Stream Sampling Methods Used for the Lower Fox River Watershed Monitoring Program

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THE LOWER FOX RIVER watershed monitoring program
www.uwgb.edu/watershed

Introduction

The LFRWMP is a multi-year monitoring and assessment program in and around the Lower Fox River Basin. Two of the major goals are:

- To compare relative contributions of phosphorus (P) and sediment from watersheds within the Fox Basin to receiving waters and to identify and quantify sources of these pollutants;
- To link stream ecological integrity to water quality and land use.

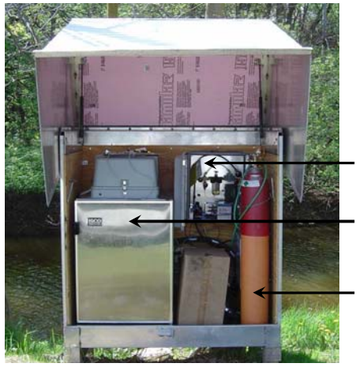
To reach those goals, we need to answer the following questions:

1. What are the annual and seasonal loads from each watershed?
2. How much of the total P is dissolved P?
3. What is the watershed yield per area (kg/ha) of P and sediment?
4. What is the range and variability of key water quality parameters?
5. How do land use and management impact flows and water quality?
6. How does water quality affect stream life?
7. How well do models predict flows, concentrations and loads?

To obtain accurate information needed to reach these goals, automated monitoring stations have been installed on the following five streams to provide event and low-flow information on precipitation, stream discharge and pollutant concentrations:

- Apple Creek
- Ashwaubenon Creek
- Baird Creek
- Duck Creek
- East River

Automated Monitoring Stations



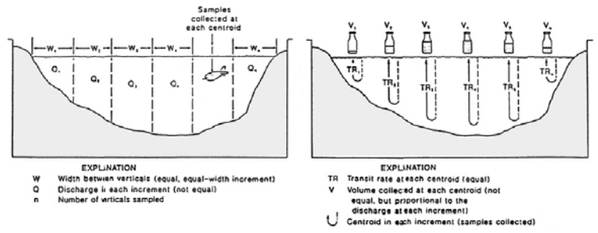
- Each USGS station is equipped with an ISCO 3700R automated sampler, a rain gauge, a gas-bubble water level measuring system, a data logger, and a modem.
- Water sampling is triggered by changes in water level during flow events.


Accessing the data logger


24 1-liter samples can be collected before servicing


Station rain gauge

Collecting Low-Flow Samples




Collecting an EWI sample

- Low-flow samples are collected to determine pollutant concentrations in streams between runoff events.
- The Equal-Width Increment (EWI) method is used to accurately sample the entire cross-section of the stream, not just a single grab point.

Processing Water Samples


Filtering a sample for dissolved phosphorus


ISCO sample bottles showing changes in sediment concentrations over an event hydrograph

- Storm event and low-flow samples are transported on ice from the field to the UW-Green Bay laboratory.
- A Teflon cone splitter is used to divide discrete samples from the field into separate containers for analysis.
- Samples to be run for dissolved phosphorus are filtered at 0.45 µm.
- The Green Bay Metropolitan Sewerage District laboratory analyzes samples for total suspended solids (TSS), total phosphorus, and total dissolved phosphorus. Suspended sediment concentration (SSC) samples are analyzed by a USGS lab.


Splitting an ISCO sample bottle into SSC, TSS, and total phosphorus subsamples using a Teflon cone splitter

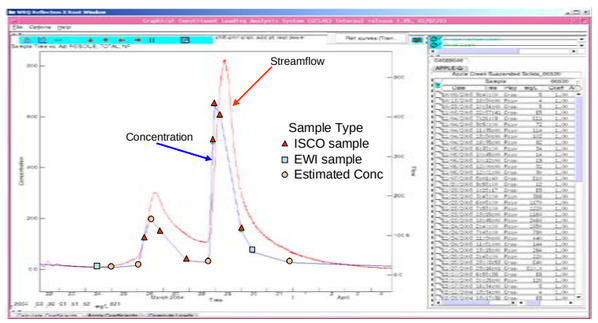
Determining Stream Discharge

- Flow measurements are taken at all stream stages and plotted against measured gage heights to create a flow rating curve.
- The rating curve is used to estimate discharge for continuously-measured gage heights.

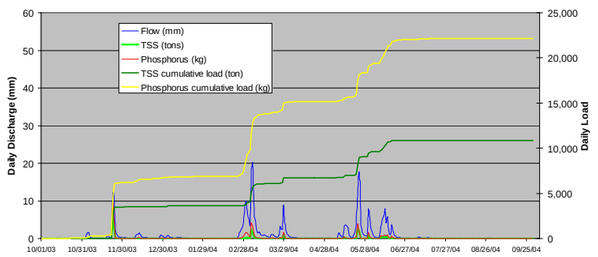
Flow measurements (upper left) and gage heights (upper right) generate the flow rating curve (lower left), which is then used to estimate stream discharge (lower right).

Analyzing Data and Predicting Loads

- USGS predicts pollutant loads by relating the calculated discharge to individual sample concentrations using Graphical Constituent Loading Analysis System (GCLAS) software.
- Loads are calculated on a daily, monthly, seasonal, and annual basis.
- Comparisons are made between watersheds and on long-term trends.



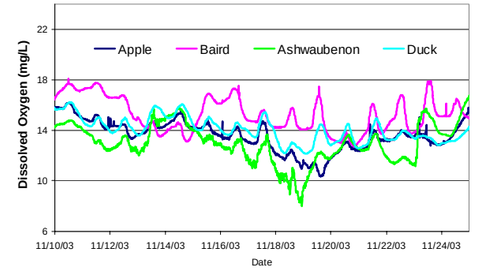
Graphical Constituent Loading Analysis System (GCLAS) software



Flow and load data for Apple Creek, Water Year 2004

Monitoring In-Stream Water Quality Conditions

- YSI 6200 sondes measure temperature, pH, dissolved oxygen, turbidity, conductance, and depth.
- Readings are taken every 10 minutes, 24 hours a day, 7 days a week.
- Data can be accessed real-time using a computer modem. Data is downloaded every night to the "Uncalibrated Daily Sonde Data" link at *http://www.uwgb.edu/watershed/data/UWM.htm*.
- Post calibration of data is essential to account for equipment sensor drift during deployment.



YSI-6200 sonde and example dissolved oxygen data from fall 2003.

Sampling Habitat, Fish, and Macroinvertebrates

- A habitat index score is calculated for each stream using the USDA's "Guidelines for Evaluating Fish Habitat in Wisconsin Streams," which samples the following eight parameters:
  - Width:Depth Ratio
  - % Pool Area
  - Bank Erosion
  - Riparian Buffer
  - % Fine Sediments
  - % In Stream Cover
  - Riffle:Riffle Ratio
  - % Shading
- Fish are collected during summer low-flow conditions using a stream or backpack electrofisher at two stations in each watershed.
  - Station length is 35 times the mean stream width.
  - Fish are identified, counted, weighed and measured, and then returned to the stream unharmed.
  - An Index of Biological Integrity (IBI) score is calculated for comparing streams.
- Macroinvertebrates are also collected by electrofishing at the stations.
  - A Hilsenhoff Family Biotic Index (FBI) score is calculated to determine stream water quality ratings.


Collecting samples by electrofishing


Performing a stream habitat assessment