Riverwatch Water Quality Monitoring

Spring Workshop

Katrina Froese, Education Programs Coordinator
FortWhyte Alive
April 15, 2020
Full Manual for Riverwatch Sampling

Presentation Structure

- **FortWhyte Alive Science Offerings**
  - Grades 7-12 School Programs
  - Hands-On Science Days
  - PD and Consultation Services
  - Custom Programming
- **Outdoor Education Tips**
- **Riverwatch Water Monitoring Program**
  - Introduction and History
  - Manitoba Watersheds and Water Quality
  - Booking a Program
  - Site Selection
  - Scientific Equipment Tutorials
  - Water Chemistry Tutorials
- **Other Organizations and Resources**

FortWhyte Alive's Environmental Education Programs

FortWhyte Alive is dedicated to providing students with the highest quality environmental education in an outdoor setting. For over 30 years, our programs have offered opportunities for students and teachers to re-connect and learn about nature…in nature.

Grade 7-12 Science Programs

Grade 7-8

- Everchanging Ecology
- Dynamic Diversity
- Blue Planet
- Water Watchers
- Predator vs. Prey

Grade 10-12

- Life Support
- Riparian Health Assessment
- High School a la Carte (1 hour options)
  -Wildlife Diversity
  -Forest Plant Survey
  -Soil Chemistry
  -Water Monitoring (water or ice)
  -Snow Science

All programs are outdoor experiences which link to Manitoba curriculum outcomes.

www.fortwhyte.org/schoolprograms

Hands-On Science Days

Freshwater Ecology Day - October

- Learning stations include water sampling, water chemistry, shoreline remediation, aquatic invertebrates, and watershed concepts.
- FREE for Grades 7-12, registration open to groups of 10 students.
- Led by partners and experts from: IISD-Experimental Lakes Area, University of Manitoba, Manitoba Conservation Districts, and more.

Hands-On Science Days

Arctic Science Day - March

- Researchers from U of M's Centre for Earth Observation Science run learning stations connecting to biology, chemistry and physical changes in the Arctic related to climate change.

- FREE - Middle Years (Grade 6-9) – 30 students per school, half day

- FREE - High School (Grade 10-12) – 5 students per school, full day

Hands-On Science Days

Soil Science Day - May (2020 cancelled)

- Experts from Manitoba Agriculture, Conservation Districts and U of M teach concepts of soil science and management,including nutrient cycles, soil types, sustainable land use and more.

- FREE Grades 9-12, 10 students per school.

PD and Consultation Services

Outdoor Educator: Professional Development Workshop

- In-depth PD workshop involving theory, practice, risk management, and curriculum linking
- Half-day or full day sessions available

Consultation

- Naturalist Services
- safety analysis of outdoor space
- teaching/land use idea audit
- Custom-built lessons for your school, online lesson plans
- Anything we can do to get your students outside more often!

Barret Miller, FortWhyte Alive
Email: bmiller@fortwhyte.org
https://www.fortwhyte.org/foreducators/teacherpd/outdoor-educator/

Deeper Connections Custom Programs

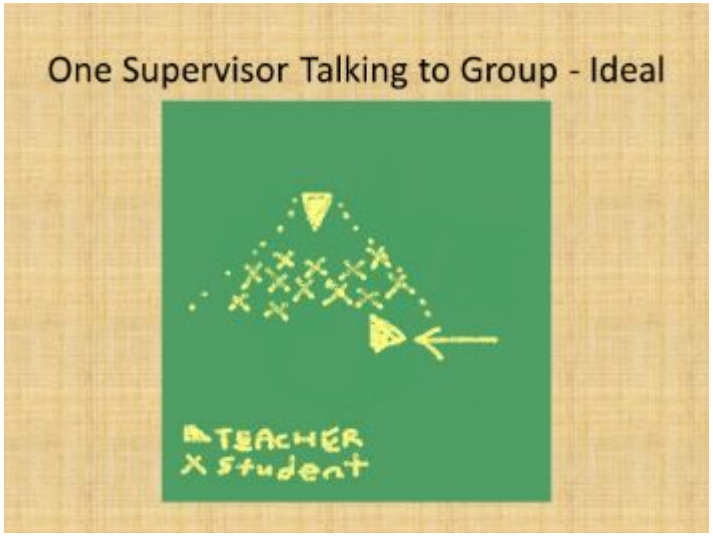
- We work with educators to develop custom outdoor inquiry-based learning programs and facilitate these programs with students.
- These programs can happen at school, at FortWhyte, or both.
- Price varies, but is in line with other student experiences that FortWhyte offers.

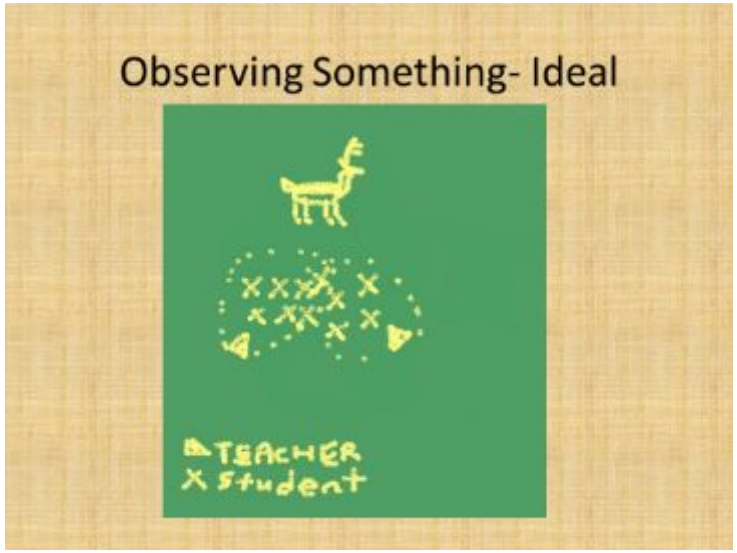
Examples:

- Ecole Edward Schreyer Gr 10 Science: After an ecological inventory, students developed a field guide to the forests in their town.
- Balmoral Hall Gr 10 Science/Social Studies: using map reading and GPS skills, students explored our watershed and how to protect it.
- Contact education@fortwhyte.org

Tips for Teaching Outdoors

- Think about your strategies for getting attention.
- Take advantage of teachable moments.
- Be aware of risk, and be aware that your students may have different perceptions of risk than you do.
- Identify and mitigate risk as a group.





Real Risk vs. Perceived Risk

- **Real Risk:** The actual likelihood of a negative outcome for the group or any member of the group.

- **Perceived Risk:** a group or participant's anticipated likelihood of a negative outcome of an activity.

With an experienced group leader, a snowshoe hike has low real risk, but high perceived risk for inexperienced participants.

Some Examples of Real and Perceived Risk

- Separation from the group:

  Real risk – medium-low. Perceived risk – can be high.

- "Stranger Danger":

  Real Risk - Low. Perceived Risk - High.

- Traffic:

  Real Risk – High. Perceived Risk - Medium-low.

- Environmental Hazards: Plants, Animals, Weather, Water, Elevation

  Real Risk - Generally Low. Perceived Risk - Moderate to High.

Riverwatch

Riverwatch Goals: Engage students in the water quality issues in their local community through hands-on experiences.

Objectives:

- Promote safe and effective outdoor curriculum-linked learning
- Provide access to water testing equipment
- Collect student data in Winnipeg rivers and streams, contribute to local database
- Increase awareness of water issues and inform student action related to local water quality issues.

- RiverWatch began its life in Manitoba through Oak Hammock Marsh, in 1995, and at the same time became very active in Minnesota and North Dakota.
- Since 2009, South Central Eco Institute (Kent Lewarne, Prairie Spirit School Division) has facilitated the Riverwatch.
- FortWhyte Alive began facilitating Riverwatch with Winnipeg schools in Fall 2017.

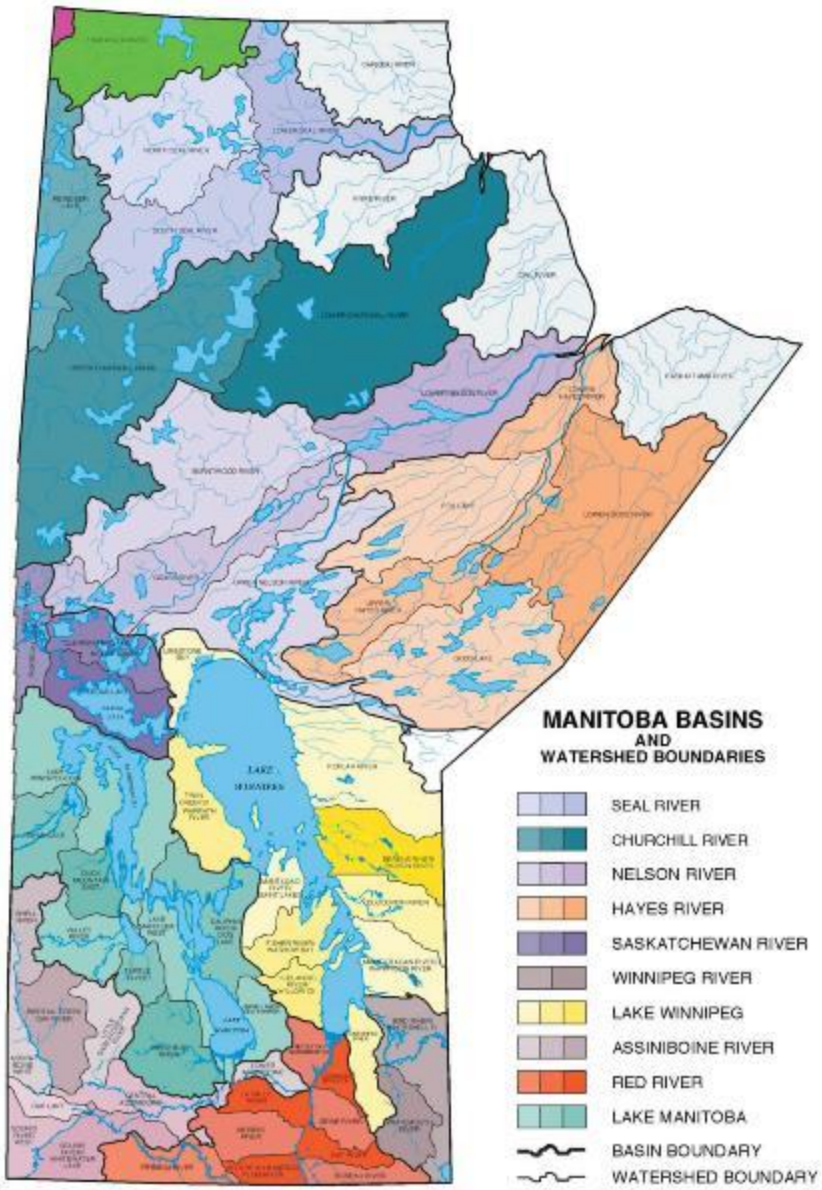
Riverwatch in North Dakota

h er-w
a

Watersheds

Watershed: the land and waters that drain into a particular waterbody.

- Lake Winnipeg's watershed is 1 million sq. km. and includes sections of 4 provinces and 4 states.
- Manitoba is home to many smaller sub-watersheds.
- 68% of the total phosphorus contribution to Lake Winnipeg enters through the Red River Watershed.



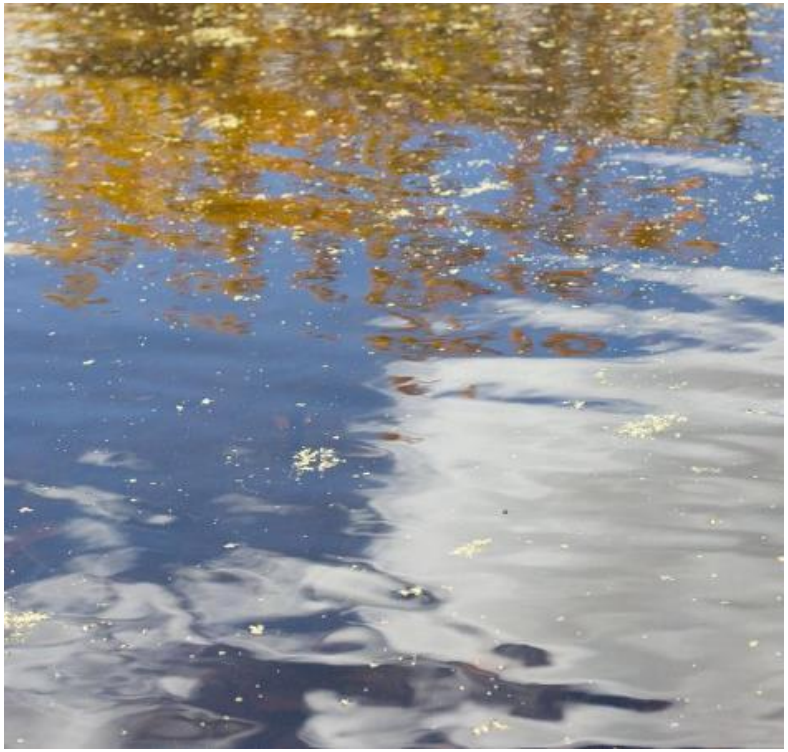
https://www.gov.mb.ca/waterstewardship/water_info/transboundary/maps.html

What is Water Quality?

Water quality is a measure of safety or health when compared with particular guidelines.

Canadian Quality Guidelines:
- Protection of Aquatic Life
- Drinking Water

What we can measure:
- **Physical:** how transparent is the water? What is the temperature, depth?
- **Chemical:** nutrients: phosphorus, nitrate, ammonia, dissolved oxygen
- **Biological:** invertebrates, bacteria, algae, fish etc.



Winnipeg's Urban Water Quality

Some issues that are discovered:

- Perceived vs. real water quality measurements (often students perceive worse water quality than reality)
- Shoreline erosion impacts
- Eutrophication (nutrient pollution) – impact of flooding and phosphorus
- Litter – need for community cleanup
- Zebra Mussel awareness
- Stormwater/wastewater impacts

Blue green algae at Grand Beach, Lake Winnipeg, 2019

Litter in a Winnipeg ditch, 2019

How to Book a FWA Riverwatch Program

- Contact FWA with group size, 3 date options, and a location requested.
- We will assist you by choosing a monitoring site that works for you.
- We will meet your group at the site to complete a monitoring session using the Riverwatch Kit full of scientific equipment.
- Students take a variety of measurements: water depth, transparency, a variety of water chemistry tests, and aquatic invertebrate investigation.
- We may also clean up garbage at the site.
- FWA uploads the data collected to the Riverwatch database.

April 20-June 26, 2020
Program Fee: $175
Group Size: 4 - 25 students*
Length: 2 hours
*** Custom group sizes available upon request**

Rural teachers, please contact Kent Lewarne, **klewarne@prspirit.org**

Winnipeg Site Selection

Small rivers, streams, and creeks

- Sample from pedestrian bridges
- Many creeks have been impacted by city drainage.

Red and Assiniboine Rivers

- Divided pedestrian walkways on bridges allow safe sampling.

Retention Ponds

- Store stormwater* to settle out some pollutants before water flows to rivers.
- Shallow shorelines and safety protocol can provide wading access.

Marshes or ponds

- "Duck ponds" - Assiniboine Park, Kildonan Park, St. Vital can be accessed with cement barriers.

*Stormwater = runoff from city streets after snowmelt or rainfall.

Site Safety

Rule of Respect

- yourself, each other, nature/environment

Expectations

- Site safety check by students using worksheet/discussion
- Assess the risk
- Plan to minimize
- Mitigate factors that can't be 'planned out'

Students sampling from bridge wearing reflective vests.

Physical Measurements

Trundle Wheel

50 m transect tape

50 m tape or Trundle Wheel

- measure the width of the river estimating from the bridge surface.

Depth measuring tape with weight

- measure the depth of the river at the centre from the bridge.

Water Sampling

Van Dorn Water Sampler

- A horizontal tube with cups on each end, and a mechanism to pop the ends closed by deploying a heavy metal “messenger” down the line.

- Collect a water sample from the bridge using this “water trap” into sample bottles

Physical Measurements

Transparency Tube

- Water samples are poured into the tube.
- Water is let out until the black-and-white Secchi disc at the bottom of the tube is clearly visible through the water.
- Secchi discs have been used by water scientists for hundreds of years to assess water transparency
- Video (Youtube)
- Transparency Tube Info

Water Chemistry Test Options

La Motte TesTabs (Grade 7-9)

- non-hazardous dry tablets are added to water samples and compared with colour chart using easy-to-read, diagrammed instructions
- **pH, Phosphorus, and Dissolved Oxygen**

La Motte Reagent Kits (Grade 10-12)

- liquid and dry reagents are mixed following written directions, reagents are potentially hazardous and require hand and eye protection.

pH -
Instructions, MSDS and Video

Low Range Phosphate -
Instructions, MSDS, and Video

Dissolved Oxygen (titration kit)
Instructions, MSDS

Nitrate-Nitrogen -
Instructions, MSDS, and Video

Aquatic Invertebrate Collection

- Aquatic invertebrate populations respond quickly to changes in water quality.

- Some species are particularly sensitive to reductions in dissolved oxygen, including types of dragonflies, caddisflies and mayflies which breathe using gills.

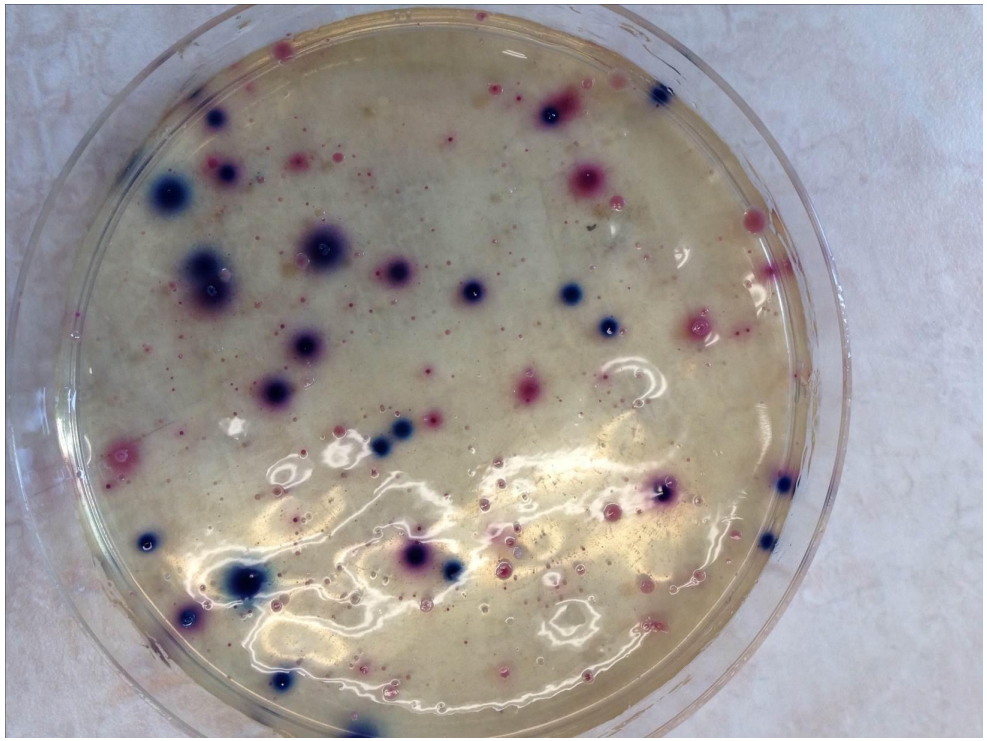
- Students use nets or a plankton tow to collect invertebrates and identify their diversity.

E. Coli Counts

E. coli bacteria are found in water with fecal contamination from waterfowl, pets or in some cases sewage inflow

Schools can be provided with a growth medium called Coliscan Easygel and a petri plate to culture and count the number of colonies in water from their site.

Purple and dark blue colonies are E. coli - this 5mL sample grew 26 colonies, so this would represent water with 520 colonies / 100mL - well above the advisory range.



Water Tests Interpreting Results

> ppm = parts per million, also expressed as mg/L (milligrams per litre).
NTU = Nephelometric Turbidity Units

Dissolved Oxygen
> 8 ppm high oxygen
< 5 ppm low oxygen - fish stress
< 1-2 ppm anoxic - fish death possible

Phosphate (Orthophosphate)
0.7 – 1.2 ppm expected for Manitoba's urban/agricultural areas
0.03 – 0.1 ppm expected for Manitoba's natural areas
(Lake Winnipeg Foundation)
* 1 ppm total phosphorus is the current Manitoba wastewater release target

E. Coli
> 200 colonies/ 100mL – contamination, take caution if swimming

pH
> 9.2 basic
6.5-8.4 normal range
< 4.8 acidic

Turbidity/Transparency
> 60 NTU/ < 15 cm = murky
< 10 NTU/ > 50 cm = clear

Nitrate
> 10 ppm long term toxicity in drinking water
> 3 ppm long term negative impact on fish and invertebrates.

- Expected value less than 1ppm

Organizations and Resources

FortWhyte Alive

Barret Miller
Professional Development, Workshops, Deeper Connections Custom
bmiller@fortwhyte.org

Katrina Froese
Riverwatch, Hands on Science Days
kfroese@fortwhyte.org

South Central Eco Institute Riverwatch
Kent Lewarne, Prairie Spirit School Division
klewarne@prspirit.org

IISD - Experimental Lakes Area
Sarah Warrack, Education Officer
swarrack@iisd-ela.org
https://www.iisd.org/ela/education-and-outreach/

Lake Winnipeg Foundation Teaching Resources
https://www.lakewinnipegfoundation.org/teachers