

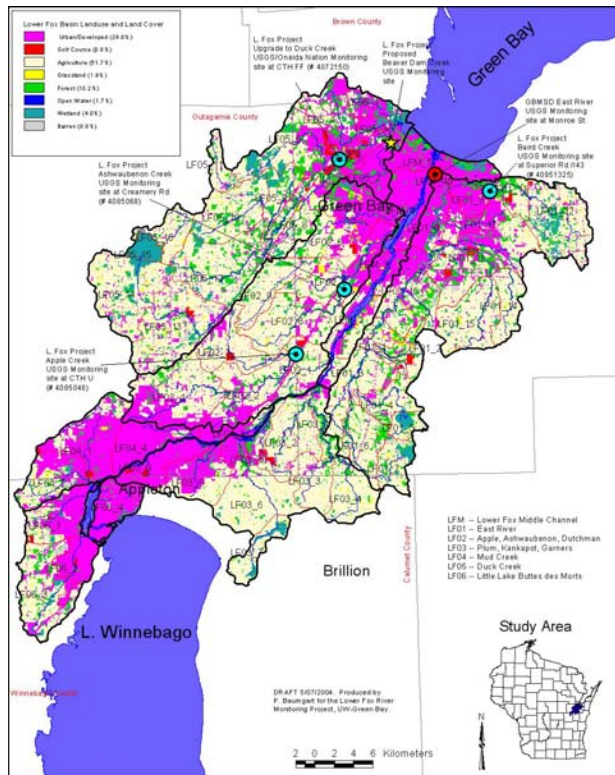
Preliminary Monitoring Results – Annual Flow, Precip., TSS and Phosphorus: WY 2004

Project Overview – Continuous Monitoring Program

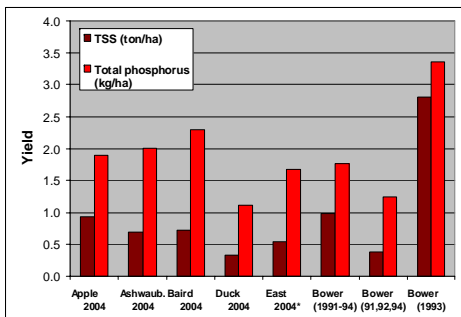
Five USGS continuous monitoring stations within the 1,580 sq. km Lower Fox Basin have been installed directly through the project. These stations will provide 3 years of data beginning in October 2003 and ending September 30, 2006:

- Duck Creek at CTH FF (276 km²) -- upgraded with sampler (co-sponsored by Oneida Tribe)
- Baird Creek at Superior Road (~55 km²)
- Apple Creek at CTH U / Campground (117 km²)
- Ashwaubenon Creek at Creamery Road (~48 km²)
- East River at Monroe St. (374 km²) -- (co-sponsored by GBMSD)

USGS has computed daily total phosphorus (TP) and total suspended solids (TSS) loads for each stream, and will estimate the dissolved phosphorus (DP) loads. TSS concentrations have also been correlated with turbidity data from UW-Milwaukee.



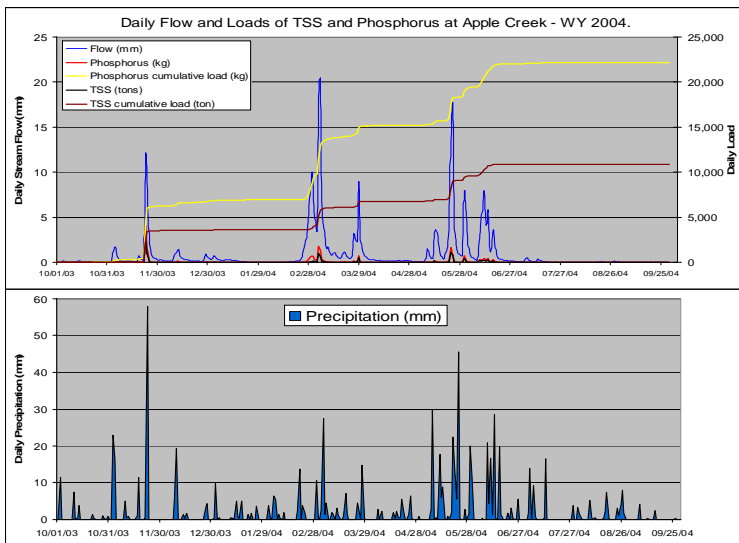
Average annual total suspended solids and phosphorus yields from LFRWMP watersheds in 2004 water year



- LFRWMP Apple, Ash, and Baird clay soil watersheds fairly similar in 2004. TSS yields (~0.75 ton/ha) and phosphorus yields (~2.0 kg/ha). East R. only partial year (> Dec. 15).
- Duck Cr. TSS & P yields about 50% of yields from Apple, Ash, and Baird watersheds.

- 2004 yields from clay soil watersheds similar to 1991-94 average annual yields from Bower Creek (35 sq. km), but much lower than in 1993 (no samples collected during the largest two runoff events in 1993, so only estimated).
- 2004 measured yields nearly twice as high as SWAT-modeled TSS yield of 0.45 t/ha and P yield of 1.0 kg/ha under 1989-2000 climatic period from similar areas (Baumgart 2005 modeling report for Oneida Nation).

Daily flow, and daily and cumulative loads of TSS and P

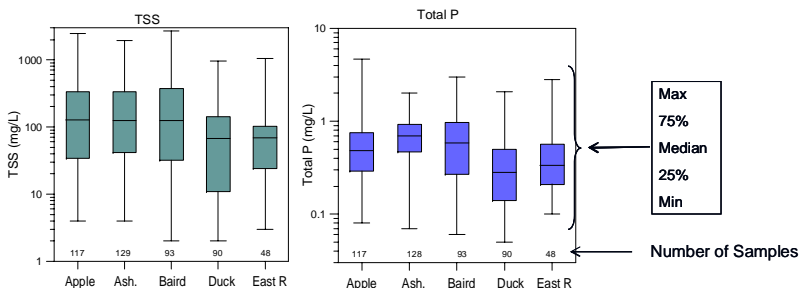


- Three high runoff periods: Nov. 23, spring snowmelt/rainfall in March, and May to early June account for most of the stream flow, and loads of TSS and P.
- Very large runoff events captured in fall (Nov. 23-25), spring snowmelt period (March 1-4), and May 23-24.

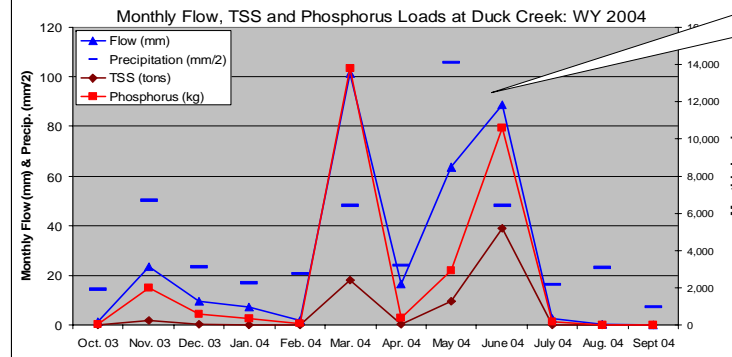
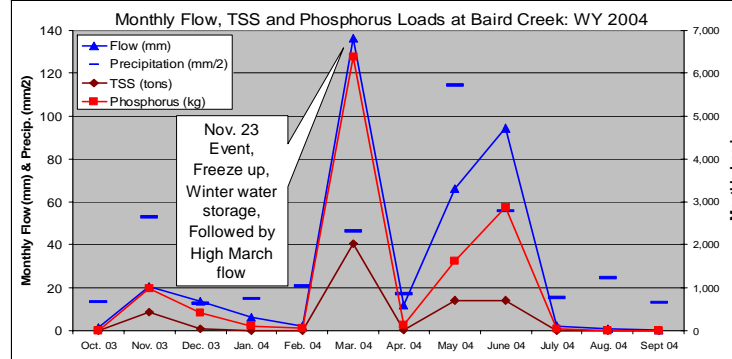
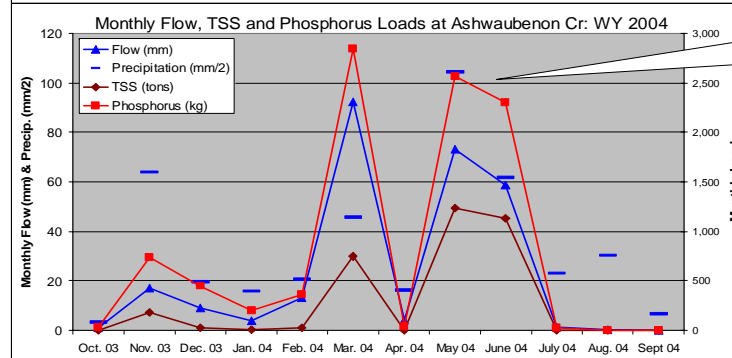
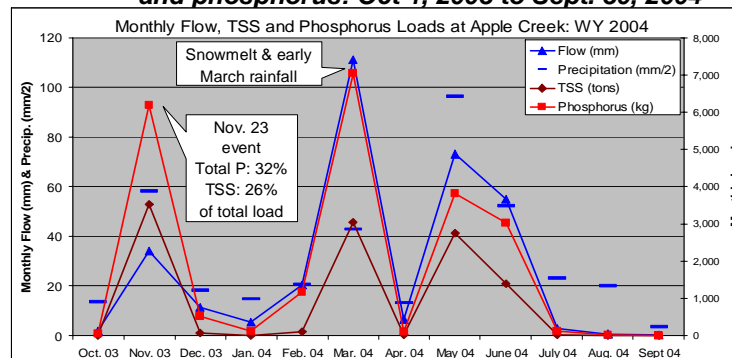
Annual summary of flow, precip, TSS & total phosphorus

	Apple	Ashwaub.	Baird	Duck	East*	Total	Extrapolated to L Fox Basin
Area at Station (km ²)	117	48	55	276	374	870	1581
Flow (mm)	322	274	356	316	339		
Precip (mm)	751	819	801	796	801		
Flow/Precip	43%	33%	44%	40%	42%		
TSS load (tons)	10,900	3,300	3,900	9,200	20,600	48,000	90,800
TSS yield (t/ha)	0.93	0.70	0.72	0.33	0.55		
Phosphorus load (kg)	22,200	9,600	12,600	30,900	62,700	137,900	258,900
Phosphorus yield (kg/ha)	1.90	2.00	2.29	1.12	1.68		

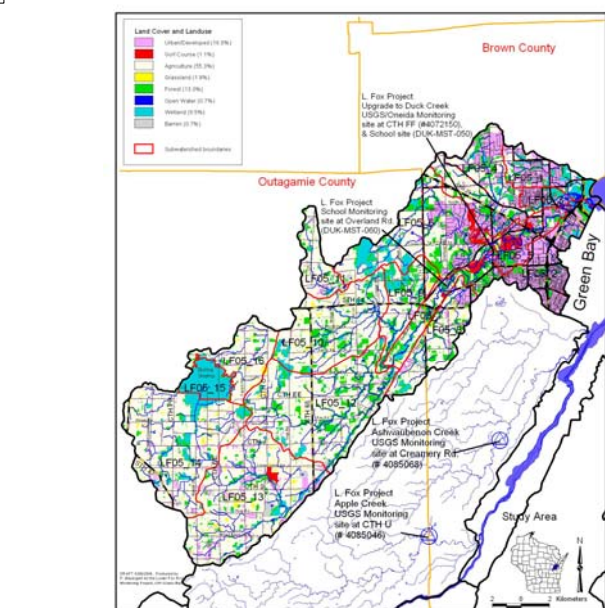
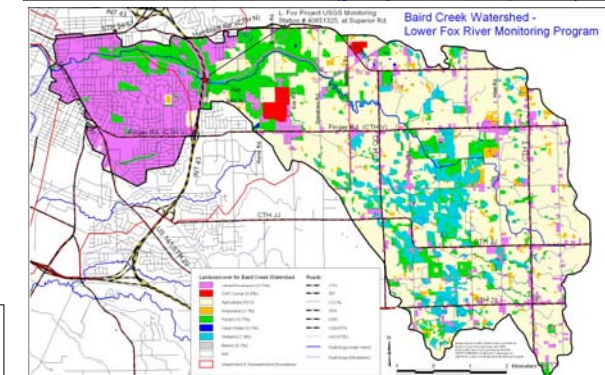
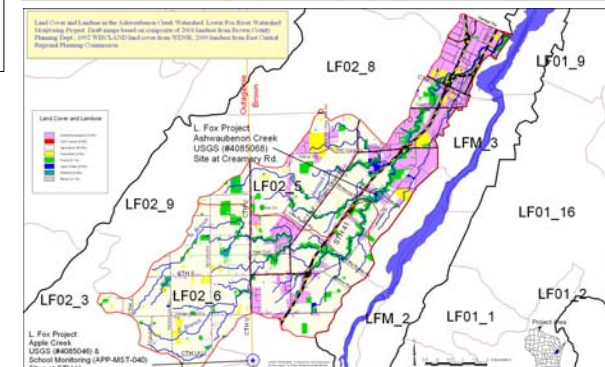
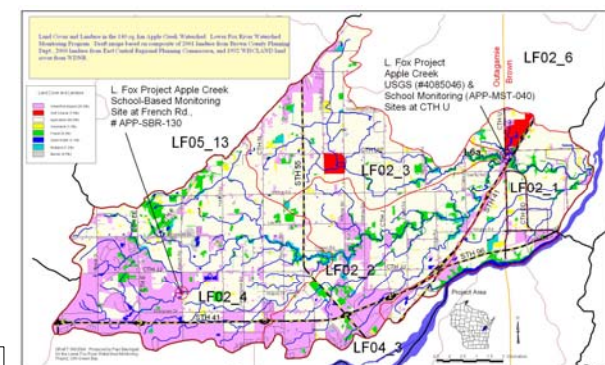
- TSS and phosphorus loads and yields high in 2004. *East River only partial year.
- ~2x average load contribution to Green Bay from Lower Fox River Basin.



Monthly Stream Flow, Precip. and Loads of TSS and phosphorus: Oct 1, 2003 to Sept. 30, 2004



Landuse/Cover Comparisons in Monitored Watersheds



Apple & Ash. Similar May-June Response

Baird & Duck Similar May-June Response

Major Objectives:

1. Better understand cause/effect through event and continuous monitoring.
2. Compare flow, phosphorus, and suspended sediment concentrations and loads from different source areas (e.g. urban, urbanizing, and rural/agriculture).

Preliminary Results

- Second wettest May on record (211 mm) was 3x normal, and responsible for excessive runoff and loads in May and early June.
- Annual precipitation (813 mm) was only 10% above normal (741 mm).
- Annual stream flow ranged from 33 to 43% of total precipitation.
- Apple, Ash., Baird similar median total suspended solids (TSS) conc. (~126 mg/L); ~2.5x previous studies.
- Duck Creek and East River similar median TSS conc. (~67 mg/L); however, East River samples are composites.
- Maximum TSS: from 960 mg/L at Duck to 2,700 mg/L at Baird.
- High total phosphorus (TP), dissolved phosphorus (DP) in all streams.
- TP median concentration 0.28 – 0.70 mg/L. 25% of Ash. Creek samples > 0.93 mg/L. TP max. concentrations > 2 mg/L at all sites.
- Annual median DP to TP fractions ranged from 49-57%. DP 40-54% of TP during events, > 70% DP during low flow.
- Highly event driven: 13 days = 80% of TSS, 67% of TP from Apple.

- Excluding Apple Creek, March, May and June account for: 87-96% of the TSS load, and 81-88% of the phosphorus load in 2004 USGS water year.
- Apple and Ashwaubenon Creek respond similarly on a seasonal basis; as do Baird and Duck Creek which have a greater proportion of wetlands.
- Late November heavy rain, freeze, and winter precip. contributed to March flows.
- Loading highly event driven.
- 13 days account for 80% of annual TSS load, 67% of TP load from Apple Creek.
- Baird Creek, less influenced: 13 days = 67% of TSS, 52% TP loads.

Partners:

- UW-Green Bay – Program Lead
 - UW-Milwaukee
 - U.S. Geological Survey (Contributes cost share for stations)
 - 5 Area High Schools
 - Green Bay Metropolitan Sewerage District
 - Oneida Nation
- Major funding for the program is through a four year grant from Arjo Wiggins Appleton, Inc.

Figure 1. Duck Creek Watershed Landuse/Cover. DRAFT image based on composite of: 2001 landuse from Brown County Planning Dept., 1992 WISLAND land cover from WDNR, 2000 landuse from East Central Regional Planning Commission.