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Lake Echo Watershed / Servicing Study

Presentation to:

Harbour East Community Council

18 April 2013

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Agenda

Introduction of Project and Team

Purpose of the Study

Focus of this Presentation

Impacts of Existing Development

What Should be Done for Existing Issues

Future Development

Development Case 01278

Questions and Comments

Purpose of the Study

To determine the carrying capacity of the study area by:

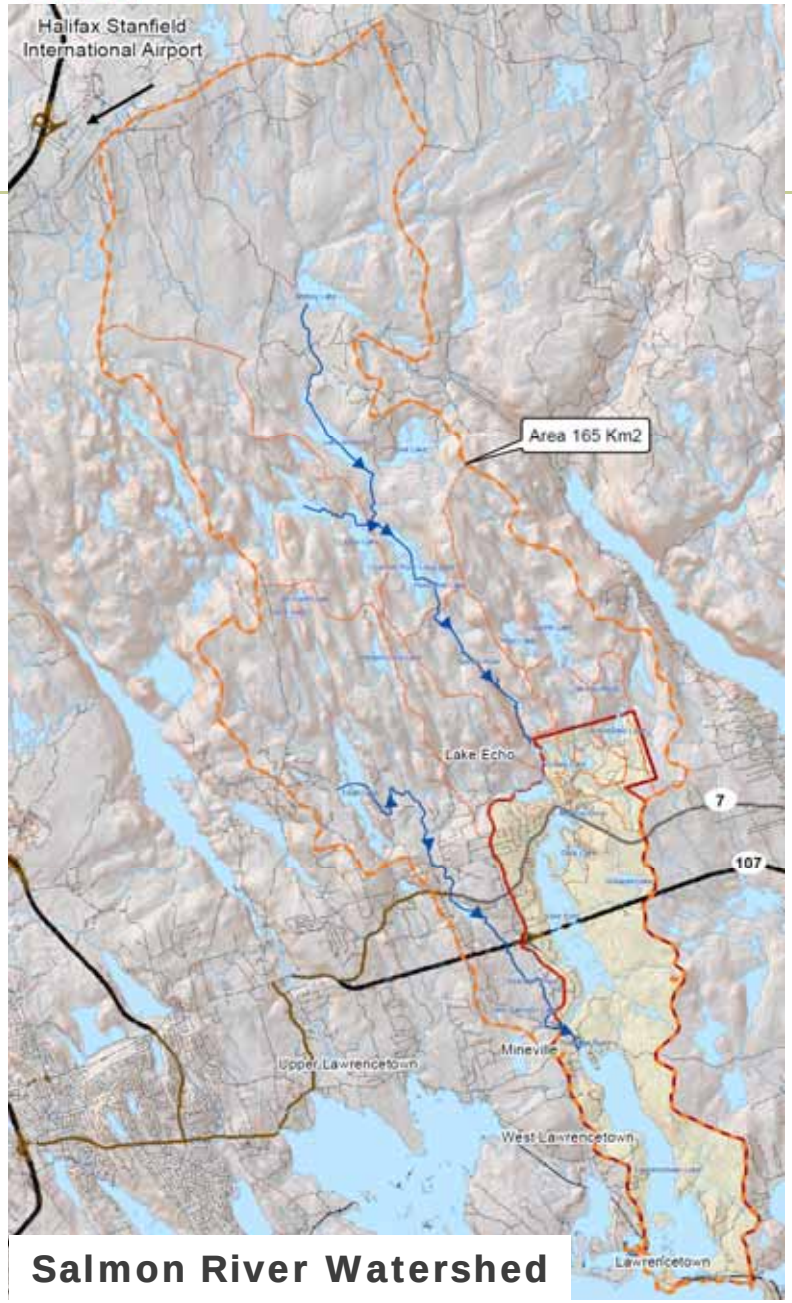
- Defining existing environments (terrestrial and aquatic) within the Study Area;
- Identifying existing constraints and assessing the cause(s);

To recommend means to:

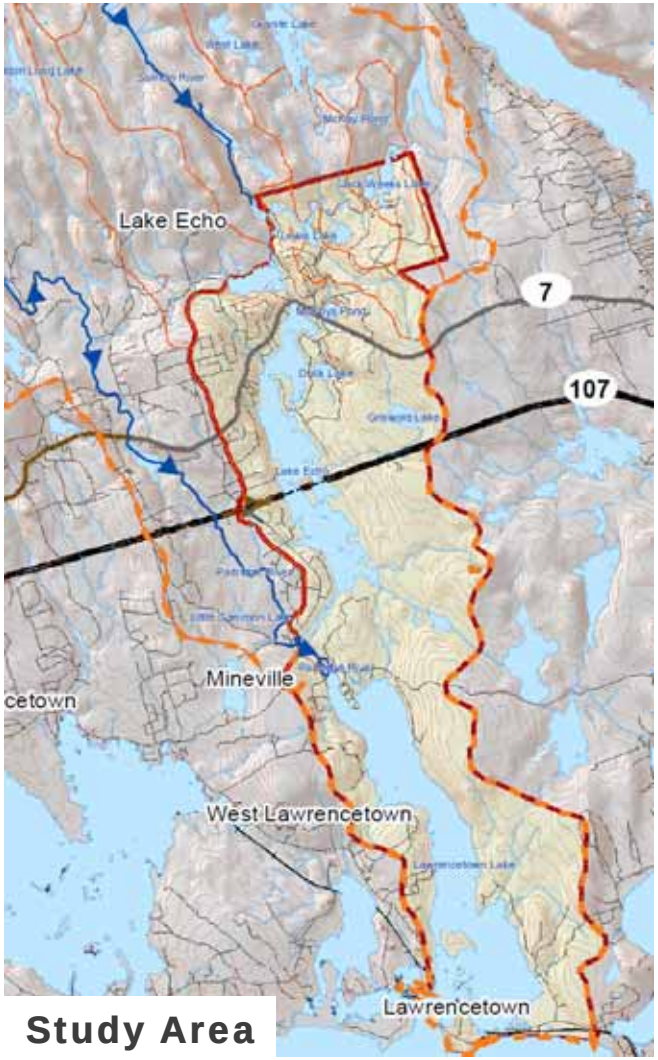
- Address existing issues; and
- Allow further development without creating new problems or worsening existing problems.

The **study area** is in the lower reaches of the Salmon River Watershed.

Lake Echo Study Area



Salmon River Watershed

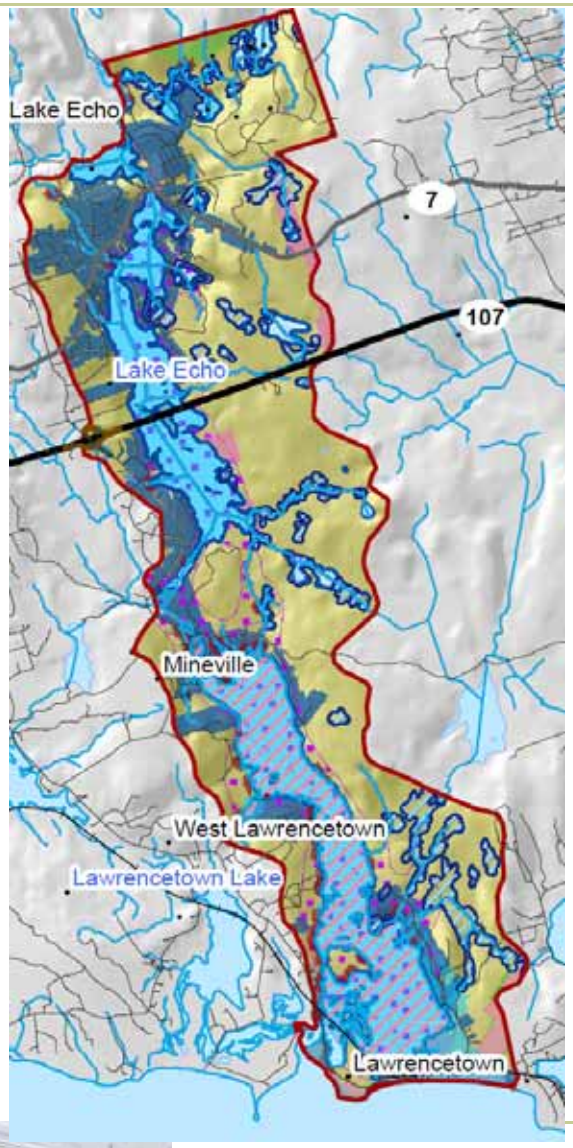


Study Area

Focus of this Presentation

- Areas that should not be developed: **"No Go"** areas;
- Capacity of receiving environments to support development
- Best locations for new development
- Suitable forms of development
- Servicing requirements

"No Go" Areas



- Study Area
- Streets
- Trunk Highway
- Divided Highway
- Arterial
- Collector
- Railroad
- Wetlands
- Wetlands 20m Buffer
- Lakes 20m Buffer
- Salt Marshes
- Less Than 2pt5m ASL
- Nondesignated Park Reserve
- Rivers 20m Buffer
- Areas of Elevated Archaeological Potential
- Areas of Elevated Cultural Significance
- Provincial Crown Land
- Protected Areas
- Existing Regional Parks
- Protected Beaches
- Provincial Parks
- OpenSpace and Natural Resources Network
- Flood Potential 2m
- <all other values>

Areas where development should not occur were identified based on criteria adapted from "A Guide to Open Space Design Development in HRM".

"No Go" areas should be preserved

Capacity of Receiving Environments

Areas outside of the “No Go” areas were considered developable. How much development should occur?

This was assessed based on the ability of the environment to support development. Considered:

- **Groundwater** availability and quality;
- Lake water quality and **assimilative capacity**.

Groundwater Availability and Quality

Review of well logs and well water sampling program indicates a mix of wells in surficial and bedrock aquifers:

- **Surficial** (water taken from soils over bedrock):
  - Median depth – 11 m
  - Median Yield – 23 L/min, can supply a cluster of more than 10 units
  - Water quality issues include iron, manganese, coliform bacteria and colour
- **Bedrock** (water taken from cracks and fissures in bedrock):
  - Median depth – 49 m
  - Median Yield – 14 L/min, can supply a cluster of less than 10 units
  - Water quality issues include arsenic , iron, manganese

Existing demand: **4%** of groundwater recharge, high growth scenario: **9%**

Should be sustainable - not stress other users – but should be monitored

Lake Water Quality and Assimilative Capacity

Assimilative Capacity was defined in a 4 step process that identified:

- Desired **water uses**;
- **Water quality required** for desired water uses;
- **Measured water quality** in Lake Echo;
- **Comparison** of water quality objectives to measured water quality:
  - Assimilative capacity available where measured less than required

Water Use Objectives

Minimum water use objectives provided in the HRM Regional MPS include:

- All water bodies should be **suitable for swimming**;
- All lakes should be **oligotrophic or mesotrophic;**
- Development should **not change the trophic status of lakes**.

Respondents (**111**) to an online survey indicated that the water in Lake Echo (and other waterbodies) should be of high quality - **suitable for drinking** (28%) or able to provide **habitat for fish and wildlife** (68%) suitable for human consumption.

Water Quality Objectives

Guidelines and standards were used to develop specific objectives for water quality parameters typically used to define the suitability of water for swimming, habitat suitable for consumption of fish, and trophic status.

Recommended water quality objectives for lakes in the Study Area:

- **E coli** concentration less than 200 counts/100 mL for swimming, less than 14 counts/100 mL to support fish and wildlife habitat.
- **Total phosphorous** concentrations less than 10 micrograms/ L for oligotrophic, 20 micrograms/ L for mesotrophic;
- **pH** > 5.4 - DFO characterizes as acute toxicity for Atlantic Salmon waters with pH 5.0 to 5.4.

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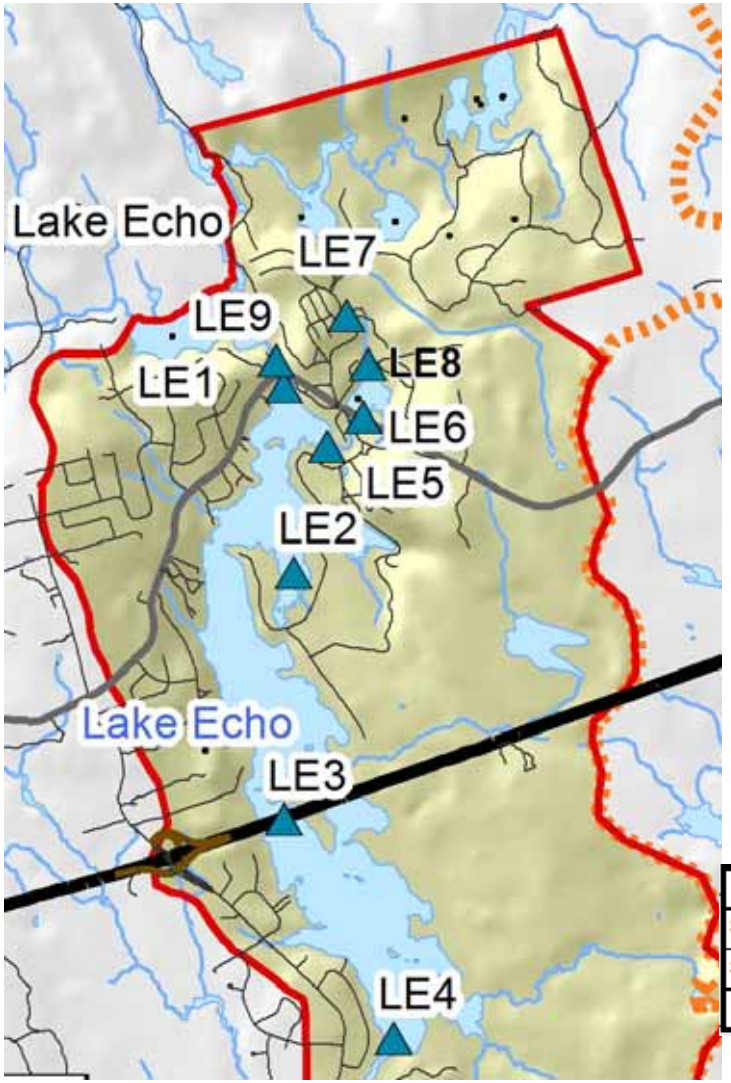
Measured Water Quality 2010



Sample Location	Parameter	Mean	Max	Min
LE1	E Coli (CFU/100 ml)	68	240	4
	Tp (MPN/100 ml)	0.059	0.177	0.019
	Chl A (ug/l)	4.8	9.8	2.2
	pH	5.7	6.1	4.9
LE2	E Coli (CFU/100 ml)	17	41	7
	Tp (MPN/100 ml)	0.026	0.03	0.02
	Chl A (ug/l)	3.6	5.8	1.2
	pH	6.0	6.4	5.5
LE3	E Coli (CFU/100 ml)	19	40	1
	Tp (MPN/100 ml)	0.024	0.03	0.019
	Chl A (ug/l)	4.5	6.9	1.1
	pH	6.3	7.9	5.6
LE4	E Coli (CFU/100 ml)	8	15	1
	Tp (MPN/100 ml)	0.02	0.02	0.02
	Chl A (ug/l)	4.2	6.7	1.5
	pH	5.8	6.2	5.5
LE5	E Coli (CFU/100 ml)	42	55	28
	Tp (MPN/100 ml)	0.03	0.04	0.02
	Chl A (ug/l)	11.1	19.4	6.2
	pH	5.7	6.2	5.2
LE6	E Coli (CFU/100 ml)	34	100	5
	Tp (MPN/100 ml)	0.098	0.16	0.02
	Chl A (ug/l)	30.1	66.8	13.4
	pH	6.3	6.9	5.1

E-Coli thresholds CFU/100ml	
Shellfish harvesting	14
Swimming	200
	400

Trophic Status Indicator	TP (mg/l)	Chl a (µg/l)
Oligotrophic	<0.01	<2.5
Mesotrophic	0.01 - 0.02	2.5 - 5
Meso-eutrophic	0.02 - 0.035	5 - 8
Eutrophic	0.035 - 0.1	8 - 25
Hypereutrophic	> 0.1	> 25

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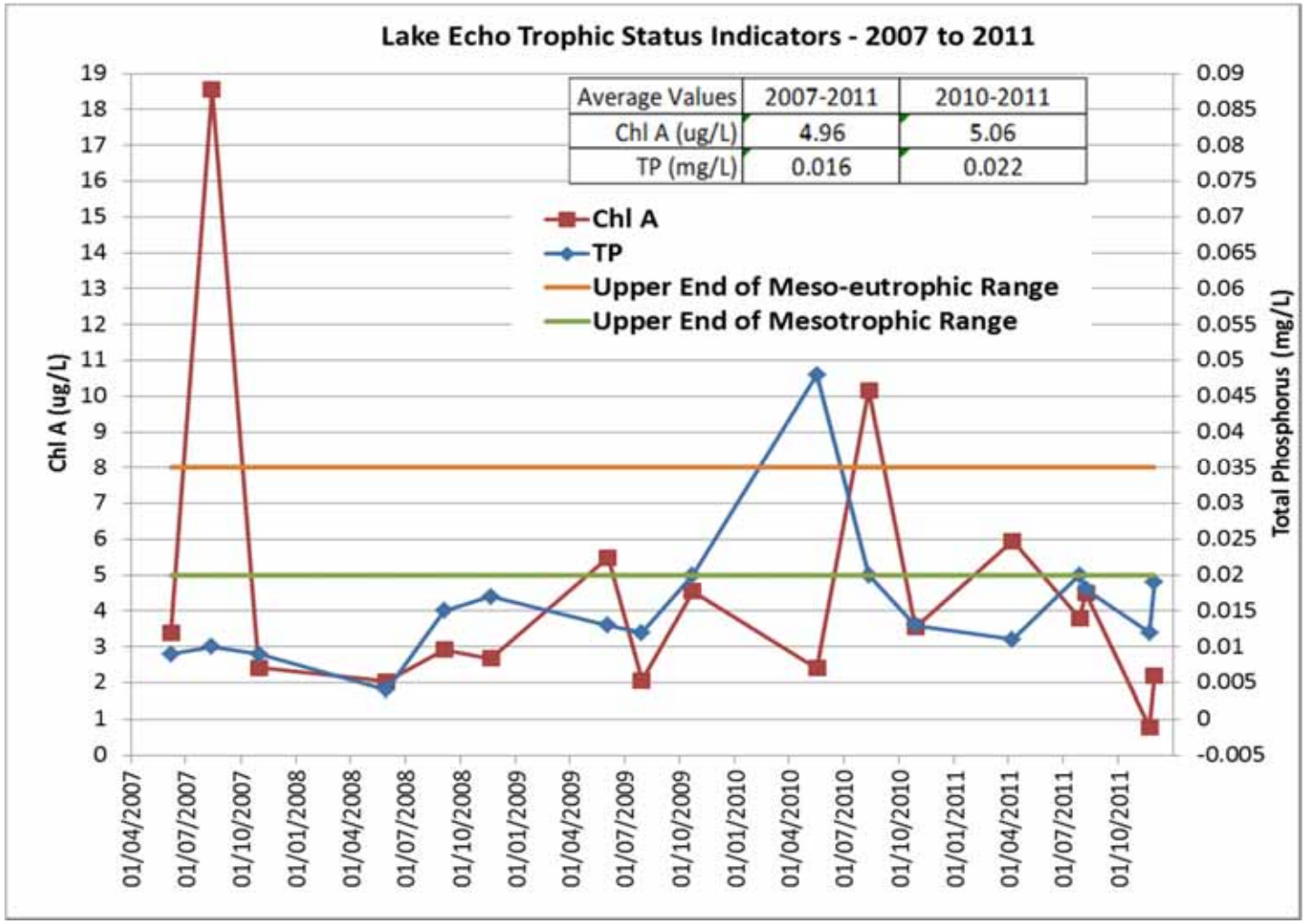
Measured Water Quality Parameters
HRM's 2007 to 2011 Sampling Program

Was 2010 a representative year?



Existing Status of Lake Echo

- **E coli concentrations** were typically below 200 counts in Lake Echo and McCoys Pond so water is suitable for HRM's objective for swimming in most areas most of the time; mean E coli concentrations were above 14 counts so water does not meet the objective recommended for habitat that is suitable for consumption of fish

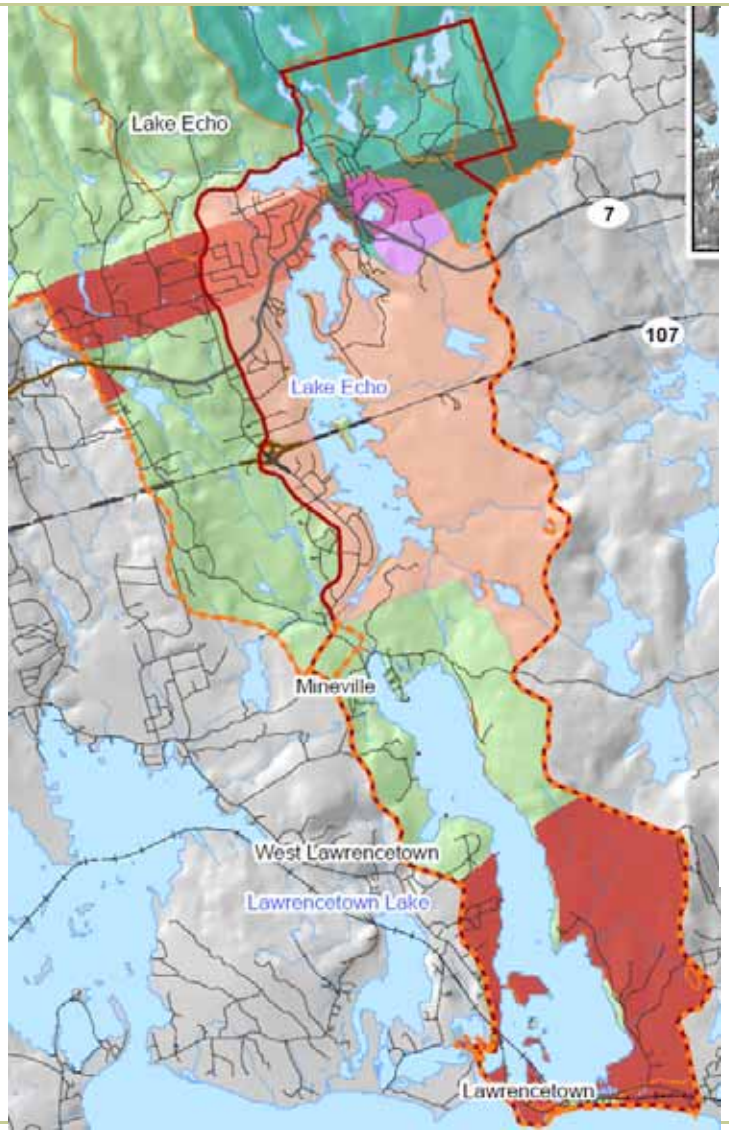
- Lake Echo is considered to be in the **mesotrophic to meso-eutrphic** range based on the average TP and Chlorophyll A concentrations – meets HRM objective?, McCoys Pond is hyper-eutrophic – does not meet HRM objective

  At times the **pH** of waters in the upper reaches of Lake Echo do not meet the DFO objective to be considered suitable for habitat

Assimilative Capacity

There is **no assimilative capacity in Lake Echo** for additional:

- **E coli** loads to meet habitat objective;
- **TP** to meet trophic status objective;
- **Acidic runoff** to meet Low pH objective at the upper end of the lake.



Study Area
Rivers
Area with High TP and EColi Concentration in Receiving Waters
Area with High TP Concentration in Receiving Waters
Pyretic Slate Bedrock
Area with Low pH in Receiving Waters
Area with assimilative capacity
Subwatersheds Limits
Watershed Limits
Streets
Highway
Collector
Railroad

Need to confirm with additional sampling that there is assimilative capacity in Lawrencetown Lake

Factors Affecting Existing Water Quality

In the questionnaire, the two most popular answers to a request to identify potential sources of contamination:

1. Construction/excavation/development too close to the water;
2. Wastewater treatment systems (including onsite systems, domestic and community) are not functioning properly;
3. Stormwater

Assessments were completed to evaluate the validity of these suggestions

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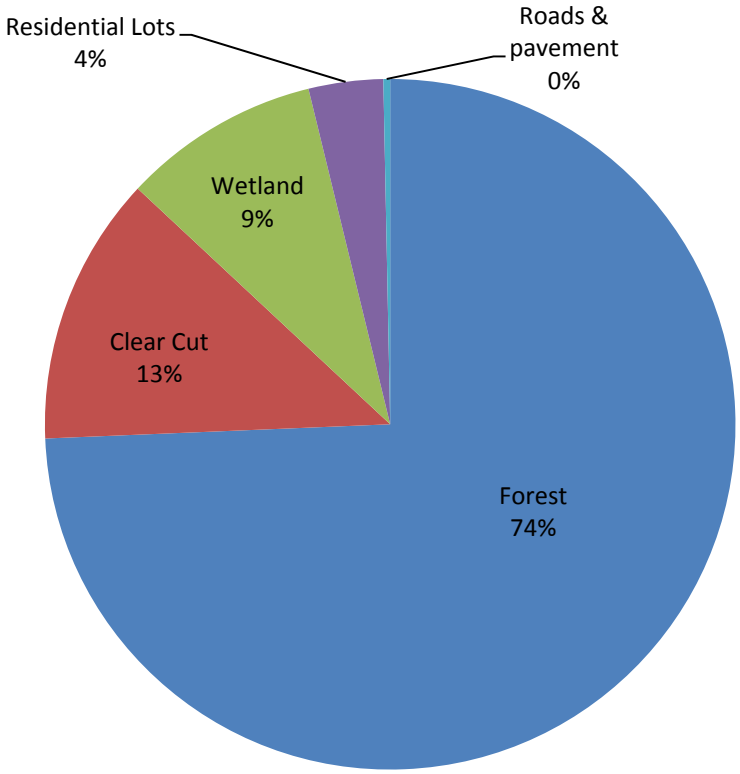
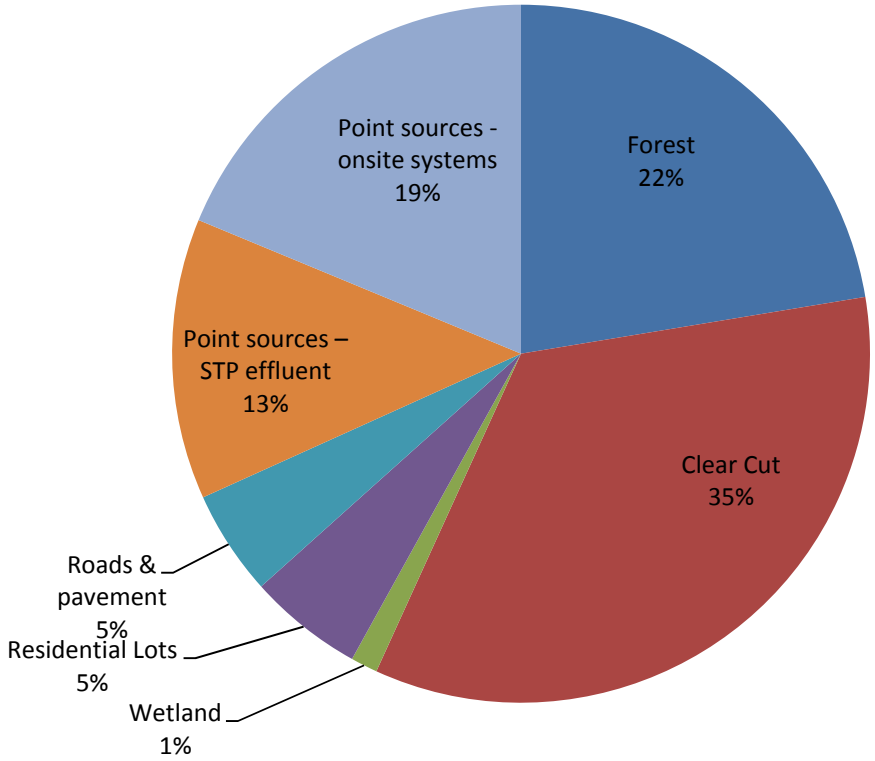
Potential Sources of Phosphorous

The assessment shows that 42% of the annual phosphorous load from the land is generated by less than 5% of the land use



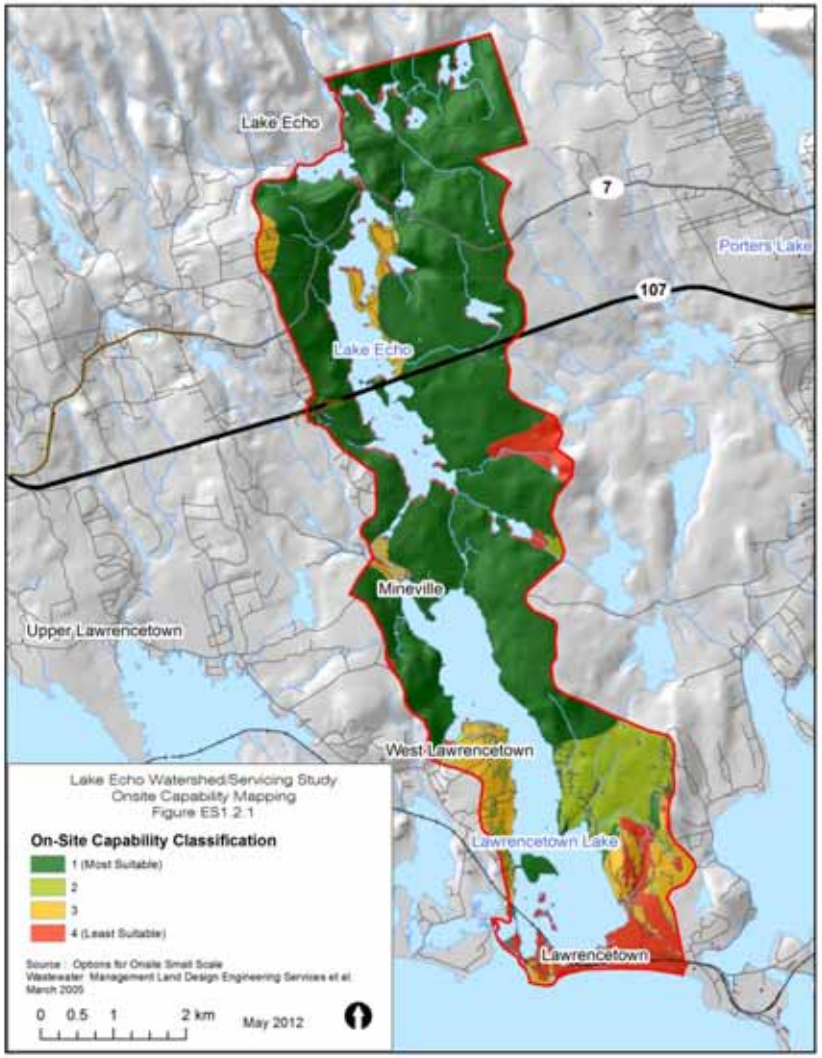
Land-Use in Lake Echo Watershed



Phosphorus Loads in Lake Echo watershed

Annual phosphorous loads were estimated using the Nova Scotia phosphorous loading model, developed by Brylinski under the guidance of NSE for use on lakes in Nova Scotia

Onsite Wastewater Treatment



Screening Level Assessment indicates that:

- Some existing development has occurred on soils identified as less suitable and older lot sizes are typically smaller than current standards.
- There are areas for additional development that are suitable.

Where Do We Go from Here?

Most significant issues generated by existing development are related to receiving water quality

Need to address **existing water quality issues**:

- Lower E coli discharges
- Lower phosphorous discharges
- Reduce acidic runoff for higher pH

Need to plan and implement **future development** so that it doesn't cause the same problems

What to Do in Existing Development

1. **Improve wastewater treatment** in the study area:

- Establish an assessment and monitoring program to make sure that existing wastewater treatment systems are operating as required
- Replace or upgrade malfunctioning or failing onsite systems and systems that produce effluent that is not suitable for their receiving waters

2. **Retrofit stormwater systems** to limit peak flows and enhance infiltration and treatment (rain gardens and barrels on individual lots, wet ponds and constructed wetlands for larger areas)
3. **Cap and re-vegetate disturbed areas** that are experiencing erosion and acid runoff

Potential Future Development

Year	Low (Community Counts)	High (Transit Plan)	Mid-Range
2010 pop	2,800	4,200	
2010 units	1,000	1,600	
2030 pop.	2,300	5,200	3,700
2030 Units	1,000	2,300	1,600
Pop growth 2010-2030	-500	1,000	200
Unit growth 2010-2030	-100	700	300

Note: High and low scenarios selected on basis of population change

Members of a Focus Group expected that future development will be distributed across the Study Area

Objectives for Future Development

Future development should generate lower pollutant loads by changing the type of development and the way it is serviced

New development should incorporate conservation design practices to preserve “No Go” areas

Servicing objectives:

1. Make sure **lots are large enough to support all on-site systems** – site specific plans are required
2. Provide more **strict controls on construction activity** and lot clearing including monitoring plans
3. Need appropriate **stormwater management plans**, including minimizing disturbance of acidic slate bedrock as well as infiltration and treatment of runoff where possible

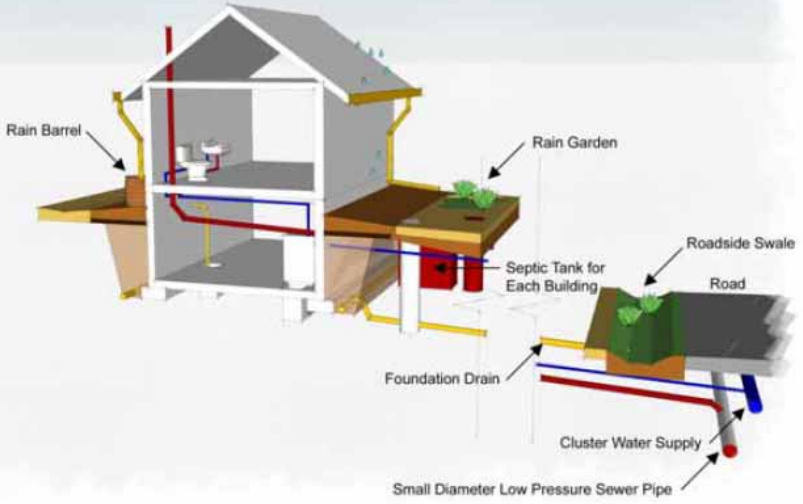
Typical On-site Services

On-site septic systems for individual properties and clusters of properties

Stormwater best management practices will be required on individual properties and at the Community level.

Individual Property

Cluster Systems



Groundwater quality is a concern, particularly where bedrock is pyritic slate. Alternatives to onsite wells were investigated. Central water may be cost effective. Central supply from Lake Echo may be feasible

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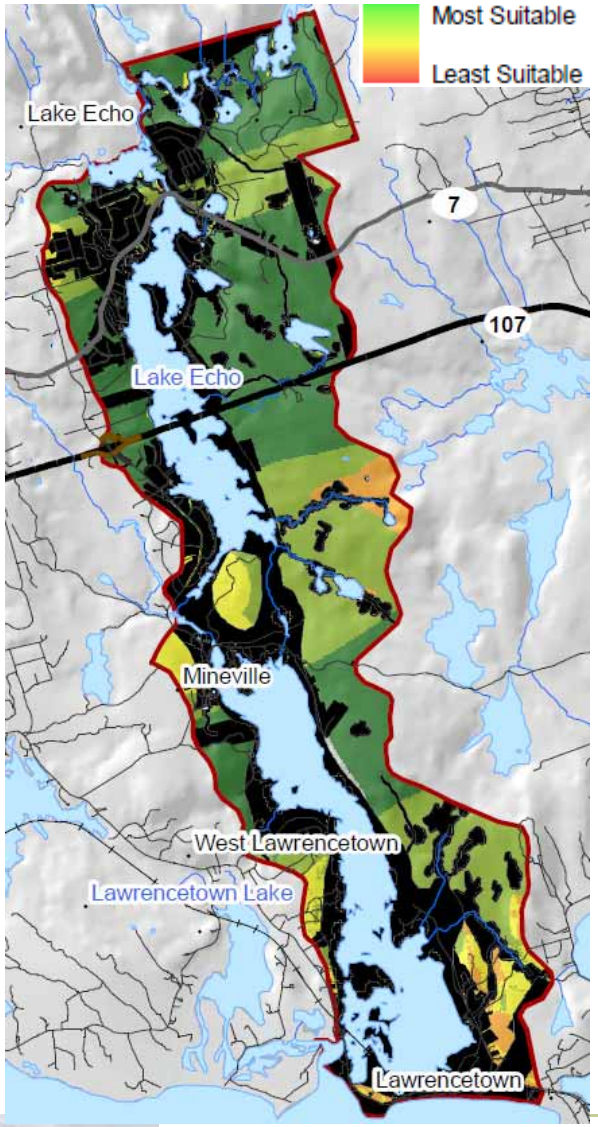
Where Should Future Development be Located?



In the areas tributary to water bodies with assimilative capacity and on the lands most suitable for onsite services

Based on the recommended water quality objectives Lake Echo and McCoys Pond do not have assimilative capacity and are not always able to accept additional E. coli, nutrient or acid loads. Additional development in the areas directly tributary to these waterbodies should:

- Include plans to minimize water quality issues in the receiving waters;
- Be preceded by reductions in existing pollutant loads (or reduction in expectations for lake water quality).

The colour coding ranks the suitability of land for onsite water and wastewater treatment. Dark green areas are considered most suitable for development.

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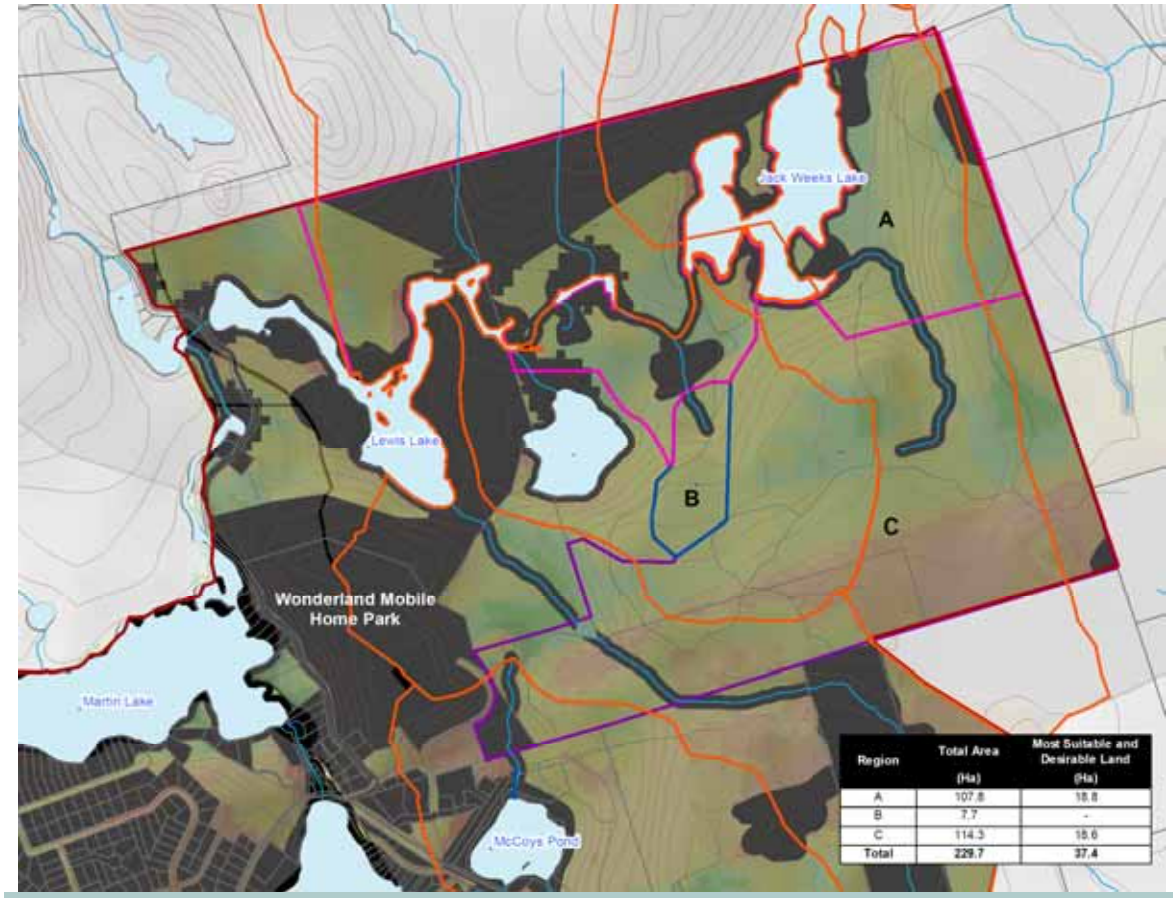
Assessment of Potential Impacts from Proposed Development: Case 01278



Region	Total Area (Ha)	Most Suitable and Desirable Land (Ha)
A	107.8	18.8
B	7.7	-
C	114.3	18.6
Total	229.7	37.4

Proposed Development:

240 hectares, 315 units – **medium growth scenario was 300 units** in the study area

Areas A&B Classic Open Space Design

Area C Hybrid Open Space Design

Most areas outside of "No Go " Areas appear suitable for onsite services, the exception is the band on the south , underlying bedrock is Halifax Formation

Impacts **Jack Weeks Lake** and **Lewis Lake** as well as the water supply pond for the Wonderland Park

Potential impacts – **acidic runoff** and lower pH if bedrock is disturbed, **change in trophic status** of Lewis Lake , from oligotrophic to mesotrophic

Required for Development to Proceed (same requirements apply to all proposed development in this study area):

- Plans to cap areas where acidic slate bedrock was disturbed and minimize future disturbance of this bedrock and cover;
- Erosion and Sediment Control Plans;
- SWM Plan to minimize increases in runoff volume and peak flows, enhance infiltration and provide

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Thank You!

Lake Echo Watershed / Servicing Study

2010

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Existing Water Quality

Loc.	Description	FC (max. value)	pH (min. value)
LE1	Northern area near Canoe Club	1,100	4.9
LE2	Northeast cove surrounded by Ponderosa drive	4,400	5.5
LE3	Middle of Lake Echo under Hwy 107 bridge	1,700	5.6
LE4	Near outlet	900	5.5
LE5	Northeast cove near McCoys pond discharge	890	5.2
LE6	McCoys pond outlet	>10,000	5.1
LE7	WWTP discharge ponds outlet	568	7.2
LE8	McCoys pond inlet	190	6.2
LE9	Martins Lake outlet	10	-