

# DISCOVERY FARMS

## Trained Local Sampler Program Heisner Farm

### Program Overview 2002-2003

The Trained Local Sampler (TLS) program of the Discovery Farms was initiated in the fall of 2002. The TLS program has four main objectives:

1. Obtain high quality data to evaluate current and future surface water quality trends on the Farms;
2. Relate changes in environmental quality with costs/benefits of changed management;
3. Educate farmers and area citizens about the role of agriculture within ecosystems;
4. Bring farmer and community interests together by using study results for education.

Allen Bauman was selected as the TLS at the Heisner Farm in Mineral Point, WI. He has monitored every other week at the farm since October 2002. He worked with former Discovery Farms staff person, Shannon Hayes, & partnered with the ecology teacher at Mineral Point H.S. to bring students out to assist with monitoring. Shannon and Allen took responsibility for entering data to the online database for the program (located at: <http://www1.uwex.edu/ces/erc/discovery/>). Allen also coordinated a presentation about the program to the Mineral Point Kiwanis Club in October 2003.

### B.I.

Biotic Index (B.I.) scores are based on macro-invertebrates' tolerance to oxygen levels in the water. The scores range from 1 to 3.6. A stream is assigned a water quality rating based on its score. Sites 2-6 had scores of 2.0, while site 7 was higher at 2.3, indicating poor-fair water quality.



Heisner Farm Sampling locations  
(original map created by Larry Cutforth,  
adapted for this publication)

January 2004

# Monitoring Results 2002-3

## Sites

Seven monitoring locations were identified by Discovery Farms staff and the Heisners during summer 2002. These are shown on the map on page 1. Descriptions of the sites follow:

Site 1: Heisner Stream headwaters north of Antoine Rd, at field 64

Site 2: Heisner Stream just downstream Antoine Road, at field 30

Site 3: Heisner Farm pond outlet (north side of dam)

Site 4: Heisner Stream down from pond outlet pool

Site 5: Heisner Stream at culvert crossing near dairy, at field 18

Site 6: Heisner Stream just up from confluence with east tributary, at field 52

Site 7: Unnamed stream, east tributary, at field 52

An 8th site was monitored downstream of the confluence of sites 6 and 7 on a few occasions.

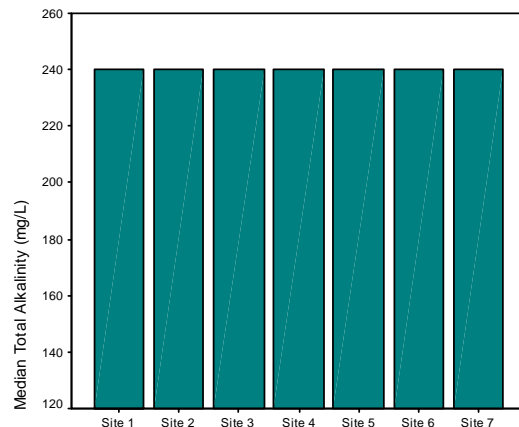
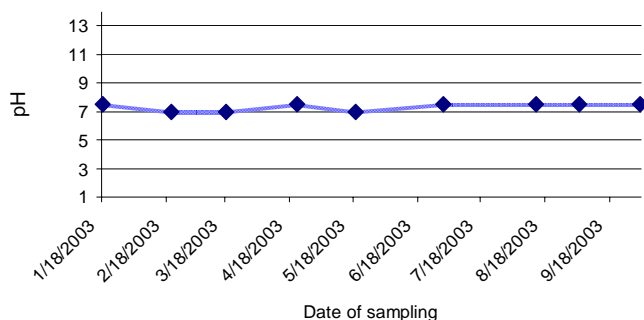


## Alkalinity

## pH

As expected, pH was extremely consistent at all sites and on all sampling dates. The chart below shows pH on all sampling dates at Site 5 to demonstrate the consistency that was found at all monitoring locations.

pH was expected to range between 7 and 8 pH units as it did, based on the types soils found in the area and their ability to keep pH of water slightly basic.



Like pH, alkalinity was a very consistent measure. Median alkalinity was 240 mg/LCaCO<sub>3</sub> at every site (and never less than 180 mg/L always at times of rain or snow melt which likely diluted the highly mineral water). Alkalinity is a measure of how much acid it takes to lower the pH of water. High alkalinity water can cause build up of lime in pipes. Because the range of the test strips used was 0-240 mg/L, a recommendation for future sampling is to eliminate this test or to use an alternative test method.

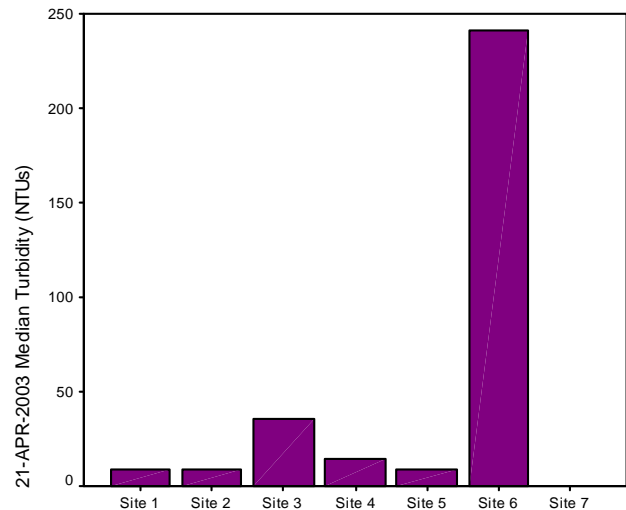
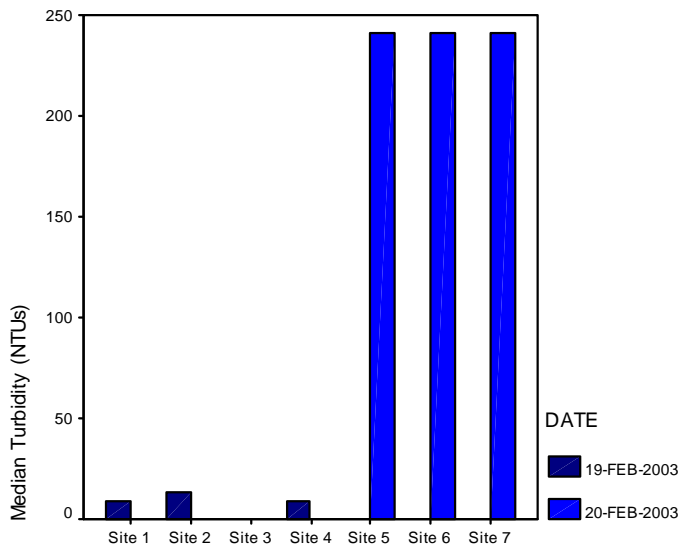
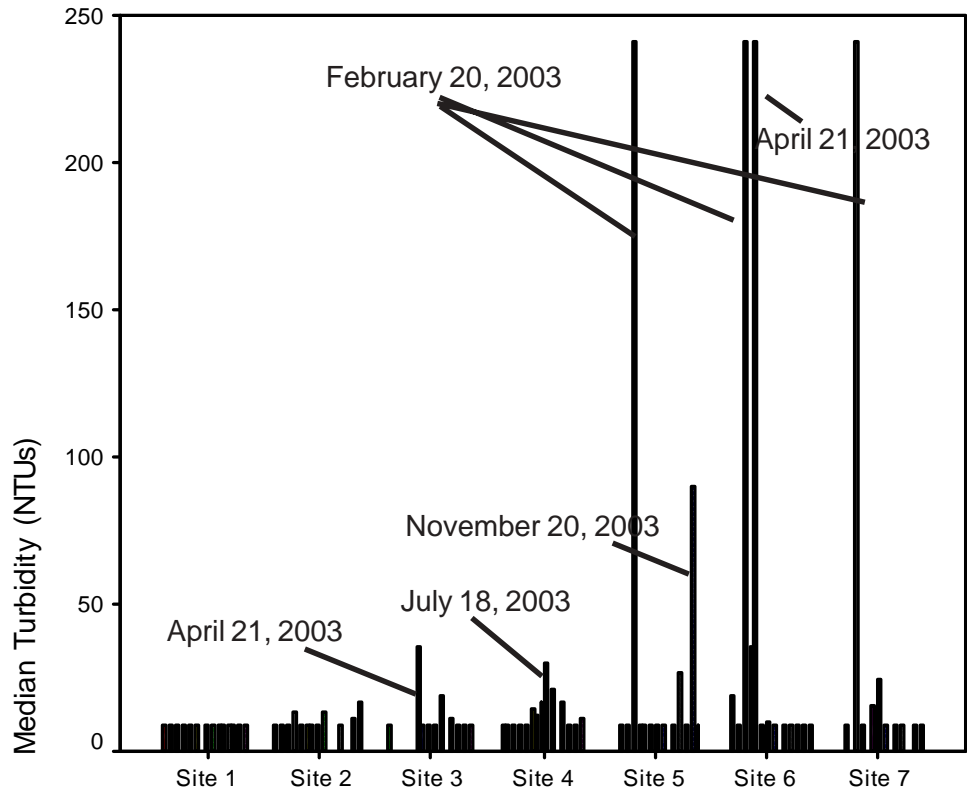
# Turbidity

At headwaters sites, turbidity was excellent over the year, with median readings of <10 NTUs (plotted on the graphs as 9 NTUs).

At downstream sites (south of Antoine Road; sites 3-7), clarity was good except on a few occasions. The dates of the largest spikes are noted on the graph to the right.

A comment made by Allen Bauman on February 20, 2003, was that "the creek was very muddy and fast moving". The weather that day and the

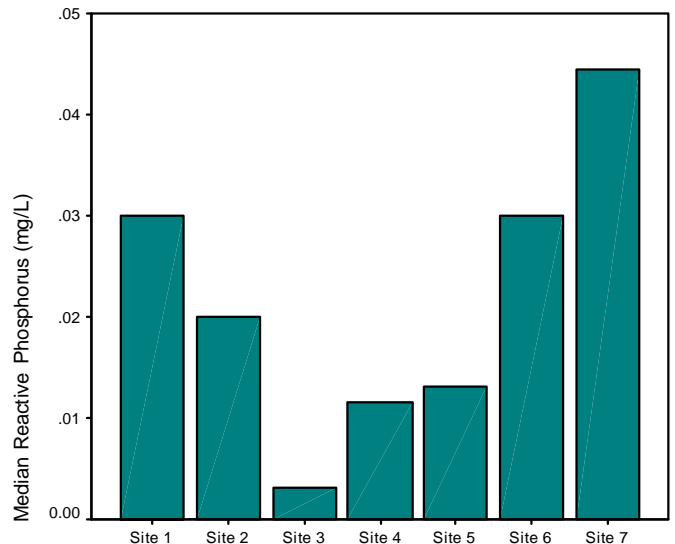
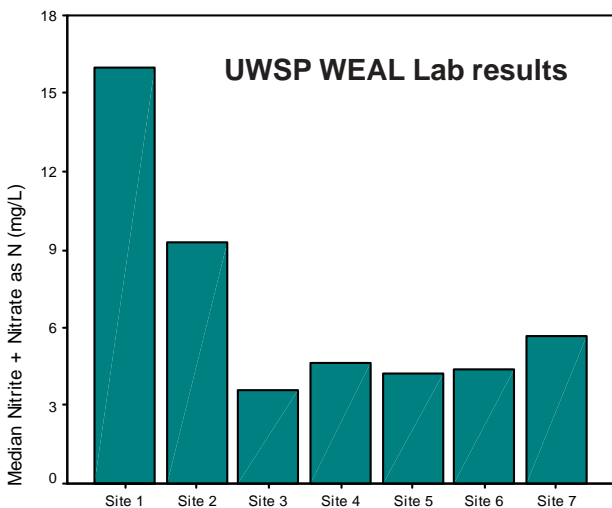
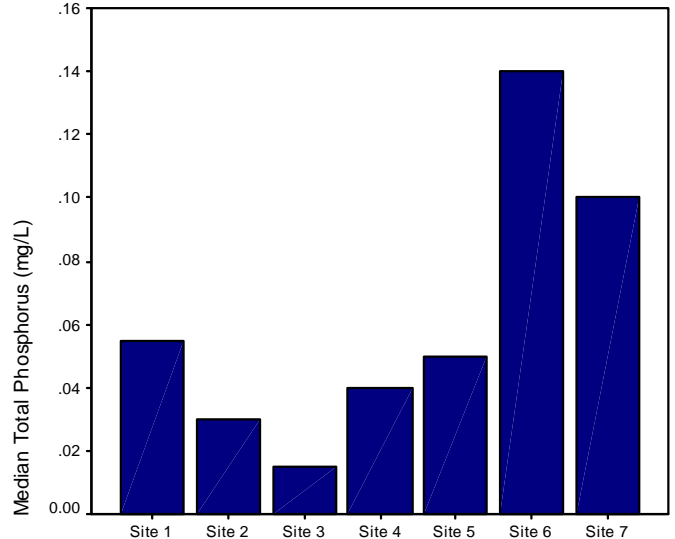
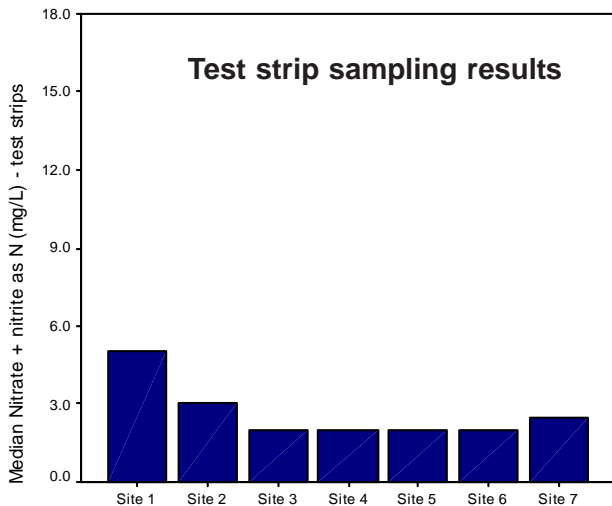
previous day was sunny. Although the water temperature didn't increase, air temperatures increased by 4 C, which may have contributed runoff to the system and caused the increased turbidity (see chart below left). On April 21, 2003, turbidity was low at most sites except site 6, where it was found to exceed 240 NTUs (see figure below to the right). Median conductivity at site 6 is 705 microS, with a range of 270 to 810 microS (see figure on page 5). On this date both turbidity and conductivity were high, which is logical since increased turbidity indicates an addition of particles to the water (which would alter conductivity). A maximum turbidity value for the year was also noted at site 3 on April 21, 2003. Although not generally considered to be a level of turbidity of concern (unless sustained for a number of hours or days), the 35 NTUs that were measured there that day do well exceed the median of 9 NTUs recorded at the site in the year of sampling that has been done. On November 20, 2003, turbidity was measured as 90 NTUs at site 5. Cows were noted to be in the water nearby. Turbidity at site 6 was not affected by this (9 NTUs of turbidity recorded on that date). A similar note was made on July 18, 2003 at site 4 ("cattle grazing in area") when turbidity was recorded to be 30 NTUs, exceeding the median of 10 NTUs recorded in 14 visits to the site over the year.



# Nitrates

On a seasonal basis, grab samples were taken and shipped to the Water and Environmental Analysis Laboratory at the UW-Stevens Point. They were analyzed for a number of nutrients. Additionally, Allen used test strips in the field to assess nutrient levels immediately. This method of testing proved very valuable in late August when nitrate levels exceeded limits of the test strips (50 mg/L as N) at site 1 (in more than one rep.). Normally nitrate concentrations at the headwaters site had a median of 5 mg/L as N (see figure below). Allen visited the site 2 days later and concentrations were down to 35 mg/L. Two weeks later, nitrate concentrations were still slightly elevated (10 mg/L), but returning to more normal conditions. He did not find a similar pattern at other sites. Site 1 consistently had higher

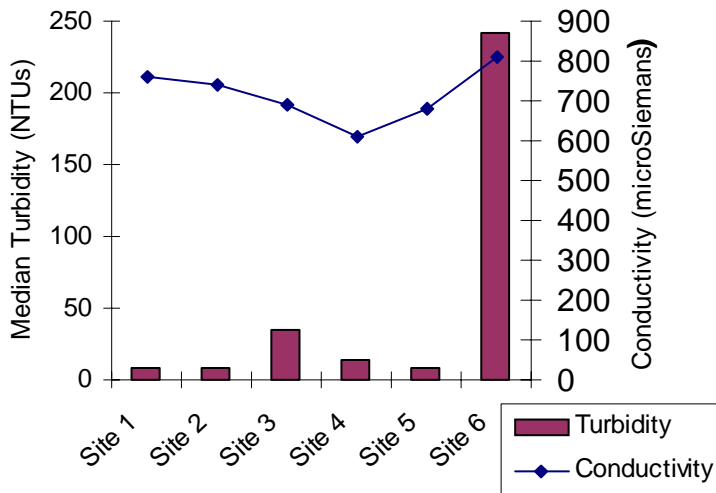
nitrate levels than other sites, with site 2 having the second highest nitrate levels. A similar pattern was seen in nitrite + nitrate as N samples run at UWSP (see figures below left). According to WEAL, The natural level of nitrate in Wisconsin's groundwater is less than 0.2 mg/L so all sites on the farm have nitrate levels that exceed the average nitrate levels in WI.



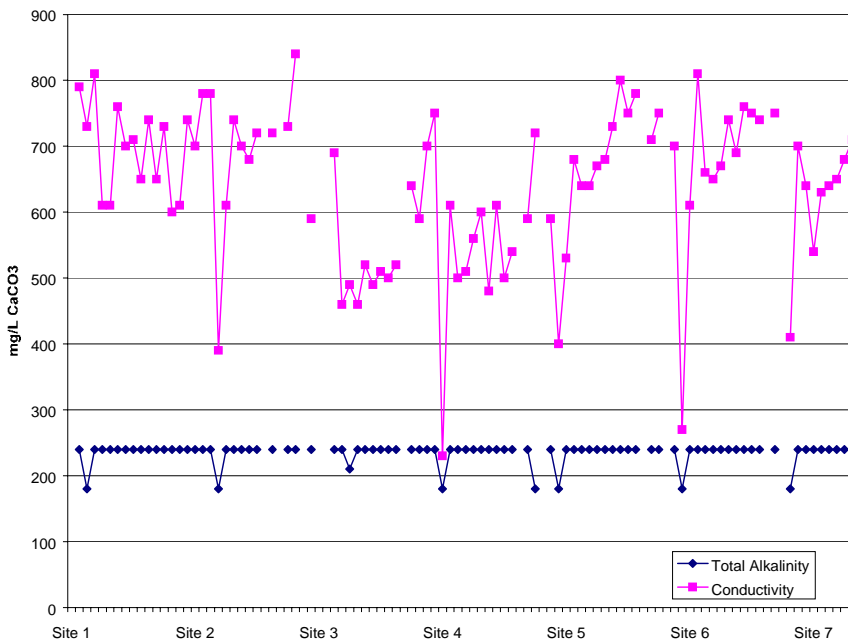
# Phosphorus

Phosphorus concentrations did not follow the same pattern. Instead WEAL lab results indicated highest median reactive and total phosphorus (mg/L) levels at the most downstream sites, with elevated levels at the 2 most upstream sites as well. The pond site had lowest phosphorus levels possibly due to plant uptake of the nutrient. Reactive phosphorus is what is biologically available for use by organisms for growth, while total phosphorus includes other forms of phosphorus that are not as readily available for use.

# Conductivity

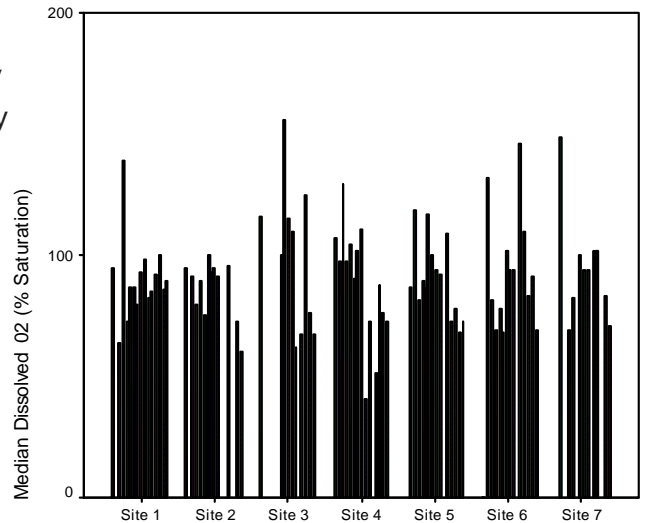


Conductivity measures how well water can conduct an electrical current. Particles (minerals and nutrients) in the water affect this quality. As mentioned earlier, when turbidity was much increased on April 21, 2003, at site 6, conductivity was also found to increase (see chart above). In general, according to WEAL, water's hardness (measured in the same units as alkalinity) should be about equal to alkalinity. Further, conductivity should be about two times the hardness of the water. We do not monitor hardness, but do find that conductivity is greater than alkalinity (see figure below). We cannot say for sure how much greater conductivity is than alkalinity since we reached the limits of the test strips when monitoring alkalinity however.



# Dissolved Oxygen

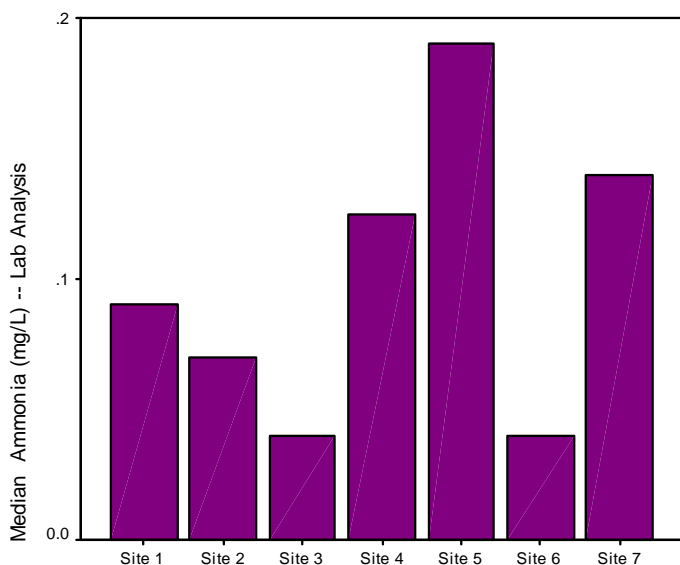
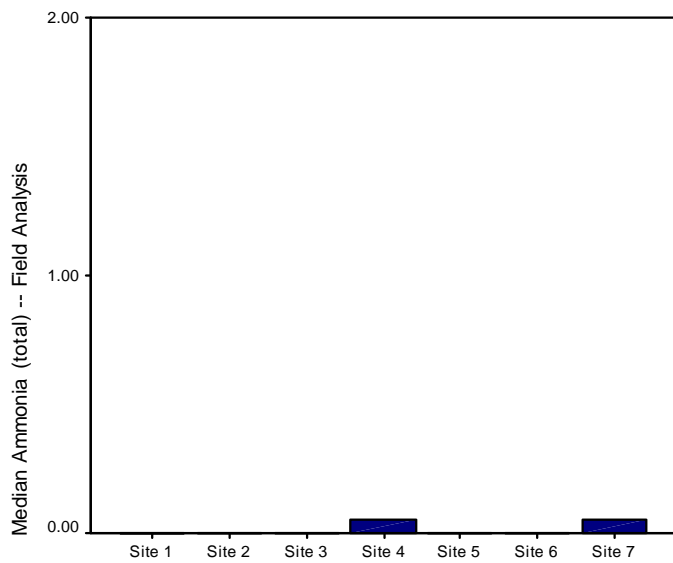
Dissolved oxygen (% saturation) describes the amount of oxygen that can be held in water at a given temperature and pressure. Dissolved oxygen levels will fluctuate during the day/night, with lowest levels expected just before sunrise when plants have not been photosynthesizing, but organisms have been using oxygen to respire. Water at higher temperatures can hold less oxygen. It was expected that stream temperatures would be moderated in the Heisner Farm stream due to plentiful inputs of naturally cool (50 degrees F) groundwater year round. Nevertheless, daily fluctuations of D.O. were expected.



You can see in the chart above that D.O. % saturation did fluctuate at each site. There was not a clear pattern to explain the fluctuation (e.g., time of day sampling was done, season, turbidity, etc.). However, the fact that D.O. dropped below 80% at every site (lows ranged from 41-69%) and exceeded 120% at all but sites 2 and 5 (highs ranged from 125-156%) suggests a reason for poor-fair biotic index scores. Organisms with highest water quality ratings require high oxygen levels for their entire life cycle, and such swings as were noted here indicate a habitat limitation for high quality organisms' survival.

# Ammonia

Allen monitored ammonia using test strips in the field as well as sending in grab samples to be analyzed seasonally. The expectation was that ammonia concentrations should be zero mg/L when using the test strips due to their precision and since ammonia should usually not be present in a stream unless there is a source (such as cattle urinating into the stream) at or nearby the site as the sample is being collected (since it readily converts to other forms of nitrogen). This expectation held true (see chart with blue bars below).

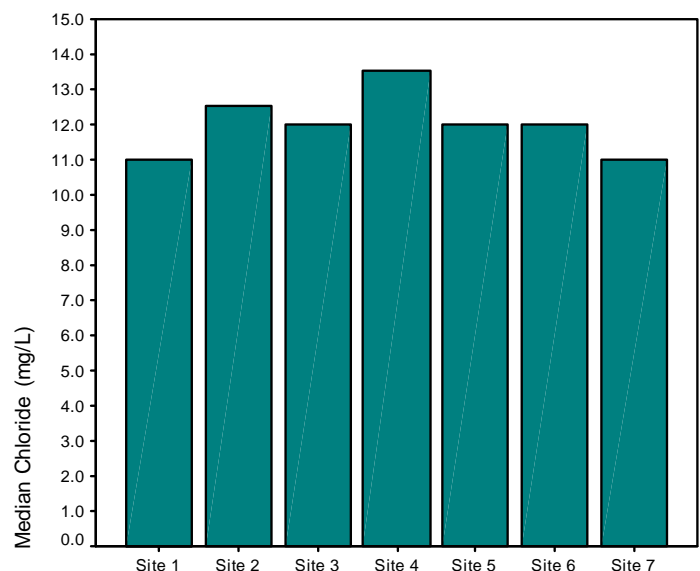


Ammonia concentrations were able to be better pinpointed through lab analyses, as shown in the figure with purple bars below to the left.

In a USGS National Water-Quality Assessment Program study, a portion of which was conducted in Wisconsin, ammonia tended to be less than 0.1 mg/L in minimally impacted watersheds. For most sites at the Heisner Farm, this held true (median concentrations are plotted on the graph). However, sites, 4, 5, and 7 had slightly more elevated ammonia

# Chloride

Chloride levels were monitored by WEAL and revealed fairly similar levels at the Heisner Farm sites (see chart directly below). According to the Student Watershed Research Project, clean rivers can normally have chloride levels of 20-50 mg/L. Chloride concentrations noted at the Heisner Farm sites fall below this range.



## Resources:

Nutrients in the Nation's Waters--Too Much of a Good Thing?

(<http://water.usgs.gov/nawqa/circ-1136h8.html>)

Interpreting your drinking water quality test results: identifying problems and solutions. (<http://www.uwsp.edu/cnr/etf/Interpre.htm#jump7>)

Student Watershed Research Project manual. 3rd. edition. 1996. Published by Saturday Academy.