

Monitoring and Implementation in the Fox River Basin

Cindy Skrukrud

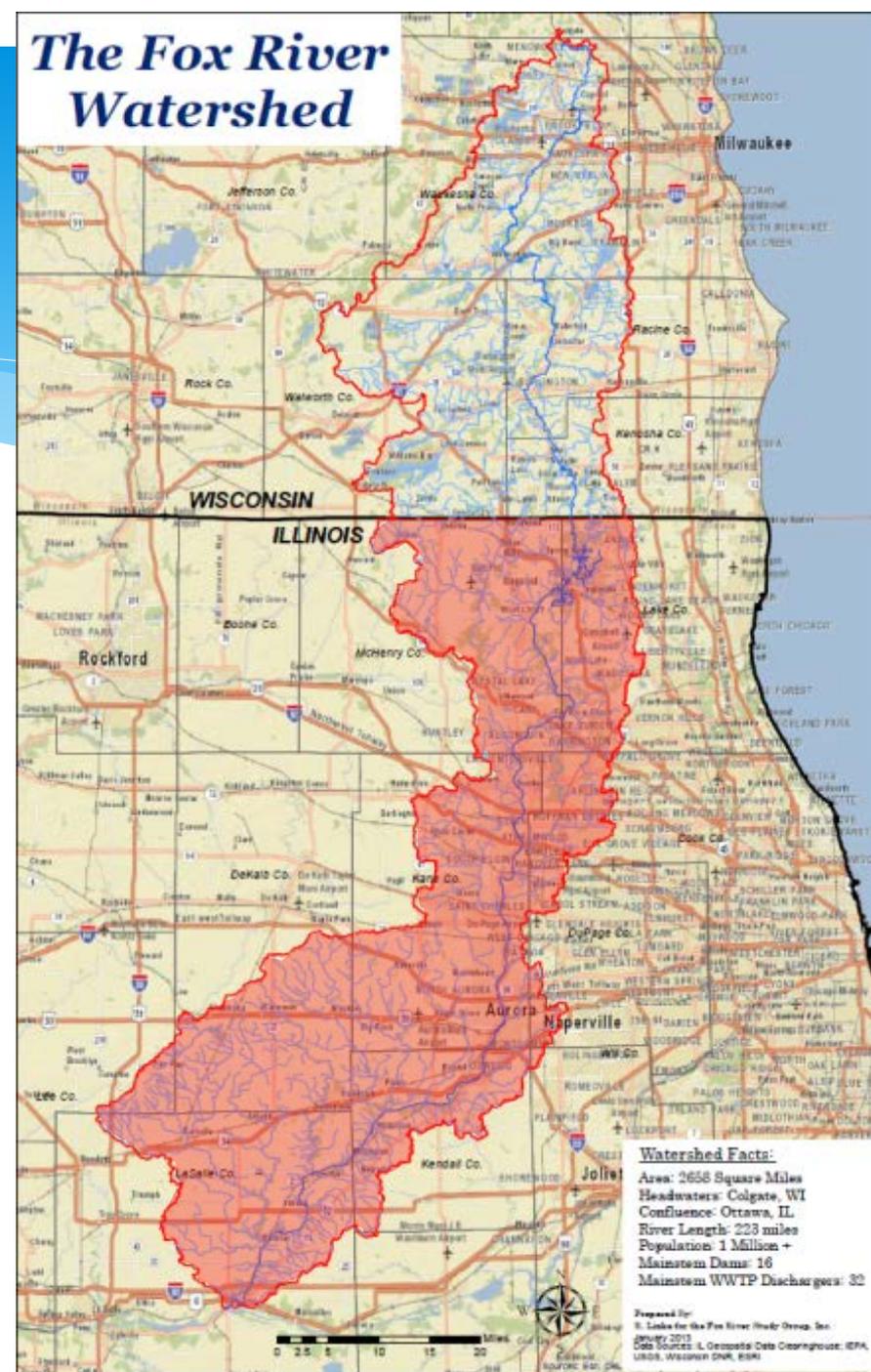
Clean Water Program Director
Sierra Club, Illinois Chapter

Chair, Fox River Study Group

Fox River Watershed

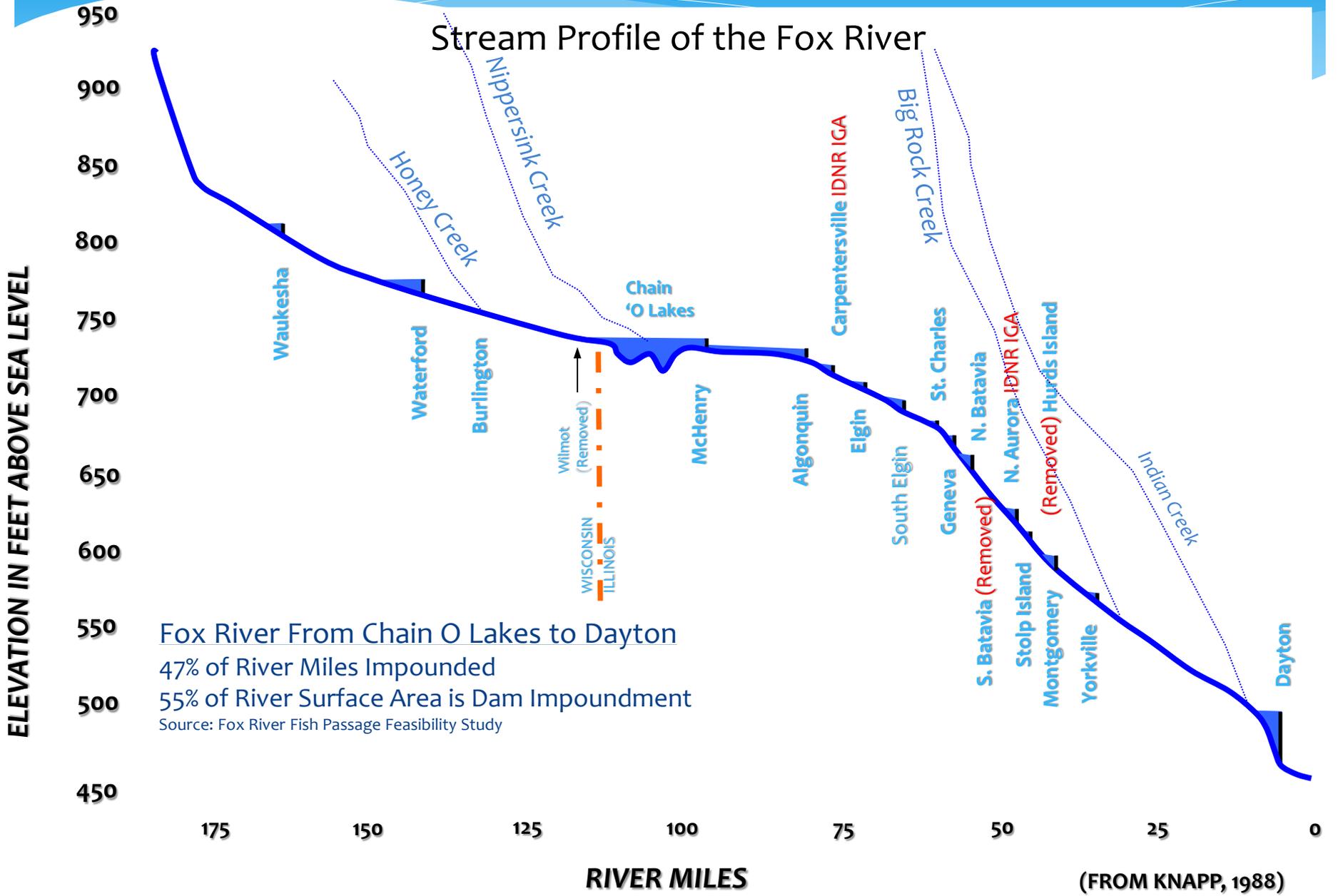
- 2658 Sq. miles
 - 938 Sq. miles WI
 - 1720 Sq. miles in IL
- 223 miles long
- Population > 1 Million
- 16 Dams
- 32 WWTPs on river

The Fox River Watershed



FOX RIVER PROFILE

Stream Profile of the Fox River



Fox River From Chain O Lakes to Dayton
 47% of River Miles Impounded
 55% of River Surface Area is Dam Impoundment
 Source: Fox River Fish Passage Feasibility Study

Illinois EPA 2012 Report to Congress

Mainstem of Fox River in Illinois suffers from nutrient-caused impairments

- ◆ Algae is over-fed by nutrients
- ◆ Algal blooms suck oxygen out of water
- ◆ Low oxygen harmful to aquatic life
- ◆ Algae causes taste and odor problems for drinking water

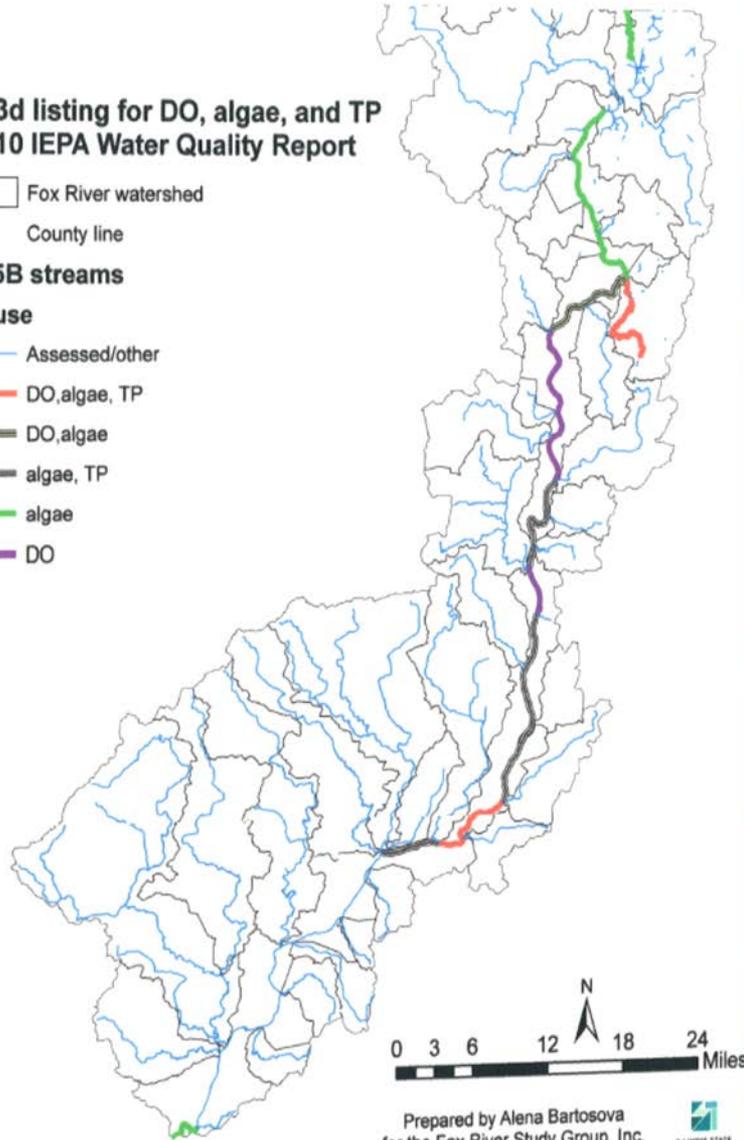
303d listing for DO, algae, and TP 2010 IEPA Water Quality Report

□ Fox River watershed
— County line

305B streams

Cause

— Assessed/other
— DO,algae, TP
— DO,algae
— algae, TP
— algae
— DO



Algae in the Fox River



Listed Impairments

- * State's 303(d) list includes multiple impairments
- * Multiple reaches are listed for DO, phosphorus and algae impairments

Reach ID and Description	Length (mi)	Listed Cause of Impairment	Downstream River Mile	Upstream River Mile
IL_DT-35 From: Grass Lake To: IL/WI state line	5.03	aquatic algae	110.1	115.1
IL_DT-23 From: about 0.52 miles downstream Stratton Dam To: Pistakee Lake	7.77	aquatic algae	97.7	105
IL_DT-22 From: Confluence with Flint Creek To: Stratton Dam	7.86	aquatic algae	98.2	97.7
IL_DT-06 From: Crystal Lake Outlet To: Flint Creek	8.06	DO, aquatic algae	84.55	92.6
IL_DT-20 From: Confluence with Jelkes Creek To: Confluence with Crystal Lake Outlet	9.95	DO	74.6	84.55
IL_DT-18 From: Confluence with Poplar Creek To: Confluence with Jelkes Creek	5.8	DO	68.8	74.6
IL_DT-09 From: Confluence with Ferson Creek To: Confluence with Poplar Creek	7.9	total phosphorus, aquatic algae	60.9	68.8
IL_DT-58 From: Confluence with Whites Creek To: Confluence with Ferson Creek	3.76	DO	59.5	63.25
IL_DT-69 From: Confluence with Mill Creek To: Confluence with Whites Creek	4.51	total phosphorus, aquatic algae	55	59.5
IL_DT-38 From: Confluence with Waubensee Creek To: Mill Creek	12.3	total phosphorus, aquatic algae	42.7	55
IL_DT-03 From: Confluence with Blackberry Creek To: Confluence with Waubensee Creek	7.1	DO, total phosphorus, aquatic algae	35.6	42.7
IL_DT-11 From: Confluence with Big Rock Creek To: Confluence with Blackberry Creek	4.6	total phosphorus, aquatic algae	31.0	35.6

Managing a Multi-Purpose Resource

- ◆ Drinking water for 300,000+ Illinoisans
 - ◆ Wastewater and stormwater conveyance
 - ◆ Recreation for inhabitants and visitors
- ◆ Habitat for aquatic and terrestrial species
 - ◆ Aesthetic value



Fox River Study Group

Incorporated as a Not For Profit in 2003

- City of Aurora
- City of Elgin
- Fox Metro Water Reclamation District
- Fox River Ecosystem Partnership
- Fox River Water Reclamation District
- Friends of the Fox River
- Kane County
- Sierra Club - Illinois Chapter
- Tri-Cities (Batavia, Geneva, St. Charles)

Mission: To bring a diverse coalition of stakeholders together to work to preserve and enhance water quality in the Fox River watershed

Scientific Tools

- Extensive monitoring of Fox River (monthly since 2002, low flows, storms)
- Computer models of watershed runoff and Fox River mainstem

www.foxriverstudygroup.org

Fox River Study Group

Home About Meetings News Our Partners FRSG News Resources

About FRSG

The Fox River Study Group (FRSG) is a diverse coalition of stakeholders working together to assess water quality in the Fox River watershed. Participants include Friends of the Fox River, Sierra Club, Fox River Water Reclamation District (Elgin), Fox Metro Water Reclamation District (Aurora), Fox River Ecosystem Partnership, Illinois Environmental Protection Agency (IEPA) and Backberry Creek Watershed Run Implementation Council as well as representatives from Agonquin, Aurora, Batavia, Crystal Lake, Elgin, Geneva, Island Lake, Kane County, Lake in the Hills, St. Charles and Yorkville.

The FRSG began meeting in the summer of 2001 to plan how to prepare for the upcoming Total Maximum Daily Load (TMDL) study of the river. A TMDL study is required by federal law because three segments of the Fox River appeared on the Illinois Environmental Protection Agency's list of impaired waters (the 1998 303(d) list). These segments, which lie between Holiday Hills and North Aurora, were listed because results from at least one water sample suggest there are water quality concerns. The most common concerns include low dissolved oxygen levels or high concentrations of fecal coliform bacteria. The 303(d) listing was updated in 2002, and now includes the entire length of the Fox River from the Wisconsin state line to the river's mouth at Ottawa with the most numerous causes listed as flow alteration, habitat alteration, low dissolved oxygen, nutrients, organic enrichment, PCBs, siltation or suspended solids.

Although the emphasis in the original meetings was on monitoring water quality, it soon became clear that the FRSG presented a unique opportunity to foster sustainable growth throughout the watershed. To guide these efforts, the FRSG reached a consensus on the following work plan.

The Work Plan

The work plan is made up of four phases. Brief descriptions of the objectives of each phase, the schedule, and estimated costs are given in the table below. Phase I work is being conducted by the Illinois State Water Survey and funded by the IEPA. Part of the Phase II effort also began in April 2002 when the FRSG water quality monitoring program started collecting samples at seven sites along the Fox River. The program, an all-volunteer effort organized by the Fox River and Fox Metro water reclamation districts, was carefully designed to satisfy rigorous data quality requirements of the IEPA. Results from this program will be combined with results from Phase I to identify times and locations where additional information is needed. These data, especially information describing how the watershed responds to storm events, will be used in Phase III to calibrate a model of the Fox River watershed.

The fourth and final phase of the work plan is to implement and maintain the watershed model as a management tool. The model will be used to:

- Ensure efficient use of taxpayer and private money on watershed projects
- Assess the effect of various development options throughout the watershed
- Educate stakeholders
- Evaluate management priorities
- Identify sensitive regions within the watershed
- Develop effective continuing monitoring programs

Board of Directors

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- Neil Laska, President of the Fox River
- Caroline Jacobs, Fox River Ecosystem Partnership

For additional information about Fox River Study Group contact:

Gindy Sklarz 815-875-2588
gsklarz@foxriverstudygroup.org

Mailing Address:
Fox River Study Group, Inc.
P.O. Box 715 Orange, IL 60643

FRSG NEWS Monitoring Group

Four Phase Approach

Phase I: 2002-2003

Understand
Available
Information

Water quality (FoxDB)

GIS data

Literature review and
publication database

How to address the
issues

Phase II: 2003-2009

Develop Planning
Tools

HSPF: loads, storm
events

QUAL2K: DO regime
during low flows

Monitoring plan

Biological data (FoxDB
modified)

Phase III: 2006-2013

Integrated
Monitoring/
Refine models

Low flow monitoring
Completed 2012

Storm event monitoring
Completed 2011

Refinement of Planning
Tools

Initial evaluation of
management options
(scenarios)

Phase IV: 2013-

Implementation

**Fox River
Implementation Plan
In works**

Evaluate, propose &
promote management
actions

Additional monitoring
to investigate issues
and track progress

Volunteer Water Quality Monitoring

Methods

- * Monthly since 2002
- * IEPA-approved QA/QC program
- * Volunteer collection, transport and analysis
- * Samples analyzed by Fox Metro & Fox River WRDs & City of Elgin Water Dept.
- * **Constituents:** Temp, pH, DO, conductivity, BOD, TSS, fecal coliform, TKN, Ammonia N, Nitrate N, Organic N, chlorophyll a, est. biomass, Total P, Dissolved P, Chloride, Turbidity

Sites

- * Seven sites on Fox River-
Johnsburg to Yorkville
- * Sleepy Hollow Creek
- * Tyler Creek
- * Silver Creek
- * Indian Creek
- * Crystal Creek
- * Ferson Creek
- * Blackberry Creek

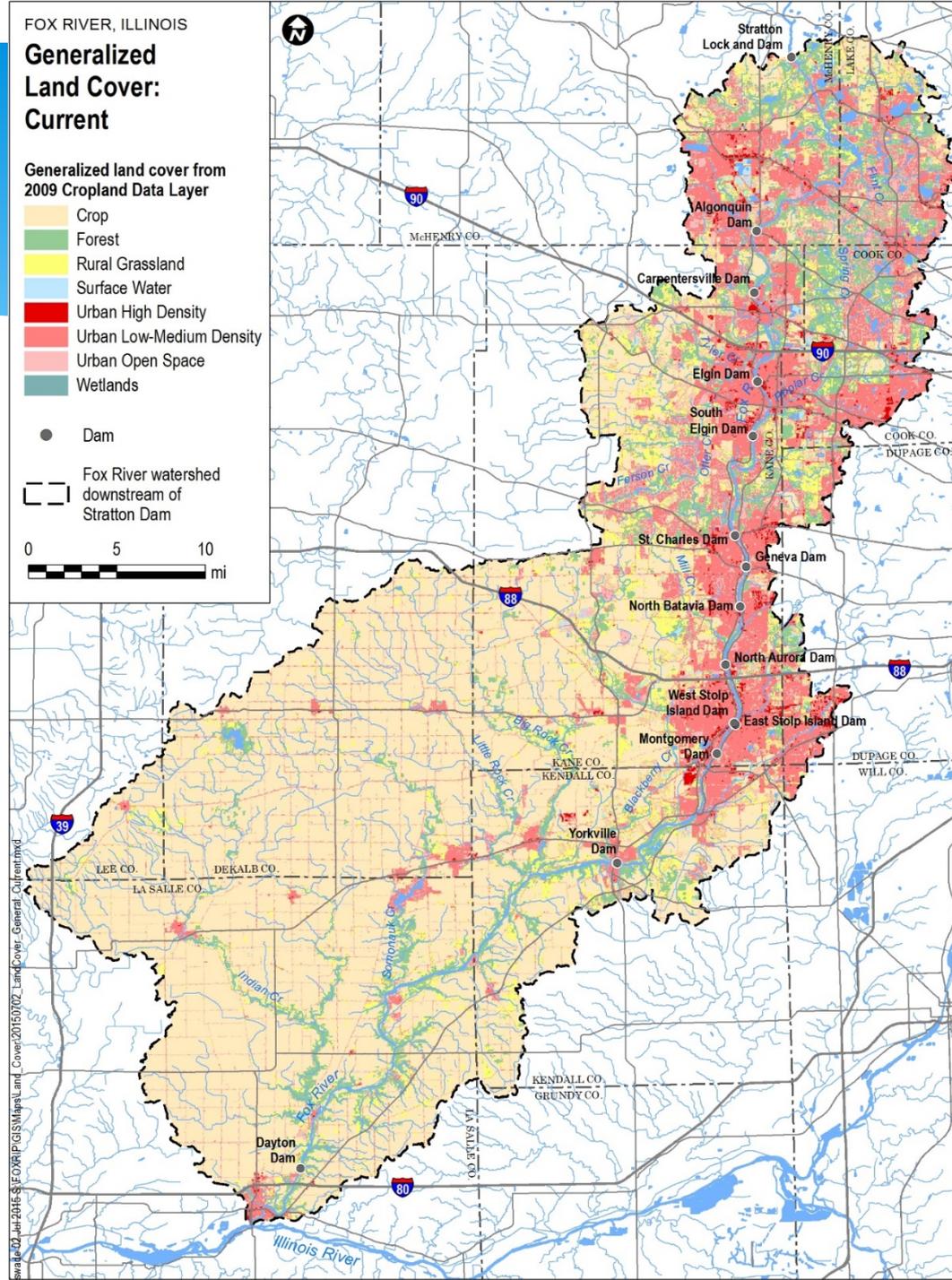
FOX RIVER, ILLINOIS

Generalized Land Cover: Current

Generalized land cover from 2009 Cropland Data Layer

- Crop
- Forest
- Rural Grassland
- Surface Water
- Urban High Density
- Urban Low-Medium Density
- Urban Open Space
- Wetlands

- Dam
- Fox River watershed downstream of Stratton Dam



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Monthly Water Quality Monitoring

Fox River Water Quality Study Sample Date: June 16, 2015

Test Parameters	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Chapel Hill	Sleepy Hollow	Silver Creek	Rawson Br.	Crystal Creek	Algonquin	Tyler Creek	South Elgin	Ferson Creek	Fabyan	Indian Creek	Mill Street	Route 47	Blackberry Cr.
TSS (mg/L)	19	NS	18	18	25	23	123	70	95	109	94	128	170	170
Fecal Coliforms (#/100mL)	70	NS	220	220	600	150	1500	1500	2700	5300	4400	3500	10000	1300
TKN (mg/L)	1.52	NS	0.64	1.44	0.93	1.5	1.99	1.66	1.5	1.79	0.91	1.85	2.2	1.45
Ammonia N (mg/L)	0.15	NS	0.03	0.15	0.07	0.17	0.13	0.14	0.07	0.12	0.05	0.12	0.12	0.04
Nitrate N (mg/L)	0.48	NS	< 0.05	0.57	0.78	0.43	6.78	1.36	1.63	1.28	0.48	1.24	1.51	1.51
Organic N (mg/L)	1.37	NS	0.61	1.29	0.86	1.33	1.86	1.52	1.43	1.67	0.86	1.73	2.08	1.41
Chlorophyll a (ug/L)	45.4	NS	< 4	38.8	29.6	52	11.4	49.6	9	39.8	11.4	35.2	39.8	16.6
Chlorophyll a corr. (ug/L)	37.4	NS	< 4	34.8	24	50.8	< 4	42.8	< 4	34.8	5.4	24	16	10.6
Estimated biomass (mg/m ³)	3,048	NS	< 300	2,604	1978	3,484	762	3,322	602	2,672	760	2,364	2,672	1116
Total P (mg/L)	0.12	NS	0.06	0.14	0.13	0.19	0.39	0.31	0.37	0.41	0.28	0.61	0.60	0.33
Dissolved P (mg/L)	0.04	NS	0.03	0.06	0.06	0.07	0.16	0.10	0.16	0.12	0.10	0.17	0.13	0.13
Chloride (mg/L)	113	NS	225	110	229	134	72.4	118	32.7	93.9	125	81.7	86.7	86.7
Turbidity (NTU)	16	NS	5.7	15	21	19	90	55	90	75	80	120	140	140

Cell Color Key: = Main Stem Sampling Point

= Tributary Sampling Point

Abbreviations: NS = No Sample

AF = Analysis Failure

TNTC = Too Numerous to Count

ND = Not Determined

CG = Confluent Growth

OUT = Outlier

FoxDB database

<http://ilrdss.sws.uiuc.edu/fox/>

Web Mapping

View GIS data and print maps for the Fox Watershed with the [Fox River Watershed GIS Data Viewer](#)

Minimum browser requirements: Internet Explorer 5+, Netscape Navigator 6+. (Opens in a separate browser window)

Fox Watershed GIS datasets

Download [GIS datasets](#) developed for the Fox River Watershed Investigation, as well as state-wide datasets of interest to Fox watershed users.

Download detailed [watershed delineation GIS data](#) developed for Fox River tributaries.

Environmental Database

Download the [FoxDB environmental database](#) (updated 7/1/2014) developed during the Fox River Watershed Investigation. The FoxDB (MS Access, 15 MB zip format) database file contains the complete water quality, sediment quality, habitat, and biological database. The structure of the relational database is described in [Phase I Report: Water Quality Issues and Data](#) (water and sediment quality data) and [Analyses of Biological Data](#) (database expanded to include biological and habitat data). The database compiles all available data from various sources and studies within the Fox River watershed (starting in 1956) and serves as a primary depository for the FRSG monitoring data (2002-present). The Access database can be used with the [Data Loader/Viewer](#) to add and view sample records. The Data Loader/Viewer is a viewing and editing tool designed to work with the water quality database. A [user's manual](#) is also available.

The Fox River Study Group has worked with the Illinois State Water Survey to compile water chemistry data for the Fox River watershed. Those data are available through this database. Interpretation of the data by other parties does not represent the opinion of the Fox River Study Group or the Illinois State Water Survey ([Data Disclaimer](#)).

NPDES Dischargers downstream the Stratton Dam

Information on NPDES discharges was obtained from the USEPA EnviroFacts Data Warehouse. Locations were checked against description and corrected to better represent the described location if necessary. A 1996 dataset on NPDES provided by the IEPA was used for additional verification. The dataset was submitted to the FRSG for comments and updates. An Excel file ([NPDESdsSTRATTON.zip](#)) has been prepared listing the identified NPDES discharge sites. The USEPA 5-digit parameter codes are listed in ([epacodelists.zip](#)).

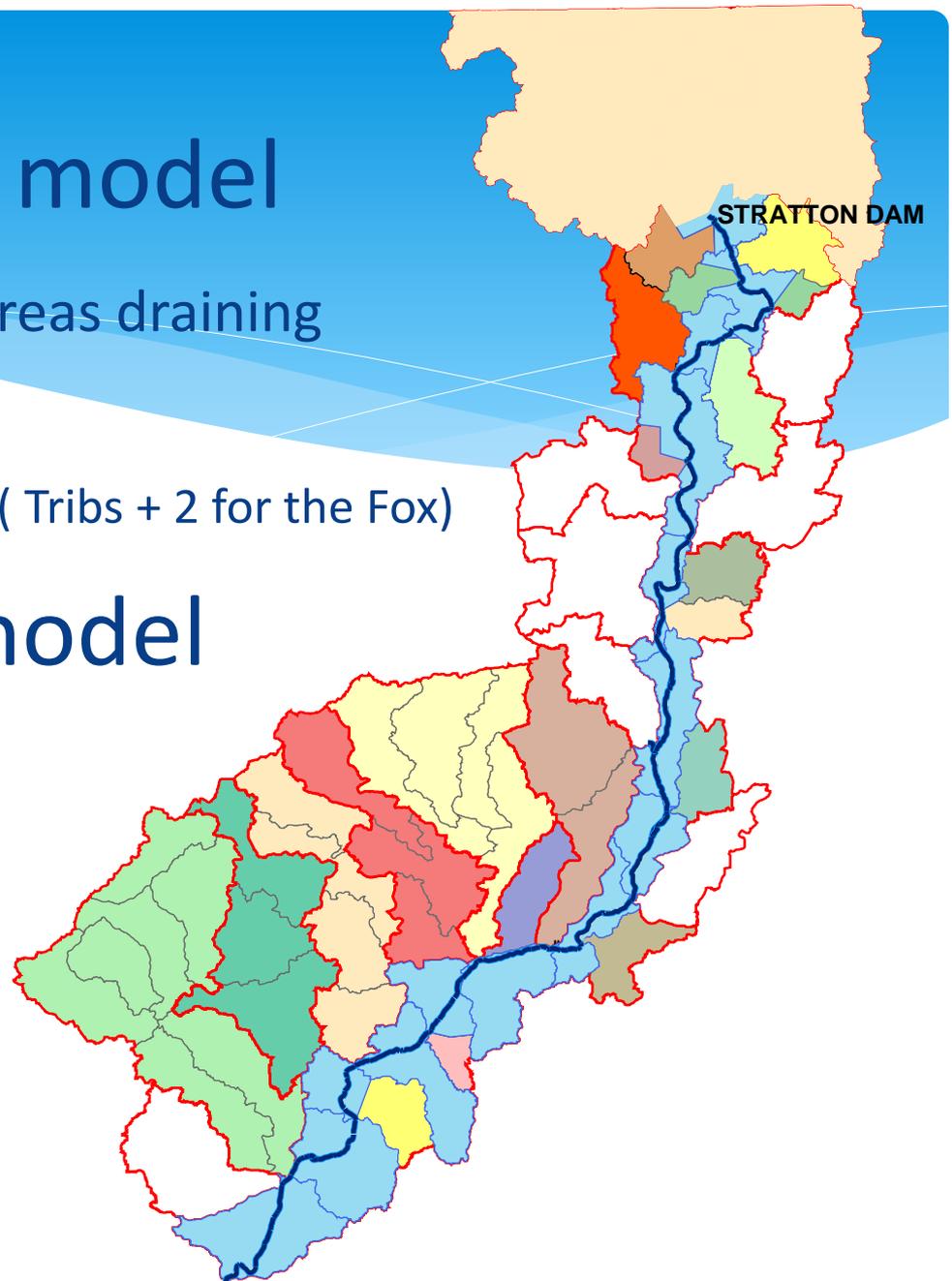
Watershed loading model

- 31 Tributaries + Areas draining directly to Fox R.
- 33 HSPF Models (Tribs + 2 for the Fox)

Receiving stream model

- QUAL2K (1 model)
- Steady State

Work performed by ISWS



Intensive Water Quality Monitoring

for model calibration

Water Years 2010 & 2011

- * Biweekly and storm events
- * 20 sites on Fox River, 8 tributaries and 3 CSOs in Elgin
- * 18 water quality parameters
- * 7 precipitation gages
- * 5 flow gages
- * Work performed by ISWS and USGS

June 2012

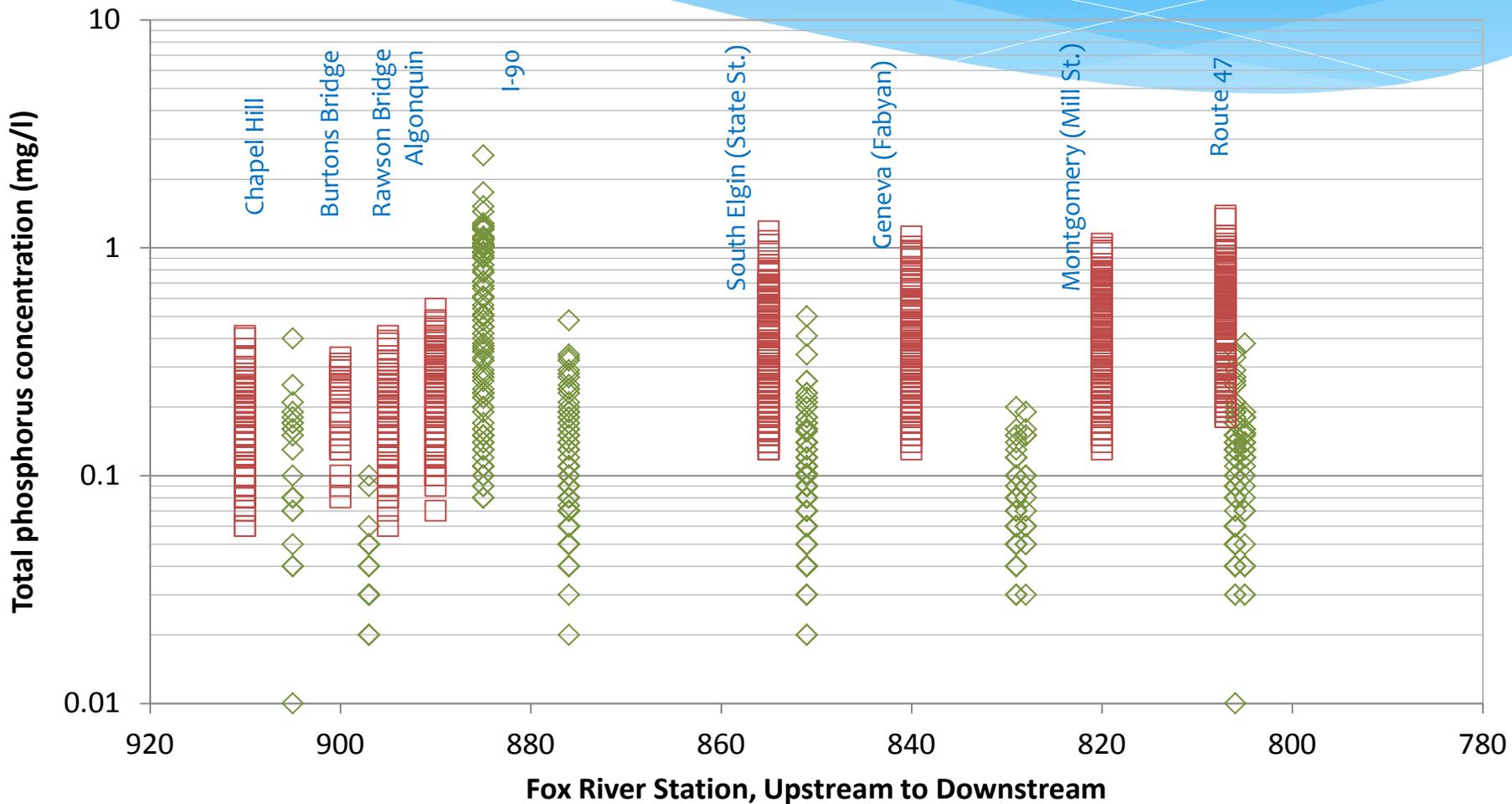
- * 3 days under low flow conditions
- * 13 sites on Fox River and 10 tributaries
- * Continuous DO, T, pH, conductivity at Fox R sites
- * Nutrient-related parameters measured at all sites
- * SOD at 3 Fox R sites
- * Benthic algae at 5 Fox R sites
- * Stage and discharge measurements
- * Work performed by ISWS, USGS and Deuchler Environmental



ILLINOIS STATE
WATER SURVEY
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TP During 2002-2013 Sampling (FRSG)

◇ Tributaries □ Mainstem

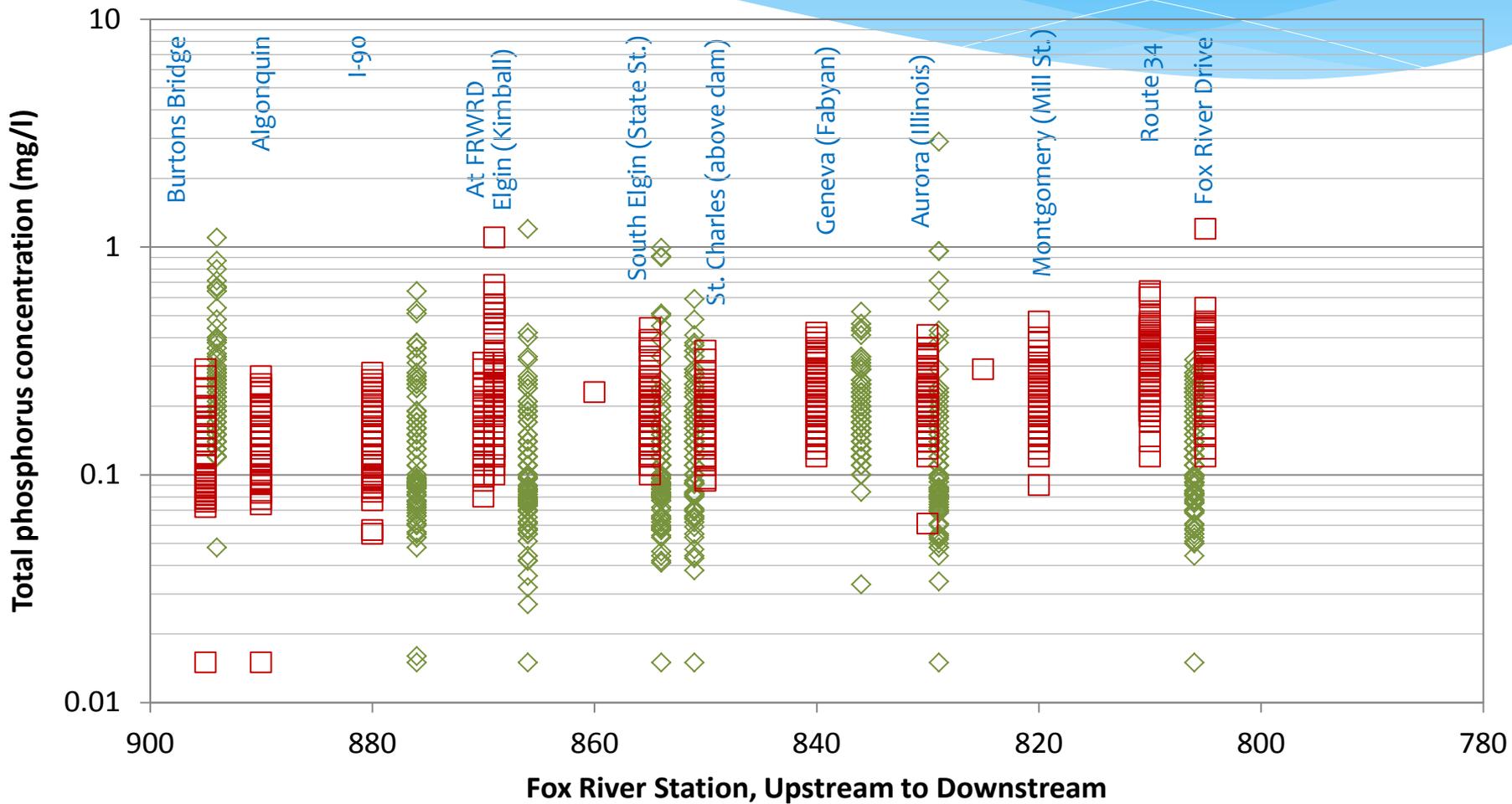




TP During 2010-2011 Sampling

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◇ Tributaries □ Mainstem

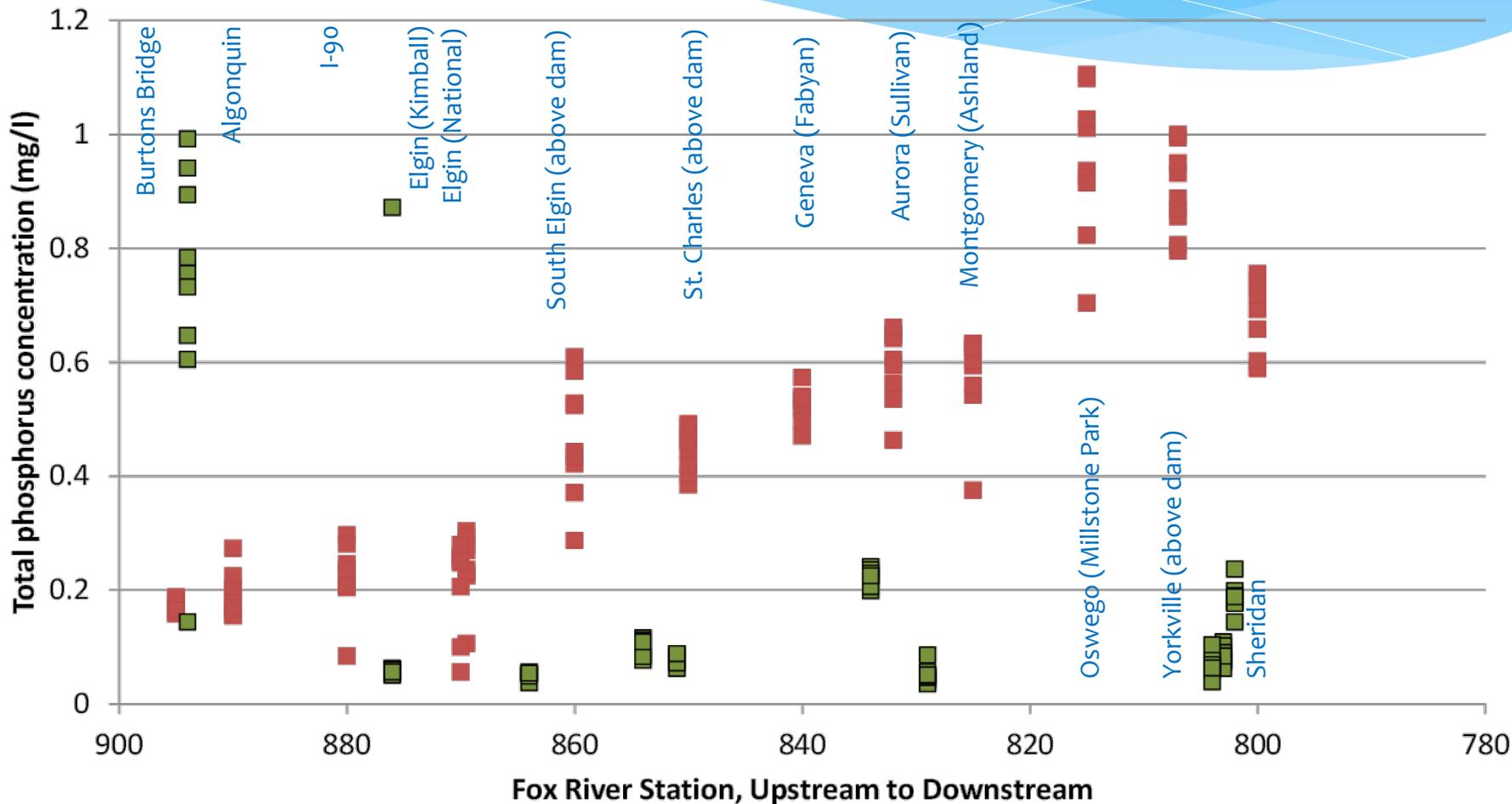




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TP During June 2012 Sampling

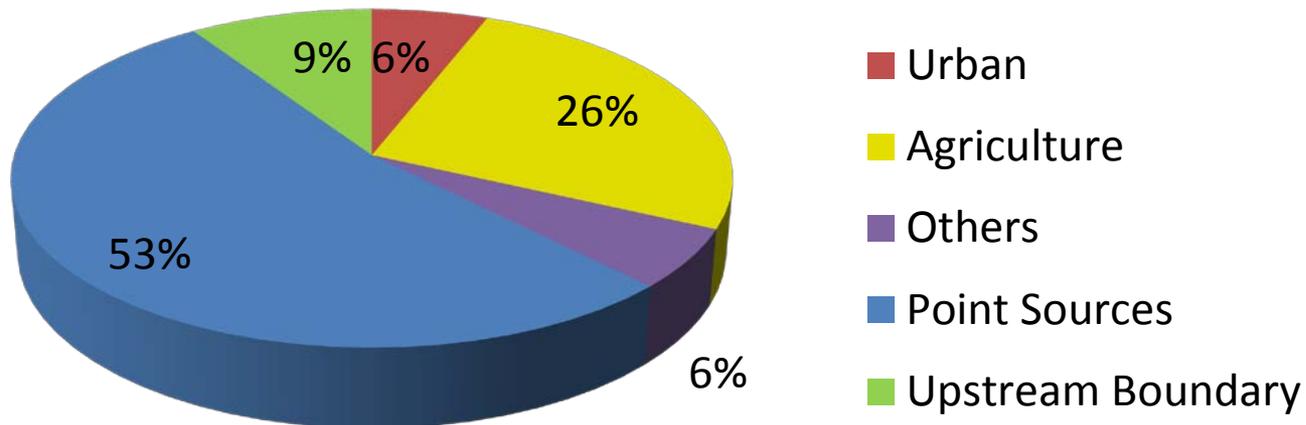
■ Mainstem ■ Tributaries





Sources of TP in Fox River watershed

Fox Total, long-term average annual TP load



Area between Stratton Dam and Fox River confluence with Illinois River
Determined from calibrated HSPF model runs for 1991-2011

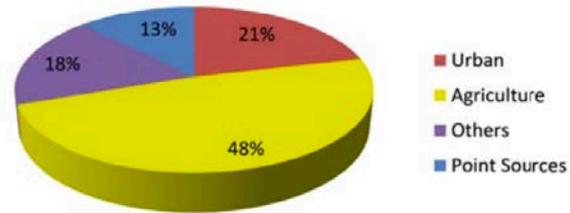


Sources of TP in Fox River watershed by tributary

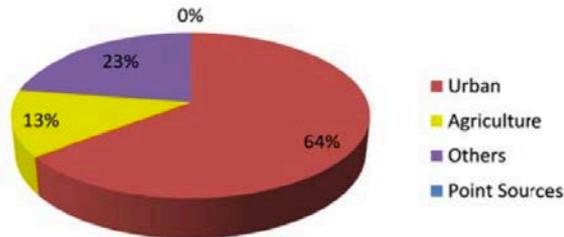
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Blackberry, long-term average annual TP load



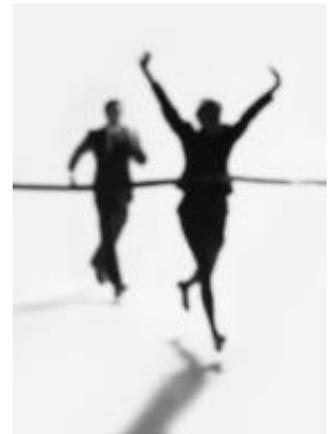
Brewster, long-term average annual TP load



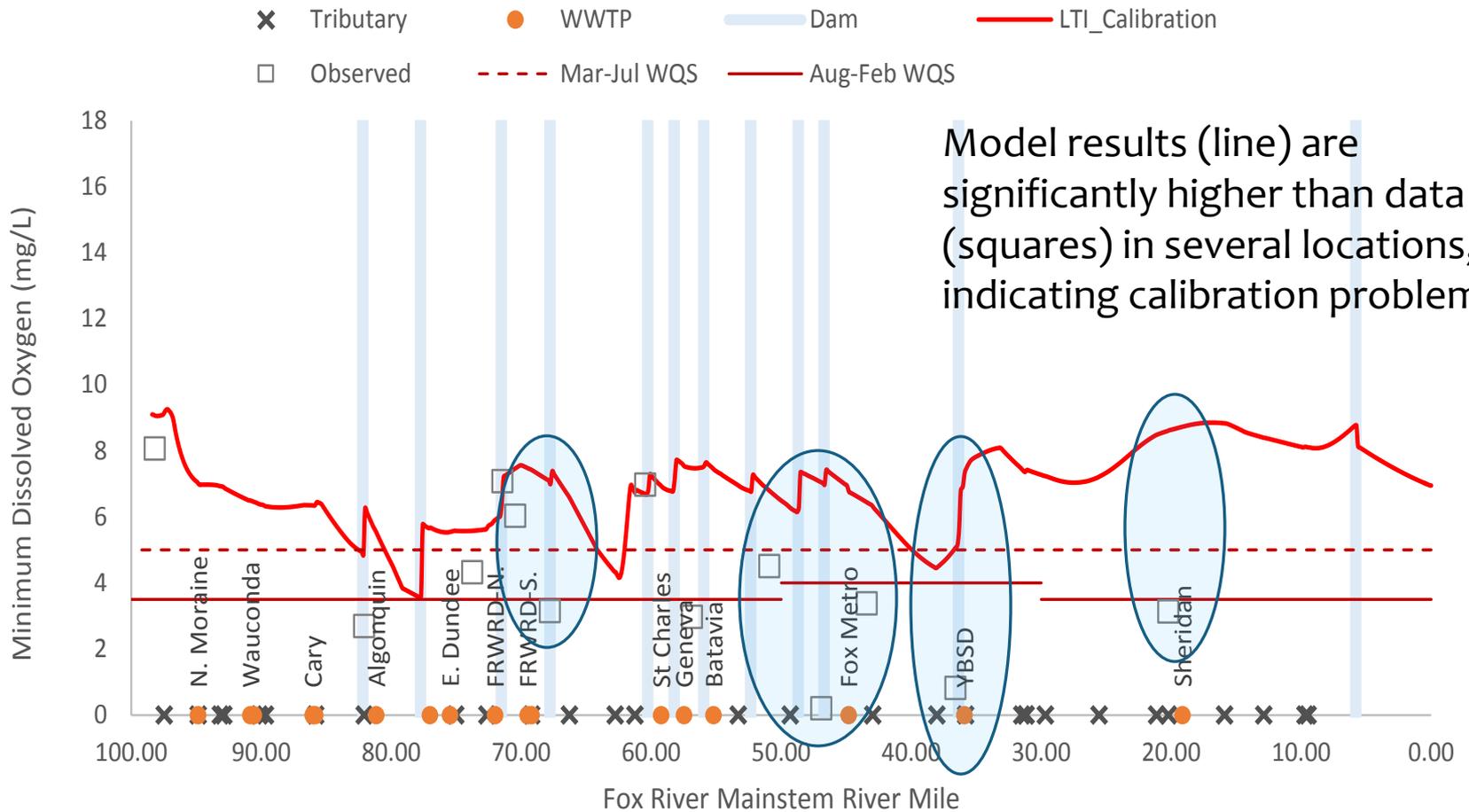
Fox River Implementation Plan

Goals

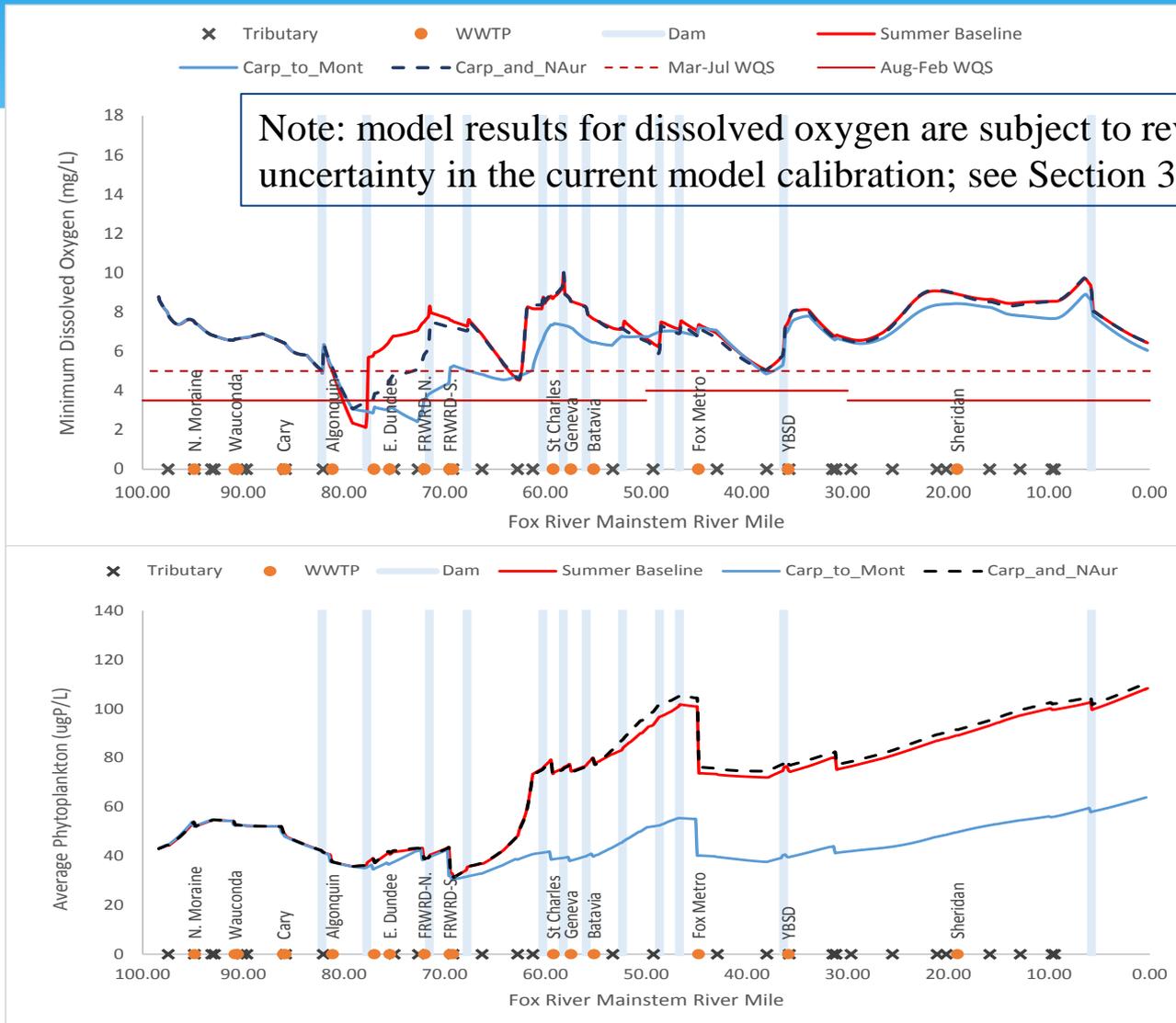
- Attain water quality for dissolved oxygen
- Reduce nuisance algae
- Replace a traditional TMDL plan
- Recommendations developed based on good science with input from local decision makers
- Report due to IEPA on Dec. 31, 2015



Model Calibration – Min. Dissolved Oxygen

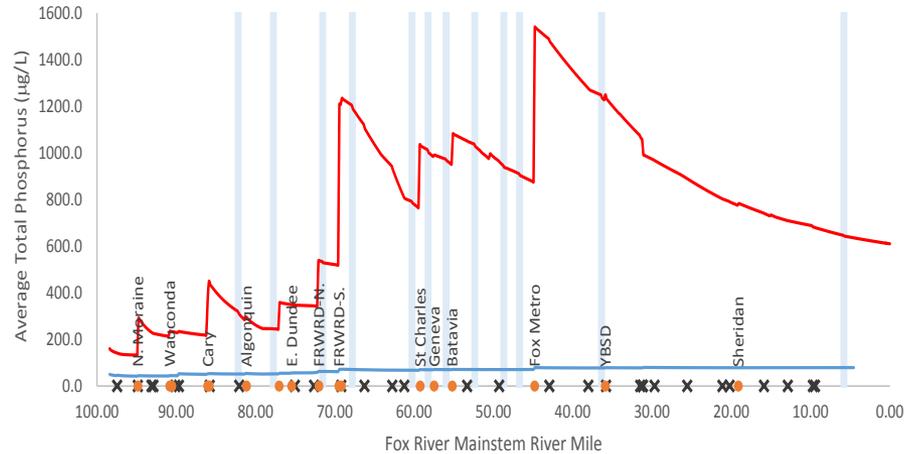


Dam Removal Scenario – Min. DO & Algae

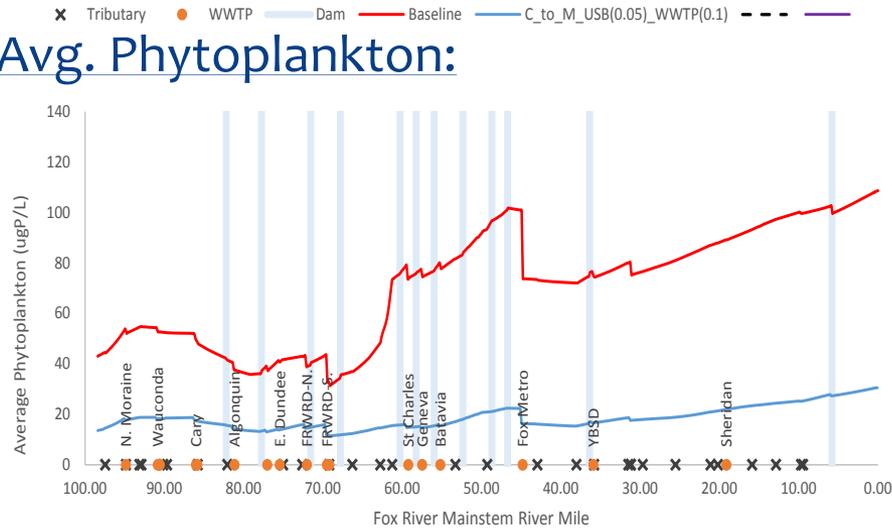


Most Aggressive Alternative

Total Phosphorus:



Avg. Phytoplankton:



Fox River Implementation Plan

Key Findings:

- * Summer low flow conditions are critical
- * Non-point sources play little role during summer low flow, but are important at other times of the year
- * Reducing phosphorus from WWTPs and upstream sources will significantly reduce the amount of phosphorus in the system
- * Modeling results for dam removal show some unexpected results

Fox River Implementation Plan

FRIP Implementation – Near Term Actions:

- * WWTP effluent TP limits = 1.0 mg/L
 - * ~460,000 lbs/y reduction
 - * ~35% reduction
- * Potential removal of Carpentersville and North Aurora Dams
- * TMDLs established for upstream TP
- * Model improvements

Future Monitoring

For Model Improvement

- * Investigate area downstream of Algonquin dam
- * Investigate reaeration coefficients
- * Coordinate with IDNR and IEPA on 2017 intensive basin sampling
- * Before and after measurements on dam removals

Implementation Tracking

- * Continued monthly monitoring
- * Reporting of P load reductions by wastewater plants, municipalities and farmers
- * Non-point source planning and tracking tools

Non-Point Source Scenario Planning Tool

- * Spreadsheet tool to allow “what-if” scenario testing
- * Two versions: MS4s and tributary watersheds

The image displays two Excel spreadsheets side-by-side. The left spreadsheet, titled 'Summary - Excel', shows a table of MS4 districts and their phosphorus loads. The right spreadsheet, titled 'Editor - Excel', shows the 'MS4 District Editor' interface for '01 - Oregonville Village'.

FOX RIVER TOTAL PHOSPHORUS LOAD REDUCTION TOOL - Summary

MS4 District	Scenario (lbs P/yr)	Load Reduction	Baseline (lbs P/yr)
01 Algonquin township	2,105		2,105
02 Algonquin village	3,541		3,541
03 Aurora city	11,697		11,697
04 Aurora township	1,396		1,396
05 Barrington Hills village	7,478		7,478
06 Barrington village	1,380		1,380
07 Bartlett village	2,528		2,528
08 Batavia city	2,826		2,826
09 Batavia township	1,759		1,759
10 Blackberry township	1,305		1,305
11 Bristol township	1,240		1,240
12 Carpentersville village	1,834		1,834
13 Cary village	1,576		1,576
14 Crystal Lake city	4,837		4,837
15 Cuba township	1,531	0.69%	1,544
16 Deer Park village	442		442
17 Dorr township	16		16
18 Dundee township	2,356		2,356
19 East Dundee village	830		830
20 Ela township	626		626
21 Elburn village	859		859
22 Elgin city	10,886		10,886
23 Fox River Grove village	499		499
24 Fremont township	14		14
25 Geneva city	2,749		2,749
26 Gilberts village	886		886
27 Grafton township	112		112
28 Hanover Park village	37		37
29 Hawthorn Woods village	427		427

FOX RIVER TOTAL PHOSPHORUS LOAD REDUCTION TOOL - MS4 District Editor

01 - Oregonville Village

Change Land Use Save Workbook

Reset Windows BMP Bulk Edit Close Workbook

	BMP Enrollment	Removal Efficiency	TP Load Removed	Baseline Load (lbs P/yr)	Acres
Total	0.0%	0.0%	-	7,478.1	17,702.9

Land Use

Crop (CROP)	0%	0.0%	-	451.3	446.8
Conservation tillage		66%	-		
Field borders		61%	-		
Grassed waterways		30%	-		
Nutrient management		35%	-		
Other			-		

Urban - High Density (UHD) 0% 0.0% - 4.3 4.3

Urban - Low/Medium Density (ULM) 0% 0.0% - 1,089.8 1,910.7

Urban - Open Space (UOS) 0% 0.0% - 1,602.2 4,755.1

Forest (FOR) n/a 2,928.9 8,033.6

Rural Grassland (RGR) n/a 1,284.0 2,068.0

Surface Water (SWA) n/a 113.2 466.3

Wetlands (SWM) n/a 4.4 18.0

Scenario 01 Title

Baseline Store Scenario



Questions?

www.foxriverstudygroup.org