



Bridgewater State University

Virtual Commons - Bridgewater State University

Watershed Access Lab Projects

Watershed Access Lab

5-7-2004

A Water Quality Study of the Braintree Farm River

Follow this and additional works at: https://vc.bridgew.edu/wal_projects



Part of the [Environmental Monitoring Commons](#), and the [Natural Resources and Conservation Commons](#)

Recommended Citation

Braintree High School, Braintree, Massachusetts (2004). *A Water Quality Study of the Braintree Farm River*. In Watershed Access Lab Projects. Project 20.
Available at: https://vc.bridgew.edu/wal_projects/20

This item is available as part of Virtual Commons, the open-access institutional repository of Bridgewater State University, Bridgewater, Massachusetts.

A Water Quality Study of the Braintree Farm River



Braintree High School
David Morrissey, Katie Ponder,
Brian Wilson, Elton Wong

The Farm River

- Originates from an outlet of the Great Pond in the Blue Hills of Braintree and joins with the Cochato River to form the headwaters of Monatiquot River.
- Fore River Watershed (Braintree, Weymouth, Quincy, and parts of Holbrook, Randolph, Milton, Stoughton, Canton and Avon.
 - subwatershed of the Boston Basin watershed.

Tell you a little about the Farm River in Braintree.

It's Part of the Fore Watershed. Includes town of

Braintree Farm River

- Class B River, Warm Water Fishery
 - Habitat for fish, aquatic life, primary and secondary contact recreation; suitable for public water supply with appropriate treatment.
- 2.7 mile segment
- Drains an area of 7.9 square miles.
- During summer months up to 80% of water may be pumped to Richardi Reservoir where it is then pumped to Great Pond for use by the Braintree Water and Sewer Dept.

Farm River is classified as a Class B River—suitable for primary and secondary contact; can be consumed after suitable treatment.— must meet certain pH, temperature, dissolved oxygen, and fecal coliform parameters.

The Study

Goals:

To determine the general water quality of the Farm River as it flows through an industrialized/recreational area of Braintree.

Does the water quality change as the Farm River flows through the Golf Course (fertilizers)?

Compare samples from October (end of summer) and March (end of winter)

Study Sites

Two sampling sites

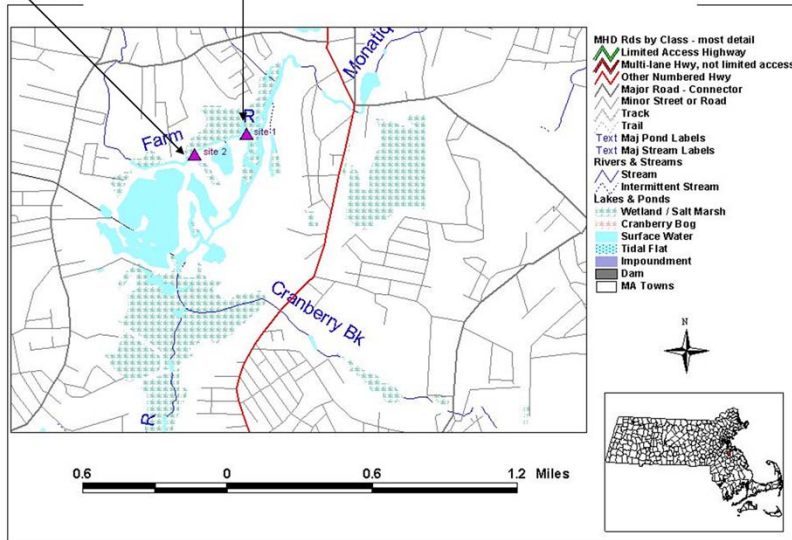
- Site A -- ½ mile upstream of the Braintree Golf course.
- Site B -- at the Golf Course before it joins with the Cochato River to form the Monatiquot River.

Note: A moderately impacted benthic community was identified in the Monatiquot River (1999, DWM)

Braintree Farm River

Site A

Site B



Hollingsworth Field Site A



Golf Course – Site B



Sampling Schedule

- October of 2003
 - Water chemistry – temp., pH, dissolved oxygen
 - Nutrient levels – nitrates, phosphorous
 - Flow and load
 - Macroinvertebrates
 - Fecal coliform
- March of 2004
 - Water chemistry
 - Nutrient levels
 - Flow and load

We took two series of samples in the fall and then the spring.



Site Comparison

	Site A (Field)	Site B (Golf Course)
Average Flow (ft/s)	October .08 March .44 *Man-made dam in stream*	October .15 March 1.35
Bottom composition	Boulders	Boulders with plant material attached.
Riparian vegetation	Deciduous trees and shrubs	Wetland plants and a few deciduous trees. Mostly grasses around actual site sampled.



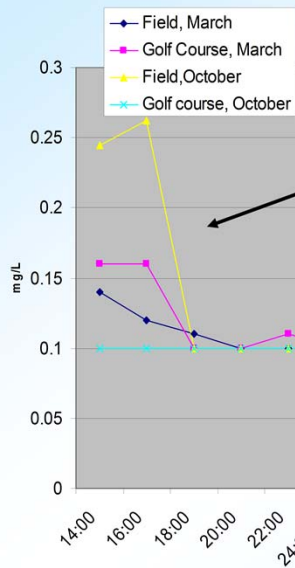
Dave setting up the hydrolab and sigma at the Golf Course in March



Nutrients in Streams

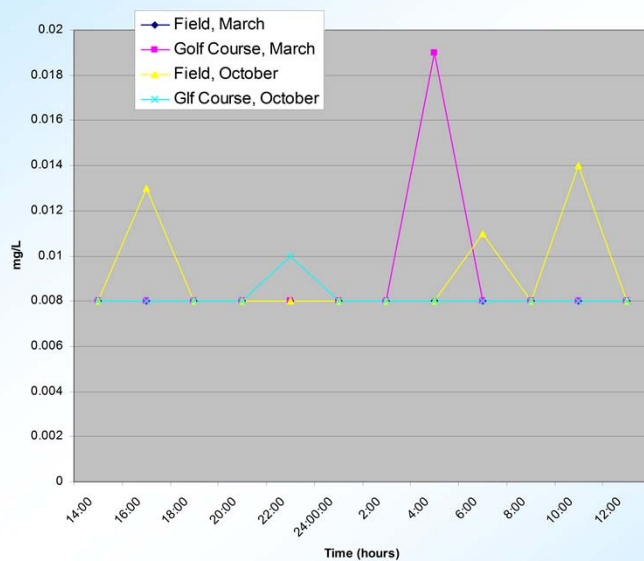
- Small amount of nitrates and phosphates are found in all aquatic ecosystems
 - Used by plants for growth as well as by-products of plant and animal decomposition.
 - Nitrates– can increase from runoff of sewage, fertilizer, and agriculture.
 - Phosphates – can increase from runoff of fertilizer, detergent, cattle feedlot, and human sewage.
- (Watershed Science for Educators, Chapter 7)

Nitrogen Comparison



Elevated nitrate concentrations in early afternoon in October and March— unsure of reason why. Exception: Isn't detected in OCTOBER at the Golf Course— water plants may be using nitrates before they are being detected.

Soluble Reactive Phosphorous

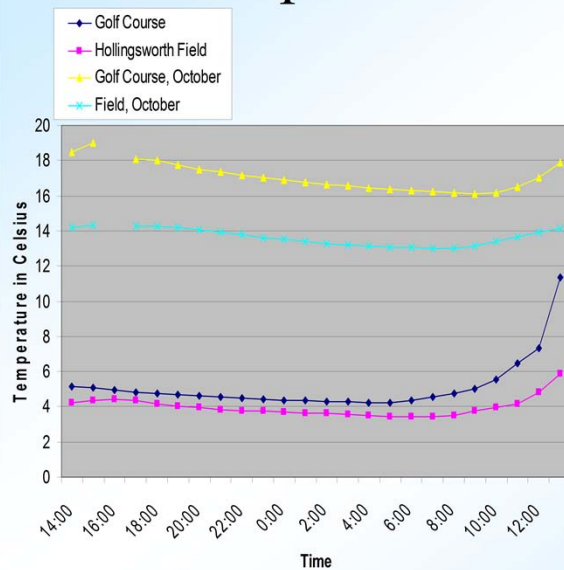


October – less SRP detected at Golf Course as compared to the field – perhaps plants are using it before detection.

March – both sites are BDL, except a spike in SRP at 4:00 pm at the Golf Course.



Temperature Comparison



October – Golf Course is an average of 4° Celsius higher than Field; there is very little overhead canopy at the golf course

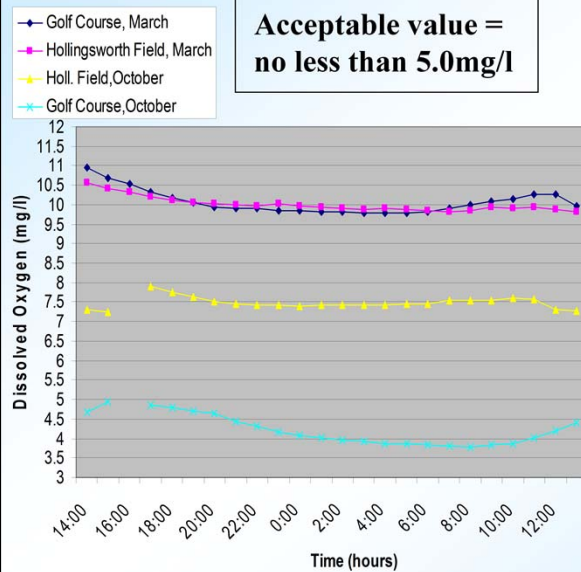
March – similar temperatures at both sites.

Comparison of temp. at two sites in the fall and in the spring.

At end of winter: Temp. much lower – snow melt – at both sites, temperature range is similar—slightly higher at golf course.

In Fall, temp. is higher. The Golf course is significantly higher, because less trees; field has more of a canopy.

Dissolved Oxygen



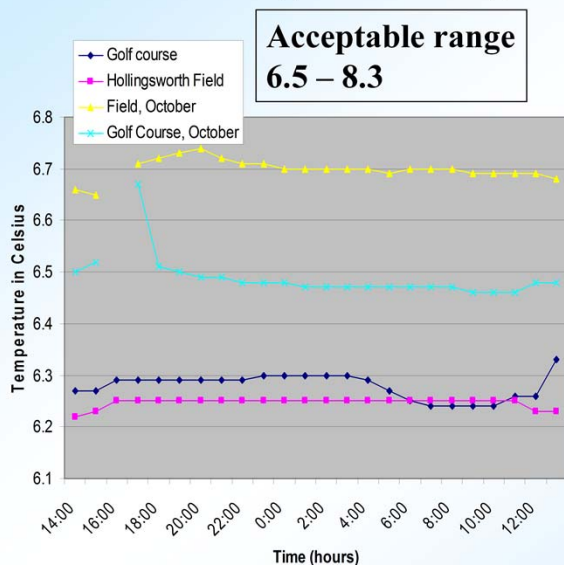
October

-Golf course is always below the acceptable value for DO concentration
-sharp decline at night due to large amount of plants using up oxygen.
Also, decaying plant material = high numbers of bacteria using oxygen.

March

Both sites above acceptable level

pH Comparison



October

Field – “acceptable” pH range for Class B WWF (MA DEP).

Golf course – pH dips below 6.5 during night – large amount of plant material releasing carbon dioxide, making water more acidic.

March

Both sites were below acceptable range, perhaps because of snow melting runoff.

pH is the level of acidity in a stream.

Higher pH at field and lower at golf course– golf course is marshland which is a more acidic environment with less buffering capability.

Macroinvertebrates

- **Benthic macroinvertebrates are defined as animals without backbones that live at least part of their life cycles in or on the bottom of a body of water.**
 - **Excellent indicators of the impacts of physical, chemical and biological changes.**



Macroinvertebrates

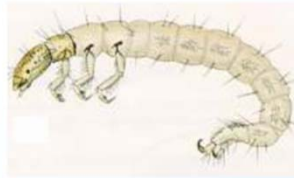
- **An increase in intolerant species/decrease in tolerant species can indicate pollution in a stream**
 - **Pollution/environmental changes can cause water chemistry changes (pH, dissolved oxygen, temperature), which can affect the types of macro invertebrates than can live in a river bed.**

Tolerance Values

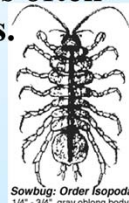
- **Tolerance values range from 1 – 10, with 1 being intolerant and 10 being most tolerant.**
- **Organism density and tolerance values are used to calculate the major group biotic index (MGBI)**
 - **0 – 3.75 = no impairment**
 - **3.76 – 6.5 = moderate impairment**
 - **> 6.5 = severe impairment**

Examples

–Ephemeropterans (mayflies), Plecopterans (stoneflies), and Trichopterans (caddisflies), are usually well represented in healthy streams.



–Amphipods and Isopods are tolerant species often found in high abundance in polluted streams.



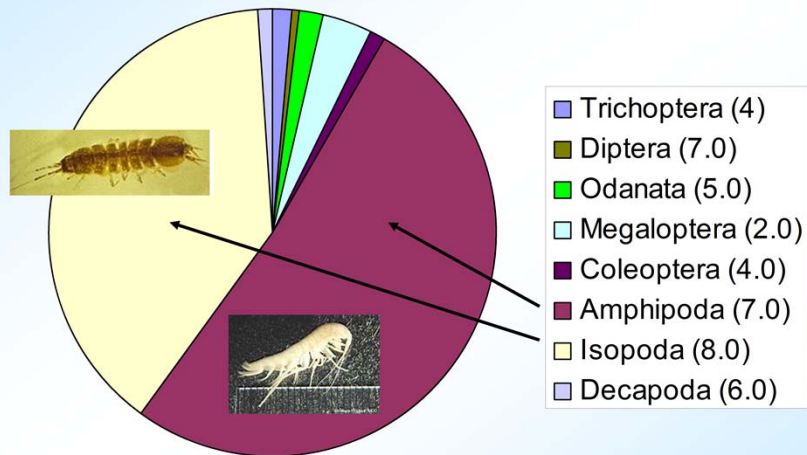
Sowbug: Order Isopoda
1 1/4" - 3 1/4" - gray oblong body
wider than it is high, more
than 6 legs, long antennae

Macroinvertebrates

	Hollingsworth Field	Golf Course
Total Organism Count	220	270
Total Organism density	440	729
% of organism density with tolerance values between 7-10	91.3%	91.1%
% of Organism Density that are intolerant (0-3)	3.6%	0.0%
Major group biotic index	7.1 (Poor)	7.1 (Poor)

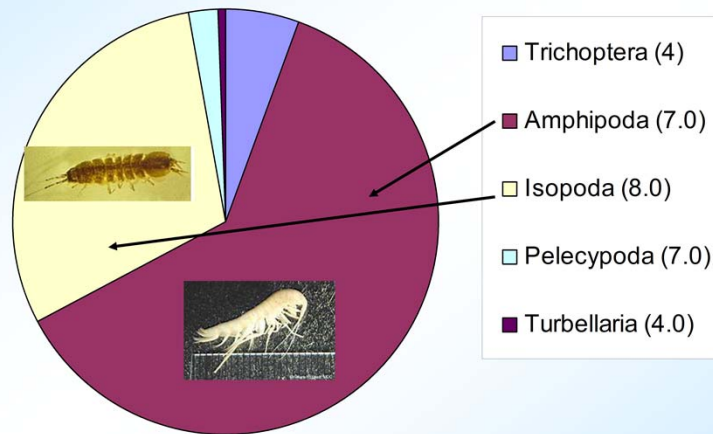
Higher density of organisms at Golf Course – more organic matter to feed on.

Field Macroinvertebrates



No mayflies and stoneflies; 1.4% of sample caddisflies

Golf Course Macroinvertebrates



Less diversity than at the field; higher density.
No mayflies and stoneflies; 5.6% of population caddisflies.

FORE!



Conclusions

Golf course water is negatively impacted.

OCTOBER

Finding	Possible causes
Elevated water temperature	little overhead canopy
Water plant overgrowth	fertilizer runoff
Low DO concentration	*Higher temp =less DO *Plants die → increase in bacterial decomposition→ use oxygen in water *Plants use oxygen at night for cellular respiration
Acidic pH	plants releasing CO ₂ at night lowering pH

Conclusions, cont.

Golf course in March – recovers from summer plant growth

- Temperature and DO in acceptable ranges
- Low pH – snow runoff.

Conclusions, cont.

- Both sites show severely impacted macro-invertebrate communities.

- Water chemistry at the Field appears normal; peaks in nitrogen concentration in the afternoon
 - Is there an unknown source of pollution causing impact at the Field? (sewage, human activity, industry upstream)
- Benthic community at Golf Course most likely impacted by pollution which is disturbing the water chemistry -- could be fertilizer runoff

What the Future Holds

- Identify macroinvertebrates to the family level.
- Perform sampling again to compare results.
- Sample from sources upstream of the Field to determine why field site is experiencing impacted macroinvertebrate community.
- Uncover source of nitrate peaks in early afternoon.
- Protect waterways at Golf Course from fertilizer runoff.



Special Thanks!!!

- A special thanks to the staff at the BSC Watershed Access Lab (Professor Curry, Kim McCoy, and Erin Collupy)!
- Thank you to Braintree High School for supporting our efforts in this cause!
- Thank you to Katie and her parents for lending us the waders!
- Thanks to Braintree Golf Course for access to the river and carts for supplies!