUAL2E model was set up and calibrated using field data collected in summer 1997. Model setup and calibration results were presented in Section 5.3. Finally, the streamflow in the calibrated model was replaced with the 7Q5 low flow (the minimum of 7-day/5-year running averages) to develop the TMDL allocations.

6.4.1 Critical Condition

Section 303(d) of the CWA and the USEPA's regulations at 40 CFR 130.7 require the consideration of seasonal variation of conditions affecting the constituent of concern and the inclusion of an MOS in the development of a TMDL. The critical condition for DO was determined on the basis of common knowledge of DO problems in surface water, long-term monitoring data, and two sets of extensive 24-hour sampling data from summer 1997. Summer low flow represented the critical condition for DO. The 7Q10 low flow as shown on the IEPA low flow map was used in developing TMDL allocations. The low flow map indicates that point sources make up almost the entire flow during low flow conditions. Thus, for the allocation scenario, it was assumed that there was no nonpoint source contribution (or incremental flow) to the stream. In other words point source discharges constituted the entire streamflow at the Bolingbrook and Downers Grove gauges. The model was run iteratively for various scenarios until the water quality target was met.

In the absence of algae data, the steady-state QUAL2E model (as opposed to diurnal algae simulation) was used for developing the DO TMDL.

6.4.2 Margin of Safety

MOS was incorporated implicitly in this DO TMDL development based on the following conservative assumptions:

- The pollutant loads from all point sources were discharging at their maximum allowable limits simultaneously.
- The 7Q10 flow occurs under extended drought conditions and is lower than normal summer flows. Therefore, the allocations based on 7Q10 flow are stringent and would provide an implicit MOS under normal summer flow conditions.
- High summer temperatures, based on the historical data, were used in the model.
- The Illinois WQS requires that the DO (STORET number 300) shall not be less than 6 mg/L during at least 16 hours of any 24-hour period nor less than 5 mg/L at any time. For this TMDL development, field measurements of DO (STORET number 299) and laboratory measurements of DO (STORET number 300) were used. The number of DO measurements in the field well exceeded the number of laboratory samples. Using both types of data led to a comprehensive analysis and reduced the uncertainty in the TMDL analysis. Additionally, a DO concentration of 6 mg/L, the more stringent of the two DO criterion, was used as the water quality target for the TMDL allocation development using the steady-state model. Thus, up to 1 mg/L (the difference between the 16-hour average and the instantaneous standards) of nighttime DO reduction by algae can be accommodated under the worst conditions without violating the WQS.

6.4.3 Load Allocation and Waste Load Allocation

Various pollutant-reduction scenarios were analyzed to evaluate the importance of SOD and the point source loads and to determine the pollutant load reduction necessary to achieve a minimum DO concentration of 6 mg/L. This TMDL endpoint was selected based on the Illinois WQS.

The DO concentrations for existing conditions, four scenarios and three allocation scenarios were modeled. Descriptions of these scenarios are presented in Table 6-5. Figure 6-2 shows the modeled DO concentrations for four scenarios and the WQS. Figure 6-3 shows that the model DO concentrations for the TMDL allocation scenarios meet the water quality target. Except for the existing condition, all scenarios and the TMDL allocation considered 7Q10 flow and no nonpoint source flow. The point sources were included in the model at their permitted design flows.

Two extreme conditions were simulated in Scenarios 1 and 2 to evaluate the effect of existing SOD and point source discharge on DO, respectively. Scenario 1, as presented in Table 6-6, included the monthly average permit limits for point source effluent concentrations. But the SOD values in all stream segments were set to 0. This scenario shows that if all the SOD is eliminated, the WQS is met under existing point source effluent limits for most model elements. However, this scenario is not realistic. Scenario 2 was similar to Scenario 1 except that existing SOD values were used in all stream segments and the pollutant (CBOD and ammonia) concentrations in the point source effluents were set to 0. This scenario demonstrates that the WQS of 6 mg/L cannot be fully achieved even in the absence of the point source loads. Scenario 3 shows that the WQS can be met when the observed point source effluent concentrations are used instead of the monthly average permit limits and the SOD is set to 0. Since SOD cannot be realistically reduced to 0.0 g/ft^2-day by controlling point and nonpoint sources, background SOD of 0.02 g/ft^2-day in reaches 1, 2, 4, and 5, and 0.06 g/ft^2-day in reaches 6–8 were used in Scenario 4. Additionally, DO was increased to 7 mg/L in the lake in Churchill Woods Forest Preserve. DO in the lake can be increased through artificial reaeration. Existing monthly average permit limits for CBOD5 and ammonia nitrogen were used in this scenario. Model results for Scenario 4 shows that the DO target of 6 mg/L is not achieved under existing permit limits near the mouth of East Branch.

TABLE 6-5
Description of Various Modeling Scenarios

Scenario	Flow	Point Source Effluent Concentrations	SOD	Other Changes	Comment
Existing	Observed flow	Observed concentrations	Existing condition		Existing condition violated the WQS for DO
1	7Q10	Monthly average permit limits for CBOD5 and ammonia-N	0.0 in all reaches	None	Modeled DO is slightly lower than 6 mg/L at one model point
2	7Q10	Observed DO, CBOD5 = 0.0 mg/L and Ammonia-N = 0.0 mg/L	Existing condition	None	DO is less than 6 mg/L between 15.4 and 20.0 and between 21.8 and 22.8 miles. Also DO reaches below 5.0 mg/L between 16.0 and 18.6 miles.
3	7Q10	Observed concentrations	0.0 in all reaches	None	The water quality target (6 mg/L) is met at all locations.
4	7Q10	Monthly average permit limits for CBOD5 and ammonia-N	Reduced to 0.02 g/ft^2-day in reaches 1-2 and 4-5, and to 0.06 g/ft^2-day in reaches 6- 8.	Increased DO in the lake (just upstream of Crescent Blvd) to 7 mg/L through artificial reaeration	Modeled DO is less than 6 mg/L near mouth
Allocation 1	7Q10	CBOD = 8 mg/L Ammonia N = 1.00 mg/L	Reduced to 0.02 g/ft^2-day in reaches 1-2 and 4-5, and to 0.06 g/ft^2-day in reaches 6-8.	None	The water quality target (6 mg/L) is met at all locations.
Allocation 2	7Q10	Monthly average permit limits for CBOD5 and ammonia-N	Reduced to 0.02 g/ft^2-day in reaches 1-2 and 4-5, and to 0.06 g/ft^2-day in reaches 6-8.	Removed dam	The water quality target (6 mg/L) is met at all locations.
Allocation 3	7Q10	Monthly average permit limits for CBOD5 and ammonia-N	Reduced to 0.02 g/ft^2-day in reaches 1-2 and 4-5, and to 0.06 g/ft^2-day in reaches 6-8.	Increased DO in the lake (just upstream of Crescent Blvd) to 7 mg/L through artificial reaeration	The water quality target (6 mg/L) is met at all locations.

FIGURE 6-2
Modeled Dissolved Oxygen Concentrations for Scenarios 1, 2, 3, and 4

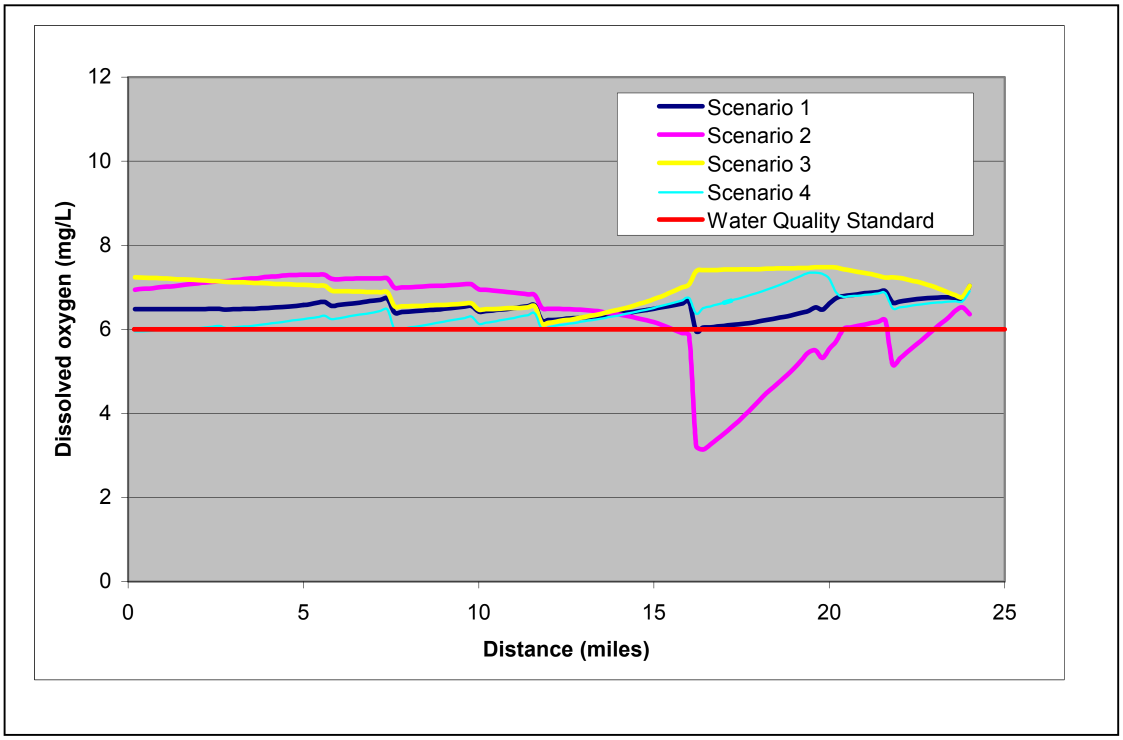
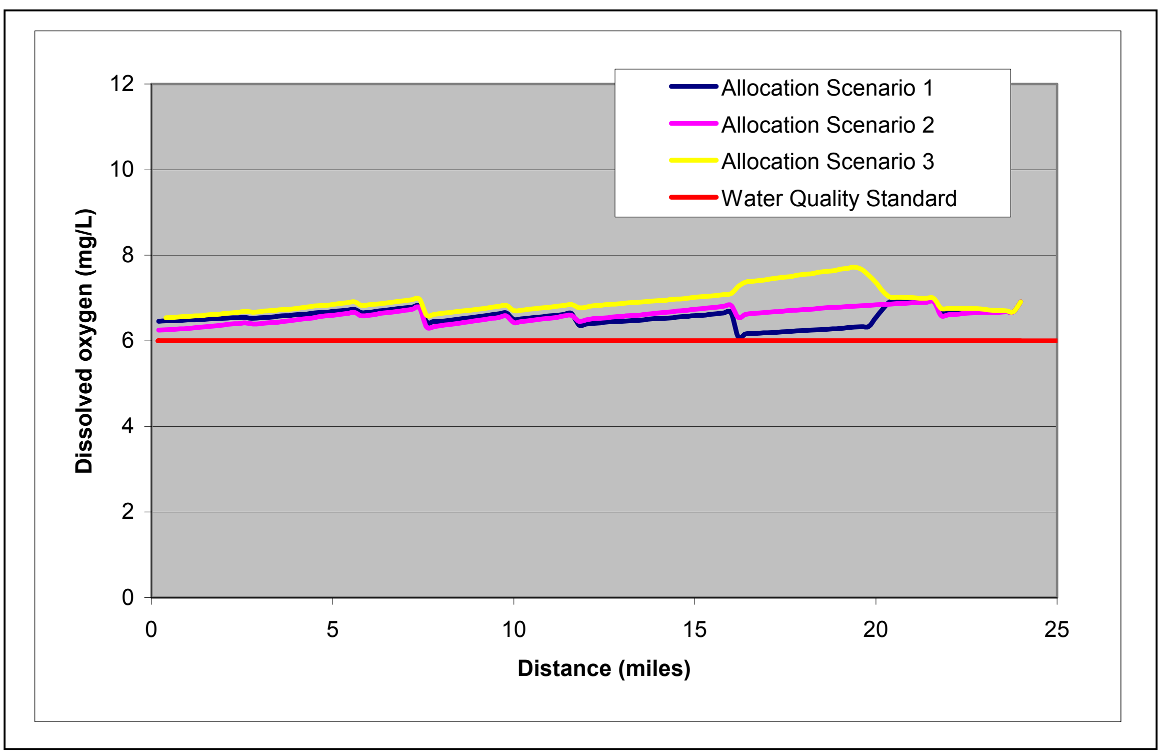


FIGURE 6-3
Allocation Scenario Results



For the allocation scenarios, a combination of point source load reduction, SOD reduction, increased DO through artificial reaeration, and dam removal were used to meet the water quality target. Figure 6-3 illustrates the allocation scenario results. For Allocation Scenario 1, a background SOD of 0.02 g/ft^2-day in reaches 1, 2, 4, and 5 and of 0.06 g/ft^2-day in reaches 6–8 was used. Additionally, CBOD5 and ammonia nitrogen concentrations in point source effluents were reduced to 8 mg/L and 1 mg/L, respectively. The final allocation scenario achieves water quality target at all locations of the East Branch. The modeled allocation scenarios from the first draft TMDL (August 2003) used current flow (as recorded in the 1997 diel survey) for WWTPs in the watershed. This revised draft TMDL uses permitted design average flow for the WWTPs. For this reason the original proposed reduction for CBOD5 of 5mg/L has been revised to 8 mg/L. The proposed reduction of 1 mg/l for ammonia nitrogen remains the same.

For Allocation Scenario 2, a background SOD of 0.02 g/ft^2-day in reaches 1, 2, 4, and 5 and of 0.06 g/ft^2-day in reaches 6–8 was used. Point sources were included in the model at their current design flows and current permitted concentrations for CBOD5 and ammonia nitrogen. The dam in Reach 3 was removed, and hydraulic characteristics similar to Reaches 2 and 4 were included. This allocation scenario achieves the water quality target at all locations on East Branch.

For Allocation Scenario 3, a background SOD of 0.02 g/ft^2-day in reaches 1, 2, 4, and 5 and of 0.06 g/ft^2-day in reaches 6–8 was used. Point sources were included in the model at their current design flows and current permitted concentrations for CBOD5 and ammonia nitrogen. DO was artificially increased to 7 mg/L in Reach 3 in the impoundment. This allocation scenario achieves the water quality target at all locations on East Branch. Under the conditions in the first Draft TMDL (August 2003), WQS for DO would not be reached through removal of the dam in reach 3 (at Churchhill Woods). However, for this revised report, using permitted design average flow for the WWTPs, the WQS for DO was achieved through removal of the dam.

The TMDL allocations of CBOD and ammonia nitrogen are provided in Table 6-6. The loads are expressed as pounds per day for the critical 7Q10 low-flow conditions. As discussed in section 6.4.1, East Branch flow under 7Q10 low-flow condition consists of point source discharge only. The CBOD and ammonia loads for the TMDL are calculated using the point source discharge from Bloomingdale, Glendale Heights, Glenbard, and Downers Grove SD STPs at their permitted design flows. Discharge for these point sources affect the water quality in the East Branch segments (GBL 05, GBL 08, and GBL 10) listed for DO impairment. Table 6-7 also includes the point source loads included in the model for Dupage County (Woodridge), Bolingbrook, and Citizens Utility for information purposes. Since these point sources discharge below the impaired segment, they are not included in the TMDL allocation. No nonpoint source flow is expected under critical summer low-flow conditions. Therefore, nonpoint source contributions or load allocations of CBOD and ammonia nitrogen are not applicable for the TMDL. Modeled effluent CBOD and ammonia nitrogen concentrations from the TMDL allocation run were multiplied by the permitted design flows (see Table 6-6) for the point sources to calculate the WLA. Modeled DO, CBOD, and ammonia nitrogen values for all reaches are listed in Appendix F.

TABLE 6-6
Point Source Allocations

		Allocation Scenario 1				Allocation Scenarios 2 and 3			
Point Source	**Permit Design Flow (mgd)**	**CBOD (mg/L)**	**NH3 (mg/L)**	**CBOD (lb/d)**	**NH3 (lb/d)**	**CBOD (mg/L)**	**NH3 (mg/L)**	**CBOD (lb/d)**	**NH3 (lb/d)**
Blooming-dale	3.45	8	1	230.2	28.8	10.0	1.5	287.7	43.2
Glendale Heights	5.26	8	1	350.9	43.9	10.0	1.5	438.7	65.8
Glenbard	16.02	8	1	1068.9	133.6	10.0	1.5	1336.1	200.4
Downers Grove	11	8	1	733.9	91.7	10.0	1.5	917.4	137.6
**Subtotal*				2383.9	298.0			2979.9	447.0
Dupage County - Woodridge	12	8	1	800.6	100.1	10.0	1.5	1000.8	150.1
Bolingbrook	2.04	8	1	136.1	17.0	20.0	1.5	340.3	25.5
Citizens Utility	3	8	1	200.2	25.0	20.0	1.5	500.4	37.5
**Total*				3520.8	440.1			4821.4	660.2

* This subtotal is overall WLA in table 6-7.

**Woodridge, Bolingbrook and Citizens Utility are not included in Final TMDL allocation (table 6-7) since they are located out of the area of impairment.

To achieve the water quality target, SOD in reaches 1, 2, 4, and 5 needs to be reduced to 0.02 g/ft^2-day and SOD in reaches 6,7, and 8 needs to be reduced to 0.06 g/ft^2-day. SOD is caused by the oxidation of organic matter deposited in the streambed. Sources of such organic matter include leaf litter and other particulate BOD from point and nonpoint sources. Literature values suggest that the desired SOD of 0.02 g/ft^2-day in some reaches is rarely found in natural streams. Nonpoint source contribution of particulate BOD (e.g., leaf litter and road runoff) must be controlled in order to achieve low SOD in East Branch. Figure 6-4, a 1998 aerial photograph, shows an example of a potential nonpoint source that may exacerbate the DO problem: two of a series of large detention ponds next to East Branch. One detention pond located between the North-South Tollway (I-355) and East Branch has eroded banks, marked by circles. Such breaches may lead to short-circuiting between the pond and the stream and cause serious water quality problems including increased SOD. Proper control of these sources may lower SOD significantly. One method to determine if organic loading is being reduced is through the measurement of VSS. IEPA may wish to consider adding this parameter to its ambient monitoring program for East Branch.

TABLE 6-7
Summary of East Branch DO TMDL

Pollutant	Load Allocation (lb/day)	Wasteload Allocation (lb/day)	Margin of Safety	TMDL (lb/day)	Observed Load (lb/day)[a]	Percent Reduction Needed from Observed Load
Allocation Scenario 1						
5-day carbon. biochemical oxygen demand	NA	2384	Implicit	2384	268	0
Ammonia nitrogen	NA	298	Implicit	298	273	0
Allocation Scenario 2 and 3						
5-day carbon. biochemical oxygen demand	NA	2980	Implicit	2980	268	0
Ammonia nitrogen	NA	447	Implicit	447	273	0

[a] Current observed loads based on effluent data from June 24-25, 1997 IEPA dataset
WLA based only on Bloomingdale, Glendale Heights, Glenbard, and Downers Grove facilities as remaining facilities discharge downstream of the impaired segment

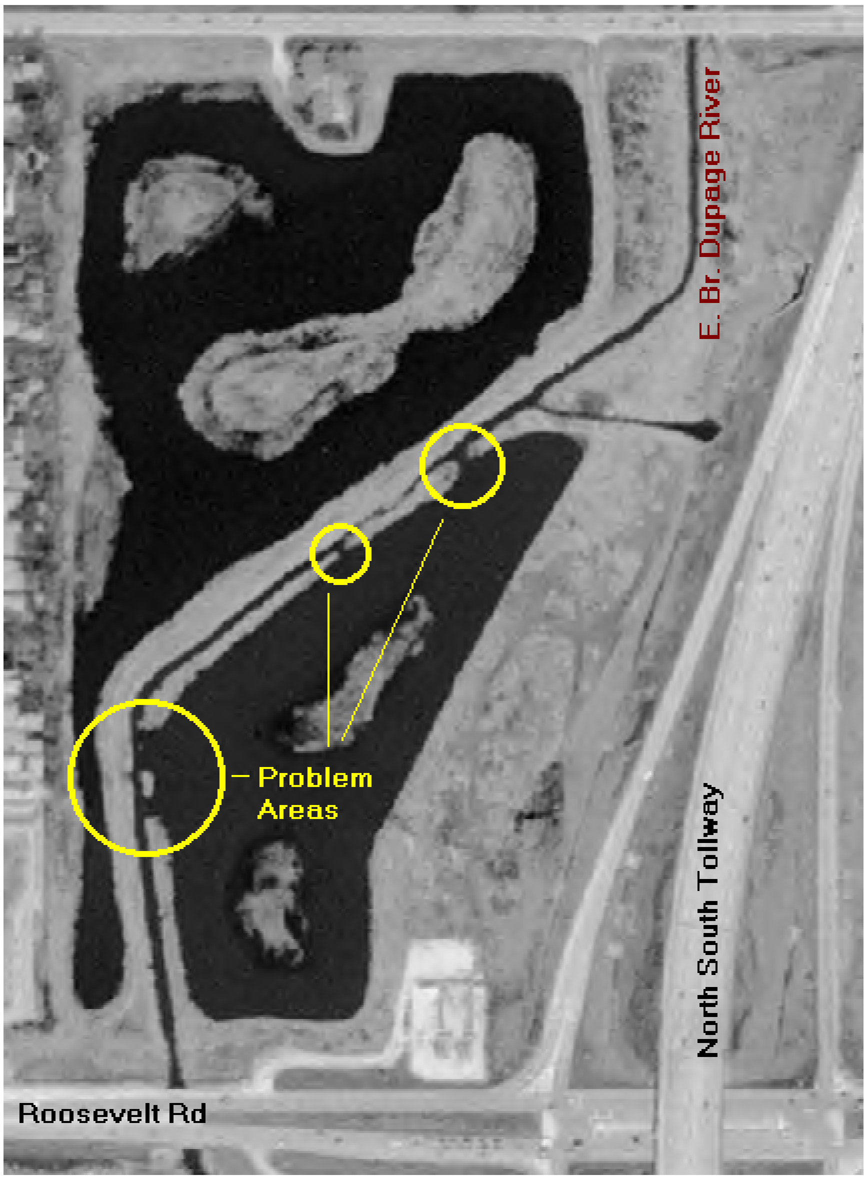
6.4.4 Implementation Considerations

Table 6-7 indicates that point source discharges would not be required to reduce CBOD and ammonia loads to meet the waste load allocations for these pollutants based on observed effluent loads. This is because the observed effluent loads from point sources based on a 1997 IEPA sampling of these discharges are well below current permitted monthly limitations. In order to protect water quality, the point sources need to either accept a reduction in their permitted concentrations (Allocation Scenario 1) to CBOD and ammonia limits of 8 and 1 mg/L respectively. Alternatively, the point sources can remain at their current permitted concentrations, but the impoundment in reach 3 would need to be removed (Allocation Scenario 2).

The implementation impacts on these dischargers, therefore, will depend on what their actual loads are today and in the foreseeable future. This information should be derived and evaluated as part of the implementation process, and adjustments made as appropriate. In addition, this TMDL did not evaluate different allocation scenarios that may be worth considering. For example, an allocation scenario other than equal percent reduction for all facilities may be appropriate and would be consistent with this TMDL as long as the overall target is met and DO standards are protected in East Branch. Water quality trading may also be an option.

Finally, for Allocation Scenario 1, the point source flows can be increased above design average flows and still maintain water quality standards. Thus, the TMDL can be implemented as concentration-based limits if a given NPDES facility needs to request an expansion to its NPDES facility.

FIGURE 6-4
A 1998 Aerial Photograph of the East Branch of the DuPage River and Adjacent Detention Ponds near Roosevelt Road.



7 References

AQUA TERRA Consultants and HydroQual, Inc. *Modeling Nutrient Loads to Long Island Sound from Connecticut Watersheds, and Impacts of Future Buildout and Management Scenarios*. Prepared for CT Department of Environmental Protection. Hartford, Connecticut. 2000.

Bicknell, B.R., et al. *Hydrological Simulation Program - FORTRAN, User's Manual for Version 11*. EPA/600/R-97/080. U.S. EPA, National Exposure Research Laboratory. Athens, Georgia. 1997.

Bicknell, B.R., et al. (Draft) *Hydrological Simulation Program - FORTRAN, User's Manual for Version 12*. U.S. EPA, National Exposure Research Laboratory. Athens, Georgia. 2000.

Chow, V.T. 1959. Open Channel Hydraulics. McGraw-Hill. New York.

Donigian, Jr., A.S., *HSPF Training Workshop Handbook and CD*. Lecture #19. Calibration and Verification Issues, Slide #L19-22. USEPA Headquarters, Washington Information Center, 10-14 January, 2000. Presented and prepared for USEPA, Office of Water, Office of Science and Technology. Washington, D.C. 2000.

Donigian, A. Personal communication. 2001.

Environmental Systems Research Institute, Inc. http://www.esri.com/data/online/tiger/index.html.

Illinois Department of Natural Resources (DNR) Illinois, Geographic Information System (IGIS) Digital Datasets of Illinois CD-ROM. Forest coverage.

Illinois General Use Water Quality Standards.

Lumb, A.M., et al. *Users Manual for an Expert System (HSPEXP) for Calibration of the Hydrological Simulation Program - FORTRAN*. Water-Resources Investigations Report 94-4168, U.S. Geological Survey. Reston, Virginia. 1994.

Melching, C. S. and T. J. Chang. *Simulation of Water Quality for East Branch DuPage River in Northeastern Illinois*. U.S. Geological Survey Open-File Report 96-318, Urbana, Illinois. 1996.

National Weather Service. *Evaporation Atlas for the Contiguous 48 United States*. NOAA Technical Report NWS 33. U. S. Department of Commerce, NOAA. Washington, D.C. 1982a.

National Weather Service. *Mean Monthly, Seasonal, and Annual Pan Evaporation for the United States*. NOAA Technical Report NWS 34. U. S. Department of Commerce, NOAA. Washington, D.C. 1982b.

National Weather Service. *Mean Monthly, Seasonal, and Annual Pan Evaporation for the United States*. NOAA Technical Report NWS 34. U. S. Department of Commerce, NOAA. Washington, D.C. Map 4/4 "Pan Coefficients". 1982c.

NIPC (Northeastern Illinois Planning Commission). Projected future population data. http://www.nipc.cog.il.us/. November, 2002.

Novotny and Olem. 1994.

Novotny, V., et al. *Urban and Highway Snowmelt: Minimizing the Impact on Receiving Water.* Final Report. Project 94-IRM-2. Water Environment Research Federation. 1999.

Oregon State University. Software system Website. http://www.ocs.orst.edu/prism.

Price, Thomas H. *Application Guide for the Hydrologic Modeling in DuPage County Using Hydrologic Simulation Program - Fortran (HSPF): Model Organization and Use, Data Collection and Processing, Calibration*. Northeastern Illinois Planning Commission. Prepared for Stormwater Management Division, Environmental Concerns. DuPage County, Illinois. May 1996.

Price, Thomas H. *Hydrologic Calibration of HSPF Model for DuPage County*. Prepared for Stormwater Management Division, Environmental Concerns. DuPage County, Illinois. 1994.

Singh, K.P., and Ramamurthy, G.S. *Seven-day, Ten-year Low Flows of Streams in Northeastern Illinois*. Illinois State Water Survey Contract Report 545. Champaign, Illinois. 1993.

STORET. http://www.epa.gov/storet.

Thackston, Edward L. and Young, Katherine D. "Housing Density and Bacterial Loading in Urban Streams." *Journal Environmental Engineering*. December, 1999.

USEPA. *Guidance for Water Quality-based Decisions: The TMDL process*. EPA 440-4-19-001, Office of Water (WH-553), Washington, DC. 1991.

USGS. *Simulation of Water Quality for East Branch DuPage River in Northeastern Illinois*. Prepared in cooperation with the Illinois Environmental Protection Agency. Urbana, Illinois. 1996.

Appendix A — RF3 Summary Table

TABLE A-1
Reach File 3 Reach Summary

Reach ID	Watershed	Type	Length (ft)
7120004 18 0.00	East Branch DuPage River DuPage River	Stream	22852
7120004 18 4.10	East Branch DuPage River DuPage River	Lake	944
7120004 18 4.33	East Branch DuPage River DuPage River	Lake	701
7120004 18 4.45	East Branch DuPage River DuPage River	Stream	7397
7120004 18 5.78	East Branch DuPage River DuPage River	Stream	4475
7120004 18 6.58	East Branch DuPage River DuPage River	Stream	4226
7120004 18 7.33	East Branch DuPage River DuPage River	Stream	3528
7120004 18 7.96	East Branch DuPage River DuPage River	Stream	5380
7120004 18 8.91	East Branch DuPage River DuPage River	Stream	935
7120004 18 9.07	East Branch DuPage River DuPage River	Stream	10584
7120004 18 9.85	East Branch DuPage River DuPage River	Stream	2001
7120004 1810.00	East Branch DuPage River DuPage River	Stream	14352
7120004 1811.07	East Branch DuPage River DuPage River	Stream	6973
7120004 1811.59	East Branch DuPage River DuPage River	Stream	1326
7120004 1811.69	East Branch DuPage River DuPage River	Stream	15297
7120004 1812.83	East Branch DuPage River DuPage River	Lake	4733
7120004 1813.14	East Branch DuPage River DuPage River	Stream	1404
7120004 1813.25	East Branch DuPage River DuPage River	Stream	1248
7120004 1813.34	East Branch DuPage River DuPage River	Stream	6363

TABLE A-1
Reach File 3 Reach Summary

Reach ID	Watershed	Type	Length (ft)
	DuPage River		
7120004 1813.81	East Branch DuPage River DuPage River	Stream	871
7120004 1813.88	East Branch DuPage River DuPage River	Stream	7462
7120004 1814.43	East Branch DuPage River DuPage River	Stream	5696
7120004 1814.86	East Branch DuPage River DuPage River	Lake	556
7120004 1814.90	East Branch DuPage River DuPage River	Stream	4279
7120004 29 0.00	East Branch DuPage River DuPage River	Stream	20954
7120004 618 0.00	East Branch DuPage River DuPage River	Stream	262
7120004 618 0.05	East Branch DuPage River DuPage River	Lake	230
7120004 618 0.10	East Branch DuPage River DuPage River	Stream	2214
7120004 618 0.52	East Branch DuPage River DuPage River	Stream	7105
7120004 619 0.00	East Branch DuPage River DuPage River	Stream	6832
7120004 620 0.00	East Branch DuPage River DuPage River	Stream	9016
7120004 621 0.00	East Branch DuPage River DuPage River	Stream	6207
7120004 622 0.00	East Branch DuPage River DuPage River	Stream	7715
7120004 623 0.00	East Branch DuPage River DuPage River	Stream	5870
7120004 624 0.00	East Branch DuPage River DuPage River	Stream	2974
7120004 624 0.57	East Branch DuPage River DuPage River	Stream	4681
7120004 624 1.45	East Branch DuPage River DuPage River	Stream	14991
7120004 625 0.00	East Branch DuPage River DuPage River	Stream	5395
7120004 626 0.00	East Branch DuPage River DuPage River	Stream	6890
7120004 627 0.00	East Branch DuPage River	Stream	690

TABLE A-1
Reach File 3 Reach Summary

Reach ID	Watershed	Type	Length (ft)
	DuPage River		
7120004 627 0.13	East Branch DuPage River DuPage River	Stream	5104
7120004 628 0.00	East Branch DuPage River DuPage River	Stream	19229
7120004 629 0.00	East Branch DuPage River DuPage River	Stream	392
7120004 629 0.08	East Branch DuPage River DuPage River	Lake	497
7120004 629 0.16	East Branch DuPage River DuPage River	Stream	8850
7120004 631 0.00	East Branch DuPage River DuPage River	Stream	4189
7120004 632 0.00	East Branch DuPage River DuPage River	Stream	3886
7120004 633 0.00	East Branch DuPage River DuPage River	Stream	3495
7120004 634 0.00	East Branch DuPage River DuPage River	Stream	10371
7120004 635 0.00	East Branch DuPage River DuPage River	Stream	5483
7120004 636 0.00	East Branch DuPage River DuPage River	Stream	7641
7120004 637 0.00	East Branch DuPage River DuPage River	Stream	18868
7120004 638 0.00	East Branch DuPage River DuPage River	Stream	10573

Appendix B — Hydrologic Calibration Data

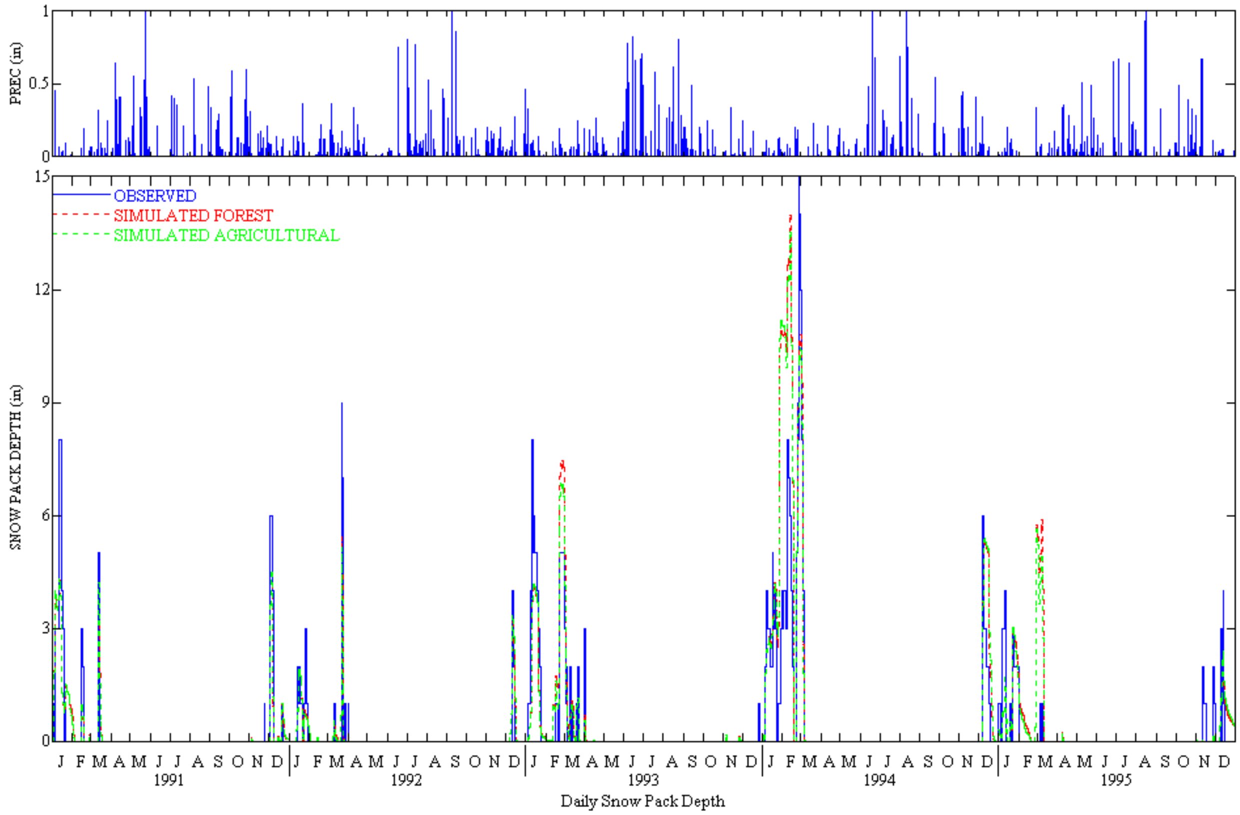


FIGURE B1 PLOT OF SNOW PACK DEPTH ON THE EAST BRANCH DUPAGE RIVER DUPAGE WATERSHED

Table B1: HSPEXP Output at Downers Grove:

```
 Simulated Observed
Total runoff, in inches 118.300 121.451
Total of highest 10% flows, in inches 42.770 44.237
Total of lowest 50% flows, in inches 26.550 27.659

 Simulated Potential
Evapotranspiration, in inches 107.700 152.200

 Simulated Observed
Total storm volume, in inches 22.300 25.167
Average of storm peaks, in cfs 174.528 180.029
Baseflow recession rate 0.980 0.930

Total simulated storm interflow, in inches > 16.380
Total simulated storm surface runoff, in inches > 23.410

 Simulated Observed
Summer flow volume, in inches 24.210 24.527
Winter flow volume, in inches 26.940 28.814
Summer storm volume, in inches 4.920 4.698

 Current Criteria
Error in total volume -2.600 10.000
Error in low flow recession -0.050 0.060
Error in 50% lowest flows -4.000 10.000
Error in 10% highest flws -3.300 15.000
Error in storm volumes -3.100 15.000
Seasonal volume error 5.200 10.000
Summer storm volume error 16.100 15.000
```

Table B2: HSPEXP Output at Bolingbrook

```
 Simulated Observed
Total runoff, in inches 105.700 103.388
Total of highest 10% flows, in inches 40.430 37.197
Total of lowest 50% flows, in inches 20.730 21.687

 Simulated Potential
Evapotranspiration, in inches 108.700 152.200

 Simulated Observed
Total storm volume, in inches 20.600 20.672
Average of storm peaks, in cfs 402.315 377.353
Baseflow recession rate 0.980 0.940

Total simulated storm interflow, in inches > 16.520
Total simulated storm surface runoff, in inches > 22.010

 Simulated Observed
Summer flow volume, in inches 20.920 19.195
Winter flow volume, in inches 24.010 24.540
Summer storm volume, in inches 4.480 4.151

 Current Criteria
Error in total volume 2.200 10.000
Error in low flow recession -0.040 0.060
Error in 50% lowest flows -4.400 10.000
Error in 10% highest flws 8.700 15.000
Error in storm volumes 6.600 15.000
Seasonal volume error 11.200 10.000
Summer storm volume error 8.300 15.000
```

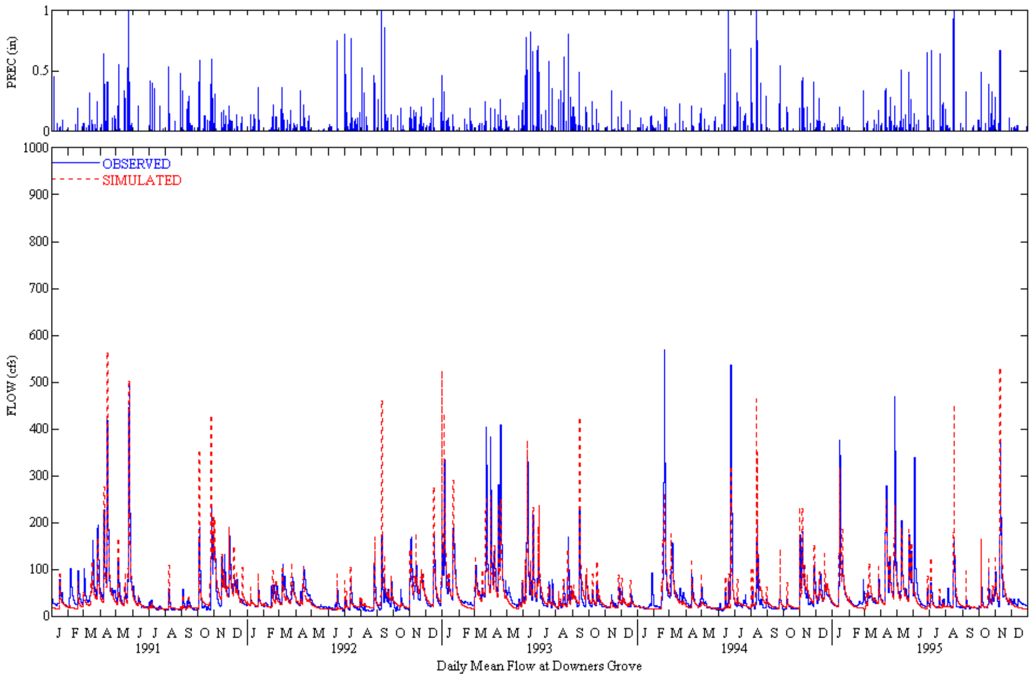


FIGURE B2 SIMULATED VERSUS OBSERVED FLOW FOR THE CALIBRATION PERIOD. AT DOWNERS GROVE

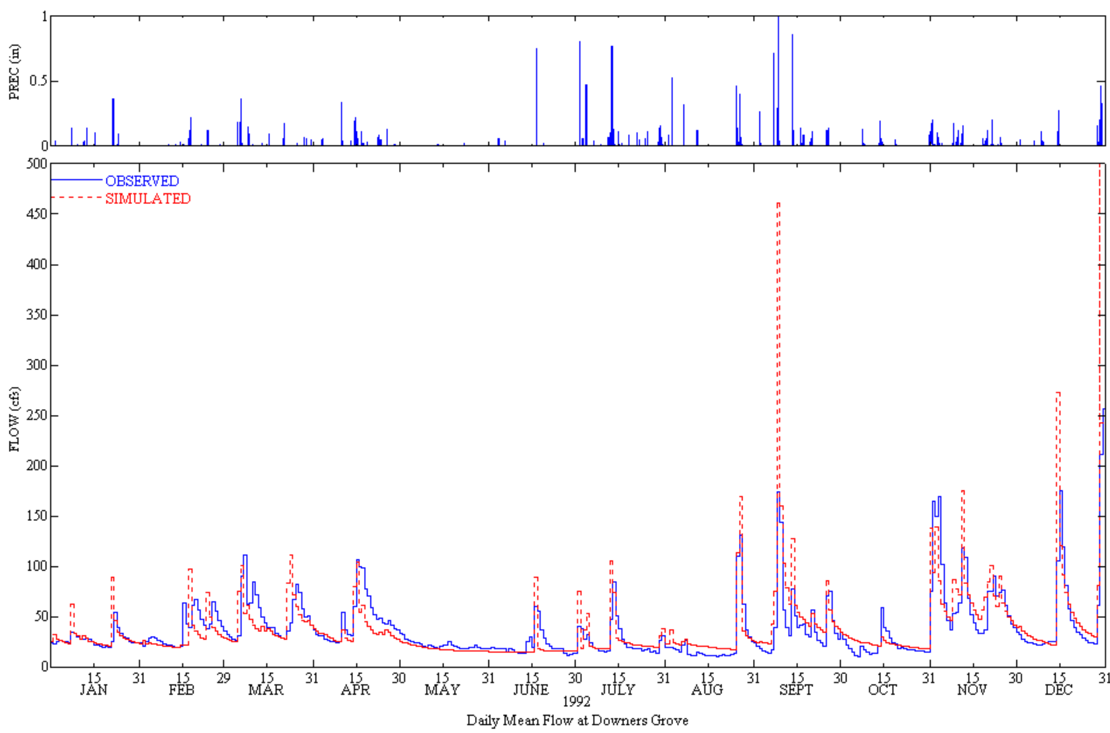


FIGURE B3 SIMULATED VERSUS OBSERVED FLOW FOR PART OF THE CALIBRATION PERIOD.AT DOWNERS GROVE

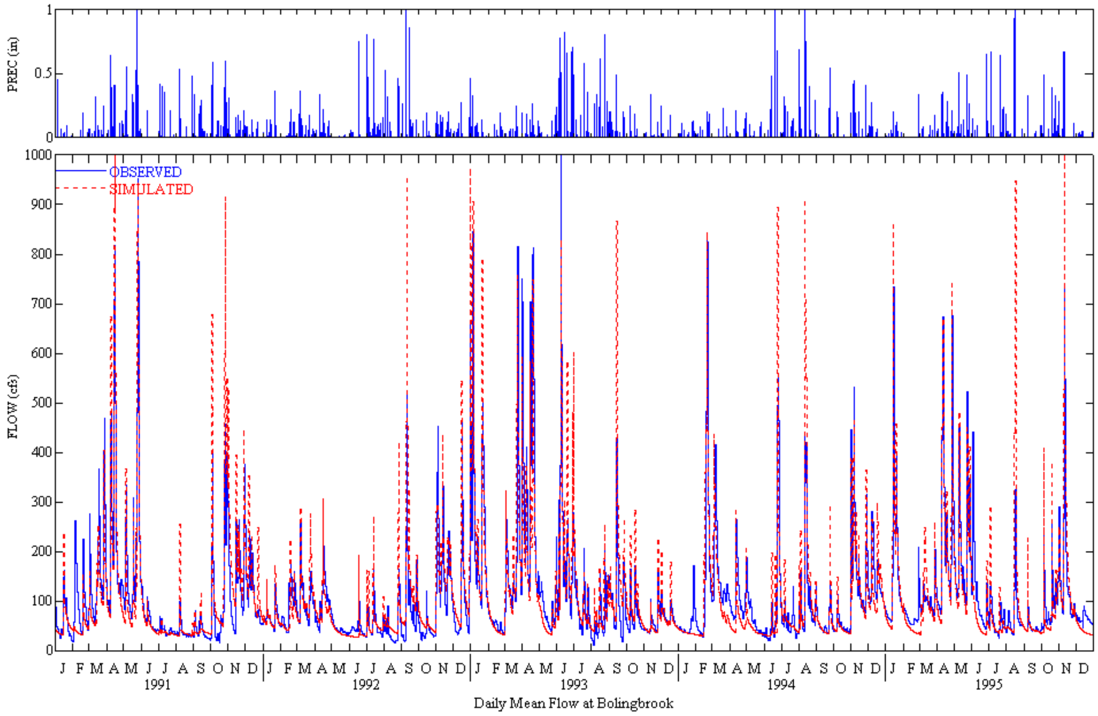


FIGURE B4 SIMULATED VERSUS OBSERVED FLOW FOR THE CALIBRATION PERIOD. AT BOILINGSBROOK

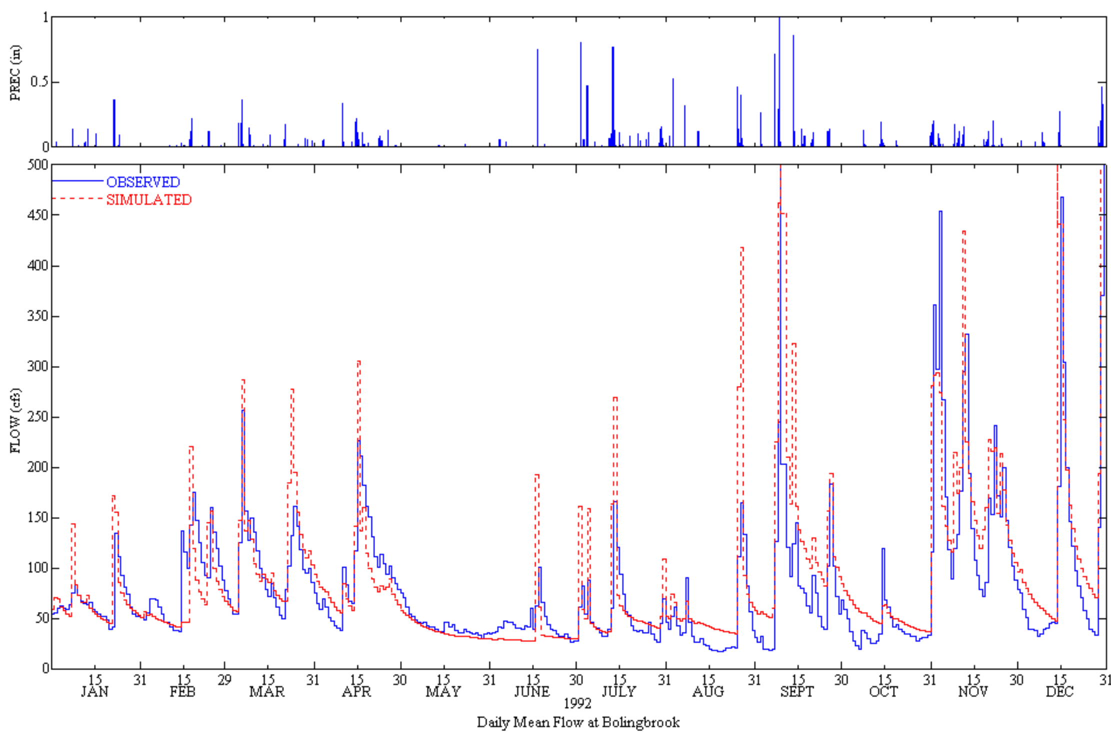
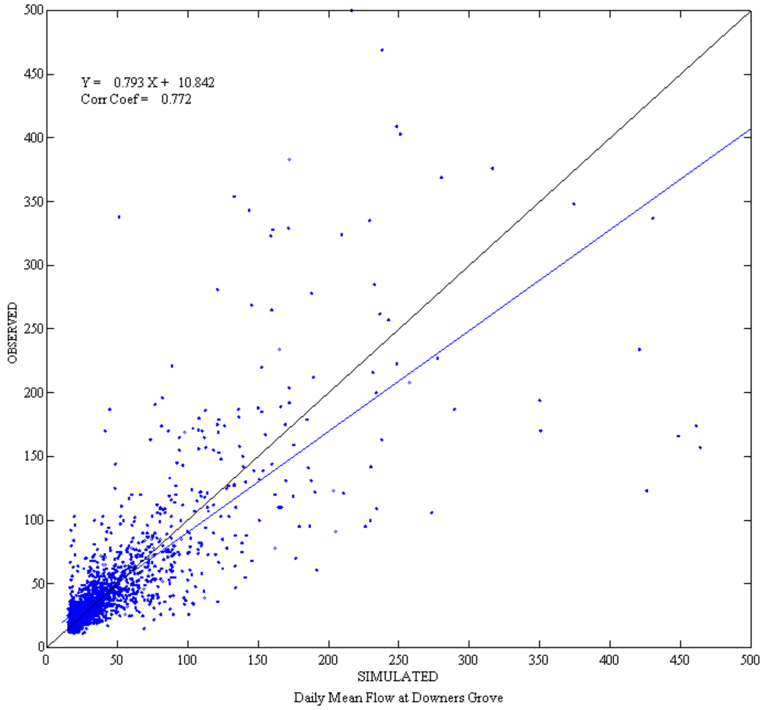


FIGURE B5 SIMULATED VERSUS OBSERVED FLOW FOR PART OF THE CALIBRATION PERIOD. AT BOILINGSBROOK



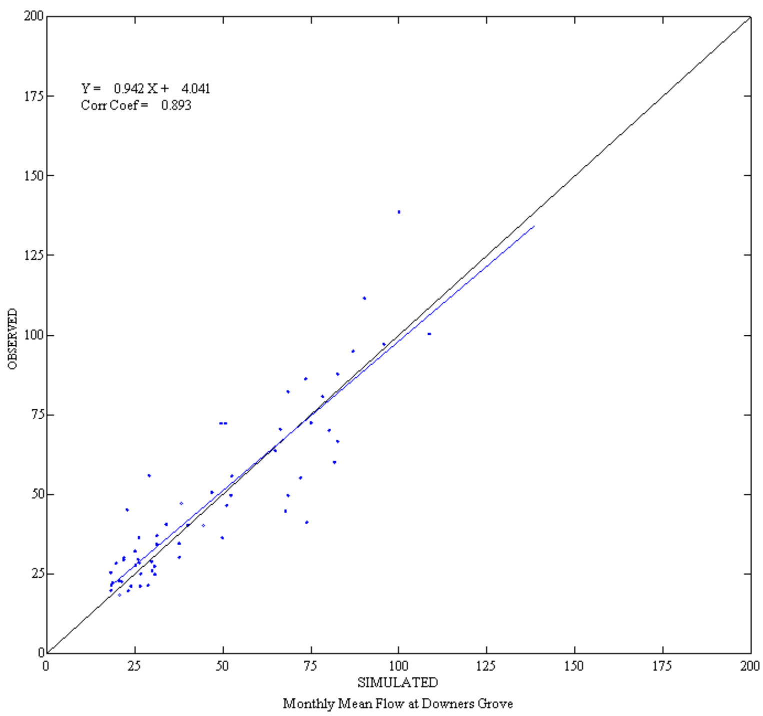
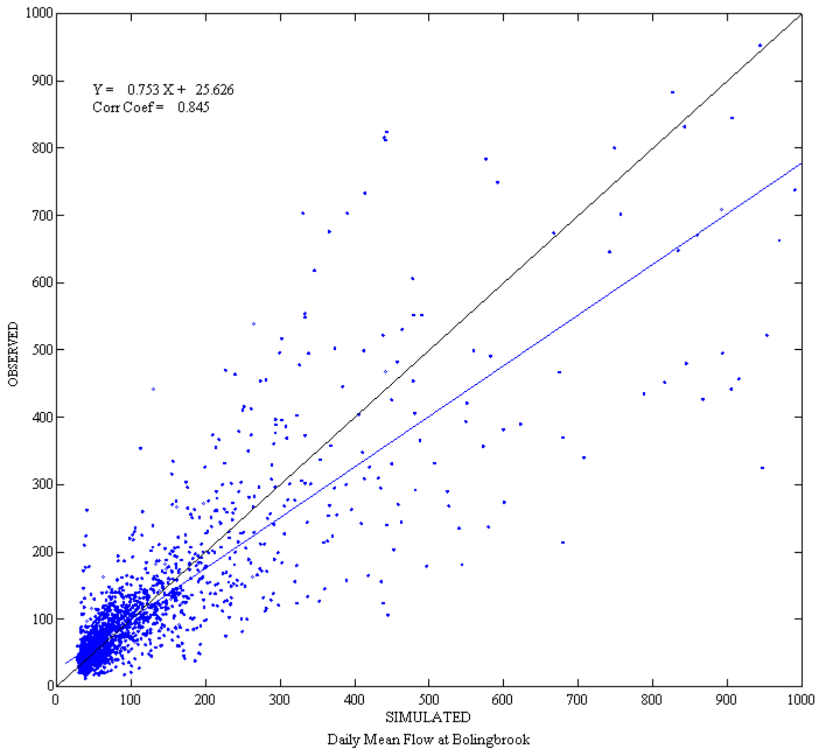


FIGURE B6 SCATTER PLOTS AT DOWNERS GROVE



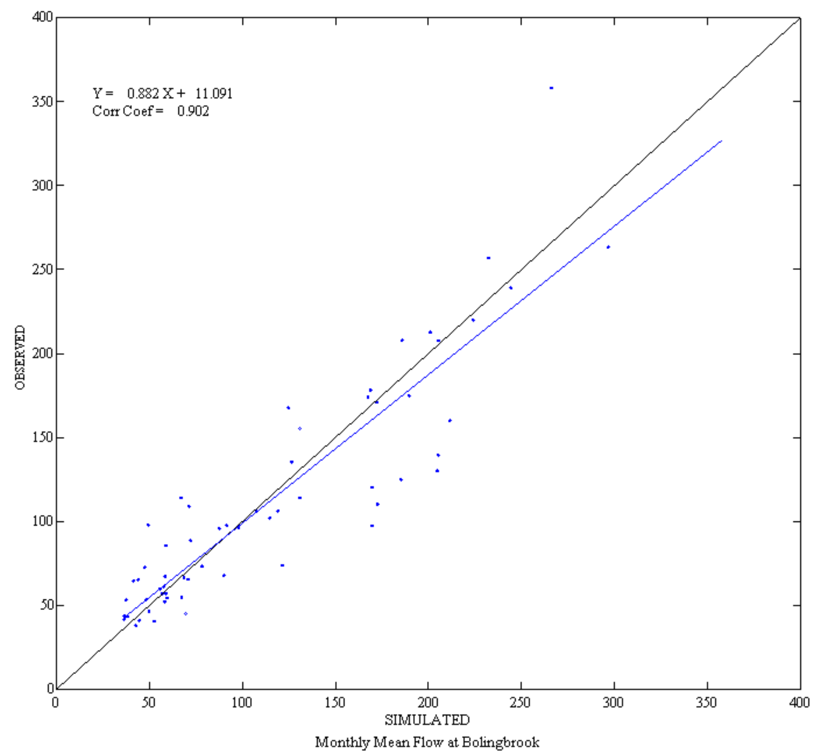


FIGURE B7 SCATTER PLOTS AT BOLINGBROOK

```
Water Balance for PERLND 1 - Cemeteries and Vacant - East Branch DuPage River

 1991 1992 1993 1994 1995 SUM/AVER
Rainfall (in) 38.59 34.15 42.11 36.43 37.97 37.85

Runoff (in)
 Surface 0.7130 0.4640 0.4780 0.4350 0.7150 0.5610
 Interflow 4.250 2.456 6.384 3.156 4.623 4.174
 Baseflow 9.539 8.218 12.69 8.553 9.773 9.754
 Total 14.50 11.14 19.55 12.14 15.11 14.49

Deep Groundwater (in 0.5070 0.4630 0.6370 0.4550 0.5030 0.5130

Evaporation (in)
 Potential 33.54 27.88 27.33 34.03 29.41 30.44
 Intercep St 6.733 5.985 6.796 5.991 6.829 6.467
 Upper Zone 8.568 7.421 11.61 8.805 9.737 9.227
 Lower Zone 8.577 7.624 5.517 9.165 6.835 7.544
 Ground Water 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Baseflow 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Total 23.88 21.03 23.92 23.96 23.40 23.24


Water Balance for PERLND 2 - Commercial - East Branch DuPage River

 1991 1992 1993 1994 1995 SUM/AVER
Rainfall (in) 38.59 34.15 42.11 36.43 37.97 37.85

Runoff (in)
 Surface 0.7130 0.4640 0.4780 0.4350 0.7150 0.5610
 Interflow 4.250 2.456 6.384 3.156 4.623 4.174
 Baseflow 9.539 8.218 12.69 8.553 9.773 9.754
 Total 14.50 11.14 19.55 12.14 15.11 14.49

Deep Groundwater (in 0.5070 0.4630 0.6370 0.4550 0.5030 0.5130

Evaporation (in)
 Potential 33.54 27.88 27.33 34.03 29.41 30.44
 Intercep St 6.733 5.985 6.796 5.991 6.829 6.467
 Upper Zone 8.568 7.421 11.61 8.805 9.737 9.227
 Lower Zone 8.577 7.624 5.517 9.165 6.835 7.544
 Ground Water 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Baseflow 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Total 23.88 21.03 23.92 23.96 23.40 23.24


Water Balance for PERLND 3 - Forest - East Branch DuPage River

 1991 1992 1993 1994 1995 SUM/AVER
Rainfall (in) 38.59 34.14 42.07 36.43 37.95 37.84

Runoff (in)
 Surface 0.1800E-01 0.1500E-01 0.2800E-01 0.1200E-01 0.1600E-01 0.1780E-01
 Interflow 0.8790 0.4420 2.124 0.3840 1.109 0.9876
 Baseflow 7.699 6.155 13.81 6.059 9.365 8.618
 Total 8.597 6.611 15.96 6.454 10.49 9.623

Deep Groundwater (in 1.648 1.464 2.388 1.474 1.785 1.752

Evaporation (in)
 Potential 33.64 27.95 27.41 34.28 29.49 30.55
 Intercep St 8.303 7.582 9.127 7.688 8.605 8.261
 Upper Zone 6.397 5.708 10.06 7.380 8.577 7.624
 Lower Zone 10.72 9.587 6.131 11.80 8.129 9.274
 Ground Water 1.513 1.367 0.8220 1.921 1.231 1.371
 Baseflow 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Total 26.94 24.24 26.14 28.79 26.54 26.53
```

```
Water Balance for PERLND 4 - Industrial - East Branch DuPage River

 1991 1992 1993 1994 1995 SUM/AVER
Rainfall (in) 38.59 34.15 42.11 36.43 37.97 37.85

Runoff (in)
 Surface 0.7130 0.4640 0.4780 0.4350 0.7150 0.5610
 Interflow 4.250 2.456 6.384 3.156 4.623 4.174
 Baseflow 9.539 8.218 12.69 8.553 9.773 9.754
 Total 14.50 11.14 19.55 12.14 15.11 14.49

Deep Groundwater (in 0.5070 0.4630 0.6370 0.4550 0.5030 0.5130

Evaporation (in)
 Potential 33.54 27.88 27.33 34.03 29.41 30.44
 Intercep St 6.733 5.985 6.796 5.991 6.829 6.467
 Upper Zone 8.568 7.421 11.61 8.805 9.737 9.227
 Lower Zone 8.577 7.624 5.517 9.165 6.835 7.544
 Ground Water 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Baseflow 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Total 23.88 21.03 23.92 23.96 23.40 23.24


Water Balance for PERLND 5 - Institutional - East Branch DuPage River

 1991 1992 1993 1994 1995 SUM/AVER
Rainfall (in) 38.59 34.15 42.11 36.43 37.97 37.85

Runoff (in)
 Surface 0.7130 0.4640 0.4780 0.4350 0.7150 0.5610
 Interflow 4.250 2.456 6.384 3.156 4.623 4.174
 Baseflow 9.539 8.218 12.69 8.553 9.773 9.754
 Total 14.50 11.14 19.55 12.14 15.11 14.49

Deep Groundwater (in 0.5070 0.4630 0.6370 0.4550 0.5030 0.5130

Evaporation (in)
 Potential 33.54 27.88 27.33 34.03 29.41 30.44
 Intercep St 6.733 5.985 6.796 5.991 6.829 6.467
 Upper Zone 8.568 7.421 11.61 8.805 9.737 9.227
 Lower Zone 8.577 7.624 5.517 9.165 6.835 7.544
 Ground Water 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Baseflow 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Total 23.88 21.03 23.92 23.96 23.40 23.24


Water Balance for PERLND 6 - Open Space - East Branch DuPage River

 1991 1992 1993 1994 1995 SUM/AVER
Rainfall (in) 38.59 34.15 42.11 36.43 37.97 37.85

Runoff (in)
 Surface 0.7130 0.4640 0.4780 0.4350 0.7150 0.5610
 Interflow 4.250 2.456 6.384 3.156 4.623 4.174
 Baseflow 9.539 8.218 12.69 8.553 9.773 9.754
 Total 14.50 11.14 19.55 12.14 15.11 14.49

Deep Groundwater (in 0.5070 0.4630 0.6370 0.4550 0.5030 0.5130

Evaporation (in)
 Potential 33.54 27.88 27.33 34.03 29.41 30.44
 Intercep St 6.733 5.985 6.796 5.991 6.829 6.467
 Upper Zone 8.568 7.421 11.61 8.805 9.737 9.227
 Lower Zone 8.577 7.624 5.517 9.165 6.835 7.544
 Ground Water 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Baseflow 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Total 23.88 21.03 23.92 23.96 23.40 23.24
```

Water Balance for PERLND 7 - Residential - East Branch DuPage River

	1991	1992	1993	1994	1995	SUM/AVER
Rainfall (in)	38.58	34.15	42.09	36.43	37.95	37.84
Runoff (in)						
Surface	0.7140	0.4640	0.4780	0.4340	0.7160	0.5612
Interflow	4.259	2.473	6.384	3.130	4.649	4.179
Baseflow	9.532	8.211	12.68	8.580	9.731	9.746
Total	14.51	11.15	19.54	12.14	15.10	14.49
Deep Groundwater (in	0.5060	0.4630	0.6360	0.4560	0.5010	0.5124
Evaporation (in)						
Potential	33.53	27.88	27.32	34.03	29.40	30.43
Intercep St	6.731	5.978	6.793	5.989	6.831	6.464
Upper Zone	8.565	7.421	11.60	8.804	9.737	9.226
Lower Zone	8.575	7.622	5.517	9.166	6.829	7.542
Ground Water	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Baseflow	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	23.87	21.02	23.91	23.96	23.40	23.23

Water Balance for PERLND 8 - TCU Excl Interstates - East Branch DuPage River

	1991	1992	1993	1994	1995	SUM/AVER
Rainfall (in)	38.59	34.15	42.11	36.43	37.97	37.85
Runoff (in)						
Surface	0.7130	0.4640	0.4780	0.4350	0.7150	0.5610
Interflow	4.250	2.456	6.384	3.156	4.623	4.174
Baseflow	9.539	8.218	12.69	8.553	9.773	9.754
Total	14.50	11.14	19.55	12.14	15.11	14.49
Deep Groundwater (in	0.5070	0.4630	0.6370	0.4550	0.5030	0.5130
Evaporation (in)						
Potential	33.54	27.88	27.33	34.03	29.41	30.44
Intercep St	6.733	5.985	6.796	5.991	6.829	6.467
Upper Zone	8.568	7.421	11.61	8.805	9.737	9.227
Lower Zone	8.577	7.624	5.517	9.165	6.835	7.544
Ground Water	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Baseflow	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	23.88	21.03	23.92	23.96	23.40	23.24

Water Balance for PERLND 9 - Expressways - East Branch DuPage River

	1991	1992	1993	1994	1995	SUM/AVER
Rainfall (in)	38.59	34.15	42.11	36.43	37.97	37.85
Runoff (in)						
Surface	0.7130	0.4640	0.4780	0.4350	0.7150	0.5610
Interflow	4.250	2.456	6.384	3.156	4.623	4.174
Baseflow	9.539	8.218	12.69	8.553	9.773	9.754
Total	14.50	11.14	19.55	12.14	15.11	14.49
Deep Groundwater (in	0.5070	0.4630	0.6370	0.4550	0.5030	0.5130
Evaporation (in)						
Potential	33.54	27.88	27.33	34.03	29.41	30.44
Intercep St	6.733	5.985	6.796	5.991	6.829	6.467
Upper Zone	8.568	7.421	11.61	8.805	9.737	9.227
Lower Zone	8.577	7.624	5.517	9.165	6.835	7.544
Ground Water	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Baseflow	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	23.88	21.03	23.92	23.96	23.40	23.24

```
Water Balance for PERLND 10 - Wetlands - East Branch DuPage River

 1991 1992 1993 1994 1995 SUM/AVER
Rainfall (in) 38.59 34.15 42.11 36.43 37.97 37.85

Runoff (in)
 Surface 0.6000E-02 0.5000E-02 0.1200E-01 0.4000E-02 0.7000E-02 0.6800E-02
 Interflow 0.1130 0.7800E-01 0.4260 0.5900E-01 0.1210 0.1594
 Baseflow 11.52 9.480 18.36 10.38 13.51 12.65
 Total 11.64 9.563 18.80 10.44 13.64 12.82

Deep Groundwater (in 2.415 2.200 3.214 2.316 2.580 2.545

Evaporation (in)
 Potential 33.54 27.88 27.33 34.03 29.41 30.44
 Intercep St 6.733 5.985 6.796 5.991 6.829 6.467
 Upper Zone 4.483 4.120 7.710 4.630 5.721 5.333
 Lower Zone 9.755 8.735 7.053 10.52 8.353 8.882
 Ground Water 2.133 1.772 1.282 2.341 1.686 1.843
 Baseflow 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Total 23.10 20.61 22.84 23.48 22.59 22.52


Water Balance for PERLND 11 - Agricultural - East Branch DuPage River

 1991 1992 1993 1994 1995 SUM/AVER
Rainfall (in) 38.59 34.15 42.11 36.43 37.97 37.85

Runoff (in)
 Surface 0.1340 0.6200E-01 0.8400E-01 0.4500E-01 0.8000E-01 0.8100E-01
 Interflow 2.534 1.126 3.984 1.383 2.603 2.326
 Baseflow 10.49 8.472 15.27 9.517 11.03 10.96
 Total 13.16 9.660 19.34 10.95 13.71 13.36

Deep Groundwater (in 0.5560 0.4860 0.7620 0.5060 0.5700 0.5760

Evaporation (in)
 Potential 33.54 27.88 27.33 34.03 29.41 30.44
 Intercep St 6.281 5.972 6.953 5.799 6.609 6.323
 Upper Zone 7.048 5.992 10.26 7.231 8.475 7.801
 Lower Zone 11.66 10.26 7.276 11.87 9.718 10.16
 Ground Water 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Baseflow 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 Total 24.99 22.22 24.49 24.90 24.80 24.28
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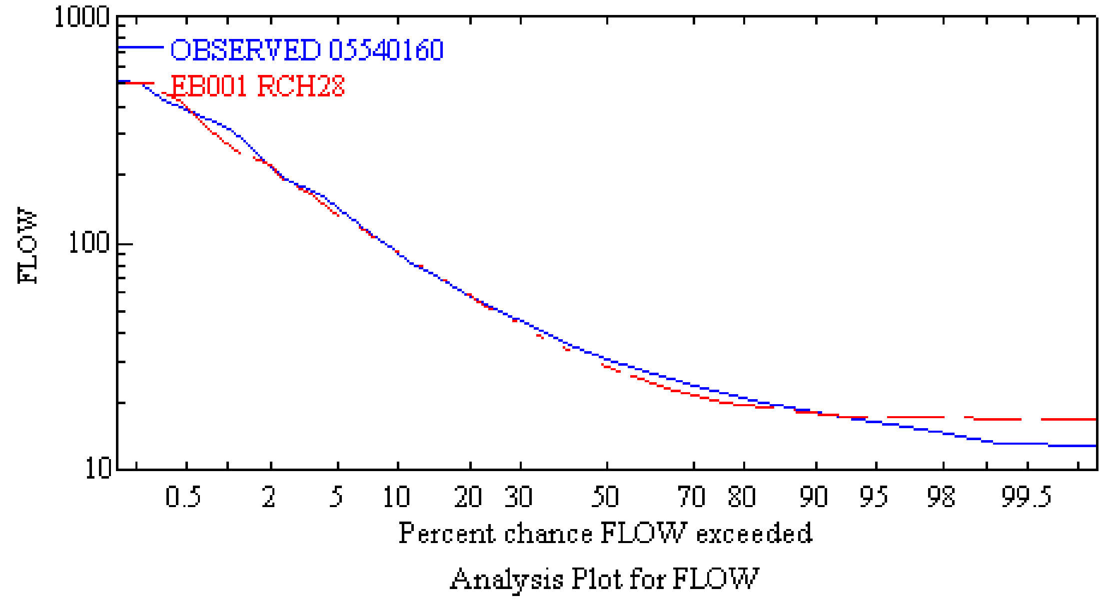

FIGURE B8 FLOW DURATION PLOT – EAST BRANCH DUPAGE RIVER DUPAGE RIVER AT DOWNERS GROVE

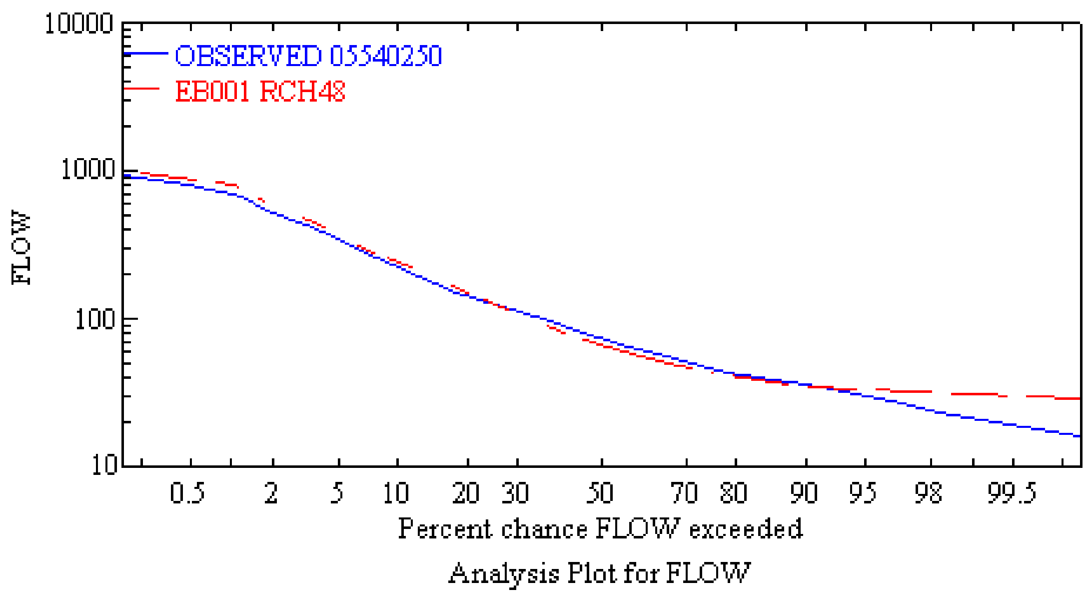

FIGURE B9 FLOW DURATION PLOT – EAST BRANCH DUPAGE RIVER DUPAGE RIVER AT BOLINGBROOK

Appendix C — DMR Update

TABLE C1 SUMMARY OF DMR DATA FOR POINT DISCHARGERS WHERE NO SIGNIFICANT MONTHLY VARIATIONS WERE OBSERVED

EAST BRANCH DUPAGE RIVER	IL0021130	IL0021547	IL0028380	IL0028967	IL0031844	IL0032689	IL0032735	IL0053155	IL0022471	Average over all stations
Acute / tot copper (as CU) 1042	0.01125	no data	no data	0.00825	0.007553	0.00525	0.028	no data	no data	0.012061
Chloride (residual) 50060	0.012377	0.009394	0.21108	0.047998	0.082077	0.111429	0.010147	no data	1.035385	0.189986
Silver in Water (tot AG as AG) 1077	0.025	no data	no data	0.00325	0.001561	0.0002	0.0135	no data	no data	0.008702
Lead (tot lead as Pb) 1051	0.0125	no data	no data	0.013	no data	0.001	0.038	no data	no data	0.016125
Mercury (tot mercury as Hg) 71900	0.000379	no data	no data	0.0001	4.75E-05	0.0001	0.000292	no data	no data	0.000184
Nitrate (tot Nitrate as N) 620	no data	no data	no data	no data	no data	no data	no data	no data	no data	
Fecal coliform 74055	29.2623	131.3125	66.09766	28.90244	827.2097	42.0061	44.125	no data	51.14615	152.5077
Total Suspended Solids TSS 530	3.344262	4.010606	3.103977	3.812589	2.332308	5.075893	3.495588	12.4717	27.63077	7.253077
pH 400	7.104098	6.915909	3.068466	3.970223	7.558462	5.311607	5.002941	6.407925	4.151538	5.499019
BOD 5 at 20 deg C 310	no data	no data	4.705682	3.053571	no data	1.892857	4.4	no data	17.12308	6.235037

TABLE C2 AMMONIA CONCENTRATIONS FROM POINT DISCHARGERS

Ammonia	IL0021130	IL0021547	IL0028380	IL0028967	IL0031844	IL0032689	IL0032735	IL0053155	IL0022471
January	0.32	0.74	0.5	0.2308	0.9	0.085	1.59125	no data	no data
Feburary	0.5425	1.25	0.41	0.43045	0.73125	0.076	0.8	no data	no data
March	0.325	1.257143	0.5375	0.3785	1.092857	0.095	0.3	no data	no data
April	0.4	1.35	0.46	0.312667	0.8	0.162	0.768	no data	no data
May	0.36	0.9	0.34	0.6815	2.025	0.093333	0.446667	no data	no data
June	0.433333	0.7	0.425	0.2924	1.025	0.103333	0.3	no data	no data
July	0.47	0.502	0.357143	0.246	1.666667	0.116667	1.02	no data	no data
August	0.48	0.707143	0.3	0.325857	1.266667	0.133333	1.655	no data	no data
September	0.58	1.46	0.4225	0.339	0.971429	0.35	1.145	no data	no data
October	0.38	0.491667	0.426	0.1694	1.02	0.124286	0.24	no data	no data
November	0.516667	0.8175	0.478	0.3174	0.828571	0.182	0.536667	no data	no data
December	0.349222	0.816667	0.54125	0.369	1.24	0.175	0.42875	no data	no data
average value	0.429727	0.91601	0.433116	0.341081	1.13062	0.141329	0.769278	no data	no data

Appendix D: Diel Survey and SOD Data

TABLE D1 SUMMARY OF DIEL 1 SURVEY DATA JUNE 24-25 1997 – ROUND 1

EAST BRANCH DUPAGE RIVER WATER QUALITY DATA

DIEL 1 - (JUNE 24 & 25,1997) Round 1 (8:00 AM to 2:00 PM)

		River			Air Temp	H2O Temp	DO	CBOD	Ammonia-N		Conductivity	TSS	TKN	Fecal Coliform	Total CN	Total Chloride	Total Ag	Chl a	Total P	NO3-NO2
Site ID	Site Description	Mile	Date	Time	Degrees C	Degrees C	mg/L	mg/L	mg/L	pH		mg/L	mg/L	counts/100mL	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L
1/GBL14	U/S Bloomingdale STP at Glen Ellyn Road	23.80	24-Jun	0715	26	27.16	6.95	2	0.28	7.76	96	22	0.81	300	<0.01		<3	16.02	0.07	0.12
2/GBL-B-E	Bloomingdale STP	23.70	24-Jun	1115	32	21.1	7.40	1	0.67	7.04	83	2	1.97	10	<0.01	158	<3	-	4.6	15.58
3/GB/11	Dr's Bloomingdale STP at Army Trail Road	23.67	24-Jun	0735	26	21.26	7.26	<1	0.13	7.6	14	10	0.56	880	<0.01	270	<3	1.78	0.06	0.25
4/GB/15	Fullerton Ave. in Glendale Heights	22.07	24-Jun	0810	26	22.11	5.23	1	0.6	7.24	9	41	2.00	400	<0.01	147	<3	2.67	2.8	9.3
5/GBlg/01	Armitage Ditch V/S of Glendale HTS. STP	21.50	24-Jun	0830	27	24.8	14.43	1	0.14	8.61	116	3	0.68	180	<0.01	189	<3	0.89	0.03	<0.01
6/GBLG-GH-E	Glendale Heights STP	21.50	24-Jun	1055	31	20.55	7.54	1	0.18	6.98	81	2	1.10	<10	<0.01	164	<3	-	2.9	13.6
7GBl16	St. Charles Rd. in Glen Ellyn	19.95	24-Jun	0850	26	22.61	4.83	2	0.57	7.16	100	57	1.93	600	<0.01	126	<3	13.35	2	7.7
8GBl17	Hill Ave. in Lombard	18.50	24-Jun	0915	26	26.65	4.31	3	0.65	7.40	99	62	2.40	400	<0.01	125	<3	52.51	1.5	5.2
9/GBL08	Roosevelt Rd. (RT. 36) in Glen Ellyn	16.92	24-Jun	0935	27	27.14	3.70	2	0.71	7.42	105	52	2.41	21,000	<0.01	126	<3	42.72	1.2	3.7
10/GBL-GB-E	Glenbard STP	15.90	24-Jun	1025	31	18.78	7.04	1	2.4	7.03	109	2	4.10	<10	<0.01	145	<3	-	2.3	6.7
11/GBL09	Butterfield Rd. (Rt. 56)	14.78	24-Jun	1000	28	23.81	4.58	2	1.3	7.20	111	30	2.60	350	<0.01	135	<3	32.04	1.4	4.4
12/GBL13	Rt 53 in Lisle Morton Arboretum	13.06	24-Jun	1020	28	24.86	5.39	2	1.1	7.38	112	60	2.73	700	<0.01	127	<3	28.48	1.3	4
13/GBLB01	Ogden Ave. (Rt 34) in Lisle St. Joseph CK.	11.90	24-Jun	0650	24	24.01	2.57	1	0.27	7.30	912	7	0.89	270	<0.01	281	<3	0.89	0.3	1.39
14/GBL10	Ogden Ave (Rt 34) in Lisle AWQMN	11.66	24-Jun	0713	25	23.46	4.63	2	1.6	7.28	1108	30	2.57	800	<0.01	231	<3	18.69	1.7	3.6
15/GBL-DG-E1	Downers Grove SD STP	11.50	24-Jun	0915	31	19.80	7.28	<1	1.7	7.03	938	2	1.76	10	<0.01	207	<3	-	3.4	16
16/GBL051	Maple Ave. in Lise	10.64	24-Jun	0740	26	23.12	5.01	2	1.4	7.27	1071	43	2.73	210	<0.01	517	<3	20.47	2	5.9
17/GBL12	75th Street near woodridge	7.99	24-Jun	0808	26	23.82	4.67	1	0.58	7.32	1066	46	2.11	280	<0.01	141	<3	20.47	1.7	7.3
19/GBLD-W-E	Woodridge STP	7.39	24-Jun	0920	31	20.51	8.33	2	0.19	7.20	1036	3	1.60	<10	<0.01	264	<3		3.2	16
20/GBL19	Royce Road in Bolingbrook	5.59	24-Jun	0827	27	24.32	5.51	2	0.27	7.45	1049	42	1.83	310	<0.01	178	<3	32.93	1.8	8
21/GBL-BB-E	Bolingbrook #1 STP	5.50	24-Jun	0910	30	20.80	7.83	<1	0.17	7.62	2362	2	0.88	10	<0.01	205	<3		2.8	10.8
22/GBL13	Hidden Lakes off Boughton Road	4.39	24-Jun	0910	27	24.67	5.63	2	0.23	7.46	1124	55	1.46	360	<0.01	354	<3	32.04	1.9	7.9
	U/S of Foot Bo-Gravel Pit																			
23/GBL-HL-E	Hidden Lakes Fishing Pond Discharge	4.37	24-Jun	0940	27	23.99	8.93	<1	0.05	7.67	1245	28	0.31	210	<0.01	206	<3	5.34	0.02	0.05
	treat as Point Source																			
24/GBL-EC-E	Quary discharge D/S Hidden Lake	4.35	24-Jun					<1	0.16			50	<0.1	-	<0.01	157	<3	0.89	<0.01	<0.01
	Treat as Point Source																			
25/GBL20	U/S Citizen's Utilities W.S. #2 STP	2.85	24-Jun	1730	26	26.09	7.41	1	0.18	7.69	1176	94	1.84	-	<0.01	185	<3	41.83	1.4	6.2
26/GBL-CU-E	Citizen's W.S. #2 STP	2.40	24-Jun	0815	30	19.52	6.70	<1	0.15	7.22	1960	3	0.92	<10	0.014	245	<3		3.2	15.3
27/GBL02	Washington Street near Naperville	1.60	24-Jun	1005	288	24.85	6.81	1	0.05	7.60	1160	74	1.33	260	<0.01	214	<3	34.71	1.3	6.6
	Unnamed Ditch U/A of Royce RD NW	5.6	24-Jun	0850	27	27.07	5.17	1	0.14	7.72	1124	124	1.49	250	<0.01	191	<3		0.21	5.6
	Site of Bridge - This was not ___																			
	on 6/23/97 @ 1700 hrs much higer flow																			
	and turbid																			

TABLE D2 SUMMARY OF DIEL 1 SURVEY DATA JUNE 24-25, 1997 – ROUND 2

EAST BRANCH DUPAGE RIVER WATER QUALITY DATA
DIEL 1 - (JUNE 24 & 25,1997) Round 2 (2:00 PM - 8:00 PM)

Site ID	Site Description	River Mile	Date	Time	Air Temp Degrees C	Air Temp Degrees C	DO mg/L	CBOD mg/L	Ammonia-N mg/L	pH	Conductivity	TSS mg/L	TKN mg/L	Fecal Coliform counts/100mL	Total CN mg/L	Total Chloride mg/L	Total Ag ug/L	Chl a ug/L	Total P mg/L	NO3-NO2 mg/L
1/GBL14	U/S Bloomingdale STP at Glen Ellyn Road	23.80	24-Jun	1250	30	33.14	9.89	2	0.29	8.41	94	16	1.32	-	-	179	-	18.69	0.06	0.09
2/GBL-B-E	Bloomingdale STP	23.70	24-Jun	1625	33	21.42	6.76	1	0.27	7.04	90	6	2.20	-	-	131	-		4.6	18
3/GB/11	Dr's Bloomingdale STP at Army Trail Road	23.67	24-Jun	1305	31	24.33	8.79	1	0.4	7.12	87	17	1.84	-	-	125	-	2.67	4.3	14.7
4/GB/15	Fullerton Ave. in Glendale Heights	22.07	24-Jun	1330	31	31.23	8.68	2	0.27	7.54	898	72	2.18	-	-	136	-	4.45	3.7	12.7
5/GBlg/01	Armitage Ditch V/S of Glendale HTS. STP	21.50	24-Jun	1345	33	33.34	9.32	2	0.18	8.58	122	56	0.98	-	-	283	-	8.01	0.07	0.11
6/GBLG-GH-E	Glendale Heights STP	21.50	24-Jun	1600	33.5	21.28	7.93	1	0.15	7.04	850	6	1.29	-	-	119	-		3	13.7
7GBl16	St. Charles Rd. in Glen Ellyn	19.95	24-Jun	1410	33	26.70	6.45	2	0.5	7.27	950	130	1.87	-	-	152	-	15.13	2.1	9
8GBl17	Hill Ave. in Lombard	18.50	24-Jun	1420	34	29.96	6.35	3	0.66	7.55	980	108	2.64	-	-	158	-	55.13	1.6	5.6
9/GBL08	Roosevelt Rd. (RT. 36) in Glen Ellyn	16.92	24-Jun	1445	34	31.03	5.93	3	0.73	7.68	103	124	2.76	-	-	167	-	48.95	1.2	3.8
10/GBL-GB-E	Glenbard STP	15.90	24-Jun	1530	33.5	19.33	7.37	<1	2.5	7.07	109	7	3.79	-	-	137	-		1.9	6.2
11/GBL09	Butterfield Rd. (Rt. 56)	14.78	24-Jun	1510	34	24.90	6.37	2	1	7.29	109	80	2.72	-	-	161	-	32.13	1.4	4.7
12/GBL13	Rt 53 in Lisle Morton Arboretum	13.06	24-Jun	1535	34	30.56	7.26	2	0.88	7.63	1116	78	2.20	-	-	158	-	31.15	1.3	4.2
13/GBLB01	Ogden Ave. (Rt 34) in Lisle St. Joseph CK.	11.90	24-Jun	1345	33	28.21	9.09	1	0.32	7.97	967	14	1.14	-	-	184	-	2.67	0.29	1.29
14/GBL10	Ogden Ave (Rt 34) in Lisle AWQMN	11.66	24-Jun	1400	33	28.36	7.33	2	0.78	7.56	1110	96	2.24	-	-	177	-	39.16	1.2	3.6
15/GBL-DG-E1	Downers Grove SD STP	11.50	24-Jun	1505	35	29.76	7.41	<1	0.94	7.03	913	5	2.67	-	-	142	-		3.3	16.7
16/GBL051	Maple Ave. in Lise	10.64	24-Jun	1420	33	26.67	7.78	2	0.83	7.36	103	32	2.84	-	-	165	-	24.92	2	3.4
17/GBL12	75th Street near woodridge	7.99	24-Jun	1445	33	27.97	6.98	2	1.1	7.50	107	86	2.89	-	-	169	-	25.81	1.9	6.5
19/GBLD-W-E	Woodridge STP	7.39	24-Jun	1445	34	20.88	8.52	2	0.32	7.27	1022	6	1.29	-	-	172	-		3.3	16.4
20/GBL19	Royce Road in Bolingbrook	5.59	24-Jun	1510	33	26.60	7.24	2	;0.58	7.54	1066	72	2.62	-	-	175	-	42.72	2	8.4
21/GBL-BB-E	Bolingbrook #1 STP	5.50	24-Jun	1430	34	21.62	8.25	<1	0.13	7.64	2262	9	1.10	-	-	496	-		2.8	11.4
22/GBL13	Hidden Lakes off Boughton Road	4.39	24-Jun	1540	33	26.76	7.16	2	0.43	7.58	1125	40	2.30	-	-	185	-	45.37	2	8.8
	U/S of Foot Bo-Gravel Pit																			
23/GBL-HL-E	Hidden Lakes Fishing Pond Discharge	4.37	24-Jun	1558	33	25.48	9.37			7.76	1243	42	<0.1	-	-	156	-	8.90	<0.01	0.01
	treat as Point Source																			
24/GBL-EC-E	Quary discharge D/S Hidden Lake	4.35	24-Jun																	
	Treat as Point Source																			
25/GBL20	U/S Citizen's Utilities W.S. #2 STP	2.85	24-Jun																	
26/GBL-CU-E	Citizen's W.S. #2 STP	2.40	24-Jun	1400	34	20.41	7.53	2	0.24	7.20	2030	10	1.12	-	-	350	-		3.2	15.8
27/GBL02	Washington Street near Naperville	1.60	24-Jun	1635	33	27.08	8.11	1	0.13	7.78	1205	92	1.72	-	-	196	-	46.28	1.4	6.1
	Unnamed Ditch U/A of Royce RD NW	5.6																		
	Site of Bridge - This was not ___																			
	on 6/23/97 @ 1700 hrs much higer flow																			
	and turbid																			

TABLE D3 SUMMARY OF DIEL1 SURVEY DATA JUNE 24-25, 1997 – ROUND 3

EAST BRANCH DUPAGE RIVER WATER QUALITY DATA
DIEL 1 - (JUNE 24 & 25,1997) Round 3 (8:00 PM - 2:00 AM)

Site ID	Site Description	River Mile	Date	Time	Air Temp Degrees C	Air Temp Degrees C	DO mg/L	CBOD mg/L	Ammonia-N mg/L	pH	Conductivity	TSS mg/L	TKN mg/L	Fecal Coliform counts/100mL	Total CN mg/L	Total Chloride mg/L	Total Ag ug/L	Chl a ug/L	Total P mg/L	NO3-NO2 mg/L
1/GBL14	U/S Bloomingdale STP at Glen Ellyn Road	23.80	24-Jun	1901	32	26.90	6.61	3	0.34	7.83	980	32	1.42	-	-	192	-		0.07	0.09
2/GBL-B-E	Bloomingdale STP	23.70	24-Jun	2030	28	21.46	6.43	1	0.39	7.02	900	9	2.28	-	-	128	-		4.8	18.7
3/GB/11	Dr's Bloomingdale STP at Army Trail Road	23.67	24-Jun	1918	31	26.62	6.64	1	0.13	6.85	91	11	1.51	-	-	146	-		4.4	16.5
4/GB/15	Fullerton Ave. in Glendale Heights	22.07	24-Jun	1932	29	26.60	7.35	1	0.20	7.52	93	90	1.77	-	-	146	-		3.5	13.8
5/GBlg/01	Armitage Ditch V/S of Glendale HTS. STP	21.50	24-Jun	1947	31	26.52	4.85	1	0.19	7.52	134	70	0.97	-	-	286	-		0.08	0.28
6/GBLG-GH-E	Glendale Heights STP	21.50	24-Jun	2000	26	20.42	6.78	1	0.19	7.02	869	8	1.57	-	-	108	-		3.2	14.8
7GBl16	St. Charles Rd. in Glen Ellyn	19.95	24-Jun	2002	28.5	26.99	6.30	2	0.38	7.28	986	76	1.90	-	-	152	-		2.1	9.5
8GBl17	Hill Ave. in Lombard	18.50	24-Jun	2022	30	27.22	5.75	3	0.8	7.31	113	112	2.40	-	-	163	-		1.6	5.9
9/GBL08	Roosevelt Rd. (RT. 36) in Glen Ellyn	16.92	24-Jun	2040	29	27.45	5.57	3	0.72	7.49	1109	76	2.48	-	-	167	-		1.1	4.0
10/GBL-GB-E	Glenbard STP	15.90	24-Jun	2040	25	18.92	7.17	1	3.5	7.18	1087	4	3.79	-	-	138	-		1.6	7.6
11/GBL09	Butterfield Rd. (Rt. 56)	14.78	24-Jun	2059	28	24.42	5.43	2	1.3	7.13	1127	34	2.30	-	-	158	-		1.2	5.2
12/GBL13	Rt 53 in Lisle Morton Arboretum	13.06	24-Jun	2125	30	25.50	5.11	2	0.79	7.29	1130	38	2.22	-	-	152	-		1.3	4.4
13/GBLB01	Ogden Ave. (Rt 34) in Lisle St. Joseph CK.	11.90	24-Jun	1900	34	27.96	9.56	1	0.27	8.55	953	14	1.86	-	-	185	-		0.27	1.25
14/GBL10	Ogden Ave (Rt 34) in Lisle AWQMN	11.66	24-Jun	1913	32	28.91	5.95	2	0.64	7.65	1069	86	2.05	-	-	179	-		1.2	4.1
15/GBL-DG-E1	Downers Grove SD STP	11.50	24-Jun	2015	30	20.67	7.01	1	0.94	7.04	9110	6	2.37	-	-	141	-		3.5	17.4
16/GBL051	Maple Ave. in Lise	10.64	24-Jun	1946	32	25.98	6.13	2	0.48	7.53	1014	33	2.30	-	-	172	-		1.8	7.8
17/GBL12	75th Street near woodridge	7.99	24-Jun	2006	33	26.96	6.30	2	0.55	7.59	1004	74	2.09	-	-	167	-		1.8	8.0
19/GBLD-W-E	Woodridge STP	7.39	24-Jun	1950	30	20.42	8.12	3	0.18	7.65	958	11	1.98	-	-	187	-		3.3	18.9
20/GBL19	Royce Road in Bolingbrook	5.59	24-Jun	2032	31	26.24	6.21	2	0.71	7.63	1007	84	2.12	-	-	169	-		2.1	9.1
21/GBL-BB-E	Bolingbrook #1 STP	5.5	24-Jun	2130	33.30	21.35	7.97	1	0.17	7.81	2270	20	1.53	-	-	497	-		2.9	12
22/GBL13	Hidden Lakes off Boughton Road	4.39	24-Jun	2055	30	26.06	6.39	2	0.55	7.72	1081	44	2.09	-	-	187	-		1.9	8.2
	U/S of Foot Bo-Gravel Pit																			
23/GBL-HL-E	Hidden Lakes Fishing Pond Discharge	4.37	24-Jun																	
	treat as Point Source																			
24/GBL-EC-E	Quary discharge D/S Hidden Lake	4.35	24-Jun																	
	Treat as Point Source																			
25/GBL20	U/S Citizen's Utilities W.S. #2 STP	2.85	24-Jun																	
26/GBL-CU-E	Citizen's W.S. #2 STP	2.40	24-Jun	1900	26	20.4	7.26	2	0.28	7.29	2010	4	1.55	-	-	381	-		3.3	17.2
27/GBL02	Washington Street near Naperville	1.60	24-Jun	2117	30	24.9	6.39	1	0.27	7.80	1139	104	1.89	-	-	185	-		1.5	7.1
	Unnamed Ditch U/A of Royce RD NW	5.6																		
	Site of Bridge - This was not ___																			
	on 6/23/97 @ 1700 hrs much higer flow																			
	and turbid																			

TABLE D4 SUMMARY OF DIEL1 SURVEY DATA JUNE 24-25, 1997 – ROUND 4

EAST BRANCH DUPAGE RIVER WATER QUALITY DATA
DIEL 1 - (JUNE 24 & 25,1997) Round 4 (2:00 AM - 8:00 AM)

Site ID	Site Description	River Mile	Date	Time	Air Temp Degrees C	H2O Temp Degrees C	DO mg/L	CBOD mg/L	Ammonia-N mg/L	pH	Conductivity	TSS mg/L	TKN mg/L	Fecal Coliform counts/100mL	Total CN mg/L	Total Chloride mg/L	Total Ag ug/L	Chl a ug/L	Total P mg/L	NO3-NO2 mg/L
1/GBL14	U/S Bloomingdale STP at Glen Ellyn Road	23.80	25-Jun	0100	27	25.15	4.26	2	0.41	7.53	97	19	1.26	-	-	180	-		0.06	0.06
2/GBL-B-E	Bloomingdale STP	23.70	25-Jun	0420	22.11	21.46	6.04	2	0.46	7.23	82	12	1.76	-	-	126	-		4.8	18.4
3/GB/11	Dr's Bloomingdale STP at Army Trail Road	23.67	25-Jun	0111	27.00	21.90	5.35	1	0.4	6.86	89	15	2.16	-	-	132	-		4.3	16.7
4/GB/15	Fullerton Ave. in Glendale Heights	22.07	25-Jun	0125	25	21.81	5.44	1	0.49	7.10	91	68	1.88	-	-	132	-		4.0	15.4
5/GBlg/01	Armitage Ditch V/S of Glendale HTS. STP	21.50	25-Jun	0137	27.5	23	4.50	2	0.37	7.54	128	57	1.26	-	-	277	-		0.06	0.21
6/GBLG-GH-E	Glendale Heights STP	21.50	25-Jun	0400	22.19	20.44	6.36	1	0.19	7.13	83	8	1.45	-	-	119	-		1.6	14.6
7GBl16	St. Charles Rd. in Glen Ellyn	19.95	25-Jun	0156	28	23.58	4.99	1	0.43	7.17	90	60	2.03	-	-	142	-		2.8	10.7
8GBl17	Hill Ave. in Lombard	18.50	25-Jun	0205	27	26.80	4.69	3	0.84	7.38	100	324	2.74	-	-	156	-		2.4	6.0
9/GBL08	Roosevelt Rd. (RT. 36) in Glen Ellyn	16.92	25-Jun	0227	27	25.50	3.82	2	0.77	7.37	107	46	2.45	-	-	171	-		1.1	4.2
10/GBL-GB-E	Glenbard STP	15.90	25-Jun	0320	22.54	18.83	6.48	1	3.5	7.20	108	5	5.03	-	-	144	-		3.7	9.0
11/GBL09	Butterfield Rd. (Rt. 56)	14.78	25-Jun	0241	26	22.68	4.57	2	2.1	7.11	114	28	2.43	-	-	163	-		1.1	5.9
12/GBL13	Rt 53 in Lisle Morton Arboretum	13.06	25-Jun	0252	28	22.88	3.66	1	1.5	7.22	113	42	2.89	-	-	152	-		1.1	5.0
13/GBLB01	Ogden Ave. (Rt 34) in Lisle St. Joseph CK.	11.90	25-Jun	0230	28	23.84	4.85	1	0.31	8.15	940	10	1.58	-	-	181	-		0.24	1.01
14/GBL10	Ogden Ave (Rt 34) in Lisle AWQMN	11.66	25-Jun	0250	28	23.63	0.23	2	0.74	7.61	1050	38	2.34	-	-	176	-		1.1	4.6
15/GBL-DG-E1	Downers Grove SD STP	11.50	25-Jun	0255	22.61	19.95	7.66	1	1.4	7.10	950	8	2.67	-	-	154	-		1.5	18.6
16/GBL051	Maple Ave. in Lise	10.64	25-Jun	0305	28	23.12	4.15	1	0.75	7.57	1015	33	2.18	-	-	169	-		1.8	8.2
17/GBL12	75th Street near woodridge	7.99	25-Jun	0330	27	24.55	0.12	1	0.52	7.77	1012	38	1.72	-	-	174	-		1.7	7.7
19/GBLD-W-E	Woodridge STP	7.39	25-Jun	0225	23	19.21	7.22	3	0.18	7.32	273	14	1.64	-	-	142	-		4.0	19.8
20/GBL19	Royce Road in Bolingbrook	5.59	25-Jun	0110	29	24.55	5.88	2	0.27	7.70	986	41	2.01	-	-	167	-		2.2	10.4
21/GBL-BB-E	Bolingbrook #1 STP	5.50	25-Jun	0260	23.20	20.49	12.41	1	0.16	7.32	237	12	0.94	-	-	512	-		2.5	14.2
22/GBL13	Hidden Lakes off Boughton Road	4.39	25-Jun	0135	29	24.85	5.55	2	0.38	7.72	1061	112	2.02	-	-	206	-		2.2	10.7
	U/S of Foot Bo-Gravel Pit																			
23/GBL-HL-E	Hidden Lakes Fishing Pond Discharge	4.37	25-Jun																	
	treat as Point Source																			
24/GBL-EC-E	Quary discharge D/S Hidden Lake	4.35	25-Jun																	
	Treat as Point Source																			
25/GBL20	U/S Citizen's Utilities W.S. #2 STP	2.85	25-Jun																	
26/GBL-CU-E	Citizen's W.S. #2 STP	2.40	25-Jun	0140	21.98	19.75	7.31	2	0.18	7.36	1940	7	1.37	-	-	373	-		3.5	18.1
27/GBL02	Washington Street near Naperville	1.60	25-Jun	0158	28	24.10	5.64	2	0.44	7.85	1124	116	2.08	-	-	185	-		2.5	6.3
	Unnamed Ditch U/A of Royce RD NW	5.6																		
	Site of Bridge - This was not ___																			
	on 6/23/97 @ 1700 hrs much higer flow																			
	and turbid																			

TABLE D5 SUMMARY OF DIEL2 SURVEY DATA SEPTEMBER 16-17, 1997– ROUND 1

EAST BRANCH DUPAGE RIVER WATER QUALITY DATA
DIEL 2 - (SEPTEMBER 16-17,1997) Round 1 (8:00 AM - 2:00 PM)

Site ID	Site Description	River Mile	Date	Time	Air Temp Degrees C	H2O Temp Degrees C	DO mg/L	CBOD mg/L	Ammonia-N mg/L	pH	Conductivity	TSS mg/L	TKN mg/L	Fecal Coliform counts/100mL	Total CN mg/L	Total Chloride mg/L	Total Ag ug/L	Chl a ug/L	Total P mg/L	NO3-NO2 mg/L
1/GBL14	U/S Bloomingdale STP at Glen Ellyn Road	23.80																		
2/GBL-B-E	Bloomingdale STP	23.70	16-Sep	0800	22	23.18	6.22	1	0.46	6.91	761		0.96	120	0.01	104	<3	-	5.2	14.8
3/GB/11	Dr's Bloomingdale STP at Army Trail Road	23.67	16-Sep	0715	18	21.72	6.13	2	0.19	7.00	768		1.2	500	<0.01	103	<3	5.34	4.6	13.7
4/GB/15	Fullerton Ave. in Glendale Heights	22.07	16-Sep	0745	18	19.6	600	1	0.26	6.98	778		1.3	1400	<0.01	106	<3	9.61	4.6	13.2
5/GBlg/01	Armitage Ditch V/S of Glendale HTS. STP	21.50	16-Sep	0810	19	19.43	6.81	2	0.36	7.65	172		0.81	3700	<0.01	339	<3	9.35	0.08	0.11
6/GBLG-GH-E	Glendale Heights STP	21.59	16-Sep	0825	22	22.4	5.82	1	0.47	6.92	700		0.74	30	<0.01	89.5	<3	-	2.8	8.8
7GBl16	St. Charles Rd. in Glen Ellyn	19.95	16-Sep	0830	20	20.49	6.01	<1	0.29	7.1	801		1.6	220	<0.01	104	<3	8.01	3.5	9.6
8GBl17	Hill Ave. in Lombard	18.50	16-Sep	0900	20	21.67	9.94	3	0.39	8.1	850		1.4	220	0.02	115	<3	74.76	2.0	9.1
9/GBL08	Roosevelt Rd. (RT. 36) in Glen Ellyn	16.92	16-Sep	0945	23	20.84	7.19	2	0.47	7.56	981		1.7	600	0.02	123	<3	56.96	1.7	7.6
10/GBL-GB-E	Glenbard STP	15.90	16-Sep	0850	22.5	20.92	8.72	<1	0.51	6.86	980		1.1	40	0.01	119	<3	-	2.5	14.3
11/GBL09	Butterfield Rd. (Rt. 56)	14.78	16-Sep	1010	24	21.24	7.55	3	0.22	7.25	103		1.2	600	0.01	128	<3	49.84	1.6	9.1
12/GBL13	Rt 53 in Lisle Morton Arboretum	13.06	16-Sep	0650	17	20.2	6.20	2	0.63	7.1	100		1.4	800	<0.01	134	<3	19.35	1.6	9.4
13/GBLB01	Ogden Ave. (Rt 34) in Lisle St. Joseph CK.	11.90	16-Sep	0730	17	20.4	7.2	6	0.17	7.6	118		2.6	130	<0.01	249	<3	204.92	0.42	0.11
14/GBL10	Ogden Ave (Rt 34) in Lisle AWQMN	11.66	16-Sep	0757	18.5	20.3	6.1	2	0.57	7.4	102		1.7	1200	<0.01	138	<3	36.85	1.6	9.1
15/GBL-DG-E1	Downers Grove SD STP	11.50	16-Sep	0815	22.5	21.94	6.85	2	0.98	6.98	820		1.6	20	0.02	123	<3	-	3.9	15
16/GBL051	Maple Ave. in Lise	10.64	16-Sep	0850	19.5	20.9	6.5	2	0.58	7.4	960		1.3	900	<0.01	136	<3	38.98	2.2	10.2
17/GBL12	75th Street near woodridge	7.99	16-Sep	0845	20	21.3	6.3	2	0.51	7.4	910		1.1	400	<0.01	123	<3	34.71	2.4	10.5
19/GBLD-W-E	Woodridge STP	7.39	16-Sep	0940	22.5	22.32	7.45	2	0.43	7.05	903		1.4	20	0.01	134	<3	-	3.3	20.1
20/GBL19	Royce Road in Bolingbrook	5.59	16-Sep	0900	20	21.6	6	2	0.33	7.4	916		1.2	500	<0.01	-	-	38.05	2.3	11
21/GBL-BB-E	Bolingbrook #1 STP	5.50	16-Sep	0952	22.5	22.1	6.47	1	0.12	7.42	256		0.76	20	0.03	541	<3	-	3.3	11.7
22/GBL13	Hidden Lakes off Boughton Road	4.39	16-Sep	0952	21	21.7	6.5	2	0.44	7.5	1030		1.1	1000	<0.01	163	<3	32.71	2.2	11
	U/S of Foot Bo-Gravel Pit																			
23/GBL-HL-E	Hidden Lakes Fishing Pond Discharge	4.37	16-Sep	0925	21	19.1	8.6	<1	0.27	7.6	1253		0.29	100	<0.01	144	<3	2.67	0.01	0.11
	treat as Point Source																			
24/GBL-EC-E	Quary discharge D/S Hidden Lake	4.35	16-Sep	0925									-	-	-	-	-	-	-	-
	Treat as Point Source																			
25/GBL20	U/S Citizen's Utilities W.S. #2 STP		16-Sep	0930		21.07	7.05	2	0.22	7.68	1040		1.1	600	<0.01	149	<3	28.7	1.6	8.6
26/GBL-CU-E	Citizen's W.S. #2 STP	2.40	16-Sep	1005	22.5	21.86	6.5	1	0.2	7.36	201		1.1	120	0.03	349	<3	-	3.6	16
27/GBL02	Washington Street near Naperville		16-Sep	1000		21.7	8.0	2	0.18	8.0	416		0.82	900	<0.01	167	<3	36.49	1.6	13.1
	Unnamed Ditch U/A of Royce RD NW	5.6											0.87	55	<0.01	138	<3		0.13	10
	Site of Bridge - This was not ___																			
	on 6/23/97 @ 1700 hrs much higer flow																			
	and turbid																			

TABLE D6 SUMMARY OF DIEL2 SURVEY DATA SEPTEMBER 16-17, 1997– ROUND 2

EAST BRANCH DUPAGE RIVER WATER QUALITY DATA
DIEL 2 - (SEPTEMBER 16-17,1997) Round 2 (2:00 PM - 8:00 PM)

Site ID	Site Description	River Mile	Date	Time	Air Temp Degrees C	H2O Temp Degrees C	DO mg/L	CBOD mg/L	Ammonia-N mg/L	pH	Conductivity	TSS mg/L	TKN mg/L	Fecal Coliform counts/100mL	Total CN mg/L	Total Chloride mg/L	Total Ag ug/L	Chl a ug/L	Total P mg/L	NO3-NO2 mg/L
1/GBL14	U/S Bloomingdale STP at Glen Ellyn Road	23.80																		
2/GBL-B-E	Bloomingdale STP	23.70	16-Sep	1300	28.2	23.5	7.23	1	0.12	6.86	700	1.3	1.3	-	-	103	-		5.1	15.8
3/GB/11	Dr's Bloomingdale STP at Army Trail Road	23.67	16-Sep	1234	29	24.67	6.42	2	0.05	7.17	770	1.1	1.1	-	-	102	-	4.73	4.9	15.1
4/GB/15	Fullerton Ave. in Glendale Heights	22.07	16-Sep	1253	26	26.79	5.82	1	0.06	7.65	779	1.2	1.2	-	-	109	-	5.34	4.4	14.2
5/GBlg/01	Armitage Ditch V/S of Glendale HTS. STP	21.50	16-Sep	1307	23	24.59	5.67	2	0.16	7.95	166	1.1	1.1	-	-	329	-	8.01	<0.01	0.01
6/GBLG-GH-E	Glendale Heights STP	21.59	16-Sep	1318	28.5	23.14	6.87	1	0.19	7.07	68	0.72	0.72	-	-	88.6	-	-	2.9	9.0
7GBl16	St. Charles Rd. in Glen Ellyn	19.95	16-Sep	1323	24	22.1	4.68	<1	0.21	7.16	83	1.1	1.1	-	-	107	-	3.74	3.0	9.6
8GBl17	Hill Ave. in Lombard	18.50	16-Sep	1337	25	23.12	5.49	4	0.11	8.28	84	1.6	1.6	-	-	123	-	110.14	2.2	9.7
9/GBL08	Roosevelt Rd. (RT. 36) in Glen Ellyn	16.92	16-Sep	1404	26	24.71	5.35	2	0.11	7.97	103	1.7	1.7	-	-	144	-	54.07	1.5	7.2
10/GBL-GB-E	Glenbard STP	15.90	16-Sep	1338	28.5	21.85	7.67	2	0.53	7.09	970	1.6	1.6	-	-	118	-	-	2.8	13.3
11/GBL09	Butterfield Rd. (Rt. 56)	14.78	16-Sep	1425	27	23.32	5	2	0.21	7.19	103	1.6	1.6	-	-	131	-	27.23	2.0	10.8
12/GBL13	Rt 53 in Lisle Morton Arboretum	13.06	16-Sep	1304	29	24.6	10.3	3	0.15	7.7	100	1.4	1.4	-	-	137	-	57.41	0.25	8.9
13/GBLB01	Ogden Ave. (Rt 34) in Lisle St. Joseph CK.	11.90	16-Sep	1325	29	23.8	13	6	0.11	8.6	124	1.6	1.6	-	-	301	-	144.18	0.29	0.05
14/GBL10	Ogden Ave (Rt 34) in Lisle AWQMN	11.66	16-Sep	1345	29	23.7	9.1	2	0.34	7.9	1000	1.6	1.6	-	-	140	-	65.42	1.5	9.4
15/GBL-DG-E1	Downers Grove SD STP	11.50	16-Sep	1405	28.5	22.62	7.36	2	0.31	6.89	820	1.2	1.2	-	-	125	-	-	4.0	16.5
16/GBL051	Maple Ave. in Lise	10.64	16-Sep	1407	29	24.9	9.7	2	0.41	7.6	934	1.2	1.2	-	-	138	-	37.38	2.4	12.2
17/GBL12	75th Street near woodridge	7.99	16-Sep	1440	29.5	24.5	11.5	2	0.19	7.9	955	1.4	1.4	-	-	136	-	56.07	2.0	10.1
19/GBLD-W-E	Woodridge STP	7.39	16-Sep	1425	28.5	22.73	7.14	1	1.2	7.02	905	2.5	2.5	-	-	138	-	-	2.2	17.8
20/GBL19	Royce Road in Bolingbrook	5.59	16-Sep	1502	29.5	25	9.1	2	0.26	7.8	903	1.4	1.4	-	-	135	-	44.72	2.4	13.2
21/GBL-BB-E	Bolingbrook #1 STP	5.50	16-Sep	1435	28	22.5	6.86	1	0.19	7.45	248	0.92	0.92	-	-	234	-	-	3.3	11.5
22/GBL13	Hidden Lakes off Boughton Road	4.39	16-Sep	1535	31	24.3	9.1	2	0.13	7.7	993	0.94	0.94	-	-	155	-	43.39	2.5	12.7
	U/S of Foot Bo-Gravel Pit																			
23/GBL-HL-E	Hidden Lakes Fishing Pond Discharge	4.37	16-Sep	1535	31	21.3	8.7	<1	0.22	7.7	1249	0.29	0.29	-	-	146	-	2.67	0.02	0.16
	Treat as Point Source																			
24/GBL-EC-E	Quary discharge D/S Hidden Lake	4.35											-	-	-	-	-	-	-	-
	Treat as Point Source																			
25/GBL20	U/S Citizen's Utilities W.S. #2 STP												-	-	-	-	-	-	-	-
26/GBL-CU-E	Citizen's W.S. #2 STP	2.40	16-Sep	1450	28	22.17	6.54	1	0.21	7.42	203	1.3	1.3	-	-	527	-	-	3.6	16.2
27/GBL02	Washington Street near Naperville		16-Sep	1405	30.5	24.3	10.2	1	0.11	8.0	1127	0.91	0.91	-	-	178	-	35.38	1.8	8.9

TABLE D7 SUMMARY OF DIEL2 SURVEY DATA SEPTEMBER 16-17, 1997– ROUND 3

EAST BRANCH DUPAGE RIVER WATER QUALITY DATA
DIEL 2 - (SEPTEMBER 16-17,1997) Round 3 (8:00 PM - 2:00 AM)

Site ID	Site Description	River Mile	Date	Time	Air Temp Degrees C	H2O Temp Degrees C	DO mg/L	CBOD mg/L	Ammonia-N mg/L	pH	Conductivity	TSS mg/L	TKN mg/L	Fecal Coliform counts/100mL	Total CN mg/L	Total Chloride mg/L	Total Ag ug/L	Chl a ug/L	Total P mg/L	NO3-NO2 mg/L
1/GBL14	U/S Bloomingdale STP at Glen Ellyn Road	23.80																		
2/GBL-B-E	Bloomingdale STP	23.70	16-Sep	1915	23.65	23.47	6.50	<1	0.13	6.94	713		1.2			113			5.4	18.6
3/GB/11	Dr's Bloomingdale STP at Army Trail Road	23.67	16-Sep	1922	29.00	23.40	6.73	1	0.12	7.02	772		1.0			101			5.2	18.1
4/GB/15	Fullerton Ave. in Glendale Heights	22.07	16-Sep	1941	28.50	25.32	9.08	2	0.66	7.77	751		1.1			102			4.2	13.7
5/GBlg/01	Armitage Ditch V/S of Glendale HTS. STP	21.50	16-Sep	1959	29.00	22.99	8.30	1	0.19	7.70	1479		0.74			327			0.05	0.03
6/GBLG-GH-E	Glendale Heights STP	21.59	16-Sep	1735	23.12	22.85	6.94	1	0.16	6.94	706		0.92			90.2			3.0	10.1
7GBl16	St. Charles Rd. in Glen Ellyn	19.95	16-Sep	2018	29.02	24.70	6.59	1	0.19	7.28	761		1.5			99.1			2.9	9.3
8GBl17	Hill Ave. in Lombard	18.50	16-Sep	2051	29.00	25.22	9.58	2	0.23	7.46	1140		1.6			122			2.0	8.8
9/GBL08	Roosevelt Rd. (RT. 36) in Glen Ellyn	16.92	16-Sep	2116	29.00	24.28	8.98	6	0.10	8.22	958		2.8			133			1.6	7.0
10/GBL-GB-E	Glenbard STP	15.90	16-Sep	2025	22.85	21.16	7.30	<1	0.76	6.97	999		1.8			122			2.6	12.2
11/GBL09	Butterfield Rd. (Rt. 56)	14.78	16-Sep	2135	29.00	22.52	7.65	2	0.42	7.26	1014		2.0			132			1.9	10.3
12/GBL13	Rt 53 in Lisle Morton Arboretum	13.06	16-Sep	1852	26.00	25.19	8.81	2	0.05	7.52	1025		1.5			128			1.9	9.5
13/GBLB01	Ogden Ave. (Rt 34) in Lisle St. Joseph CK.	11.90	16-Sep	1915	25.00	23.66	11.33	6	0.15	8.67	1250		1.4			268			0.22	0.11
14/GBL10	Ogden Ave (Rt 34) in Lisle AWQMN	11.66	16-Sep	1950	26.00	24.87	8.21	2	0.21	7.70	1014		1.4			127			1.7	9.3
15/GBL-DG-E1	Downers Grove SD STP	11.50	16-Sep	2055	22.20	22.50	7.09	2	0.79	6.80	850		2.0			135			4.1	16.9
16/GBL051	Maple Ave. in Lise	10.64	16-Sep	2015	25.00	23.66	7.49	2	0.09	7.40	966		1.6			130			2.4	11.2
17/GBL12	75th Street near woodridge	7.99	16-Sep	2050	-	24.02	8.74	2	0.11	7.67	957		1.3			129			2.3	11.4
19/GBLD-W-E	Woodridge STP	7.39	16-Sep	2115	23.09	22.42	7.47	1	0.11	7.63	890		1.1			159			2.0	18.6
20/GBL19	Royce Road in Bolingbrook	5.59	16-Sep	2110	25.00	23.77	8.90	2	0.28	7.73	951		1.3			137			2.1	12.1
21/GBL-BB-E	Bolingbrook #1 STP	5.50	16-Sep	2135	23.09	22.42	7.75	1	0.18	7.13	2520		0.82			555			3.3	11.3
22/GBL13	Hidden Lakes off Boughton Road	4.39	16-Sep	2130	26.00	23.64	8.61	2	0.14	7.76	1033		1.8			148			2.0	0.11
	U/S of Foot Bo-Gravel Pit																			
23/GBL-HL-E	Hidden Lakes Fishing Pond Discharge	4.37	16-Sep	-	-	-	-	-	-	-	-		-			-			-	-
	treat as Point Source																			
24/GBL-EC-E	Quary discharge D/S Hidden Lake	4.35	16-Sep	-	-	-	-	-	-	-	-		-			-			-	-
	Treat as Point Source																			
25/GBL20	U/S Citizen's Utilities W.S. #2 STP		16-Sep	-	-	-	-	-	-	-	-		-			-			-	-
26/GBL-CU-E	Citizen's W.S. #2 STP	2.40	16-Sep	2205	22.8	21.98	5.88	1	0.18	725	2190		1.5			432			3.8	19.5
27/GBL02	Washington Street near Naperville		16-Sep	2210									1.1			165			2.2	11.2

TABLE D8 SUM SUMMARY OF DIEL2 SURVEY DATA SEPTEMBER 16-17, 1997– ROUND 4

EAST BRANCH DUPAGE RIVER WATER QUALITY DATA
DIEL 2 - (SEPTEMBER 16-17,1997) Round 4 (2:00 AM - 8:00 AM)

Site ID	Site Description	River Mile	Date	Time	Air Temp Degrees C	H2O Temp Degrees C	DO mg/L	CBOD mg/L	Ammonia-N mg/L	pH	Conductivity	TSS mg/L	TKN mg/L	Fecal Coliform counts/100mL	Total CN mg/L	Total Chloride mg/L	Total Ag ug/L	Chl a ug/L	Total P mg/L	NO3-NO2 mg/L
1/GBL14	U/S Bloomingdale STP at Glen Ellyn Road	23.80																		
2/GBL-B-E	Bloomingdale STP	23.70	17-Sep	0115	23.56	23.40	6.48	1	0.12	6.97	79		1.2			10.3			5.4	17.8
3/GB/11	Dr's Bloomingdale STP at Army Trail Road	23.67	17-Sep	0355	23.00	22.81	6.71	3	0.14	7.53	55		1.1			82.8			1.5	5
4/GB/15	Fullerton Ave. in Glendale Heights	22.07	17-Sep	0427	23.00	22.03	6.55	3	0.24	7.25	53		0.85			84			1.4	3.5
5/GBlg/01	Armitage Ditch V/S of Glendale HTS. STP	21.50	17-Sep	0437	22	21.41	7.73	4	0.17	7.5	39		0.77			55.3			0.18	0.67
6/GBLG-GH-E	Glendale Heights STP	21.59	17-Sep	0130	21.17	22.62	5.62	1	1	6.96	73		2.2			95.2			3.2	8.3
7GBl16	St. Charles Rd. in Glen Ellyn	19.95	17-Sep	0452	22	21.77	5.75	4	0.28	7.08	42		1.5			62.2			1.4	2.8
8GBl17	Hill Ave. in Lombard	18.50	17-Sep	0510	23	23.05	9.60	3	0.14	8.37	766		1.5			113			1.7	7.7
9/GBL08	Roosevelt Rd. (RT. 36) in Glen Ellyn	16.92	17-Sep	0533	23	21.80	5.97	4	0.43	7.48	73		1.8			98			0.94	3.9
10/GBL-GB-E	Glenbard STP	15.90	17-Sep	0215	21.06	21.52	7.62	2	2	6.84	98		3.3			117			3.3	11.4
11/GBL09	Butterfield Rd. (Rt. 56)	14.78	17-Sep	0552	23	21.84	6.33	4	0.84	7.14	78		2.5			100			1.2	4.1
12/GBL13	Rt 53 in Lisle Morton Arboretum	13.06	17-Sep	0310	22	21.77	6.52	3	0.36	7.3	52		2.2			71.1			1.2	4
13/GBLB01	Ogden Ave. (Rt 34) in Lisle St. Joseph CK.	11.90	17-Sep	0345	20	21.56	7.25	5	0.27	7.42	25		1.4			37.2			0.34	0.91
14/GBL10	Ogden Ave (Rt 34) in Lisle AWQMN	11.66	17-Sep	0350	20	21.79	6.44	5	0.32	7.35	39		2.1			48.5			0.84	2.3
15/GBL-DG-E1	Downers Grove SD STP	11.50	17-Sep	0245	20.69	22.35	5.88	2	0.70	6.83	857		2.2			128			4.1	16.6
16/GBL051	Maple Ave. in Lise	10.64	17-Sep	0405	20	21.76	6.25	4	0.36	7.28	552		2.4			74.2			1.4	4.7
17/GBL12	75th Street near woodridge	7.99	17-Sep	0425	20	22.1	6.0	4	0.31	7.36	48		2.4			58.5			1.4	3.8
19/GBLD-W-E	Woodridge STP	7.39	17-Sep	0320	20.19	22.18	7.69	2	2.7	7.2	875		4.4			149			2.8	15.1
20/GBL19	Royce Road in Bolingbrook	5.59	17-Sep	0445	20	22.56	6.6	3	0.37	7.45	750		2.1			107			1.8	8.8
21/GBL-BB-E	Bolingbrook #1 STP	5.50	17-Sep	0340	20.8	22.34	7.64	1	0.10	7.61	261		0.77			1720			3.3	13.6
22/GBL13	Hidden Lakes off Boughton Road	4.39	17-Sep	0510	20	22.34	6.44	2	0.30	7.52	730		2.5			113			1.9	7.2
	U/S of Foot Bo-Gravel Pit																			
23/GBL-HL-E	Hidden Lakes Fishing Pond Discharge	4.37	17-Sep										-			-			-	-
	treat as Point Source																			
24/GBL-EC-E	Quary discharge D/S Hidden Lake	4.35	17-Sep										-			-			-	-
	Treat as Point Source																			
25/GBL20	U/S Citizen's Utilities W.S. #2 STP		17-Sep										-			-			-	-
26/GBL-CU-E	Citizen's W.S. #2 STP	2.40	17-Sep	0415	20.99	21.7	5.78	2	0.29	7.26	2080		2.0			-			3.6	15.8
27/GBL02	Washington Street near Naperville		17-Sep	0530	21	22.63	6.33	3	0.27	7.55	979		1.8			14.8			2	10.8

TABLE D-9: SEDIMENT OXYGEN DEMAND DATA

Station ID	River Mile	Date	Time	True SOD ($g/m^2/day$)
GBL-15	22.07	9/24/1997	1257-1430	1.03
GBL-17	18.50	9/16/1997	1425-1557	0.56
GBL-08	16.92	9/16/1997	1638-1803	1.64
GBL-07	14.78	9/24/1997	0945-1120	1.37
GBL-05	10.64	9/16/1997	1139-1307	0.99
GBL-19	5.59	9/24/1997	1211-1363	1.17
GBL-13	4.39	9/24/1997	0925-1050	1.47
GBL-02	1.80	9/16/1997	0730-0908	0.20

Appendix E: QUAL2E Input Files

TABLE E1 CALIBRATION INPUT FOR QUAL2E

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* * * QUAL-2E  STREAM QUALITY ROUTING MODEL * * *
                                                           Version 3.22  --  May 1996

          $$$ (PROBLEM TITLES) $$$

         CARD TYPE                             QUAL-2E PROGRAM TITLES
         TITLE01              East Branch - Calibration Run - June 24-25, 1997
         TITLE02
         TITLE03  YES         CONSERVATIVE MINERAL I     Cond IN
         TITLE04  NO          CONSERVATIVE MINERAL II
         TITLE05  NO          CONSERVATIVE MINERAL III
         TITLE06  YES         TEMPERATURE
         TITLE07  YES         5-DAY BIOCHEMICAL OXYGEN DEMAND
         TITLE08  YES         ALGAE AS CHL-A IN UG/L
         TITLE09  YES         PHOSPHORUS CYCLE AS P IN MG/L
         TITLE10                (ORGANIC-P; DISSOLVED-P)
         TITLE11  YES         NITROGEN CYCLE AS N IN MG/L
         TITLE12                (ORGANIC-N; AMMONIA-N; NITRITE-N;' NITRATE-N)
         TITLE13  YES         DISSOLVED OXYGEN IN MG/L
         TITLE14  NO          FECAL COLIFORM IN NO./100 ML
         TITLE15  NO          ARBITRARY NON-CONSERVATIVE
         ENDTITLE

          $$$ DATA TYPE 1 (CONTROL DATA) $$$

         CARD TYPE                                    CARD TYPE
         LIST DATA INPUT             0.00000                                  0.00000
         NO WRITE OPTIONAL SUMMARY   0.00000                                  0.00000
         NO FLOW AUGMENTATION        0.00000                                  0.00000
         STEADY STATE                0.00000                                  0.00000
         TRAPAZOIDAL                 0.00000                                  0.00000
         NO PRINT LCD/SOLAR DATA     0.00000                                  0.00000
         NO PLOT DO AND BOD DATA     0.00000                                  0.00000
         FIXED DNSTM CONC (YES=1)=   0.00000          5D-ULT BOD CONV K COEF  =   0.23000
         INPUT METRIC           =    0.00000          OUTPUT METRIC           =   0.00000
         NUMBER OF REACHES      =   14.00000          NUMBER OF JUNCTIONS     =   0.00000
         NUM OF HEADWATERS      =    1.00000          NUMBER OF POINT LOADS   =   7.00000
         TIME STEP (HOURS)      =    1.00000          LNTH. COMP. ELEMENT (DX)=   0.20000
         MAXIMUM ROUTE TIME (HRS)=  30.00000          TIME INC. FOR RPT2 (HRS)=   1.00000
         LATITUDE OF BASIN (DEG) =  34.00000          LONGITUDE OF BASIN (DEG)=  85.00000
         STANDARD MARIDIAN (DEG) =  75.00000          DAY OF YEAR START TIME  = 180.00000
         EVAP. COEF.,(AE)       =    0.00103          EVAP. COEF.,(BE)        =   0.00016
         ELEV. OF BASIN (ELEV)   =1000.00000          DUST ATTENUATION COEF.  =   0.06000
         ENDATA1                     0.00000                                  0.00000

          $$$ DATA TYPE 1A (ALGAE PRODUCTION AND NITROGEN OXIDATION CONSTANTS) $$$

         CARD TYPE                                           CARD TYPE
         O UPTAKE BY NH3 OXID(MG O/MG N)=    3.4300          O UPTAKE BY NO2 OXID(MG O/MG N)=    1.1400
         O PROD  BY ALGAE (MG O/MG A)   =    1.6000          O UPTAKE BY ALGAE (MG O/MG A)  =    2.0000
         N CONTENT OF ALGAE (MG N/MG A) =    0.0850          P CONTENT OF ALGAE (MG O/MG A) =    0.0140
         ALG MAX SPEC GROWTH RATE(1/DAY)=    2.5000          ALGAE RESPIRATION RATE (1/DAY) =    0.0500
         N HALF SATURATION CONST (MG/L) =    0.2000          P HALF SATURATION CONST (MG/L) =    0.0400
         LIN ALG SHADE CO (1/FT-UGCHA/L=)    0.0008          NLIN SHADE(1/FT-(UGCHA/L)**2/3)=    0.0000
         LIGHT FUNCTION OPTION (LFNOPT) =    1.0000          LIGHT SAT'N COEF (BTU/FT2-MIN) =    0.1100
         DAILY AVERAGING OPTION (LAVOPT)=    2.0000          LIGHT AVERAGING FACTOR (AFACT) =    0.9200
         NUMBER OF DAYLIGHT HOURS (DLH) =   14.0000          TOTAL DAILY SOLR RAD (BTU/FT-2)= 1300.0000
         ALGY GROWTH CALC OPTION(LGROPT)=    2.0000          ALGAL PREF FOR NH3-N (PREFN)   =    0.9000
         ALG/TEMP SOLR RAD FACTOR(TFACT)=    0.4400          NITRIFICATION INHIBITION COEF  =   10.0000
         ENDATA1A                            0.0000                                              0.0000

          $$$ DATA TYPE 1B (TEMPERATURE CORRECTION CONSTANTS FOR RATE COEFFICIENTS) $$$

         CARD TYPE     RATE CODE     THETA VALUE

         THETA( 1)      BOD DECA        1.047     USER
         THETA( 2)      BOD SETT        1.024     USER
         THETA( 3)      OXY TRAN        1.024     USER
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THETA( 4)      SOD RATE        1.060     USER
THETA( 5)      ORGN DEC        1.047     USER
THETA( 6)      ORGN SET        1.024     USER
THETA( 7)      NH3 DECA        1.083     USER
THETA( 8)      NH3 SRCE        1.074     USER
THETA( 9)      NO2 DECA        1.047     USER
THETA(10)      PORG DEC        1.047     USER
THETA(11)      PORG SET        1.024     USER
THETA(12)      DISP SRC        1.074     USER
THETA(13)      ALG GROW        1.047     USER
THETA(14)      ALG RESP        1.047     USER
THETA(15)      ALG SETT        1.024     USER
THETA(16)      COLI DEC        1.047     DFLT
THETA(17)      ANC DECA        1.000     DFLT
THETA(18)      ANC SETT        1.024     DFLT
THETA(19)      ANC SRCE        1.000     DFLT
ENDATA1B

 $$$ DATA TYPE 2 (REACH IDENTIFICATION) $$$

CARD TYPE           REACH ORDER AND IDENT              R. MI/KM            R. MI/KM
STREAM REACH     1.0  RCH=         Reach 1   FROM         24.0     TO          23.4
STREAM REACH     2.0  RCH=         Reach 2   FROM         23.4     TO          20.2
STREAM REACH     3.0  RCH=         Reach 3   FROM         20.2     TO          19.4
STREAM REACH     4.0  RCH=         Reach 4   FROM         19.4     TO          18.0
STREAM REACH     5.0  RCH=         Reach 5   FROM         18.0     TO          16.2
STREAM REACH     6.0  RCH=         Reach 6   FROM         16.2     TO          14.8
STREAM REACH     7.0  RCH=         Reach 7   FROM         14.8     TO          13.0
STREAM REACH     8.0  RCH=         Reach 8   FROM         13.0     TO          12.0
STREAM REACH     9.0  RCH=         Reach 9   FROM         12.0     TO           9.6
STREAM REACH    10.0  RCH=        Reach 10   FROM          9.6     TO           8.4
STREAM REACH    11.0  RCH=        Reach 11   FROM          8.4     TO           6.0
STREAM REACH    12.0  RCH=        Reach 12   FROM          6.0     TO           4.4
STREAM REACH    13.0  RCH=        Reach 13   FROM          4.4     TO           2.2
STREAM REACH    14.0  RCH=        Reach 14   FROM          2.2     TO           0.0
ENDATA2          0.0                                       0.0                  0.0

 $$$ DATA TYPE 3 (TARGET LEVEL DO AND FLOW AUGMENTATION SOURCES) $$$

CARD TYPE                  REACH  AVAIL HDWS TARGET     ORDER OF AVAIL SOURCES
ENDATA3                     0.         0.       0.0  0.   0.   0.   0.   0.   0.

 $$$ DATA TYPE 4 (COMPUTATIONAL REACH FLAG FIELD) $$$

CARD TYPE        REACH ELEMENTS/REACH             COMPUTATIONAL FLAGS
FLAG FIELD        1.        3.          1.6.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        2.       16.          2.2.2.2.2.2.2.2.2.6.2.2.2.2.2.2.0.0.0.0.
FLAG FIELD        3.        4.          2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        4.        7.          2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        5.        9.          2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        6.        7.          2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        7.        9.          2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        8.        5.          2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        9.       12.          2.2.6.2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       10.        6.          2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       11.       12.          2.2.2.2.2.6.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       12.        8.          2.2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       13.       11.          2.2.2.2.2.2.2.2.2.2.6.2.0.0.0.0.0.0.0.0.
FLAG FIELD       14.       11.          2.2.2.2.2.2.2.2.2.2.5.0.0.0.0.0.0.0.0.0.
ENDATA4           0.        0.          0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.

 $$$ DATA TYPE 5 (HYDRAULIC DATA FOR DETERMINING VELOCITY AND DEPTH) $$$

CARD TYPE        REACH  COEF-DSPN    SS1       SS2     WIDTH     SLOPE     CMANN
HYDRAULICS        1.     60.00     1.000     1.000     5.000     0.002     0.050
HYDRAULICS        2.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        3.     60.00     1.000     1.000   260.000     0.001     0.050
HYDRAULICS        4.     60.00     1.000     1.000    10.000     0.000     0.050
HYDRAULICS        5.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        6.     60.00     1.000     1.000    15.000     0.001     0.050
HYDRAULICS        7.     60.00     1.000     1.000    18.000     0.001     0.050
HYDRAULICS        8.     60.00     1.000     1.000    20.000     0.001     0.050
HYDRAULICS        9.     60.00     1.000     1.000    23.000     0.001     0.050
HYDRAULICS       10.     60.00     1.000     1.000    26.000     0.001     0.050
HYDRAULICS       11.     60.00     1.000     1.000    30.000     0.001     0.050
HYDRAULICS       12.     60.00     1.000     1.000    35.000     0.000     0.050
HYDRAULICS       13.     60.00     1.000     1.000    42.000     0.000     0.050
HYDRAULICS       14.     60.00     1.000     1.000    45.000     0.000     0.050
ENDATA5           0.      0.00     0.000     0.000     0.000     0.000     0.000

 $$$ DATA TYPE 5A (STEADY STATE TEMPERATURE AND CLIMATOLOGY DATA) $$$
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CARD TYPE	REACH	ELEVATION	DUST COEF	CLOUD COVER	DRY BULB TEMP	WET BULB TEMP	ATM PRESSURE	WIND	SOLAR RAD ATTENUATION
TEMP/LCD	1.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	2.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	3.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	4.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	5.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	6.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	7.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	8.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	9.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	10.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	11.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	12.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	13.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	14.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
ENDATA5A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6 (REACTION COEFFICIENTS FOR DEOXYGENATION AND REAERATION) $$$

CARD TYPE	REACH	K1	K3	SOD RATE	K2OPT	K2	COEQK2 OR TSIV COEF FOR OPT 8	OR	EXPQK2 OR SLOPE FOR OPT 8
REACT COEF	1.	0.14	0.00	0.100	1.	2.00	0.000		0.00000
REACT COEF	2.	0.14	0.01	0.100	1.	2.00	0.000		0.00000
REACT COEF	3.	0.14	0.02	0.020	1.	2.00	0.000		0.00000
REACT COEF	4.	0.14	0.02	0.200	1.	2.00	0.000		0.00000
REACT COEF	5.	0.14	0.02	0.200	1.	2.00	0.000		0.00000
REACT COEF	6.	0.14	0.02	0.200	1.	3.00	0.000		0.00000
REACT COEF	7.	0.14	0.02	0.200	1.	3.00	0.000		0.00000
REACT COEF	8.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	9.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	10.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	11.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	12.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	13.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	14.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
ENDATA6	0.	0.00	0.00	0.000	0.	0.00	0.000		0.00000

$$$ DATA TYPE 6A (NITROGEN AND PHOSPHORUS CONSTANTS) $$$

CARD TYPE	REACH	CKNH2	SETNH2	CKNH3	SNH3	CKNO2	CKPORG	SETPORG	SPO4
N AND P COEF	1.	0.02	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	2.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	3.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	4.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	5.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	6.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	7.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	8.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	9.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	10.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	11.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	12.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	13.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	14.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
ENDATA6A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6B (ALGAE/OTHER COEFFICIENTS) $$$

CARD TYPE	REACH	ALPHAO	ALGSET	EXCOEF	CK5 CKCOLI	CKANC	SETANC	SRCANC
ALG/OTHER COEF	1.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	2.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	3.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	4.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	5.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	6.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	7.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	8.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	9.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	10.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	11.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	12.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	13.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	14.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ENDATA6B	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7 (INITIAL CONDITIONS) $$$

CARD TYPE	REACH	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INITIAL COND-1	1.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	2.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	3.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	4.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	5.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	6.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	7.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	8.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	9.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	10.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	11.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	12.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	13.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	14.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
ENDATA7	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7A (INITIAL CONDITIONS FOR CHOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INITIAL COND-2	1.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	2.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	3.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	4.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	5.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	6.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	7.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	8.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	9.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	10.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	11.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	12.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	13.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	14.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA7A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 8 (INCREMENTAL INFLOW CONDITIONS) $$$

CARD TYPE	REACH	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INCR INFLOW-1	1.	0.250	88.00	8.00	2.00	973.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	2.	1.000	88.00	8.00	6.00	1250.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	3.	0.700	88.00	8.00	6.00	1250.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	4.	2.000	88.00	8.00	7.00	1250.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	5.	1.890	88.00	8.00	4.00	1250.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	6.	1.000	88.00	8.00	3.00	1250.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	7.	2.800	88.00	8.00	3.00	1250.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	8.	1.560	88.00	8.00	3.00	1250.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	9.	3.730	88.00	8.00	3.00	1250.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	10.	1.870	88.00	8.00	3.00	1250.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	11.	3.730	88.00	8.00	3.00	1250.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	12.	2.490	88.00	8.00	3.00	1250.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	13.	3.420	88.00	8.00	3.00	1250.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	14.	3.420	88.00	8.00	3.00	1250.00	0.00	0.00	0.00	0.00
ENDATA8	0.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 8A (INCREMENTAL INFLOW CONDITIONS FOR CHLOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INCR INFLOW-2	1.	0.00	0.90	0.15	0.00	2.37	0.06	0.36
INCR INFLOW-2	2.	0.00	0.90	1.50	0.00	2.37	0.06	0.36
INCR INFLOW-2	3.	0.00	0.90	1.50	0.00	2.37	0.06	0.36
INCR INFLOW-2	4.	0.00	0.90	1.50	0.00	2.37	0.06	0.36
INCR INFLOW-2	5.	0.00	0.90	1.50	0.00	2.37	0.06	0.36
INCR INFLOW-2	6.	0.00	0.30	1.50	0.00	2.37	0.06	0.36
INCR INFLOW-2	7.	0.00	0.30	0.15	0.00	2.37	0.06	0.36
INCR INFLOW-2	8.	0.00	0.30	0.15	0.00	2.37	0.06	0.36
INCR INFLOW-2	9.	0.00	0.30	0.15	0.00	2.37	0.06	0.36
INCR INFLOW-2	10.	0.00	0.30	0.15	0.00	2.37	0.06	0.36
INCR INFLOW-2	11.	0.00	0.30	0.15	0.00	2.37	0.06	0.36
INCR INFLOW-2	12.	0.00	0.30	0.15	0.00	2.37	0.06	0.36
INCR INFLOW-2	13.	0.00	0.30	0.15	0.00	2.37	0.06	0.36
INCR INFLOW-2	14.	0.00	0.30	0.15	0.00	2.37	0.06	0.36
ENDATA8A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 9 (STREAM JUNCTIONS) $$$

CARD TYPE	JUNCTION ORDER AND IDENT	UPSTRM	JUNCTION	TRIB
ENDATA9	0.	0.	0.	0.

$$$ DATA TYPE 10 (HEADWATER SOURCES) $$$

CARD TYPE	HDWTR ORDER	NAME	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
HEADWTR-1	1.	Reach 1	1.00	80.00	7.00	2.00	973.00	0.00	0.00
ENDATA10	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 10A (HEADWATER CONDITIONS FOR CHLOROPHYLL, NITROGEN, PHOSPHORUS, COLIFORM AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	HDWTR ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
HEADWTR-2	1.	0.00	0.00E+00	15.00	1.02	0.34	0.00	6.29	0.18	1.01
ENDATA10A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11 (POINT SOURCE / POINT SOURCE CHARACTERISTICS) $$$

CARD TYPE	POINT LOAD ORDER	NAME	EFF	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
POINTLD-1	1.	BLOOMINGDALE	0.00	2.06	70.00	6.66	1.30	866.00	0.00	0.00
POINTLD-1	2.	GLENDALE HEI	0.00	3.16	70.00	7.15	1.00	844.00	0.00	0.00
POINTLD-1	3.	GLENBARD WW	0.00	12.01	70.00	7.02	1.00	1091.00	0.00	0.00
POINTLD-1	4.	DOWNERS GROV	0.00	9.20	70.00	7.34	1.00	928.00	0.00	0.00
POINTLD-1	5.	DUPAGE COUNT	0.00	7.49	70.00	8.05	2.50	822.00	0.00	0.00
POINTLD-1	6.	BOLINGBROOK	0.00	1.80	70.00	9.12	1.00	2315.00	0.00	0.00
POINTLD-1	7.	CITIZENS UTI	0.00	1.45	70.00	7.20	1.80	1985.00	0.00	0.00
ENDATA11	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11A (POINT SOURCE CHARACTERISTICS - CHLOROPHYLL A, NITROGEN, PHOSPHORUS, COLIFORMS AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	POINT LOAD ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	N03-N	ORG-P	DIS-P
POINTLD-2	1.	0.00	0.00E+00	0.00	0.43	0.45	0.00	13.34	0.41	2.25
POINTLD-2	2.	0.00	0.00E+00	0.00	0.43	0.18	0.00	13.34	0.41	2.25
POINTLD-2	3.	0.00	0.00E+00	0.00	0.43	2.98	0.00	13.34	0.41	2.25
POINTLD-2	4.	0.00	0.00E+00	0.00	0.20	1.25	0.00	13.34	0.41	2.25
POINTLD-2	5.	0.00	0.00E+00	0.00	0.20	0.22	0.00	13.34	0.41	2.25
POINTLD-2	6.	0.00	0.00E+00	0.00	0.20	0.16	0.00	13.34	0.41	2.25
POINTLD-2	7.	0.00	0.00E+00	0.00	0.20	0.21	0.00	13.34	0.41	2.25
ENDATA11A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 12 (DAM CHARACTERISTICS) $$$

	DAM	RCH	ELE	ADAM	BDAM	FDAM	HDAM
DAM DATA	1.	3.	4.	1.50	0.33	1.00	2.00
DAM DATA	2.	9.	12.	1.30	0.33	1.00	1.00
ENDATA12	0.	0.	0.	0.00	0.00	0.00	0.00

$$$ DATA TYPE 13 (DOWNSTREAM BOUNDARY CONDITIONS-1) $$$

CARD TYPE	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI

ENDATA13 DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED

$$$ DATA TYPE 13A (DOWNSTREAM BOUNDARY CONDITIONS-2) $$$

CARD TYPE	CHL-A	ORG-N	NH3-N	NO2-N	NH3-N	ORG-P	DIS-P

ENDATA13A DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED

TABLE E2 SCENARIO 1 INPUT FOR QUAL2E

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* * * QUAL-2E  STREAM QUALITY ROUTING MODEL * * *
                                                           Version 3.22  --  May 1996

          $$$ (PROBLEM TITLES) $$$

         CARD TYPE                            QUAL-2E PROGRAM TITLES
         TITLE01             East Branch Scenario 1 -- 7Q10 flow
         TITLE02             Daily Max Permit Limit; SOD=0
         TITLE03  YES        CONSERVATIVE MINERAL I     Cond IN
         TITLE04  NO         CONSERVATIVE MINERAL II
         TITLE05  NO         CONSERVATIVE MINERAL III
         TITLE06  YES        TEMPERATURE
         TITLE07  YES        5-DAY BIOCHEMICAL OXYGEN DEMAND
         TITLE08  YES        ALGAE AS CHL-A IN UG/L
         TITLE09  YES        PHOSPHORUS CYCLE AS P IN MG/L
         TITLE10               (ORGANIC-P; DISSOLVED-P)
         TITLE11  YES        NITROGEN CYCLE AS N IN MG/L
         TITLE12               (ORGANIC-N; AMMONIA-N; NITRITE-N;' NITRATE-N)
         TITLE13  YES        DISSOLVED OXYGEN IN MG/L
         TITLE14  NO         FECAL COLIFORM IN NO./100 ML
         TITLE15  NO         ARBITRARY NON-CONSERVATIVE
         ENDTITLE

          $$$ DATA TYPE 1 (CONTROL DATA) $$$

         CARD TYPE                                     CARD TYPE
         LIST DATA INPUT             0.00000                                       0.00000
         NO WRITE OPTIONAL SUMMARY   0.00000                                       0.00000
         NO FLOW AUGMENTATION        0.00000                                       0.00000
         STEADY STATE                0.00000                                       0.00000
         TRAPAZOIDAL                 0.00000                                       0.00000
         NO PRINT LCD/SOLAR DATA     0.00000                                       0.00000
         NO PLOT DO AND BOD DATA     0.00000                                       0.00000
         FIXED DNSTM CONC (YES=1)=   0.00000          5D-ULT BOD CONV K COEF  =    0.23000
         INPUT METRIC           =    0.00000          OUTPUT METRIC           =    0.00000
         NUMBER OF REACHES      =   14.00000          NUMBER OF JUNCTIONS     =    0.00000
         NUM OF HEADWATERS      =    1.00000          NUMBER OF POINT LOADS   =    7.00000
         TIME STEP (HOURS)      =    1.00000          LNTH. COMP. ELEMENT (DX)=    0.20000
         MAXIMUM ROUTE TIME (HRS)=  30.00000          TIME INC. FOR RPT2 (HRS)=    1.00000
         LATITUDE OF BASIN (DEG) =  34.00000          LONGITUDE OF BASIN (DEG)=   85.00000
         STANDARD MARIDIAN (DEG) =  75.00000          DAY OF YEAR START TIME  =  180.00000
         EVAP. COEF.,(AE)        =   0.00103          EVAP. COEF.,(BE)        =    0.00016
         ELEV. OF BASIN (ELEV)   =1000.00000          DUST ATTENUATION COEF.  =    0.06000
         ENDATA1                     0.00000                                       0.00000

          $$$ DATA TYPE 1A (ALGAE PRODUCTION AND NITROGEN OXIDATION CONSTANTS) $$$

         CARD TYPE                                          CARD TYPE
         O UPTAKE BY NH3 OXID(MG O/MG N)=    3.4300         O UPTAKE BY NO2 OXID(MG O/MG N)=    1.1400
         O PROD  BY ALGAE (MG O/MG A)   =    1.6000         O UPTAKE BY ALGAE (MG O/MG A)  =    2.0000
         N CONTENT OF ALGAE (MG N/MG A) =    0.0850         P CONTENT OF ALGAE (MG O/MG A) =    0.0140
         ALG MAX SPEC GROWTH RATE(1/DAY)=    2.5000         ALGAE RESPIRATION RATE (1/DAY) =    0.0500
         N HALF SATURATION CONST (MG/L) =    0.2000         P HALF SATURATION CONST (MG/L) =    0.0400
         LIN ALG SHADE CO (1/FT-UGCHA/L=)    0.0008         NLIN SHADE(1/FT-(UGCHA/L)**2/3)=    0.0000
         LIGHT FUNCTION OPTION (LFNOPT) =    1.0000         LIGHT SAT'N COEF (BTU/FT2-MIN) =    0.1100
         DAILY AVERAGING OPTION (LAVOPT)=    2.0000         LIGHT AVERAGING FACTOR (AFACT) =    0.9200
         NUMBER OF DAYLIGHT HOURS (DLH) =   14.0000         TOTAL DAILY SOLR RAD (BTU/FT-2)= 1300.0000
         ALGY GROWTH CALC OPTION(LGROPT)=    2.0000         ALGAL PREF FOR NH3-N (PREFN)   =    0.9000
         ALG/TEMP SOLR RAD FACTOR(TFACT)=    0.4400         NITRIFICATION INHIBITION COEF  =   10.0000
         ENDATA1A                            0.0000                                             0.0000

          $$$ DATA TYPE 1B (TEMPERATURE CORRECTION CONSTANTS FOR RATE COEFFICIENTS) $$$

         CARD TYPE     RATE CODE     THETA VALUE

         THETA( 1)      BOD DECA        1.047     USER
         THETA( 2)      BOD SETT        1.024     USER
         THETA( 3)      OXY TRAN        1.024     USER
         THETA( 4)      SOD RATE        1.060     USER
         THETA( 5)      ORGN DEC        1.047     USER
         THETA( 6)      ORGN SET        1.024     USER
         THETA( 7)      NH3 DECA        1.083     USER
         THETA( 8)      NH3 SRCE        1.074     USER
         THETA( 9)      NO2 DECA        1.047     USER
         THETA(10)      PORG DEC        1.047     USER
         THETA(11)      PORG SET        1.024     USER
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THETA(12)      DISP SRC        1.074     USER
THETA(13)      ALG GROW        1.047     USER
THETA(14)      ALG RESP        1.047     USER
THETA(15)      ALG SETT        1.024     USER
THETA(16)      COLI DEC        1.047     DFLT
THETA(17)      ANC DECA        1.000     DFLT
THETA(18)      ANC SETT        1.024     DFLT
THETA(19)      ANC SRCE        1.000     DFLT
ENDATA1B

 $$$ DATA TYPE 2 (REACH IDENTIFICATION) $$$

CARD TYPE           REACH ORDER AND IDENT              R. MI/KM            R. MI/KM
STREAM REACH     1.0  RCH=         Reach 1   FROM         24.0    TO          23.4
STREAM REACH     2.0  RCH=         Reach 2   FROM         23.4    TO          20.2
STREAM REACH     3.0  RCH=         Reach 3   FROM         20.2    TO          19.4
STREAM REACH     4.0  RCH=         Reach 4   FROM         19.4    TO          18.0
STREAM REACH     5.0  RCH=         Reach 5   FROM         18.0    TO          16.2
STREAM REACH     6.0  RCH=         Reach 6   FROM         16.2    TO          14.8
STREAM REACH     7.0  RCH=         Reach 7   FROM         14.8    TO          13.0
STREAM REACH     8.0  RCH=         Reach 8   FROM         13.0    TO          12.0
STREAM REACH     9.0  RCH=         Reach 9   FROM         12.0    TO           9.6
STREAM REACH    10.0  RCH=        Reach 10   FROM          9.6    TO           8.4
STREAM REACH    11.0  RCH=        Reach 11   FROM          8.4    TO           6.0
STREAM REACH    12.0  RCH=        Reach 12   FROM          6.0    TO           4.4
STREAM REACH    13.0  RCH=        Reach 13   FROM          4.4    TO           2.2
STREAM REACH    14.0  RCH=        Reach 14   FROM          2.2    TO           0.0
ENDATA2          0.0                                       0.0                 0.0

 $$$ DATA TYPE 3 (TARGET LEVEL DO AND FLOW AUGMENTATION SOURCES) $$$

CARD TYPE                  REACH  AVAIL HDWS TARGET     ORDER OF AVAIL SOURCES
ENDATA3                     0.        0.       0.0   0.   0.   0.   0.   0.   0.

 $$$ DATA TYPE 4 (COMPUTATIONAL REACH FLAG FIELD) $$$

CARD TYPE        REACH ELEMENTS/REACH            COMPUTATIONAL FLAGS
FLAG FIELD        1.        3.         1.6.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        2.       16.         2.2.2.2.2.2.2.2.6.2.2.2.2.2.2.2.0.0.0.0.
FLAG FIELD        3.        4.         2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        4.        7.         2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        5.        9.         2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        6.        7.         2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        7.        9.         2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        8.        5.         2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        9.       12.         2.2.6.2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       10.        6.         2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       11.       12.         2.2.2.2.2.6.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       12.        8.         2.2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       13.       11.         2.2.2.2.2.2.2.2.2.6.2.0.0.0.0.0.0.0.0.0.
FLAG FIELD       14.       11.         2.2.2.2.2.2.2.2.2.2.5.0.0.0.0.0.0.0.0.0.
ENDATA4           0.        0.         0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.

 $$$ DATA TYPE 5 (HYDRAULIC DATA FOR DETERMINING VELOCITY AND DEPTH) $$$

CARD TYPE        REACH  COEF-DSPN    SS1       SS2      WIDTH     SLOPE     CMANN
HYDRAULICS        1.     60.00     1.000     1.000     5.000     0.002     0.050
HYDRAULICS        2.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        3.     60.00     1.000     1.000   260.000     0.001     0.050
HYDRAULICS        4.     60.00     1.000     1.000    10.000     0.000     0.050
HYDRAULICS        5.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        6.     60.00     1.000     1.000    15.000     0.001     0.050
HYDRAULICS        7.     60.00     1.000     1.000    18.000     0.001     0.050
HYDRAULICS        8.     60.00     1.000     1.000    20.000     0.001     0.050
HYDRAULICS        9.     60.00     1.000     1.000    23.000     0.001     0.050
HYDRAULICS       10.     60.00     1.000     1.000    26.000     0.001     0.050
HYDRAULICS       11.     60.00     1.000     1.000    30.000     0.001     0.050
HYDRAULICS       12.     60.00     1.000     1.000    35.000     0.000     0.050
HYDRAULICS       13.     60.00     1.000     1.000    42.000     0.000     0.050
HYDRAULICS       14.     60.00     1.000     1.000    45.000     0.000     0.050
ENDATA5           0.      0.00     0.000     0.000     0.000     0.000     0.000

 $$$ DATA TYPE 5A (STEADY STATE TEMPERATURE AND CLIMATOLOGY DATA) $$$

CARD TYPE                              DUST     CLOUD   DRY BULB  WET BULB     ATM                 SOLAR RAD
                REACH   ELEVATION      COEF     COVER     TEMP      TEMP     PRESSURE      WIND   ATTENUATION
TEMP/LCD          1.     1000.00       0.06      0.00     60.00     60.00     30.00        2.00       1.00
TEMP/LCD          2.     1000.00       0.06      0.00     60.00     60.00     30.00        2.00       1.00
TEMP/LCD          3.     1000.00       0.06      0.00     60.00     60.00     30.00        2.00       1.00
TEMP/LCD          4.     1000.00       0.06      0.00     60.00     60.00     30.00        2.00       1.00
TEMP/LCD          5.     1000.00       0.06      0.00     60.00     60.00     30.00        2.00       1.00
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TEMP/LCD	6.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	7.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	8.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	9.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	10.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	11.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	12.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	13.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	14.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
ENDATA5A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6 (REACTION COEFFICIENTS FOR DEOXYGENATION AND REAERATION) $$$

CARD TYPE	REACH	K1	K3	SOD RATE	K2OPT	K2	COEQK2 OR TSIV COEF OR FOR OPT 8	EXPQK2 SLOPE FOR OPT 8
REACT COEF	1.	0.14	0.00	0.000	1.	2.00	0.000	0.00000
REACT COEF	2.	0.14	0.01	0.000	1.	2.00	0.000	0.00000
REACT COEF	3.	0.14	0.02	0.000	1.	2.00	0.000	0.00000
REACT COEF	4.	0.14	0.02	0.000	1.	2.00	0.000	0.00000
REACT COEF	5.	0.14	0.02	0.000	1.	2.00	0.000	0.00000
REACT COEF	6.	0.14	0.02	0.000	1.	3.00	0.000	0.00000
REACT COEF	7.	0.14	0.02	0.000	1.	3.00	0.000	0.00000
REACT COEF	8.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
REACT COEF	9.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
REACT COEF	10.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
REACT COEF	11.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
REACT COEF	12.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
REACT COEF	13.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
REACT COEF	14.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
ENDATA6	0.	0.00	0.00	0.000	0.	0.00	0.000	0.00000

$$$ DATA TYPE 6A (NITROGEN AND PHOSPHORUS CONSTANTS) $$$

CARD TYPE	REACH	CKNH2	SETNH2	CKNH3	SNH3	CKNO2	CKPORG	SETPORG	SPO4
N AND P COEF	1.	0.02	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	2.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	3.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	4.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	5.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	6.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	7.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	8.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	9.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	10.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	11.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	12.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	13.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	14.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
ENDATA6A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6B (ALGAE/OTHER COEFFICIENTS) $$$

CARD TYPE	REACH	ALPHAO	ALGSET	EXCOEF	CK5 CKCOLI	CKANC	SETANC	SRCANC
ALG/OTHER COEF	1.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	2.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	3.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	4.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	5.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	6.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	7.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	8.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	9.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	10.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	11.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	12.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	13.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	14.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ENDATA6B	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7 (INITIAL CONDITIONS) $$$

CARD TYPE	REACH	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INITIAL COND-1	1.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	2.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	3.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	4.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	5.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	6.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	7.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00

INITIAL COND-1	8.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	9.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	10.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	11.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	12.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	13.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	14.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
ENDATA7	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7A (INITIAL CONDITIONS FOR CHOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INITIAL COND-2	1.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	2.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	3.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	4.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	5.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	6.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	7.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	8.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	9.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	10.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	11.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	12.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	13.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	14.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA7A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 8 (INCREMENTAL INFLOW CONDITIONS) $$$

CARD TYPE	REACH	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INCR INFLOW-1	1.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	2.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	3.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	4.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	5.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	6.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	7.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	8.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	9.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	10.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	11.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	12.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	13.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	14.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA8	0.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 8A (INCREMENTAL INFLOW CONDITIONS FOR CHLOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INCR INFLOW-2	1.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	2.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	3.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	4.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	5.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	6.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	7.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	8.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	9.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	10.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	11.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	12.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	13.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	14.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA8A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 9 (STREAM JUNCTIONS) $$$

CARD TYPE	JUNCTION ORDER AND IDENT	UPSTRM	JUNCTION	TRIB
ENDATA9	0.	0.	0.	0.

$$$ DATA TYPE 10 (HEADWATER SOURCES) $$$

CARD TYPE	HDWTR ORDER	NAME	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
HEADWTR-1	1.	Reach 1	0.50	80.00	7.00	2.00	973.00	0.00	0.00
ENDATA10	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 10A (HEADWATER CONDITIONS FOR CHLOROPHYLL, NITROGEN, PHOSPHORUS,
COLIFORM AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	HDWTR ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
HEADWTR-2	1.	0.00	0.00E+00	15.00	1.02	0.34	0.00	6.29	0.18	1.01
ENDATA10A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11 (POINT SOURCE / POINT SOURCE CHARACTERISTICS) $$$

CARD TYPE	POINT LOAD ORDER	NAME	EFF	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
POINTLD-1	1.	BLOOMINGDALE	0.00	2.06	70.00	6.66	10.00	866.00	0.00	0.00
POINTLD-1	2.	GLENDALE HEI	0.00	3.16	70.00	7.15	10.00	844.00	0.00	0.00
POINTLD-1	3.	GLENBARD WW	0.00	12.01	70.00	7.02	10.00	1091.00	0.00	0.00
POINTLD-1	4.	DOWNERS GROV	0.00	9.20	70.00	7.34	10.00	928.00	0.00	0.00
POINTLD-1	5.	DUPAGE COUNT	0.00	7.49	70.00	8.05	10.00	822.00	0.00	0.00
POINTLD-1	6.	BOLINGBROOK	0.00	1.80	70.00	9.12	20.00	2315.00	0.00	0.00
POINTLD-1	7.	CITIZENS UTI	0.00	1.45	70.00	7.20	20.00	1985.00	0.00	0.00
ENDATA11	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11A (POINT SOURCE CHARACTERISTICS - CHLOROPHYLL A, NITROGEN, PHOSPHORUS, COLIFORMS AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	POINT LOAD ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	N03-N	ORG-P	DIS-P
POINTLD-2	1.	0.00	0.00E+00	0.00	0.43	1.50	0.00	13.34	0.41	2.25
POINTLD-2	2.	0.00	0.00E+00	0.00	0.43	1.50	0.00	13.34	0.41	2.25
POINTLD-2	3.	0.00	0.00E+00	0.00	0.43	1.50	0.00	13.34	0.41	2.25
POINTLD-2	4.	0.00	0.00E+00	0.00	0.20	1.50	0.00	13.34	0.41	2.25
POINTLD-2	5.	0.00	0.00E+00	0.00	0.20	1.50	0.00	13.34	0.41	2.25
POINTLD-2	6.	0.00	0.00E+00	0.00	0.20	1.50	0.00	13.34	0.41	2.25
POINTLD-2	7.	0.00	0.00E+00	0.00	0.20	1.50	0.00	13.34	0.41	2.25
ENDATA11A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 12 (DAM CHARACTERISTICS) $$$

	DAM	RCH	ELE	ADAM	BDAM	FDAM	HDAM
DAM DATA	1.	3.	4.	1.50	0.33	1.00	2.00
DAM DATA	2.	9.	12.	1.30	0.33	1.00	1.00
ENDATA12	0.	0.	0.	0.00	0.00	0.00	0.00

$$$ DATA TYPE 13 (DOWNSTREAM BOUNDARY CONDITIONS-1) $$$

CARD TYPE	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
ENDATA13	DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED							

$$$ DATA TYPE 13A (DOWNSTREAM BOUNDARY CONDITIONS-2) $$$

CARD TYPE	CHL-A	ORG-N	NH3-N	NO2-N	NH3-N	ORG-P	DIS-P
ENDATA13A	DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED						

TABLE E3 SCENARIO 2 INPUT FOR QUAL2E

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* * * QUAL-2E  STREAM QUALITY ROUTING MODEL * * *
                                                           Version 3.22  --  May 1996

         $$$ (PROBLEM TITLES) $$$

        CARD TYPE                            QUAL-2E PROGRAM TITLES
        TITLE01             East Branch Scenario 2 - SOD = Existing Cond
        TITLE02              PS Load = 0
        TITLE03  YES        CONSERVATIVE MINERAL I     Cond IN
        TITLE04  NO         CONSERVATIVE MINERAL II
        TITLE05  NO         CONSERVATIVE MINERAL III
        TITLE06  YES        TEMPERATURE
        TITLE07  YES        5-DAY BIOCHEMICAL OXYGEN DEMAND
        TITLE08  YES        ALGAE AS CHL-A IN UG/L
        TITLE09  YES        PHOSPHORUS CYCLE AS P IN MG/L
        TITLE10               (ORGANIC-P; DISSOLVED-P)
        TITLE11  YES        NITROGEN CYCLE AS N IN MG/L
        TITLE12               (ORGANIC-N; AMMONIA-N; NITRITE-N;' NITRATE-N)
        TITLE13  YES        DISSOLVED OXYGEN IN MG/L
        TITLE14  NO         FECAL COLIFORM IN NO./100 ML
        TITLE15  NO         ARBITRARY NON-CONSERVATIVE
        ENDTITLE

         $$$ DATA TYPE 1 (CONTROL DATA) $$$

        CARD TYPE                                     CARD TYPE
        LIST DATA INPUT             0.00000                                    0.00000
        NO WRITE OPTIONAL SUMMARY   0.00000                                    0.00000
        NO FLOW AUGMENTATION        0.00000                                    0.00000
        STEADY STATE                0.00000                                    0.00000
        TRAPAZOIDAL                 0.00000                                    0.00000
        NO PRINT LCD/SOLAR DATA     0.00000                                    0.00000
        NO PLOT DO AND BOD DATA     0.00000                                    0.00000
        FIXED DNSTM CONC (YES=1)=   0.00000          5D-ULT BOD CONV K COEF  =   0.23000
        INPUT METRIC           =    0.00000          OUTPUT METRIC           =   0.00000
        NUMBER OF REACHES      =   14.00000          NUMBER OF JUNCTIONS     =   0.00000
        NUM OF HEADWATERS      =    1.00000          NUMBER OF POINT LOADS   =   7.00000
        TIME STEP (HOURS)      =    1.00000          LNTH. COMP. ELEMENT (DX)=   0.20000
        MAXIMUM ROUTE TIME (HRS)=  30.00000          TIME INC. FOR RPT2 (HRS)=   1.00000
        LATITUDE OF BASIN (DEG) =  34.00000          LONGITUDE OF BASIN (DEG)=  85.00000
        STANDARD MARIDIAN (DEG) =  75.00000          DAY OF YEAR START TIME  = 180.00000
        EVAP. COEF.,(AE)       =    0.00103          EVAP. COEF.,(BE)        =   0.00016
        ELEV. OF BASIN (ELEV)   =1000.00000          DUST ATTENUATION COEF.  =   0.06000
        ENDATA1                     0.00000                                    0.00000

         $$$ DATA TYPE 1A (ALGAE PRODUCTION AND NITROGEN OXIDATION CONSTANTS) $$$

        CARD TYPE                                           CARD TYPE
        O UPTAKE BY NH3 OXID(MG O/MG N)=    3.4300          O UPTAKE BY NO2 OXID(MG O/MG N)=    1.1400
        O PROD  BY ALGAE (MG O/MG A)   =    1.6000          O UPTAKE BY ALGAE (MG O/MG A)  =    2.0000
        N CONTENT OF ALGAE (MG N/MG A) =    0.0850          P CONTENT OF ALGAE (MG O/MG A) =    0.0140
        ALG MAX SPEC GROWTH RATE(1/DAY)=    2.5000          ALGAE RESPIRATION RATE (1/DAY) =    0.0500
        N HALF SATURATION CONST (MG/L) =    0.2000          P HALF SATURATION CONST (MG/L) =    0.0400
        LIN ALG SHADE CO (1/FT-UGCHA/L=)    0.0008          NLIN SHADE(1/FT-(UGCHA/L)**2/3)=    0.0000
        LIGHT FUNCTION OPTION (LFNOPT) =    1.0000          LIGHT SAT'N COEF (BTU/FT2-MIN) =    0.1100
        DAILY AVERAGING OPTION (LAVOPT)=    2.0000          LIGHT AVERAGING FACTOR (AFACT) =    0.9200
        NUMBER OF DAYLIGHT HOURS (DLH) =   14.0000          TOTAL DAILY SOLR RAD (BTU/FT-2)= 1300.0000
        ALGY GROWTH CALC OPTION(LGROPT)=    2.0000          ALGAL PREF FOR NH3-N (PREFN)   =    0.9000
        ALG/TEMP SOLR RAD FACTOR(TFACT)=    0.4400          NITRIFICATION INHIBITION COEF  =   10.0000
        ENDATA1A                            0.0000                                              0.0000

         $$$ DATA TYPE 1B (TEMPERATURE CORRECTION CONSTANTS FOR RATE COEFFICIENTS) $$$

        CARD TYPE     RATE CODE     THETA VALUE

        THETA( 1)      BOD DECA       1.047     USER
        THETA( 2)      BOD SETT       1.024     USER
        THETA( 3)      OXY TRAN       1.024     USER
        THETA( 4)      SOD RATE       1.060     USER
        THETA( 5)      ORGN DEC       1.047     USER
        THETA( 6)      ORGN SET       1.024     USER
        THETA( 7)      NH3 DECA       1.083     USER
        THETA( 8)      NH3 SRCE       1.074     USER
        THETA( 9)      NO2 DECA       1.047     USER
        THETA(10)      PORG DEC       1.047     USER
        THETA(11)      PORG SET       1.024     USER
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THETA(12)      DISP SRC       1.074     USER
THETA(13)      ALG GROW       1.047     USER
THETA(14)      ALG RESP       1.047     USER
THETA(15)      ALG SETT       1.024     USER
THETA(16)      COLI DEC       1.047     DFLT
THETA(17)      ANC DECA       1.000     DFLT
THETA(18)      ANC SETT       1.024     DFLT
THETA(19)      ANC SRCE       1.000     DFLT
ENDATA1B

 $$$ DATA TYPE 2 (REACH IDENTIFICATION) $$$

CARD TYPE           REACH ORDER AND IDENT              R. MI/KM            R. MI/KM
STREAM REACH     1.0  RCH=          Reach 1   FROM         24.0    TO          23.4
STREAM REACH     2.0  RCH=          Reach 2   FROM         23.4    TO          20.2
STREAM REACH     3.0  RCH=          Reach 3   FROM         20.2    TO          19.4
STREAM REACH     4.0  RCH=          Reach 4   FROM         19.4    TO          18.0
STREAM REACH     5.0  RCH=          Reach 5   FROM         18.0    TO          16.2
STREAM REACH     6.0  RCH=          Reach 6   FROM         16.2    TO          14.8
STREAM REACH     7.0  RCH=          Reach 7   FROM         14.8    TO          13.0
STREAM REACH     8.0  RCH=          Reach 8   FROM         13.0    TO          12.0
STREAM REACH     9.0  RCH=          Reach 9   FROM         12.0    TO           9.6
STREAM REACH    10.0  RCH=         Reach 10   FROM          9.6    TO           8.4
STREAM REACH    11.0  RCH=         Reach 11   FROM          8.4    TO           6.0
STREAM REACH    12.0  RCH=         Reach 12   FROM          6.0    TO           4.4
STREAM REACH    13.0  RCH=         Reach 13   FROM          4.4    TO           2.2
STREAM REACH    14.0  RCH=         Reach 14   FROM          2.2    TO           0.0
ENDATA2          0.0                                        0.0                 0.0

 $$$ DATA TYPE 3 (TARGET LEVEL DO AND FLOW AUGMENTATION SOURCES) $$$

CARD TYPE                  REACH  AVAIL HDWS TARGET     ORDER OF AVAIL SOURCES
ENDATA3                     0.        0.       0.0   0.    0.    0.    0.    0.    0.

 $$$ DATA TYPE 4 (COMPUTATIONAL REACH FLAG FIELD) $$$

CARD TYPE        REACH ELEMENTS/REACH            COMPUTATIONAL FLAGS
FLAG FIELD        1.        3.          1.6.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        2.       16.          2.2.2.2.2.2.2.2.2.6.2.2.2.2.2.2.0.0.0.0.
FLAG FIELD        3.        4.          2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        4.        7.          2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        5.        9.          2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        6.        7.          2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        7.        9.          2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        8.        5.          2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        9.       12.          2.2.6.2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       10.        6.          2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       11.       12.          2.2.2.2.2.6.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       12.        8.          2.2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       13.       11.          2.2.2.2.2.2.2.2.2.6.2.0.0.0.0.0.0.0.0.0.
FLAG FIELD       14.       11.          2.2.2.2.2.2.2.2.2.2.5.0.0.0.0.0.0.0.0.0.
ENDATA4           0.        0.          0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.

 $$$ DATA TYPE 5 (HYDRAULIC DATA FOR DETERMINING VELOCITY AND DEPTH) $$$

CARD TYPE        REACH  COEF-DSPN    SS1       SS2      WIDTH     SLOPE     CMANN
HYDRAULICS        1.     60.00     1.000     1.000     5.000     0.002     0.050
HYDRAULICS        2.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        3.     60.00     1.000     1.000   260.000     0.001     0.050
HYDRAULICS        4.     60.00     1.000     1.000    10.000     0.000     0.050
HYDRAULICS        5.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        6.     60.00     1.000     1.000    15.000     0.001     0.050
HYDRAULICS        7.     60.00     1.000     1.000    18.000     0.001     0.050
HYDRAULICS        8.     60.00     1.000     1.000    20.000     0.001     0.050
HYDRAULICS        9.     60.00     1.000     1.000    23.000     0.001     0.050
HYDRAULICS       10.     60.00     1.000     1.000    26.000     0.001     0.050
HYDRAULICS       11.     60.00     1.000     1.000    30.000     0.001     0.050
HYDRAULICS       12.     60.00     1.000     1.000    35.000     0.000     0.050
HYDRAULICS       13.     60.00     1.000     1.000    42.000     0.000     0.050
HYDRAULICS       14.     60.00     1.000     1.000    45.000     0.000     0.050
ENDATA5           0.      0.00     0.000     0.000     0.000     0.000     0.000

 $$$ DATA TYPE 5A (STEADY STATE TEMPERATURE AND CLIMATOLOGY DATA) $$$

CARD TYPE                               DUST     CLOUD   DRY BULB  WET BULB     ATM                 SOLAR RAD
                REACH   ELEVATION       COEF     COVER     TEMP      TEMP     PRESSURE     WIND   ATTENUATION
TEMP/LCD          1.     1000.00        0.06      0.00     60.00     60.00     30.00       2.00      1.00
TEMP/LCD          2.     1000.00        0.06      0.00     60.00     60.00     30.00       2.00      1.00
TEMP/LCD          3.     1000.00        0.06      0.00     60.00     60.00     30.00       2.00      1.00
TEMP/LCD          4.     1000.00        0.06      0.00     60.00     60.00     30.00       2.00      1.00
TEMP/LCD          5.     1000.00        0.06      0.00     60.00     60.00     30.00       2.00      1.00
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TEMP/LCD	6.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	7.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	8.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	9.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	10.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	11.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	12.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	13.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	14.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
ENDATA5A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6 (REACTION COEFFICIENTS FOR DEOXYGENATION AND REAERATION) $$$

CARD TYPE	REACH	K1	K3	SOD RATE	K2OPT	K2	COEQK2 OR TSIV COEF FOR OPT 8	OR	EXPQK2 OR SLOPE FOR OPT 8
REACT COEF	1.	0.14	0.00	0.100	1.	2.00	0.000		0.00000
REACT COEF	2.	0.14	0.01	0.100	1.	2.00	0.000		0.00000
REACT COEF	3.	0.14	0.02	0.020	1.	2.00	0.000		0.00000
REACT COEF	4.	0.14	0.02	0.200	1.	2.00	0.000		0.00000
REACT COEF	5.	0.14	0.02	0.200	1.	2.00	0.000		0.00000
REACT COEF	6.	0.14	0.02	0.100	1.	3.00	0.000		0.00000
REACT COEF	7.	0.14	0.02	0.100	1.	3.00	0.000		0.00000
REACT COEF	8.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	9.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	10.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	11.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	12.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	13.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	14.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
ENDATA6	0.	0.00	0.00	0.000	0.	0.00	0.000		0.00000

$$$ DATA TYPE 6A (NITROGEN AND PHOSPHORUS CONSTANTS) $$$

CARD TYPE	REACH	CKNH2	SETNH2	CKNH3	SNH3	CKNO2	CKPORG	SETPORG	SPO4
N AND P COEF	1.	0.02	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	2.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	3.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	4.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	5.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	6.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	7.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	8.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	9.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	10.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	11.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	12.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	13.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	14.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
ENDATA6A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6B (ALGAE/OTHER COEFFICIENTS) $$$

CARD TYPE	REACH	ALPHAO	ALGSET	EXCOEF	CK5 CKCOLI	CKANC	SETANC	SRCANC
ALG/OTHER COEF	1.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	2.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	3.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	4.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	5.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	6.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	7.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	8.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	9.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	10.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	11.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	12.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	13.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	14.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ENDATA6B	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7 (INITIAL CONDITIONS) $$$

CARD TYPE	REACH	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INITIAL COND-1	1.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	2.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	3.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	4.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	5.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	6.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	7.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00

INITIAL COND-1	8.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	9.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	10.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	11.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	12.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	13.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	14.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
ENDATA7	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7A (INITIAL CONDITIONS FOR CHOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INITIAL COND-2	1.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	2.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	3.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	4.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	5.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	6.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	7.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	8.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	9.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	10.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	11.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	12.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	13.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	14.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA7A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 8 (INCREMENTAL INFLOW CONDITIONS) $$$

CARD TYPE	REACH	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INCR INFLOW-1	1.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	2.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	3.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	4.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	5.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	6.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	7.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	8.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	9.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	10.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	11.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	12.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	13.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	14.	0.000	88.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA8	0.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 8A (INCREMENTAL INFLOW CONDITIONS FOR CHLOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INCR INFLOW-2	1.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	2.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	3.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	4.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	5.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	6.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	7.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	8.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	9.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	10.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	11.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	12.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	13.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	14.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA8A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 9 (STREAM JUNCTIONS) $$$

CARD TYPE	JUNCTION ORDER AND IDENT	UPSTRM	JUNCTION	TRIB
ENDATA9	0.	0.	0.	0.

$$$ DATA TYPE 10 (HEADWATER SOURCES) $$$

CARD TYPE	HDWTR ORDER	NAME	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
HEADWTR-1	1.	Reach 1	0.50	80.00	7.00	2.00	973.00	0.00	0.00
ENDATA10	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 10A (HEADWATER CONDITIONS FOR CHLOROPHYLL, NITROGEN, PHOSPHORUS,
COLIFORM AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	HDWTR ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
HEADWTR-2	1.	0.00	0.00E+00	15.00	1.02	0.34	0.00	6.29	0.18	1.01
ENDATA10A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11 (POINT SOURCE / POINT SOURCE CHARACTERISTICS) $$$

CARD TYPE	POINT LOAD ORDER	NAME	EFF	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
POINTLD-1	1.	BLOOMINGDALE	0.00	2.06	70.00	6.66	0.00	866.00	0.00	0.00
POINTLD-1	2.	GLENDALE HEI	0.00	3.16	70.00	7.15	0.00	844.00	0.00	0.00
POINTLD-1	3.	GLENBARD WW	0.00	12.01	70.00	7.02	0.00	1091.00	0.00	0.00
POINTLD-1	4.	DOWNERS GROV	0.00	9.20	70.00	7.34	0.00	928.00	0.00	0.00
POINTLD-1	5.	DUPAGE COUNT	0.00	7.49	70.00	8.05	0.00	822.00	0.00	0.00
POINTLD-1	6.	BOLINGBROOK	0.00	1.80	70.00	9.12	0.00	2315.00	0.00	0.00
POINTLD-1	7.	CITIZENS UTI	0.00	1.45	70.00	7.20	0.00	1985.00	0.00	0.00
ENDATA11	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11A (POINT SOURCE CHARACTERISTICS - CHLOROPHYLL A, NITROGEN, PHOSPHORUS, COLIFORMS AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	POINT LOAD ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	N03-N	ORG-P	DIS-P
POINTLD-2	1.	0.00	0.00E+00	0.00	0.43	0.00	0.00	13.34	0.41	2.25
POINTLD-2	2.	0.00	0.00E+00	0.00	0.43	0.00	0.00	13.34	0.41	2.25
POINTLD-2	3.	0.00	0.00E+00	0.00	0.43	0.00	0.00	13.34	0.41	2.25
POINTLD-2	4.	0.00	0.00E+00	0.00	0.20	0.00	0.00	13.34	0.41	2.25
POINTLD-2	5.	0.00	0.00E+00	0.00	0.20	0.00	0.00	13.34	0.41	2.25
POINTLD-2	6.	0.00	0.00E+00	0.00	0.20	0.00	0.00	13.34	0.41	2.25
POINTLD-2	7.	0.00	0.00E+00	0.00	0.20	0.00	0.00	13.34	0.41	2.25
ENDATA11A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 12 (DAM CHARACTERISTICS) $$$

	DAM	RCH	ELE	ADAM	BDAM	FDAM	HDAM
DAM DATA	1.	3.	4.	1.50	0.33	1.00	2.00
DAM DATA	2.	9.	12.	1.30	0.33	1.00	1.00
ENDATA12	0.	0.	0.	0.00	0.00	0.00	0.00

$$$ DATA TYPE 13 (DOWNSTREAM BOUNDARY CONDITIONS-1) $$$

CARD TYPE	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
ENDATA13	DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED							

$$$ DATA TYPE 13A (DOWNSTREAM BOUNDARY CONDITIONS-2) $$$

CARD TYPE	CHL-A	ORG-N	NH3-N	NO2-N	NH3-N	ORG-P	DIS-P
ENDATA13A	DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED						

TABLE E4 SCENARIO 3 INPUT FOR QUAL2E

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* * * QUAL-2E  STREAM QUALITY ROUTING MODEL * * *
                                                              Version 3.22  --  May 1996

          $$$ (PROBLEM TITLES) $$$

         CARD TYPE                            QUAL-2E PROGRAM TITLES
         TITLE01              East Branch Scenario 3; 7Q10 flow
         TITLE02              Existing PS load and 0.0 SOD
         TITLE03  YES         CONSERVATIVE MINERAL I     Cond IN
         TITLE04  NO          CONSERVATIVE MINERAL II
         TITLE05  NO          CONSERVATIVE MINERAL III
         TITLE06  YES         TEMPERATURE
         TITLE07  YES         5-DAY BIOCHEMICAL OXYGEN DEMAND
         TITLE08  YES         ALGAE AS CHL-A IN UG/L
         TITLE09  YES         PHOSPHORUS CYCLE AS P IN MG/L
         TITLE10                (ORGANIC-P; DISSOLVED-P)
         TITLE11  YES         NITROGEN CYCLE AS N IN MG/L
         TITLE12                (ORGANIC-N; AMMONIA-N; NITRITE-N;' NITRATE-N)
         TITLE13  YES         DISSOLVED OXYGEN IN MG/L
         TITLE14  NO          FECAL COLIFORM IN NO./100 ML
         TITLE15  NO          ARBITRARY NON-CONSERVATIVE
         ENDTITLE

          $$$ DATA TYPE 1 (CONTROL DATA) $$$

         CARD TYPE                                     CARD TYPE
         LIST DATA INPUT             0.00000                                       0.00000
         NO WRITE OPTIONAL SUMMARY   0.00000                                       0.00000
         NO FLOW AUGMENTATION        0.00000                                       0.00000
         STEADY STATE                0.00000                                       0.00000
         TRAPAZOIDAL                 0.00000                                       0.00000
         NO PRINT LCD/SOLAR DATA     0.00000                                       0.00000
         NO PLOT DO AND BOD DATA     0.00000                                       0.00000
         FIXED DNSTM CONC (YES=1)=   0.00000          5D-ULT BOD CONV K COEF  =    0.23000
         INPUT METRIC           =    0.00000          OUTPUT METRIC           =    0.00000
         NUMBER OF REACHES      =   14.00000          NUMBER OF JUNCTIONS     =    0.00000
         NUM OF HEADWATERS      =    1.00000          NUMBER OF POINT LOADS   =    7.00000
         TIME STEP (HOURS)      =    1.00000          LNTH. COMP. ELEMENT (DX)=    0.20000
         MAXIMUM ROUTE TIME (HRS)=  30.00000          TIME INC. FOR RPT2 (HRS)=    1.00000
         LATITUDE OF BASIN (DEG) =  34.00000          LONGITUDE OF BASIN (DEG)=   85.00000
         STANDARD MARIDIAN (DEG) =  75.00000          DAY OF YEAR START TIME  =  180.00000
         EVAP. COEF.,(AE)        =   0.00103          EVAP. COEF.,(BE)        =    0.00016
         ELEV. OF BASIN (ELEV)   =1000.00000          DUST ATTENUATION COEF.  =    0.06000
         ENDATA1                     0.00000                                       0.00000

          $$$ DATA TYPE 1A (ALGAE PRODUCTION AND NITROGEN OXIDATION CONSTANTS) $$$

         CARD TYPE                                           CARD TYPE
         O UPTAKE BY NH3 OXID(MG O/MG N)=    3.4300          O UPTAKE BY NO2 OXID(MG O/MG N)=    1.1400
         O PROD  BY ALGAE (MG O/MG A)   =    1.6000          O UPTAKE BY ALGAE (MG O/MG A)  =    2.0000
         N CONTENT OF ALGAE (MG N/MG A) =    0.0850          P CONTENT OF ALGAE (MG O/MG A) =    0.0140
         ALG MAX SPEC GROWTH RATE(1/DAY)=    2.5000          ALGAE RESPIRATION RATE (1/DAY) =    0.0500
         N HALF SATURATION CONST (MG/L) =    0.2000          P HALF SATURATION CONST (MG/L) =    0.0400
         LIN ALG SHADE CO (1/FT-UGCHA/L=)    0.0008          NLIN SHADE(1/FT-(UGCHA/L)**2/3)=    0.0000
         LIGHT FUNCTION OPTION (LFNOPT) =    1.0000          LIGHT SAT'N COEF (BTU/FT2-MIN) =    0.1100
         DAILY AVERAGING OPTION (LAVOPT)=    2.0000          LIGHT AVERAGING FACTOR (AFACT) =    0.9200
         NUMBER OF DAYLIGHT HOURS (DLH) =   14.0000          TOTAL DAILY SOLR RAD (BTU/FT-2)= 1300.0000
         ALGY GROWTH CALC OPTION(LGROPT)=    2.0000          ALGAL PREF FOR NH3-N (PREFN)   =    0.9000
         ALG/TEMP SOLR RAD FACTOR(TFACT)=    0.4400          NITRIFICATION INHIBITION COEF  =   10.0000
         ENDATA1A                            0.0000                                              0.0000

          $$$ DATA TYPE 1B (TEMPERATURE CORRECTION CONSTANTS FOR RATE COEFFICIENTS) $$$

         CARD TYPE     RATE CODE     THETA VALUE

         THETA( 1)      BOD DECA        1.047     USER
         THETA( 2)      BOD SETT        1.024     USER
         THETA( 3)      OXY TRAN        1.024     USER
         THETA( 4)      SOD RATE        1.060     USER
         THETA( 5)      ORGN DEC        1.047     USER
         THETA( 6)      ORGN SET        1.024     USER
         THETA( 7)      NH3 DECA        1.083     USER
         THETA( 8)      NH3 SRCE        1.074     USER
         THETA( 9)      NO2 DECA        1.047     USER
         THETA(10)      PORG DEC        1.047     USER
         THETA(11)      PORG SET        1.024     USER
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THETA(12)      DISP SRC        1.074     USER
THETA(13)      ALG GROW        1.047     USER
THETA(14)      ALG RESP        1.047     USER
THETA(15)      ALG SETT        1.024     USER
THETA(16)      COLI DEC        1.047     DFLT
THETA(17)      ANC DECA        1.000     DFLT
THETA(18)      ANC SETT        1.024     DFLT
THETA(19)      ANC SRCE        1.000     DFLT
ENDATA1B

 $$$ DATA TYPE 2 (REACH IDENTIFICATION) $$$

CARD TYPE           REACH ORDER AND IDENT              R. MI/KM             R. MI/KM
STREAM REACH     1.0  RCH=         Reach 1   FROM         24.0    TO          23.4
STREAM REACH     2.0  RCH=         Reach 2   FROM         23.4    TO          20.2
STREAM REACH     3.0  RCH=         Reach 3   FROM         20.2    TO          19.4
STREAM REACH     4.0  RCH=         Reach 4   FROM         19.4    TO          18.0
STREAM REACH     5.0  RCH=         Reach 5   FROM         18.0    TO          16.2
STREAM REACH     6.0  RCH=         Reach 6   FROM         16.2    TO          14.8
STREAM REACH     7.0  RCH=         Reach 7   FROM         14.8    TO          13.0
STREAM REACH     8.0  RCH=         Reach 8   FROM         13.0    TO          12.0
STREAM REACH     9.0  RCH=         Reach 9   FROM         12.0    TO           9.6
STREAM REACH    10.0  RCH=        Reach 10   FROM          9.6    TO           8.4
STREAM REACH    11.0  RCH=        Reach 11   FROM          8.4    TO           6.0
STREAM REACH    12.0  RCH=        Reach 12   FROM          6.0    TO           4.4
STREAM REACH    13.0  RCH=        Reach 13   FROM          4.4    TO           2.2
STREAM REACH    14.0  RCH=        Reach 14   FROM          2.2    TO           0.0
ENDATA2          0.0                                       0.0                 0.0

 $$$ DATA TYPE 3 (TARGET LEVEL DO AND FLOW AUGMENTATION SOURCES) $$$

CARD TYPE                  REACH  AVAIL HDWS TARGET     ORDER OF AVAIL SOURCES
ENDATA3                      0.        0.       0.0   0.   0.   0.   0.   0.   0.

 $$$ DATA TYPE 4 (COMPUTATIONAL REACH FLAG FIELD) $$$

CARD TYPE        REACH ELEMENTS/REACH             COMPUTATIONAL FLAGS
FLAG FIELD        1.        3.         1.6.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        2.       16.         2.2.2.2.2.2.2.2.2.6.2.2.2.2.2.2.0.0.0.0.
FLAG FIELD        3.        4.         2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        4.        7.         2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        5.        9.         2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        6.        7.         2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        7.        9.         2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        8.        5.         2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        9.       12.         2.2.6.2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       10.        6.         2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       11.       12.         2.2.2.2.2.6.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       12.        8.         2.2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       13.       11.         2.2.2.2.2.2.2.2.2.6.2.0.0.0.0.0.0.0.0.0.
FLAG FIELD       14.       11.         2.2.2.2.2.2.2.2.2.2.5.0.0.0.0.0.0.0.0.0.
ENDATA4           0.        0.         0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.

 $$$ DATA TYPE 5 (HYDRAULIC DATA FOR DETERMINING VELOCITY AND DEPTH) $$$

CARD TYPE        REACH  COEF-DSPN    SS1       SS2      WIDTH     SLOPE     CMANN
HYDRAULICS        1.     60.00     1.000     1.000     5.000     0.002     0.050
HYDRAULICS        2.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        3.     60.00     1.000     1.000   260.000     0.001     0.050
HYDRAULICS        4.     60.00     1.000     1.000    10.000     0.000     0.050
HYDRAULICS        5.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        6.     60.00     1.000     1.000    15.000     0.001     0.050
HYDRAULICS        7.     60.00     1.000     1.000    18.000     0.001     0.050
HYDRAULICS        8.     60.00     1.000     1.000    20.000     0.001     0.050
HYDRAULICS        9.     60.00     1.000     1.000    23.000     0.001     0.050
HYDRAULICS       10.     60.00     1.000     1.000    26.000     0.001     0.050
HYDRAULICS       11.     60.00     1.000     1.000    30.000     0.001     0.050
HYDRAULICS       12.     60.00     1.000     1.000    35.000     0.000     0.050
HYDRAULICS       13.     60.00     1.000     1.000    42.000     0.000     0.050
HYDRAULICS       14.     60.00     1.000     1.000    45.000     0.000     0.050
ENDATA5           0.      0.00     0.000     0.000     0.000     0.000     0.000

 $$$ DATA TYPE 5A (STEADY STATE TEMPERATURE AND CLIMATOLOGY DATA) $$$

CARD TYPE                              DUST     CLOUD   DRY BULB  WET BULB     ATM                  SOLAR RAD
                REACH   ELEVATION      COEF     COVER     TEMP      TEMP     PRESSURE      WIND   ATTENUATION
TEMP/LCD          1.     1000.00       0.06      0.00     60.00     60.00     30.00        2.00       1.00
TEMP/LCD          2.     1000.00       0.06      0.00     60.00     60.00     30.00        2.00       1.00
TEMP/LCD          3.     1000.00       0.06      0.00     60.00     60.00     30.00        2.00       1.00
TEMP/LCD          4.     1000.00       0.06      0.00     60.00     60.00     30.00        2.00       1.00
TEMP/LCD          5.     1000.00       0.06      0.00     60.00     60.00     30.00        2.00       1.00
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TEMP/LCD	6.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	7.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	8.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	9.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	10.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	11.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	12.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	13.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	14.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
ENDATA5A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6 (REACTION COEFFICIENTS FOR DEOXYGENATION AND REAERATION) $$$

CARD TYPE	REACH	K1	K3	SOD RATE	K2OPT	K2	COEQK2 OR TSIV COEF OR FOR OPT 8	EXPQK2 OR SLOPE FOR OPT 8
REACT COEF	1.	0.14	0.00	0.000	1.	2.00	0.000	0.00000
REACT COEF	2.	0.14	0.01	0.000	1.	2.00	0.000	0.00000
REACT COEF	3.	0.14	0.02	0.000	1.	2.00	0.000	0.00000
REACT COEF	4.	0.14	0.02	0.000	1.	2.00	0.000	0.00000
REACT COEF	5.	0.14	0.02	0.000	1.	2.00	0.000	0.00000
REACT COEF	6.	0.14	0.02	0.000	1.	3.00	0.000	0.00000
REACT COEF	7.	0.14	0.02	0.000	1.	3.00	0.000	0.00000
REACT COEF	8.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
REACT COEF	9.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
REACT COEF	10.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
REACT COEF	11.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
REACT COEF	12.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
REACT COEF	13.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
REACT COEF	14.	0.14	0.01	0.000	1.	3.00	0.000	0.00000
ENDATA6	0.	0.00	0.00	0.000	0.	0.00	0.000	0.00000

$$$ DATA TYPE 6A (NITROGEN AND PHOSPHORUS CONSTANTS) $$$

CARD TYPE	REACH	CKNH2	SETNH2	CKNH3	SNH3	CKNO2	CKPORG	SETPORG	SPO4
N AND P COEF	1.	0.02	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	2.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	3.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	4.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	5.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	6.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	7.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	8.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	9.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	10.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	11.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	12.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	13.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	14.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
ENDATA6A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6B (ALGAE/OTHER COEFFICIENTS) $$$

CARD TYPE	REACH	ALPHAO	ALGSET	EXCOEF	CK5 CKCOLI	CKANC	SETANC	SRCANC
ALG/OTHER COEF	1.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	2.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	3.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	4.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	5.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	6.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	7.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	8.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	9.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	10.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	11.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	12.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	13.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	14.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ENDATA6B	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7 (INITIAL CONDITIONS) $$$

CARD TYPE	REACH	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INITIAL COND-1	1.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	2.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	3.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	4.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	5.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	6.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	7.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00

INITIAL COND-1	8.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	9.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	10.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	11.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	12.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	13.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	14.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
ENDATA7	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7A (INITIAL CONDITIONS FOR CHOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INITIAL COND-2	1.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	2.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	3.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	4.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	5.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	6.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	7.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	8.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	9.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	10.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	11.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	12.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	13.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	14.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA7A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 8 (INCREMENTAL INFLOW CONDITIONS) $$$

CARD TYPE	REACH	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INCR INFLOW-1	1.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	2.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	3.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	4.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	5.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	6.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	7.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	8.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	9.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	10.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	11.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	12.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	13.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	14.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA8	0.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 8A (INCREMENTAL INFLOW CONDITIONS FOR CHLOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INCR INFLOW-2	1.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	2.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	3.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	4.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	5.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	6.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	7.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	8.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	9.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	10.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	11.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	12.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	13.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	14.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA8A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 9 (STREAM JUNCTIONS) $$$

CARD TYPE	JUNCTION ORDER AND IDENT	UPSTRM	JUNCTION	TRIB
ENDATA9	0.	0.	0.	0.

$$$ DATA TYPE 10 (HEADWATER SOURCES) $$$

CARD TYPE	HDWTR ORDER	NAME	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
HEADWTR-1	1.	Reach 1	0.50	80.00	7.00	2.00	973.00	0.00	0.00
ENDATA10	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 10A (HEADWATER CONDITIONS FOR CHLOROPHYLL, NITROGEN, PHOSPHORUS,
COLIFORM AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	HDWTR ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
HEADWTR-2	1.	0.00	0.00E+00	15.00	1.02	0.34	0.00	6.29	0.18	1.01
ENDATA10A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11 (POINT SOURCE / POINT SOURCE CHARACTERISTICS) $$$

CARD TYPE	POINT LOAD ORDER	NAME	EFF	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
POINTLD-1	1.	BLOOMINGDALE	0.00	2.06	70.00	6.66	1.30	866.00	0.00	0.00
POINTLD-1	2.	GLENDALE HEI	0.00	3.16	70.00	7.15	1.00	844.00	0.00	0.00
POINTLD-1	3.	GLENBARD WW	0.00	12.01	70.00	7.02	1.00	1091.00	0.00	0.00
POINTLD-1	4.	DOWNERS GROV	0.00	9.20	70.00	7.34	1.00	928.00	0.00	0.00
POINTLD-1	5.	DUPAGE COUNT	0.00	7.49	70.00	8.05	2.50	822.00	0.00	0.00
POINTLD-1	6.	BOLINGBROOK	0.00	1.80	70.00	9.12	1.00	2315.00	0.00	0.00
POINTLD-1	7.	CITIZENS UTI	0.00	1.45	70.00	7.20	1.80	1985.00	0.00	0.00
ENDATA11	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11A (POINT SOURCE CHARACTERISTICS - CHLOROPHYLL A, NITROGEN, PHOSPHORUS, COLIFORMS AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	POINT LOAD ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	N03-N	ORG-P	DIS-P
POINTLD-2	1.	0.00	0.00E+00	0.00	0.43	0.45	0.00	13.34	0.41	2.25
POINTLD-2	2.	0.00	0.00E+00	0.00	0.43	0.18	0.00	13.34	0.41	2.25
POINTLD-2	3.	0.00	0.00E+00	0.00	0.43	2.98	0.00	13.34	0.41	2.25
POINTLD-2	4.	0.00	0.00E+00	0.00	0.20	1.25	0.00	13.34	0.41	2.25
POINTLD-2	5.	0.00	0.00E+00	0.00	0.20	0.22	0.00	13.34	0.41	2.25
POINTLD-2	6.	0.00	0.00E+00	0.00	0.20	0.16	0.00	13.34	0.41	2.25
POINTLD-2	7.	0.00	0.00E+00	0.00	0.20	0.21	0.00	13.34	0.41	2.25
ENDATA11A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 12 (DAM CHARACTERISTICS) $$$

	DAM	RCH	ELE	ADAM	BDAM	FDAM	HDAM
DAM DATA	1.	3.	4.	1.50	0.33	1.00	2.00
DAM DATA	2.	9.	12.	1.30	0.33	1.00	1.00
ENDATA12	0.	0.	0.	0.00	0.00	0.00	0.00

$$$ DATA TYPE 13 (DOWNSTREAM BOUNDARY CONDITIONS-1) $$$

CARD TYPE	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
ENDATA13	DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED							

$$$ DATA TYPE 13A (DOWNSTREAM BOUNDARY CONDITIONS-2) $$$

CARD TYPE	CHL-A	ORG-N	NH3-N	NO2-N	NH3-N	ORG-P	DIS-P
ENDATA13A	DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED						

TABLE E5 SCENARIO 4 INPUT FOR QUAL2E

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* * * QUAL-2E  STREAM QUALITY ROUTING MODEL * * *
                                                            Version 3.22  --  May 1996

          $$$ (PROBLEM TITLES) $$$

         CARD TYPE                            QUAL-2E PROGRAM TITLES
         TITLE01             East Branch Scenario 4 -- 7Q10 flow
         TITLE02             Monthly avg permit limits; Reduced SOD
         TITLE03  YES        CONSERVATIVE MINERAL I     Cond IN
         TITLE04  NO         CONSERVATIVE MINERAL II
         TITLE05  NO         CONSERVATIVE MINERAL III
         TITLE06  YES        TEMPERATURE
         TITLE07  YES        5-DAY BIOCHEMICAL OXYGEN DEMAND
         TITLE08  YES        ALGAE AS CHL-A IN UG/L
         TITLE09  YES        PHOSPHORUS CYCLE AS P IN MG/L
         TITLE10               (ORGANIC-P; DISSOLVED-P)
         TITLE11  YES        NITROGEN CYCLE AS N IN MG/L
         TITLE12               (ORGANIC-N; AMMONIA-N; NITRITE-N;' NITRATE-N)
         TITLE13  YES        DISSOLVED OXYGEN IN MG/L
         TITLE14  NO         FECAL COLIFORM IN NO./100 ML
         TITLE15  NO         ARBITRARY NON-CONSERVATIVE
         ENDTITLE

          $$$ DATA TYPE 1 (CONTROL DATA) $$$

         CARD TYPE                                     CARD TYPE
         LIST DATA INPUT             0.00000                                         0.00000
         NO WRITE OPTIONAL SUMMARY   0.00000                                         0.00000
         NO FLOW AUGMENTATION        0.00000                                         0.00000
         STEADY STATE                0.00000                                         0.00000
         TRAPAZOIDAL                 0.00000                                         0.00000
         NO PRINT LCD/SOLAR DATA     0.00000                                         0.00000
         NO PLOT DO AND BOD DATA     0.00000                                         0.00000
         FIXED DNSTM CONC (YES=1)=   0.00000           5D-ULT BOD CONV K COEF  =    0.23000
         INPUT METRIC           =    0.00000           OUTPUT METRIC           =    0.00000
         NUMBER OF REACHES      =   14.00000           NUMBER OF JUNCTIONS     =    0.00000
         NUM OF HEADWATERS      =    1.00000           NUMBER OF POINT LOADS   =    7.00000
         TIME STEP (HOURS)      =    1.00000           LNTH. COMP. ELEMENT (DX)=    0.20000
         MAXIMUM ROUTE TIME (HRS)=  30.00000           TIME INC. FOR RPT2 (HRS)=    1.00000
         LATITUDE OF BASIN (DEG) =  34.00000           LONGITUDE OF BASIN (DEG)=   85.00000
         STANDARD MARIDIAN (DEG) =  75.00000           DAY OF YEAR START TIME  =  180.00000
         EVAP. COEF.,(AE)       =    0.00103           EVAP. COEF.,(BE)        =    0.00016
         ELEV. OF BASIN (ELEV)   =1000.00000           DUST ATTENUATION COEF.  =    0.06000
         ENDATA1                     0.00000                                         0.00000

          $$$ DATA TYPE 1A (ALGAE PRODUCTION AND NITROGEN OXIDATION CONSTANTS) $$$

         CARD TYPE                                            CARD TYPE
         O UPTAKE BY NH3 OXID(MG O/MG N)=    3.4300          O UPTAKE BY NO2 OXID(MG O/MG N)=    1.1400
         O PROD  BY ALGAE (MG O/MG A)   =    1.6000          O UPTAKE BY ALGAE (MG O/MG A)  =    2.0000
         N CONTENT OF ALGAE (MG N/MG A) =    0.0850          P CONTENT OF ALGAE (MG O/MG A) =    0.0140
         ALG MAX SPEC GROWTH RATE(1/DAY)=    2.5000          ALGAE RESPIRATION RATE (1/DAY) =    0.0500
         N HALF SATURATION CONST (MG/L) =    0.2000          P HALF SATURATION CONST (MG/L) =    0.0400
         LIN ALG SHADE CO (1/FT-UGCHA/L=)    0.0008          NLIN SHADE(1/FT-(UGCHA/L)**2/3)=    0.0000
         LIGHT FUNCTION OPTION (LFNOPT) =    1.0000          LIGHT SAT'N COEF (BTU/FT2-MIN) =    0.1100
         DAILY AVERAGING OPTION (LAVOPT)=    2.0000          LIGHT AVERAGING FACTOR (AFACT) =    0.9200
         NUMBER OF DAYLIGHT HOURS (DLH) =   14.0000          TOTAL DAILY SOLR RAD (BTU/FT-2)= 1300.0000
         ALGY GROWTH CALC OPTION(LGROPT)=    2.0000          ALGAL PREF FOR NH3-N (PREFN)   =    0.9000
         ALG/TEMP SOLR RAD FACTOR(TFACT)=    0.4400          NITRIFICATION INHIBITION COEF  =   10.0000
         ENDATA1A                            0.0000                                              0.0000

          $$$ DATA TYPE 1B (TEMPERATURE CORRECTION CONSTANTS FOR RATE COEFFICIENTS) $$$

         CARD TYPE     RATE CODE     THETA VALUE

         THETA( 1)      BOD DECA        1.047     USER
         THETA( 2)      BOD SETT        1.024     USER
         THETA( 3)      OXY TRAN        1.024     USER
         THETA( 4)      SOD RATE        1.060     USER
         THETA( 5)      ORGN DEC        1.047     USER
         THETA( 6)      ORGN SET        1.024     USER
         THETA( 7)      NH3 DECA        1.083     USER
         THETA( 8)      NH3 SRCE        1.074     USER
         THETA( 9)      NO2 DECA        1.047     USER
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THETA(10)      PORG DEC       1.047    USER
THETA(11)      PORG SET       1.024    USER
THETA(12)      DISP SRC       1.074    USER
THETA(13)      ALG GROW       1.047    USER
THETA(14)      ALG RESP       1.047    USER
THETA(15)      ALG SETT       1.024    USER
THETA(16)      COLI DEC       1.047    DFLT
THETA(17)      ANC DECA       1.000    DFLT
THETA(18)      ANC SETT       1.024    DFLT
THETA(19)      ANC SRCE       1.000    DFLT
ENDATA1B

 $$$ DATA TYPE 2 (REACH IDENTIFICATION) $$$

CARD TYPE           REACH ORDER AND IDENT              R. MI/KM            R. MI/KM
STREAM REACH    1.0  RCH=        Reach 1   FROM        24.0    TO          23.4
STREAM REACH    2.0  RCH=        Reach 2   FROM        23.4    TO          20.2
STREAM REACH    3.0  RCH=        Reach 3   FROM        20.2    TO          19.4
STREAM REACH    4.0  RCH=        Reach 4   FROM        19.4    TO          18.0
STREAM REACH    5.0  RCH=        Reach 5   FROM        18.0    TO          16.2
STREAM REACH    6.0  RCH=        Reach 6   FROM        16.2    TO          14.8
STREAM REACH    7.0  RCH=        Reach 7   FROM        14.8    TO          13.0
STREAM REACH    8.0  RCH=        Reach 8   FROM        13.0    TO          12.0
STREAM REACH    9.0  RCH=        Reach 9   FROM        12.0    TO           9.6
STREAM REACH   10.0  RCH=       Reach 10   FROM         9.6    TO           8.4
STREAM REACH   11.0  RCH=       Reach 11   FROM         8.4    TO           6.0
STREAM REACH   12.0  RCH=       Reach 12   FROM         6.0    TO           4.4
STREAM REACH   13.0  RCH=       Reach 13   FROM         4.4    TO           2.2
STREAM REACH   14.0  RCH=       Reach 14   FROM         2.2    TO           0.0
ENDATA2         0.0                                     0.0                 0.0

 $$$ DATA TYPE 3 (TARGET LEVEL DO AND FLOW AUGMENTATION SOURCES) $$$

CARD TYPE                  REACH  AVAIL HDWS TARGET     ORDER OF AVAIL SOURCES
ENDATA3                     0.       0.       0.0   0.   0.   0.   0.   0.   0.

 $$$ DATA TYPE 4 (COMPUTATIONAL REACH FLAG FIELD) $$$

CARD TYPE        REACH ELEMENTS/REACH            COMPUTATIONAL FLAGS
FLAG FIELD        1.       3.         1.6.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        2.      16.         2.2.2.2.2.2.2.2.2.6.2.2.2.2.2.2.0.0.0.0.
FLAG FIELD        3.       4.         2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        4.       7.         2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        5.       9.         2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        6.       7.         2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        7.       9.         2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        8.       5.         2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        9.      12.         2.2.6.2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       10.       6.         2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       11.      12.         2.2.2.2.2.6.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       12.       8.         2.2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       13.      11.         2.2.2.2.2.2.2.2.2.6.2.0.0.0.0.0.0.0.0.0.
FLAG FIELD       14.      11.         2.2.2.2.2.2.2.2.2.2.5.0.0.0.0.0.0.0.0.0.
ENDATA4           0.       0.         0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.

 $$$ DATA TYPE 5 (HYDRAULIC DATA FOR DETERMINING VELOCITY AND DEPTH) $$$

CARD TYPE        REACH  COEF-DSPN   SS1       SS2      WIDTH     SLOPE     CMANN
HYDRAULICS        1.     60.00     1.000     1.000     5.000     0.002     0.050
HYDRAULICS        2.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        3.     60.00     1.000     1.000   260.000     0.001     0.050
HYDRAULICS        4.     60.00     1.000     1.000    10.000     0.000     0.050
HYDRAULICS        5.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        6.     60.00     1.000     1.000    15.000     0.001     0.050
HYDRAULICS        7.     60.00     1.000     1.000    18.000     0.001     0.050
HYDRAULICS        8.     60.00     1.000     1.000    20.000     0.001     0.050
HYDRAULICS        9.     60.00     1.000     1.000    23.000     0.001     0.050
HYDRAULICS       10.     60.00     1.000     1.000    26.000     0.001     0.050
HYDRAULICS       11.     60.00     1.000     1.000    30.000     0.001     0.050
HYDRAULICS       12.     60.00     1.000     1.000    35.000     0.000     0.050
HYDRAULICS       13.     60.00     1.000     1.000    42.000     0.000     0.050
HYDRAULICS       14.     60.00     1.000     1.000    45.000     0.000     0.050
ENDATA5           0.      0.00     0.000     0.000     0.000     0.000     0.000

 $$$ DATA TYPE 5A (STEADY STATE TEMPERATURE AND CLIMATOLOGY DATA) $$$

CARD TYPE                          DUST     CLOUD   DRY BULB  WET BULB     ATM              SOLAR RAD
                REACH  ELEVATION   COEF     COVER     TEMP      TEMP     PRESSURE     WIND  ATTENUATION
TEMP/LCD          1.    1000.00    0.06      0.00     60.00     60.00     30.00       2.00      1.00
TEMP/LCD          2.    1000.00    0.06      0.00     60.00     60.00     30.00       2.00      1.00
TEMP/LCD          3.    1000.00    0.06      0.00     60.00     60.00     30.00       2.00      1.00
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TEMP/LCD	4.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	5.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	6.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	7.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	8.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	9.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	10.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	11.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	12.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	13.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	14.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
ENDATA5A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6 (REACTION COEFFICIENTS FOR DEOXYGENATION AND REAERATION) $$$

CARD TYPE	REACH	K1	K3	SOD RATE	K2OPT	K2	COEQK2 TSIV COEF FOR OPT 8	OR EXPQK2 OR SLOPE FOR OPT 8
REACT COEF	1.	0.14	0.00	0.020	1.	2.00	0.000	0.00000
REACT COEF	2.	0.14	0.01	0.020	1.	2.00	0.000	0.00000
REACT COEF	3.	0.14	0.02	0.020	1.	13.00	0.000	0.00000
REACT COEF	4.	0.14	0.02	0.020	1.	2.00	0.000	0.00000
REACT COEF	5.	0.14	0.02	0.020	1.	2.00	0.000	0.00000
REACT COEF	6.	0.14	0.02	0.060	1.	3.00	0.000	0.00000
REACT COEF	7.	0.14	0.02	0.060	1.	3.00	0.000	0.00000
REACT COEF	8.	0.14	0.01	0.060	1.	3.00	0.000	0.00000
REACT COEF	9.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	10.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	11.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	12.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	13.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	14.	0.14	0.01	0.090	1.	3.00	0.000	0.00000
ENDATA6	0.	0.00	0.00	0.000	0.	0.00	0.000	0.00000

$$$ DATA TYPE 6A (NITROGEN AND PHOSPHORUS CONSTANTS) $$$

CARD TYPE	REACH	CKNH2	SETNH2	CKNH3	SNH3	CKNO2	CKPORG	SETPORG	SPO4
N AND P COEF	1.	0.02	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	2.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	3.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	4.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	5.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	6.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	7.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	8.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	9.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	10.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	11.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	12.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	13.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	14.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
ENDATA6A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6B (ALGAE/OTHER COEFFICIENTS) $$$

CARD TYPE	REACH	ALPHAO	ALGSET	EXCOEF	CK5 CKCOLI	CKANC	SETANC	SRCANC
ALG/OTHER COEF	1.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	2.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	3.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	4.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	5.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	6.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	7.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	8.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	9.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	10.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	11.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	12.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	13.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	14.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ENDATA6B	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7 (INITIAL CONDITIONS) $$$

CARD TYPE	REACH	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INITIAL COND-1	1.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	2.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	3.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	4.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	5.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00

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INITIAL COND-1        6.     70.00       6.00       1.00    800.00       0.00       0.00       0.00       0.00
INITIAL COND-1        7.     70.00       6.00       1.00    800.00       0.00       0.00       0.00       0.00
INITIAL COND-1        8.     70.00       6.00       1.00    800.00       0.00       0.00       0.00       0.00
INITIAL COND-1        9.     70.00       6.00       1.00    800.00       0.00       0.00       0.00       0.00
INITIAL COND-1       10.     70.00       6.00       1.00    800.00       0.00       0.00       0.00       0.00
INITIAL COND-1       11.     70.00       6.00       1.00    800.00       0.00       0.00       0.00       0.00
INITIAL COND-1       12.     70.00       6.00       1.00    800.00       0.00       0.00       0.00       0.00
INITIAL COND-1       13.     70.00       6.00       1.00    800.00       0.00       0.00       0.00       0.00
INITIAL COND-1       14.     70.00       6.00       1.00    800.00       0.00       0.00       0.00       0.00
ENDATA7               0.      0.00       0.00       0.00      0.00       0.00       0.00       0.00       0.00

 $$$ DATA TYPE 7A (INITIAL CONDITIONS FOR CHOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE            REACH    CHL-A      ORG-N      NH3-N      NO2-N      NO3-N      ORG-P      DIS-P
INITIAL COND-2        1.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INITIAL COND-2        2.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INITIAL COND-2        3.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INITIAL COND-2        4.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INITIAL COND-2        5.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INITIAL COND-2        6.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INITIAL COND-2        7.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INITIAL COND-2        8.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INITIAL COND-2        9.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INITIAL COND-2       10.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INITIAL COND-2       11.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INITIAL COND-2       12.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INITIAL COND-2       13.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INITIAL COND-2       14.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
ENDATA7A              0.      0.00       0.00       0.00       0.00       0.00       0.00       0.00

 $$$ DATA TYPE 8 (INCREMENTAL INFLOW CONDITIONS) $$$

CARD TYPE            REACH     FLOW       TEMP       D.O.        BOD       CM-1       CM-2       CM-3        ANC       COLI
INCR INFLOW-1         1.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-1         2.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-1         3.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-1         4.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-1         5.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-1         6.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-1         7.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-1         8.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-1         9.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-1        10.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-1        11.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-1        12.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-1        13.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-1        14.     0.000      88.00       7.00       0.00       0.00       0.00       0.00       0.00       0.00
ENDATA8               0.     0.000       0.00       0.00       0.00       0.00       0.00       0.00       0.00       0.00

 $$$ DATA TYPE 8A (INCREMENTAL INFLOW CONDITIONS FOR CHLOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE            REACH    CHL-A      ORG-N      NH3-N      NO2-N      NO3-N      ORG-P      DIS-P
INCR INFLOW-2         1.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-2         2.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-2         3.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-2         4.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-2         5.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-2         6.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-2         7.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-2         8.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-2         9.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-2        10.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-2        11.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-2        12.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-2        13.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
INCR INFLOW-2        14.      0.00       0.00       0.00       0.00       0.00       0.00       0.00
ENDATA8A              0.      0.00       0.00       0.00       0.00       0.00       0.00       0.00

 $$$ DATA TYPE 9 (STREAM JUNCTIONS) $$$

CARD TYPE               JUNCTION ORDER AND IDENT          UPSTRM   JUNCTION    TRIB
ENDATA9                 0.                                  0.        0.        0.

 $$$ DATA TYPE 10 (HEADWATER SOURCES) $$$

CARD TYPE     HDWTR     NAME                FLOW       TEMP       D.O.        BOD       CM-1       CM-2       CM-3
              ORDER
HEADWTR-1      1.           Reach 1         0.50      80.00       7.00       2.00     973.00       0.00       0.00
ENDATA10       0.                           0.00       0.00       0.00       0.00       0.00       0.00       0.00

 $$$ DATA TYPE 10A (HEADWATER CONDITIONS FOR CHLOROPHYLL, NITROGEN, PHOSPHORUS,
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COLIFORM AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	HDWTR ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
HEADWTR-2	1.	0.00	0.00E+00	15.00	1.02	0.34	0.00	6.29	0.18	1.01
ENDATA10A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11 (POINT SOURCE / POINT SOURCE CHARACTERISTICS) $$$

CARD TYPE	POINT LOAD ORDER	NAME	EFF	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
POINTLD-1	1.	BLOOMINGDALE	0.00	5.35	70.00	6.66	10.00	866.00	0.00	0.00
POINTLD-1	2.	GLENDALE HEI	0.00	8.15	70.00	7.15	10.00	844.00	0.00	0.00
POINTLD-1	3.	GLENBARD WW	0.00	24.83	70.00	7.02	10.00	1091.00	0.00	0.00
POINTLD-1	4.	DOWNERS GROV	0.00	17.05	70.00	7.34	10.00	928.00	0.00	0.00
POINTLD-1	5.	DUPAGE COUNT	0.00	18.60	70.00	8.05	10.00	822.00	0.00	0.00
POINTLD-1	6.	BOLINGBROOK	0.00	3.16	70.00	9.12	20.00	2315.00	0.00	0.00
POINTLD-1	7.	CITIZENS UTI	0.00	4.65	70.00	7.20	20.00	1985.00	0.00	0.00
ENDATA11	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11A (POINT SOURCE CHARACTERISTICS - CHLOROPHYLL A, NITROGEN, PHOSPHORUS, COLIFORMS AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	POINT LOAD ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	N03-N	ORG-P	DIS-P
POINTLD-2	1.	0.00	0.00E+00	0.00	0.43	1.50	0.00	13.34	0.41	2.25
POINTLD-2	2.	0.00	0.00E+00	0.00	0.43	1.50	0.00	13.34	0.41	2.25
POINTLD-2	3.	0.00	0.00E+00	0.00	0.43	1.50	0.00	13.34	0.41	2.25
POINTLD-2	4.	0.00	0.00E+00	0.00	0.20	1.50	0.00	13.34	0.41	2.25
POINTLD-2	5.	0.00	0.00E+00	0.00	0.20	1.50	0.00	13.34	0.41	2.25
POINTLD-2	6.	0.00	0.00E+00	0.00	0.20	1.50	0.00	13.34	0.41	2.25
POINTLD-2	7.	0.00	0.00E+00	0.00	0.20	1.50	0.00	13.34	0.41	2.25
ENDATA11A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 12 (DAM CHARACTERISTICS) $$$

	DAM	RCH	ELE	ADAM	BDAM	FDAM	HDAM
DAM DATA	1.	3.	4.	1.50	0.33	1.00	2.00
DAM DATA	2.	9.	12.	1.30	0.33	1.00	1.00
ENDATA12	0.	0.	0.	0.00	0.00	0.00	0.00

$$$ DATA TYPE 13 (DOWNSTREAM BOUNDARY CONDITIONS-1) $$$

CARD TYPE	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
ENDATA13	DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED							

$$$ DATA TYPE 13A (DOWNSTREAM BOUNDARY CONDITIONS-2) $$$

CARD TYPE	CHL-A	ORG-N	NH3-N	NO2-N	NH3-N	ORG-P	DIS-P
ENDATA13A	DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED						

TABLE E6 ALLOCATION SCENARIO 1 INPUT FOR QUAL2E

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* * * QUAL-2E  STREAM QUALITY ROUTING MODEL * * *
                                                    Version 3.22  --  May 1996

         $$$ (PROBLEM TITLES) $$$

        CARD TYPE                             QUAL-2E PROGRAM TITLES
        TITLE01              East Branch Allocation -- 7Q5 flow
        TITLE02              Point Sources 8/1; Reduced SOD; Calib KA at dam
        TITLE03  YES         CONSERVATIVE MINERAL I     Cond IN
        TITLE04  NO          CONSERVATIVE MINERAL II
        TITLE05  NO          CONSERVATIVE MINERAL III
        TITLE06  YES         TEMPERATURE
        TITLE07  YES         5-DAY BIOCHEMICAL OXYGEN DEMAND
        TITLE08  YES         ALGAE AS CHL-A IN UG/L
        TITLE09  YES         PHOSPHORUS CYCLE AS P IN MG/L
        TITLE10                (ORGANIC-P; DISSOLVED-P)
        TITLE11  YES         NITROGEN CYCLE AS N IN MG/L
        TITLE12                (ORGANIC-N; AMMONIA-N; NITRITE-N;' NITRATE-N)
        TITLE13  YES         DISSOLVED OXYGEN IN MG/L
        TITLE14  NO          FECAL COLIFORM IN NO./100 ML
        TITLE15  NO          ARBITRARY NON-CONSERVATIVE
        ENDTITLE

         $$$ DATA TYPE 1 (CONTROL DATA) $$$

        CARD TYPE                                     CARD TYPE
        LIST DATA INPUT             0.00000                                  0.00000
        NO WRITE OPTIONAL SUMMARY   0.00000                                  0.00000
        NO FLOW AUGMENTATION        0.00000                                  0.00000
        STEADY STATE                0.00000                                  0.00000
        TRAPAZOIDAL                 0.00000                                  0.00000
        NO PRINT LCD/SOLAR DATA     0.00000                                  0.00000
        NO PLOT DO AND BOD DATA     0.00000                                  0.00000
        FIXED DNSTM CONC (YES=1)=   0.00000         5D-ULT BOD CONV K COEF  =   0.23000
        INPUT METRIC           =    0.00000         OUTPUT METRIC           =   0.00000
        NUMBER OF REACHES      =   14.00000         NUMBER OF JUNCTIONS     =   0.00000
        NUM OF HEADWATERS      =    1.00000         NUMBER OF POINT LOADS   =   7.00000
        TIME STEP (HOURS)      =    1.00000         LNTH. COMP. ELEMENT (DX)=   0.20000
        MAXIMUM ROUTE TIME (HRS)=  30.00000         TIME INC. FOR RPT2 (HRS)=   1.00000
        LATITUDE OF BASIN (DEG) =  34.00000         LONGITUDE OF BASIN (DEG)=  85.00000
        STANDARD MARIDIAN (DEG) =  75.00000         DAY OF YEAR START TIME  = 180.00000
        EVAP. COEF.,(AE)        =   0.00103         EVAP. COEF.,(BE)        =   0.00016
        ELEV. OF BASIN (ELEV)   =1000.00000         DUST ATTENUATION COEF.  =   0.06000
        ENDATA1                     0.00000                                  0.00000

         $$$ DATA TYPE 1A (ALGAE PRODUCTION AND NITROGEN OXIDATION CONSTANTS) $$$

        CARD TYPE                                            CARD TYPE
        O UPTAKE BY NH3 OXID(MG O/MG N)=    3.4300          O UPTAKE BY NO2 OXID(MG O/MG N)=    1.1400
        O PROD  BY ALGAE (MG O/MG A)   =    1.6000          O UPTAKE BY ALGAE (MG O/MG A)  =    2.0000
        N CONTENT OF ALGAE (MG N/MG A) =    0.0850          P CONTENT OF ALGAE (MG O/MG A) =    0.0140
        ALG MAX SPEC GROWTH RATE(1/DAY)=    2.5000          ALGAE RESPIRATION RATE (1/DAY) =    0.0500
        N HALF SATURATION CONST (MG/L) =    0.2000          P HALF SATURATION CONST (MG/L) =    0.0400
        LIN ALG SHADE CO (1/FT-UGCHA/L=)    0.0008          NLIN SHADE(1/FT-(UGCHA/L)**2/3)=    0.0000
        LIGHT FUNCTION OPTION (LFNOPT) =    1.0000          LIGHT SAT'N COEF (BTU/FT2-MIN) =    0.1100
        DAILY AVERAGING OPTION (LAVOPT)=    2.0000          LIGHT AVERAGING FACTOR (AFACT) =    0.9200
        NUMBER OF DAYLIGHT HOURS (DLH) =   14.0000          TOTAL DAILY SOLR RAD (BTU/FT-2)= 1300.0000
        ALGY GROWTH CALC OPTION(LGROPT)=    2.0000          ALGAL PREF FOR NH3-N (PREFN)   =    0.9000
        ALG/TEMP SOLR RAD FACTOR(TFACT)=    0.4400          NITRIFICATION INHIBITION COEF  =   10.0000
        ENDATA1A                            0.0000                                              0.0000

         $$$ DATA TYPE 1B (TEMPERATURE CORRECTION CONSTANTS FOR RATE COEFFICIENTS) $$$

        CARD TYPE     RATE CODE     THETA VALUE

        THETA( 1)      BOD DECA        1.047     USER
        THETA( 2)      BOD SETT        1.024     USER
        THETA( 3)      OXY TRAN        1.024     USER
        THETA( 4)      SOD RATE        1.060     USER
        THETA( 5)      ORGN DEC        1.047     USER
        THETA( 6)      ORGN SET        1.024     USER
        THETA( 7)      NH3 DECA        1.083     USER
        THETA( 8)      NH3 SRCE        1.074     USER
        THETA( 9)      NO2 DECA        1.047     USER
        THETA(10)      PORG DEC        1.047     USER
        THETA(11)      PORG SET        1.024     USER
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THETA(12)      DISP SRC       1.074     USER
THETA(13)      ALG GROW       1.047     USER
THETA(14)      ALG RESP       1.047     USER
THETA(15)      ALG SETT       1.024     USER
THETA(16)      COLI DEC       1.047     DFLT
THETA(17)      ANC DECA       1.000     DFLT
THETA(18)      ANC SETT       1.024     DFLT
THETA(19)      ANC SRCE       1.000     DFLT
ENDATA1B

 $$$ DATA TYPE 2 (REACH IDENTIFICATION) $$$

CARD TYPE            REACH ORDER AND IDENT              R. MI/KM             R. MI/KM
STREAM REACH     1.0  RCH=         Reach 1   FROM         24.0    TO          23.4
STREAM REACH     2.0  RCH=         Reach 2   FROM         23.4    TO          20.2
STREAM REACH     3.0  RCH=         Reach 3   FROM         20.2    TO          19.4
STREAM REACH     4.0  RCH=         Reach 4   FROM         19.4    TO          18.0
STREAM REACH     5.0  RCH=         Reach 5   FROM         18.0    TO          16.2
STREAM REACH     6.0  RCH=         Reach 6   FROM         16.2    TO          14.8
STREAM REACH     7.0  RCH=         Reach 7   FROM         14.8    TO          13.0
STREAM REACH     8.0  RCH=         Reach 8   FROM         13.0    TO          12.0
STREAM REACH     9.0  RCH=         Reach 9   FROM         12.0    TO           9.6
STREAM REACH    10.0  RCH=        Reach 10   FROM          9.6    TO           8.4
STREAM REACH    11.0  RCH=        Reach 11   FROM          8.4    TO           6.0
STREAM REACH    12.0  RCH=        Reach 12   FROM          6.0    TO           4.4
STREAM REACH    13.0  RCH=        Reach 13   FROM          4.4    TO           2.2
STREAM REACH    14.0  RCH=        Reach 14   FROM          2.2    TO           0.0
ENDATA2          0.0                                       0.0                 0.0

 $$$ DATA TYPE 3 (TARGET LEVEL DO AND FLOW AUGMENTATION SOURCES) $$$

CARD TYPE                   REACH  AVAIL HDWS TARGET     ORDER OF AVAIL SOURCES
ENDATA3                       0.        0.       0.0   0.   0.   0.   0.   0.   0.

 $$$ DATA TYPE 4 (COMPUTATIONAL REACH FLAG FIELD) $$$

CARD TYPE        REACH ELEMENTS/REACH             COMPUTATIONAL FLAGS
FLAG FIELD        1.        3.         1.6.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        2.       16.         2.2.2.2.2.2.2.2.2.6.2.2.2.2.2.2.0.0.0.0.
FLAG FIELD        3.        4.         2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        4.        7.         2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        5.        9.         2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        6.        7.         2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        7.        9.         2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        8.        5.         2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        9.       12.         2.2.6.2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       10.        6.         2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       11.       12.         2.2.2.2.2.6.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       12.        8.         2.2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       13.       11.         2.2.2.2.2.2.2.2.2.6.2.0.0.0.0.0.0.0.0.0.
FLAG FIELD       14.       11.         2.2.2.2.2.2.2.2.2.2.5.0.0.0.0.0.0.0.0.0.
ENDATA4           0.        0.         0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.

 $$$ DATA TYPE 5 (HYDRAULIC DATA FOR DETERMINING VELOCITY AND DEPTH) $$$

CARD TYPE        REACH  COEF-DSPN    SS1       SS2      WIDTH     SLOPE     CMANN
HYDRAULICS        1.     60.00     1.000     1.000     5.000     0.002     0.050
HYDRAULICS        2.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        3.     60.00     1.000     1.000   260.000     0.001     0.050
HYDRAULICS        4.     60.00     1.000     1.000    10.000     0.000     0.050
HYDRAULICS        5.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        6.     60.00     1.000     1.000    15.000     0.001     0.050
HYDRAULICS        7.     60.00     1.000     1.000    18.000     0.001     0.050
HYDRAULICS        8.     60.00     1.000     1.000    20.000     0.001     0.050
HYDRAULICS        9.     60.00     1.000     1.000    23.000     0.001     0.050
HYDRAULICS       10.     60.00     1.000     1.000    26.000     0.001     0.050
HYDRAULICS       11.     60.00     1.000     1.000    30.000     0.001     0.050
HYDRAULICS       12.     60.00     1.000     1.000    35.000     0.000     0.050
HYDRAULICS       13.     60.00     1.000     1.000    42.000     0.000     0.050
HYDRAULICS       14.     60.00     1.000     1.000    45.000     0.000     0.050
ENDATA5           0.      0.00     0.000     0.000     0.000     0.000     0.000

 $$$ DATA TYPE 5A (STEADY STATE TEMPERATURE AND CLIMATOLOGY DATA) $$$

CARD TYPE                               DUST     CLOUD   DRY BULB  WET BULB     ATM                 SOLAR RAD
                REACH   ELEVATION       COEF     COVER     TEMP      TEMP     PRESSURE      WIND   ATTENUATION
TEMP/LCD          1.     1000.00        0.06      0.00     60.00     60.00     30.00        2.00       1.00
TEMP/LCD          2.     1000.00        0.06      0.00     60.00     60.00     30.00        2.00       1.00
TEMP/LCD          3.     1000.00        0.06      0.00     60.00     60.00     30.00        2.00       1.00
TEMP/LCD          4.     1000.00        0.06      0.00     60.00     60.00     30.00        2.00       1.00
TEMP/LCD          5.     1000.00        0.06      0.00     60.00     60.00     30.00        2.00       1.00
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TEMP/LCD	6.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	7.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	8.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	9.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	10.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	11.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	12.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	13.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	14.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
ENDATA5A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6 (REACTION COEFFICIENTS FOR DEOXYGENATION AND REAERATION) $$$

CARD TYPE	REACH	K1	K3	SOD RATE	K2OPT	K2	COEQK2 TSIV COEF FOR OPT 8	OR OR	EXPQK2 SLOPE FOR OPT 8
REACT COEF	1.	0.14	0.00	0.020	1.	2.00	0.000		0.00000
REACT COEF	2.	0.14	0.01	0.020	1.	2.00	0.000		0.00000
REACT COEF	3.	0.14	0.02	0.020	1.	2.00	0.000		0.00000
REACT COEF	4.	0.14	0.02	0.020	1.	2.00	0.000		0.00000
REACT COEF	5.	0.14	0.02	0.020	1.	2.00	0.000		0.00000
REACT COEF	6.	0.14	0.02	0.060	1.	3.00	0.000		0.00000
REACT COEF	7.	0.14	0.02	0.060	1.	3.00	0.000		0.00000
REACT COEF	8.	0.14	0.01	0.060	1.	3.00	0.000		0.00000
REACT COEF	9.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	10.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	11.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	12.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	13.	0.14	0.01	0.100	1.	3.00	0.000		0.00000
REACT COEF	14.	0.14	0.01	0.090	1.	3.00	0.000		0.00000
ENDATA6	0.	0.00	0.00	0.000	0.	0.00	0.000		0.00000

$$$ DATA TYPE 6A (NITROGEN AND PHOSPHORUS CONSTANTS) $$$

CARD TYPE	REACH	CKNH2	SETNH2	CKNH3	SNH3	CKNO2	CKPORG	SETPORG	SPO4
N AND P COEF	1.	0.02	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	2.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	3.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	4.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	5.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	6.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	7.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	8.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	9.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	10.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	11.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	12.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	13.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	14.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
ENDATA6A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6B (ALGAE/OTHER COEFFICIENTS) $$$

CARD TYPE	REACH	ALPHAO	ALGSET	EXCOEF	CK5 CKCOLI	CKANC	SETANC	SRCANC
ALG/OTHER COEF	1.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	2.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	3.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	4.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	5.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	6.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	7.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	8.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	9.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	10.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	11.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	12.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	13.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	14.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ENDATA6B	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7 (INITIAL CONDITIONS) $$$

CARD TYPE	REACH	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INITIAL COND-1	1.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	2.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	3.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	4.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	5.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	6.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	7.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00

INITIAL COND-1	8.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	9.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	10.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	11.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	12.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	13.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	14.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
ENDATA7	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7A (INITIAL CONDITIONS FOR CHOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INITIAL COND-2	1.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	2.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	3.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	4.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	5.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	6.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	7.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	8.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	9.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	10.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	11.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	12.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	13.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	14.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA7A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 8 (INCREMENTAL INFLOW CONDITIONS) $$$

CARD TYPE	REACH	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INCR INFLOW-1	1.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	2.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	3.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	4.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	5.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	6.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	7.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	8.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	9.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	10.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	11.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	12.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	13.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	14.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA8	0.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 8A (INCREMENTAL INFLOW CONDITIONS FOR CHLOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INCR INFLOW-2	1.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	2.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	3.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	4.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	5.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	6.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	7.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	8.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	9.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	10.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	11.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	12.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	13.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	14.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA8A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 9 (STREAM JUNCTIONS) $$$

CARD TYPE	JUNCTION ORDER AND IDENT	UPSTRM	JUNCTION	TRIB
ENDATA9	0.	0.	0.	0.

$$$ DATA TYPE 10 (HEADWATER SOURCES) $$$

CARD TYPE	HDWTR ORDER	NAME	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
HEADWTR-1	1.	Reach 1	0.50	80.00	7.00	2.00	973.00	0.00	0.00
ENDATA10	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 10A (HEADWATER CONDITIONS FOR CHLOROPHYLL, NITROGEN, PHOSPHORUS,
COLIFORM AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	HDWTR ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
HEADWTR-2	1.	0.00	0.00E+00	15.00	1.02	0.34	0.00	6.29	0.18	1.01
ENDATA10A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11 (POINT SOURCE / POINT SOURCE CHARACTERISTICS) $$$

CARD TYPE	POINT LOAD ORDER	NAME	EFF	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
POINTLD-1	1.	BLOOMINGDALE	0.00	5.35	70.00	6.66	8.00	866.00	0.00	0.00
POINTLD-1	2.	GLENDALE HEI	0.00	8.15	70.00	7.15	8.00	844.00	0.00	0.00
POINTLD-1	3.	GLENBARD WW	0.00	24.83	70.00	7.02	8.00	1091.00	0.00	0.00
POINTLD-1	4.	DOWNERS GROV	0.00	17.05	70.00	7.34	8.00	928.00	0.00	0.00
POINTLD-1	5.	DUPAGE COUNT	0.00	18.60	70.00	8.05	8.00	822.00	0.00	0.00
POINTLD-1	6.	BOLINGBROOK	0.00	3.16	70.00	9.12	8.00	2315.00	0.00	0.00
POINTLD-1	7.	CITIZENS UTI	0.00	4.65	70.00	7.20	8.00	1985.00	0.00	0.00
ENDATA11	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11A (POINT SOURCE CHARACTERISTICS - CHLOROPHYLL A, NITROGEN, PHOSPHORUS, COLIFORMS AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	POINT LOAD ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	N03-N	ORG-P	DIS-P
POINTLD-2	1.	0.00	0.00E+00	0.00	0.43	1.00	0.00	13.34	0.41	2.25
POINTLD-2	2.	0.00	0.00E+00	0.00	0.43	1.00	0.00	13.34	0.41	2.25
POINTLD-2	3.	0.00	0.00E+00	0.00	0.43	1.00	0.00	13.34	0.41	2.25
POINTLD-2	4.	0.00	0.00E+00	0.00	0.20	1.00	0.00	13.34	0.41	2.25
POINTLD-2	5.	0.00	0.00E+00	0.00	0.20	1.00	0.00	13.34	0.41	2.25
POINTLD-2	6.	0.00	0.00E+00	0.00	0.20	1.00	0.00	13.34	0.41	2.25
POINTLD-2	7.	0.00	0.00E+00	0.00	0.20	1.00	0.00	13.34	0.41	2.25
ENDATA11A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 12 (DAM CHARACTERISTICS) $$$

	DAM	RCH	ELE	ADAM	BDAM	FDAM	HDAM
DAM DATA	1.	3.	4.	1.50	0.33	1.00	2.00
DAM DATA	2.	9.	12.	1.30	0.33	1.00	1.00
ENDATA12	0.	0.	0.	0.00	0.00	0.00	0.00

$$$ DATA TYPE 13 (DOWNSTREAM BOUNDARY CONDITIONS-1) $$$

CARD TYPE TEMP D.O. BOD CM-1 CM-2 CM-3 ANC COLI

ENDATA13 DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED

$$$ DATA TYPE 13A (DOWNSTREAM BOUNDARY CONDITIONS-2) $$$

CARD TYPE CHL-A ORG-N NH3-N NO2-N NH3-N ORG-P DIS-P

ENDATA13A DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED

TABLE E7 ALLOCATION SCENARIO 2 INPUT FOR QUAL2E

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* * * QUAL-2E  STREAM QUALITY ROUTING MODEL * * *
                                                           Version 3.22  --  May 1996

          $$$ (PROBLEM TITLES) $$$

         CARD TYPE                            QUAL-2E PROGRAM TITLES
         TITLE01              East Branch Allocation 2  - 7Q10 flow
         TITLE02              SOD as in Scenario 4; Dam removed; permitted BOD
         TITLE03  YES         CONSERVATIVE MINERAL I     Cond IN
         TITLE04  NO          CONSERVATIVE MINERAL II
         TITLE05  NO          CONSERVATIVE MINERAL III
         TITLE06  YES         TEMPERATURE
         TITLE07  YES         5-DAY BIOCHEMICAL OXYGEN DEMAND
         TITLE08  YES         ALGAE AS CHL-A IN UG/L
         TITLE09  YES         PHOSPHORUS CYCLE AS P IN MG/L
         TITLE10                (ORGANIC-P; DISSOLVED-P)
         TITLE11  YES         NITROGEN CYCLE AS N IN MG/L
         TITLE12                (ORGANIC-N; AMMONIA-N; NITRITE-N;' NITRATE-N)
         TITLE13  YES         DISSOLVED OXYGEN IN MG/L
         TITLE14  NO          FECAL COLIFORM IN NO./100 ML
         TITLE15  NO          ARBITRARY NON-CONSERVATIVE
         ENDTITLE

          $$$ DATA TYPE 1 (CONTROL DATA) $$$

         CARD TYPE                                    CARD TYPE
         LIST DATA INPUT             0.00000                                    0.00000
         NO WRITE OPTIONAL SUMMARY   0.00000                                    0.00000
         NO FLOW AUGMENTATION        0.00000                                    0.00000
         STEADY STATE                0.00000                                    0.00000
         TRAPAZOIDAL                 0.00000                                    0.00000
         NO PRINT LCD/SOLAR DATA     0.00000                                    0.00000
         NO PLOT DO AND BOD DATA     0.00000                                    0.00000
         FIXED DNSTM CONC (YES=1)=   0.00000          5D-ULT BOD CONV K COEF  =   0.23000
         INPUT METRIC          =     0.00000          OUTPUT METRIC           =   0.00000
         NUMBER OF REACHES     =    14.00000          NUMBER OF JUNCTIONS     =   0.00000
         NUM OF HEADWATERS     =     1.00000          NUMBER OF POINT LOADS   =   7.00000
         TIME STEP (HOURS)     =     1.00000          LNTH. COMP. ELEMENT (DX)=   0.20000
         MAXIMUM ROUTE TIME (HRS)=  30.00000          TIME INC. FOR RPT2 (HRS)=   1.00000
         LATITUDE OF BASIN (DEG) =  34.00000          LONGITUDE OF BASIN (DEG)=  85.00000
         STANDARD MARIDIAN (DEG) =  75.00000          DAY OF YEAR START TIME  = 180.00000
         EVAP. COEF.,(AE)      =     0.00103          EVAP. COEF.,(BE)        =   0.00016
         ELEV. OF BASIN (ELEV)   =1000.00000          DUST ATTENUATION COEF.  =   0.06000
         ENDATA1                     0.00000                                    0.00000

          $$$ DATA TYPE 1A (ALGAE PRODUCTION AND NITROGEN OXIDATION CONSTANTS) $$$

         CARD TYPE                                           CARD TYPE
         O UPTAKE BY NH3 OXID(MG O/MG N)=    3.4300          O UPTAKE BY NO2 OXID(MG O/MG N)=    1.1400
         O PROD  BY ALGAE (MG O/MG A)   =    1.6000          O UPTAKE BY ALGAE (MG O/MG A)  =    2.0000
         N CONTENT OF ALGAE (MG N/MG A) =    0.0850          P CONTENT OF ALGAE (MG O/MG A) =    0.0140
         ALG MAX SPEC GROWTH RATE(1/DAY)=    2.5000          ALGAE RESPIRATION RATE (1/DAY) =    0.0500
         N HALF SATURATION CONST (MG/L) =    0.2000          P HALF SATURATION CONST (MG/L) =    0.0400
         LIN ALG SHADE CO (1/FT-UGCHA/L=)    0.0008          NLIN SHADE(1/FT-(UGCHA/L)**2/3)=    0.0000
         LIGHT FUNCTION OPTION (LFNOPT) =    1.0000          LIGHT SAT'N COEF (BTU/FT2-MIN) =    0.1100
         DAILY AVERAGING OPTION (LAVOPT)=    2.0000          LIGHT AVERAGING FACTOR (AFACT) =    0.9200
         NUMBER OF DAYLIGHT HOURS (DLH) =   14.0000          TOTAL DAILY SOLR RAD (BTU/FT-2)= 1300.0000
         ALGY GROWTH CALC OPTION(LGROPT)=    2.0000          ALGAL PREF FOR NH3-N (PREFN)   =    0.9000
         ALG/TEMP SOLR RAD FACTOR(TFACT)=    0.4400          NITRIFICATION INHIBITION COEF  =   10.0000
         ENDATA1A                            0.0000                                              0.0000

          $$$ DATA TYPE 1B (TEMPERATURE CORRECTION CONSTANTS FOR RATE COEFFICIENTS) $$$

         CARD TYPE     RATE CODE     THETA VALUE

         THETA( 1)      BOD DECA        1.047     USER
         THETA( 2)      BOD SETT        1.024     USER
         THETA( 3)      OXY TRAN        1.024     USER
         THETA( 4)      SOD RATE        1.060     USER
         THETA( 5)      ORGN DEC        1.047     USER
         THETA( 6)      ORGN SET        1.024     USER
         THETA( 7)      NH3 DECA        1.083     USER
         THETA( 8)      NH3 SRCE        1.074     USER
         THETA( 9)      NO2 DECA        1.047     USER
         THETA(10)      PORG DEC        1.047     USER
         THETA(11)      PORG SET        1.024     USER
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THETA(12)      DISP SRC        1.074     USER
THETA(13)      ALG GROW        1.047     USER
THETA(14)      ALG RESP        1.047     USER
THETA(15)      ALG SETT        1.024     USER
THETA(16)      COLI DEC        1.047     DFLT
THETA(17)      ANC DECA        1.000     DFLT
THETA(18)      ANC SETT        1.024     DFLT
THETA(19)      ANC SRCE        1.000     DFLT
ENDATA1B

 $$$ DATA TYPE 2 (REACH IDENTIFICATION) $$$

CARD TYPE           REACH ORDER AND IDENT              R. MI/KM            R. MI/KM
STREAM REACH     1.0  RCH=         Reach 1   FROM         24.0    TO          23.4
STREAM REACH     2.0  RCH=         Reach 2   FROM         23.4    TO          20.2
STREAM REACH     3.0  RCH=         Reach 3   FROM         20.2    TO          19.4
STREAM REACH     4.0  RCH=         Reach 4   FROM         19.4    TO          18.0
STREAM REACH     5.0  RCH=         Reach 5   FROM         18.0    TO          16.2
STREAM REACH     6.0  RCH=         Reach 6   FROM         16.2    TO          14.8
STREAM REACH     7.0  RCH=         Reach 7   FROM         14.8    TO          13.0
STREAM REACH     8.0  RCH=         Reach 8   FROM         13.0    TO          12.0
STREAM REACH     9.0  RCH=         Reach 9   FROM         12.0    TO           9.6
STREAM REACH    10.0  RCH=        Reach 10   FROM          9.6    TO           8.4
STREAM REACH    11.0  RCH=        Reach 11   FROM          8.4    TO           6.0
STREAM REACH    12.0  RCH=        Reach 12   FROM          6.0    TO           4.4
STREAM REACH    13.0  RCH=        Reach 13   FROM          4.4    TO           2.2
STREAM REACH    14.0  RCH=        Reach 14   FROM          2.2    TO           0.0
ENDATA2          0.0                                       0.0                 0.0

 $$$ DATA TYPE 3 (TARGET LEVEL DO AND FLOW AUGMENTATION SOURCES) $$$

CARD TYPE                  REACH  AVAIL HDWS TARGET     ORDER OF AVAIL SOURCES
ENDATA3                      0.        0.       0.0   0.    0.    0.    0.    0.    0.

 $$$ DATA TYPE 4 (COMPUTATIONAL REACH FLAG FIELD) $$$

CARD TYPE        REACH ELEMENTS/REACH           COMPUTATIONAL FLAGS
FLAG FIELD        1.         3.         1.6.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        2.        16.         2.2.2.2.2.2.2.2.6.2.2.2.2.2.2.2.0.0.0.0.
FLAG FIELD        3.         4.         2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        4.         7.         2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        5.         9.         2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        6.         7.         2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        7.         9.         2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        8.         5.         2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        9.        12.         2.2.6.2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       10.         6.         2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       11.        12.         2.2.2.2.6.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       12.         8.         2.2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       13.        11.         2.2.2.2.2.2.2.2.2.6.2.0.0.0.0.0.0.0.0.0.
FLAG FIELD       14.        11.         2.2.2.2.2.2.2.2.2.2.5.0.0.0.0.0.0.0.0.0.
ENDATA4           0.         0.         0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.

 $$$ DATA TYPE 5 (HYDRAULIC DATA FOR DETERMINING VELOCITY AND DEPTH) $$$

CARD TYPE        REACH  COEF-DSPN    SS1       SS2      WIDTH     SLOPE     CMANN
HYDRAULICS        1.     60.00     1.000     1.000     5.000     0.002     0.050
HYDRAULICS        2.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        3.     60.00     1.000     1.000    10.000     0.001     0.050
HYDRAULICS        4.     60.00     1.000     1.000    10.000     0.000     0.050
HYDRAULICS        5.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        6.     60.00     1.000     1.000    15.000     0.001     0.050
HYDRAULICS        7.     60.00     1.000     1.000    18.000     0.001     0.050
HYDRAULICS        8.     60.00     1.000     1.000    20.000     0.001     0.050
HYDRAULICS        9.     60.00     1.000     1.000    23.000     0.001     0.050
HYDRAULICS       10.     60.00     1.000     1.000    26.000     0.001     0.050
HYDRAULICS       11.     60.00     1.000     1.000    30.000     0.001     0.050
HYDRAULICS       12.     60.00     1.000     1.000    35.000     0.000     0.050
HYDRAULICS       13.     60.00     1.000     1.000    42.000     0.000     0.050
HYDRAULICS       14.     60.00     1.000     1.000    45.000     0.000     0.050
ENDATA5           0.      0.00     0.000     0.000     0.000     0.000     0.000

 $$$ DATA TYPE 5A (STEADY STATE TEMPERATURE AND CLIMATOLOGY DATA) $$$

CARD TYPE                               DUST     CLOUD   DRY BULB  WET BULB     ATM                 SOLAR RAD
                REACH   ELEVATION       COEF     COVER     TEMP      TEMP     PRESSURE     WIND   ATTENUATION
TEMP/LCD          1.     1000.00        0.06      0.00     60.00     60.00     30.00       2.00       1.00
TEMP/LCD          2.     1000.00        0.06      0.00     60.00     60.00     30.00       2.00       1.00
TEMP/LCD          3.     1000.00        0.06      0.00     60.00     60.00     30.00       2.00       1.00
TEMP/LCD          4.     1000.00        0.06      0.00     60.00     60.00     30.00       2.00       1.00
TEMP/LCD          5.     1000.00        0.06      0.00     60.00     60.00     30.00       2.00       1.00
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TEMP/LCD	6.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	7.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	8.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	9.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	10.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	11.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	12.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	13.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	14.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
ENDATA5A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6 (REACTION COEFFICIENTS FOR DEOXYGENATION AND REAERATION) $$$

CARD TYPE	REACH	K1	K3	SOD RATE	K2OPT	K2	COEQK2 OR TSIV COEF OR FOR OPT 8	EXPQK2 SLOPE FOR OPT 8
REACT COEF	1.	0.14	0.00	0.020	1.	2.00	0.000	0.00000
REACT COEF	2.	0.14	0.01	0.020	1.	2.00	0.000	0.00000
REACT COEF	3.	0.14	0.02	0.020	1.	2.00	0.000	0.00000
REACT COEF	4.	0.14	0.02	0.020	1.	2.00	0.000	0.00000
REACT COEF	5.	0.14	0.02	0.020	1.	2.00	0.000	0.00000
REACT COEF	6.	0.14	0.02	0.060	1.	3.00	0.000	0.00000
REACT COEF	7.	0.14	0.02	0.060	1.	3.00	0.000	0.00000
REACT COEF	8.	0.14	0.01	0.060	1.	3.00	0.000	0.00000
REACT COEF	9.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	10.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	11.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	12.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	13.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	14.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
ENDATA6	0.	0.00	0.00	0.000	0.	0.00	0.000	0.00000

$$$ DATA TYPE 6A (NITROGEN AND PHOSPHORUS CONSTANTS) $$$

CARD TYPE	REACH	CKNH2	SETNH2	CKNH3	SNH3	CKNO2	CKPORG	SETPORG	SPO4
N AND P COEF	1.	0.02	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	2.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	3.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	4.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	5.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	6.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	7.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	8.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	9.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	10.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	11.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	12.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	13.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	14.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
ENDATA6A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6B (ALGAE/OTHER COEFFICIENTS) $$$

CARD TYPE	REACH	ALPHAO	ALGSET	EXCOEF	CK5 CKCOLI	CKANC	SETANC	SRCANC
ALG/OTHER COEF	1.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	2.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	3.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	4.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	5.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	6.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	7.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	8.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	9.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	10.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	11.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	12.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	13.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	14.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ENDATA6B	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7 (INITIAL CONDITIONS) $$$

CARD TYPE	REACH	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INITIAL COND-1	1.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	2.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	3.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	4.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	5.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	6.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	7.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00

INITIAL COND-1	8.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	9.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	10.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	11.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	12.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	13.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	14.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
ENDATA7	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7A (INITIAL CONDITIONS FOR CHOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INITIAL COND-2	1.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	2.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	3.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	4.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	5.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	6.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	7.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	8.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	9.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	10.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	11.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	12.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	13.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INITIAL COND-2	14.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA7A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 8 (INCREMENTAL INFLOW CONDITIONS) $$$

CARD TYPE	REACH	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INCR INFLOW-1	1.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	2.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	3.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	4.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	5.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	6.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	7.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	8.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	9.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	10.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	11.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	12.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	13.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	14.	0.000	88.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA8	0.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 8A (INCREMENTAL INFLOW CONDITIONS FOR CHLOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INCR INFLOW-2	1.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	2.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	3.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	4.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	5.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	6.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	7.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	8.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	9.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	10.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	11.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	12.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	13.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	14.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDATA8A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 9 (STREAM JUNCTIONS) $$$

CARD TYPE	JUNCTION ORDER AND IDENT	UPSTRM	JUNCTION	TRIB
ENDATA9	0.	0.	0.	0.

$$$ DATA TYPE 10 (HEADWATER SOURCES) $$$

CARD TYPE	HDWTR ORDER	NAME	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
HEADWTR-1	1.	Reach 1	0.50	80.00	7.00	2.00	973.00	0.00	0.00
ENDATA10	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 10A (HEADWATER CONDITIONS FOR CHLOROPHYLL, NITROGEN, PHOSPHORUS, COLIFORM AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	HDWTR ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
HEADWTR-2	1.	0.00	0.00E+00	15.00	1.02	0.34	0.00	6.29	0.18	1.01
ENDATA10A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11 (POINT SOURCE / POINT SOURCE CHARACTERISTICS) $$$

CARD TYPE	POINT LOAD ORDER	NAME	EFF	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
POINTLD-1	1.	BLOOMINGDALE	0.00	5.35	70.00	6.66	10.00	866.00	0.00	0.00
POINTLD-1	2.	GLENDALE HEI	0.00	8.15	70.00	7.15	10.00	844.00	0.00	0.00
POINTLD-1	3.	GLENBARD WW	0.00	24.83	70.00	7.02	10.00	1091.00	0.00	0.00
POINTLD-1	4.	DOWNERS GROV	0.00	9.20	70.00	7.34	10.00	928.00	0.00	0.00
POINTLD-1	5.	DUPAGE COUNT	0.00	18.60	70.00	8.05	10.00	822.00	0.00	0.00
POINTLD-1	6.	BOLINGBROOK	0.00	3.16	70.00	9.12	20.00	2315.00	0.00	0.00
POINTLD-1	7.	CITIZENS UTI	0.00	4.65	70.00	7.20	20.00	1985.00	0.00	0.00
ENDATA11	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11A (POINT SOURCE CHARACTERISTICS - CHLOROPHYLL A, NITROGEN, PHOSPHORUS,
COLIFORMS AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	POINT LOAD ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	N03-N	ORG-P	DIS-P
POINTLD-2	1.	0.00	0.00E+00	0.00	0.43	1.00	0.00	13.34	0.41	2.25
POINTLD-2	2.	0.00	0.00E+00	0.00	0.43	1.00	0.00	13.34	0.41	2.25
POINTLD-2	3.	0.00	0.00E+00	0.00	0.43	1.00	0.00	13.34	0.41	2.25
POINTLD-2	4.	0.00	0.00E+00	0.00	0.20	1.00	0.00	13.34	0.41	2.25
POINTLD-2	5.	0.00	0.00E+00	0.00	0.20	1.00	0.00	13.34	0.41	2.25
POINTLD-2	6.	0.00	0.00E+00	0.00	0.20	1.00	0.00	13.34	0.41	2.25
POINTLD-2	7.	0.00	0.00E+00	0.00	0.20	1.00	0.00	13.34	0.41	2.25
ENDATA11A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 12 (DAM CHARACTERISTICS) $$$

	DAM	RCH	ELE	ADAM	BDAM	FDAM	HDAM
DAM DATA	1.	9.	12.	1.30	0.33	1.00	1.00
ENDATA12	0.	0.	0.	0.00	0.00	0.00	0.00

$$$ DATA TYPE 13 (DOWNSTREAM BOUNDARY CONDITIONS-1) $$$

CARD TYPE	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI

ENDATA13 DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED

$$$ DATA TYPE 13A (DOWNSTREAM BOUNDARY CONDITIONS-2) $$$

CARD TYPE	CHL-A	ORG-N	NH3-N	NO2-N	NH3-N	ORG-P	DIS-P

ENDATA13A DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED

TABLE E8 ALLOCATION SCENARIO 3 INPUT FOR QUAL2E

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* * * QUAL-2E  STREAM QUALITY ROUTING MODEL * * *
                                                            Version 3.22  --  May 1996

         $$$ (PROBLEM TITLES) $$$

        CARD TYPE                            QUAL-2E PROGRAM TITLES
        TITLE01             East Branch Allocation 3  - 7Q10 flow
        TITLE02             SOD as in Scenario 4; Dam in, Ka up; permitted BOD
        TITLE03  YES        CONSERVATIVE MINERAL I     Cond IN
        TITLE04  NO         CONSERVATIVE MINERAL II
        TITLE05  NO         CONSERVATIVE MINERAL III
        TITLE06  YES        TEMPERATURE
        TITLE07  YES        5-DAY BIOCHEMICAL OXYGEN DEMAND
        TITLE08  YES        ALGAE AS CHL-A IN UG/L
        TITLE09  YES        PHOSPHORUS CYCLE AS P IN MG/L
        TITLE10               (ORGANIC-P; DISSOLVED-P)
        TITLE11  YES        NITROGEN CYCLE AS N IN MG/L
        TITLE12               (ORGANIC-N; AMMONIA-N; NITRITE-N;' NITRATE-N)
        TITLE13  YES        DISSOLVED OXYGEN IN MG/L
        TITLE14  NO         FECAL COLIFORM IN NO./100 ML
        TITLE15  NO         ARBITRARY NON-CONSERVATIVE
        ENDTITLE

         $$$ DATA TYPE 1 (CONTROL DATA) $$$

        CARD TYPE                                     CARD TYPE
        LIST DATA INPUT             0.00000                                    0.00000
        NO WRITE OPTIONAL SUMMARY   0.00000                                    0.00000
        NO FLOW AUGMENTATION        0.00000                                    0.00000
        STEADY STATE                0.00000                                    0.00000
        TRAPAZOIDAL                 0.00000                                    0.00000
        NO PRINT LCD/SOLAR DATA     0.00000                                    0.00000
        NO PLOT DO AND BOD DATA     0.00000                                    0.00000
        FIXED DNSTM CONC (YES=1)=   0.00000       5D-ULT BOD CONV K COEF  =   0.23000
        INPUT METRIC           =    0.00000       OUTPUT METRIC           =   0.00000
        NUMBER OF REACHES      =   14.00000       NUMBER OF JUNCTIONS     =   0.00000
        NUM OF HEADWATERS      =    1.00000       NUMBER OF POINT LOADS   =   7.00000
        TIME STEP (HOURS)      =    1.00000       LNTH. COMP. ELEMENT (DX)=   0.20000
        MAXIMUM ROUTE TIME (HRS)=  30.00000       TIME INC. FOR RPT2 (HRS)=   1.00000
        LATITUDE OF BASIN (DEG) =  34.00000       LONGITUDE OF BASIN (DEG)=  85.00000
        STANDARD MARIDIAN (DEG) =  75.00000       DAY OF YEAR START TIME  = 180.00000
        EVAP. COEF.,(AE)       =    0.00103       EVAP. COEF.,(BE)        =   0.00016
        ELEV. OF BASIN (ELEV)   =1000.00000       DUST ATTENUATION COEF.  =   0.06000
        ENDATA1                     0.00000                                    0.00000

         $$$ DATA TYPE 1A (ALGAE PRODUCTION AND NITROGEN OXIDATION CONSTANTS) $$$

        CARD TYPE                                           CARD TYPE
        O UPTAKE BY NH3 OXID(MG O/MG N)=    3.4300          O UPTAKE BY NO2 OXID(MG O/MG N)=    1.1400
        O PROD  BY ALGAE (MG O/MG A)   =    1.6000          O UPTAKE BY ALGAE (MG O/MG A)  =    2.0000
        N CONTENT OF ALGAE (MG N/MG A) =    0.0850          P CONTENT OF ALGAE (MG O/MG A) =    0.0140
        ALG MAX SPEC GROWTH RATE(1/DAY)=    2.5000          ALGAE RESPIRATION RATE (1/DAY) =    0.0500
        N HALF SATURATION CONST (MG/L) =    0.2000          P HALF SATURATION CONST (MG/L) =    0.0400
        LIN ALG SHADE CO (1/FT-UGCHA/L=)    0.0008          NLIN SHADE(1/FT-(UGCHA/L)**2/3)=    0.0000
        LIGHT FUNCTION OPTION (LFNOPT) =    1.0000          LIGHT SAT'N COEF (BTU/FT2-MIN) =    0.1100
        DAILY AVERAGING OPTION (LAVOPT)=    2.0000          LIGHT AVERAGING FACTOR (AFACT) =    0.9200
        NUMBER OF DAYLIGHT HOURS (DLH) =   14.0000          TOTAL DAILY SOLR RAD (BTU/FT-2)= 1300.0000
        ALGY GROWTH CALC OPTION(LGROPT)=    2.0000          ALGAL PREF FOR NH3-N (PREFN)   =    0.9000
        ALG/TEMP SOLR RAD FACTOR(TFACT)=    0.4400          NITRIFICATION INHIBITION COEF  =   10.0000
        ENDATA1A                            0.0000                                              0.0000

         $$$ DATA TYPE 1B (TEMPERATURE CORRECTION CONSTANTS FOR RATE COEFFICIENTS) $$$

        CARD TYPE     RATE CODE     THETA VALUE

        THETA( 1)      BOD DECA        1.047     USER
        THETA( 2)      BOD SETT        1.024     USER
        THETA( 3)      OXY TRAN        1.024     USER
        THETA( 4)      SOD RATE        1.060     USER
        THETA( 5)      ORGN DEC        1.047     USER
        THETA( 6)      ORGN SET        1.024     USER
        THETA( 7)      NH3 DECA        1.083     USER
        THETA( 8)      NH3 SRCE        1.074     USER
        THETA( 9)      NO2 DECA        1.047     USER
        THETA(10)      PORG DEC        1.047     USER
        THETA(11)      PORG SET        1.024     USER
        THETA(12)      DISP SRC        1.074     USER
        THETA(13)      ALG GROW        1.047     USER
        THETA(14)      ALG RESP        1.047     USER
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THETA(15)      ALG SETT        1.024     USER
THETA(16)      COLI DEC        1.047     DFLT
THETA(17)      ANC DECA        1.000     DFLT
THETA(18)      ANC SETT        1.024     DFLT
THETA(19)      ANC SRCE        1.000     DFLT
ENDATA1B

 $$$ DATA TYPE 2 (REACH IDENTIFICATION) $$$

CARD TYPE           REACH ORDER AND IDENT              R. MI/KM            R. MI/KM
STREAM REACH     1.0  RCH=         Reach 1   FROM         24.0    TO          23.4
STREAM REACH     2.0  RCH=         Reach 2   FROM         23.4    TO          20.2
STREAM REACH     3.0  RCH=         Reach 3   FROM         20.2    TO          19.4
STREAM REACH     4.0  RCH=         Reach 4   FROM         19.4    TO          18.0
STREAM REACH     5.0  RCH=         Reach 5   FROM         18.0    TO          16.2
STREAM REACH     6.0  RCH=         Reach 6   FROM         16.2    TO          14.8
STREAM REACH     7.0  RCH=         Reach 7   FROM         14.8    TO          13.0
STREAM REACH     8.0  RCH=         Reach 8   FROM         13.0    TO          12.0
STREAM REACH     9.0  RCH=         Reach 9   FROM         12.0    TO           9.6
STREAM REACH    10.0  RCH=        Reach 10   FROM          9.6    TO           8.4
STREAM REACH    11.0  RCH=        Reach 11   FROM          8.4    TO           6.0
STREAM REACH    12.0  RCH=        Reach 12   FROM          6.0    TO           4.4
STREAM REACH    13.0  RCH=        Reach 13   FROM          4.4    TO           2.2
STREAM REACH    14.0  RCH=        Reach 14   FROM          2.2    TO           0.0
ENDATA2          0.0                                       0.0                 0.0

 $$$ DATA TYPE 3 (TARGET LEVEL DO AND FLOW AUGMENTATION SOURCES) $$$

CARD TYPE                  REACH  AVAIL HDWS TARGET     ORDER OF AVAIL SOURCES
ENDATA3                      0.        0.       0.0   0.   0.   0.   0.   0.   0.

 $$$ DATA TYPE 4 (COMPUTATIONAL REACH FLAG FIELD) $$$

CARD TYPE        REACH ELEMENTS/REACH            COMPUTATIONAL FLAGS
FLAG FIELD        1.        3.          1.6.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        2.       16.          2.2.2.2.2.2.2.2.2.6.2.2.2.2.2.2.2.0.0.0.0.
FLAG FIELD        3.        4.          2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        4.        7.          2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        5.        9.          2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        6.        7.          2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        7.        9.          2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        8.        5.          2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD        9.       12.          2.2.6.2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       10.        6.          2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       11.       12.          2.2.2.2.2.6.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD       12.        8.          2.2.6.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD       13.       11.          2.2.2.2.2.2.2.2.2.6.2.0.0.0.0.0.0.0.0.0.
FLAG FIELD       14.       11.          2.2.2.2.2.2.2.2.2.2.5.0.0.0.0.0.0.0.0.0.
ENDATA4           0.        0.          0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.

 $$$ DATA TYPE 5 (HYDRAULIC DATA FOR DETERMINING VELOCITY AND DEPTH) $$$

CARD TYPE        REACH  COEF-DSPN    SS1       SS2      WIDTH     SLOPE     CMANN
HYDRAULICS        1.     60.00     1.000     1.000     5.000     0.002     0.050
HYDRAULICS        2.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        3.     60.00     1.000     1.000    10.000     0.001     0.050
HYDRAULICS        4.     60.00     1.000     1.000    10.000     0.000     0.050
HYDRAULICS        5.     60.00     1.000     1.000    12.000     0.001     0.050
HYDRAULICS        6.     60.00     1.000     1.000    15.000     0.001     0.050
HYDRAULICS        7.     60.00     1.000     1.000    18.000     0.001     0.050
HYDRAULICS        8.     60.00     1.000     1.000    20.000     0.001     0.050
HYDRAULICS        9.     60.00     1.000     1.000    23.000     0.001     0.050
HYDRAULICS       10.     60.00     1.000     1.000    26.000     0.001     0.050
HYDRAULICS       11.     60.00     1.000     1.000    30.000     0.001     0.050
HYDRAULICS       12.     60.00     1.000     1.000    35.000     0.000     0.050
HYDRAULICS       13.     60.00     1.000     1.000    42.000     0.000     0.050
HYDRAULICS       14.     60.00     1.000     1.000    45.000     0.000     0.050
ENDATA5           0.      0.00     0.000     0.000     0.000     0.000     0.000

 $$$ DATA TYPE 5A (STEADY STATE TEMPERATURE AND CLIMATOLOGY DATA) $$$

CARD TYPE                             DUST     CLOUD   DRY BULB  WET BULB    ATM                SOLAR RAD
                REACH   ELEVATION     COEF     COVER     TEMP      TEMP    PRESSURE     WIND   ATTENUATION
TEMP/LCD          1.     1000.00      0.06      0.00     60.00     60.00     30.00      2.00      1.00
TEMP/LCD          2.     1000.00      0.06      0.00     60.00     60.00     30.00      2.00      1.00
TEMP/LCD          3.     1000.00      0.06      0.00     60.00     60.00     30.00      2.00      1.00
TEMP/LCD          4.     1000.00      0.06      0.00     60.00     60.00     30.00      2.00      1.00
TEMP/LCD          5.     1000.00      0.06      0.00     60.00     60.00     30.00      2.00      1.00
TEMP/LCD          6.     1000.00      0.06      0.00     60.00     60.00     30.00      2.00      1.00
TEMP/LCD          7.     1000.00      0.06      0.00     60.00     60.00     30.00      2.00      1.00
TEMP/LCD          8.     1000.00      0.06      0.00     60.00     60.00     30.00      2.00      1.00
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TEMP/LCD	9.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	10.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	11.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	12.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	13.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
TEMP/LCD	14.	1000.00	0.06	0.00	60.00	60.00	30.00	2.00	1.00
ENDATA5A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6 (REACTION COEFFICIENTS FOR DEOXYGENATION AND REAERATION) $$$

CARD TYPE	REACH	K1	K3	SOD RATE	K2OPT	K2	COEQK2 OR TSIV COEF FOR OPT 8	OR EXPQK2 OR SLOPE FOR OPT 8
REACT COEF	1.	0.14	0.00	0.020	1.	2.00	0.000	0.00000
REACT COEF	2.	0.14	0.01	0.020	1.	2.00	0.000	0.00000
REACT COEF	3.	0.14	0.02	0.020	1.	13.00	0.000	0.00000
REACT COEF	4.	0.14	0.02	0.020	1.	2.00	0.000	0.00000
REACT COEF	5.	0.14	0.02	0.020	1.	2.00	0.000	0.00000
REACT COEF	6.	0.14	0.02	0.060	1.	3.00	0.000	0.00000
REACT COEF	7.	0.14	0.02	0.060	1.	3.00	0.000	0.00000
REACT COEF	8.	0.14	0.01	0.060	1.	3.00	0.000	0.00000
REACT COEF	9.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	10.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	11.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	12.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	13.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
REACT COEF	14.	0.14	0.01	0.100	1.	3.00	0.000	0.00000
ENDATA6	0.	0.00	0.00	0.000	0.	0.00	0.000	0.00000

$$$ DATA TYPE 6A (NITROGEN AND PHOSPHORUS CONSTANTS) $$$

CARD TYPE	REACH	CKNH2	SETNH2	CKNH3	SNH3	CKNO2	CKPORG	SETPORG	SPO4
N AND P COEF	1.	0.02	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	2.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	3.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	4.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	5.	0.20	0.00	0.30	0.00	1.20	0.00	1.00	0.00
N AND P COEF	6.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	7.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	8.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	9.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	10.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	11.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	12.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	13.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
N AND P COEF	14.	0.01	0.00	1.00	0.00	1.20	0.00	1.00	0.00
ENDATA6A	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 6B (ALGAE/OTHER COEFFICIENTS) $$$

CARD TYPE	REACH	ALPHAO	ALGSET	EXCOEF	CK5 CKCOLI	CKANC	SETANC	SRCANC
ALG/OTHER COEF	1.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	2.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	3.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	4.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	5.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	6.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	7.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	8.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	9.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	10.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	11.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	12.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	13.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ALG/OTHER COEF	14.	50.00	1.00	0.10	0.00	0.00	0.00	0.00
ENDATA6B	0.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 7 (INITIAL CONDITIONS) $$$

CARD TYPE	REACH	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INITIAL COND-1	1.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	2.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	3.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	4.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	5.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	6.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	7.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	8.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	9.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00
INITIAL COND-1	10.	70.00	6.00	1.00	800.00	0.00	0.00	0.00	0.00

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INITIAL COND-1       11.     70.00      6.00      1.00    800.00      0.00      0.00      0.00      0.00
INITIAL COND-1       12.     70.00      6.00      1.00    800.00      0.00      0.00      0.00      0.00
INITIAL COND-1       13.     70.00      6.00      1.00    800.00      0.00      0.00      0.00      0.00
INITIAL COND-1       14.     70.00      6.00      1.00    800.00      0.00      0.00      0.00      0.00
ENDATA7               0.      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

 $$$ DATA TYPE 7A (INITIAL CONDITIONS FOR CHOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE           REACH    CHL-A     ORG-N     NH3-N     NO2-N     NO3-N     ORG-P     DIS-P
INITIAL COND-2        1.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INITIAL COND-2        2.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INITIAL COND-2        3.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INITIAL COND-2        4.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INITIAL COND-2        5.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INITIAL COND-2        6.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INITIAL COND-2        7.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INITIAL COND-2        8.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INITIAL COND-2        9.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INITIAL COND-2       10.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INITIAL COND-2       11.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INITIAL COND-2       12.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INITIAL COND-2       13.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INITIAL COND-2       14.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
ENDATA7A              0.      0.00      0.00      0.00      0.00      0.00      0.00      0.00

 $$$ DATA TYPE 8 (INCREMENTAL INFLOW CONDITIONS) $$$

CARD TYPE           REACH     FLOW      TEMP      D.O.       BOD      CM-1      CM-2      CM-3       ANC      COLI
INCR INFLOW-1         1.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-1         2.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-1         3.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-1         4.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-1         5.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-1         6.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-1         7.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-1         8.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-1         9.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-1        10.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-1        11.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-1        12.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-1        13.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-1        14.     0.000     88.00      7.00      0.00      0.00      0.00      0.00      0.00      0.00
ENDATA8               0.     0.000      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

 $$$ DATA TYPE 8A (INCREMENTAL INFLOW CONDITIONS FOR CHLOROPHYLL A, NITROGEN, AND PHOSPHORUS) $$$

CARD TYPE           REACH    CHL-A     ORG-N     NH3-N     NO2-N     NO3-N     ORG-P     DIS-P
INCR INFLOW-2         1.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-2         2.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-2         3.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-2         4.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-2         5.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-2         6.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-2         7.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-2         8.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-2         9.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-2        10.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-2        11.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-2        12.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-2        13.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
INCR INFLOW-2        14.      0.00      0.00      0.00      0.00      0.00      0.00      0.00
ENDATA8A              0.      0.00      0.00      0.00      0.00      0.00      0.00      0.00

 $$$ DATA TYPE 9 (STREAM JUNCTIONS) $$$

CARD TYPE                 JUNCTION ORDER AND IDENT         UPSTRM   JUNCTION    TRIB
ENDATA9                     0.                                0.        0.        0.

 $$$ DATA TYPE 10 (HEADWATER SOURCES) $$$

CARD TYPE    HDWTR      NAME                FLOW      TEMP      D.O.       BOD      CM-1      CM-2      CM-3
             ORDER
HEADWTR-1      1.          Reach 1          0.50     80.00      7.00      2.00    973.00      0.00      0.00
ENDATA10       0.                           0.00      0.00      0.00      0.00      0.00      0.00      0.00

 $$$ DATA TYPE 10A (HEADWATER CONDITIONS FOR CHLOROPHYLL, NITROGEN, PHOSPHORUS,
                   COLIFORM AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE     HDWTR     ANC      COLI     CHL-A     ORG-N     NH3-N     NO2-N     NO3-N     ORG-P     DIS-P
              ORDER
HEADWTR-2       1.     0.00 0.00E+00     15.00      1.02      0.34      0.00      6.29      0.18      1.01
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ENDATA10A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11 (POINT SOURCE / POINT SOURCE CHARACTERISTICS) $$$

CARD TYPE	POINT LOAD ORDER	NAME	EFF	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
POINTLD-1	1.	BLOOMINGDALE	0.00	5.35	70.00	6.66	10.00	866.00	0.00	0.00
POINTLD-1	2.	GLENDALE HEI	0.00	8.15	70.00	7.15	10.00	844.00	0.00	0.00
POINTLD-1	3.	GLENBARD WW	0.00	24.83	70.00	7.02	10.00	1091.00	0.00	0.00
POINTLD-1	4.	DOWNERS GROV	0.00	9.20	70.00	7.34	10.00	928.00	0.00	0.00
POINTLD-1	5.	DUPAGE COUNT	0.00	18.60	70.00	8.05	10.00	822.00	0.00	0.00
POINTLD-1	6.	BOLINGBROOK	0.00	3.16	70.00	9.12	20.00	2315.00	0.00	0.00
POINTLD-1	7.	CITIZENS UTI	0.00	4.65	70.00	7.20	20.00	1985.00	0.00	0.00
ENDATA11	0.		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 11A (POINT SOURCE CHARACTERISTICS - CHLOROPHYLL A, NITROGEN, PHOSPHORUS,
COLIFORMS AND SELECTED NON-CONSERVATIVE CONSTITUENT) $$$

CARD TYPE	POINT LOAD ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	N03-N	ORG-P	DIS-P
POINTLD-2	1.	0.00	0.00E+00	0.00	0.43	1.00	0.00	13.34	0.41	2.25
POINTLD-2	2.	0.00	0.00E+00	0.00	0.43	1.00	0.00	13.34	0.41	2.25
POINTLD-2	3.	0.00	0.00E+00	0.00	0.43	1.00	0.00	13.34	0.41	2.25
POINTLD-2	4.	0.00	0.00E+00	0.00	0.20	1.00	0.00	13.34	0.41	2.25
POINTLD-2	5.	0.00	0.00E+00	0.00	0.20	1.00	0.00	13.34	0.41	2.25
POINTLD-2	6.	0.00	0.00E+00	0.00	0.20	1.00	0.00	13.34	0.41	2.25
POINTLD-2	7.	0.00	0.00E+00	0.00	0.20	1.00	0.00	13.34	0.41	2.25
ENDATA11A	0.	0.00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

$$$ DATA TYPE 12 (DAM CHARACTERISTICS) $$$

	DAM	RCH	ELE	ADAM	BDAM	FDAM	HDAM
DAM DATA	1.	3.	4.	1.50	0.33	1.00	2.00
DAM DATA	2.	9.	12.	1.30	0.33	1.00	1.00
ENDATA12	0.	0.	0.	0.00	0.00	0.00	0.00

$$$ DATA TYPE 13 (DOWNSTREAM BOUNDARY CONDITIONS-1) $$$

CARD TYPE	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
ENDATA13	DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED							

$$$ DATA TYPE 13A (DOWNSTREAM BOUNDARY CONDITIONS-2) $$$

CARD TYPE	CHL-A	ORG-N	NH3-N	NO2-N	NH3-N	ORG-P	DIS-P
ENDATA13A	DOWNSTREAM BOUNDARY CONCENTRATIONS ARE UNCONSTRAINED						

Appendix F: QUAL2E Model Output

TABLE F1 QUAL2E MODEL OUTPUT

RCH NUM	ELE NUM	Mile	Allocation Scenario 1 DO MG/L	Allocation Scenario 1 BOD MG/L	Allocation Scenario 1 NH3N MG/L	Allocation Scenario 2 DO MG/L	Allocation Scenario 2 BOD MG/L	Allocation Scenario 2 NH3N MG/L	Allocation Scenario 3 DO MG/L	Allocation Scenario 3 BOD MG/L	Allocation Scenario 3 NH3N MG/L
1	1	24	6.91	2.01	0.34	6.91	2.01	0.34	6.91	2.01	0.34
1	2	23.8	6.68	7.48	0.94	6.68	9.3	0.94	6.68	9.3	0.94
1	3	23.6	6.69	7.46	0.94	6.68	9.29	0.94	6.68	9.29	0.94
2	1	23.4	6.69	7.44	0.93	6.67	9.26	0.93	6.67	9.26	0.93
2	2	23.2	6.69	7.42	0.93	6.67	9.23	0.93	6.67	9.23	0.93
2	3	23	6.69	7.39	0.92	6.67	9.2	0.92	6.67	9.2	0.92
2	4	22.8	6.69	7.37	0.92	6.66	9.16	0.92	6.66	9.16	0.92
2	5	22.6	6.69	7.34	0.91	6.65	9.13	0.91	6.65	9.13	0.91
2	6	22.4	6.69	7.31	0.91	6.64	9.1	0.91	6.64	9.1	0.91
2	7	22.2	6.68	7.28	0.9	6.62	9.06	0.9	6.62	9.06	0.9
2	8	22	6.67	7.26	0.9	6.61	9.03	0.9	6.61	9.03	0.9
2	9	21.8	6.66	7.23	0.89	6.59	9	0.89	6.59	9	0.89
2	10	21.6	6.94	7.66	0.95	6.91	9.56	0.95	6.91	9.56	0.95
2	11	21.4	6.94	7.64	0.95	6.9	9.53	0.95	6.9	9.53	0.95
2	12	21.2	6.94	7.62	0.94	6.89	9.51	0.94	6.89	9.51	0.94
2	13	21	6.94	7.6	0.94	6.89	9.48	0.94	6.89	9.48	0.94
2	14	20.8	6.93	7.58	0.94	6.88	9.46	0.94	6.88	9.46	0.94
2	15	20.6	6.93	7.56	0.93	6.87	9.43	0.93	6.87	9.43	0.93
2	16	20.4	6.92	7.54	0.93	6.86	9.41	0.93	6.86	9.41	0.93
3	1	20.2	6.75	7.5	0.92	6.85	9.38	0.92	6.99	9.38	0.92
3	2	20	6.55	7.42	0.9	6.84	9.35	0.92	7.22	9.35	0.92
3	3	19.8	6.34	7.34	0.89	6.83	9.33	0.92	7.4	9.33	0.92
3	4	19.6	6.33	7.26	0.87	6.82	9.3	0.91	7.7	9.3	0.91
4	1	19.4	6.32	7.21	0.86	6.81	9.27	0.91	7.73	9.27	0.91
4	2	19.2	6.31	7.18	0.85	6.8	9.24	0.9	7.69	9.24	0.9
4	3	19	6.29	7.16	0.85	6.79	9.21	0.9	7.64	9.21	0.9
4	4	18.8	6.28	7.13	0.84	6.78	9.18	0.89	7.6	9.18	0.89

			Allocation Scenario 1			Allocation Scenario 2			Allocation Scenario 3		
RCH NUM	ELE NUM	Mile	DO MG/L	BOD MG/L	NH3N MG/L	DO MG/L	BOD MG/L	NH3N MG/L	DO MG/L	BOD MG/L	NH3N MG/L
4	5	18.6	6.27	7.1	0.84	6.77	9.15	0.89	7.56	9.15	0.89
4	6	18.4	6.26	7.08	0.83	6.76	9.12	0.88	7.52	9.12	0.88
4	7	18.2	6.25	7.05	0.82	6.74	9.09	0.88	7.48	9.09	0.88
5	1	18	6.24	7.03	0.82	6.73	9.06	0.87	7.44	9.06	0.87
5	2	17.8	6.23	7	0.81	6.72	9.04	0.87	7.41	9.04	0.87
5	3	17.6	6.22	6.98	0.81	6.71	9.01	0.87	7.37	9.01	0.87
5	4	17.4	6.21	6.95	0.8	6.69	8.98	0.86	7.33	8.98	0.86
5	5	17.2	6.2	6.93	0.8	6.68	8.95	0.86	7.3	8.95	0.86
5	6	17	6.19	6.91	0.79	6.67	8.93	0.85	7.27	8.93	0.85
5	7	16.8	6.18	6.88	0.79	6.65	8.9	0.85	7.23	8.9	0.85
5	8	16.6	6.17	6.86	0.78	6.64	8.87	0.85	7.2	8.87	0.85
5	9	16.4	6.16	6.83	0.78	6.62	8.85	0.84	7.17	8.85	0.84
6	1	16.2	6.09	6.82	0.76	6.55	8.83	0.82	7.07	8.83	0.82
6	2	16	6.66	7.56	0.9	6.83	9.56	0.92	7.01	9.56	0.92
6	3	15.8	6.65	7.54	0.89	6.81	9.53	0.91	6.98	9.53	0.91
6	4	15.6	6.63	7.52	0.87	6.79	9.51	0.9	6.96	9.51	0.9
6	5	15.4	6.62	7.5	0.86	6.77	9.49	0.88	6.93	9.49	0.88
6	6	15.2	6.6	7.49	0.84	6.75	9.47	0.87	6.91	9.47	0.87
6	7	15	6.59	7.47	0.83	6.74	9.45	0.86	6.89	9.45	0.86
7	1	14.8	6.57	7.45	0.82	6.72	9.43	0.84	6.86	9.43	0.84
7	2	14.6	6.56	7.44	0.8	6.7	9.41	0.83	6.84	9.41	0.83
7	3	14.4	6.54	7.42	0.79	6.68	9.39	0.82	6.82	9.39	0.82
7	4	14.2	6.53	7.4	0.78	6.67	9.37	0.81	6.8	9.37	0.81
7	5	14	6.52	7.39	0.77	6.65	9.35	0.8	6.77	9.35	0.8
7	6	13.8	6.51	7.37	0.76	6.63	9.33	0.78	6.75	9.33	0.78
7	7	13.6	6.49	7.36	0.74	6.62	9.31	0.77	6.73	9.31	0.77
7	8	13.4	6.48	7.34	0.73	6.6	9.29	0.76	6.72	9.29	0.76
7	9	13.2	6.47	7.32	0.72	6.59	9.27	0.75	6.7	9.27	0.75
8	1	13	6.46	7.31	0.71	6.57	9.25	0.74	6.68	9.25	0.74
8	2	12.8	6.45	7.29	0.7	6.56	9.24	0.73	6.66	9.24	0.73
8	3	12.6	6.44	7.28	0.69	6.54	9.22	0.72	6.64	9.22	0.72
8	4	12.4	6.42	7.27	0.68	6.53	9.2	0.71	6.62	9.2	0.71

RCH NUM	ELE NUM	Mile	Allocation Scenario 1 DO MG/L	Allocation Scenario 1 BOD MG/L	Allocation Scenario 1 NH3N MG/L	Allocation Scenario 2 DO MG/L	Allocation Scenario 2 BOD MG/L	Allocation Scenario 2 NH3N MG/L	Allocation Scenario 3 DO MG/L	Allocation Scenario 3 BOD MG/L	Allocation Scenario 3 NH3N MG/L
8	5	12.2	6.41	7.25	0.67	6.52	9.18	0.7	6.61	9.18	0.7
9	1	12	6.39	7.24	0.66	6.49	9.17	0.69	6.57	9.17	0.69
9	2	11.8	6.37	7.22	0.65	6.46	9.15	0.68	6.54	9.15	0.68
9	3	11.6	6.64	7.44	0.74	6.6	9.29	0.73	6.67	9.29	0.73
9	4	11.4	6.62	7.43	0.73	6.58	9.27	0.71	6.64	9.27	0.71
9	5	11.2	6.6	7.41	0.72	6.55	9.25	0.7	6.61	9.25	0.7
9	6	11	6.58	7.39	0.71	6.53	9.23	0.69	6.59	9.23	0.69
9	7	10.8	6.56	7.38	0.7	6.51	9.2	0.68	6.56	9.2	0.68
9	8	10.6	6.55	7.36	0.68	6.49	9.18	0.67	6.54	9.18	0.67
9	9	10.4	6.53	7.35	0.67	6.47	9.16	0.66	6.52	9.16	0.66
9	10	10.2	6.51	7.33	0.66	6.45	9.14	0.65	6.5	9.14	0.65
9	11	10	6.5	7.32	0.65	6.43	9.12	0.63	6.48	9.12	0.63
9	12	9.8	6.65	7.3	0.64	6.58	9.1	0.62	6.62	9.1	0.62
10	1	9.6	6.63	7.28	0.63	6.55	9.08	0.61	6.59	9.08	0.61
10	2	9.4	6.61	7.27	0.62	6.53	9.06	0.6	6.56	9.06	0.6
10	3	9.2	6.58	7.26	0.61	6.5	9.05	0.6	6.54	9.05	0.6
10	4	9	6.56	7.24	0.6	6.48	9.03	0.59	6.51	9.03	0.59
10	5	8.8	6.54	7.23	0.59	6.45	9.01	0.58	6.49	9.01	0.58
10	6	8.6	6.52	7.21	0.59	6.43	8.99	0.57	6.46	8.99	0.57
11	1	8.4	6.5	7.2	0.58	6.4	8.97	0.56	6.43	8.97	0.56
11	2	8.2	6.48	7.18	0.57	6.38	8.95	0.55	6.41	8.95	0.55
11	3	8	6.46	7.16	0.56	6.36	8.92	0.54	6.38	8.92	0.54
11	4	7.8	6.45	7.15	0.55	6.33	8.9	0.53	6.36	8.9	0.53
11	5	7.6	6.44	7.13	0.54	6.32	8.88	0.52	6.35	8.88	0.52
11	6	7.4	6.81	7.33	0.64	6.77	9.17	0.64	6.79	9.17	0.64
11	7	7.2	6.79	7.32	0.63	6.74	9.15	0.63	6.76	9.15	0.63
11	8	7	6.77	7.3	0.62	6.72	9.13	0.62	6.73	9.13	0.62
11	9	6.8	6.75	7.29	0.61	6.69	9.11	0.61	6.71	9.11	0.61
11	10	6.6	6.73	7.27	0.6	6.67	9.09	0.6	6.68	9.09	0.6
11	11	6.4	6.71	7.26	0.59	6.65	9.07	0.59	6.66	9.07	0.59
11	12	6.2	6.69	7.24	0.58	6.62	9.05	0.58	6.64	9.05	0.58
12	1	6	6.67	7.22	0.57	6.6	9.03	0.57	6.61	9.03	0.57

RCH NUM	ELE NUM	Mile	Allocation Scenario 1 DO MG/L	Allocation Scenario 1 BOD MG/L	Allocation Scenario 1 NH3N MG/L	Allocation Scenario 2 DO MG/L	Allocation Scenario 2 BOD MG/L	Allocation Scenario 2 NH3N MG/L	Allocation Scenario 3 DO MG/L	Allocation Scenario 3 BOD MG/L	Allocation Scenario 3 NH3N MG/L
12	2	5.8	6.66	7.2	0.56	6.58	9.01	0.56	6.59	9.01	0.56
12	3	5.6	6.74	7.21	0.57	6.67	9.47	0.56	6.68	9.47	0.56
12	4	5.4	6.72	7.19	0.55	6.64	9.44	0.55	6.65	9.44	0.55
12	5	5.2	6.7	7.17	0.54	6.62	9.42	0.54	6.63	9.42	0.54
12	6	5	6.69	7.15	0.53	6.6	9.39	0.53	6.61	9.39	0.53
12	7	4.8	6.67	7.13	0.52	6.58	9.36	0.51	6.59	9.36	0.51
12	8	4.6	6.66	7.11	0.51	6.56	9.33	0.5	6.57	9.33	0.5
13	1	4.4	6.64	7.09	0.49	6.53	9.3	0.49	6.54	9.3	0.49
13	2	4.2	6.62	7.07	0.48	6.51	9.28	0.48	6.52	9.28	0.48
13	3	4	6.61	7.05	0.47	6.49	9.25	0.47	6.5	9.25	0.47
13	4	3.8	6.59	7.03	0.46	6.47	9.22	0.46	6.48	9.22	0.46
13	5	3.6	6.58	7.01	0.45	6.45	9.2	0.45	6.46	9.2	0.45
13	6	3.4	6.56	6.99	0.44	6.43	9.17	0.44	6.44	9.17	0.44
13	7	3.2	6.55	6.97	0.44	6.42	9.14	0.43	6.42	9.14	0.43
13	8	3	6.54	6.95	0.43	6.4	9.12	0.42	6.41	9.12	0.42
13	9	2.8	6.53	6.93	0.42	6.39	9.1	0.41	6.39	9.1	0.41
13	10	2.6	6.55	6.97	0.44	6.42	9.74	0.44	6.43	9.74	0.44
13	11	2.4	6.54	6.96	0.43	6.4	9.72	0.43	6.41	9.72	0.43
14	1	2.2	6.54	6.94	0.42	6.39	9.69	0.42	6.39	9.69	0.42
14	2	2	6.53	6.92	0.41	6.37	9.67	0.41	6.37	9.67	0.41
14	3	1.8	6.52	6.9	0.41	6.35	9.64	0.4	6.36	9.64	0.4
14	4	1.6	6.51	6.88	0.4	6.34	9.61	0.39	6.34	9.61	0.39
14	5	1.4	6.5	6.87	0.39	6.32	9.59	0.39	6.33	9.59	0.39
14	6	1.2	6.49	6.85	0.38	6.31	9.56	0.38	6.31	9.56	0.38
14	7	1	6.49	6.83	0.37	6.29	9.54	0.37	6.3	9.54	0.37
14	8	0.8	6.48	6.81	0.37	6.28	9.51	0.36	6.28	9.51	0.36
14	9	0.6	6.47	6.8	0.36	6.27	9.49	0.36	6.27	9.49	0.36
14	10	0.4	6.47	6.78	0.35	6.26	9.46	0.35	6.26	9.46	0.35
14	11	0.2	6.46	6.76	0.35	6.25	9.44	0.34	6.25	9.44	0.34

Appendix G: MS4s in East Branch Watershed

MS4 Permittees in DuPage County

County: DU PAGE

Permit No.	*Operator Name*	*Address*	*Date Recd*	*Final Action*
ILR400001	ADDISON ADDISON TOWNSHIP	441 W POTTER ST, ADDISON, IL. 60191	3/10/2003	
ILR400277	ADDISON VILLAGE OF ADDISON	ONE FRIENDSHIP PLAZA, ADDISON, IL. 60101	3/10/2003	
ILR400283	AURORA CITY OF AURORA	44 E DOWNER PL, AURORA, IL. 60507	3/14/2003	
ILR400286	BARTLETT VILLAGE OF BARTLETT	228 S MAIN ST, BARTLETT, IL. 60103	3/10/2003	
ILR400292	BENSENVILLE VILLAGE OF BENSENVILLE	12 S CENTER STREET, BENSENVILLE, IL. 60106	3/10/2003	
ILR400013	BLOOMINGDALE BLOOMINGDALE TOWNSHIP	123 N ROSEDALE RD, BLOOMINGDALE, IL. 60108	3/10/2003	
ILR400295	BLOOMINGDALE VILLAGE OF BLOOMINGDALE	201 S BLOOMINGDALE RD, BLOOMINGDALE, IL. 60108	3/10/2003	
ILR400538	Campton Township Campton Township	4N928 Brown Road, Saint Charles, IL. 60175		
ILR400308	CAROL STREAM VILLAGE OF CAROL STREAM	500 N GARY AVE, CAROL STREAM, IL. 60187	3/10/2003	
ILR400175	CLARENDON CLARENDON HILLS VILLAGE	1 N PROSPECT AVE, CLARENDON HILLS, IL. 60514	3/10/2003	
ILR400180	DARIEN	1702 PLAINFIELD RD, DARIEN, IL. 60561	3/10/2003	

DARIEN CITY

ILR400040	DOWNERS GROVE	4340 PRINCE ST, DOWNERS GROVE, IL. 60515	3/10/2003	
	DOWNERS GROVE TOWNSHIP			

Permit No.	Operator Name	Address	Date Recd	Final Act
ILR400183	DOWNERS GROVE	801 BURLINGTON AVENUE, DOWNERS GROVE, IL. 60515	3/10/2003	
	DOWNERS GROVE VILLAGE			
ILR400502	DUPAGE COUNT	421 N COUNTY FARM ROAD, WHEATON, IL. 60187	3/10/2003	
	DUPAGE COUNTY			
ILR400187	ELMHURST	209 N YORK ST, ELMHURST, IL. 60126	3/10/2003	
	ELMHURST CITY			
ILR400199	GLEN ELLYN	30 S LAMBERT ROAD, GLEN ELLYN, IL. 60137	3/10/2003	
	GLEN ELLYN VILLAGE			
ILR400342	GLENDALE HEIGHTS	300 CIVIC CENTER, GLENDALE HEIGHTS, IL. 60139	3/10/2003	
	VILLAGE OF GLENDALE HEIGHTS			
ILR400347	HANOVER PARK	2121 WEST LAKE ST, HANOVER PARK, IL. 60103	3/10/2003	
	VILLAGE OF HANOVER PARK			
ILR400355	HINSDALE	19 EAST CHICAGO AVE, HINSDALE, IL. 60521	3/10/2003	
	VILLAGE OF HINSDALE			
ILR400494	ILLINOIS STATE TOLL HIGHWAY AUTHORITY	2700 OGDEN AVENUE, DOWNERS GROVE, IL. 60515	3/7/2003	
	ILLINOIS STATE TOLL HIGHWAY AUTHORITY			
ILR400360	ITASCA	100 N WALNUT ST, ITASCA, IL. 60143	3/10/2003	
	VILLAGE OF ITASCA			
ILR400497	LEMONT	418 MAIN STREET, LEMONT, IL. 60439	2/28/2003	
	VILLAGE OF LEMONT			
ILR400079	LISLE	4721 INDIANA AVE, LISLE, IL. 60532	3/10/2003	
	LISLE TOWNSHIP			
ILR400376	LISLE	1040 BURLINGTON AVE, LISLE, IL. 60532	3/10/2003	
	VILLAGE OF LISLE			

ILR400378	LOMBARD VILLAGE OF LOMBARD	255 E WILSON, LOMBARD, IL. 60148	3/10/2003
ILR400086	MILTON MILTON TOWNSHIP	1492 N MAIN ST, WHEATON, IL. 60187	3/10/2003

Permit No.	*Operator Name*	*Address*	*Date Recd*	*Final Act*
ILR400092	NAPERVILLE NAPERVILLE TOWNSHIP	31W331 NORTH AURORA ROAD, NAPERVILLE, IL. 60563	3/10/2003	
ILR400396	NAPERVILLE CITY OF NAPERVILLE	400 S EAGLE ST POB 3020, NAPERVILLE, IL. 60566	3/10/2003	
ILR400407	OAK BROOK VILLAGE OF OAK BROOK	1200 OAK BROOK RD, OAK BROOK, IL. 60521	3/10/2003	
ILR400232	OAKBROOK TERRACE OAKBROOK TERRACE CITY	17W275 BUTTERFIELD RD, OAKBROOK TERRACE, IL. 60181	3/10/2003	
ILR400437	ROSELLE VILLAGE OF ROSELLE	31 S PROSPECT STREET, ROSELLE, IL. 60172	3/10/2003	
ILR400463	VILLA PARK VILLAGE OF VILLA PARK	20 S ARDMORE AVE, VILLA PARK, IL. 60181	3/10/2003	
ILR400274	WARRENVILLE CITY OF WARRENVILLE	28 W 701 STAFFORD PLACE, WARRENVILLE, IL. 60555	3/10/2003	
ILR400149	WAYNE WAYNE TOWNSHIP	4N 230 KLEIN ROAD, WEST CHICAGO, IL. 60185	3/10/2003	
ILR400500	WAYNE VILLAGE OF WAYNE	5N430 RAILROAD STREET, WAYNE, IL. 60184	3/10/2003	
ILR400466	WEST CHICAGO CITY OF WEST CHICAGO	475 MAIN STREET POB 488, WEST CHICAGO, IL. 60185	3/10/2003	
ILR400254	WESTMONT WESTMONT VILLAGE	31 W QUINCY ST, WESTMONT, IL. 60559	3/10/2003	
ILR400470	WHEATON CITY OF WHEATON	303 W WESLEY ST POB 727, WHEATON, IL. 60187	3/10/2003	

ILR400255	WILLOWBROOK	7760 S QUINCY ST, WILLOWBROOK, IL. 60521	3/10/2003
	WILLOWBROOK VILLAGE		
ILR400155	WINFIELD	30W575 ROOSEVELT RD, WEST CHICAGO, IL. 60185	3/10/2003
	WINFIELD TOWNSHIP		

Permit No.	*Operator Name*	*Address*	*Date Recd Final Act*
ILR400474	WINFIELD	27W465 JEWELL ROAD, WINFIELD, IL. 60190	3/10/2003
	VILLAGE OF WINFIELD		
ILR400478	WOOD DALE	404 NORTH WOOD DALE ROAD, WOOD DALE, IL. 60191	3/10/2003
	CITY OF WOOD DALE		
ILR400480	WOODRIDGE	ONE PLAZA DR, WOODRIDGE, IL. 60517	3/10/2003
	VILLAGE OF WOODRIDGE		
ILR400159	YORK	19W475 ROOSEVELT ROAD, LOMBARD, IL. 60148	3/10/2003
	YORK TOWNSHIP		

EAST BRANCH OF THE DUPAGE RIVER TMDL

APPENDIX H

RESPONSIVENESS SUMMARY

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RESPONSIVENESS SUMMARY

This responsiveness summary responds to substantive questions and comments received during the public comment period from August 29, 2003, through December 1, 2003 (postmarked) including those from the September 29 public meeting.

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 applicable water quality standards. The East Branch of the DuPage River TMDL report contains a plan detailing the actions necessary to reduce pollutant loads to East Branch of the DuPage 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 Branch of the DuPage River (ILGBL10). The targeted waterbody segments are GBL 05, GBL 10 and GBL 08. Located in DuPage and Will Counties, Illinois, the East Branch of the DuPage River ("East Branch") and its tributaries were placed on the 1998 Illinois 303(d) List of impaired waters for several pollutants, including conductivity, chloride, and dissolved oxygen (DO). TMDLs for all pollutants causing applicable WQS violations were established for each identified waterbody.

The East Branch watershed encompasses about 79.3 square miles of northeastern Illinois. Approximately 40 percent of the land use in the watershed is residential. Approximately 16 percent of the total watershed area is impervious surfaces. There are eight wastewater treatment plants in the watershed. The DuPage County Department of Environmental Concerns (DEC) Stormwater Management Division (DCDS) developed subwatershed boundaries for its stormwater management program. The boundaries take into account areas in DuPage County that are drained by storm sewer systems, with sometimes non-topographically based drainage characteristics. The subwatershed areas range from 0.2 to 2,109 acres with an average area of 119 acres. Because of the watershed's complex nature, existing subwatershed delineations that include storm sewer areas were used wherever possible in the TMDL modeling process. The Illinois EPA contracted CH2MHILL, St. Louis, Missouri, to prepare a TMDL report for Illinois EPA on this waterbody.

PUBLIC MEETINGS

An initial public meeting was held at the Lisle Public Library Meeting Room AB on January 25, 2001 at 6:30 p.m. to discuss and seek comments on development of the TMDL. A second public meeting on the Draft Final Report was held on September 29, 2003 at the Lisle Police Department Conference Room. Thirty-eight people attended the meeting. The meeting record remained open until midnight December 1, 2003. A total of 15 exhibits were received either during the meeting or within the public comment period.

The Illinois EPA provided public notice for the meeting by placing boxed display ads in local newspapers and by mailing meeting notices to individual citizens, legislators, municipalities, and interested groups. The notice gave the date, time, location, and purpose of the public meeting. The notice 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. 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 was also available by mail upon request.

On January 28, 2004, Illinois Environmental Protection Agency (the Agency) met with representatives from the Illinois Association of Wastewater Agencies (IAWA) and other stakeholders to discuss issues relating to the Draft TMDL Reports on Salt Creek and East Branch of the DuPage River. Based on these discussions, the Agency developed the responses to comments #1 and #2 that constitute our approach to this TMDL, particularly as it affects dissolved oxygen (DO).

In several cases, comments were filed for both the Salt Creek and East Branch TMDLs. The questions and our responses may reflect these joint filings.

QUESTIONS AND COMMENTS

Impairment Issues

1. Failure to identify maximum nutrient loads is unacceptable. Several pollutants contribute to violations of dissolved oxygen (DO) standards. One purpose of the draft TMDL is to identify maximum loads for pollutants that affect DO to ensure that the standards are met at all times. Therefore, it is not appropriate to exclude nutrients from this analysis. It is not necessary to have adopted nutrient standards before determining maximum loads for meeting DO standards. There are currently no instream water quality standards for CBOD, but water quality based effluent limits are determined and enforced to ensure that DO standards are met. Nutrients should be similarly limited to ensure that these standards are met.

   Additionally, the largest reduction of oxygen demand that is proposed in this TMDL is the reduction of sediment oxygen demand (SOD). Nutrients contribute to water column algae and periphyton growth. These organisms eventually die, may settle to the stream bottoms, and decay. This process contributes to sediment oxygen demand. Therefore, to reduce SOD, nutrients should be limited.

   We have described the modeling effort and the assumption that SOD is an obvious contributor to low DO (page 5-17). We believe an adaptive management approach dictates prioritizing the obvious sources and least cost options. In addition, current nutrient control is complicated by the adoption of new standards within the next 5-7 years, rendering nutrient control now potentially difficult to manage economically if additional controls are necessary after those imposed through the TMDL are in-place.

   We agree that algal response and nutrients are important to the understanding of the SOD factor. However, the model indicates attainment of the DO standard through other means—such as dam removal or artificial re-aeration of Churchill Woods Lake and further control of CBOD through stormwater management. If additional controls prove necessary or if these options are not practical or achievable, we will consider other methods of increasing DO, such as nutrient control.

   In general, the Illinois EPA agrees with your comment. We recognize that the dissolved oxygen (DO) concentration in a water body is affected by numerous factors. However, the important factors that affect DO concentrations with space and time in a stream/river are:

   - **Atmospheric re-aeration (K2)**
   - **Biochemical oxygen demand (BOD – carbonaceous BOD (CBOD) and nitrogenous BOD (NBOD))**
   - **Nutrients (nitrogen (N) – ammonia N (NH3-N), nitrate N (NO3-N), nitrite N (NO2-N), and phosphorus (P – total and available))**

- **Algae (chlorophyll a)**
- **Macrophytes**
- **Sediment oxygen demand (SOD)**
- **Water temperature**
- **Time of the day**
- **Stream flow (depth, velocity and quantity) and configuration**
- **Decay and settling rates associated with BOD, nutrients and algae, and others**

In turn each of these components influencing DO in a stream/river is affected by more than one factor. For example, K2 is affected by depth, velocity and quantity of flow, energy gradient and temperature. SOD is affected by the ability of the stream to move the bed load, the amount of BOD, nutrients and algae that settle to the bottom of the stream, nonpoint source contributions of BOD and nutrients to the stream, mixing/disturbance that occurs at the interface of stream bed and water column, and temperature. Most of the components/factors that affect DO concentrations in a stream/river can be measured in-situ. However, assumptions have to be made about the applicability of these measurements with respect to space and time.

In recognition of these matters and consistent with the original implementation plan in the draft TMDL, we are therefore proposing that the Agency, WWTPs, environmental groups and other partners take the following actions between the time that the TMDL is approved by USEPA and the time that nutrient standards are adopted:

1) Convene a watershed stakeholders committee to plan activities and act as a clearinghouse for further action related to the TMDL.
2) Establish a monitoring program for DO and related constituents.
3) Use this new monitoring data to investigate dam removal and re-aeration scenarios.
4) Catalogue all NPS related activities in the watershed.
5) Initiate CSO controls in an expedited time frame.

Illinois EPA plans to use a phased adaptive management approach to bring the stream into compliance with the water quality standards (WQS) for DO. This will be accomplished with the help of a newly created local watershed committee consisting of representatives from Illinois EPA, point source dischargers, environmental groups, USEPA, the public, and others.
The approach will be flexible/adaptable and will include a phased-in step-by-step implementation of a plan concurrent with monitoring, and capable of reviewing and revisiting model calibration and verification.

The adaptive management aspects, to be employed consistent with the monitoring program, will allow us to identify success or failure in achieving WQS for DO as each remedy is implemented successively or as the plan is modified as needed over time. The monitoring program will address several needs and be designed to:

1) **Measure results of the implemented plan(s).**
2) **Collect additional data (DO, nutrients and others).**
3) **Pin-point DO levels now and as management steps occur.**
4) **Supplement existing Agency monitoring efforts.**
5) **Allow the Agency to list or de-list current and future causes of impairment.**
6) **Support development of nutrient standards and control strategy.**
7) **Support decision making for the expansion of existing wastewater treatment plants (WWTP) and establishment of new sources/WWTPs.**

2. In the case of the East Branch, none of the wastewater plants which discharge to the river will need to reduce BOD or ammonia beyond their current loadings. So no change in current conditions is required. The Watershed Implementation Plan (WIP) also recommends that Churchill Woods Lake be aerated and organic matter getting into the river from runoff be reduced. The reduction in organic matter input into the river is aimed at reducing the sediment oxygen demand (SOD) to levels as low as 0.02 g/ sq. ft/ day in some stream reaches. However, the feasibility of this is questioned in both the TMDL and the WIP:

    a. Literature values suggest that the desired SOD of 0.02 g/ft^2-day in some reaches is rarely found in natural streams (East Branch TMDL, Sec. 6.4.3)

    b. DO due to reduction of SOD that derives from this will take an uncertain amount of time and its effectiveness will initially be unknown. (East Branch WIP, Sec. 4.2)

    This leaves the situation in which aeration of Churchill Lake is the sole immediate action to be taken to increase dissolved oxygen levels in the East Branch.

    As discussed in our response to #1, the Agency is planning a phased approach with this TMDL that involves recommendations for dam removal, re-aeration, CSO and stormwater management and additional monitoring. Adaptive management will allow us, through the monitoring program to be developed with a local watershed committee, to identify success or failure to achieve WQS for DO as each remedy is implemented successively, and make changes/improvements as we go.

    The implementation plan for these TMDLs will be phased-in in the following sequence:

    Step 1: Organize a local watershed committee. Establish a meeting schedule, organizational structure and funding mechanisms. Begin a monitoring program (e.g.,participants, QAPP, schedule

    Step 2: Place re-aerators at strategic locations in the stream to achieve WQS for DO. Conduct pre- and post installation monitoring over a critical period. Make adjustments to the monitoring and re-aeration system as necessary to attain WQS. If this proposition is not cost-effective or for some reason not institutionally acceptable or practical, information regarding this option will be discussed by the local watershed committee prior to moving on to step 3.

    Step 3: Removal of low head dams in East Branch of the DuPage River (East Branch) and the Fullersburg dam in Salt Creek. If dam removal fails institutionally (i.e., we cannot convince the dam owner to rectify the situation) or technically (we remove or bypass the dam and WQS for DO is not attained and maintained), this will be discussed by the local watershed committee prior to moving on to step 4.

    Step 4: A combination of steps 2 and 3, assuming that steps 2 and 3 are institutionally acceptable. This would occur if, for example, re-aeration failed initially or was not acceptable or cost-effective, and dam removal was tried but did not positively affect DO concentrations. In this case, re-aeration may be needed in addition to dam removal and should be reconsidered, assuming acceptability issues had changed. (Acceptability may include an issue like acquiring utility right of way.)

Step 5: If Steps 2 through 4, taken in sequence, do not bring the East Branch and Salt Creek into compliance with the WQS for DO, then with the understanding of the local watershed committee, appropriate effluent limits will be incorporated in the NPDES permits of the point source dischargers on these two streams.

In addition to the above-indicated steps of the phased approach, we will continue to rely on Phase II storm water controls and CSO control strategies to reduce volatile suspended solid (VSS) input to reduce SOD. Also, when nutrients standards become available, we will re-visit the model to develop a strategy for compliance with DO and nutrient water quality standards.

3. Several other pollutants are listed on the 303(d) list as causes of impairment. What is the state's projected timeline for completing TMDLs for these other pollutants?

   The Agency has adopted a policy of developing TMDLs only on potential causes of impairment that have Water Quality Standards. State nutrient standards are expected to be finalized in the next 5-7 years. Until that time, the Agency will continue to work with watershed planning groups and other stakeholders to identify and apply existing control mechanisms to potential sources causing impairment for waters, but not develop TMDLs for such impairment. Watershed groups are encouraged to apply for funding from the Agency and IL Dept of Agriculture to implement nonpoint source BMPs as recommended in the TMDL and to develop watershed restoration plans. Waters on the 303(d) list will be given priority in funding.

4. The TMDL Report does not provide a complete list of impairments for all segments of the East Branch DuPage River. Table 1 presents this information based on our review of the IEPA's 1998 303(d) list and their 2002 303(d) list. Glendale Heights Wastewater treatment plant (WWTP) discharges to segment GBL 08. It is unclear whether the draft TMDL report and implementation plan were prepared based on the 1998 list, the draft 2002 list, or both. It is important to note the following about the listed causes of impairment shown in Table 1: (1) nutrients are listed in all segments of the East Branch and in St. Joseph Creek; (2) excessive algal growth is listed in segments GBL 08 and GBL 10 from the Downers Grove area upstream to Glendale Heights (and including Churchill Woods Lake); (3) all segments except for the most upstream segment are listed for low DO on the 2002 list, but none were listed for low dissolved oxygen (DO) on the 1998 list; and (4) between 1998 and 2002 several segments were delisted for salinity/TDS/chlorides including GBL 02, GBL 08, and GBL 11. The following should be noted about the listed sources of impairment: municipal point sources are listed as sources for all segments of the East Branch, not just the upper segments; and urban runoff/storm sewers, construction, and channelization are listed as sources for all segments.

   The TMDL for East Branch officially began in January of 2000. In determining the parameters to target for TMDL development, the Agency bases its analysis on the most recent data available at the time. In January 2000, the most recent data available were those in the 1998 303(d) list and 2000 305(b) (Illinois Water Quality Report). The Agency was not required to compile a 2000 303(d) list. Please see the response to #3. No segments of the East Branch were listed for DO in the 1998 303(d) list. However, in the 2000 305(b) list, GBL 05, GBL 10 and GBL 08 are listed for DO. GBL 05 and GBL 10 are also listed for salinity/TDS/chlorides.

5. Each TMDL should explain why or why not a cause of impairment listed in the 1998 303(d) list for any waterbody in the three watersheds was addressed in the TMDL. For example, St. Joseph Creek in the East Branch watershed is listed for nutrients, chloride and habitat alterations, yet the creek's

impairments are not considered in the East Branch TMDL, even though chloride is one of the parameters that the TMDL does address.

Please see the responses to comments #3 and #4.

6. Impairments in the East Branch due to nutrients, siltation, habitat alterations, pathogens and chlorine are not addressed by the East Branch TMDL. In addition, the impairments of St. Joseph Creek, Lacey Creek and Hidden Lake are not addressed. Which is correct- Table 2-1 or Figure 2-1? They show a different number of impaired segments on the East Branch and its tributaries.

   Please see the response to comment #4. In the Final Draft, Table 2-1 will clearly list which segments and which potential causes of impairment were addressed in the TMDL report. Figure 2-1 will be clarified to include all the segments of the East Branch.

7. Sierra Club sees the draft TMDLs for the East Branch and West Branch of the DuPage River and Salt Creek as a first step in addressing the problems of these waterways. We support the proposals for limiting BOD and ammonia loading into the East Branch and Salt Creek and for reducing pollution from runoff, especially road salt, in all 3 watersheds. However, we find the absence of any control of nutrient pollution into the East Branch and Salt Creek to be a serious omission from the cleanup plans. Nutrient contributions to algae and aquatic plant growth must be addressed if we are serious about restoring the levels of dissolved oxygen in these streams to levels supportive of aquatic life. Our greatest concern is the failure to address the role that nutrients play in the problems with low dissolved oxygen levels in the East Branch and Salt Creek. The combination of the decision to not develop TMDLs for water quality parameters for which there is not an Illinois water quality standard and the limited algal information available for modeling have produced TMDLs which consequently focus all their attention on the reduction of oxygen demand from other sources to resolve the low dissolved oxygen problems of these waterways. We are concerned that this will make the recovery of dissolved oxygen levels necessary to sustain aquatic life more difficult.

   We understand that nutrients play a role in affecting the DO level in the East Branch of the DuPage River (the East Branch). Please see the responses to comments #1 and #2 for a detailed explanation of how we plan to address this issue.

8. We support the recommendations of East Branch and Salt Creek TMDLs and WIPs to limit the discharge of deoxygenating waste (BOD) and ammonia into these waterways as a component of the plan to achieve compliant levels of dissolved oxygen. However, we are concerned that by not addressing the role which nutrient-fed algae play, the scope of the problem will not be addressed. This is manifested in various specific ways in the TMDLs and WIPs for both watersheds as described below. For the East Branch, the resulting WIP places its emphasis on reductions in sediment oxygen demand to levels that cannot feasibly be reached. Clearly, in order to develop a workable WIP to restore the East Branch, further reductions of BOD from other sources and nutrients from a variety of sources will be necessary. In the case of Salt Creek, it meant that future increases in wastewater discharge were ignored in the modeling.

   Please see the response to comments #1 and #2.

9. In summary, our concern with both the East Branch and Salt Creek TMDLs is that by overlooking the role which nutrients play in causing low dissolved oxygen levels in both streams, WIPs have been produced which place much of the burden to restore the streams to healthy DO levels on reducing VSS in runoff. The uncertainty of this approach, reiterated in the text of the TMDLs and WIPs numerous times, does not bode well for restoration of dissolved oxygen to levels protective of aquatic life. We are also concerned that future impacts of increases in wastewater discharge have also been underestimated by this approach. Clearly, to be effective, the TMDL must consider and address all water quality parameters which affect dissolved oxygen levels, even those such as nutrients for which Illinois water quality standards currently do not exist. We recommend that resources be put towards the collection of nutrient, diurnal DO, algal (both water column and attached) and macrophyte data needed to properly model the role of nutrients in these waterways. The control of nutrients should be included as a component of the TMDLs.

   Thank you for your comments. Until nutrient standards are developed, the Agency will continue to address the nutrient issue through methods other than a TMDL. This TMDL is one step in improving water quality in the East Branch of the DuPage River. We believe an adaptive management approach that involves prioritizing the obvious sources and most cost efficient options for pollution control is the best strategy to follow at this stage in the TMDL process. Please see our responses to comments #1, #2 and #3.

10. Stream Improvement Options - The proposed TMDL references a substantial dissolved oxygen sink in the sediments that are located along the bottom of the East Branch of the DuPage River. These sediments exert what is referred to as a Sediment Oxygen Demand (SOD) which helps decrease the dissolved oxygen level in the river. The study of the East Branch of the DuPage River did not include specific analyses of the SOD on the East Branch of the DuPage River. The data was taken from other streams and fed into the model developed for the East Branch. We believe that specific data for the East Branch should be utilized in developing the TMDL's for this river.

    Please refer to the responses to comments #1 and #2.

11. The report notes a substantial reduction in oxygen in the East Branch of the river directly upstream of the Lombard CSO plant. This reduction in oxygen is in the area of Churchill Lake and upstream of a dam constructed north of Crescent Boulevard. This manmade impoundment causes the river to slow at this point and is an area noted for reduced levels of oxygen. We believe the study should consider options available such as possible dam removal and re-initiation of wetlands in this area rather than increased treatment plant costs proposed to reduce discharge standards at the Glenbard plant. Another option that should be considered would be the possible implementation of additional re-aeration devices in the river in order to meet the dissolved oxygen deficiencies noted in the study.

    Due to a substantial number of comments regarding possible dam removal in the East Branch, the Agency asked CH2MHILL to investigate removal of the Churchill Woods dam. Additional modeling using permitted design flow for the WWTPs (as opposed to current flow, as was used initially) indicates that removal of the dam will achieve the WQS for DO. A description of the scenario is provided in Section 6.4.3 of the revised Draft TMDL. These results will be evaluated and discussed by the Salt Creek/DuPage River Workgroup as they work to implement the strategy outlined in the responses to comments #1 and #2.

12. The Village of Bloomingdale requests that newer data be admitted, additional monitoring performed as necessary, and delisting of the East Branch of the DuPage River and tributary segments for DO and total dissolved solids (TDS)/conductivity be considered: The listing of conductivity and DO as use impairment causes in the East Branch of the DuPage River may have been based on insufficient data. Before demands are placed on wastewater treatment plants (WWTPs), the compliance with which might ultimately cost municipalities millions of dollars, it would make sense to make sure that the alleged impairment and its causes are real. If it is found that there really was no impairment or that impairment causes were misattributed, and that the taxpayers paid large sums for no benefit, the credibility of the IEPA, the TMDL program, the treatment plant operators, the engineers, and the environmental advocacy groups could be irreparably damaged. Requests for funding to meet future TMDLs may meet with firm resistance regardless of how much they are needed.

    Please see our responses to comments #1 and #2.

13. We suggest that delisting of the East Branch of the DuPage River and tributary segments for conductivity and for DO be considered. More recent or additional monitoring results may justify delisting for DO or TDS/conductivity. We suggest continued monitoring to build a sound database to establish irrefutable evidence of the presence or absence of any impairment. Additionally, new data should be collected as necessary for the proper investigation of eutrophication effects on instream DO in the East Branch of the DuPage River.

    Delisting of the East Branch is not an option at this point in development of the TMDL. Please refer to the responses to comments #1 and #2 for a more detailed explanation of the Agency's position on this issue.

14. At the public meeting the IEPA indicated that nutrients were not considered in this TMDL process because no nutrient WQSs have been developed yet. The Draft TMDL Report, however, states that the nutrient impacts related to eutrophication are potentially a significant contributor to the DO situation in the East Branch of the DuPage River. Yet these effects were not studied, and the effect of algae was not even included in the QUAL2E model of the East Branch of the DuPage River.

    Please see the responses to comments #1 and #2.

15. The Draft TMDL Report shows that clearly measurable diurnal fluctuations in DO have been observed in the East Branch of the DuPage River, especially in the reaches in which an existing DO problem is alleged to exist. This suggests that eutrophication problems exist in the East Branch of the DuPage River. The most recent (2002) 303(d) list includes nutrients and algae as causes of impairments in several segments of the East Branch of the DuPage River. We do not believe that a DO TMDL that fails to address the effect of nutrients and aquatic plants on instream DO concentrations in the East Branch of the DuPage River is scientifically defensible.

    Please see the responses to comments #1 and #2.

16. We are aware that the IEPA is in the process of developing nutrient WQSs as rapidly as resources allow and expects to issue them sometime between 2004 and 2008. By that time, the East Branch of the DuPage River will probably be in line for the development of TMDLs for nutrients, assuming that nutrients are still listed as the cause of impairments. To comply with the nutrient limits derived from

the nutrient WQSs or TMDLs, whichever arrive sooner, the WWTPs will have to install facilities to remove phosphorus and/or nitrates, and the diurnal DO problems related to eutrophication can be expected to decrease in severity. We believe the above to be sufficient reasons to postpone the implementation of the DO TMDL until the effect of effluent limits for nutrients can be adequately addressed. We further believe that the impact of nutrients and aquatic plants on DO must be investigated satisfactorily before stricter limits are established for CBOD and ammonia in WWTP effluents. (If such investigations were impossible because of the lack of data, then the necessary data needs to be collected.) Otherwise, the CBOD and ammonia limits established for WWTPs with respect to the DO TMDL are premature, unjustified, arbitrary and scientifically indefensible.

To postpone implementation of the DO TMDL is not an option at this time. The Agency plans to move forward. Please see the responses to comments #1 and #2, which, hopefully, will alleviate your concerns.

17. *"Literature values suggest the desired SOD of 0.02 g/ft^2-day in some reaches is rarely found in natural streams."* (page 6-10). The East Branch is more of an urban stream than a natural one. The plan does not offer means to mitigate this problem, except to generally call for reductions in NPS contributions. But little hope for such reductions is provided in the implementation plan. Nor does the plan mention methods to mitigate current in-stream SOD conditions. This means the TMDL for DO cannot be met in the foreseeable future, and pressure will remain on point sources.

    The report calls for reductions in the nonpoint source contribution of particulate BOD in order to achieve low SOD in the East Branch. The report also provides a photograph (figure 6-5) of two large detention ponds, in need of maintenance, that are potential sources of SOD. The implementation plan gives a summary of stormwater regulations, and makes a recommendation for artificial re-aeration of Churchill Woods Lake such that DO concentrations in the outflow from the lake are at least 7.0 mg/L. Also, please see our responses to comments #1 and #2 for further information on implementation considerations.

18. The DO TMDL is based on POTW's discharging at their maximum allowable limits (6.4.2) during dry weather and zero contributions from groundwater, septic fields or nonpoint sources; this is an unrealistic condition and data are not provided to demonstrate a correlation between in-stream flow and total POTW effluent. Scenarios 1-4 and the TMDL do not evaluate the site specific causes of DO sag commencing at mile 20 and rebounding at mile 16, nor does the Plan evaluate cost-effective alternatives to address it.

    A Margin of Safety (MOS) was incorporated implicitly into the TMDL by following the conservative assumption (worse case conditions) that all point sources were discharging at their maximum permitted effluent limits simultaneously. Due to dry weather low flow conditions exhibited by an extended period of minimal to no rainfall, it was assumed that there was no nonpoint source contribution (or incremental flow) to streamflow. In other words, streamflows at the Bolingbrook and Downers Grove were primarily dominated by point source discharges. The model was run iteratively for various scenarios until the water quality target was met. Each scenario consisted of a combination of pollutant loads from point sources and background sources and sinks.

    There is not a specific explanation for the DO sag between river mile 20 and mile 16. Analysis done is explained in section 5.3 of the TMDL. Additional monitoring, as proposed in the responses to comments #1 and #2, could provide insight in to the problem. To do a cost-effective analysis of implementation strategies was outside the scope of the TMDL contractual

work. This type of analysis would be done at a later date when stakeholders in the watershed consider strategies to put the implementation plan in place.

19. The IEPA's draft guidelines for preparing the state 2004 305(b) report (IEPA, 2003) have methods for determining impairment that appear to agree with USEPA guidance (USEPA, 2002, 2003). However, much of the data used for the listing are not included in the reports. Data on fish IBI and MBI were obtained from IEPA upon our consultant's request. The data were collected between 1987 and 1998. Based on this data, only two segments of the East Branch were monitored for these parameters, once each. Segment GBL 02 (closest to the main branch DuPage River) had a 1997 MBI that would indicate full aquatic life use support and an Alternative IBI (AIBI) only slightly below the Illinois cutoff of 41 for full support (using IEPA, 2003 Figure 3-3). GBL 10 (about midway up the river) had a 1998 IBI indicating partial support and an MBI indicating full support. The limited data combined with relatively good indices lead us to suggest additional biological and habitat assessment should be done before a costly TMDL is implemented.

    In general, we agree that more data are always useful in making water quality decisions. However, the Agency believes assessment decisions for East Branch of the DuPage were based on adequate data and are indicative of stream conditions at that time. As stated in the responses to comments #1 and #2, we plan to take an adaptive management approach to this TMDL and will continue to monitor conditions in the stream, adjusting management actions as new data become available.

20. Point source contributions to chloride standard violations may have been underestimated. The contribution to chloride loads from point sources was estimated from the measured concentrations on September 16, 1997. While the report indicated that CSO discharge data was unavailable, there are likely combined sewers in the area. Because some stormwater is routed to and through the sewage treatment plant, it is reasonable to expect that the road salt that causes increased chloride instream during winter months could also cause increased chloride at the sewage treatment plants that receive stormwater. If chloride has not been monitored in the effluent of these sewage treatment plants during winter months, such monitoring should be conducted before assuming that the efflluent contributions to chloride standards violations are minimal.

    While we conducted no site-specific monitoring of chloride from dischargers in this watershed, we recently conducted such monitoring in the West Branch of the DuPage River, as part of the TMDL for that watershed. Based on those results showing chloride effluent concentrations of approximately 350 mg/L, in meeting water quality standards for chloride in East Branch it appears wastewater treatment plant effluent is not expected to be problematic. It is unlikely that CSO controls could positively affect chloride concentration in a cost effective way, relative to the proposed chloride BMPs contained in the Implementation Plan and the ongoing CSO improvements.

21. It appears from the TMDL report that the chloride concentrations are very seldom exceeded, and generally are at least 25 percent below the TMDL of 500 mg/L. As long as communities use sodium chloride only to the degree needed to maintain public safety, new regulations restricting its use seem to be unnecessary.

    Thank you for your comment. Elevated levels of chloride in the winter months have been shown to be a non-point source issue related to de-icing of roadways. The Agency does not have

regulatory authority over non-point sources. Recommendations in the TMDL for reduction of sodium chloride use are voluntary. It is up to local governments, watershed groups and stakeholders to follow through with these recommendations in an effort to decrease unnecessary use of de-icing materials and work toward lower chloride levels in the East Branch.

22. As a recreational user of the stream, there are large algae pools in the stream that are not addressed in the TMDL. If we had data on algae, would the TMDL include that?

    Hypothetically, if we had data, the waterbody may be listed, with excessive algal growth as a cause of impairment. That was not identified as a cause of impairment in this watershed.

23. St. Joseph Creek, Lacey Creek and Hidden Lake were also considered waterbodies to be addressed in the East Branch TMDL. What is to be done about their impairments?

    Please see our response to comment #4.

24. What is the problem here? What is causing the problem? Where is the SOD coming from?

    The assessment took into account a number of different sources that included wastewater treatment plants, stormwater runoff and out flowing water from Churchill Lake Preserve. SOD is a very significant component that was measured in the field. We looked at a number of scenarios that are described in Chapter 6. When we set SOD to zero in the model, meaning there was no oxygen depletion caused by bottom deposits, the stream still did not meet WQS. We removed all the point sources and kept SOD where it was, and that did not restore DO to standards. After a number of these scenarios, it was a combination of several factors that ultimately led to standards compliance.

25. It says here, "...generally pre-dawn and morning DO concentrations at all sampling locations upstream of river mile 7.5 were less than 5 mg/L. So, that's a violation for every finding we had in the morning. This is in June rather than August, so it's not even under worst conditions. How does that figure into your calculations? I'm reading from page 5-16, the middle of the second paragraph. Are you confident that you are modeling to meet the 6.0-mg/L level but you are ignoring the 5.0 mg/L absolute limit. Lets assume, hypothetically, you modeled this perfectly and you are meeting the 6.0 all the time, if it varies over the course between nine and three, so that you are averaging 6.0. You are meeting your six but you have violations half the time.

    The model used was QUAL2E, which is a steady state model that is not designed to predict instantaneous dynamic changes. To compensate for not using a more complex model, the more conservative end point of 6.0 mg/L was used as an absolute number rather than the need for compliance in 16 out of 24 hours as the standard reads.

Water Quality Standards and Data

26. Use of the chloride standard as a surrogate for the TDS standard is unjustified. In developing the TMDL for total dissolved solids (TDS) and chloride, it was assumed that if the chloride standard of

500 mg/L is met, the total dissolved solids standard of 1000 mg/L will be met. However, the information presented in the TMDL document suggest that this is not an appropriate assumption.

Please see the response to comment #27.

27. The correlation between chloride and conductivity was estimated for the East Branch stations as shown on the plot on page 4-4 of the report. It was stated that the TDS standard of 1000 mg/L is equivalent to conductivity of 1667 µmho/cm. The plot and equation presented suggest that a more appropriate target for chloride would be approximately 400 mg/L.

    The purpose of addressing the correlation between conductivity and chloride was to simplify the TMDL by showing that chloride contributed to the conductivity excursions and could be modeled and controlled as one constituent. Road salt contributes more to increased conductivity than simply increasing the chloride concentration. Sodium and other materials add to the conductivity. In controlling chloride via road salt, the Agency must address the need for deicing measures that affect public safety. We must therefore take an incremental approach and continue to monitor the improvement.

28. The TMDL is based on data that are four to eight years old, with most of the DO modeling based on data that are six years old. There was only one exceedance of the standard for total dissolved solids (TDS) (conductivity) and one for chloride, and these may have been outliers. If available, newer data on chloride, TDS, and DO in the river should be provided and reviewed to determine if the river can be delisted for any parameters. It appears this must have been done by IEPA between 1998 and 2002 because three segments were delisted for salinity/TDS/chloride and all segments were listed for low DO; this newer information should be presented and utilized in the TMDL. The newer data should also be used in the modeling if appropriate. The discussion in Section 6.3.3 appears to support this approach. However, the IEPA is not obligated to obtain new data and they may be reluctant to rerun the model using new data because of budget concerns. Also, there is a possibility that the new data may not benefit the Village.

    Regarding the age of data used in these TMDL modeling efforts, not only do collection and analysis of data take time, but so do communication of results to the parties involved. At any point the results that we use will be based on data and information, which can potentially be three to five years old. There is typically a lag of about two years in the Agency's data collection, assessment and impairment listing process. As stated in our response to questions #1 and #2, the Agency plans to take an adaptive management approach that involves additional monitoring and modeling.

29. The draft TMDLs do not explain the basis behind including the various segments and streams on the Illinois 303(d) list. This information should be provided in these and future draft TMDLs because of the relevance to the TMDL program and to the issue of designated use attainability. If the listing was based on the fish Index of Biotic Integrity (IBI) or the Macroinvertebrate Biotic Index (MBI) values, the reports should state this and should include a summary of those values. If fish IBI and MBI data were not available for the streams and the listing was based on chemical and other information, this should also be stated and the relative chemical data provided. Habitat assessment scores, if available, should also be provided in the reports. The IEPA needs to demonstrate the linkages between the proposed TMDL pollutants of concern and the basis for the impairment listing. The IEPA should identify the real stressors that cause biological impairment and document the scientific evidence that

points to potential causes of impairment (USEPA, 2000). Without this information, it is impossible to assess whether the proposed TMDL and Implementation Plan will lead to the ultimate water quality goal. The ultimate goal, of course, is to attain full support of the designated use for the stream or stream reach.

Illinois EPA biologists determine water quality impairments on the basis of physical, chemical and biological data and their personal/professional experiences related to the waterbody. This process and the linkage between TMDL pollutants (causes) and the basis for the impairment listing are described in the 2000 Illinois 305(b) Water Quality Report section B. Assessment Methodology, pages 24-41. Impaired waters from the 305(b) are then placed on the 303(d) List. Waters from the 303(d) List are then chosen, based on a variety of factors, for TMDL development.

30. Providing information on the reasons for listing and the linkages between cause and effect is particularly important when the TMDLs do not attempt to address all listed causes and sources of impairment, as is the case with these draft TMDLs. These draft TMDLs address only a few listed causes (TDS/chloride/salinity and low DO) and not others such as habitat, flow alteration, nutrients, algae, and bacteria. The potential cost to address these few causes is so high that IEPA must provide a very high level of assurance (not just "reasonable assurance") that the proposed Implementation Plans will attain full support of the designated use. If this assurance cannot be provided, then consideration should be given to evaluating other causes or changing the designated use.

    The Agency has adopted the policy of limiting development of TMDLs to potential causes of impairment that have established water quality standards. We have adopted this policy to give the TMDL a scientific and legally binding endpoint. Unfortunately, there are parameters that impair our waters for which there are no legal water quality standards. Potential causes of impairment not analyzed in the TMDL will be addressed holistically through the BMPs and recommendations in the implementation plan and by working with stakeholders in the watershed to develop a watershed plan and nonpoint source control projects.

31. In addition to the above, IAWA would like to know the basis for the original designation of these stream segments and the assessment of support for those uses. For example, some of the segments are listed in the 2002 303(d) list as partially supporting "overall use," yet "overall use" does not appear to be an official use category in Illinois. Many of the East Branch and Salt Creek stream segments are not designated as primary contact; therefore, we question whether the Secondary Contact and Indigenous Aquatic Life standards (with a numerical DO standard of 4 mg/L) could apply instead of the General Use standards. Furthermore, what is the technical basis for the numerical DO standards for General Use and Secondary Contact and Indigenous Aquatic Life; what organisms are we protecting by requiring 5.0 mg/L DO at all times and 6.0 mg/L most of the time, and are these organisms indigenous to these streams? There is an exception to the 4.0 mg/L Secondary Contact DO standard for Calumet-Sag Channel of 3.0 mg/L; could there perhaps be an exception to the General Use DO standard during dry weather in point-source dominated streams in highly urbanized watersheds? We request IEPA's clarification on these points so we can further evaluate the appropriateness of these draft TMDLs and designated use attainability.

    The "overall use" designation was used until 2002 as a summation of all designated uses. Please see page 41 of the Illinois 2000 305(b) Report for a definition of overall use.

The Illinois Pollution Control Board adopted the current DO water quality standard (WQS) on March 7, 1972. The standard is not targeted at a specific species, but is meant to meet the needs of all aquatic life in the stream.

At this time, the Agency has no plans to make exception to the DO standard during dry weather, low flow conditions in point source dominated urban streams. We note that during the drafting of this TMDL, the Illinois Association of Wastewater Agencies (IAWA) filed a proposal with the Illinois Pollution Control Board to revise the DO Standard. If the Board adopts a new standard, we believe the adaptive management approach specified in our responses to comments #1 and #2 will be an effective means of achieving compliance with the new DO standard.

32. The data used in the report is based on a time period from the mid-1990's through the end of the decade. An individual excursion in the stream standard for chloride and dissolved oxygen was noted during this time period. The entire basis for the TMDL has been developed based on this one excursion. We believe that additional data should be collected on the stream that would provide a more comprehensive and complete overview of the current situation on the East Branch of the DuPage River. The data should be collected in a more complete and extensive manner so that the current situation of the river can be analyzed more accurately.

    Please see our response to question #28.

33. The new TMDL standard appears incomplete. There are no nutrient standards included in the current draft report and nutrient loading is deferred to a later date when state based water quality standards are developed. We believe implementing the CBOD and ammonia standard at this time, without taking into consideration the likely nutrient standard to be developed in the future, is unreasonable and inefficient from the wastewater treatment authority perspective. If the Glenbard Wastewater Authority needs to make modifications to its current plant to meet the newly adopted TMDL standard, the Authority may be required to implement additional work that could modify that approach when nutrient standards are adopted. We believe that the current proposed TMDL standard should be deferred until the new nutrient standards can be implemented with the entire loading level limitations being reviewed and implemented at one time. This will allow the Authority to make any necessary modifications that may be required in order to meet the new discharge standards for the stream. The Glenbard Wastewater Authority is very supportive of steps to improve the quality of the East Branch of the DuPage River. In making that statement the Authority believes that the cost effective use of the revenue received from its residents should be considered in making these improvements, and that adopting two sets of standards that could contradict each other and cause unnecessary spending should be avoided.

    Please see the response to comment #16.

34. The plan appears to hinder local determination of appropriate alternatives for water quality improvements, and interferes with local autonomy in land use and zoning matters. While the plan admits to the uncertainties of modeling to support decision-making, it does not describe a program of enhanced WQ monitoring and data evaluation to update modeling results from 1997 data, monitor progress and provide reliable feedback on current conditions and the effect of measures implemented.

Thank you for your comment. The Agency supports many efforts by local stakeholders to improve water quality in their watersheds. This TMDL report is meant to serve as a guide for stakeholders in making decisions and planning future water quality improvement projects such as monitoring programs and non-point source reduction activities. In recognition of these matters, we have outlined an adaptive management approach in the responses to comments #1 and #2.

35. Why couldn't federal nutrient standards be used for this report? Are there no Federal standards on phosphorus or other fertilizer type chemicals? There is no standard for streams in Illinois for phosphorus. The fertilizers cause the problem. They cause the extra algae that pull the oxygen out of the water and kill the fish. I'm amazed that's not part of the State's plan.

    In the late 1990s , USEPA directed all states, to develop nutrient standards. USEPA initially gave us nutrient water quality standards to adopt that we did not think could be scientifically or technically supported in a rulemaking process. Consequently, for the last several years we have been in the process of developing nutrient standards specific to Illinois. Please see the response to comment #3.

Modeling

36. Can modeling tell us the quantitative DO reduction from problem areas and benefit provided by repair and routine maintenance of the stream channel to avoid such conditions? If so, this should be shared with the public.

    With the appropriate and specific information it is possible for a model to provide this type of information. These type of data were not available and this type of analysis has not been done directly for this report. As a result, we do not have this specific information to share.

37. After calibrating the model, the model should be validated using available water quality data to determine the extent to which it accurately predicts conditions.

    Water quality data were collected in June and September 1997. The June data set was used to calibrate the QUAL2E model. The September data set was not used since data were not collected at the headwater location. To better respond to this comment, the model was run for September assuming headwater conditions that were identical to the June conditions. The model does not predict DO for September as well as it did for June, but the predictions were within the range of observed values.

38. Estimated BMPs that are already in place should be included in the modeling.

    Cataloging of existing BMPs in the watershed is one task listed in the response to comment #1 for the watershed committee. Once a comprehensive list and descriptions of the BMPs is complete, this can be analyzed.

39. On page 3-13, the report states that no BMPs were included in the model because data regarding the location of these practices was not available. This assumption represents an overestimate of the contribution from stormwater sources. When these sources are overestimated and the model is

calibrated to actual conditions, other sources of pollutants, including point source contributions, may be underestimated. To the extent possible, the BMPs that are already in place should be estimated and included in the modeling.

Please see the response to comment # 38.

40. It is not clear from the draft reports why Glenbard-Lombard and the other point sources downstream of Downers Grove were not included in the DO modeling. The draft TMDL report does not fully explain this. Glenbard-Lombard appears to be located in an impaired segment of the East Branch just downstream of the Churchill Woods Lake. This seems to be near an area where increases in ammonia and CBOD were observed in 1997, according to the TMDL report (pages 5-13 and 5-14, respectively). However, these increases could also be from the impoundment or other sources. We requested and received from IEPA the June 1997 discharge monitoring reports (DMRs) for many of the point source dischargers in the watershed. The DMR for Glenbard-Lombard indicates that this WWTP was not discharging in June 1997, which may be why it was excluded from the modeling. This treatment plant was discharging from outfall 001 during several months (including "dry weather" summer months) in 2001 through 2003, according to the limited data available in USEPA's permit compliance system (PCS).

    Glenbard-Lombard is a wet weather discharge and was not discharging during the June calibration study. Since it is a wet weather discharge, it is unlikely that it would discharge during low flow conditions, the conditions upon which the TMDL allocation is based.

41. It appears from USEPA's Enviromapper there may be other point source dischargers in the watershed that were not included in the TMDL. Armour Swift-Eckrick was shown as a discharger in the vicinity of Downers Grove when we first checked Enviromapper. However, it is no longer shown, indicating it was incorrectly mapped initially, has changed hands, or has revoked its permit. According to IEPA, some of the point source dischargers may have been excluded because they have flows less than 1.0 MGD or do not discharge oxygen-depleting substances. However, if these or other point sources contribute to the CBOD, ammonia, or nutrient load in the impaired segments of the river, they should be included in the modeling, the WLA, and the implementation plan in order to provide a complete and defensible TMDL.

    Only major dischargers were included in the analysis. If a discharger was less than 1 MGD, it was excluded. However, all dischargers in the watershed would be subject to the same restrictions.

42. The TMDL Report indicates that monthly average data for the WWTPs were used in the modeling and other assessment efforts, in lieu of daily flow data. Daily flow data are not available on WWTP DMRs; IEPA's contractor would have had to obtain this data directly from the WWTPs. Use of the monthly average data could introduce error to the hydrologic calibration, and this is acknowledged in the TMDL Report. It may be appropriate for the WWTPs to look up these daily flow values for June 24 and 25, 1997, and September 16 and 17, 1997, and provide them to the IEPA's contractor if the modeling can be redone.

    The Price report (see references) indicated that stormwater infiltrates the sanitary sewer system. Thus, to avoid double-counting flow during storm events, the average point source discharge during low flow was assumed to come from point sources during storm events as well.

The additional water generated during storm events was included as nonpoint source flow. Using this methodology resulted in predicted flows being within 5 percent of observed flow at the gages. This is an excellent hydrologic calibration. Since QUAL2E is a steady-state model, only one flow is input for each point source in the model. Therefore, DO analyses were not impacted by the assumption.

43. The report does not explain how the tributaries were modeled. Some of these tributaries could introduce low DO water or oxygen-depleting substances to the East Branch because of SOD or point source discharges. The IEPA's contractor has indicated that the tributaries were modeled as point inputs to the East Branch; this should be explained in the report.

    The impaired segments in the East Branch are summarized in Table 2-1 and Figure 2-1. The entire East Branch of the DuPage watershed was modeled for chlorides using HSPF. This modeling therefore addressed all segments impaired by chloride and conductivity. For DO, the entire East Branch watershed was modeled using QUAL2E, including the tributaries, which were modeled as inputs.

44. The TMDL Report does not indicate that the DO model (QUAL2E) was ever validated. It is normal practice to calibrate *and* validate a model, using separate data sets. June 24 and 25 , 1997, data were used for model calibration. It would appear the September 16 and 17, 1997, water quality data could have been used for model validation. The lack of validation is not explained in the report, and the September data are not presented; this should be addressed by IEPA.

    Please see the response to comment #37.

45. It is not clear from the reports how the East Branch SOD values were determined. The IEPA's contractor has indicated they were determined through model calibration rather than by measuring SOD in the field. This method seems subject to significant error, particularly since the model was never validated using an independent data set. The true value of the SOD is very important since the TMDL WLA and implementation plan does not assign much significance to the SOD and, instead, places the burden of load reductions on the point source dischargers. The SOD in East Branch should be measured to reduce the uncertainty.

    Actual SOD measurements were taken at eight different sites on the East Branch in September 1997 (please see Appendix D). These SOD measurements were used as a guide in model calibration for the portion of the stream for which measured SOD values were not available. Additional SOD monitoring could be included as part of the strategy outlined in the response to comments #1 and #2.

46. In Section 6-2 it is stated that the point source contribution has the most significant impact on DO concentration. However, the actual SOD should be measured and (or at a minimum) the model should be validated before such a statement can be made. The Salt Creek draft TMDL report indicates that SOD has much more impact on the in-stream DO than CBOD and ammonia oxidation; this may also prove true for the East Branch watershed.

There is evidence of the need for additional monitoring and modeling of SOD in the East Branch. Compilation of additional data should be made a priority by the watershed committee, referenced in the responses to comments #1 and #2, as a monitoring program is designed.

47. It appears that water quality data were not collected from Churchill Woods Lake during the 1997 sampling events, or there is an error in the reported locations of the sampling stations and modeled reaches. If lake samples were not used in the model calibration for reach 3, we believe there could be significant error in the modeling in the vicinity of this reach, which could impact Glendale Heights.

    Station GBL 16 at St. Charles Road is located in the model segment that contains Churchill Woods Lake. Please see the response to comment #37.

48. The Village of Bloomingdale objects to the application of a non-validated mathematical model to the DO TMDL development. The QUAL2E model used in the DO TMDL for the East Branch of the DuPage River was apparently not validated. Especially considering that the most significant sink of DO in the model, the sediment oxygen demand (SOD), was used as one of the calibration parameters, it would seem highly appropriate to validate the calibrated model on a data set separate from that used in the calibration. We understand that the QUAL2E model validation performed for Salt Creek by Melching and Chang (1996) showed that the model validation significantly improved the utility of that model for water quality planning purposes because it produced "more reasonable DO concentrations". We request that the East Branch of the DuPage River model also be properly validated before it is used for allocation runs.

    Please see the response to comment #37. SOD data were collected on the East Branch in September 1997, and the results were used to calibrate the QUAL2E model.

49. To investigate to what extent the concentration limits can be increased, the DO model can be re-run with the treatment plants being expanded in increments up to their ultimate projected capacities. Each run of the model should determine the maximum load each plant can discharge at the expanded capacity. If the model shows that the effluent limit for ammonia nitrogen can be increased from 1.0 mg/l to, say, 1.5 mg/l as the plants expand, then provisions should be made to allow the effluent limit to be raised accordingly and not let antibacksliding regulations lock in the 1.0 mg/l limit.

    This scenario can be investigated further as part of the approach outlined in the responses to comments #1 and #2.

50. If the IEPA cannot or will not suspend antibacksliding, a solution may consist of simply not including the questionable mass limits in the permits. The DO model used in the TMDL development should provide a strong enough tool to satisfy any related antidegradation concerns, especially after it is validated and the implicit margin of safety (MOS) estimated for the allocation run and the future growth run. The concentration limits would remain, but the absence of the mass limits would allow plant expansions.

    If antibacksliding becomes an issue in the future, the Agency may consider adjustments to effluent limits. However, we anticipate that this will not become an issue since action on CBOD and ammonia effluent limit reductions, if found necessary according to the phased-in approach detailed in the response to comment #2, will coincide with adoption of nutrient standards.

Adjustments would be contingent on the discharger proving that increased effluent limits will not lead to degradation of water quality.

51. Let's go back to the diurnal DO swings. So, you used the 6 mg/L and assumed the swing isn't more than 1 mg/L? But we know it is more than that. They go from 9 to 3.

    We have not modeled the diurnal variation. Very Little data were available to indicate, or use in modeling the diurnal variation. Additional data on this matter are needed. Please see the response to comment #2.

52. So your conservatism was to model six rather than five, but if your swing is more than one, then what?

    Since QUAL2E cannot model the impact of macrophytes and attached algae, it was determined that for this adaptive management TMDL, the steady-state model without simulation of algae was appropriate to use. Monitoring will continue in the East Branch to determine if management strategies implemented as part of this TMDL are working. Also, see responses to comments # 1 and # 2.

53. Is there algae data?

    Yes, there is chlorophyll-a data. Please see the response to question 52.

Load Reductions

54. The methods used in the TMDLs to arrive at load and wasteload allocations, particularly for the DO impairment, do not take full advantage of current guidance on this topic. The USEPA's Technical Support Document for Water Quality-based Toxics Control (USEPA, 1991) lists 19 possible allocation scenarios but also states the list is not all-inclusive, and "any reasonable allocation scheme that meets the antidegradation provisions and other requirements of State water quality standards" can be used. The Federal Advisory Committee came to a similar conclusion in 1998 (NACEPT, 1998) and went on to identify four considerations in making allocation decisions: technical and programmatic feasibility, cost-effectiveness, relative source contributions, the degree of certainty (i.e., reasonable assurance WQS will be met).

    The USEPA has various other documents that provide guidance on allocation methods and stress the importance of economic considerations and stakeholder involvement in the development of allocations (USEPA 1999a, b, and c and 2001). In addition, the USEPA has guidance available on its Internet site including a spreadsheet-based model framework entitled "Framework for Identifying Optimal Allocations." This framework compares the relative costs and feasibility of three different allocation scenarios including equal percent reduction, equal loads, and minimum total abatement cost.

    Despite these recently developed guidance documents and tools, it appears that IEPA has focused primarily on the "degree of certainty" consideration from the older guidance documents and also on the technical and programmatic feasibility criteria in deriving the load and WLAs contained in the reports. Relative source contributions and cost-effectiveness were not seriously considered, particularly for the East Branch. This is evidenced by the fact that SOD is shown to be the most important factor in oxygen depletion whereas the most significant costs appear to be associated with CBOD and ammonia control. We recognize that an attempt was made to look at alternatives to point source controls (e.g., aerating an impoundment on the East Branch and removing a dam on Salt Creek). However, there does not appear to be any systematic or logical approach to developing and evaluating these scenarios. For example, why wasn't a dam removal scenario modeled on the East Branch? We believe IEPA should reassess its methods for allocating loads and wasteloads, placing more emphasis on cost-effectiveness and stakeholder involvement. This should be done for the draft TMDLs discussed herein as well as new TMDLs.

Various pollutant reduction scenarios were analyzed to understand the importance of SOD and the point source loads and to determine the pollutant load reduction necessary to achieve an average DO concentration of at least 6 mg/L. A total of 4 different scenarios are listed in Table 6-3 of the report. The TMDL was not designed to be a cost analysis of pollution reduction strategies in the watershed. Cost analysis, done with stakeholder involvement, will be an important aspect of future actions in the watershed and of Agency policy going forward. Dam removal was not initially considered on the East Branch of the DuPage River. However, the dam removal scenario has now been evaluated. Please see the response to comment #11 for the Agency's strategy for moving forward with TMDL implementation.

55. There are a number of IAWA member agencies that discharge to the East Branch and Salt Creek. These areas are undergoing growth, and that growth means the member agencies, as well as other similar situated communities, will have increased utilization of their existing WWTPs. In many instances, they will have to undergo substantial WWTP expansion in the future.

    The purpose of the TMDL is not to discourage/reduce/impede growth and expansion in Illinois. The TMDL provides estimates of the maximum amount of pollutant loads that a waterbody can receive and still be in compliance with applicable water quality standards. Illinois EPA stands ready to support growth and expansion within the state in an environmentally compatible and cost-effective manner. However, it must be accepted that along with increased population and economic growth come inevitable environmental consequences. The pressure of urbanization on natural resources will likely increase as economic growth continues. Plant upgrades will eventually be necessary to meet <u>present</u> permit limits. Also, see the responses to comments #1 and #2 that outlines a strategy to address the water quality impairment issues in the East Branch of the DuPage River watershed.

56. In the Salt Creek and East Branch draft TMDLs, the DO model was used to simulate future population growth. WWTP effluent concentrations were held constant while flow rates from the WWTPs were increased. Model results indicated the simulation of future higher discharge rates resulted in a small increase in DO in the streams even though the CBOD and ammonia mass load increased. If the proposed mass loading limits are based on the concentrations as described in the Implementation Plan, then future plant expansions will require a decrease in effluent concentration limits in direct proportion to the increase in plant capacity. This conflicts with the results from the future growth simulations. The modeling demonstrates that a decrease in CBOD and ammonia concentrations will not be needed in the future.

    In effluent dominated streams, QUAL2E often predicts higher dissolved oxygen when WWTPs achieve high levels of treatment due to increased velocity. The TMDLs will be modified to illustrate that they can be concentration-based. Also, see responses to comments # 1 and # 2.

57. A TMDL is the maximum mass the particular waterbody can accept or assimilate and still meet water quality standards. It is normally expected that this mass will not increase over time because the assimilative capacity of the waterbody often does not change. However, in the case of the East Branch and Salt Creek, the assimilative capacity of the rivers will increase as WWTP flows increase, as indicated by the modeling results. Because of this, it is not appropriate to set a mass "cap" for CBOD and ammonia, and the CBOD and ammonia WLAs as presented are not valid.

    There is no general evidence showing that the assimilative capacity of the stream will change with increased flow. The statement in the TMDL report suggesting that increased flows improved the DO regime was based on our initial modeling, and the DO increases shown in those model runs indicate very low level changes. However, it may be subject to revision after additional model runs. Also, please see our responses to comments #1 and #2.

58. Since the draft reports indicate that in-stream DO increases with WWTP flow, we suggest the IEPA determine another method of expressing the TMDL DO-related allocations that makes more scientific sense for this unique situation. Possible ways include expressing the CBOD and ammonia WLAs in terms of concentration only or allowing the mass-based WLA to increase with flow.

    Please see the responses to comments #1, #2 and # 57.

59. The technical feasibility of meeting the CBOD and ammonia discharge limits and sustaining them for long periods of time is questionable. It is technically feasible to meet the monthly average concentration limits proposed in the draft TMDL during dry weather, but it may not be feasible to meet weekly limits or mass limits that may be proposed by the IEPA.

    Please see the responses to comments #1 and #2. If in the event changes in permit limits are required, the 8 mg/L and 1 mg/L limits for $CBOD_5$ and ammonia nitrogen, respectively, will only apply during the critical period that will be determined at the time of permit renewal, based on historic flows. This period will most likely be the critical summer low flow (7Q10). There would be two load limits: one on DAF and one on Design Maximum Flow (DMF). Mass and concentration of daily and monthly maximum would change.

60. Related to the above, consideration should be given to the levels at which point sources discharge in relation to their permit limits. Typical point source dischargers make a practice of targeting a pollutant discharge concentration level significantly lower than the NPDES permit limit. This practice is necessary to remain in compliance when the inherently variable testing and operational parameters at a WWTP range beyond the norm and so that future discharge levels will remain consistently below permit limits. As a result, the imposition of permit limits at one level will result in lower discharge levels most, if not all, of the time. The data from the TMDL report appears to show this to be the case. There can be a reasonable expectation that there will be times when discharge concentrations at a particular discharge are near or at the permit level. We believe that evaluation of the data will demonstrate this variability and show how frequently pollutant levels range near permit limits.

    Thank you for your comment. The Agency will take this point into account in its phased adaptive management approach to bring East Branch of the DuPage River into compliance

with DO water quality standards and as we evaluate the load allocation scenarios presented in the report. Also, see responses to comments #1 and #2.

61. We encourage consideration of this variability when considering the impact on stream quality from several point sources. The variability of discharge from each point source is predictable based on historic performance. Similarly, the variability of the overall load from a number of point source discharges can be characterized as well. Analysis of the data will show that the likelihood that all permitees are discharging at their permit limits at the same time is statistically remote. This is consistent with the actual conditions in the stream, as evidenced by the historical stream DO data shown in the TMDL. This is a valid consideration to take when setting limits to protect water quality and could support keeping permit limits at 10 mg/L, for example, and still meeting water quality goals.

    Please see the responses to comments #1 and #2. This issue will be addressed in the proposed phased-in adaptive management approach to bring the East Branch of the Dupage River in compliance with DO water quality standards.

62. A TMDL should specify the allowable loading and percent reductions required to meet the proposed reduction of SOD. The implementation plan refers to a reduction of VSS in order to achieve the reductions of SOD. However, the TMDL document describes no TMDL for VSS. Additionally, it is not clear that VSS is the only component of SOD. Because these are not settleable solids and would not be expected to settle to the stream bottom, this relationship between VSS and SOD is particularly unclear.

    Since VSS data are not available, the revised Draft TMDL recommends baseline monitoring of VSS that will be used to determine how the implementation plan is working. This response will be refined based on the above process. VSS was chosen as the surrogate for organic materials that may settle and contribute to SOD for several reasons: 1) the VSS procedure is an accepted analytical method, 2) data may be more readily available for VSS than other parameters and 3) there are no approved or readily accepted methods for other surrogates (such as volatile settleable solids, or settleable organic matter, etc.). Also, see responses to comments #1 and # 2, which outline Agency's approach to address issues related to DO. Please note that SOD is a major component, which is used to balance the DO equation.

63. The chloride TMDL presented in the draft report is based on Glendale Heights chloride discharge being 90 mg/L, a concentration that was apparently determined from one sampling event in September. This concentration also happens to be the lowest of the WWTPs that were sampled, which could lead to Glendale Heights being given a smaller percentage of the WLA than would be provided if their chloride concentration had happened to be higher on that day. It would be more appropriate to base the modeling and load allocations on a chloride concentration determined statistically from additional samples. The samples should be collected during winter months from the WWTP discharges, since that is the most critical time period for chloride. This should be explored further before accepting a chloride waste load allocation (WLA), particularly if the WLA is to be incorporated into Glendale Heights WPCF's NPDES permit after all.

    The report does not recommend chloride, total dissolved solids (TDS) or conductivity to be parts of the effluent permit limits. Effluent concentrations of these constituents are not expected to be problematic. The report has shown that elevated levels of chloride, TDS and

conductivity are seasonal and occur predominantly during the winter months and are therefore believed to result from road de-icing activities. In this report, the Agency has recommended chloride BMPs and ongoing CSO improvements to address the problem.

64. The draft TMDL Report and Implementation Plan propose reducing the WWTP discharge limits from 10 to 5 mg/L carbonaceous biochemical oxygen demand (CBOD) monthly average and reducing the ammonia-nitrogen monthly average limits from 1.5 to 1.0 mg/L, in the summer only. This requirement is being applied only to the four uppermost major (over 1.0 mgd) point source dischargers in the watershed. The IEPA has stated they are not sure how these limits will be incorporated into permits; they just know they will be incorporated. Some of the current questions include the following:

    Will the concentration limits be monthly average only or will there be maximum day or weekly limits as well?

    The concentration limits would be monthly average. Determination of specifics of the limits will be made at the time of permit renewal. Please see the responses to #59 and #60.

65. When will the limits be in effect (i.e., during certain months of the year, during times when the river is below a certain stage, etc.)?

    Proposed permit limits would be in effect during the critical time period. The period modeled indicates low flow summer conditions are the critical period. That time period would be determined at the time of permit renewal or when permit limits are modified. Also, see responses to comments #1 and #2.

66. Will there be mass limits in addition to concentration limits?

    There will be both mass and concentration limits.

67. If there are mass limits, will they be based on Design Average Flow (DAF) or Design Maximum Flow (DMF) or some other flow value?

    The basis of permit limits will be determined using the current method.

68. Will any or all of the limits be subject to antibacksliding regulations?

    Antibacksliding regulations could become an issue in the future after nutrient standards are adopted. If a WWTP can prove that increasing a permit limit would not negatively impact water quality, backsliding could be considered. As expressed in response #2, we do not anticipate the imposition of lower effluent limits (if required at all) until after nutrient water quality standards are adopted.

69. What will the compliance schedule be?

Traditionally, adequate time has been given to permittees for compliance. The same would follow for any TMDL related permit modifications. We recognize that if lower effluent limits are imposed, case by case review and scheduling will be necessary.

70. The WLAs for CBOD and ammonia appear to have been determined from current summer flows (page 6-9 of the TMDL Report). If these WLAs are used to set mass limits at the treatment plants, they will be very restrictive and will essentially eliminate growth. This issue is also very important because of antibacksliding regulations that may make it difficult or impossible to increase the limits in the future, even if the DO standards are consistently met in the river in the future.

    Please see responses to questions #55 and #68.

71. Future Growth and CBOD/Ammonia Waste Load Allocations – The proposed TMDL standard for CBOD and Ammonia show a reduction from the current discharge standard in the Glenbard NPDES permit. This reduction represents an attempt to increase the Dissolved Oxygen (DO) in the river in periods of low flow by decreasing the oxygen-depleting portion of Glenbard's effluent. The new discharge level cuts the allowable CBOD that can be discharged to the East Branch of the DuPage River by 50% and the ammonia loading by one-third. Although the Glenbard Wastewater plant has been able to meet this lowered standard under its current operation, the plant is not fully loaded to its maximum design level nor was the plant designed to meet the lower discharge level. We believe this could have a major impact on the Glenbard Wastewater Authority as the plant becomes fully loaded in the future and the plant is required to meet a standard below that which it has been designed. The Authority may be required to expend significant amounts of money to modify the existing plant in order to meet this new discharge standard.

    Please see our response to comment #56.

72. We believe that focusing on the discharge from individual wastewater treatment plants in order to improve the DO concentrations in the river is not an issue that should be addressed at this time. All contributors to the DO deficiencies should be considered including Sediment Oxygen Demand (SOD), algae and non-point sources, in addition to the point discharges such as the Glenbard Wastewater effluent.

    Please see responses to comments #1 and #2.

73. Provide for relaxation of any stricter CBOD and ammonia limits imposed on WWTPs as a result of the DO TMDL if nutrients are found to be the cause of the alleged DO impairment: In the event that stricter CBOD and ammonia limits are imposed on WWTPs as a result of the TMDL for DO, and that during the future development of the nutrient TMDLs it is found that nutrients, such as phosphorus, are the cause of the alleged DO impairment, and that WWTPs need only to remove phosphorus, we suggest that provisions be made to allow the IEPA to relax the CBOD and ammonia effluent limits back to their current values. The IEPA should have the authority, in this case, to overrule the antibacksliding regulations so that the WWTPs do not get locked into effluent limits that have no effect on overcoming the DO impairment.

    Please see our response to question #68.

74. We fear the IEPA will be unable or unwilling to provide for a potential future relaxation of the CBOD and ammonia concentration limits due to antibacksliding regulations. This is yet another reason to delay the imposition of the DO TMDL to make sure that the proposed reductions in the CBOD and ammonia effluent limits are really necessary to alleviate the alleged DO impairment.

    Please see our response to questions #1, #2 and #68.

75. Properly restrict the applicable period for stricter CBOD and ammonia limits: The Draft TMDL Report indicates that the DO impairment will only occur during hot weather when the flow in the East Branch of the DuPage River is low. Therefore, we request that the stricter CBOD and ammonia effluent limits, if any, be in effect only during that portion of the summer when these conservative conditions might occur, say the period from July 1through August 31. We request that this proposed period of applicability be clarified.

    Please see our response to question #65.

76. Clarify the applicable averaging periods for any stricter limits for CBOD and ammonia: The Draft TMDL Report and the Draft Implementation Plan are both silent on other than monthly averaging periods for TMDL-derived CBOD and ammonia limits. Yet the determination of the critical averaging period for compliance with WQS should have been (and probably was) undertaken in the Draft TMDL Report during the selection of the QUAL2E model, its input data, and in the formulation of the water quality scenarios for the model. We request that the reports be clarified with respect to potential WWTP effluent limits based on shorter than monthly averaging periods, such as weekly average limits and daily maximum limits. Further, should any such shorter averaging periods be found to apply, we request that the manner of determination of the appropriate numeric limits be clearly described and justified.

    Please see our response to questions #65, #66, and #67.

77. Clarify the potential inclusion of stricter mass limits for CBOD and ammonia in the NPDES permits: Although the Draft Implementation Plan mentions the "overall WLA mass restriction" for the DO TMDL (on p. 12), the Draft TMDL Report does not actually justify stricter mass limits in the NDPES permits. In fact, the Draft TMDL Report provides evidence that an increase in the WWTP discharges will result in an augmented stream discharge, which in turn will result in an increase in the amount of DO contributed by re-aeration (the most significant DO source) and in a reduction of the amount of DO consumed by the sediment oxygen demand (SOD, the most significant DO sink). Other things being equal, <u>including the CBOD and ammonia concentrations in the WWTP effluents</u>, an increase in the WWTP discharges will tend to increase the instream DO. Because restricting the mass limits in the WWTP NDPES permits would run contrary to the findings in the Draft TMDL Report and because a margin of safety is already implicit in the proposed concentration limits, we request that no stricter mass limits for CBOD and ammonia nitrogen be included in the WWTP NPDES permits as a result of the DO TMDL. Should the mass limits be deemed justified, we request that the manner of determination of such mass limits for all applicable averaging periods be clearly defined.

    Please refer to our responses to questions #1, #2, #57 and #'s 64-69.

78. Clearly address the future expansion of WWTPs. The Draft TMDL Report recommends that for the Bloomingdale WWTP, the CBOD effluent limit be reduced to 5 mg/l and the ammonia nitrogen effluent limit be reduced to 1.0 mg/l. The Village's 3.45 mgd treatment plant, which is currently permitted to discharge 10 mg/l CBOD (288 lbs of CBOD/day) and 1.5 mg/l ammonia nitrogen (43 lbs of ammonia nitrogen/day), would have those limits reduced to 5 mg/l CBOD (144 lbs of CBOD/day) and 1.0 mg/l ammonia nitrogen (29 lbs of ammonia nitrogen/day).

    The Draft Implementation Plan implies that when a treatment plant expands, the mass load limits should remain fixed. In our example, say the treatment plant is expanded from 3.45 mgd to 4.5 mgd. The Draft Implementation Plan would have the load limits unchanged at 144 lbs of CBOD/day and 29 lbs of ammonia nitrogen/day, which equates to the concentration limits of 3.8 mg/l CBOD and 0.77 mg/l ammonia nitrogen.

    However, this outcome is in direct conflict with the finding of the Draft TMDL Report that increased WWTP discharges benefit the instream DO as a consequence of streamflow augmentation. Section 6.2 of the Draft TMDL Report indicates that the projected growth in WWTP discharges will allow the DO to reach a target of 6.15 mg/l (instead of the 6.0 mg/l in the allocation run) under the critical condition. This target effectively further expands the implicit margin of safety (MOS). We suspect that the MOS is overly conservative even when the DO target is set at 6.0 mg/l (as discussed in Section 6.4.2 of the Draft TMDL Report), and fail to see the need to compound the MOS with ever more layers of conservative assumptions.

    Therefore, as treatment plants expand, it should be possible to increase the mass load limits without deleterious effects, because of the net beneficial effects of increased discharges at <u>the same effluent concentrations of CBOD and ammonia</u>. In fact, based on the information in the Draft TMDL Report, neither the concentration limits nor the mass load limits should have to remain fixed when the WWTP discharges increase.

    Please refer to the response to comment #57. The Agency believes the MOS used in the report is appropriate and serves as an additional protective measure in bringing the East Branch into compliance with DO water quality standards.

79. The Village of Bloomingdale strongly objects to a potential tightening of the carbonaceous biochemical oxygen demand (CBOD) limit and to the proposed tightening of the ammonia nitrogen limit in its NPDES permit as a result of the DO TMDL, and requests that the implementation of the DO TMDL be delayed: In the event that delisting for DO cannot be considered or justified, we believe that several justifications exist for delaying the proposed implementation of the DO TMDL: lack of water quality justification for the urgency of the proposed implementation, failure of the draft TMDL to account for the impact of nutrients and for the diurnal action of algae and other aquatic plants, and the approaching arrival of nutrient WQS in Illinois.

    Please see responses to comments #3, #4 and #16.

80. The Village of Bloomingdale strongly objects to the potential addition of any TDS, conductivity, or chloride limits to its WWTP NPDES permit: We concur with the direction taken in the Draft Implementation Plan to target the use of BMPs related to winter road deicing operations as the method for lowering the potential for violations of the water quality standard (WQS) for TDS. Due to the seasonal patterns in the instream conductivity observations, that direction seems appropriate.

Nonetheless, the Village does wish to submit its objection to the potential addition of any effluent limits related to the chloride TMDL to the NPDES permit of its WWTP.

The Agency does not have plans to implement WWTP effluent limits for chloride at this time. We determined through data analysis and modeling that point source dischargers did not contribute enough chloride to cause exceedance of water quality standards. While, the chloride impairment has been attributed to non-point sources, there is a point source component in the TMDL equation that must be accounted for.

81. The Draft TMDL Report states that under current loadings from point sources (WWTPs), no action would be required by the existing WWTPs to meet the wasteload allocations for CBOD and ammonia with respect to the DO WQS. In fact, no action is required until the theoretical situation where all the WWTPs discharge at their maximum permitted effluent limitations. Therefore, we question the ability of the proposed implementation to improve the water quality in the East Branch of the DuPage River. Furthermore, we also see no justification for any urgency to impose the DO-related TMDLs on this Village and other WWTPs, such as by tightening the CBOD and ammonia limits in the WWTP NDPES permits.

    Please see the responses to comments #1 and #2.

82. At the public meeting, a goal of 33% reduction in use of chloride was mentioned. From Table 6-2 this may be estimated to be about 6100 tons per year of chloride reduction [no weight conversion of chloride to road salt provided]. No place in the implementation plan is information provided regarding the alternatives to accomplish this goal, and whether it is attainable. Traffic volumes and roadway areas are increasing; we would expect deicing salt use to be undergoing a long term increasing trend as well. Our citizenry values more highly mobility and safety, than they do the effect of the reported single excursion of elevated chlorides in surface waters during winter months. No reasonable person will accept increased frequency of accidents, or even reduced mobility, as a consequence of limiting salt applications. For IEPA to propose such reductions without complete evaluation is irresponsible and inconsistent with its charter to safeguard human health and the environment. In addition, parties applying road salt may incur substantial legal liability in event of vehicular accidents linked with curtailment of its application.

    Please see the response to comment #21 and #80.

83. The implementation plan needs to provide figures on basin or county salt consumption, and areas of roadways treated and from such numbers propose reasonable alternatives for reductions, allocations and the time frame for these.

    Table 3 of the implementation plan summarizes snow removal and salt application information collected from selected agencies and municipalities. Tables 1 and 2 summarize information about alternative road de-icers. However, it is not the purpose of this TMDL to write a road de-icing management program for IDOT and the Illinois Tollway Authority. The Implementation plan can serve as a guide for these and other agencies to evaluate and adjust road de-icing techniques.

84. The parties applying salt to roadways need to be encouraged to participate in evaluating alternatives and committing to their implementation. Researchers in deicing technology need to be invited to participate in considering alternatives, even if they happen to be marketers of road salt. Pilot studies need to be done to further evaluate the cost-effectiveness of alternatives.

    Detailed studies such as these may be recommended and organized by a local watershed committee, as suggested in the response to comment #1.

85. The WLA uses average POTW flow and actual chloride concentration in effluent on a single day, September 16, 1997 (Table 6-1); this is inconsistent from other data sets, and does not account for variance, potentially higher concentrations in winter, and potential increases in chloride mass with population increases.

    Chloride is not normally a parameter monitored in POTW effluent. The September 16 sample result was used to represent POTW flow due to a lack of a reliable data set. Shortcomings in data can be addressed through suggestions detailed in the response to comment # 1.

86. The published WLA is only 11% of the existing NPS load (Table 6-2); failure to reduce use of road salt should not cause TMDLs to pressure POTWs to add expensive treatment to accomplish chloride reductions.

    Please see the response to comment #80.

87. Modifications to individual NPDES permits must be done though public notice and hearings; under the implementation plan, how does the IEPA expect to counter reasonable claims that the TMDL's proposed are technically unsound and not implementable as proposed, and that IEPA failed to perform cost-effective analysis of alternatives as required under the CWA. IEPA lacks defensible facts or authority to lower point source effluent limits. IEPA's proposed TMDL is essentially an unlawful taking of local authority over land use such as zoning and development. This is especially true when IEPA's data shows that WQ impairments result almost completely from sources other than POTW treated effluents, and that the implementation plan excludes cost-effective evaluations to mitigate such other sources.

    Any NPDES permit modifications would be completed at the time of permit renewal and would be done through the established public notice and hearing process. The Agency plans to work with all stakeholders in the watershed through a phased approach to implementation of TMDLs that is outlined in the responses to comments #1 and #2.

88. When will IEPA determine the WLA for chlorides to deal with the salt issue and organic matter to deal with the DO problem that will go into the permits for storm sewer discharges and municipalities?

    The permits issued earlier this year for Phase II stormwater (MS4) contain a condition for watersheds that have approved TMDLs. The MS4 permit condition states if there is an approved TMDL, the permittee must modify their program to conform to the TMDL. Permitees are given an 18-month compliance period. At the appropriate time, the Agency will notify permittees of their obligations concerning an approved TMDL in this watershed. Also, see responses to comments #1 and #2.

89. Is there anything in the TMDL that actually reduces discharge limits below what they are currently discharging?

    Data that were collected during the two diel sampling efforts (June and September, 1997) indicated dischargers were close to or below that 8 mg/L CBOD and 1 mg/L ammonia recommendation. Another key element to implementing this TMDL is to reduce the SOD from bottom sediments. That is one of the major sources of oxygen demanding materials. Also, see responses to comments #1 and #2.

90. You are not counting on any actual reductions in point sources?

    Please see the responses to comments #1 and #2.

91. After you lower point source limits to 1 and 5, is it anticipated that any of these communities are going to want to grow and increase discharge? What will happen when they increase their loading?

    The TMDL establishes load limits. The load (mass per unit time) can be converted into concentrations. For growing communities, the concentration has to be adjusted proportionately over time so they meet the load allocation.

92. When you calculated based on permits did you use the permitted flow or actual flow?

    The NPDES facilities that have permitted design flow capacities were included in the model at their permitted design flows.

93. So if a treatment plant has a capacity of 11 MGD and, in my case are using 6 to 7, we've already accounted for our growth for the plant as it's designed. If we wanted a plant expansion, then that load allocation would be it. You would have to design that plant for even more reduction on that new expansion.

    There is a discussion in the report about using the model to project out to 2020 population figures and flows. We indicated that the increase in flows from the treatment plants is a benefit to the DO regime. The DO increases from 6.10 to 6.15 mg/L under that future growth scenario. However, this difference is not substantial enough to have any effect on load allocations or reductions.

94. This is a follow up question to the apparent improvement of the DO due to 2020 population levels. Does that include any WWTP expansions beyond current designed flows? Are current design flows in the basin sufficient to meet populations in 2020?

    This is a question that should be addressed by local governments. A 26 percent increase in flow above current average conditions was assumed in the model runs. This increase of 26 percent is based upon NIPC population projection. The adaptive management approach discussed in

response #1 and #2, particularly the monitoring component, should alleviate problems with WLA in the future.

95. If a treatment plant in the basin expands its capacity, it basically has to come up with a lower standard on a concentration basis to meet your mass load. So instead of 5 mg/L it could be 4 mg/L. And on ammonia, which is even more critical, it could be something less than 1 mg/L.

    Your observation may be a possibility in the future. Thank you for your comment.

96. The Village of Bloomingdale objects to the arbitrary manner in which the margin of safety (MOS) was applied in the development of the DO TMDL and requests that the percentage of the loading capacity set aside for this MOS be identified. We request that the portion of the overall DO-related loading capacity consumed by the assumptions in the "implicit" MOS be quantified. We understand that the implicit MOS in the Draft TMDL Report relied on modeling assumptions that were more conservative than necessary, and that its quantitative estimate is not available unless additional analyses are performed. Nonetheless, because a QUAL2E water quality model is now available for the East Branch of the DuPage River as a result of the TMDL development, these additional analyses can and should be performed. Unless we are provided an estimate of the extent to which the conservative assumptions used in the Draft TMDL Report reduced the resulting wasteload allocations, we must object to the proposed allocations as potentially exposing the Village to unjustified and arbitrary drains on our scarce resources. The analyses we are requesting could follow the recent recommendations in the 2003 "Navigating the TMDL Process: Evaluation and Improvements" report by the Water Environment Research Foundation, wherein the results of the conservatively biased model are compared with those of a more realistic "best-estimate" model, and conclusions regarding the percent MOS drawn from this comparison, both for the allocation run and for the future growth run.

    This analysis could be completed as part of the adaptive management process as detailed in the responses to comments #1 and #2.

97. Error analysis should be conducted as a means of determining an appropriate margin of safety. The margin of safety (MOS) must "take into account any lack of knowledge concerning the relationship between effluent limitations and water quality." (CWA §303(d)(1)(C)) Therefore, to set aside an appropriate margin of safety, either explicitly or implicitly, the uncertainty associated with the modeling must first be determined. It is not clear from the discussion of MOS in the TMDL document whether a relatively large MOS is assumed based on considerable uncertainty or a small MOS is assumed based on less uncertainty.

    The TMDL was developed using an implicit Margin of Safety (MOS). The MOS is an additional factor included in the TMDL to account for scientific uncertainties, growth, and other factors such that applicable water quality standards are achieved or maintained. The MOS can be included implicitly in the calculations of the WLA and LA or can be expressed explicitly as a separate value. Part of this implicit MOS included the modeling assumption that all point sources were discharging at their maximum allowable limits (monthly average limits).

    There was no direct explicit uncertainty analysis performed. However, during model calibration, parameters were adjusted to match as closely as possible with the observed values. Consequently, there was indirect understanding of uncertainty related to those parameters. By

using conservative assumptions throughout the modeling process, the agency considers the implicit MOS to be very conservative. It is not possible to present a numerical valuedue to the nature of the implicit MOS,

Implementation Considerations and Plans

98. The implementation plan does not provide reasonable assurance that load reductions from stormwater discharges will be achieved. This TMDL demonstrates that discharges from MS4s and CSOs are causing or contributing to violations of applicable water quality standards for DO and chloride. Because the general permit for MS4s specifically prohibits discharges from causing or contributing to a violation of standards and CSO permits typically contain a similar special condition, the holders of these permits are currently violating the terms of the permits. Please identify the MS4 operators whose storm sewers discharge to waters in the watershed, and provide more detail on the measures that these permittees must implement as well as the proposed timeline for compliance. If the terms of the general MS4 permit do not contain provisions specific enough to comply with water quality standards, please provide a timeline for IEPA to develop an individual permit for these discharges.

    An explanation of the IEPA General Stormwater NPDES Permit is in section 2.1.2 of the East Branch of the DuPage River TMDL Implementation Plan. Please see Appendix G for a list of MS4s in the East Branch of the DuPage River Watershed.

99. Our comment pertains to chlorides. Like most communities in northeast Illinois, we use bulk rock salt with calcium chloride pre-wetting agent for our snow and ice control. We have implemented some BMPs, such as covered salt storage and digital spreaders. These are reasonable steps, which most public agencies can meet, even within limited budgets. However, I would strongly oppose any forced state requirements to use costly CMA or other high-cost de-icers. Even calcium chloride, while reasonably cost effective, does have its shortcomings and should not be mandated.

    Please see the response to comments #1, #2 and #21.

100. Aeration proposed at Churchill Woods is just upstream of this segment; the plan needs to address the cost-effectiveness of aeration when there remain large SOD sinks immediately downstream. The implementation plan needs to be more specific regarding the decades-long time frame for implementation of MS4 controls and the expected results for in-steam DO. The plan should contrast these with the relatively immediate implementation and results of lower permit limits on POTW's, which restrict development and growth.

    Please see the response to comments #1 and #2.

101. Few, if any, local resources are available to write, implement and enforce MS4 controls and NPS controls within municipalities or DuPage County. It is inappropriate and misleading to suggest the plan will improve water quality conditions without citing realistic scenarios for implementation of programs cited. The implementation plan cost estimates need to include annual costs for all resources to implement these programs. There are high annual costs involved the public and local authorities should be aware of.

The TMDL was not designed to provide specific costs of implementation to all counties and municipalities in the watershed. The costs given in the report are preliminary, generalized estimates that may be subject to revision as local cost information is obtained by the watershed committee proposed by the IEPA in the responses to comments #1 and #2. There is money available to fund non-point source pollution BMPs through the Illinois EPA Section 319 Program. Watershed committees can contact the Watershed Management Section of the Agency for more information on developing an effective and fundable non-point source (NPS) control program. TMDL watersheds will, often times, receive priority in Section 319 funding. Some costs, however, may inevitably fall on the community since the urbanization of the watershed is what, in large part, has caused the impairment of the East Branch.

102. County and local governmental authorities, POTWs, highway authorities, park districts, the Morton Arboretum and the County Forest Preserve are among those that manage land and water resources in the East Branch watershed. None have budgeted for this program and few have had material involvement in its development or implementation to date. The implementation plan must propose an administrative means for local authorities to buy-in, design, implement and enforce the program. As proposed by IEPA, the plan cannot be implemented and does not meet basic federal or CWA requirements. The only potential enforcement means is through the NPDES program, and that is suspect as noted below.

Please see the responses to comments # 1 and #2 and #98.

103. The implementation plan does not identify means to enforce the program, except for POTWs through the NPDES program. It is misleading and wrong to suggest the MS4 program will be enforced or accomplish reductions. The burden will fall solely on the POTWs and their customers by way of limits to local development, greater risk of enforcement due to permit excursions and potentially high costs for effluent polishing.

It is not the intention of the Agency to arbitrarily impose high costs on the POTWs to implement TMDL recommendations. The Agency plans to work with all parties involved to arrive at the most cost effective solutions that bring the East Branch of the Dupage River in compliance with water quality standards. To the extent that POTWs are the apparent target of this TMDL, this is the result of federal regulatory policy. This should not limit POTWs and others from developing alternative strategies, consistent with an adaptive management and phased approach.

104. The plan does not consider the cost effectiveness of various alternative controls per unit of loading reduced; this violates CWA principles established in 1974 and implemented through the 201, 208 and 303(e) programs. The implementation plan does not show the shift in cost burden to POTW's and high unit cost reductions from effluent polishing versus low unit costs reductions from pollution prevention, site-specific stream repair, and stream maintenance.

Please see the response to comment #103.

105. Having also reviewed the draft TMDL report for Salt Creek, we are a bit puzzled as to the reason that the Graue Mill Dam (at Fullersburg Woods), has been recommended for possible removal by IEPA's engineering consultant, CH2MHILL, but the Churchill Woods Lagoon Dam, along the East

Branch of the DuPage River, has not. We understand that the type of spillway at Churchill Woods allows for significantly less re-aeration of the overflowing water than does the dam at Fullersburg Woods, and it may be more economical, at least in the short term, to install mechanical aerators than to remove the dam at Churchill Woods. However, based on the size of the upstream pools (approximately 30 acres at Churchill Woods vs. 15 acres at Fullersburg Woods), it would seem to us that there is likely much more of a problem with sediment oxygen demand (SOD) at Churchill Woods Lagoon than at Fullersburg Woods, and if removing the dam at Fullersburg Woods solves the dissolved oxygen problem along Salt Creek, then removing the Churchill Woods Dam should do the same along the East Branch. Also, if the dam at Churchill Woods were to be removed, there would be a wonderful opportunity to restore a large, riparian wetland complex in the area that is now inundated by the normal pool.

Please see the responses to comment # 11.

106. Since the Churchill Woods Dam is not what we consider to be historically significant, our existing land management policies would seem to lead us to generally support the eventual removal of a dam such as this, for the long-term betterment of the river resource. We do feel that the dam removal option is one that should be at least evaluated for comparative purposes in the East Branch TMDL report, before a proper decision can be made. We would like to know if the dam removal alternative would provide water quality benefits to the East Branch of the DuPage River equal to or perhaps greater than the mechanical aeration alternative that is currently being recommended.

Thank you for your comment. Please see our response to comment # 11 and #54.

107. The primary sources of pollution in streams and rivers flowing through the metropolitan Chicago area appear to be run-off and the overflow from combined water treatment systems. The following would no doubt alleviate the problem: (1) widen the green space surrounding streams and rivers in the metropolitan area and provide greater wetland protection initiatives; (2) provide incentives for companies that successfully market fertilizers and road salts to develop alternative products for their residential and municipal customers; and (3) increase the capacity of metropolitan sewage treatment systems or develop separate systems for run-off and sewage. It doesn't appear the storage of effluent in the deep tunnel for later treatment is easing problems along the Du Page River.

Thank you for your comments. These suggestions could be considered by the watershed committee as suggested in the response to comments #1 and #2. Funding for these initiatives could be obtained through various state and federal programs including the Illinois EPA Section 319 Non-point Source Pollution Program. Information on the 319 Program can be found at: http://www.epa.state.il.us/water/watershed/nonpoint-source.html

108. Information about the dam itself is lacking. For example, the IEPA should provide information about whether the dam discharges from the lower or the upper part of the lake. This could affect the downstream DO if the lake is deep enough to have a hypolimnion. Information about the purpose of the dam - for example, whether it is used for flood control - would be beneficial to the stakeholders. Also, without the lake, it appears that the upper portion of the watershed could be in compliance with the DO standard. Figure 5-6 indicates that this may be the case, except perhaps at sample station GBL-14 upstream of the Bloomingdale STP (interestingly, in the only segment that is not listed for a DO impairment). It is difficult to determine this from the draft TMDL report because the sampling

and modeling results from one of the sample stations (GBL-11) are not included in the report. There is no explanation as to why station GBL-11 results are not included.

This information is beyond the scope of this TMDL. This information will be determined as the Agency moves forward with this TMDL through the adaptive management strategy detailed in the responses to comments #1 and #2.

109. The Implementation Plan is vague with respect to the chloride WLA. It does not indicate how or whether the chloride WLA will be applied to the WWTPs. A WLA is provided and appears to be based on the mass discharged from the WWTPs using “average” flows and September 1997 chloride concentrations. However, there is no mention of specific mass or concentration limits for the WWTPs in their NPDES permits. The IEPA has indicated there will be no chloride limits for the WWTPs. If this is the case, then the IEPA should either remove chloride WLA from the reports or make it very clear that the WWTPs will not have limits.

The report does not recommend effluent limits for chloride, total dissolved solids (TDS) or conductivity in the WWTP National Pollutant Discharge Elimination System (NPDES) permits. Effluent concentrations of these constituents are not expected to be problematic. The report has shown that elevated levels of chloride, TDS and conductivity are seasonal and occur predominantly during the winter months as a result of road de-icing activities. In this report, the Agency has recommended chloride BMPs and ongoing CSO improvements to address the problem.

110. The Implementation Plan does not address several of the impairments listed in the 2002 303(d) list including nutrients and algae. It also does not address the issue of suspended solids and sediment load resulting from channelization. It may be appropriate for the IEPA and/or stakeholders to perform stream bank restoration in select areas. Sediment often contains organic material and nutrients; therefore, reduction in the sediment load would also reduce SOD and nutrients in the river.

Thank you for your suggestions. Nutrient and algae concentrations, affects and control will be addressed through further monitoring, as described in responses #1 and #2. Streambank restoration to aid in SOD reduction would be a very worthwhile project for IEPA and local stakeholders from the community to consider. The Watershed Committee should consider streambank restoration when water quality improvement actions are discussed.

111. USEPA guidelines and common practice suggests monitoring be included in a TMDL implementation plan. The draft Implementation Plan does not include a specific plan for continued monitoring of the river, and it should.

Please see our responses to comments #1 and #2.

112. On page 1 it is noted that organic material in stormwater contributes to SOD. There are also intermittent/wet weather discharges from at least one WWTP that should be considered here.

This comment is not specific enough for us to respond. We are not aware of which WWTP you are referring to.

113. On page 1 it is stated that there are VSS LAs associated with the DO TMDL, yet there are no numerical LAs presented for VSS, CBOD, or ammonia-nitrogen. This is a concern because it places all of the enforcement emphasis on the point source dischargers.

Please see the response to comment #62

114. Page 12: Dates should be provided for the recommended summer season limits (i.e., April through October or June through September, or other duration).

Please see the response to comment #59.

115. Page 13 indicates capital costs for filtration of $0.30 per gallon treated and this appears low unless it is based on design peak hourly flow. If based on design average flow, it is possible it does not consider intermediate pumping, site work, electrical work, and other ancillary costs. In our experience, costs are closer to $0.60 to $1.00 per gallon treated for filtration if based on monthly average flow and depending on the type of filtration and whether pumping is required. The costs listed for aeration of Churchill Lake also appear low and might only represent material costs and not installation.

The costs presented in the TMDL are best estimates based on literature values. The actual costs can only be estimated by each individual municipality. The Agency will work with all parties involved to arrive at the most cost effective solutions that work towards improving water quality. Please see the responses to comments # 101 and #103.

116. The Village of Bloomingdale believes other alternatives for implementing the DO TMDL should have received due attention instead of predominantly targeting the WWTPs. The IEPA will require WWTPs on the East Branch of the DuPage River to reduce their discharges to resolve the modeled DO problem by lowering CBOD and ammonia limits in the future NPDES permits. We are requesting that the IEPA evaluate other alternatives for implementing the DO TMDL for the East Branch of the DuPage River. One such strategy that we feel bears evaluation is the artificial aeration of impaired water segments, particularly in the Churchill Woods Forest Preserve Lake.

Please see the responses to comments #1 and #2.

117. Another option is dam removal. We suggest that dam removal be considered as a remedy for the DO situation, just as it was in the Salt Creek TMDL. The DO impairment is attributed, at least in part, to upstream impoundments, specifically the Churchill Woods Forest Preserve Lake. If the removal of this impoundment would remedy the DO impairment, then it should be considered as an option. We suggest that the model be re-run with the dam removed to determine to what extent it would remedy the DO impairment.

Please see the responses to comments #11 and #108.

118. While the IEPA's legal position to require artificial aeration or dam removal may require that the WWTPs request one or both of these as an addition to the permit, they may be the most effective methods to address the DO problem in the East Branch of the DuPage River.

Thank you for your comment. Also, see responses to comments #1 and #2.

119. Would IEPA consider establishing a local clean water committee to ensure that the implementation plan is actually implemented?

Please see response to comment #1.

120. Did you look at any opportunities for stream meandering or wetlands creation?

No, we focused specifically on chlorides and DO. We will continue to explore and be open to consider projects that would improve habitat, remove dams, etc. In some instances, dam removal leads to opportunities for wetland creation and habitat restoration.

121. The TMDL looks at artificial aeration in Busse Woods Lake. Why was dam removal not considered in this TMDL like it was in the Salt Creek TMDL report?

The Salt Creek TMDL never recommended artificial aeration in Busse Woods Lake. However, regarding removal of dams in the East Branch, please see the responses to comments #11 and #108.

Financial Considerations

122. It appears that Glendale Heights may be capable of meeting the proposed monthly average concentration limit for ammonia without any upgrades to the WPCF at current flows. However, the ability of the WPCF to meet the proposed ammonia limit in the future is less certain. It is likely that additional aeration tanks will be necessary once the WPCF reaches design capacity, if not sooner. The proposed CBOD concentration limit was exceeded in July 2002 . If mass limits are imposed by IEPA and are based on dry weather flow, these may be very difficult to meet. If the CBOD concentration limit or restrictive mass limits are implemented, it appears it will be necessary to upgrade the facility by either providing additional flocculation/sedimentation facilities upstream of the existing filters or by upgrading the filtration facilities. The improvement in performance as a result of additional flocculation/sedimentation facilities would be difficult to predict without performing bench or full-scale pilot testing. If filtration upgrade is selected, this would involve replacing the traveling bridge units with deep bed filters or an innovative technology such as cloth disk filtration or "fuzzy filters." The filtration upgrade would very likely require intermediate or effluent pumping, based on the existing hydraulic profile at the WPCF. The costs presented in the TMDL Report do not appear to include intermediate pumping nor consider the design of the filters must be based on peak hourly flow.

Please see the response to comments #1, #2 and # 115.

123. The potential capital cost to provide flocculant addition facilities could range from $50,000 to $200,000 depending on whether bulk chemical storage and/or major building modifications are required. The increase in operating costs for the flocculant would be roughly $20,000 per year assuming the flocculant is added only when the new limits are in effect (assumed to be six months of the year for purposes of this evaluation). There would also be an increase in the mass of sludge produced as a result of the flocculant addition; however, the increase in sludge volume would be relatively minor. The potential capital cost if an additional final clarifier is also needed would be $1,000,000 to $1,200,000. This assumes a 95-foot-diameter clarifier and one additional RAS pump with related piping and appurtenances. The additional costs for labor, power, and supplies associated with the polymer system, new clarifier, and RAS pump would be approximately $30,000 per year. The 20-year present worth of the flocculant and other additional O&M costs would be about $400,000, assuming a discount rate of 5 percent. If the existing filters are removed and replaced with cloth disk filters, the capital cost would be approximately $1,200,000 to $1,500,000 for the filters alone (installed in the existing filter building) and approximately $1,000,000 for an intermediate pumping station and associated piping. Operating costs would increase because of the power required for intermediate pumping and for additional replacement costs associated with the cloth filters. It is assumed the increase would be about $15,000 per year or $200,000 on a 20-year present worth basis (discount rate of 5 percent). It is possible that the new filters could be designed only for dry weather peak flow and that the existing filters could remain in service for winter and wet weather operation. This arrangement may reduce filtration capital costs; however, the required building addition may offset these savings.

Thank you for providing the Agency with this cost information. The watershed committee referred to in the response to comment #1 will be made aware of this information for use when and if deemed appropriate, according to the adaptive management and phased approach proposed.

124. Village of Glendale Heights personnel have also noted that it may be necessary to assess and make improvements to the collection system, because the variation in flows would affect staff's ability to consistently meet a 5 mg/L CBOD limit. The cost of a full sewer system evaluation survey including smoke testing, dye testing, flow metering, and assessment could be as high as $400,000 for a community the size of Glendale Heights. The study would likely be conducted over two to three years, with the cost for sewer and manhole rehabilitation and disconnection of illegal connections and removal of sources of infiltration and inflow on private property being several millions of dollars over the next decade. A program such as this would also help the Village comply with future CMOM regulations.

Thank you for your comments. Please refer to our response to comment #123.

125. The Village of Glendale Heights objects to the increased treatment costs in the future for no clear benefit. The Draft TMDL Report clearly indicates that the segment to which the Village's WWTP discharges does not show signs of impairment for the pollutants currently subject to the East Branch of the DuPage River TMDLs. The report indicates that the alleged DO impairment occurs significantly downstream from the Village's WWTP. The proposed reduction in the CBOD and ammonia effluent limits in the NPDES permit for the Village's WWTP will potentially increase the Village's future cost of treatment without any measurable environmental benefit. As the Village's WWTP nears capacity, the Village will be required to staff the WWTP 24 hours per day in order to respond to the operational fluctuations that occur when operating so near the technology's capability.

Please see the responses to comments #1 and #2, which outline the Illinois EPA approach to bring the East Branch into compliance with the DO water quality standard.

126. Operating the WWTP close to the capabilities of the applicable treatment processes will result in a higher potential for noncompliance and third-party lawsuits. As allowed for in the Clean Water Act, third parties may sue permit holders for instances of noncompliance. Noncompliance will likely occur when operating a treatment plant so close to the capabilities of the treatment processes used. The costs associated with defending lawsuits will potentially become a tremendous burden to the Village of Bloomingdale. The IEPA has not demonstrated that reducing the permit limitations will have any measurable environmental benefits, yet the stricter limits may jeopardize the Village's position relative to any future lawsuits.

Please see the responses to comments #1 and #2 The approach specified in the responses to comments #1 and #2 will involve several interested parties. As this process moves forward we believe litigation may be avoided through cooperative arrangements, plan development and data sharing.

General Questions and Comments

127. The Glenbard Wastewater Authority has attended previous meetings at which the consultant hired by the IEPA has provided a brief outline of the proposed TMDL report. The Authority was not afforded an opportunity to directly participate in the development of the TMDL either through data collection, preliminary review of the data or other involvement until the draft report was submitted. We firmly believe the IEPA should work with all stakeholders on the East Branch of the DuPage River in developing any TMDLs that would affect the various stakeholders. The involvement should be at the formative level of the report and allow the stakeholders to provide cost data, operational data and other impacts that any proposed stream changes could cause to the stakeholders.

Please see the response to comment # 1.

128. The opportunity for the involvement of the Village of Bloomingdale as a stakeholder in the East Branch of the DuPage River TMDL development process has been insufficient. The public meetings that were held prior to the release of the Draft TMDL Report and the Draft Implementation Plan were held before there was enough substantive material available for the Village's and other stakeholders' review, and merely provided the stakeholders with information of a largely generic nature on the plan for the preparation of the report. The Village has contacted both Gary Eicken and Bruce Yurdin (Illinois EPA staff) repeatedly over the last several years to request opportunities to provide input and assistance from a stakeholder position, yet such opportunities were not provided. We strongly believe that had the Village been allowed to be involved constructively in the development of the substance of the East Branch of the DuPage River TMDL, many of the resulting deficiencies (on which we comment below) would have been avoided and a more scientifically sound and defensible TMDL would have resulted. Unfortunately, this letter is the first substantive means of involvement afforded to the Village as a stakeholder in the East Branch of the DuPage River TMDL development process. Consequently, to compensate for the prior lack of opportunity for stakeholder involvement, the Village respectfully requests that it, along with other stakeholders, be allowed an opportunity for review of and comment on the updated Draft TMDL Report and the updated Draft Implementation Plan prior to the submittal of these documents to the USEPA.

Thank you for your comment. We regret that the report published in August 2003 was the earliest and most meaningful means of providing information on this TMDL to the public. We view this report as the first step in a continuing process of stakeholder involvement. Please refer to the response to comments #1 and #2 concerning the development of a watershed stakeholders group to continue planning within the basin, review monitoring data, etc.

129. The Village of Bloomingdale has recently made a FOIA request for the technical memoranda and for the comments thereon as referred to in Section 1.2 of the Draft TMDL Report. As stated in the Draft TMDL Report, a series of memoranda have been submitted and comments thereon incorporated in that report. However, neither the memoranda nor the comments are included in the Draft TMDL Report or the Draft Implementation Plan. Because the memoranda and comments presumably affected the substance of the TMDLs, the Village requests an opportunity to properly review the memoranda and the comments on those memoranda, and respond to these as appropriate in the interest of stakeholder involvement.

The technical memoranda referred to in Section 1.2 were progress reports from the consultant, CH2MHILL, to the Agency. They are part of the report development process and were not released to the public for comment. They are part of the public record and third parties may request them for review.

130. Figure 6-5 illustrates four large breeches in the river bank north of Roosevelt Road. The texts calls them problem areas that aggravate sedimentation and increase SOD, thereby reducing DO. At these breeches the East Branch is almost completely filled with sediment, forcing nearly all flow to pass into the adjacent detention ponds, by-passing the river channel. With this configuration, most flow and new sediment passes into the detention ponds where low velocity allows settling of most sediment (VSS). Flow subsequently passing slowly through these ponds is then subject to abnormally high SOD. Conditions such as these cause low DO and need to be inventoried and remedied in preference to lowering point source effluent limitations. The current poor condition of the East Branch should be expected, given the failure to properly construct or maintain it throughout the years of rapid development in DuPage County. The TMDL and Implementation Plan should address the quantitative effect of these conditions and cost-effective alternatives to remedy them.

Please see the response to comments #1 and #2.

131. Do the citizenry, county or state have any current administrative or enforcement avenues to influence property owners to maintain stream channels on their property? If yes, why is this not recommended or part of the implementation plan? If not, why does the plan not recommend measures and means to accomplish stream maintenance?

The only form of regulatory action available to the Agency is through control of NPDES permit limits. The Agency does not have regulatory authority over private landowners. Non-point source control and water quality improvement will ultimately have to be taken up by local landowners in the community and the local watershed committee.

132. Has IEPA's contractor identified other segments with structural or hydraulic problems, such as breeches and unstable banks, contributing to high SOD and low DO? Why is the affect of remediation of such segments not modeled and not part of the implementation plan?

The QUAL2E model cannot model structural issues. However, addressing unstable banks, implementing buffers to shade the stream, and controlling stormwater to reduce organic loading to the stream will address substandard DO.

There have been several streambank stabilization projects initiated in the East Branch of the Dupage River watershed through the Illinois EPA Section 319 Nonpoint Source Pollution Program. The table below was taken from "Table 7 - Illinois EPA Projects in TMDL Water Bodies" in the Draft Illinois 2004 303(d) List.

Waterbody	County	IEPA Program	Funding Year	Local Partner/Sponsor	Project Description
E. Branch DuPage River	DuPage	319	2003	Hobson Cr. Community Council	Unnamed trib to E. Br. DuPage streambank stabilization phase II
		319	2003	Village of Westmont	Muddy Waters pond (trib. of E. Br. DuPage) restoration- shoreline stabilization and wetland/prairie restoration
		319	2002	Hobson Creek Community Council	Unnamed trib to E. Br. DuPage streambank stabilization and riparian buffer phase I
		319	2002	Morton Arboretum	Morton Arboretum parking lot runoff control
		319	2001	Village of Woodridge	Prentiss Creek (trib of E. Br. DuPage) streambank stabilization
		319	2000	Village of Glendale Heights	Armitage Creek (trib of E. Br. DuPage) streambank stabilization
		319	1999	The Conservation Foundation	E. Br. DuPage River WRAS implementation phase I- urban stormwater, hydrologic modification & Info/Education
		319	1998	The Conservation Foundation	Streambank stabilization
		319	1998	Morton Arboretum	Willoway Brook (trib. of E. Br. DuPage) streambank stabilization project phase II
		319	1998	Lisle Park District	Old Tavern Park shoreline stabilization
		319	1997	Morton Arboretum	Willoway Brook (trib of E. Br. DuPage) streambank stabilization project phase I
		319	1997	The Conservation Foundation	Four Lakes Village streambank stabilization
		319	1990	DuPage County Dept of Environmental Concerns	Streambank/ shoreline stabilization
	Will, DuPage	319	2003	Downers Grove Park District	Lyman Woods streambank, streambed and gully stabilization

133. If IEPA responses to the above issues include statements that adequate funds were not available to do this work or that it was outside the work scope, then the TMDL report and implementation plan need to define additional work needed and reserve conclusions about TMDLs until results of such work are available.

Please see the response to comment #1 and #2.

134. Implementation of the recently promulgated MS4 regulations and general storm water permits may be expected to model that for industry site-specific and general storm water permits USEPA initiated in 1991. Some 12 years later there is little published evidence that the industry program has resulted in material improvements in water quality. Barriers may have included the slow pace of implementation, a program that does not require monitoring and reports, Agency failure to inspect facilities, the lack of Agency and public enforcement resources, the lack of public involvement, and the lack of water quality data to support trend analysis.

Thank you for your comments. We share your concerns and realize that some of our programs have shortcomings. We will continue working to improve upon our established programs and make adjustments as needed. The general permits issued in 2003 to address Phase II will be monitored for effectiveness.

135. Without more attention to and input from those responsible for public safety the IEPA is proposing a plan that is not implementable, is inconsistent with its obligations to the public, and does not meet the intent of federal TMDL regulations.

This TMDL report has been reviewed and commented upon by a wide range of professionals and local stakeholders. The Agency believes this report meets its obligation to uphold water quality standards and preserve designated uses. Once necessary changes to the report are made, we will submit the report to USEPA for approval and as a part of their review of the report, we assume they will make a determination if the report meets the intent of federal TMDL regulations. We acknowledge that chloride reductions pose potential public safety issues that must be resolved with local cooperation, input and additional monitoring.

136. Several figures are not labeled with a figure number. It would be helpful to list gauging stations, monitoring stations, point sources, etc., by name instead of by number on the figures. It would be also helpful to have a single figure showing the impaired segments, the impairments in those segments, and potential sources (point and nonpoint).

We feel the figures identifying gauging stations and monitoring stations in the draft are appropriate. Please see the response to comment #6.

137. Figure 2-1 indicates that all segments of the East Branch plus a few tributaries are impaired, yet Table 2-1 lists only three. Table 2-1 only lists a few of the impairments in the three segments listed. A complete list of all segments and impairments should be provided, and the tables and figures should agree with the 2002 303(d) list.

Please see the response to question # 4.

138. Table 2-2's title and the text preceding the table indicates that it includes "... Available Data, and Potential Sources," yet it does not.

The title of Table 2-2 has been corrected to read "Pollutants, Water Quality Standards and TMDL Endpoints" in the Final Report. Available data (Diel Survey and SOD Data) are presented in Appendix D.

139. Table 2-2 appears incorrect with respect to the TMDL endpoint for conductivity; this does not agree with Figure 4-1.

Please see our response to comment # 27.

140. Table 3-1 does not indicate how impervious versus pervious area was determined, and the residential impervious percentage appears low.

The impervious values are effective impervious values. DuPage County has an ordinance which requires that downspouts be routed to grassed areas. Using the percent impervious values listed in Table 3-1 for residential areas resulted in a good hydrologic calibration.

141. Section 3.6 indicates that "all WWTPs and major point sources" were included in the modeling efforts. This is not true; the Glenbard-Lombard WWTP and Stone-Barber WWTP were not included according to Table 3-3 and later sections of the report. It is not clear why these were not included.

For the QUAL2E model effort, Glenbard-Lombard is a wet weather discharge and was not discharging during the June calibration study. Since it is a wet weather discharge, it is unlikely that it would discharge during low flow conditions, the conditions upon which the TMDL allocation is based. Elmhurst-Chicago Stone, Barbers Corner (IL0053155) is a quarry, and does not have oxygen-consuming waste in it. Its flow was accounted for through runoff through groundwater.

Both discharges were omitted from the chloride TMDL analysis. Since the Glenbard-Lombard discharge contains stormwater flow, including it would have double-counted the stormwater (would have been accounted for with the discharge and in nonpoint source runoff). The Elmhurst-Chicago Stone discharge is not believed to contain high chloride values; the flow was accounted for in runoff through groundwater.

142. Page 4-6 and page 5-8 indicate that DO measurements were made on September 16 and 17, 1997. These data are not presented and should be. The IEPA should explain why they weren't used to validate the QUAL2E model.

Please see the response to comment # 37.

143. Figure 4-6 has an incorrect water quality station number in the title; the station listed is on Salt Creek.

This has been corrected in the Final Report.

144. Figure 4-6 or the text should indicate the time of day that the DO measurements were taken. The title indicates these are “monthly DO” data – does that mean monthly average?

This sample station is an ambient site where data are collected once a month for nine months in the year. In this case, monthly DO data and monthly average data are the same value since only one sample is taken per month.

145. Table 4-1 appears incomplete. There are many other causes for low DO including contaminated sediments and waterfowl mentioned on page 4-9. The references to Glenbard are not clear; is one of these the Glenbard WWTP and the other the Lombard WWTP? CSOs are not mentioned.

We agree with your comment. Table 4-1 and statements on 4-9 should be taken in consideration together for all sources of DO. Also, please see the responses to comments #1 and #2, which outline the Agency’s approach to DO related issues.

146. Page 4-8 notes that QUAL2E can simulate water quality constituents contributing to DO problems, including nutrients, yet nutrients were not evaluated. This should be fully explained, and if nutrients will potentially be included in a future TMDL, then IEPA should state that in these reports. Ideally, an evaluation of nutrients and algae should be included in this TMDL because they affect DO. Nutrients entering the river during wet weather would contribute to algae production and SOD that would, in turn, contribute to low DO during dry weather.

Please see the response to comment # 1 and #2.

147. Page 4-8 indicates that “all the pollutants listed on the 303(d) list of East Branch” are summarized in Table 4-2. This is not true according to the 1998 and 2002 303(d) lists.

Please see the response to comment #4.

148. The discussion on page 5-3 about point source data used to model flows is confusing. Daily data from the WWTPs should have been used for the modeling effort instead of monthly averages. This information could probably have been obtained from the WWTPs. The communities in the watershed have varying degrees of leaking sewers, combined sewers, and peak-to-average flow. Therefore, using monthly average WWTP flows with daily streamflows and daily water quality data could introduce a great deal of error. It is not accurate to prorate the apparent dry weather point source flow of 30.7 cfs between the WWTPs by using the monthly average flows, particularly if there were rainfall events or other deviations from normal dry weather flow in June 1997.

Dischargers record daily flows, but they do not routinely report these numbers to the Agency. Monthly flows were used in the interest of time and practicality and were considered adequate for modeling purposes.

149. On page 5-5, it would be helpful to have a graph of modeled versus observed flow.

The Agency believes that the present table is sufficient for a hydrologic calibration summary.

150. On page 5-5 through 5-7, some of the drawbacks to using monthly average WWTP data are acknowledged. Again, we think daily data should have been obtained and used.

Please see the response to comment # 148.

151. Page 5-8 indicates that nutrients were simulated by QUAL2E; if this is true, these results should be presented.

Modeled DO, CBOD and ammonia concentrations are provided in Appendix F.

152. Table 5-4 lists at least two sampling stations (GBL 11 and GBLG 01) that do not appear to be included in subsequent graphs, tables, or appendices. The data from these stations, or an explanation, should be provided.

GBL 11 data have been added to the graphical output in Figures 5-4, 5-5, and 5-6. GBLG 01 is located on a tributary to the East Branch of the DuPage River and is not included on the graphical output.

153. Table 5-6 does not appear to include all point source dischargers of BOD and ammonia in the watershed.

This table includes all point source dischargers that were included in the modeling effort. Please refer to response #141 for additional information.

154. On page 5-12 a statement is made that Citizen's Utility Company No. 2 STP and Bolingbrook STP No. 1 do not discharge to an impaired segment. This is not true; segment GBL 02 had several causes of impairment on the 1998 303(d) List and is listed for organic enrichment/low DO on the 2002 303(d) List. It is possible these WWTPs do not have much affect on in-stream DO because of stream reaeration or other factors. If so, this should be explained by IEPA, and these WWTPs should be included in the TMDL implementation plan if appropriate.

According to the 2000 305(b), GBL02 was not impaired for parameters that had a water quality standard. Therefore, a TMDL was not completed on that segment. The report states: "Segment GBL 02 is not listed for DO impairment." The Agency is taking a phased approach to this TMDL and believes the proper load allocation will improve DO and other parameters in the entire watershed, including GBL 02. Please see our response to comment #4 for a detailed explanation of Agency TMDL development policy. The 2004 305(b) lists GBL02 as full support for ALUS and Fish Consumption.

155. Page 5-13 does not explain how the assumed model values for organic nitrogen and ammonia in incremental flow were determined. These values appear high in the upper reaches, particularly for reach 2 and perhaps reach 3. If these values are inaccurately high, they might result in a model-

determined SOD that is inaccurately low, thus placing incorrectly high emphasis on the importance of the point source dischargers.

The values are higher than normally input for incremental flow. However, data collected during the June diurnal study demonstrate an increase in instream ammonia that is not accounted for by point sources. The SOD values are based on data collected by IEPA and thus should not be low.

156. Based on the information presented on page 5-13 and elsewhere, it appears the QUAL2E model was not validated. If true, the model results, conclusions, and basis for the WLAs are questionable. The IEPA should explore using the September 1997 data set or other appropriate data set for validation purposes.

Please see the response to comment #37.

157. In Table 5-7 and subsequent text on page 5-14, some WWTPs are not mentioned.

Any WWTP having a design average flow of at least 1 mgd was included in the study as it is considered a major discharge.

158. June 1997 flow information should be provided in Table 5-7. It would be helpful to have a summary of the design average flows for the WWTPs somewhere in the report.

We believe the table is adequate as presented in the report.

159. On page 5-16 it is not clear how the East Branch SOD values were derived. The IEPA's contractor has indicated they were arrived at through model calibration. There may be significant inaccuracies in the SOD values since they were not measured in the field and the model was not validated.

SOD was measured in the East Branch of the DuPage in September 1997 at 8 different locations. Please see Appendix D for a listing of the SOD values.

160. Figure 5-6 indicates that DO is maintained above the standards in the vicinity of Glendale Heights' discharge. It would be interesting to see the results of the modeling if the lake is aerated and no other changes are made in the upper segments of the river. It appears possible that the upper segments of the river might meet standards.

Lake aeration and dam removal are two possible scenarios we plan to investigate (see the responses to comments #1 and #2).

161. Figure 5-7 does not seem to show CBOD decay; this layer is either accidentally turned off, is hidden by another parameter, or is zero. This figure also indicates that ammonia oxidation in the upper segments of the watershed is essentially zero; therefore, the TMDL Report and Implementation Plan should focus more on SOD than ammonia limits in these segments.

This figure has been corrected to show CBOD as a component of the DO mass balance based on the model results for June 24-25, 1997. Ammonia oxidation is important to predicted DO as well as SOD and reaeration.

162. There is a discrepancy between the statements in Section 6.4.4 and page 5-13 and Table 6-4. Glenbard was not meeting ammonia limits during the June 24 and 25 1997, sampling event.

On average, Glenbard meets its ammonia limit. From 1995 to 2000, the average ammonia concentration in the Glenbard effluent was 0.34 mg/l compared to its monthly average limit of 1.5 mg/l.

163. On page 6-2 it is noted that DO increases as WWTP flows increase, and, therefore, it is not necessary to consider future growth in the DO TMDL. This is noteworthy because it supports the case for not having mass limits for CBOD and ammonia-nitrogen in WWTP permits and for possibly increasing CBOD and ammonia limits in the future despite anti-backsliding regulations.

Please see response to comment # 57.

164. Page 6-2, indicates that WWTP "average flow" was used along with September 16, 1997, concentration limits to develop the chloride WLA; it does not indicate whether these were 1997 monthly average flows or design average flows.

The total point source flow used in the model was 30.7 cfs as described in Section 5.2.4. However, Table 6-1 incorrectly reported the WLA that would result from this flow and the concentrations reported in Table 6-1. The chloride TMDL has been revised and the WLA portion of the TMDL is now based on design average flows for the point sources and a chloride effluent concentration of 400 mg/l.

165. Regarding Table 6-2, a back-calculation for total WWTP flow in the WLA using an assumed average concentration of 230 mg/L chloride results in only 6.3 mgd of WWTP flow. This was determined as follows: 4.42×10^6 lb/year = (230 mg/L)(6.3 mgd)(8.34)(365 days/year). The total flow value of 6.3 mgd appears low for all of the WWTPs, and there may be an error in the WLA.

There is an error in the WLA reported in Table 6-1. In addition, the total point source flow used to calculate the WLA was 30.7 cfs as described in Section 5.2.4 of the TMDL. This point source flow is lower than the point source flows observed during the low flow studies completed in 1997. Thus, the TMDL as reported may not allow for reasonable growth among the point sources. Additional modeling runs were completed that set a reasonable reduction for nonpoint sources; modeling runs with point sources set at flows that allow for reasonable growth and varying concentrations were then completed to determine the impact on instream chloride concentrations. Based on these additional modeling runs, an alternative TMDL that is protective of the chloride standard but reasonable for point and nonpoint sources was developed. This revised TMDL is based on design average flows and a concentration of 400 mg/l for the point sources. Section 6.3 of the TMDL has been modified.

166. On page 6-7, the assumed summer temperatures should be provided. If the model temperatures are not close to the observed temperature during the June 1997 sampling event, an explanation should be provided.

Effluent temperatures were assumed to be 70 ^{o} F, and headwater temperature was 80 ^{o} F; these temperatures are supported by the available data.

167. Table 6-3, Figure 6-3, the data in the appendix, and Figure 5-7 all appear to indicate that SOD has a higher impact on in-stream DO than the point source dischargers have. This supports the case for an implementation strategy that focuses on NPS controls rather than reduced WWTP effluent limits.

Please see the response to comments #1 and #2.

168. Page 6-9 indicates "daily point source flows under ${}_7Q_5$ low-flow conditions" were used to calculate the CBOD and ammonia-nitrogen WLA for the four listed WWTPs. The values of these flow rates should be provided in the report.

The model input files have been added to Appendix E.

169. Table 6-4 has a footnote that states the CBOD and ammonia allocations apply "to ${}_7Q_5$ low-flow conditions." If so, and because Section 6.2 states that the in-stream DO increases with increasing flow, reduced permit limits should only be imposed during ${}_7Q_5$ low-flow conditions.

The NPDES permits impose limits for 7Q10 conditions. However, the water quality standards for DO in Illinois apply to all flow conditions above 7Q10. Please see the response to comments #59 .

170. The municipalities along the East Branch of the DuPage River are already feeling the pinch of the current economic downturn. Numerous demands are placed on their limited financial resources. Meanwhile, more and more unfunded mandates are being placed upon them. Two prime examples are NPDES Stormwater Phase II and NPDES permit fees, the latter coming without sufficient advance warning to allow the municipalities to include them in their budgeting process. It would be unfair and unjustifiable to impose the additional financial burden of making improvements to comply with the DO TMDL when the need for its implementation is not clearly or properly justified at this time. We believe the IEPA should wait to impose the DO TMDL until additional monitoring clearly shows that a DO impairment exists and until the effects of nutrients related to eutrophication have been properly addressed.

Please see the response to comments #1 and #2.

171. On the power point presentation, a map shows three segments are impaired, but on the map in the report it does not show the same segments as impaired. (5, 10, 8).

Please see the response to comment # 6.

END.

GLOSSARY AND ACRONYMS

ALUS	Aquatic Life Use Support
AWQMN	Ambient Water Quality Monitoring 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.
CMOM	Capacity, Management, Operation & Maintenance
CSS	Combined Sewer System. Wastewater collection systems designed to carry both sanitary sewage and storm water runoff in a single pipe to a wastewater treatment plant.
CSOs	Combined Sewer Overflows. These occur during wet weather periods when the hydraulic capacity of the CSS becomes overloaded. This causes overflows at discharge points within the CSS.
DAF	Design Average Flow
DMF	Design Maximum Flow
DMR	Discharge Monitoring Reports
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)
LA	Load Allocation. The maximum load of pollutants from non-point sources.
MS4s	Municipal Separate Storm Sewer Systems
NVSS	Non-volatile suspended solids
POTWs	Publicly Owned Treatment Works
SOD	Sediment Oxygen Demand
SSO	Sanitary Sewer Overflow

STPs	Sewage Treatment Plants
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
WIP	Watershed Implementation Plan
WLA	Waste Load Allocation. The maximum load of pollutants from point sources.
WPCFs	Water Pollution Control Facilities
WQS	Water Quality Standards
WWTPs	Waste Water Treatment Plants

DISTRIBUTION OF RESPONSIVENESS SUMMARY

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

ILLINOIS EPA CONTACTS

TMDL Inquiries .... Bruce Yurdin................................217-782-3362
Legal Questions .... Sanjay Sofat................................ 217-782-5544
Public Relations.. Mark Britton................................ 217-524-7342

Questions regarding the public meeting record and access to the exhibits should be directed to Bruce Yurdin at 217-782-3362.

Written requests can be mailed to:

Illinois Environmental Protection Agency
Bureau of Water
Planning Unit, Watershed Management Section
1021 North Grand Avenue East
Post Office Box 19276
Springfield, IL 62794-9276

Final Report

Salt Creek Watershed Implementation Plan

Prepared for

Illinois Environmental Protection Agency

October 2004

CH2MHILL
727 North First Street
Suite 400
St. Louis, MO 63102-2542

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1 Scope of this Implementation Plan

Each total maximum daily load (TMDL) described in this report should have a reasonable assurance of implementation in the watershed and it should be consistent with all applicable federal regulations and guidance provided by the U. S. Environmental Protection Agency (USEPA). This plan includes the management practices to be implemented and the associated costs and institutional arrangements necessary for implementation, and it addresses the following TMDLs:

- Chloride TMDL for East Branch DuPage River
  - Applicable to road salting activities
- Dissolved oxygen (DO) TMDL for East Branch DuPage River:
  - Oxygen-demanding materials discharged to East Branch DuPage River ($CBOD_5$ and ammonia) by wastewater treatment plant (WWTP) point sources
  - Low DO in the outflow from Churchill Woods Lake

2 General Description of Applicable Pollution Control Programs

2.1 Point Sources—Stormwater

The chloride TMDL describes load allocations (LAs; i.e., NPS allocations) applicable to stormwater sources of chloride, such as road salting activities. Similarly, there are VSS LAs associated with the DO TMDL. They will also be applicable to stormwater discharges. However, Phase II of the NPDES stormwater program will apply to most or all of the municipalities in the watershed, as well as to the roads owned and operated by the state and the Tollway Authority. Thus, it is anticipated that stormwater-related allocations will actually be implemented as point source controls, as described in recent USEPA guidance and as governed by the Illinois Environmental Protection Agency (IEPA) General Permit for Stormwater Discharges.

2.1.1 USEPA Regulations and Guidance

USEPA has recently issued guidance directing how stormwater sources are to be addressed in TMDLs (source: USEPA. *Establishing Total Maximum Daily Load [TMDL] Wasteload Allocations [WLAs] for Stormwater Sources and NPDES Permit Requirements Based on Those WLAs*. Memorandum from Robert Wayland and James Hanlon to Water Division Directors. November 22, 2002). Relevant key points presented in this guidance include:

- NPDES-regulated stormwater discharges must be addressed by the WLA component of the TMDL [40 CFR 130.2(h)].
- NPDES-regulated stormwater discharges may not be addressed by the LA component of the TMDL [40 CFR 130.2(g)&(h)].

- Stormwater discharges from sources that are not currently subject to NPDES regulation may be addressed by the LA component of the TMDL [40 CFR 130.2(g)].
- It may be reasonable to express allocations for NPDES-regulated stormwater discharges from multiple point sources as a single categorical WLA when data and information are insufficient to assign each source or outfall to individual WLAs [40 CFR 130.2(i)]. In such cases where WLAs have been developed for categories of discharges, these categories should be defined as narrowly as available information allows.
- The WLAs and LAs are to be expressed in numeric form in the TMDL [40 CFR 130.2(h)&(i)]. USEPA expects TMDL authorities to make separate allocations to NPDES-regulated stormwater discharges (in the form of WLAs) and unregulated stormwater (in the form of LAs). USEPA recognizes that these allocations might be rudimentary due to data limitations and variability in the system.
- Water Quality Based Effluent Limits (WQBELs) for NPDES-regulated stormwater discharges that implement WLAs in TMDLs may be expressed in the form of best management practices (BMPs) under specific circumstances [40 CFR 122.44(k)(2)&(3)]. If BMPs alone adequately implement the WLAs, then additional controls are not necessary.
- USEPA expects that most WQBELs for NPDES-regulated municipal and small construction stormwater discharges will be in the form of BMPs, and that numeric limits will be used only in rare instances.

According to this guidance, all of the chloride and DO-related allocations for the East Branch DuPage River TMDLs should be characterized as WLAs for point sources. In all other respects, the East Branch DuPage River TMDLs are consistent with this guidance.

2.1.2 IEPA General Stormwater NPDES Permit

IEPA has recently issued General Permit No. ILR40, *General NPDES Permit for Discharges from Small Municipal Separate Storm Sewer Systems*. The effective date of this permit is March 1, 2003 through February 29, 2008. Applicable municipal separate storm sewer systems (MS4s) are expected to file a notice of intent to be covered by the permit, and then comply with all applicable permit requirements. The two sections of the permit most relevant to this plan are Part III C (Special Conditions for TMDL Watersheds) and Part IV (Stormwater Management Programs). Each of these sections is reproduced below, describing the conditions and requirements for covered permittees:

Part III. Special Conditions for TMDL Watersheds

C. If a TMDL allocation or watershed management plan is approved for any waterbody into which you discharge, you must review your stormwater management program to determine whether the TMDL or watershed management plan includes requirements for control of stormwater discharges. If you are not meeting the TMDL allocations, you must modify your stormwater management program to implement the TMDL or watershed management plan within 18 months of notification by the Agency of the TMDL's approval. Where a TMDL or watershed management plan is approved, you must:

    1. Determine whether the approved TMDL is for a pollutant likely to be found in stormwater discharges from your MS4.

2. Determine whether the TMDL includes a pollutant WLA or other performance requirements specifically for stormwater discharges from your MS4.
3. Determine whether the TMDL addresses a flow regime likely to occur during periods of stormwater discharge.
4. If, after the determinations above have been made, it is found that your MS4 must implement specific WLA provisions of the TMDL, assess whether the WLAs are being met through implementation of existing stormwater control measures or if additional control measures are necessary.
5. Document all control measures which are currently being implemented or are planned to be implemented. Also include a schedule of implementation for all planned controls. Document the calculations or other evidence which shows that the WLA will be met.
6. Describe and implement a monitoring program to determine whether the stormwater controls are adequate to meet the WLA.
7. If the evaluation shows that additional or modified controls are necessary, describe the type and schedule for the control additions/revisions. Repeat steps four through seven until two continuous monitoring cycles show that the WLAs are being met or that the WQ standards are being met.

Part IV. Stormwater Management Programs

A. Requirements

You must develop, implement, and enforce a stormwater management program designed to reduce the discharge of pollutants from your small municipal separate storm sewer system to the maximum extent practicable (MEP) to protect water quality and to satisfy the appropriate water quality requirements of the Illinois Pollution Control Board Rules and Regulations (35 Ill. Adm. Code, Subtitle C, Chapter 1) and the Clean Water Act. Your stormwater management program must include the minimum control measures described in section B of this Part. You must develop and implement your program by 5 years from your coverage date under this permit.

B. Minimum Control Measures

The six minimum control measures to be included in your stormwater management program are:

1. Public education and outreach on stormwater impacts.

You must:

a. implement a public education program to distribute educational materials to the community or conduct equivalent outreach activities about the impacts of stormwater discharges on water bodies and the steps that the public can take to reduce pollutants in stormwater runoff; and
b. define appropriate BMPs for this minimum control measure and measurable goals for each BMP. These measurable goals must ensure the reduction of all of the pollutants of concern in your stormwater discharges to the maximum extent practicable.

2. Public involvement/participation.

   You must:

   a. at a minimum, comply with state and local public notice requirements when implementing a public involvement/participation program; and

   b. define appropriate BMPs for this minimum control measure and measurable goals for each BMP. These measurable goals must ensure the reduction of all of the pollutants of concern in your stormwater discharges to the maximum extent practicable.

3. Illicit discharge detection and elimination.

   You must:

   a. develop, implement, and enforce a program to detect and eliminate illicit discharges into your small MS4;

   b. develop, if not already completed, a storm sewer system map showing the location of all outfalls and the names and locations of all waters that receive discharges from those outfalls;

   c. to the extent allowable under state or local law, effectively prohibit, through ordinance or other regulatory mechanism, non-stormwater discharges into your storm sewer system and implement appropriate enforcement procedures and actions;

   d. develop, implement, and adequately fund a plan to detect and address non-stormwater discharges, including illegal dumping, to your system;

   e. inform public employees, businesses, and the general public of the hazards associated with illegal discharges and the improper disposal of waste;

   f. address the categories of non-stormwater discharges listed in Section I.B.2 only if you identify them as a significant contributor of pollutants to your small MS4 (discharges or flows from firefighting activities are excluded from the effective prohibition against non-stormwater and only need to be addressed where they are identified as significant sources of pollutants to waters of the United States); and

   g. define appropriate BMPs for this minimum control measure and measurable goals for each BMP. These measurable goals must ensure the reduction of all of the pollutants of concern in your stormwater discharges to the maximum extent practicable.

4. Construction site stormwater runoff control.

   You must:

   a. develop, implement, and enforce a program to reduce pollutants in any stormwater runoff to your small MS4 from construction activities that result in a land disturbance of greater than or equal to 1 acre. Reduction of stormwater discharges from construction activities disturbing less than 1 acre must be included in your program if that construction activity is part of a larger common plan of development or sale that would disturb 1 acre or more, or it has been designated by the permitting authority.

Your program must include the development and implementation of, at a minimum:

i. an ordinance or other regulatory mechanism to require erosion and sediment controls, as well as sanctions to ensure compliance, to the extent allowable under state or local law;

ii. requirements for construction site operators to implement appropriate erosion and sediment control best management practices;

iii. requirements for construction site operators to control waste, such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste that may cause adverse impacts to water quality at the construction site;

iv. require all regulated construction sites to have a stormwater pollution prevention plan that meets the requirements of Part IV of NPDES permit No. ILR10, including management practices, controls, and other provisions at least as protective as the requirements contained in the Illinois Urban Manual, 2002;

v. procedures for site plan review which incorporate consideration of potential water quality impacts and review of individual pre-construction site plans to ensure consistency with local sediment and erosion control requirements;

vi. procedures for receipt and consideration of information submitted by the public; and

vii. procedures for site inspections and enforcement of control measures.

b. define appropriate BMPs for this minimum control measure and measurable goals for each BMP. These measurable goals must ensure the reduction of all of the pollutants of concern in your stormwater discharges to the maximum extent practicable.

5. Post-construction stormwater management in new development and redevelopment.

You must:

a. develop, implement, and enforce a program to address stormwater runoff from new development and redevelopment projects that disturb greater than or equal to 1 acre of land, including projects which are less than 1 acre that are part of a larger common plan of development or sale or that have been designated to protect water quality, that discharge into your small MS4. Your program must ensure that controls are in place which would protect water quality and reduce the discharge of pollutants to the maximum extent practicable;

b. develop and implement strategies which include a combination of structural and/or non-structural BMPs appropriate for your community that will reduce the discharge of pollutants to the maximum extent practicable;

c. use an ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under state or local law;

d. require all regulated construction sites to have post-construction management that meets or exceeds the requirements of Section IV (D)(2)(b) of NPDES permit No. ILR10, including management practices, controls, and other provisions that are at least as protective as the requirements contained in the Illinois Urban Manual, 2002;

e. ensure adequate long-term operation and maintenance of BMPs; and

f. define appropriate BMPs for this minimum control measure and measurable goals for each BMP. These measurable goals must ensure the reduction of all of the pollutants of concern in your stormwater discharges to the maximum extent practicable.

6. Pollution prevention/good housekeeping for municipal operations.

   You must:

   a. develop and implement an operation and maintenance program that includes a training component and is designed to prevent and reduce the discharge of pollutants to the maximum extent practicable;

   b. use training materials that are available from USEPA, the state of Illinois, or other organizations. Your program must include employee training designed to prevent and reduce stormwater pollution from activities such as park and open space maintenance, fleet and building maintenance, operation of storage yards, snow disposal, new construction and land disturbances, and stormwater system maintenance procedures for proper disposal of street cleaning debris and catch basin material; it must address ways that flood management projects impact water quality, NPS pollution control, and aquatic habitat; and

   c. define appropriate BMPs for this minimum control measure and measurable goals for each BMP. These measurable goals must ensure the reduction of all of the pollutants of concern in your stormwater discharges to the maximum extent practicable.

2.2 Point Sources—WWTPs

The WWTPs already have individual NPDES permits for their discharges. The DO TMDL should be implemented as described in Section 3.2 below. For the chloride TMDL, the available data indicate that point sources are not a significant contribution to the chloride exceedances. The TMDL can be implemented as a lumped value. As long as point sources collectively meet the lumped WLA, they will be considered with the TMDL. This will allow greater flexibility which is appropriate given that there is limited point source data, and the concentration used to calculate the TMDL is lower than the standard.

2.3 Non-point Sources

Section 319 of the Clean Water Act (CWA) authorizes states to address NPS pollution through the development of assessment reports and the adoption and implementation of NPS management programs. USEPA awards grants to states to assist in implementing these programs. Section 319 programs are largely voluntary, and promote practices on a watershed scale. IEPA is the designated state agency in Illinois for the 319 program. IEPA provides technical assistance, and informational and educational programs and funding to various units of local government and other organizations to implement projects that utilize cost-effective BMPs (source: IEPA. *Illinois EPA and Section 319*. IEPA/BOW/98-010. August 1998).

Previous Section 319 grants for watershed improvements in the East Branch DuPage River watershed have included stream stabilization, wetland restoration, and structural water quality BMP projects such as grass swales, stormwater wetland basins, or porous pavement. Additional wetland restoration and structural water quality BMP projects may provide a benefit related to DO concentration levels in the East Branch DuPage River. These particular projects are not likely to have an impact on chloride concentration levels. Other types of projects, however, could be funded through the 319 program that would help implement the chloride TMDL. These include the general BMPs identified above that are already not being utilized in the watershed. A total of $20 million in Section 319 grant money has been awarded state-wide since 1990 to fund a total of 132 watershed improvement projects (source: IEPA. *Illinois EPA and Section 319*. IEPA/BOW/98-010. August 1998).

2.4 Reasonable Assurance

For watersheds that have a combination of point sources and NPS, where reduction goals can only be achieved by including some NPS reduction, the TMDL must incorporate reasonable assurances that implemented NPS reductions will be effective in achieving the load allocation (source: USEPA. *Guidance for Water Quality-Based Decisions: The TMDL Process*. EPA 440/4-91-001. April 1991).

The East Branch DuPage River watershed is primarily urban, with only a very small percentage of agricultural land use (approximately 3 percent). As the chloride TMDL largely focuses on the use of road salt for deicing, agricultural activities are not relevant to this TMDL. In addition, there are no load allocations for $CBOD_5$ or ammonia applicable to NPS for the DO TMDL. In order to meet the DO TMDL, reductions in SOD will be needed. To meet SOD reductions, organic loading from stormwater discharges and CSOs will need to be reduced. One measure of organic loading is VSS. VSS monitoring should take place to determine if organic loading is decreasing in the watershed. VSS monitoring coupled with instream DO monitoring will ensure that water quality targets are being met.

As such, point source controls will be utilized to achieve the TMDL reduction goals. Specifically, reductions from the WWTPs will be accomplished through the incorporation of wasteload allocations into individual NPDES permits. Stormwater control for MS4s will be accomplished through the NPDES Phase II general permit. These point source controls are described above.

Thus, the incorporation of reasonable assurance of NPS control is not applicable to the TMDLs for East Branch DuPage River. The assurance of achievement of TMDL goals will be provided by point source permit programs.

3 Specific Implementation Considerations for East Branch DuPage River Chloride and DO TMDLs

3.1 Chloride TMDL

The allocation scenario for chloride assumes that the WQS is met at all times and that a reduction in overall annual road salt application mass would be used to achieve that end. This is a conservative approach, because a reduction in an overall annual load may not be feasible or necessary to meet the designated uses. Thus, as described below, this approach should be further evaluated from within the context of an adaptive or iterative implementation plan.

3.1.1 General BMPs for Road Deicing

The following BMPs are generally considered for road deicing activities (source: FHWA *Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring*. FHWQ-EP-00-002. May 2000).

- Optimization of use:

  Storage:

  - Salt storage piles need to be completely covered (i.e., use of salt domes)
  - Storage and handling operations should be performed on impervious surfaces
  - Stormwater runoff from areas where salt is stored should be contained in a suitable area

  Application:

  - Use of calibrated spreaders; trucks can be equipped with ground speed sensors that can accurately control the rate of spreading
  - Training programs for drivers and handlers should be implemented to improve the efficiency of application and to reduce losses
  - Snow plow operators need to avoid piling snow on or near frozen ponds, lakes, streams, or wetlands

- Other:

  - Identify ecosystems that are sensitive to salts
  - Use of alternatives such as calcium chloride and calcium magnesium acetate may be less environmentally harmful to sensitive ecosystems; these alternatives are more expensive than regular salt, but they are less corrosive to bridges and overpasses (see Tables 1 and 2 for information on these alternatives)
  - In some instances, sand may be used in place of salt to improve traction, but such use may not be appropriate where sedimentation presents adverse environmental impacts

3.1.2 Specific Road Salting BMPs–East Branch DuPage River Watershed

Local communities, IDOT, and the Illinois Tollway Authority are the primary parties responsible for the removal of snow and the application of road salt within the East Branch DuPage River watershed. While specific practices may vary from community to community, the following typical general description is applicable. This information is based on responses given during telephone interviews of officials from several of the communities located in the watershed, IDOT, and the Illinois Tollway Authority.

TABLE 1
Alternative Road Deicers—Temperature, Cost, and Environmental Considerations

Check the Label For	Works Down to:	Cost is:	Environmental Impacts
Calcium Magnesium Acetate (CMA)	22°F to 25°F	20× more than rock salt	(+) Less toxic
Calcium Chloride (CaCl)	-25°F	3× more than rock salt	(+) Can use lower doses (+) No cyanide (-) Chloride impact
Urea	20°F to 25°F	5× more than rock salt	(+) Less corrosion (-) Adds needless nutrients
Sand	No melting effect	~$3 for a 50 lb bag	(-) Accumulates in streets and streams
Sodium Chloride (NaCl; rock salt)	15°F	~$5 for a 50 lb bag	(-) Contains cyanide (-) Chloride impact

Source: Envirocast Newsletter. Volume 1, No. 3. http://www.stormcenter.com/envirocast/2003-01-01. January 2003.

TABLE 2
Alternative Road Deicers—Temperature and Cost Considerations

Deicer	Minimum Operating Temperature	Cost ($/lane mile/season)
Sodium chloride	12°F	$6,371-6,909
Calcium chloride	-20°F	$6,977-7,529
CG-90 Surface Saver	1°F	$5,931-6,148
Calcium Magnesium Acetate	23°F	$12,958-16,319

Source: Center for Watershed Protection. *Stormwater BMP Design Supplement for Cold Climates*. Prepared for USEPA. December 1997.

IDOT is responsible for the maintenance of state highways and roads, including snow removal and road salt application operations. These roadways typically have an U. S. or Illinois state highway route number assigned to them. While IDOT has agreements with some municipalities in the state under which the local municipality conducts the maintenance operations in place of IDOT, these agreements are rare in DuPage County.

The Illinois Tollway Authority is responsible for the maintenance of tollways, including snow removal and road salt application operations. The I-88 and I-355 Tollways are located within the East Branch DuPage River watershed. The Tollway Authority typically dispatches snow removal and road salt application crews during or immediately after a snow event. Snow that is cleared is deposited in the Tollway right-of-way off the shoulder of the road or within the Tollway median. The Tollway Authority uses digitally-calibrated spreader trucks at an application rate of either 200, 300, or 500 lb/road-mile for its salting operations. The application rate used depends on several factors, including the severity of the storm and present road conditions. The spreader trucks are automated to spread salt at the selected rate regardless of vehicle speed. Operators are required to participate in a yearly training program.

DuPage County and local communities and townships located within the watershed are responsible for maintaining all county roadways and local streets, including local collector and arterial streets. Municipal Public Works Departments typically dispatch snow removal and road salt application crews during or immediately after a snow event. In most cases, snow that is cleared is deposited on the side of the road. In certain locations, such as downtown areas, the snow that is cleared may be hauled away and stored at a central location. With the possible exception of snow storage sites located upstream of a local stormwater detention basin, such sites typically do not have erosion and sediment control practices or structural or non-structural water quality BMPs in place. Most communities are in the process of phasing in new salt spreader trucks which tend to have automated salt spreader controls that are connected to the vehicle's speedometer and which automatically apply salt at a proscribed rate regardless of vehicle speed. Newer salt spreader trucks are digitally calibrated and do not need to be calibrated yearly, as is generally required for older salt spreader trucks. Those communities which use older salt spreader trucks typically instruct drivers to stop spreading salt when the truck is stationary at a stoplight or in traffic. Training procedures vary by municipality, but all drivers are trained upon hiring, and most communities have some type of annual meeting or annual training requirements.

The following agencies or communities within the East Branch DuPage River watershed were contacted to provide information about their snow removal and salt application activities: DuPage County, Illinois Tollway Authority, Illinois Department of Transportation, Addison, and Milton Township. Information on whether the agency/community has a written snow plan, conducts yearly training, and/or owns digitally-calibrated salt spreading equipment is presented below.

TABLE 3
Summary of Snow Removal and Salt Application Information Collected from Selected Agencies and Municipalities

Agency/Community	Written Plan	Yearly Training	Digital Spreaders
IDOT	Yes	No	"Vast Majority"
Tollway	Yes	Yes	Yes
DuPage County	No	No	8 of 40
Addison	Yes	Yes	No
Milton Township	No	No	No

The following is a list of municipal and government entities which are likely to conduct snow removal and salt application operations within the East Branch DuPage River watershed:

Addison
Bloomingdale
Bolingbrook
Carol Stream
Darien
Downers Grove
Glen Ellyn
Glendale Heights
Lisle
Lombard
Naperville
Oak Brook
Villa Park
Warrenville
Westmont

Wheaton
Woodridge
Addison Township
Bloomingdale Township
Downers Grove Township
DuPage Township
Lisle Township
Milton Township
York Township
Cook County
DuPage County
Illinois Department of Transportation
Illinois Tollway Authority

3.1.3 Recommended Management Actions and Institutional Arrangements

It is recognized that road deicing is necessary for public safety. Thus, the implementation of the chloride TMDL by MS4s should be based on prudent and practicable road salting BMPs to the extent that the safety of the public is not compromised.

Section III C. of IEPA General Permit No. ILR40, *General NPDES Permit for Discharges from Small Municipal Separate Storm Sewer Systems,* identifies the specific actions and schedule that each permittee will be required to follow to comply with TMDLs. If it is determined that a permittee will need to implement additional BMPs beyond those already in place, then the general road salting BMPs identified should be evaluated for their applicability and effectiveness as a part of that permittee's plan to comply with TMDLs.

The General Permit requires each permittee to notify IEPA if it does not currently meet the WLA for a TMDL. For the chloride TMDL, separate WLAs were not identified according to each individual jurisdiction that conducts road deicing activities. Instead, a single allocation was made for a category of discharges, namely deicing-related discharges. Thus, permittees should have the option of either: 1) demonstrating to IEPA that their activities do not cause or contribute to chloride exceedances, 2) using prudent and practicable BMPs already in place, or 3) proceeding to implement the remaining TMDL provisions of the General Permit.

3.1.4 Cost Considerations

It is anticipated that many of the general BMPs identified above for road salting, if not already in place, can be implemented over time by the appropriate jurisdictions. For example, the controlled application of salt is a reasonable and prudent step that is commonly used to avoid over-salting. However, the use of alternative deicing agents will have to be carefully considered by each permittee in relation to cost, applicability, practicability, and public safety. As shown above, costs for alternatives to sodium chloride-based rock salt are substantially higher, and these alternatives cannot be used in all conditions or locations. In addition, each of the alternatives poses its own adverse water quality impacts which must be taken into consideration.

3.2 DO TMDL

3.2.1 Specific Treatment Technologies–East Branch DuPage River Watershed

The WWTPs in the East Branch DuPage River watershed have existing individual NPDES permits that contain limitations requiring at least secondary treatment (i.e., monthly $CBOD_5$ limits in the 10 to 20 mg/L range; and monthly ammonia limits of 1.5 mg/L, requiring nitrification). The 1995 model calibration data set and summer DMR data from 1995 through 2000 show that these WWTPs generally discharge $CBOD_5$ and ammonia concentrations that are well below these permitted limits (Table 4 summarizes the DMR data).

TABLE 4
Summary of Average Effluent Concentrations for East Branch DuPage River WWTPs, 1995-2000

NPDES#	Facility	Parameter	DMR Maximum, mg/L	DMR Average, mg/L	Average Monthly Limit mg/L
IL0022471	Glenbard WW Auth-Lombard	Nitrogen, ammonia total (as n)	4.70	0.61	1.5
IL0022471	Glenbard WW Auth-Lombard	Bod, carbonaceous 05 day, 20c	13.00	2.43	20
IL0032735	Citizens Utility Company #2 STP	Nitrogen, ammonia total (as n)	4.50	0.96	1.50
IL0032735	Citizens Utility Company #2 STP	Bod, carbonaceous 05 day, 20c	6.60	3.64	20.00
IL0032735	Citizens Utility Company #2 STP	Bod, 05 day, 20c	17.20	9.60	30.00
IL0031844	DuPage County Woodridge STP	Nitrogen, ammonia total (as n)	14.70	0.73	1.50
IL0031844	DuPage County Woodridge STP	Bod, carbonaceous 05 day, 20c	13.80	1.82	10.00
IL0032689	Bolingbrook STP #1	Nitrogen, ammonia total (as n)	1.30	0.10	1.50
IL0032689	Bolingbrook STP #1	Bod, carbonaceous 05 day, 20c	4.00	1.68	20.00
IL0028380	Downers Grove SD WTC	Nitrogen, ammonia total (as n)	2.10	0.51	1.50
IL0028380	Downers Grove SD WTC	Bod, carbonaceous 05 day, 20c	7.40	1.42	10.00
IL0028967	Glendale Heights STP	Nitrogen, ammonia total (as n)	10.40	0.34	1.50
IL0028967	Glendale Heights STP	Bod, carbonaceous 05 day, 20c	20.00	3.58	10.00
IL0021547	Glenbard WW Auth-Glenbard	Nitrogen, ammonia total (as n)	10.40	0.34	1.50
IL0021547	Glenbard WW Auth-Glenbard	Bod, carbonaceous 05 day, 20c	20.00	3.58	10.00
IL0021130	Bloomingdale-Reeves WRF	Nitrogen, ammonia total (as n)	2.65	0.35	1.50
IL0021130	Bloomingdale-Reeves WRF	Bod, carbonaceous 05 day, 20c	22.00	4.74	10.00

3.2.2 Recommended Actions and Institutional Arrangements

The following allocation scenarios have been developed for the TMDL:

- Reduce average monthly WWTP permit limits for the summer season to 8 mg/L $CBOD_5$ and 1 mg/L ammonia, or
- Retain existing permit limits but remove the dam in Reach 3, or
- Retain existing permit limits but increase DO in the impoundment in Reach 3 through artificial reaeration.

For each of these scenarios, organic loading from stormwater discharges and CSOs must also be reduced in order to reduce the SOD.

DMR data for the WWTPs (Table 4) show that average summer values for $CBOD_5$ and ammonia are below the proposed limits for the allocation scenario using reduced monthly limits in summer. Thus, it may be possible that these WLAs can be met with little or no additional treatment. Additional review of the design and compliance implications should be further discussed with the permittees, including how future growth might be addressed without exceeding the overall

WLA mass restriction. Institutionally, if this allocation scenario is implemented, the limits in the permits would need to be changed to be consistent with the TMDL WLAs.

A reduction in organic loading through stormwater management would be expected to occur over time in relation to the implementation of Phase II of the stormwater program. Evaluation of the long-term reduction of organic loading can be accomplished by implementing VSS monitoring instream. VSS is a measure of organic loading. The VSS monitoring should be coupled with periodic DO monitoring in East Branch DuPage River and, if resources allow, periodic measurement of the SOD at appropriate locations.

A variety of technical methods can be considered to increase the DO in the outflow from Churchill Woods Lake. These could include in-lake aeration or aeration of the outflow. Institutionally, this would involve action taken by the DuPage County Forest Preserve District. Funding for the aeration or dam removal may be possible, at least in part, via the 319 non-point source control program discussed above.

3.2.3 Cost Considerations

As noted above, the existing effluent quality may already meet the first allocation scenario. If additional treatment is required, it would likely be needed to meet the $CBOD_5$ limits, and it would likely be accomplished through effluent filtration. Effluent filtration costs can vary considerably according to specific site considerations. A capital cost of about $0.30 per gallon of wastewater treated is a fairly typical cost for municipal effluent filtration (compared to $1.50 to $2.50 per gallon treated for secondary treatment).

Several options are available for artificial reaeration of the Churchill Woods Lake. Otterbine Barebo manufactures four different underwater air diffuser systems. Based on a preliminary evaluation, the Sub-Triton Mixer or Aspirator may be appropriate aerators for the lake. Each unit requires power, and consists of a compressor motor unit located outside the lake, a diffuser/mixer manifold located underwater, and a hose from the compressor to the manifold. Costs to bring a supply of power to the system can vary, and cannot be determined at this time without information regarding power supplies in the area. It is expected that power can be brought to the lake without difficulty because a residential area is located less than one-quarter mile away. A one horsepower compressor costs $3,400. Each diffuser system costs between $13,000 and $14,000. An analysis of the lake would need to be performed to determine how many diffuser systems are required, but it is expected that this number would be between 2 and 5. The cost of the hose is $2.50 per foot, and the total cost of the hose would be $2500 if 1000 feet of hose were required. Based on this information, it is expected that the total cost of the reaeration would be approximately $50,000, but could vary depending on the cost of supplying power and the number of diffuser systems needed.

Costs to implement the dam removal option cannot be estimated at this time due to the highly variable site-specific factors.

4 Adaptive Management

4.1 Chloride TMDL

The chloride criteria exceedances for the East Branch DuPage River, both monitored and modeled, are infrequent (less than 10 percent of the time). For example, USEPA guidance recommends that water bodies should only be considered impaired if exceedances occur more than a given percent of time, depending on such factors as pollutant type and data distribution (see USEPA July 2002 Consolidated Assessment and Listing Methodology guidance). For acute and chronic chemical criteria for conventional pollutants, the USEPA guidance identifies a greater than 10 percent exceedance threshold for non-attainment of standards and 305(b) and 303(d) listings. In addition, it may be possible to identify which specific hydrologic and salt application conditions lead to elevated instream chloride concentrations through further discussion with permittees, or through additional monitoring and/or modeling activities. It may be possible to target control actions specific to these conditions. If successful, it would not be necessary to achieve an overall annual salt application reduction of the magnitude indicated in the TMDL.

4.2 DO TMDL

For the first allocation scenario above, point source WWTP discharges may not be required to reduce existing $CBOD_5$ and ammonia loads to meet the WLAs for these pollutants based on observed effluent loads, but such discharges would have to comply with allocations below existing permitted loads. This is because the observed effluent loads from point sources based on a 1997 USGS sampling of these discharges for their model calibration dataset and DMR data from 1995 through 2000 are generally below current permitted monthly limitations. In addition, this TMDL did not evaluate different allocation scenarios that may be worth considering. For example, an allocation scenario other than equal effluent quality for all facilities may be appropriate and would be consistent with this TMDL as long as the overall target is met and DO standards are protected in East Branch DuPage River. Artificial reaeration of the lake located upstream of Crescent Boulevard in the Churchill Woods Forest Preserve near Glen Ellyn should be pursued in order to raise the DO concentration at that point in the river to at least 7 mg/l. In addition, reduction of VSS from stormwater sources will occur over time in relation to implementation of the Phase II and WWTP NPDES permits. However, the improvement in DO due to reduction of SOD that derives from this will take an uncertain amount of time and its effectiveness will initially be unknown.

4.3 Recommended Elements of Adaptive TMDL Implementation

The following discussion summarizes adaptive management language included in the Tualatin River TMDL, as approved by USEPA (source: Oregon DEQ. August 2001).

As a goal of the CWA and associated administrative rules for Illinois, water quality standards shall be met or all feasible steps should be taken toward achieving the highest quality water attainable. This is a long-term goal in many watersheds. The TMDLs developed for the East Branch DuPage River watershed are based on mathematical models and other analytical methods that are designed to simulate complicated physical, chemical, and biological processes. They are, to a certain extent, simplifications of the actual processes, and thus do not produce an exact prediction of a particular system response to pollutants. These uncertainties have been recognized and conservative assumptions have been used to address them, as acknowledged in the margin of safety considerations. Subject to available resources, IEPA should review, and, if necessary, modify the TMDLs if IEPA determines that new scientific information is available which indicates that significant changes are warranted.

This watershed plan is designed to reduce pollutant loads to meet TMDL targets. However, it should be recognized that it may take an extended period of time before management practices become fully effective in reducing and controlling certain pollutants (i.e., organic load reductions manifesting in lower SODs). In addition, technology for controlling some pollutant sources, such as NPS and stormwater, are in the early stages of development, and it will take one or more iterations to develop effective techniques. Finally, it is possible that after application of all reasonable BMPs, some of these TMDLs cannot be achieved as originally established.

When developing WQBELs for NPDES permits, IEPA should ensure that the limits are consistent with the assumptions of the WLA (40 CFR 122.44(d)(1)(vii)(B)) and work with stormwater permittees in developing management plans that are consistent with the TMDLs.

IEPA should regularly review progress towards achievement of the TMDLs. If and when IEPA determines that the plan has been fully implemented, that all feasible practices have reached maximum effectiveness, and that a TMDL or its target have not been achieved, the TMDL should be reopened, and the targets and associated water quality standards adjusted as necessary. The determination that all feasible steps have been taken should be based on site-specific balancing of: 1) the protection of designated uses, 2) appropriateness to local conditions, 3) the use of best treatment technologies or BMPs, and 4) the cost of compliance.