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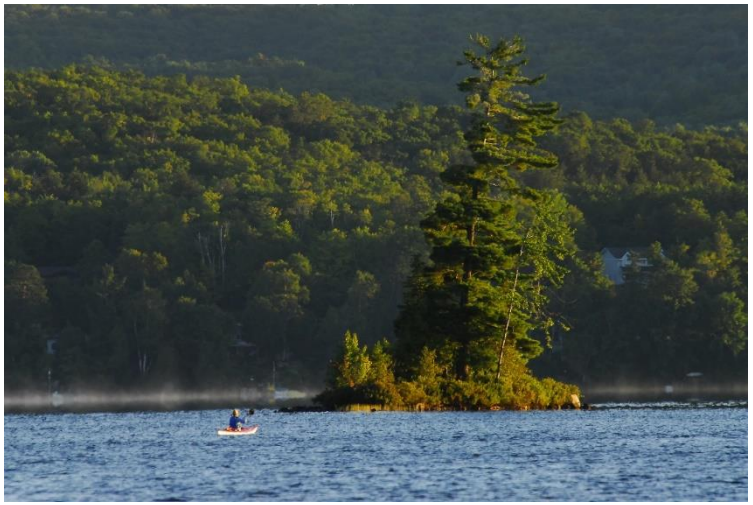

Trout Lake Study and Management Plan

Presented by: Jason Ferrigan and Brent Parsons
Date: November 14, 2023
JLR No.: 31162-000

NORTH BAY ONTARIO · CANADA
East Ferris MUNICIPALITY · MUNICIPALITÉ
NORTH BAY - MATTAWA CONSERVATION AUTHORITY 1972-2022 | 50 Years of Conservation
J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS
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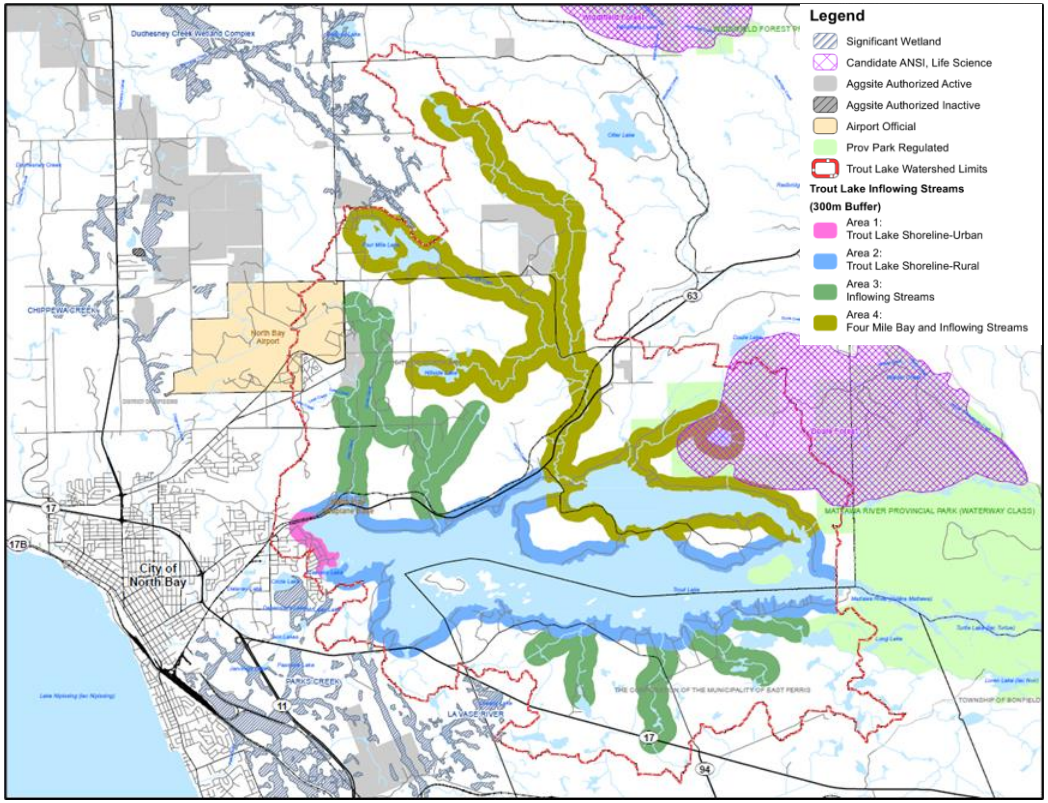
The Trout Lake Study and Management Plan

Trout Lake is an important resource. It is a drinking water source, lake trout habitat and recreational destination

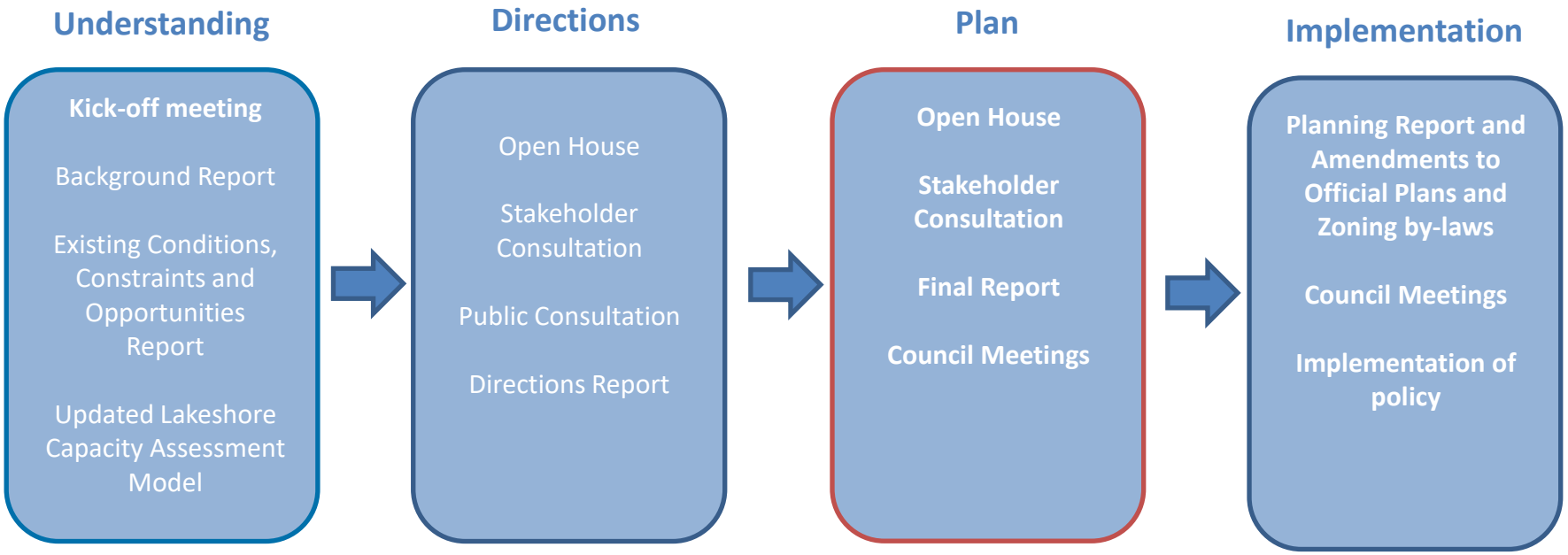
North Bay, East Ferris and the North Bay Mattawa Conservation Authority are proactively managing the lake's health

The study will build upon past work, update the understanding of lake health and recommend changes to the land use planning framework



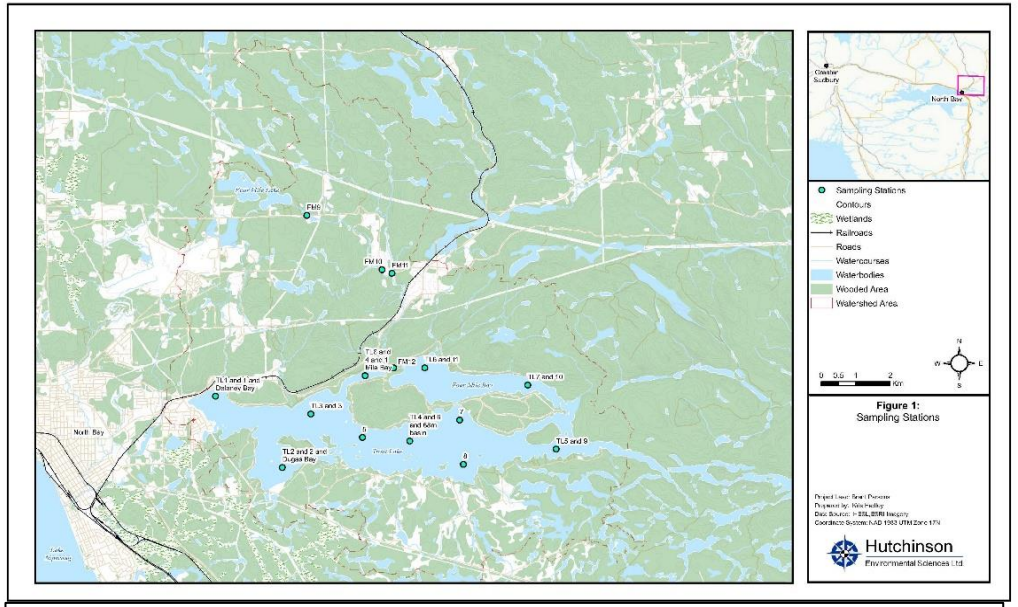
The process

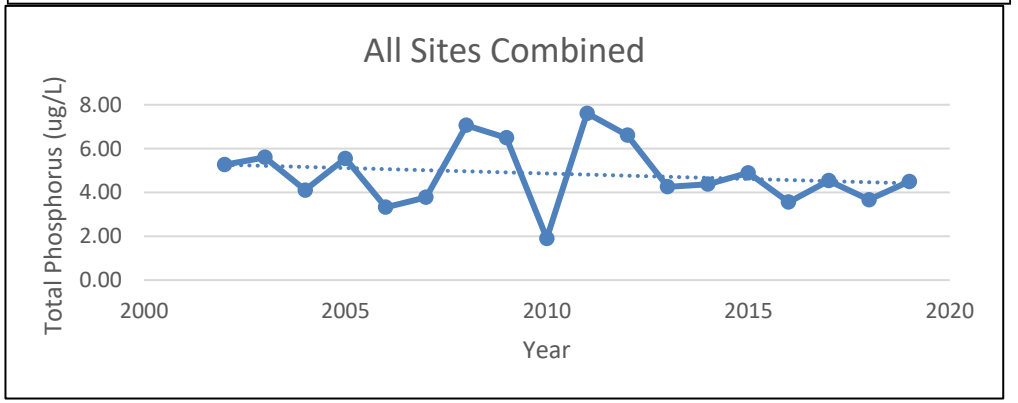
The study and plan is being developed in an open and iterative process that includes public and stakeholder involvement



Measured Lake Water Quality

- Historical and more recent data indicate that water quality in Trout Lake is excellent and nutrient concentrations are low.
- No trends in total phosphorus over time.
- Four Mile Bay and Trout Lake – Main Basin have slightly different water quality.
- Some exceedances of the Municipal Water Quality Objectives by phosphorus and dissolved oxygen but problems with datasets limit the findings.
- Recommendations developed to improve the water quality monitoring program.





Lakeshore Capacity Model

- Used to determine a lake's development capacity based on an assessment of total phosphorus loadings and lake response.
- Modelled values similar to measured values (i.e. within 11%) so able to confidently use the model to determine capacity.
- Total Phosphorus Water Quality Objectives
  - Provincial Water Quality Objective = Background + 50%
  - Municipal Water Quality Objective = 7 ug/

Lakeshore Capacity Model — Trout Lake

Anthropogenic Supply			
Shoreline Development Type	Number	Usage (capita years/yr)	
Permanent	772	2.56	
Extended Seasonal	0	1.27	
Seasonal	110	0.69	
Resort	0	1.18	
Trailer Parks	0	0.69	
Youth Camps	0	0.125	
Campgrounds/ Tent trailers/RV parks	0	0.37	
Vacant Lots of Record	151	1.27	
Retention by soil (Rs) (0-1)	0.86		
Catchment			
Lake Area (Ao)	1562.3	ha	
Catchment Area (Ad)	5912.4	ha	
Wetland	11.0	%	
Cleared	7.1	%	
Hydrological Flow			
Mean annual runoff	0.481	m/yr	
Lake outflow discharge (Q)	60843839	m3/yr	
Areal water loading rate (qs)	3.89	m/yr	
Inflow 1	24890821	m3/yr	
Inflow 2		m3/yr	
Inflow 3		m3/yr	
Natural Loading			
Atmospheric Load	260.90	kg/yr	
Runoff Load	530.97	kg/yr	
Upstream Loading			
Background Upstream Load 1	123.19	kg/yr	
Background Upstream Load 2		kg/yr	
Background Upstream Load 3		kg/yr	
Current Total Upstream Load 1	148.69	kg/yr	
Current Total Upstream Load 2		kg/yr	
Current Total Upstream Load 3		kg/yr	
Future Upstream Load 1	151.23	kg/yr	
Future Upstream Load 2		kg/yr	
Future Upstream Load 3		kg/yr	
Anthropogenic Loading			
Current Anthropogenic Load	237.71	kg/yr	
Future Anthropogenic Load	248.66	kg/yr	
Areal Load Rate			
Current Total Areal Loading Rate (L_T)	75.42	mg/m2/yr	
Future Total Areal Loading Rate (L_{FT})	76.28	mg/m2/yr	

Sedimentation		
Is the lake anoxic?	n	
Settling velocity (v)	12.4	m/yr
In lake retention (Rp)	0.76	
Monitoring Data		
Average Measured TPso	4.57	µg/L
Measured vs. Predicted TPso	5.9	%
Is the model applicable?	y	
Over or under predicted?	over	

Modeling Results		
TPlake	4.84	µg/L
TPout	4.63	µg/L
TPso	5.45	µg/L
TPfuture	4.90	µg/L
Phosphorus Thresholds		
TPbk	3.76	µg/L
TPbk+40	5.26	µg/L
TPbk+50	5.64	µg/L
TPbk+60	6.02	µg/L
*if TPbk+40% < TPlake < TPbk+60% cell is orange		
*if TPlake > TPbk+60% cell is red		
Loads		
Natural Load w/no developmer	915.06	kg/yr
Background + 50% Load	1372.59	kg/yr
Current Load	1178.26	kg/yr
Future Load	1191.76	kg/yr
Outflow Loads		
Background Outflow Load	218.71	kg/yr
Current Outflow Load	281.62	kg/yr
Future Outflow Load	284.85	kg/yr

Lakeshore Capacity Model

- Modelled values less than the Provincial Water Quality Objective or Municipal Water Quality Objective so development capacity remains.
- Build out of existing vacant lots of record + conversion from seasonal to permanent occupancy + 20% of maximum capacity (20 lots on Four Mile Bay or inflowing streams and 83 lots on Trout Lake – Main Basin or inflowing streams) :
  - Four Mile Bay: 6.25 → 6.70 ug/L
  - Main Basin: 4.84 → 5.23 ug/L
- The impact of increased phosphorus loads from future development on dissolved oxygen was modelled and changes in deep water dissolved oxygen (i.e. Lake Trout habitat) were calculated to be 0.17 mg/L or less.

Lake	Scenario	Total Phosphorus (µg/L)
Four Mile Bay	Modelled Background Total Phosphorus	5.18
	Provincial Water Quality Objective of Background + 50%	7.77
	Municipal Water Quality Objective	7.00
	Existing Modelled Total Phosphorus	6.25
Trout Lake (Main Basin)	Modelled Background Total Phosphorus	3.76
	Provincial Water Quality Objective of Background + 50%	5.64
	Existing Modelled Total Phosphorus	4.84

Other Lines of Evidence and Uncertainties

- Capacity calculated based on lake surface area (1 lot / 1.6 hectare of lake surface area) and minimum lot frontages (1 lot / 60 metres of lake shoreline) to provide a different line of evidence to determine capacity based on social density and recreation (i.e. boating).
  - No capacity for additional development on Four Mile Bay following these metrics.
  - Capacity for additional development on Trout Lake – Main Basin following these metrics.

- Uncertainties include climate change, downstream impacts and implementation of best management practices.

- Climate change could increase nutrients, decrease dissolved oxygen and promote algal growth.

- Downstream impacts on Turtle Lake and Lake Talon from future development (+23 kg/yr of phosphorus) should be modelled using the Lakeshore Capacity Model and a dissolved oxygen model.

Lake Water Quality Conclusions

Capacity Consideration	Capacity Guideline	Results		Indication of Development Capacity	
		Four Mile Bay	Trout Lake - Main Basin	Four Mile Bay	Trout Lake - Main Basin
Measured total phosphorus[1]	Municipal - Ice Free total phosphorus of 7 mg/L	Exceedances in 2008, 2009 and 2011[1]	No exceedances	No[1]	Yes
	Provincial - 10 mg/L	No exceedances	No exceedances	Yes	Yes
	Trend	No trend	No trend	Yes	Yes
Measured Mean Volume Weighted Hypolimnetic Dissolved Oxygen	Municipal - 8 mg/L	Exceedances in 1993, 1994, 2015, 2018[2]	Exceedance in 1994[2]	No[2]	No[2]
	Provincial - 7 mg/L	No exceedances	No exceedances	Yes	Yes
Lakeshore Capacity Assessment	Background + 50% or Municipal Water Quality Objective of 7 ug/L	Under capacity	Under capacity	Yes	Yes
Recreational carrying capacity	# Lots/1.62 ha surface area	Over capacity	Under capacity	No	Yes
Minimum lot frontages	# Lots/60 m of frontage	Over capacity	Under capacity	No	Yes

Notes:

[1] *Exceedances appear to be driven by variability associated with laboratory processes and Minimum Detection Limits*

[2] *Data are limited and heavily interpolated*

Best Management Practices

- Sewage Treatment Systems
  - Septic system phosphorus is largely attenuated in Precambrian Shield soils
  - Eastview Estates septic system monitoring
    - Raw effluent and effluent from the septic tile field analyzed
    - >93% total phosphorus reduction in 28 of 44 samples and reduction averaged 86%

- Shoreline Buffers
  - Biological hotspots that provide many ecological services
  - 30 m is commonly recommended in peer-reviewed literature which aligns with Provincial guidance.

- Erosion and Sediment Control
  - Used to reduce short term impacts from construction and long-term impacts from stormwater

- Site Plan Agreements on Trout Lake have included suitable BMPs.

Environmental Recommendations

1. Improve the Trout Lake water quality monitoring program:

- Increase the number of water quality parameters
- Standardize dissolved oxygen data collection and analysis
- Compare monitoring data with Provincial and Municipal Water Quality Objectives and complete annual monitoring reports

2. Model downstream impacts on Turtle Lake and Lake Talon.
3. Improve septic monitoring at previously approved minimum impact lots.
4. Apply fulsome list of Best Management Practices to all new development.
5. Encourage regulatory Best Management Practices on future and existing development through education, stewardship and enforcement.
6. Repeat the Trout Lake Management Study in the near future to assess the health of Trout Lake, effectiveness of Best Management Practices and progress on Recommendations.

Existing Best Management Practices

North Bay and East Ferris use various tools to protect Trout Lake

Provision	North Bay	East Ferris
Sewage Treatment Systems	30m setback Site evaluation report to reduce phosphorus loading	60 m setback
Shoreline Buffers (min)	15 m	15 m
Erosion and Sediment Control	Often required for development or Site Plan Control	May be required for development or Site Plan Control
Development Setbacks (min)	30 m	30 m
Lot Sizes (min)	0.4 ha – 1.2 ha	0.8 ha – 2.02 ha
Lot Frontages (min)	60 m	60 m
Lot Coverages (max)	5% - 39%	10%
Lakes at Capacity	Yes	Yes
Backlot Development	Limit development	No relevant policies
Sleeping Cabin/ARU/Secondary Dwellings	Not permitted within 300 m of Trout Lake	No relevant policies
Site Plan Control	Required for waterfront lots	Required for waterfront lots

Municipal Best Practice Review

North Bay and East Ferris use various tools to protect Trout Lake

Provision	Precedent (average*)	North Bay	East Ferris
Development Setback (min)	30 m	30m	30 m setback
Septic Setback (min)	30 m	30 m	60 m
Lot Area (min)	0.4 ha	0.4 ha – 1.2 ha	0.8 ha – 2.02 ha
Lot Frontage (min)	60 m	60 m	60 m
Lot Coverage (max)	10% and 15%	Rural 5% - 10% Urban 45%	10%
Shoreline Buffer (min)	75% of linear shoreline frontage, 15 m depth	15 m or 30 m (as part of site plan agreements), 4m corridor	15 m
*Average determined by more frequently applied provisions			

Land Use Planning Conclusions

1. Model results suggest Trout Lake is not at capacity
2. Some uncertainty in the other lines of evidence
3. Trout Lake should not be “fully developed”
4. Continue to follow a measured, pre-cautionary approach
5. Improve and align North Bay’s and East Ferris’ land use planning framework

Land Use Planning Recommendations

1. Update policies to reflect climate change and associated uncertainty
2. Update MWQO to reflect a hybrid approach

- Main Basin 5.64 µg/L of TP
- Four Mile Bay – 7.0 ug/L of TP

3. Create and implement a Trout Lake Influence Area Overlay (TLIAO)

- Apply to lands within 300 m of shoreline, major inflowing streams and Four Mile Lake

4. Permit a limited amount of new lots in the TLIAO, subject to conditions

- Up to 20 percent of modelled capacity
- Up to 83 new lots in the Main Basin (50 in North Bay and 33 in East Ferris)
- Up to 20 lots in Four Mile Bay (i.e. Bay, major inflowing streams, Four Mile Lake)
- All new lots on water subject to enhanced setback and shoreline buffer standards
- All new lots within 120m of water subject to Site Plan and Best Management Practices
- Any further lot creation prohibited, unless demonstrated through future studies
- All supported by on-site septic system monitoring, lake water quality monitoring and more frequent model updates

5. Continue to prohibit Additional Residential Units
6. Permit sleep cabins/bunkies, subject to conditions

Recommendations

7. Update and create minor variance policies to reflect administrative best practices
8. Create policies to permit limited expansions of non-complying buildings and structures, as of right and subject to Best Management Practices
9. Require that all lots within the Trout Lake Influence Area Overlay within 120 m of a shoreline be subject Site Plan Control
10. Establish consistent Best Management Practices to be used in the site plan process in the North Bay and East Ferris Official Plans