Visualizing and Quantifying Sources of Nutrients in the Agriculturally Dependent Muskrat Lake Watershed

Funding for the WAMQI project has been provided through Growing Forward 2, a federal-provincial-territorial initiative. The program is administered by Farm & Food Care Ontario.

A Presentation by : Sarah Hall and Julie Sylvestre

Growing Forward 2
A federal-provincial-territorial initiative

Water Adaptation Management and Quality Initiative

FARM & FOOD Care ONTARIO

Ontario

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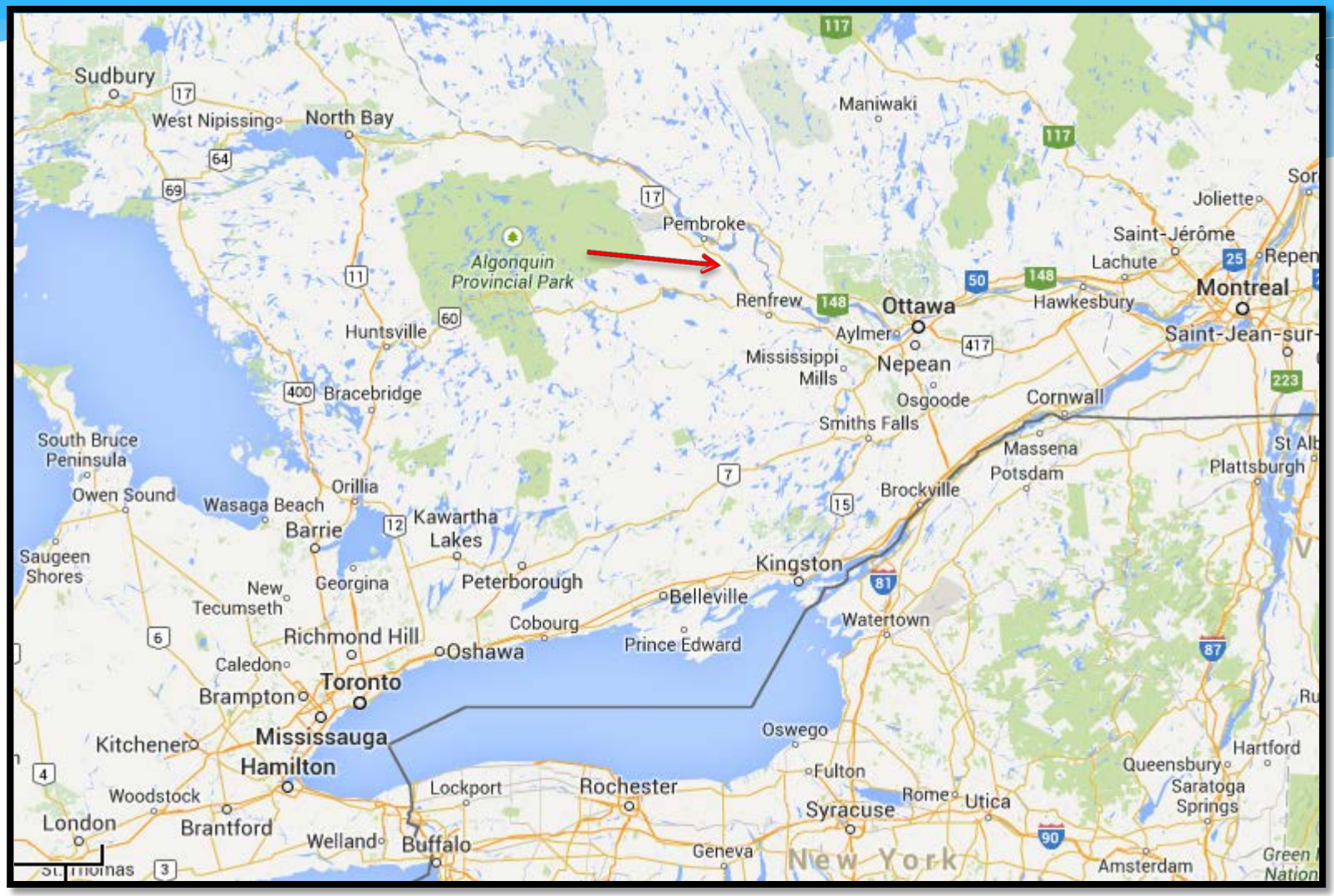
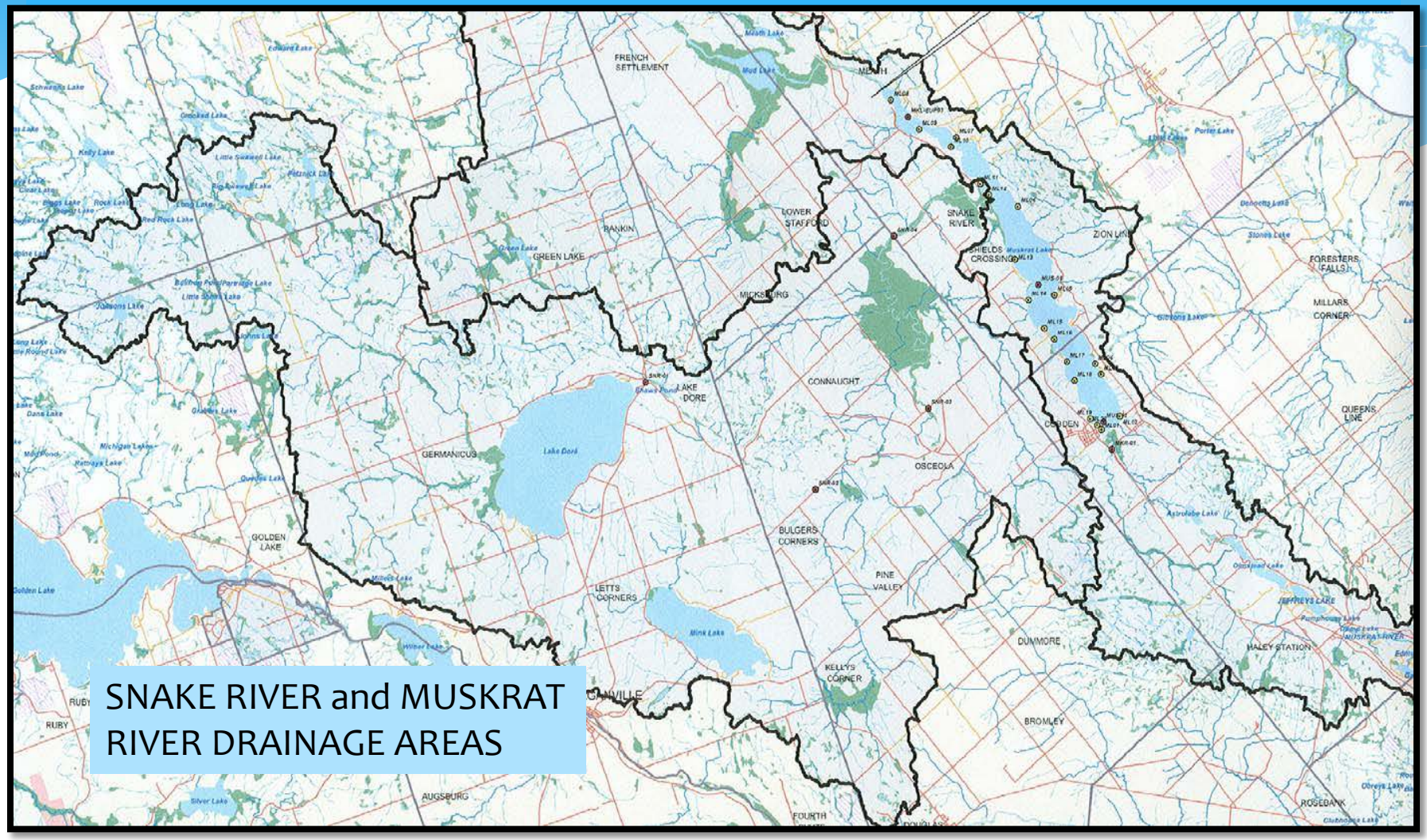
ALGONQUIN COLLEGE | Applied Research & Innovation

Muskrat Lake in Context



Muskrat Drainage



Muskrat Lake Watershed: A Rather Unique Landscape

Muskrat Lake

- Surface Area 1201 hectares
- HMSL 137.2 m
- Maximum Depth 64 m
- Lake Volume 213,200,000 cu. m
- Perimeter 34 km
- Mean Depth 17.7m
- Muskrat R.Watershed 266 sqkm
- Snake R.Watershed 393 sqkm
- Annual Lake Flushing Rate of One
- One of only 23 lakes that sustain lake trout

Source: Kirby Punt, MNR

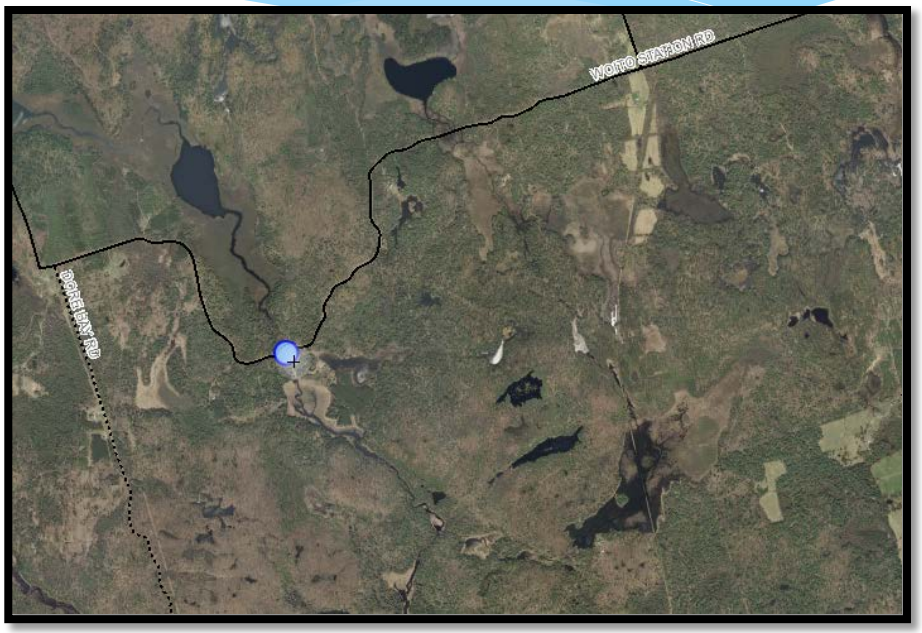
Muskrat Lake: Unique Geology

Source: Renfrew County Mapping Portal

* On the Northeast side, Canadian Shield
* On the west side largely agricultural and developed but part of the St. Lawrence Lowlands
* Geology has driven historical activity

Impacted vs Non-impacted Areas

The Snake River Drainage downstream has been significantly altered and the landscape is heavily patterned by agriculture and is influenced by many human activities



…but there are remaining areas at the headwaters which are relatively non-impacted.

Muskrat Lake: Residents

- In 1968 there were 132 cottages, 21 homes and 5 resorts.
- Today there are: approximately 160 homes, 20 farms and 5 resorts, 315 LOR
- Approximately 13.4 km of western shoreline is still agriculture
- Under pressure to continue to develop

Source: Kirby Punt, MNR

Source: Renfrew County Mapping

Muskrat Lake: Hydrology

- Significantly altered
- Extreme seasonal fluctuations
- Ice scouring
- Inconsistent inputs
- Water levels regulated


APRIL 2014 OS-01
Olmstead


JUNE 2014 OS-01

Harris Drain

Muskrat Lake: Fish Biology

- Longnose gar
- Lake trout
- Rainbow smelt
- Northern pike
- White sucker
- Smallmouth/largemouth bass
- Pumpkinseed
- Rockbass
- Yellow perch
- Walleye
- Brown bullhead
- Lake sturgeon
- Channel catfish
- American eel
- Silver redhorse
- Shorthead redhorse
- Golden shiner
- Spottail shiner
- Bluntnose minnows
- Banded killifish
- Iowa darter
- Johnny darter
- Logperch

Muskrat Lake Watershed: Use

- Drinking water supply for the town of Cobden
- Location of the Cobden sewage treatment plant
- Easily accessible and rewarding fishing
- Aggregate mining in the area
- Agriculture is extensive
- Recreation and tourism

The Same Challenges

Despite our small size, we have all of the same challenges as are seen on much larger lake systems

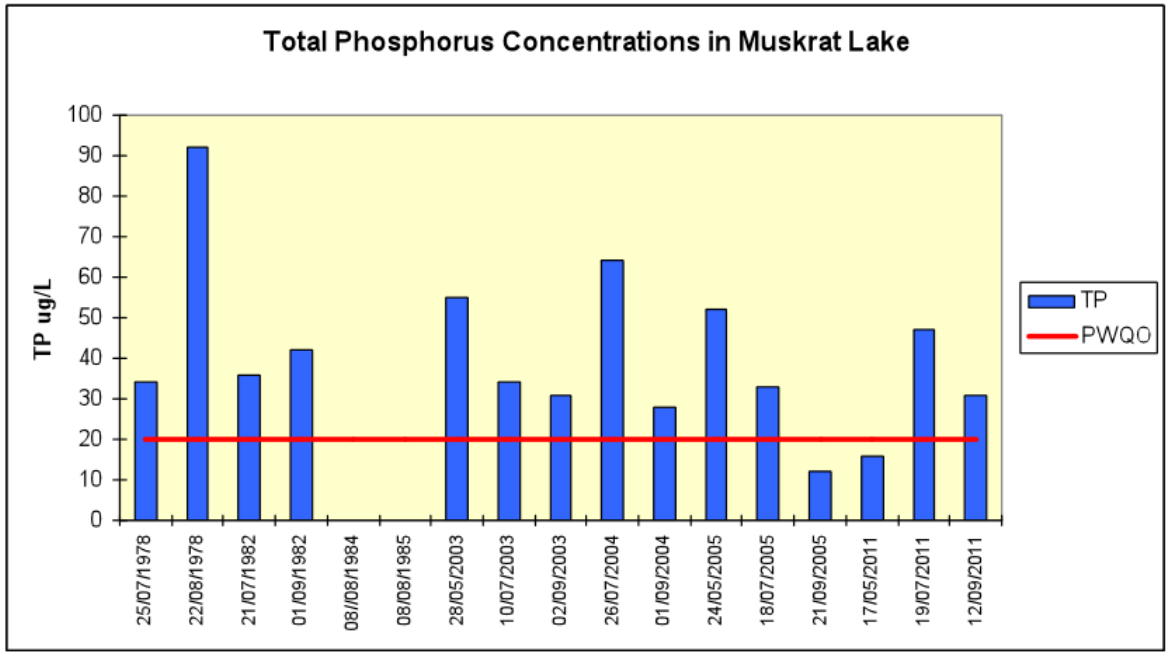
- Algal Blooms and Bacterial Contamination
- Zebra Mussels
- Sewage treatment plants not always able to meet demand
- Diversity of opinions, development vs. non development
- Naturally eutrophic (or at least mesotrophic conditions)
- Lack of awareness of the benefits of BMPs
- Confusion among landowners and also scientists
- A lack of any long term scientifically defensible data
- An at capacity lake
- Sometimes difficult to determine regulatory authorities

In a Nutshell: Too Much Phosphorus?

* Agricultural Activities
* Wastewater Treatment Plants
* Septic systems
* Removal of natural wetlands & bio-filtration
* Shoreline development
* Storm-water runoff
* Municipal/Tile drains
* Dams
* Nutrient Storage in the Lake
* Naturally high levels of nutrients

Background site: Blacks Creek

Phosphorus, an essential nutrient



Source: Victor Castro, MOE

* 10ug/l should not be exceeded
* 20ug/l can lead to excess plant growth
* 30ug/L promotes algal blooms

The Good News
Our Opportunities

- Community Momentum escalated by the Muskrat Lake Symposium, establishment of the **Muskrat Watershed Council** and the **Muskrat Lake Association,** plus many other local associations
- Algonquin College new campus with Environmental Tech program and extensive field and lab expertise
- Local people empowered to seek change and in a small enough area that progress may be seen in our lifetime
- A wealth of science expertise and a committee with diverse backgrounds
- A wealth of local ecological knowledge and willing participants who want to help
- Advanced technologies in use to help understand the issues and find solutions

Why Algonquin College?

An Opportunity for our Environmental Learners and the Community

* Provide meaningful learning experiences for students
* Seek answers to scientific questions
* Support community partners
* Secure funding
* Collect and analyze credible, reliable, and consistent scientific data
* Contribute to solutions

Our Grant Application

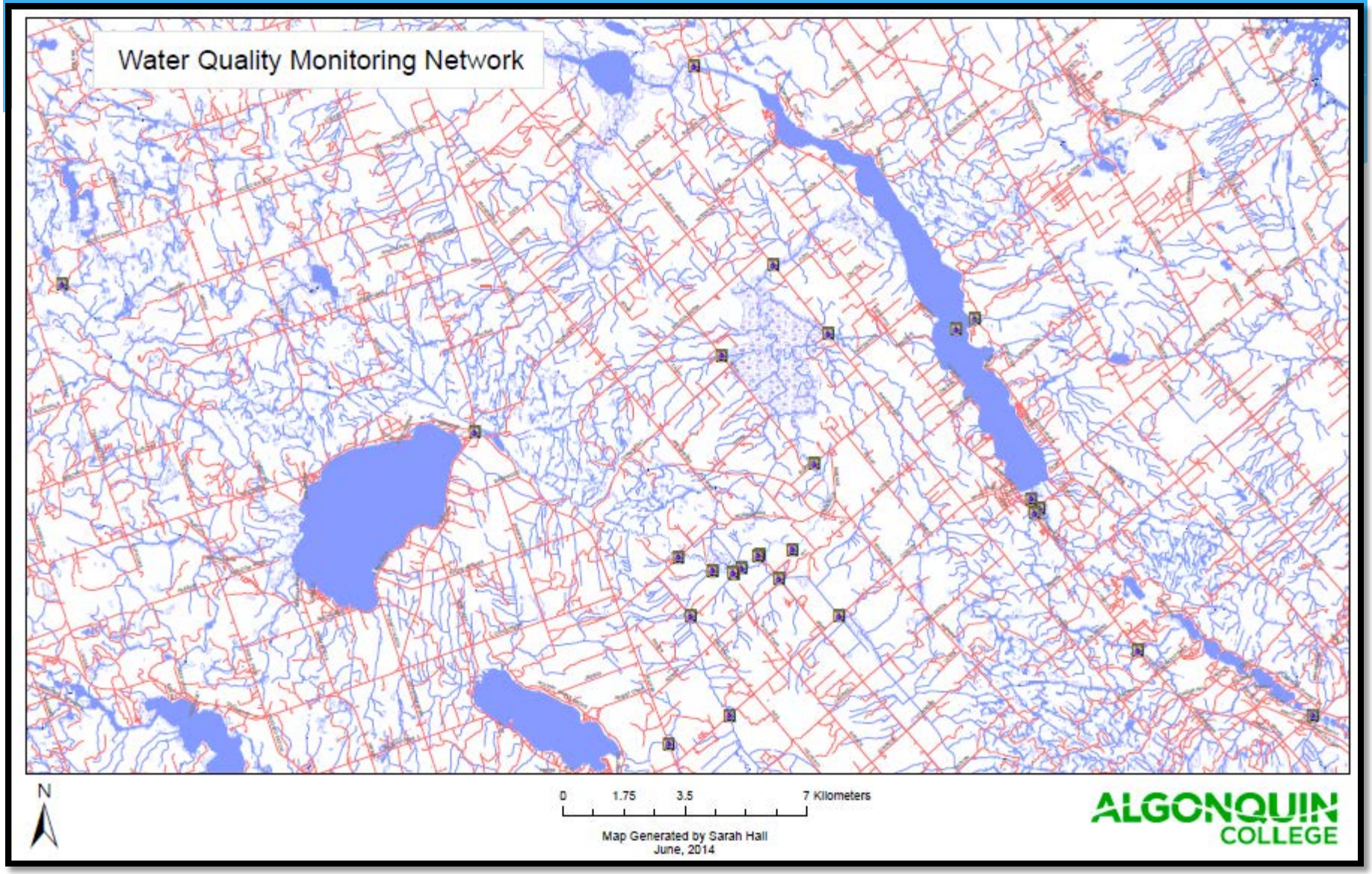
Funded by Farm and Food Care Ontario
Supported by Many Local Partners

* Identify Water Quality Issues
* Determine the extent of agricultural contribution and links to various land use practices
* Quantify other inputs of nutrients
* **Provide data to support the Muskrat Watershed Council and its Science Committee**
* Make recommendations on best practices

Environmental Tech Students:
Allison Rosien and Tanner Roderick

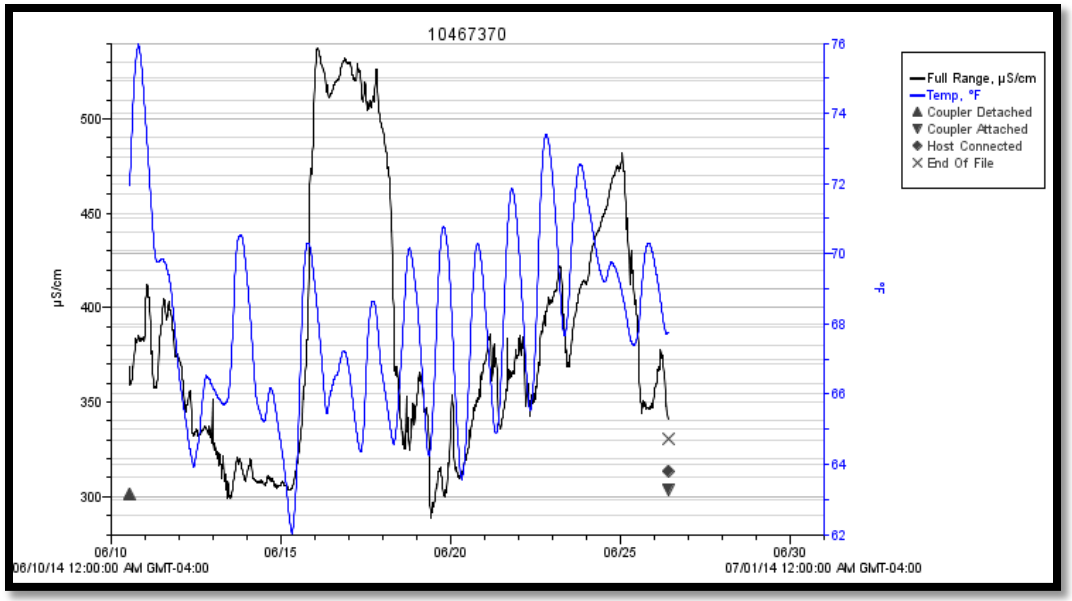
Monitoring Network Data Collection
April, 2014 – October, 2014

The Sampling Design: 28 Sites



Data Collection: Water Quality

* Monthly water quality data analyzed by MOE, major ions, nutrients and metals (no pesticides)
* Monthly water quality data analyzed by partners, some samples analyzed in house
* Real time data collection for conductivity at 3 sites using data loggers



Data Collection: Water Quantity

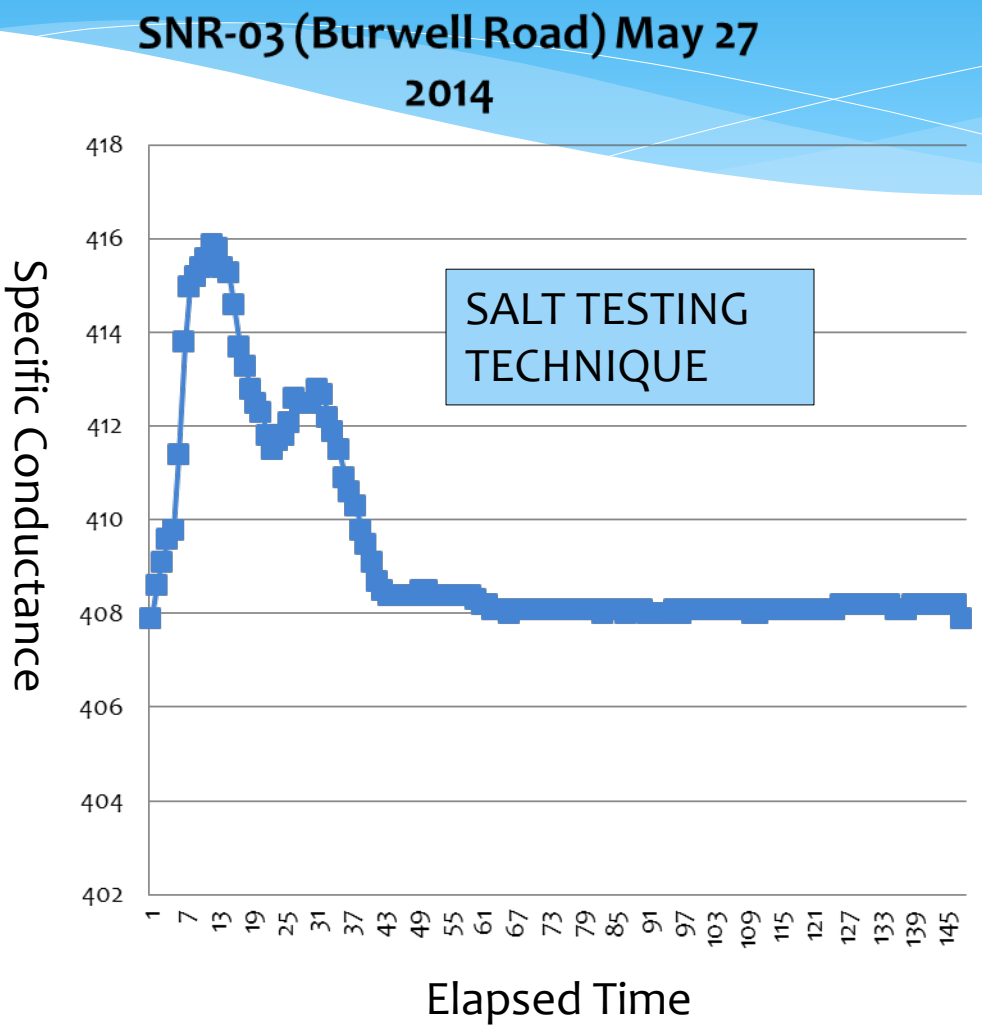
Manual:

SONTEK and Salt Slugs

Automated:

HOBO water level loggers (3)

Water level stream gauges, manually read at all sites



Protocol + Trained Student + Accredited MOE Lab
= data reliability and consistency

* 3 rinses
* pH reading
* Conductivity readings
* Gauge reading
* Logger Checks

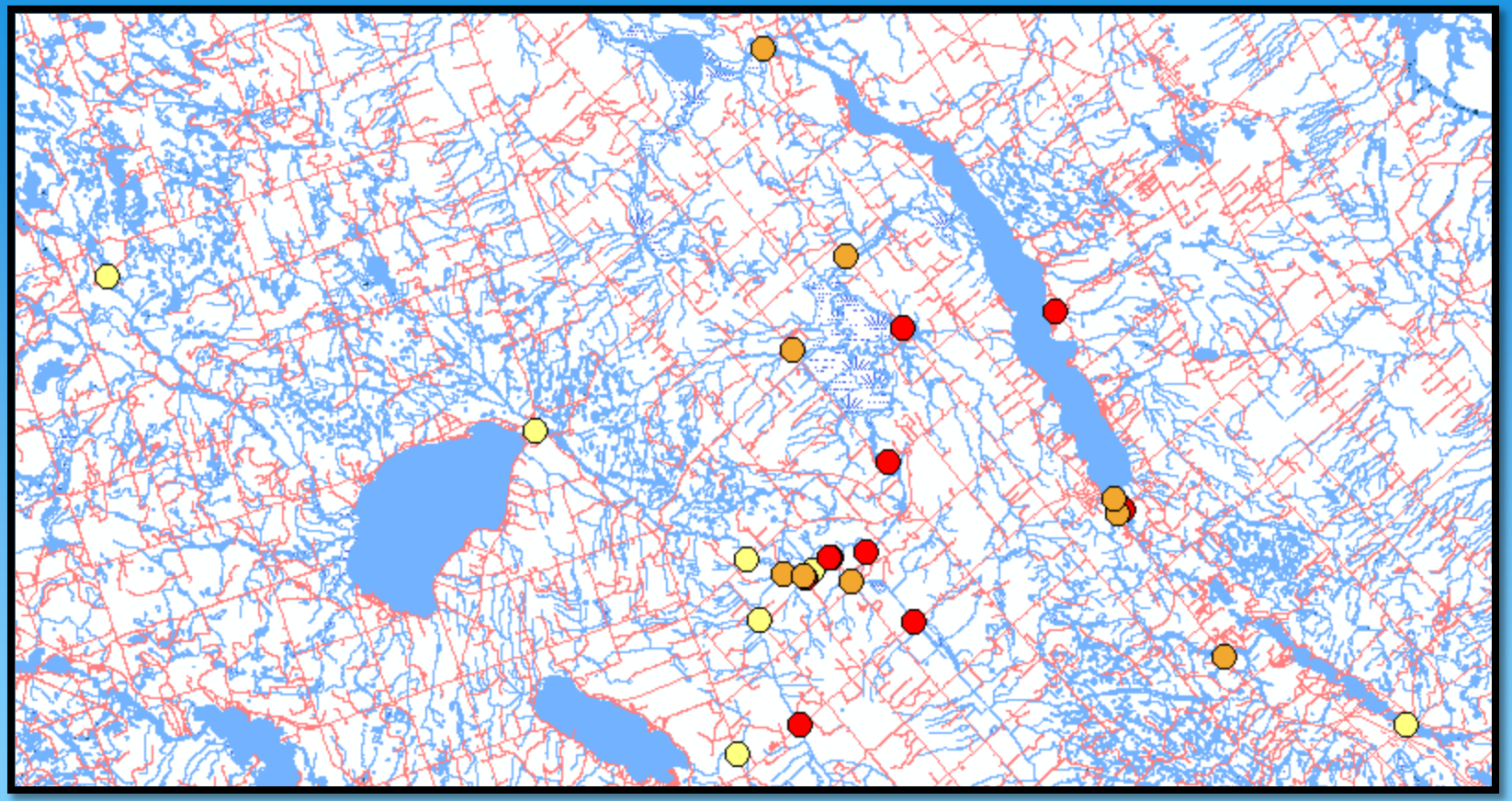
A Snapshot of the Monitoring Data

Water Quality, MOE

Spatial (Map Based) Data Summary

- Helps answer the question of where are the challenges and issues
- Are there "hotspots "and where are they ?
- Actual values are converted to a meaningful "color" to help with interpretation by the public and the science committee
- Snapshot look, limits interpretation unless a series of maps are used to illustrate changes over time and there is a full understanding of natural variation
- Not a good way to look at changes at a single site over time
- **Seasonal fluctuations and natural variability can only be understood by using a long term collection of data over a long time period**

Total Phosphorus, April 2014



Provincial Water Quality Guidelines

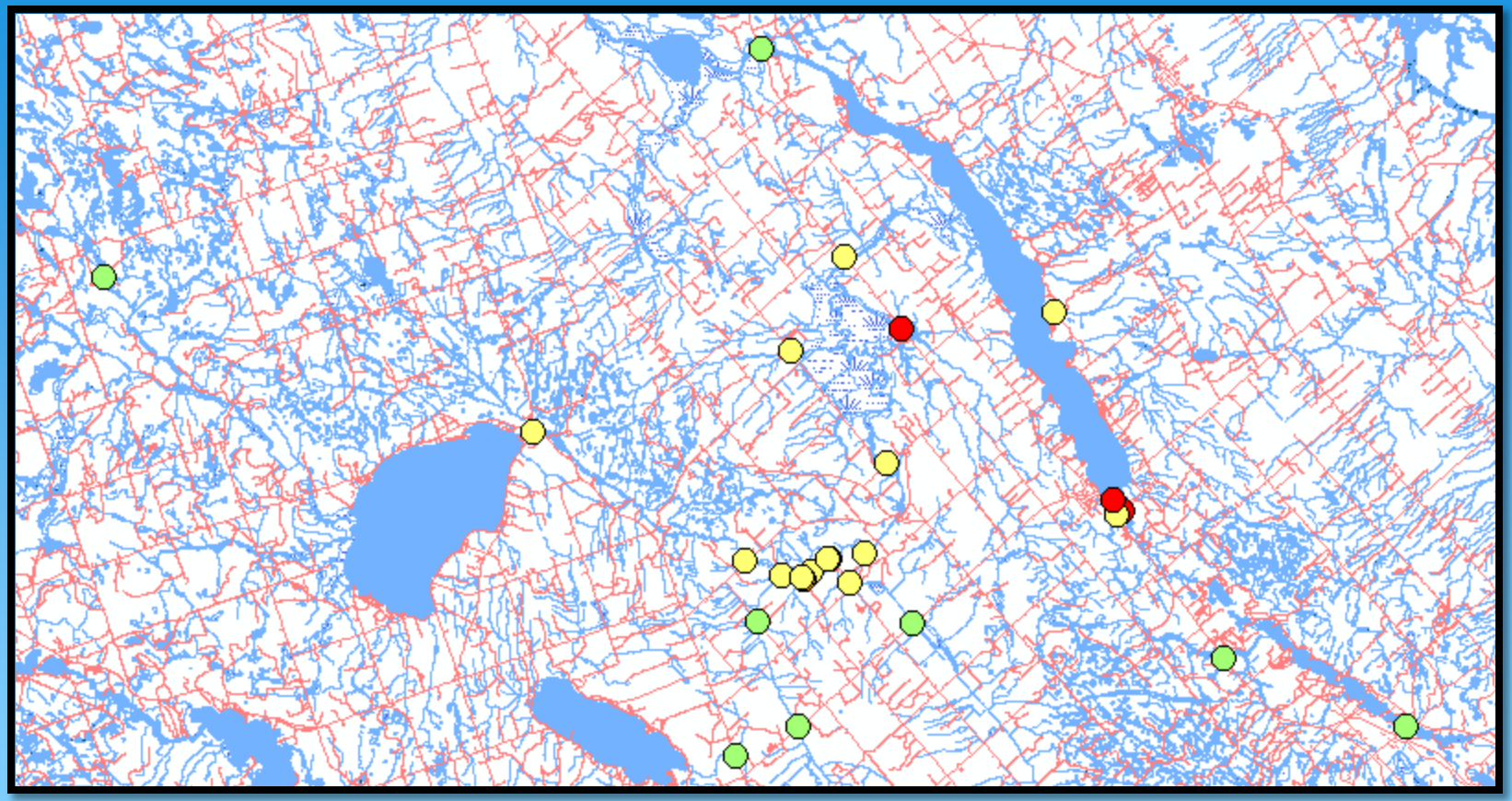
10ug/l should not be exceeded

20ug/l can lead to excess plant growth

30ug/l promotes algal blooms

- <10ug/l
- 10ug/l – 20ug/l
- 20ug/l – 30ug/l
- >30ug/l

Total Phosphorus, May 2014



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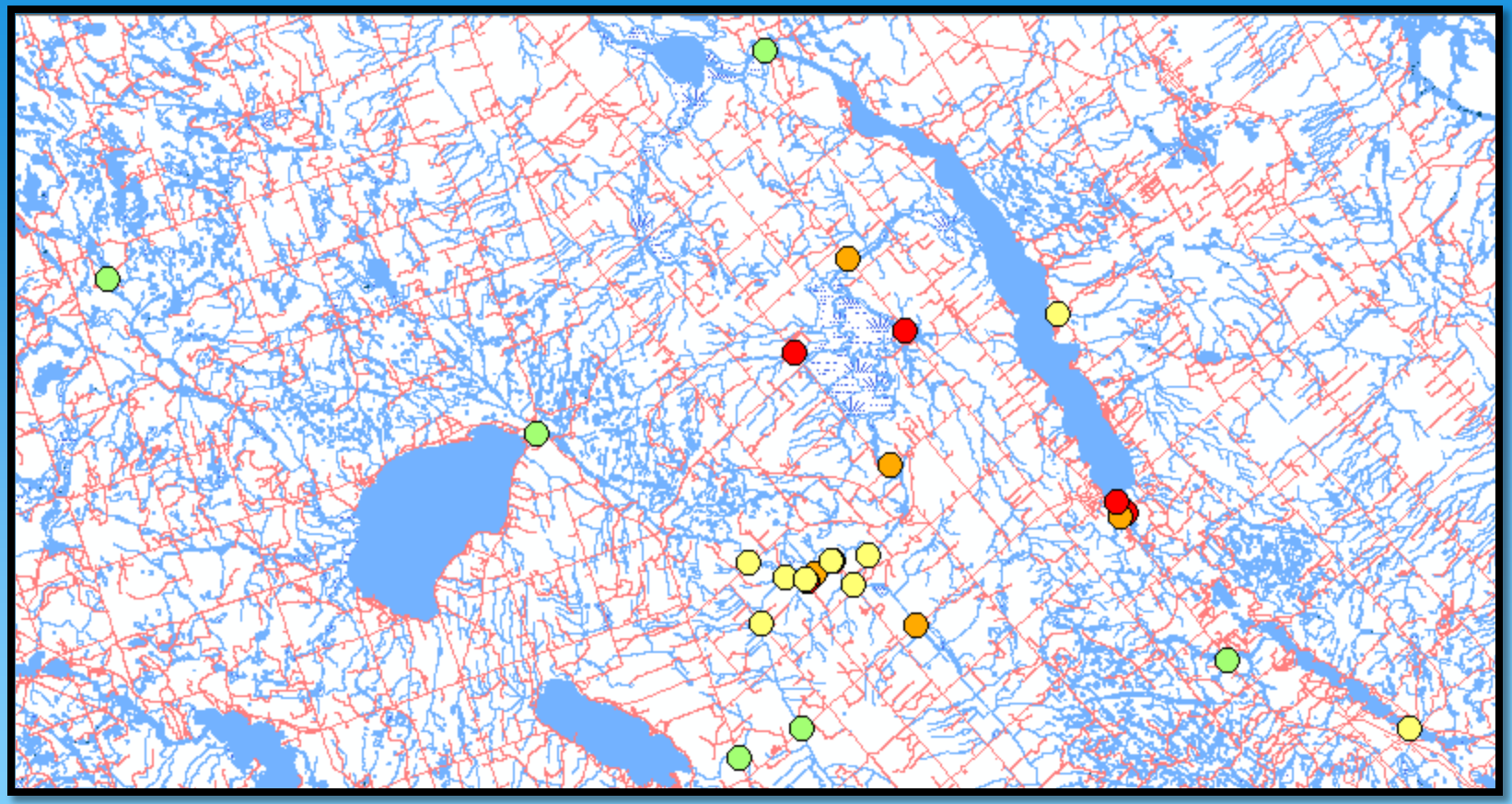
- 20ug/l – 30ug/l
- >30ug/l

Total Phosphorus, June 2014



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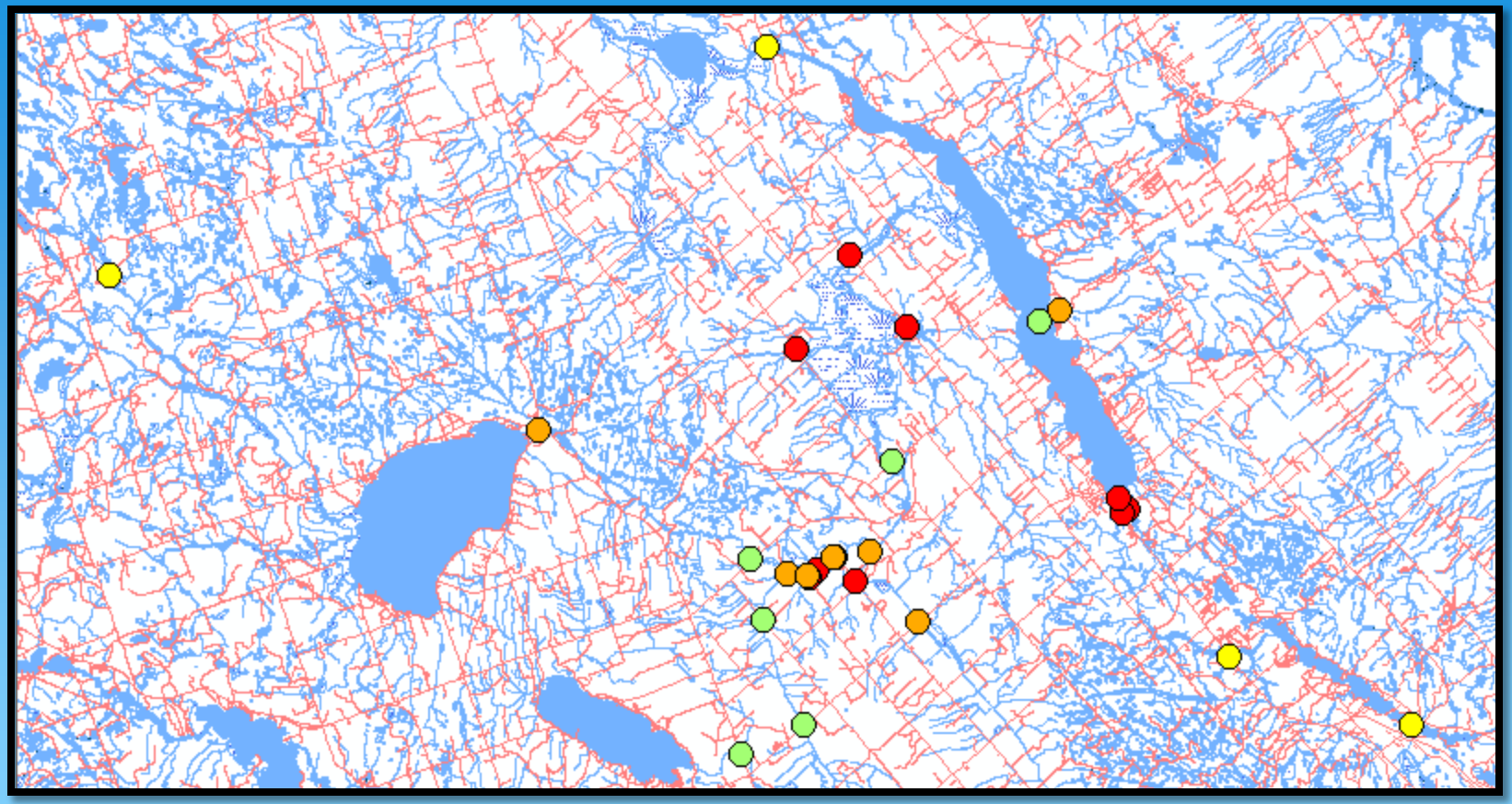
- >30ug/l

Total Phosphorus, July 2014



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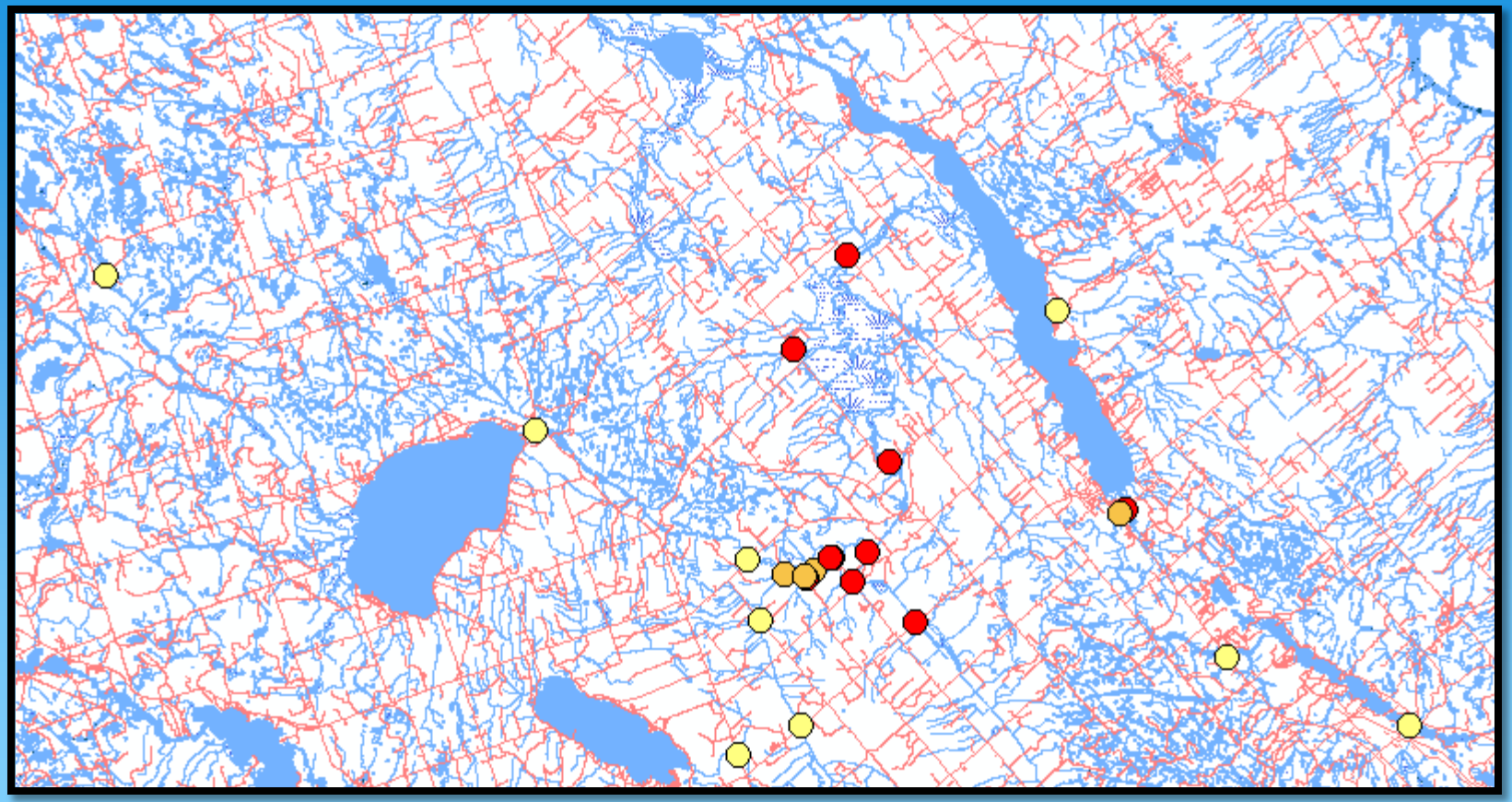
- 20ug/l – 30ug/l
- >30ug/l

Total Phosphorus, August 2014



Provincial Water Quality Guidelines

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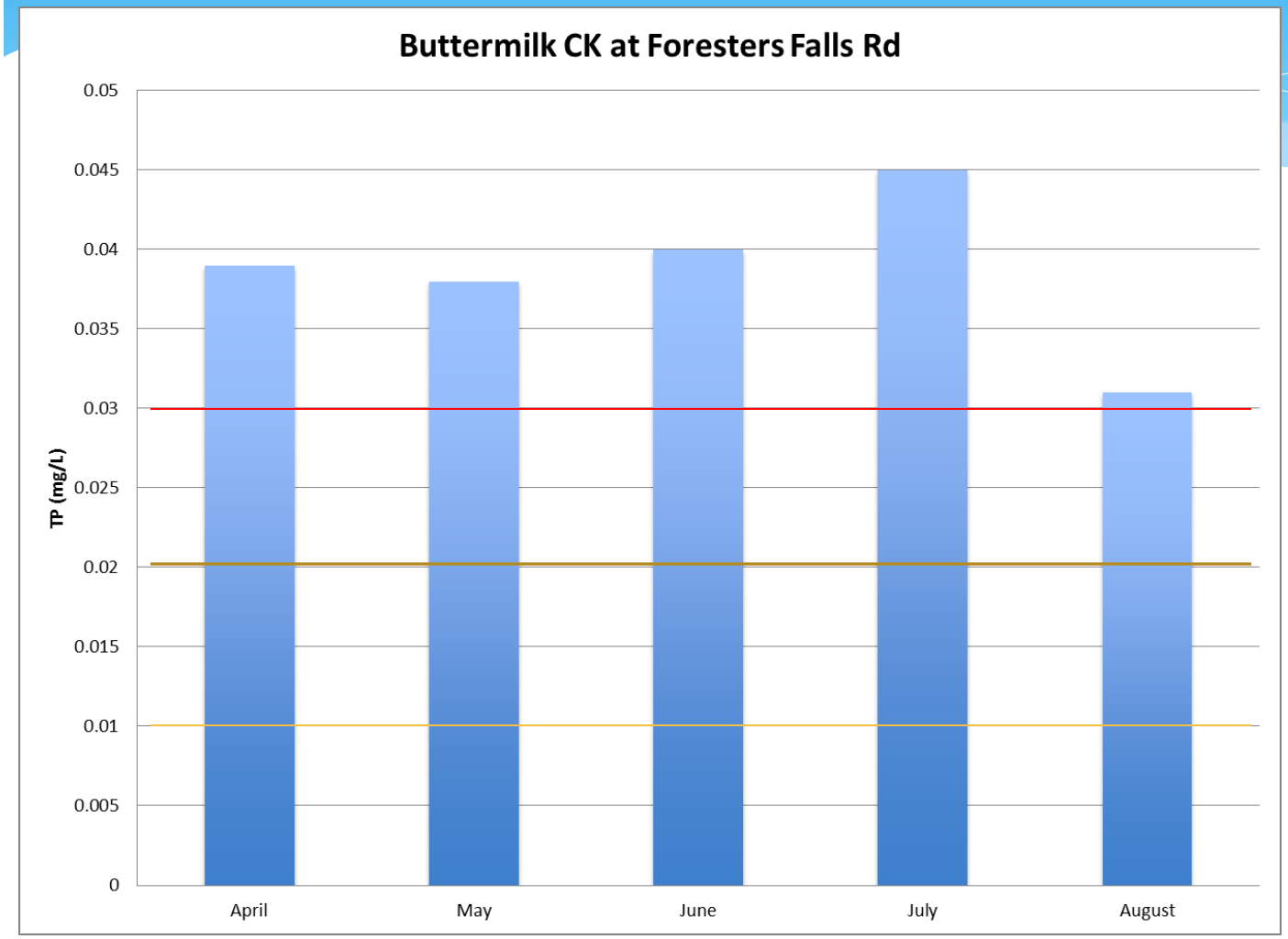
30ug/l promotes algal blooms

- <10ug/l
- 10ug/l – 20ug/l
- 20ug/l – 30ug/l
- >30ug/l

Temporal (Time Based) Data Summary

- Helps to answer the question of "what is happening at one site over time"
- Can start to understand how seasons, weather, or human activities may be impacting the results
- Actual values are converted to a graphical format to assist with interpretation
- Not a good way to conduct comparisons between sites but a useful approach for focusing on one site and starting to explain and understand what might be happening at that site.

Total Phosphorus Buttermilk Creek 2014



10ug/l (0.01mg/l) should not be exceeded

20ug/l (0.02mg/l) can lead to excess plant growth

30ug/l (0.03mg/l) promotes algal blooms

while monitoring continues...

Other Projects in the Watershed September, 2014– December, 2014

Shaw Woods Bioswale

PARTNER: Grant Dobson and Lyndsey Mask, SWOEC

OBJECTIVES:
Construct a bioswale to help mitigate nutrient and contaminant inputs from parking lot

Develop interpretive signage to explain a bioswale

Develop P-12 games for students to understand the role of plants in mitigating excess nutrients and contaminants

STUDENTS: Kaitlyn, McKenzie, Chris, and Eric

Lake Dore: Bridge Blowout

PARTNER: Bernadette Scheuneman and the Lake Dore Property Owners Association

OBJECTIVES:

- Determine the history of the bridge blowout and investigate the environmental impacts

- Determine if mitigation is required and the process for mitigation

STUDENTS: Marlie, Moumen, Beth and Sam

Photo: Garry Coburn, Lake Dore Property Owner

Snake River Wetland

PARTNER: Ole Hendrickson, Ottawa River Institute

OBJECTIVES:

- Determine the functional significance of the Snake River Marsh as a wetland

- Measure nutrients and suspended solids at various points in the wetland

STUDENTS: Tanner, CarrieAnn, Brooke, and Jen

Photo: CarrieAnn Bray

Muskrat Lake
Total Phosphorus in Sediments

PARTNER: Jaime Sebastian, Muskrat Lake Association

OBJECTIVES:

- Gain insight into the amount of Phosphorus stored in sediments of Muskrat Lake
- Develop a protocol for sediment sample collection
- Collect samples from various locations in Muskrat Lake
- Develop a lab analysis protocol
- Send samples to an accredited lab for analysis

- STUDENTS: Derek, Julie, Jeff and Lyndsey

Muskrat Lake
Riparian Zone Assessment

Photo: Katarina Pavlica

PARTNER: Les Hill, Landowner, Muskrat Lake

OBJECTIVES:

- Identify a riparian zone on the lake
- Survey and identify the various types of plants in that riparian zone, invasive and native
- Gain insight into natural vegetation which may be effective as a barrier to runoff

- STUDENTS: Meggan, Katarina, Joanne and Nick

Muskrat Lake
Analysis of MOE Water Quality Data

PARTNER: Blake Carson, Muskrat Watershed Council

OBJECTIVES:

- Prepare all MOE summer data for analysis and assessment
- Create graphs, charts and maps which best present that data
- Time permitting, identify potential areas for the installation of Biocord technologies

- STUDENTS: Allison, Mike, Kevin and Andree

Communicating our Science

OBJECTIVES:

- Create a web site which documents all of the various projects
- Conduct site visits for all projects, capture video and photos for integration into the web site
- Interview students and partners

STUDENTS: Jessica and Dylan

Dylan McDonald working with students at Hoch Farm

Aerial Photography and Drone Work

Next Steps: Path Forward

* Data analysis and reporting for all 28 sites (Students + Science Committee)
* Report writing on findings and project
* Secure ongoing funding
* Long term development of a suite of indicators and targets for phosphorus (this is one long term and key deliverable of the Science Committee)
* Support Implementation of new technologies (Biocord trials) and use of UAVs for bloom detection
* Continued Land Use and Sediment analysis

Thank You

* Algonquin College wishes to thank all of our partners for their ongoing support

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* Julie Sylvestre, Applied Research Project Manager sylvesj@algonquincollege.com