2013

An Analytical Look at Glen Helen Nature Preserve Fall 2013

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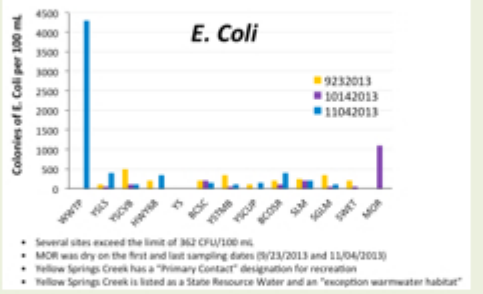
CHM 4020/6020 – Environmental Chemistry

- Service learning
- Environmental sampling and analysis
- Standard Operating Procedures (SOPs)
- Good laboratory practices (GLPs)
- EPA Methods

Sampling Dates

- September 23 — Water Quality, Anions & Metals (Water)
- October 14 — Water Quality, Anions & Metals (Water)
- November 4 — Water Quality, Anions & Metals (Sediment)

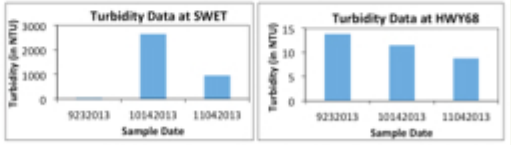


- Several sites exceed the limit of 362 CFU/100 mL
- MOR was dry on the first and last sampling dates (9/23/2013 and 11/04/2013)
- Yellow Springs Creek has a "Primary Contact" designation for recreation
- Yellow Springs Creek is listed as a State Resource Water and an "exception warmwater habitat"

	Temp (°F)	pH	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)
September 23	53.6 – 68.7	6.81 – 8.19	496 – 889	7.19 – 9.50
October 14	54.5 – 66.4	7.41 – 8.34	741 – 1658	5.07 – 10.37
November 4	48.0 – 60.8	7.59 – 8.40	727 – 1490	5.50 – 11.62

Sampling Sites

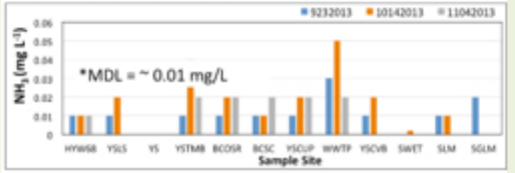
Turbidity



- Turbidity (cloudiness) limits photosynthesis in water, it reduces dissolved oxygen
- Turbidity was measured with a transparency tube, NTU is nephthelometry units
- 180 NTU limit issued by EPA for discharge from a construction site
- SWET- Stagnant, constructed wetland; does not appear to flow into the Little Miami, had excessive algae growth
- All other sites were below the limit of detection and appeared very clear

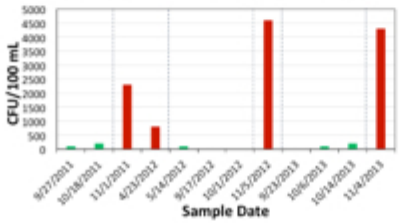
Ammonia (NH_3)

- Is toxic to wildlife and can feed algae growth
- Ammonia range measured (0.00-0.05 mg/L) is within levels considered safe
- Ammonia from WWTP is well below wastewater permit limit (0.7-2.9 mg/L)



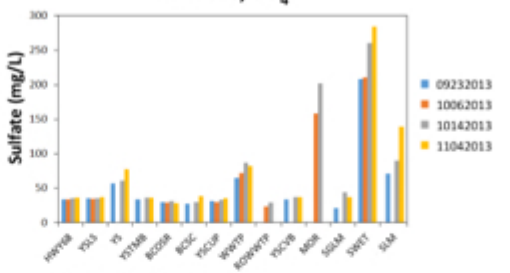
*No water was available at MOR or SMOR on any of the dates, or on 10/14/2013 for SGLM

WWTP *E. Coli*: Fall 2011 – Fall 2013

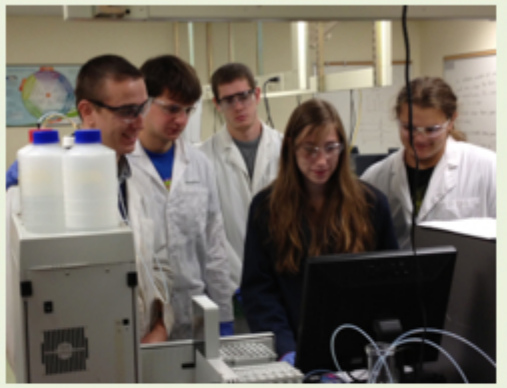


The WWTP has a summertime limit of 362 CFU (weekly) and 161 (monthly) from May 1- October 31. There is no limit in wintertime months when it is thought that recreational contact will be minimal. Chlorination of the effluent is performed during the summertime months only.

Sulfate, SO_4^{2-}



MOR, SWET – smell of sulfur present
EPA Maximum contaminant level (MCL) is 250 mg/L
The minimum detection limit (MDL) was 0.1 mg/L



Remarkable Findings for Metals in Water

- Arsenic, higher than USEPA drinking water limit of 0.01 parts-per-million (ppm), was present in water samples from The Yellow Spring
- The arsenic in The Yellow Spring is likely from naturally occurring arsenic compounds that are bound to iron compounds below the surface
- Levels of arsenic in the October 6th water sampling of the Waste Water Treatment Plant's effluent were ~ 7 times higher than the EPA's designated maximum contaminant level (MCL)
- The other sites had very low to non-detectable amounts of heavy metals in water except for the WWTP effluent, which had elevated levels of lead, arsenic, chromium, and nickel remaining from treatment of municipal wastewater

YSI Multimeter Data Conclusions

- The parameters measured using the YSI Multimeter were all within normal expected values
- Regular monitoring is important because deviations from normal ranges can indicate a more serious problem
- The decrease in temperature during the sampling period demonstrates how the change in season can affect the amount of dissolved oxygen (DO) in the water – decreasing temperature results in a normal increase in DO
- Low DO in The Yellow Spring is normal since water is depleted in oxygen as it percolated through soil into groundwater

Anion Results

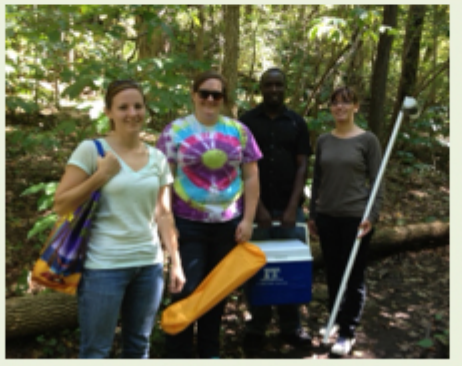
- Nitrate (NO_3^-) and phosphate (PO_4^{3-}), nutrient anions that cause excessive algae growth, were both below EPA limits
- Fluoride, bromide, nitrite, and chloride were within acceptable limits

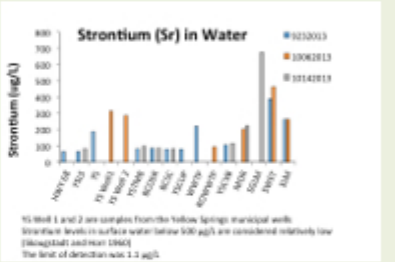
Metal Concentrations in The Yellow Spring Sediment

Metal (mg/kg dry weight)	TEC, Threshold Effect Concentration	The Yellow Spring Sediment
Arsenic (As)	9.79	170
Cadmium (Cd)	0.99	4.04
Iron (Fe)	No limit	24,892
Lead (Pb)	35.8	11.1

Remarkable Findings for Metals in The Yellow Springs Sediments

- Sediments contained very high levels of arsenic
  - Arsenic in the water deposits in sediments over time as it emerges from the spring
  - The source of arsenic is likely natural minerals associated with iron deposits
  - This can occur in SE Ohio
- Sediments contained high levels of cadmium
- Sediments contained high levels of lead
- It is not advisable for people to handle sediments from the spring
- Iron concentrations in The Yellow spring sediments are 2 to 3 times greater than sediments at other sites at about 25,000 mg/kg dry weight, giving the sediment its characteristic orange color





Strontium in Area Waters

- The significance of varying strontium (Sr) levels in area surface water and wells is unclear
- Sr is not particularly toxic but has been found at high levels in the area
- Sr is found in limestone and phosphate fertilizers
- Sr is used in some industrial processes
- A greater understanding of Sr would be good including, sources, transport, and deposits