

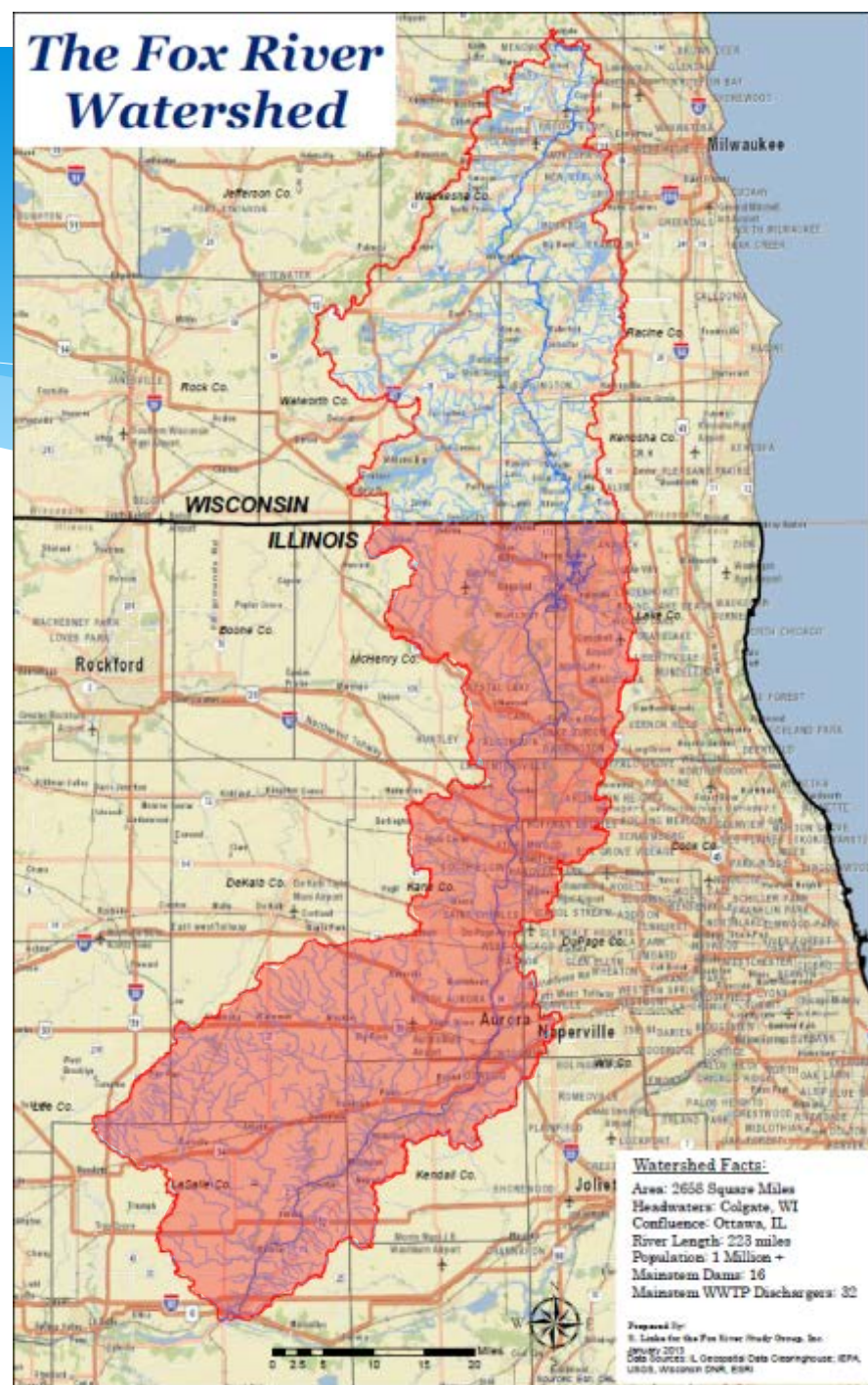
Monitoring and Implementation in the Fox River Basin

Cindy Skrukrud
Clean Water Program Director
Sierra Club, Illinois Chapter

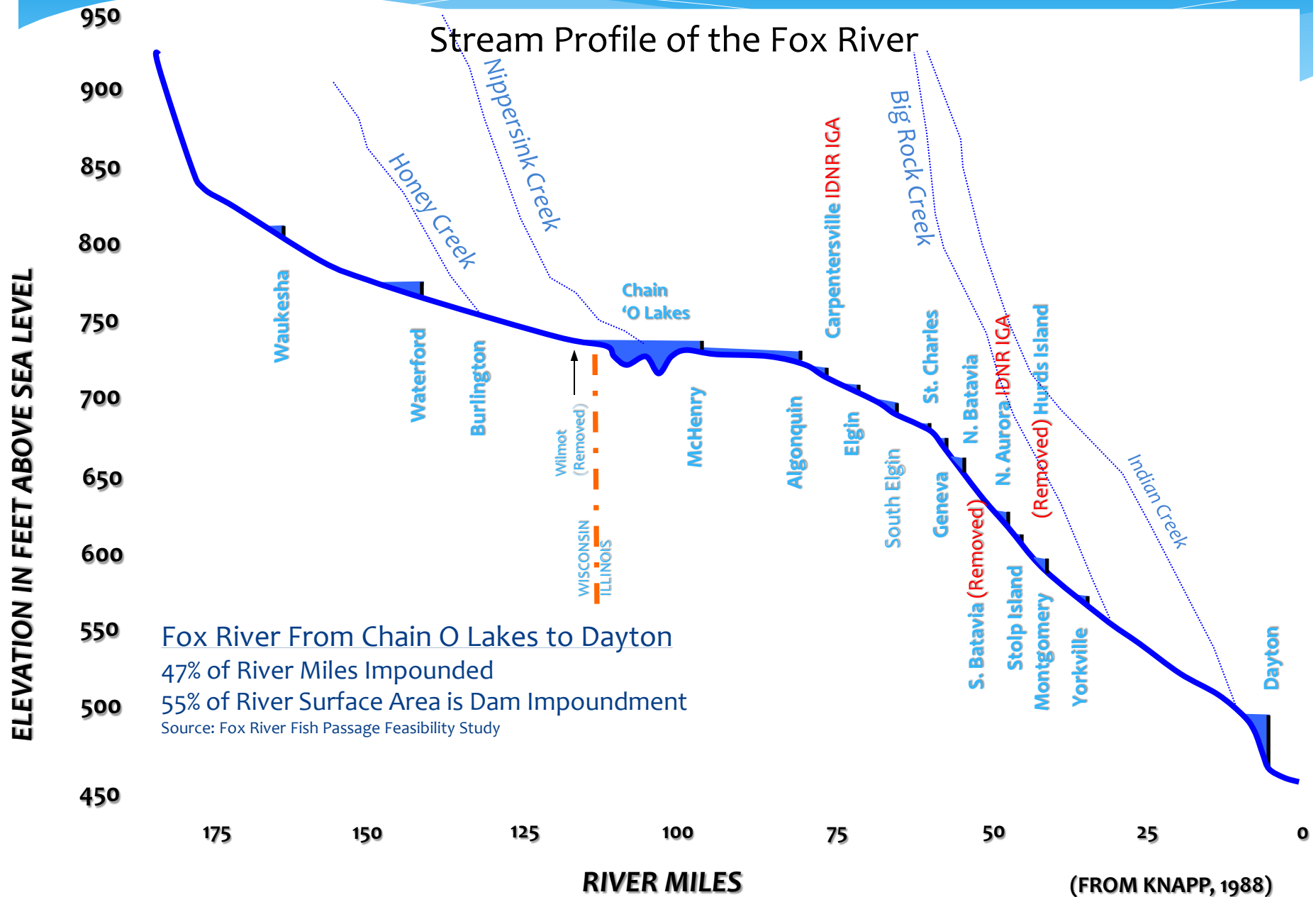
Chair, Fox River Study Group

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



FOX RIVER PROFILE



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

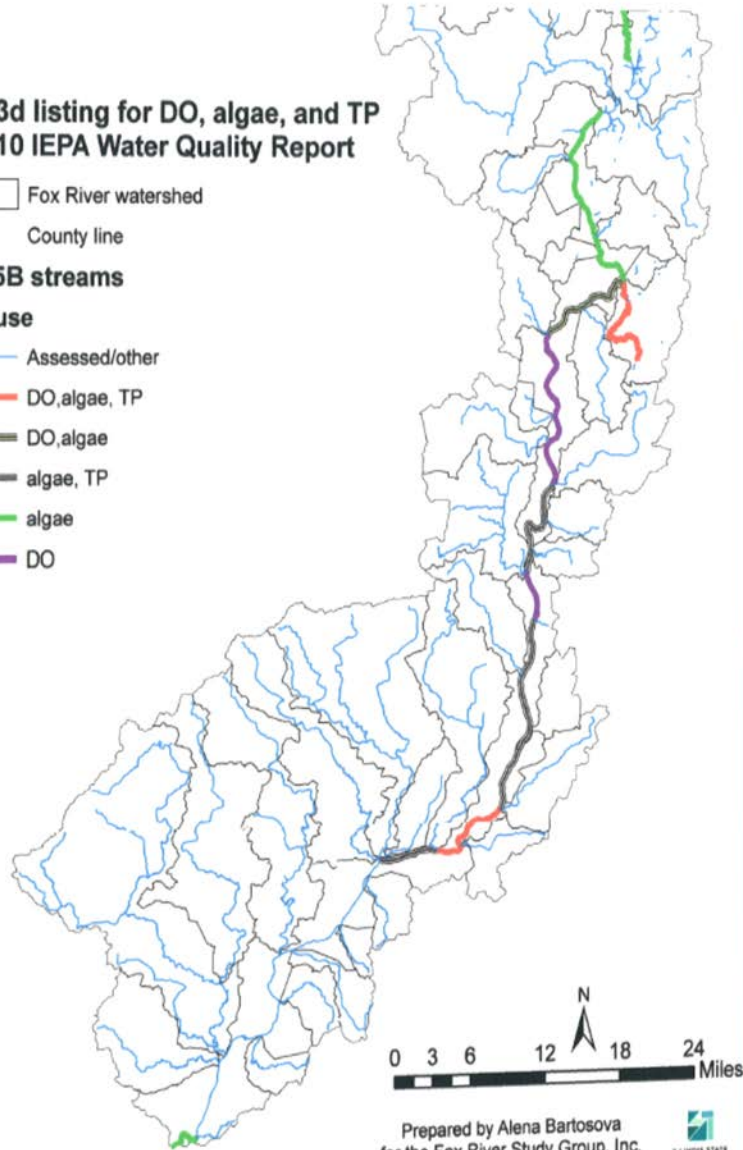
303d listing for DO, algae, and TP 2010 IEPA Water Quality Report

□ Fox River watershed
□ County line

305B streams

Cause

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



Prepared by Alena Bartosova
for the Fox River Study Group, Inc.
13 February 2012



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



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

Generalized Land Cover: Current

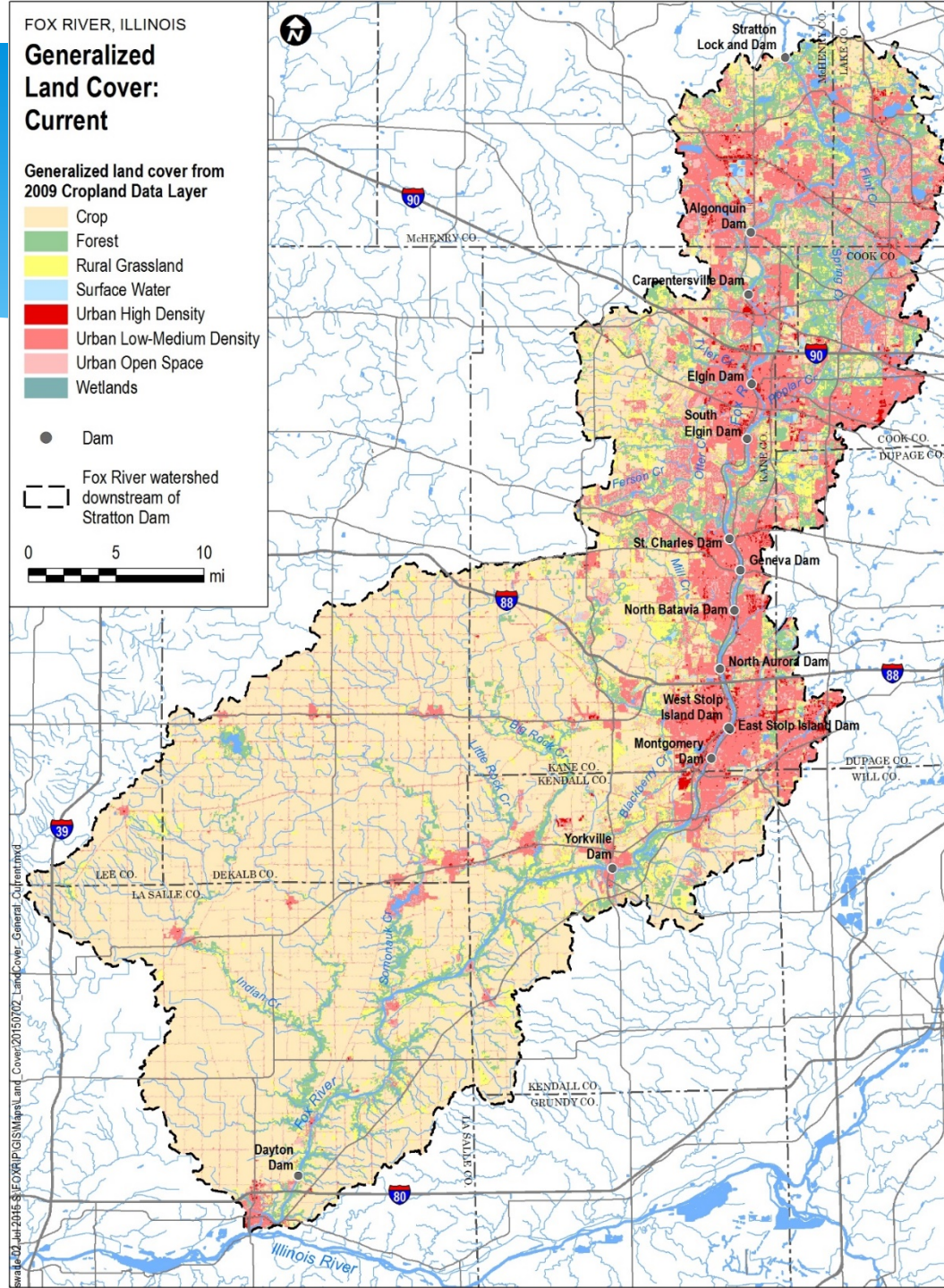
Generalized land cover from
2009 Cropland Data Layer

- 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

0 5 10
mi



Monthly Water Quality Monitoring

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

Test Parameters	1 Chapel Hill	2 Sleepy Hollow	3 Silver Creek	4 Rawson Br.	5 Crystal Creek	6 Algonquin	7 Tyler Creek	8 South Elgin	9 Ferson Creek	10 Fabyan	11 Indian Creek	12 Mill Street	13 Route 47	14 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

ND = Not Determined

AF = Analysis Failure

CG = Confluent Growth

TNTC = Too Numerous to Count

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](#)).

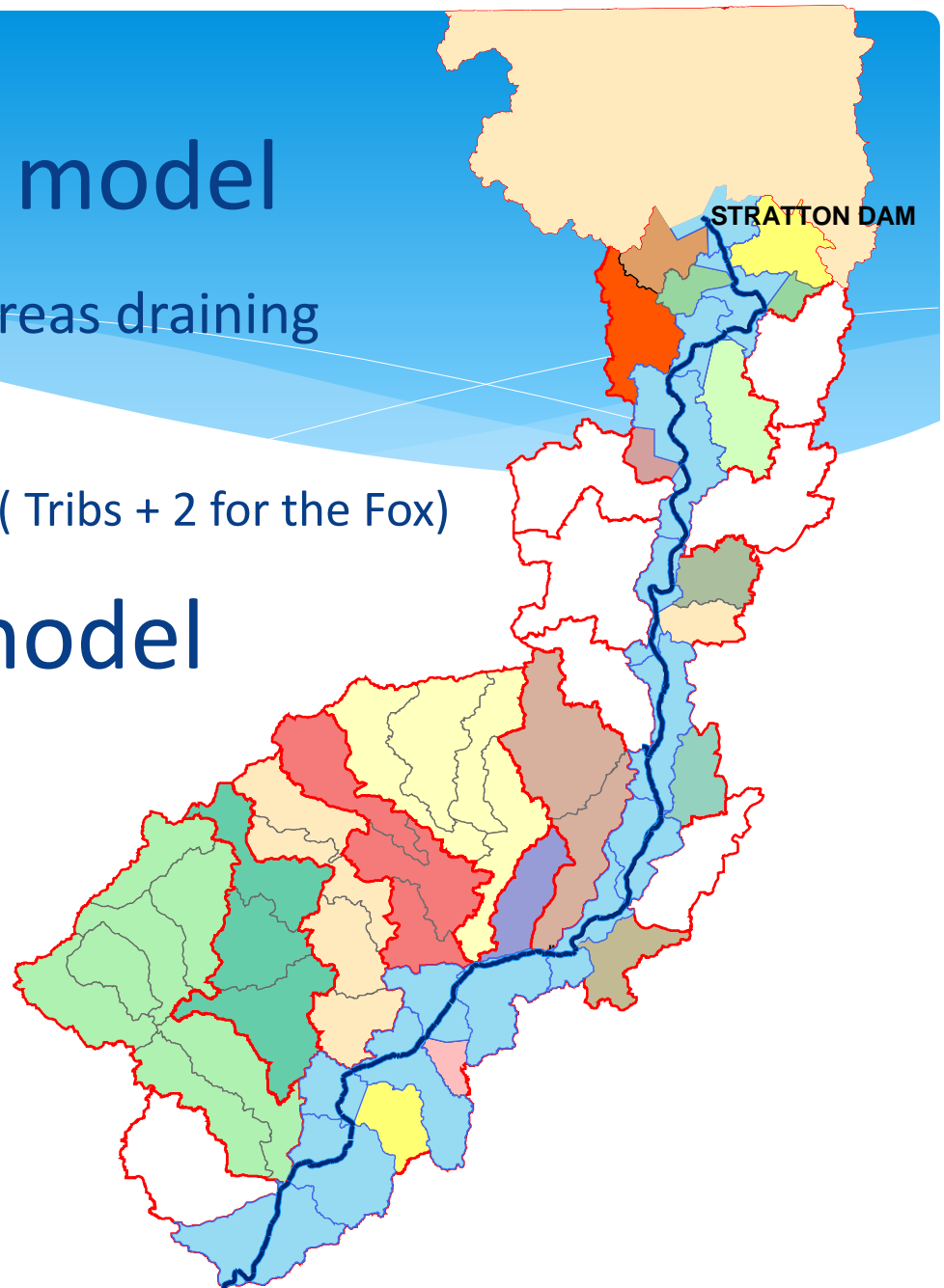
Watershed loading model

- 31 Tributaries + Areas draining directly to Fox R.
- 33 HSPF Models (Tribes + 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

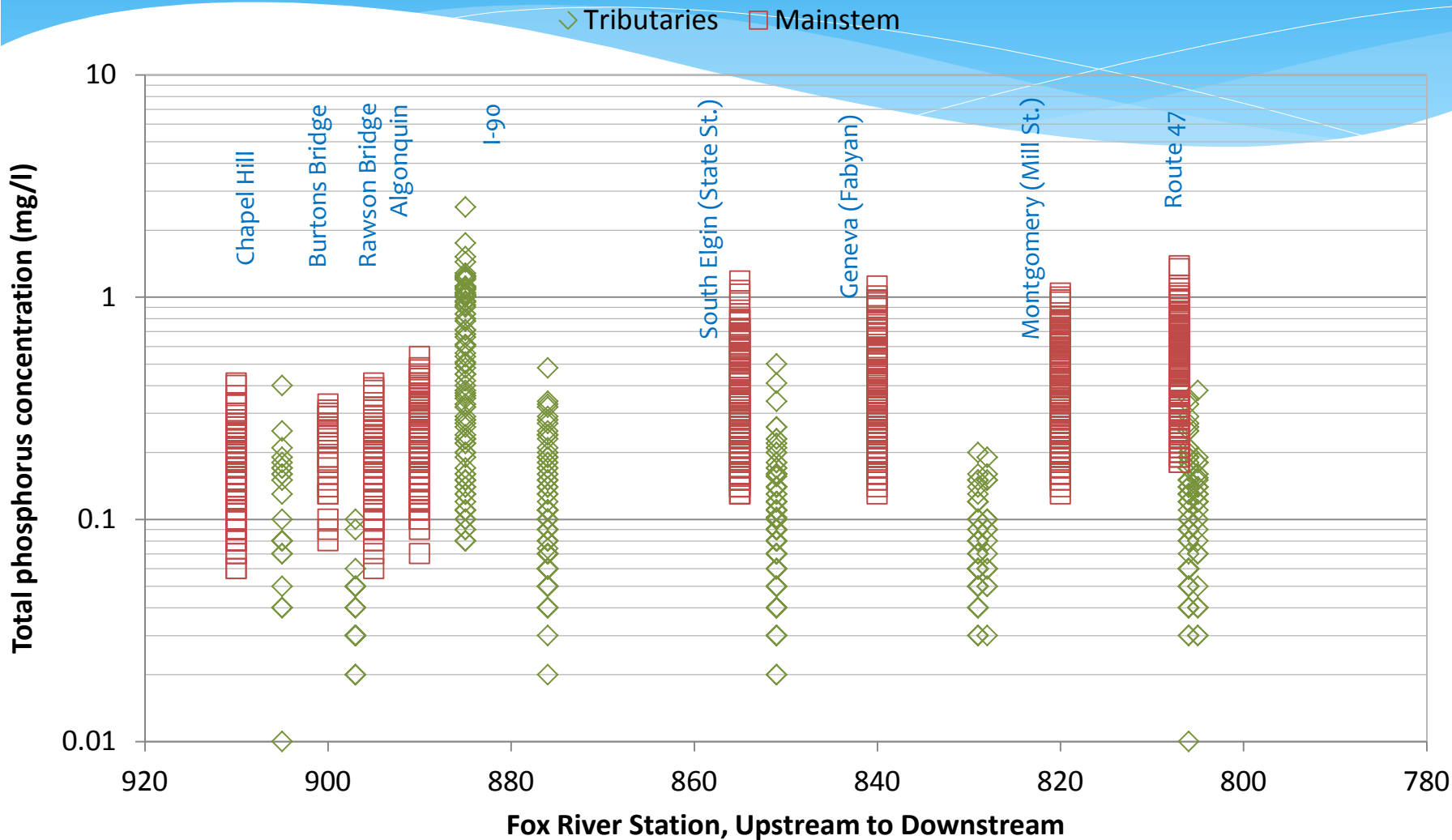
June 2012

- * 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



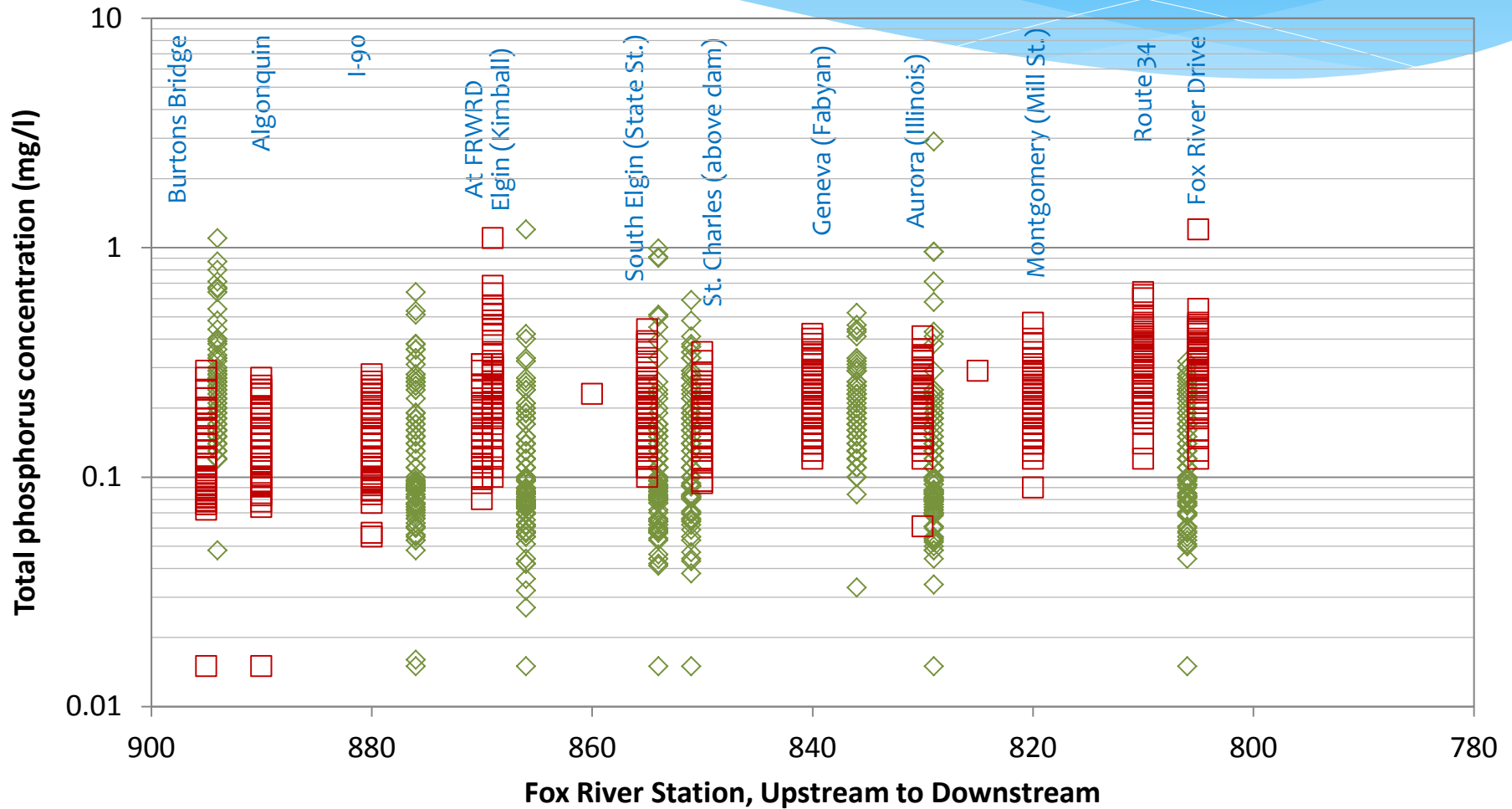
ILLINOIS STATE
WATER SURVEY
PRAIRIE RESEARCH INSTITUTE

TP During 2002-2013 Sampling (FRSG)





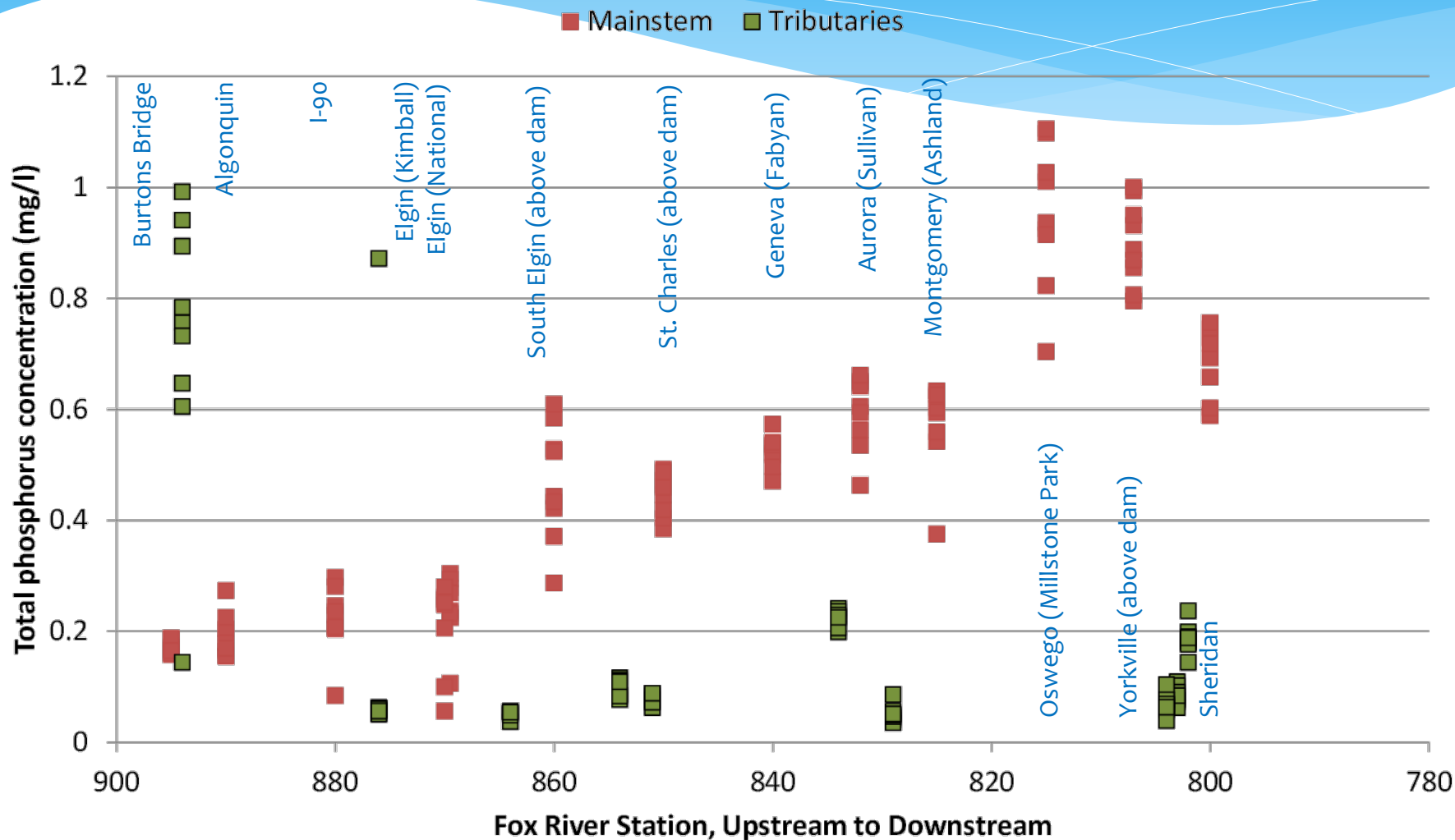
➤ Tributaries □ Mainstem





ILLINOIS STATE
WATER SURVEY
PRAIRIE RESEARCH INSTITUTE

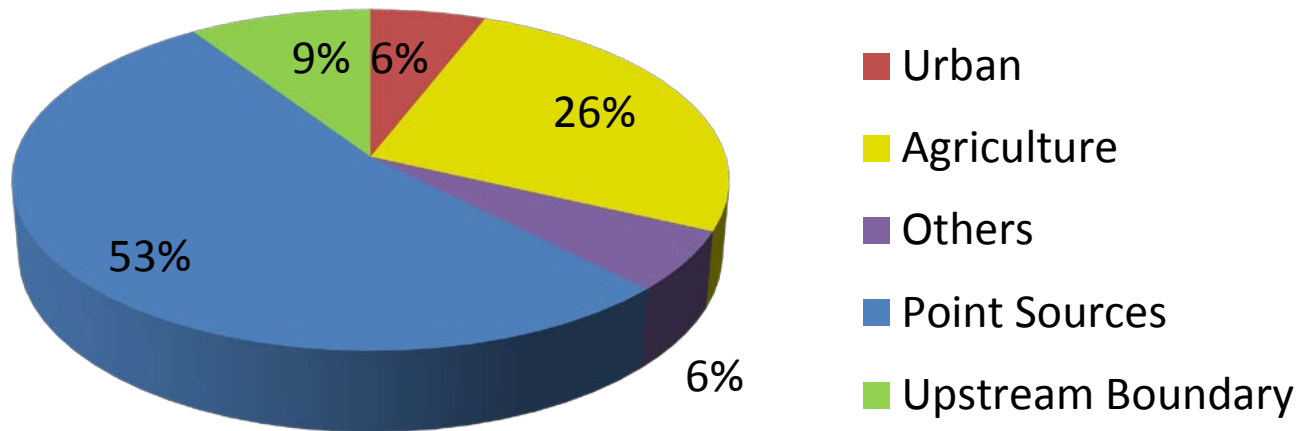
TP During June 2012 Sampling





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

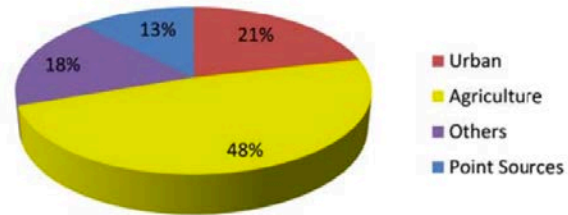


Sources of TP in Fox River watershed by tributary

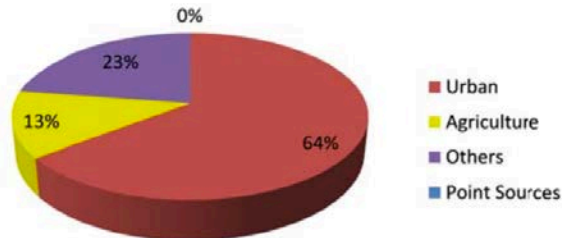
ILLINOIS STATE
WATER SURVEY

PRAIRIE RESEARCH INSTITUTE

Blackberry, long-term average annual TP load



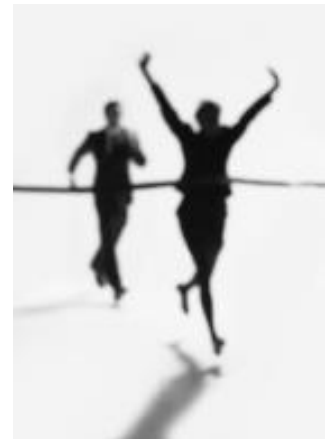
Brewster, long-term average annual TP load



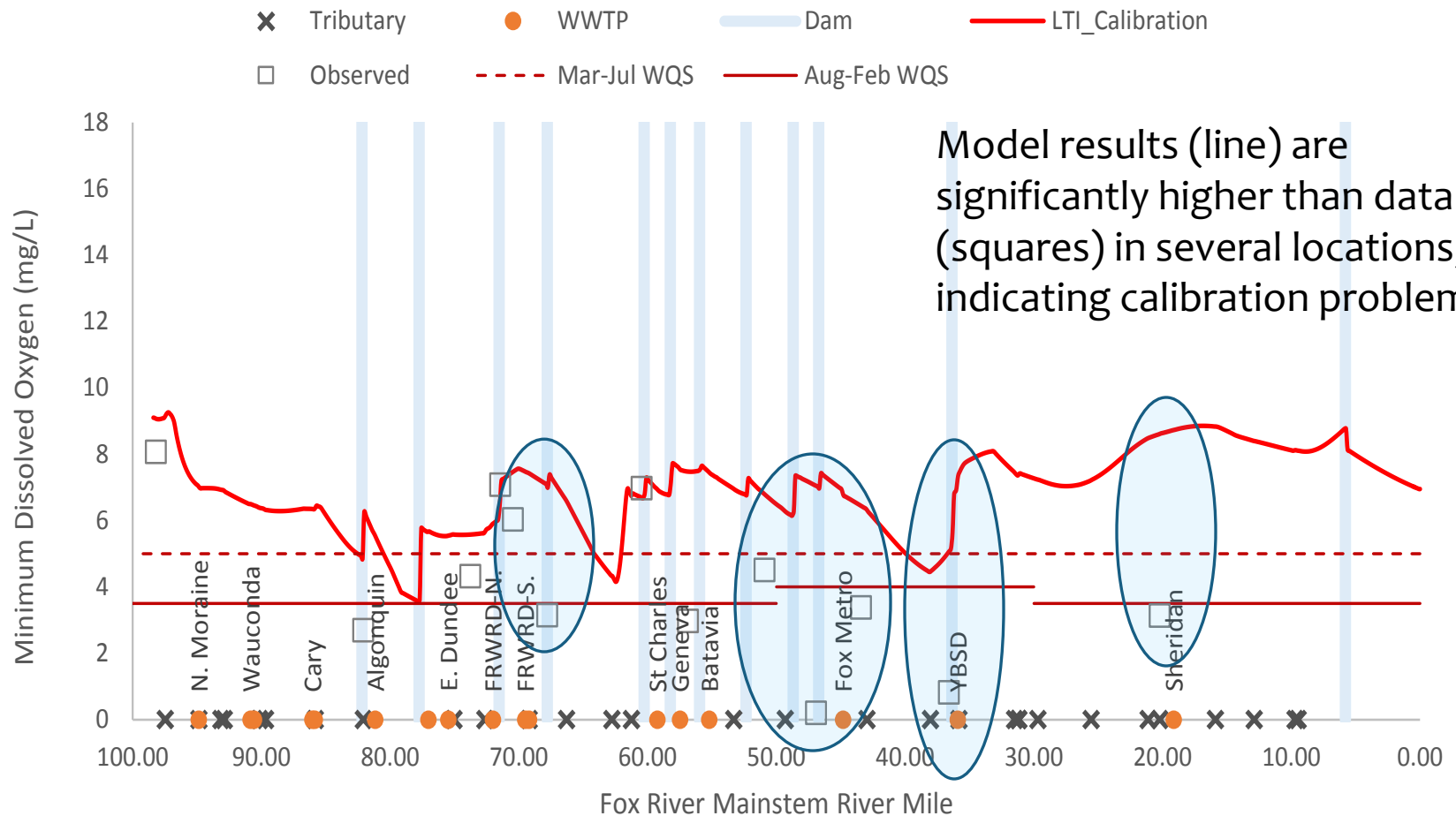
Fox River Implementation Plan

Goals

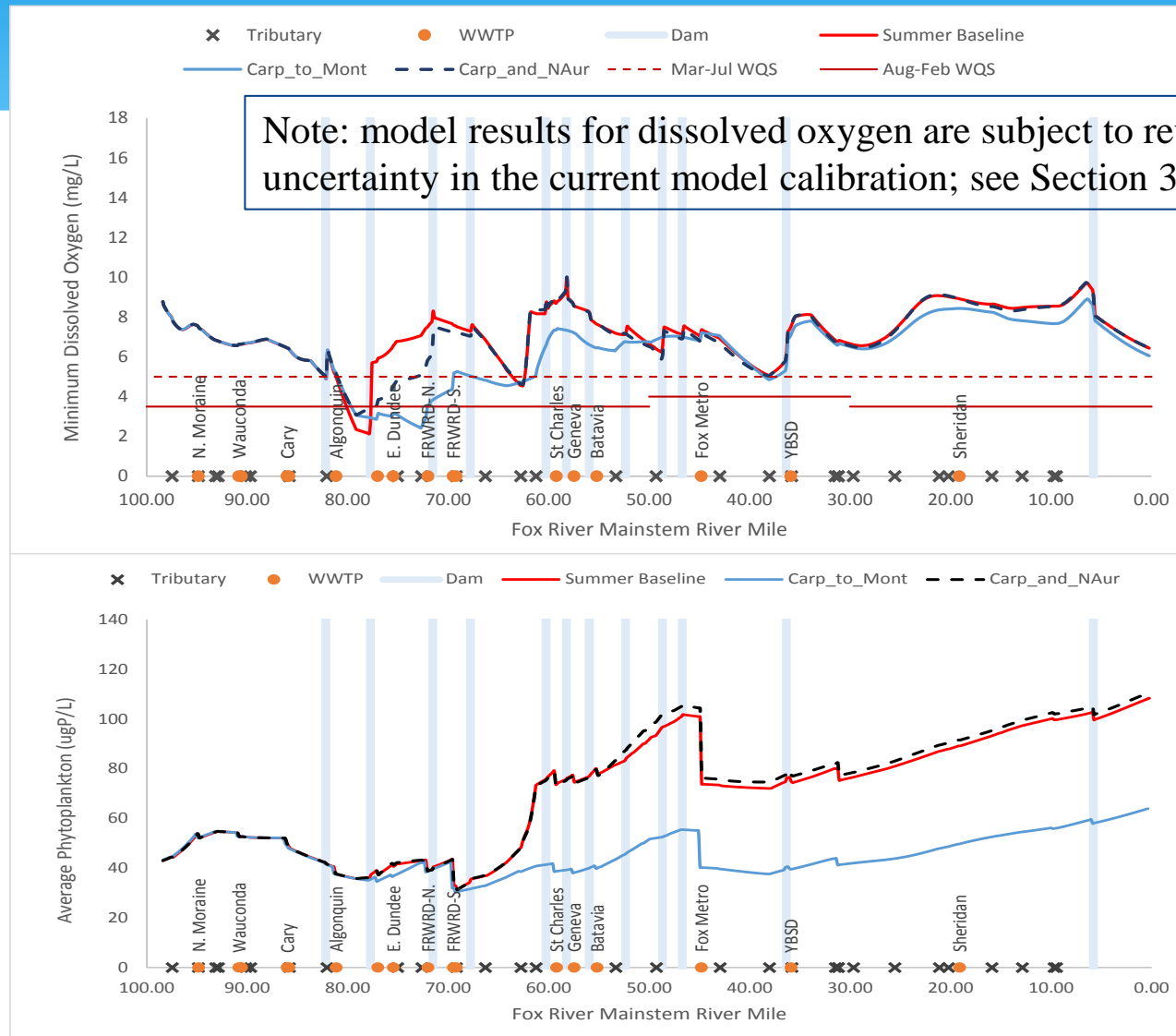
- Attain water quality for dissolved oxygen
- Reduce nuisance algae
- Replace a traditional TMDL plan
- Recommendations developed based on good science with input from local decision makers
- Report due to IEPA on Dec. 31, 2015



Model Calibration – Min. Dissolved Oxygen

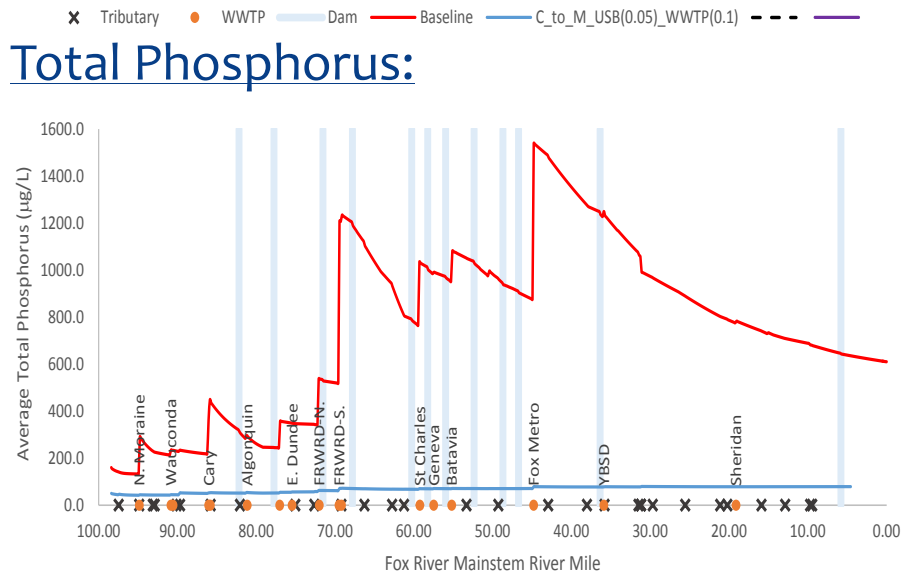


Dam Removal Scenario – Min. DO & Algae

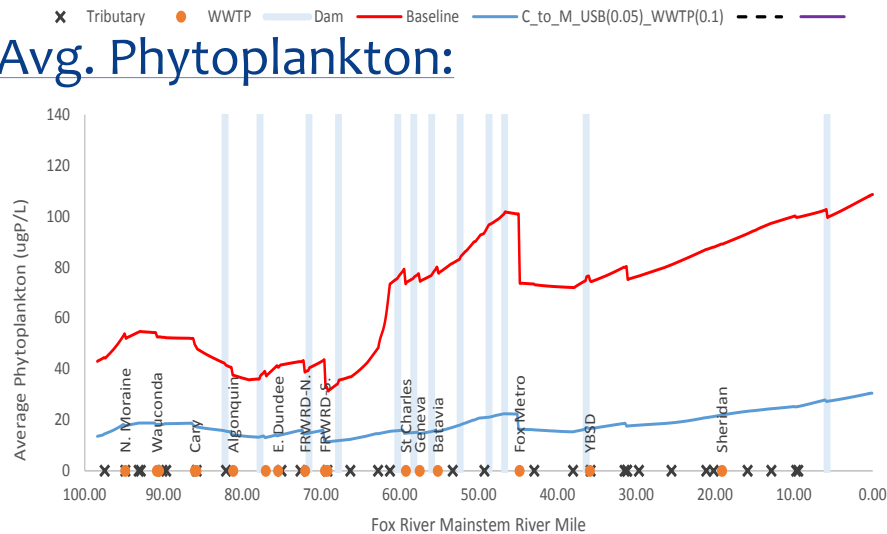


Most Aggressive Alternative

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 screenshot displays two Excel spreadsheets side-by-side. The left window, titled 'Summary - Excel', shows a table of MS4 districts and their phosphorus loads. The right window, titled 'Editor - Excel', shows the 'MS4 District Editor' for '01 Algonquin 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 Elia 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 Algonquin 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

Spreadsheet tool to simplify tracking and reporting of projects by MS4s

[illegible]



Questions?

www.foxriverstudygroup.org