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Regional Watershed Advisory Board
November 13, 2013

TO: Chair and Members of Regional Watershed Advisory Committee

SUBMITTED BY: Original signed

Jane Fraser, Director Planning and Infrastructure

DATE: October 21, 2013

SUBJECT: **Porters Lake Watershed Servicing Study Report**

ORIGIN

Study commissioned to carry out a watershed study as background for future community planning for the Porters Lake Rural Growth Centre.

LEGISLATIVE AUTHORITY

Section 229 (1)(g) of the Halifax Charter enables a Municipal Planning Strategy to require studies to be carried out prior to undertaking specified developments or developments in specified areas. This Study was initiated pursuant to Policy E-17 of the Regional Plan.

RECOMMENDATION

It is recommended that the Regional Watershed Advisory Board recommend to the Harbour East and Marine Drive Community Council, that the Porters Lake Watershed Servicing Study Report be accepted as background for future community planning.

BACKGROUND

CBCL was awarded the contract to prepare the Porters Lake Watershed Servicing Study (Attachment 1). An excerpt of the RFP outlining the study objectives and tasks is presented as Attachment 2.

This watershed study has been undertaken to provide background information for future community planning in the Porters Lake Rural Growth Centre. This Study is required pursuant to Policy E-17 of the Regional Plan. Policy E-17 requires the preparation of these studies to determine the carrying capacity of the watershed as background for future secondary planning processes.

DISCUSSION

The Porters Lake Watershed Servicing Study Report has been reviewed by the HRM and HW Steering Committee and deemed to have met the terms of reference of the RFP.

The main findings and recommendations are summarized in the executive summary of the study, which is reproduced as Attachment 3. The full report can be found at http://www.halifax.ca/planhrm/index.html (under project updates)

It is recommended that this study be recommended to the Harbour East, Marine Drive Community Council as a background study for future community planning.

FINANCIAL IMPLICATIONS

There are no direct financial implications arising from this report. The Study has been prepared as background information for future community planning.

COMMUNITY ENGAGEMENT

The Consultants have undertaken two community forums at the beginning and the end of the study, to engage the Porters Lake Community to provide feedback into the development of this Study. The first meeting was held in 2010, to obtain feedback from community and business leaders on the research and potential future development centres within the community. These selected community centres formed the areas for assessment of future growth. The findings of this Study were presented to the Porters Lake Community in Spring of 2012. An on-line survey was also undertaken to determine the preferences of individuals for desired future water quality objectives for selected water bodies in the study area.

ENVIRONMENTAL IMPLICATIONS

This Study is required to determine the impact of development on Porters Lake, as background for the preparation of the Porters Lake Secondary Municipal Planning Strategy. Matters concerning the environment will be assessed during the process to prepare the Secondary Plan.

ALTERNATIVES

There are no alternatives recommended.

ATTACHMENTS

Attachment 1 – Study Area
Attachment 2 – Excerpt from RFP
Attachment 3 – Executive Summary of Porters Lake Watershed Servicing Study Report

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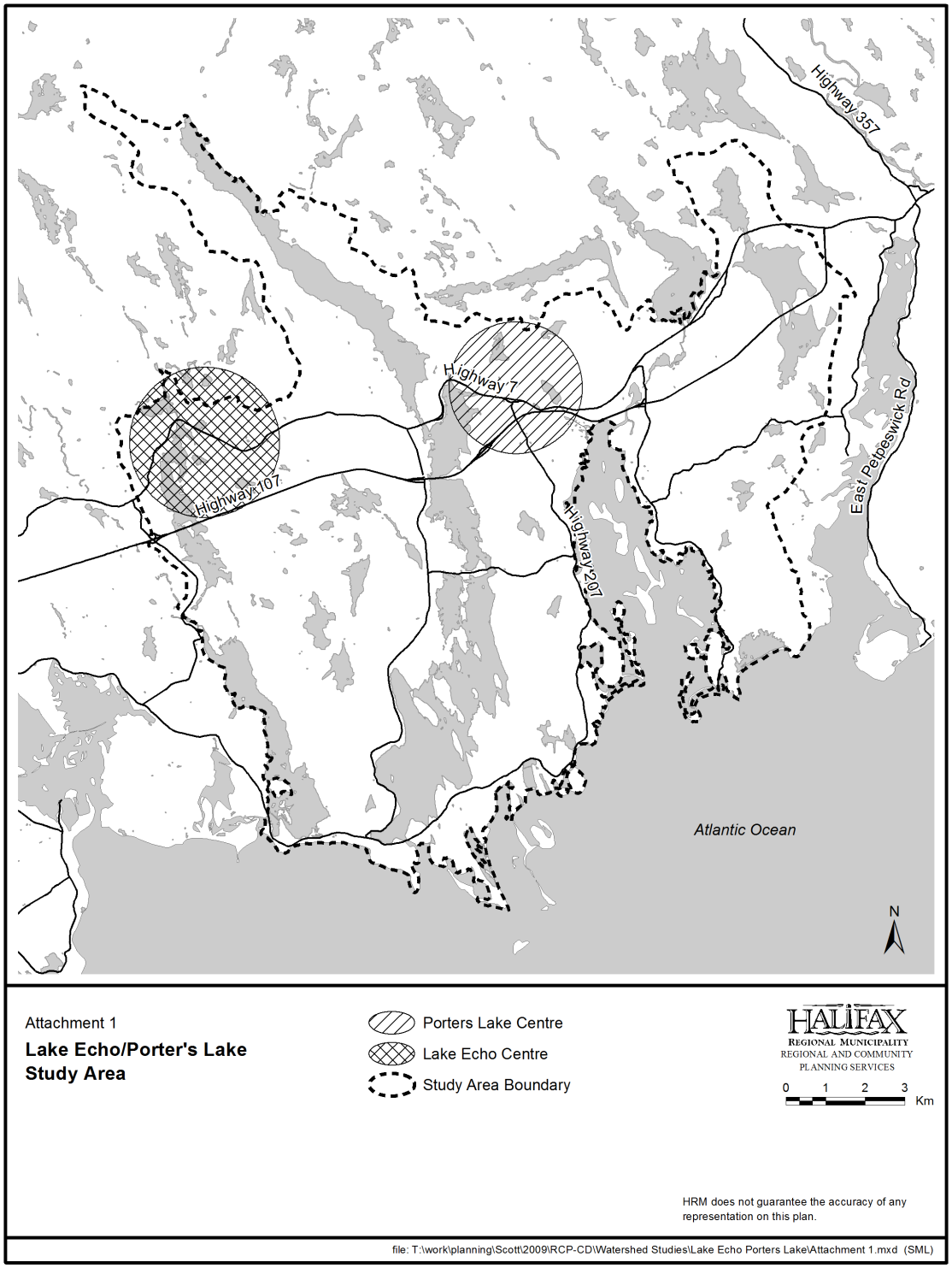
A copy of this report can be obtained online at http://www.halifax.ca/commcoun/cc.html then choose the appropriate Community Council and meeting date, or by contacting the Office of the Municipal Clerk at 490-4210, or Fax 490-4208.

Report Prepared by: Maureen Ryan, Senior Planner, Planning and Infrastructure, 490-4799

Original signed

Report Approved by: Austin French, Manager, Planning and Infrastructure, 490-6717

Attachment 1
Lake Echo/Porters Lake Study Area



Attachment 2
Study Objectives and Tasks from the RFP for the Porters Lake Watershed Servicing Study

3.0 PROJECT OBJECTIVES AND DETAILED SCOPE OF CONSULTING SERVICES

3.1 Project Background

3.1.1. NEED :

HRM's Regional Plan provides a region-wide Municipal Planning Strategy. It sets out a number of policies relating to environmental and water resource protection. Development of land is one of the major activities which impact the natural environment. The Regional Plan requires that, prior to conducting a process to prepare a secondary municipal planning strategy or amendment to an existing secondary municipal planning strategy to carry out a community vision, HRM must complete watershed studies which investigate a range of environmental issues within the watershed(s) or sub-watersheds (study areas) affected by the plan. These studies must provide solutions to existing issues or issues arising from the anticipated form and degree of development in relation to the environmental opportunities and constraints identified through the study. Recommendations must balance development versus environmental protection, and provide specific solutions appropriate to the watershed issues.

The aim is to identify those lands most suitable for development through a land and receiving water capacity analysis and analysis of options for the provision of cost efficient and sustainable water and wastewater services. The degree of effort within each (sub) watershed will need to be appropriately adjusted to the degree of development planned. All past studies, development plans and applicable municipal planning strategies within each (sub) watershed must be considered in developing recommendations. Bidders are referred to the HRM Regional Plan (August, 2006): http://www.halifax.ca/regionalplanning/index.html) http://www.halifax.ca/regionalplanning/index.htmlfor further information. Relevant studies are listed in Appendix B.

3.1.2 GOAL :

In response to the Regional Plan requirements and future initiation of a community visioning and planning process for the Lake Echo Centre, Porters Lake Centre and the Tantallon Centre, HRM requires the services of a qualified consultant to conduct two watershed studies for the watershed study areas shown on Appendices C and D.

3.1.3 OBJECTIVES / CRITICAL PATH

The objective of the Studies is to determine the opportunities for future development within the Lake Echo/Porters Lake Watershed Study Area (Appendix C) and the Tantallon/St Margaret Bay Area (Appendix D) within the environmental capacity of land and receiving waters. It will identify those lands most suitable for development within the Study Areas and determine environmentally sustainable/low impact development solutions for anticipated growth. A range of wastewater management options shall be examined for each centre as well as areas for the distribution of central water within the Porters Lake, Lake Echo and Tantallon centres.

The Studies will establish community water quality objectives for surface receiving waters and determine the amount of development that maybe undertaken in accordance with those objectives. HRM will provide data on recent subdivision and building permits, current applications and long-term Regional Plan growth allocations that were modelled under the Regional Plan. The consultants shall work with HRM, Halifax Water and the communities of Tantallon, Lake Echo, and Porters Lake to determine a range of realistic and achievable population and density targets and servicing scenarios to use as assumptions in determining carrying capacity and assessment of servicing options. Servicing assumptions to be

examined include the provision of central water and on-site and/or cluster septic systems to the Tantallon and Lake Echo centres, and the provision of central water and sewer to the Porters Lake Centre.

3.2 Detailed Scope of Work

3.2.1 REQUIREMENTS : Watershed Studies - General

As required by the Regional Plan (Policy E-17), the studies shall be designed to:

a) recommend measures to protect and manage quantity and quality ofgroundwater resources- at a broad scale, the study should identify and provide recommendations on development opportunities, constraints and appropriate mitigations in relation to groundwater resources. The study shall identify preferred locations for development and appropriate densities for development based on groundwater recharge potential and the potential for yield and quality to sustain development.
b) undertake a survey to determine and recommend desired water quality objectives for key receiving water bodies by the affected communities.
c) determine the maximum amount of development and maximum inputs (phosphorous, bacteria, suspended solids) that receiving lakes, rivers and ocean inlets can assimilate without exceeding the water quality objectives recommended for the lakes and rivers within the watershed.
d) It is intended that future growth within the Porters Lake Centre will be accommodated through central water and sewer services, and individual and /or communal septic systems in the surrounding area. Stormwater from individual properties shall be conveyed via a Clearwater Sewer. Stormwater from the street may be managed via a system of ditches, swales and other stormwater management devices in a rural cross section. Future growth within the Tantallon Centre and surrounding study area will be accommodated through central water and communal and/or individual wastewater management systems. The consultant must identify key lakes, rivers, ocean inlets within the study areas for which water quality objectives have been set (as per clause b above) and determine the maximum amount of inputs these water bodies can assimilate without exceeding those water quality objectives.
e) Water quality samples should be taken from area lakes and any ocean inlet identified for discharge for a minimum of three seasons beginning with the Spring turnover to determine baseline conditions. For key freshwater bodies in both study areas, use standard methods such as lake phosphorus modeling to assess assimilative capacity for the key lakes and recommend objectives for Total Phosphorus (in accordance with CCME Framework for Phosphorus Management), bacteria and other parameters considered problematic within the watershed, and recommend maximum densities of development that may be accommodated within the area of freshwater bodies that is likely to contribute significantly to phosphorus loading. For the Porters Lake Centre assimilative capacity analysis, the consultant must identify a potential service area boundary for the Porters Lake Centre and a location for the discharge of treated effluent in accordance with the NSDE requirements (Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment, and Disposal 2006). Parameters to be tested in marine waters shall include standard water chemistry parameters, bacteria, phosphorus, ammonia and total nitrogen. The consultants shall also test for metals that may undermine desired water quality objectives recommended under this study for all key receiving waters. Low limit detection methods shall be used. The consultant shall also determine the depth of water to sediment at Whynacht's Cove to determine the degree of change in sediment deposits from the levels documented in the Whynacht's Cove Environmental Assessment and Enhancement Study (Griffiths – Muecke Associates 1981).

f) undertake well sampling and analysis for a representative sample of households throughout the study areas on private wells per bedrock area. Samples should be analysed for those parameters identified by the consultant as important to public health.
g) identify sources of contamination within the watershed study areas; identify and catalog existing known or suspected sources of contamination including malfunctioning septic systems based upon all available information.
h) recommend strategies to adapt HRM's stormwater management guidelines to achieve the water quality objectives set out under the watershed studies; HRM has completed a set of Stormwater Management Guidelines including appropriate Best Management Practices; strategies are needed to adapt and implement these Guidelines within each watershed (the Guidelines will be made available). Specific mechanisms are needed within each (sub) watershed related to the anticipated type and form of development within that (sub) watershed which will put the Guidelines into action. The Regional Plan provides a general indication of the types of development anticipated within defined areas of HRM. Stormwater strategies should conform to the provincial Storm Drainage Works Approval Policy (http://www.gov.ns.ca/enla/water/docs/Storm_Drainage_Works_Approval_Policy.pdf) and Halifax Water Policy for the conveyance of individual lot drainage in sewer serviced areas via Clearwater Sewers.
i) recommend methods to reduce and mitigate loss of permeable surfaces, native plants and native soils, groundwater recharge areas, and other important environmental functions within the watershed.
j) recommend methods to reduce cut and fill and overall grading of development sites.
k) identify and recommend measures to protect and manage natural corridors and critical habitats for terrestrial and aquatic species, including species at risk.
l) identify appropriate riparian buffers for the watershed recommend site-specific riparian buffers in areas which require a higher degree of protection than provided in the Regional Plan; recommend other appropriate methods for protection of identified critical terrestrial or aquatic habitats within the (sub) watersheds
m) identify areas that are suitable and not suitable for development within the watershed study areas based upon water quality objectives, receiving waters constraints, critical habitats, groundwater resources and potential central water supply, floodplains, or other constraints identified within the watershed study area and the opportunities for the provision of water and wastewater services, provide details and recommendations on land capacity for development and identify which areas are suitable for development of specific types, not suitable, or suitable with specific conditions, providing supporting reasons and analysis; identify the maximum population densities and form that development may take in those areas that are deemed suitable for development and identify appropriate water and wastewater management systems that may be used to facilitate the identified form of development.
n) recommend potential regulatory controls and management strategies to achieve the desired objectives for small scale wastewater management. considering the jurisdiction and scope of municipal authority under the Halifax Regional Municipality Charter and other relevant legislation, and scope for action under the Regional Plan and secondary municipal planning strategies, identify areas that should be included within a Wastewater Management District for those areas that may be serviced by shared septic systems within the study areas and recommend best available technology for shared septic systems.
o) recommend a monitoring plan to assess if the specific water quality objectives for the watershed are being met. HRM under the Regional Plan has instituted a general water quality monitoring program, as well as developer-funded site-specific water quality monitoring in relation to specific development proposals; monitoring within the watershed as recommended by this study will be considered for incorporation in the design of the described monitoring programs.

3.2. REQUIREMENTS: Lake Echo and Porters Lake Centres Servicing Component Study

The objective of the Lake Echo and Porters Lake Centres Servicing Component Study will also be to assess, in greater detail, options for servicing the lands within the Porters Lake Centre with central water and sewer and options for the servicing of land within the Lake Echo Centre and surrounding area with on-site and/or cluster septic systems (Appendix C). If the analysis reveals that there is a significant problem with water quality and/or quantity in the Lake Echo Centre, the consultant shall examine options for the provision of central water to the Lake Echo Centre. This Component Study shall also determine, for Porters Lake Centre, whether estimated sewage flows can be assimilated by receiving waters without exceeding water quality objectives. It will also determine how central water service, if recommended for the Lake Echo Centre might affect existing on-site septic systems and stormwater. The consultant shall also design a conceptual level network distribution system, and determine order of magnitude life-cycle costs (capital, maintenance and operating) for the provision of services. In addition, this component of the study shall be designed to undertake the following:

a) A house-to-house survey shall be completed and will consist of (a minimum) asking questions to property owners related to the type, age and performance of their current on-site septic systems and wells. For septic systems, the consultant shall include a dye test for each system to confirm system performance and discharge location. For wells, the consultant shall include testing for bacteria, basic chemical parameters and the additional recommended parameters (arsenic, uranium, radon, lead and fluoride).
    a. A minimum of 40 properties within the area indicated on the attached map shall be surveyed and included in the base scope of work. The consultant shall provide a unit price (per single survey) to survey an additional 20 properties either inside or outside the area indicated.
    b. The locations of the house-to-house survey, well testing and the survey questions shall be determined in consultation with HRM staff. Suggested questions for the survey are provided in Appendix E.
    c. The results of this survey shall be plotted on a map or series of maps designed to clearly communicate the nature and extent of malfunctioning on-site septic systems and the condition of well water supplies within the study area. The maps shall be submitted to the HRM project manager along with the raw surveys and a summary of the results of the survey in text and table form.
b) Through consultation with HRM staff and others, the consultant shall develop a preliminary service boundary for the Porters Lake Centre. This boundary shall be developed using information from a number of sources (1) the results of the door-to-door survey, (2) the location of existing development, (3) some allowance for future development, based in part on input community received through Section 3.1.3 of this RFP, and (4) soil conditions and other appropriate factors. The primary purpose of this boundary will be to assist in developing suitable locations for critical infrastructure like pumping stations, and treatment plants (centralized or decentralized), sewage outfall location and the sizing of other water and sewer infrastructure. The Consultant shall also identify areas that should be included within the boundaries of a Wastewater Management District for those areas that would continue to be serviced by individual on-site or communal wastewater management systems.
    a. The consultant must clearly state the criteria used to develop sewage flows and water requirements, and provide existing, future and ultimate flows at various nodes within the proposed systems. The consultant must also provide the criteria for designing and locating treatment facilities.
    b. Based on typical local conditions, the consultant shall provide the approximate cost to construct individual on-site systems (septic and well) and the land area required
c) Within the Preliminary Service Boundary for Porters Lake Centre, Preliminary Wastewater Management Service Boundary for Porters Lake and Lake Echo, and Preliminary Boundary for Water Service to the Lake Echo Centre, the consultant shall discuss the various servicing

solutions that could be utilized. The options considered shall include a discussion of the issues related to:

a. replacing or upgrading existing malfunctioning on-site well and septic systems and maintaining these systems as the future long term servicing solution,
b. decentralized solutions - such as communal or cluster systems.
c. Conventional solutions with piped water and sewer infrastructure and centralized treatment solutions shall also be examined only within the preliminary Service Boundary for Porters Lake.
d. For each servicing solution being considered the report shall include a general summary discussion of how each servicing solution works, technical issues, land requirements, regulatory and operator requirements, ability to be integrated with existing terrain, advantages / disadvantages, the estimated capital costs, operating costs, expected service life and other factors. For treatment facilities, in addition to the above, the consultant shall provide the process design criteria, and review and document a number of potential sites.
e. For each solution considered, the consultant shall develop separate conceptual drawings. These drawings shall include property lines, dwellings, roads, water bodies, contours, system layout, facility locations, outfall / intake locations, pipe sizing and potential phasing of construction. For treatment facilities, separate conceptual level design drawings, including phasing shall be provided. The drawings shall be at a minimum 24" by 36" at an appropriate scale. A schedule of quantities and a detailed cost estimate for each phase of implementation shall be included.

d) The consultant shall be prepared to present the results of the study to the Community, respond to the resulting questions, and incorporate appropriate comments in a confidential manner, from this meeting into the final report.

Attachment 3

Executive Summary from CBCL Porter`s Lake Watershed Servicing Report

A copy of the main conclusions and recommendations from the Executive Summary of the Study is presented below. A full copy of the Final Report may be reviewed on-line at http://www.halifax.ca/planhrm/index.html

EXECUTIVE SUMMARY

Introduction

The community of Porters Lake is located in the Halifax Regional Municipality (HRM) east of Halifax as shown in Figure ES1.1. There is considerable residential development as well as commercial development occurring in the area. The existing community comprises:

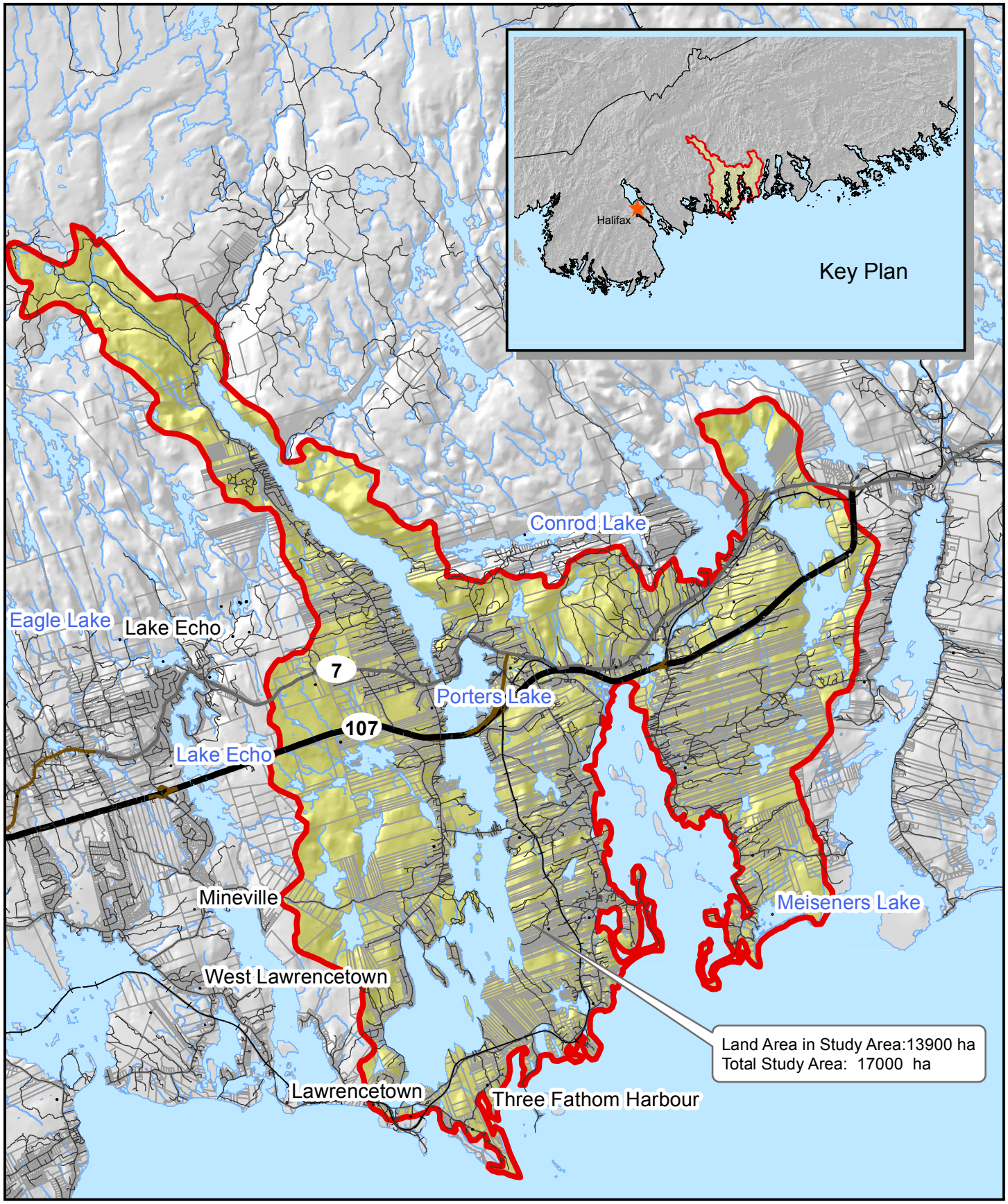
- 1,450 residences in several small communities and in strip developments along the main roads (typically older development) and in several subdivisions with large lots (newer development);
- Commercial development and small businesses centred along Highway 7;
- Three schools:
  - Porters Lake Elementary School- 40 Inspiration Drive;
  - The old Elementary School on Highway 7; and
  - Gaetz Brook Junior High School.

Existing development is serviced by onsite wastewater treatment systems, wells for water supply and roadside ditches for stormwater drainage. Receiving waters for storm runoff include streams and Porters Lake for development in the community of Porters Lake as well as streams and Chezzetcook Inlet for surrounding communities in the study area.

In the Halifax Regional Municipality's Regional Municipal Planning Strategy (HRM Regional MPS), Porters Lake is designated as a Rural Commuter Centre, which is defined as a low to medium density residential development with open space design subdivisions and a mix of convenience commercial, institutional and recreational uses. The HRM Regional MPS envisions the provision of express bus facilities connected to downtown Halifax and shared parking facilities for park and ride and commercial uses.

This study provides a means to evaluate opportunities for the provision of services required for planned development including, wastewater treatment and disposal, stormwater management and potable water while minimizing negative impacts on the natural environment. In order that HRM may promote and direct development that best suits requirements for developable land and minimizes negative impacts on the environment, the objectives of this study are to:

- Identify opportunities for development within the Porters Lake Study Area (identified in Figure ES1.1);
- Provide a range of servicing schemes for wastewater collection, treatment and disposal, stormwater management and water supply for those lands;



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Porters Lake Watershed/Servicing Study
Figure ES1.1 Study Area Location
May 2012

0 1,400 2,800 5,600 Meters

Study Area

CBCL Project # 101015
Data Sources: HRM, NSDNR
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -63.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

CBCL LIMITED
Consulting Engineers

N W E S

File Path: L:\101015 Lake Echo\101015_Layout\101015 - Porters Lake\101015 Porters Lake - Study Area.mxd

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- Discuss the "level of development" various schemes will support and the impacts on the surrounding environment of various servicing schemes; and
- Develop a site specific plan showing all land suitable for development complete with potential development densities and the services required to allow these densities to be realized.

Objectives for this study are established by policy E-17 in the HRM Regional MPS.

Results of Component Studies

Several component studies were undertaken to address the study objectives, gather baseline information and understand site conditions and system requirements of each aspect of municipal servicing infrastructure and potential development patterns and densities. The results of these component studies are outlined below.

Wastewater Collection and Treatment

Existing wastewater collection and disposal systems in the Study Area are predominantly onsite wastewater systems comprised of:

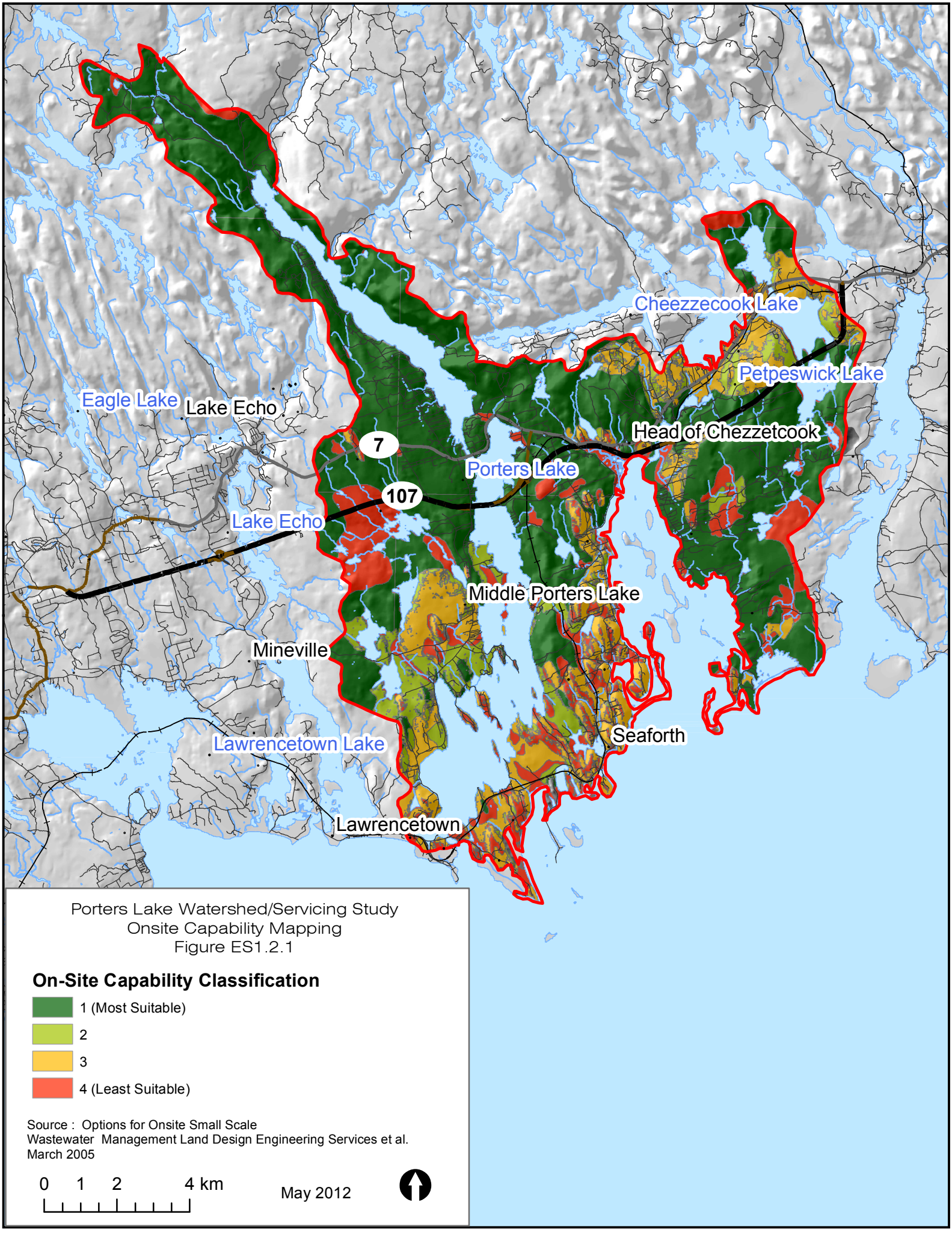
- A septic tank for solids removal; and
- An effluent dispersal system such as an area bed or contour system. Some original systems have failed and have been replaced with various alternatives including peat filters.

Figure ES 1.2.1, reproduced from the onsite study completed by Land Design Engineering in 2005[1], indicates that in general the soils in most of the Study Area are considered most suited for onsite wastewater treatment systems. The general exceptions are the lands between Chezzetcook Inlet and Porters Lake and between Porters Lake and Lawrencetown Lake. Discussions with local installers indicate that the failed systems have been in these areas and in pockets of unsuitable soils and on lots that do not meet current Nova Scotia Environment standards for the design of onsite wastewater treatment systems.

Water Supply, Treatment, and Distribution

Water is typically supplied to individual properties by onsite wells dug into locally recharged surficial aquifers and deeper wells that are drilled into the bedrock, supplied by regional aquifers. Water balance calculations were completed for the Study Area to determine, at a screening level, typical groundwater recharge rates in the community. Water demands for existing development were estimated based on typical average daily demands. These account for 7 percent of the overall recharge to local aquifers. It is estimated that the potential increase in demand generated by a high growth scenario in the community could account for up to 16 percent of the local area recharge which the aquifers are likely able to provide, this must be monitored as development proceeds.

[1] Land Design Engineering Services et al. March 2005. Options for Onsite & Small Scale Wastewater Management.



Porters Lake Watershed/Servicing Study
Onsite Capability Mapping
Figure ES1.2.1

On-Site Capability Classification

- 1 (Most Suitable)
- 2
- 3
- 4 (Least Suitable)

Source : Options for Onsite Small Scale Wastewater Management Land Design Engineering Services et al. March 2005

0 1 2 4 km

May 2012

Figure ES 1.2.2, reproduced from the onsite study completed by Land Design Engineering[2], indicates that in general the bedrock in the Study Area can supply well water of suitable quality. The general exception areas are similar to the areas considered less suitable for on-site wastewater treatment. In these areas treatment to remove common contaminants, such as iron, manganese and possibly arsenic is likely required. In practice, many residents do not treat their water to remove these contaminants and the water is considered unsuitable for drinking in these cases. Some residents use it anyway, others import drinking water.

The infiltration area required to supply groundwater to meet water demands for a single family from existing as well as potential future development is estimated to be 5,971 square metres, based on typical groundwater infiltration rates for the area and the assumptions that all permeable areas contribute equally to groundwater recharge throughout the Study Area.

The greatest risk to using groundwater from local surficial aquifers for potable water is the potential for groundwater contamination from local sources. The locations of potential sources of contamination were investigated and are documented in the main report and appendices.

Water Quality Objectives

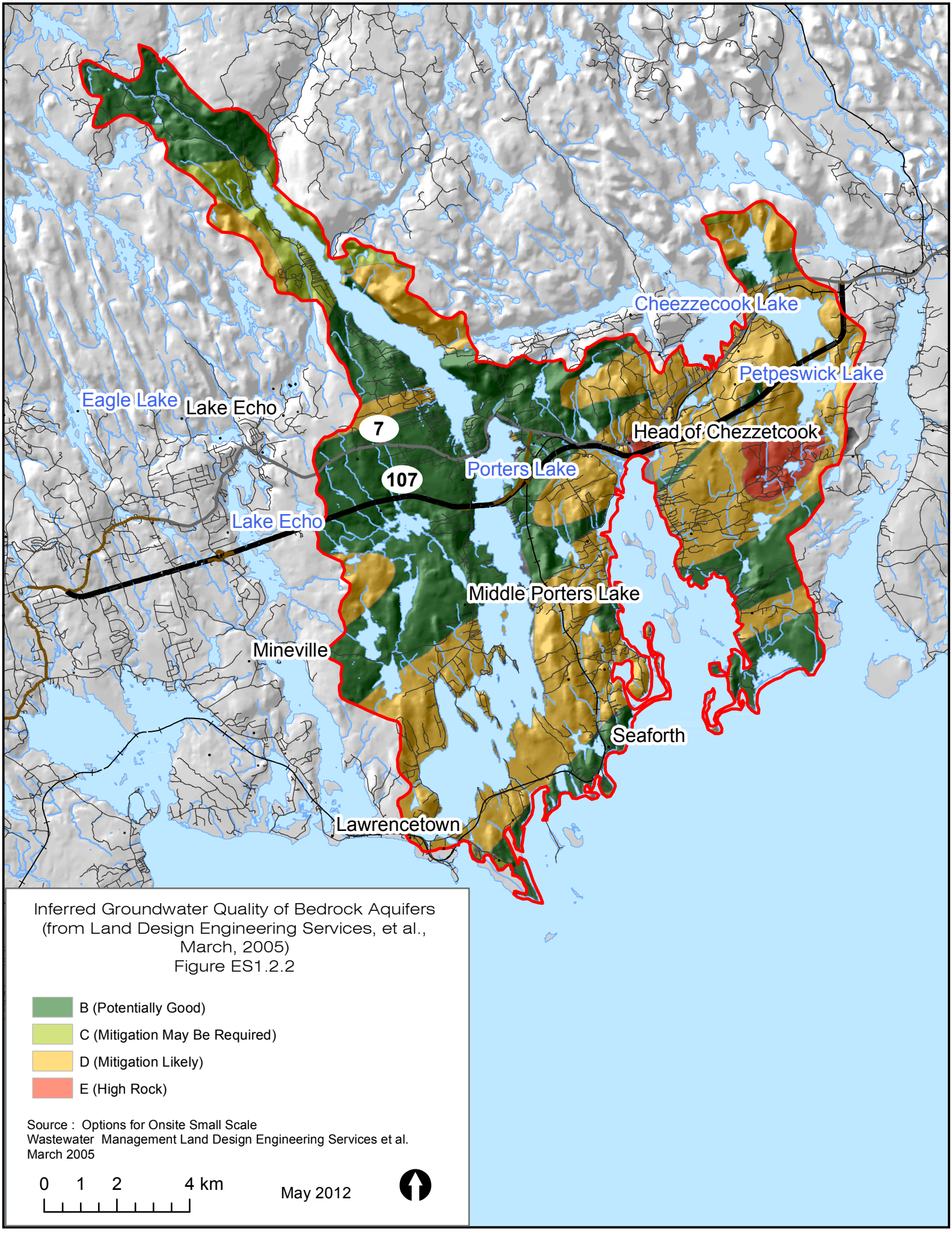
Minimum water use objectives for this study are based on the objectives described in the HRM Regional MPS indicating a desire to achieve public health standards for body contact recreation and to maintain the existing trophic status of our lakes and waterways to the extent possible.

An online survey of interested stakeholders was completed to assess the importance of water quality in local water bodies and to determine desired uses of them. A questionnaire was developed and made available online from August 5th to November 10th, 2010. There were 197 responses to the survey. In response to the question, **"Are you concerned about the water quality of the water bodies?"** more than 50 percent of the respondents were concerned with the water quality in the lakes in the watershed.

When asked: **"At what level would you be satisfied with future water quality?"** almost 90 percent of those responding indicated that the lakes should at least be suitable as fish and wildlife habitat and of those 20 to 25 percent indicated that the waters should be of the highest possible quality. More than 90 percent indicated similar desires for Chezzetcook Inlet and the ocean.

To meet HRM water use objectives E coli concentrations should be below 200 counts per 100 mL sample and have a trophic status of mesotrophic or better. To meet the water use objectives defined by the majority of respondents to the survey, water quality in the lakes should meet the CCME Guidelines for Protection of Aquatic Life (Freshwater), Chezzetcook Inlet and the ocean in the vicinity of the Study Area should meet the CCME Guidelines for Protection of Aquatic Life (Marine). In addition, to be suitable for human consumption of fish from these waters, it is recommended that mean E coli concentrations be below 14 counts.

[2] Ibid.



Inferred Groundwater Quality of Bedrock Aquifers
(from Land Design Engineering Services, et al., March, 2005)
Figure ES1.2.2

- B (Potentially Good)
- C (Mitigation May Be Required)
- D (Mitigation Likely)
- E (High Rock)

Source : Options for Onsite Small Scale Wastewater Management Land Design Engineering Services et al. March 2005

0 1 2 4 km

May 2012

When asked about willingness to pay more than the typical cost of onsite services for community based wastewater treatment systems to achieve the desired water quality in the area lakes and inlets, the answer was **"no"** for a majority (66.5 %) of respondents.

Receiving Water Quality

A receiving water sampling program was completed for this study based on the following parameters:

- Water samples were collected in spring, summer and fall of 2010, during dry conditions as well as following rain events at 5 sampling locations in Porter Lake;
- Samples were analysed for evidence of sewage (E-Coli and Fecal coliform, CBOD and Total Suspended Solids) and typical indicators of trophic status (nitrogen, phosphorus, Chlorophyll a and dissolved oxygen); and
- Additional samples were collected at the same 5 locations in the spring, summer and fall of 2012 and analysed for total phosphorus concentrations.

Results of sampling and modelling indicate:

- On the basis of data collected in the HRM 2006 to 2011 Sampling Program and data collected in 2012 by CBCL Limited, average total phosphorus concentrations at the upper end of Porters Lake are in the mesotrophic range for the 6 years of record, at the upper end of the mesotrophic range for 2010 to 2012 values and in the meso-eutrophic range for 2 of 3 samples taken in 2012. Chlorophyll a concentrations measured in the HRM program in the upper part of Porters Lake were all in the oligotrophic range;
- All of the total phosphorus samples taken at the 5 sample location in Porters Lake collected for this study in 2010 were below 0.02 mg/L, indicating oligotrophic to mesotrophic conditions with one exception, 0.03 mg/L was measured at site furthest downstream following a significant rainfall in late October, indicating meso-eutrophic conditions at that time. Chlorophyll a concentrations ranged from 0.82 to 1.37 micrograms/L in the oligotrophic range from spring to fall. In 2012 the average total phosphorus concentrations were all in the upper mesotrophic range or into the meso-eutrophic range. TP concentrations measured in the spring were all in the meso-eutrophic range, they were in the mesotrophic range at the lower end of the lake in the summer and in the oligotrophic range across the lake in the late fall;
- Porters Lake typically experienced E coli concentrations below 200 counts, making it suitable for swimming but there are incidents of E coli concentrations higher than 14 counts, typically during and following rainfall events. It is questionable whether it is suitable for consumption of fish. E coli and Fecal coliform concentrations are in excess of 14 counts according to Environment Canada; and
- Low oxygen concentrations were measured in a deep part of Porters Lake near the community of Porters Lake. The development of low oxygen concentration may be natural, but is also likely to be enhanced by the effects of human activities. The deepwater oxygen concentration should be monitored in the future, as growth of the affected area may affect the health of fish and invertebrates in Porters Lake.

These conditions can change with changes in climate and land use in the tributary areas.

Assimilative Capacity in Receiving Waters

Comparison of existing water quality to desired water uses indicates that:

- Measured E coli concentrations were below 200 counts but frequently above 14 counts, and concentrations of Chlorophyll a are typically in the oligotropic range. Therefore Porters Lake in general has assimilate capacity available to accept additional nutrient loads but no additional E coli loads; and
- Chezzetcook Inlet does not have capacity for additional E coli loads, based on the high E coli concentrations in the inlet. Fisheries and Oceans have closed the upper inlet and sheltered areas along the west coast of the inlet to shellfish harvesting for human consumption as a result.

Meetings with Focus Group of Community Representatives

Several Porters Lake community and business leaders as well as HRM Councillor David Hendsbee were contacted and asked to meet with the study team to discuss their vision for the community. The meeting took place at the community centre on January 31, 2011, 19 residents of Porters Lake attended. Population forecasts, existing water quality in receiving waters, water use objectives and associated water quality objectives from the survey were discussed as well as options for servicing future development in the community. The representatives listened to the presentations provided by the study team and were then asked to consider future development in the community and to answer two (2) questions based on their opinions of the information presented:

- What type of development should occur, low density development serviced by onsite systems as has generally occurred in the community or dense development serviced by central water, wastewater and stormwater systems?
- If there is dense development with central services, where should it be located? Participants were asked to draw the locations on the maps.

Responses from the three groups formed at the meeting were similar. Generally they agreed that:

- There should be a Core Area with denser development serviced by central systems located in the area around the existing commercial development on Highway 7 extending over to the undeveloped lands south of Highway 107 at Exit 20 and that additional expansion of the Core Area would be appropriate behind the Fire Hall. Figure ES1.2.6 shows the location and general extents of the Core Area as defined by the Focus Group at the meeting. Smaller lots and even small apartment building developments could be acceptable in appropriate locations within this area;
- The area around the O'Connell Drive School would also be appropriate for more dense smaller lot

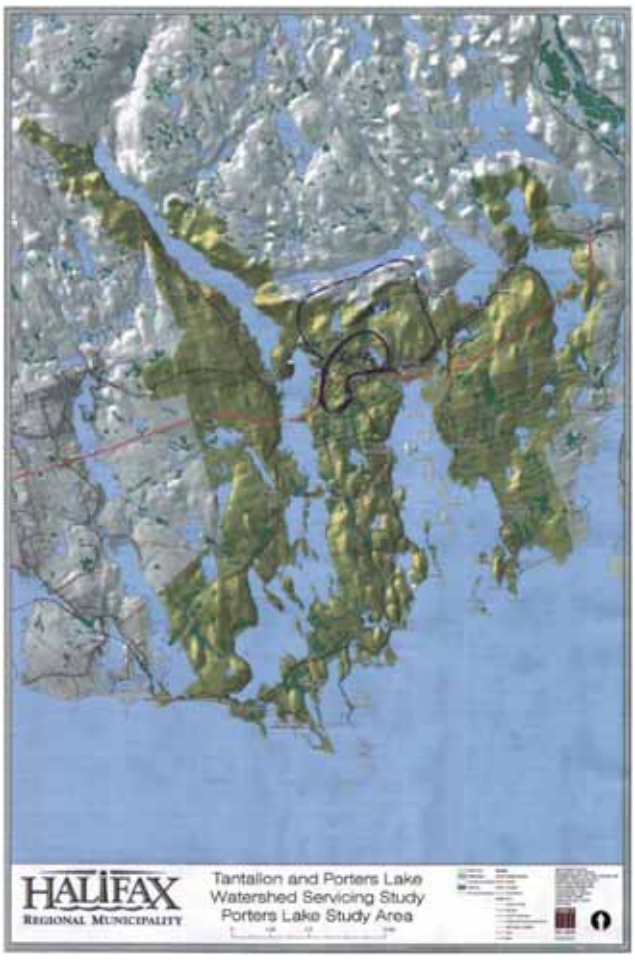


Figure ES1.2.6 Location and General Extents of the Core Area

development suitable for young families and seniors that wish to live in Porters Lake but can't afford to purchase or do not wish to maintain large properties; and

- Large lots with on-site systems or cluster developments are suitable for the rest of the area beyond the Core.

Desirability for Residential Development

Figure ES1.2.7 shows the relative suitability and desirability of the land in the Study Area for residential development. Desirability does not imply it is technically feasible to develop the lands. Factors such as slopes could make building difficult. Factors used to determine suitability and desirability are explained in the main report.

Certain areas within the Study Area are considered unsuitable for development on the basis of their capability to support on-site water and wastewater systems, regulatory restrictions or their environmental sensitivity. All areas outside the "No Go" areas (shown in Figure ES1.2.7) are considered available for development.

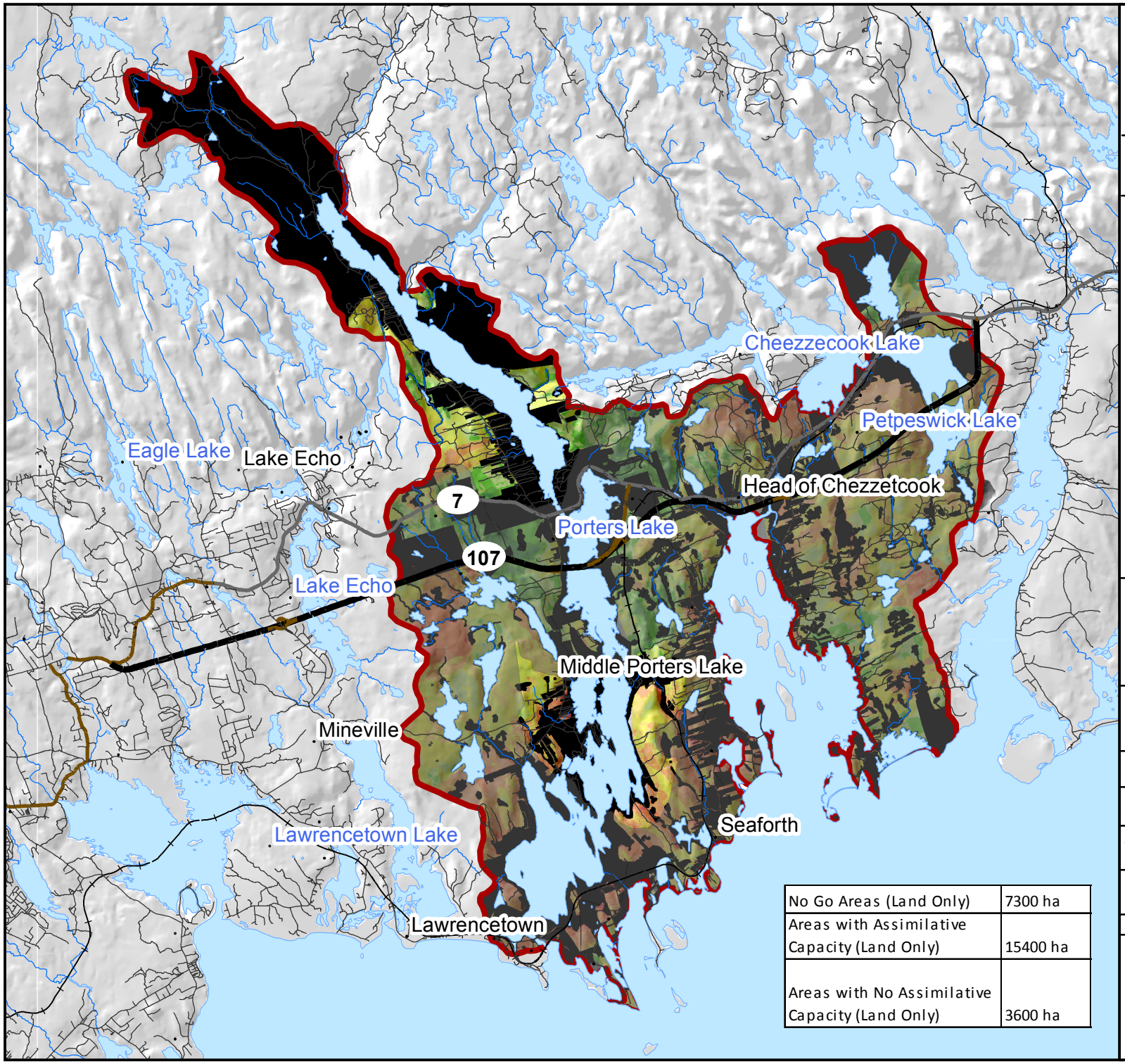
Demographics and Potential Development Densities

A low growth scenario for the Porters lake area was developed based on the provincial Community Counts data. A high-range growth scenario is based on the projection in the Transit Study. A mid-range growth scenario splitting the difference between the high and low projections was also established. Changes in population and housing units are summarized in Table ES1.2.8 (below).

Table ES1.2.8: Population Projections for Porters Lake Study Area

Year	Low (Community Counts)	High (Transit Plan)	Mid-Range (between Transit Plan and Community Counts)
2010 Population	3,200	6,100	
2010 Units	1,200	2,300	
2030 Population	5,100	11,300	8,200
2030 Units	2,200	4,900	3,600
Population Growth 2010-2030	1,900	5,200	3,200
Unit Growth 2010-2030	1,000	2,600	1,800

Note: 2010 population and number of units were different in the two studies referenced. This study takes this range into consideration in any assessments that utilize population and unit counts. Manual counts of existing units to be serviced in the Core Area were undertaken as part of the servicing assessment.



No Go Areas (Land Only)	7300 ha
Areas with Assimilative Capacity (Land Only)	15400 ha
Areas with No Assimilative Capacity (Land Only)	3600 ha

HALIFAX
REGIONAL MUNICIPALITY

Porters Lake Watershed/Servicing Study

- Streets
- Trunk Highway
- Divided Highway
- Arterial
- Collector
- Railroad
- Study Area Boundary
- No Go Areas

No Assimilative Capacity Available
- Best Suitability and Desirability
- Worst Suitability and Desirability

Assimilative Capacity Available
- Best Suitability and Desirability
- Worst Suitability and Desirability

CBCL LIMITED
Consulting Engineers

Land Available for Development with Existing Assimilative Capacity

Drawn: YO	Date: March 2012
Checked: GS	CBCL Project # 101015.00
Approved: MD	

Figure ES1.2.7

Notes:

Map Parameters

Projected Coordinate System: NAD_1983_UTM_Zone_20N
Projection: Transverse_Mercator
False Easting: 500000.00000000
False Northing: 0.00000000
Central Meridian: -63.00000000
Scale Factor: 0.99960000
Latitude Of Origin: 0.00000000
Linear Unit: Meter

N W E S

0 900 1,800 3,600 Meters

File Path: L:\101015 Lake Echo\101015_Layout\101015 - Porters Lake\101015 Porters Lake - Lands Available for Development with Existing Assimilative Capacity.mxd Last Saved: 14/03/2013 2:58:24 PM

For assessment purposes it was assumed that half of the population increases would be in the Core Area with a development density in the order of 40 persons per hectare to support central services. The remainder would be dispersed across the Study Area, with new development at an average density of 2.9 persons per hectare.

Conclusions and Recommendations

Conclusions about the state of existing development and its impacts on the environment as well as recommendations to improve existing conditions and to reduce the risks of additional negative impacts on the environment of potential future development are summarized as follows:

Water Quality

- Minimum water use objectives for the water bodies in the Study Area include:
  - All lakes should be mesotrophic or better and suitable as fish and wildlife habitat; and
  - Chezzetcook Inlet should be suitable for shellfish harvesting and human consumption.
- Existing water quality makes:
  - The lakes generally suitable for fish and wildlife habitat, sections of Porters Lake may not be suitable due to average E coli concentrations above 14 counts and total phosphorus concentrations in Mill Lake in the meso-eutrophic range; and
  - Chezzetcook Inlet unsuitable for shellfish harvesting for human consumption.

For the water bodies in the Study Area to be used as per the preferences indicated in the water quality survey, measures must be taken to improve existing water quality in Chezzetcook Inlet, portions of Porters Lake and Mill Lake. Attention should be paid to the trophic status of Porters Lake to ensure that it is oligotrophic and remains in this state. Future development in the Study Area should minimize the risk of generating additional sources of pollutants and improve existing water quality where feasible.

Recommended measures to reduce pollutant loads from existing development and minimize potential loads from future development to improve existing water quality in the Study Area include:

- Implement **public education programs** relating property owners' actions to water quality to reduce pollutant loads from individual properties;
- Encourage and assist with the development of **stewardship programs** for the lakes in the community as well as the adjacent shoreline;
- Identify **deficiencies** with existing wastewater and stormwater systems and design and construct retrofits to these systems;
- Design, construct, operate and maintain wastewater management and stormwater management systems to **minimize potential pollutant loads** released to the receiving environment by these systems; and
- **Continue monitoring water quality** in Porters Lake and additional lakes closest to proposed development on a quarterly basis to establish baseline conditions in the Study Area and to follow development progress and its impacts. Assessment of the ongoing data should be used to verify that the plan is achieving the desired reduction in pollutant loads and to modify development plans in response to unpredicted impacts. The monitoring program should **include vertical profiles of dissolved oxygen** at several locations in the lakes, particularly the deepest areas of Porters Lake.

Servicing

Recommended changes to traditional servicing to reduce potential pollutant loads to the water bodies in the Study Area include:

WASTEWATER COLLECTION, TREATMENT AND DISPERSAL

- Effluent discharge from any wastewater treatment plant should be carefully sited to avoid future environmental problems. Due to the bathymetry and hydrodynamics of Porters Lake, much of the lake is likely to be unsuitable to receive wastewater. The most southern section of Porters Lake has the greatest potential for dispersion and dilution of effluent, but is not close to centers of development. A wastewater treatment facility near the community of Porters Lake should not discharge into the deep cove adjacent to the community due to restricted flushing and stagnant deep water. Outfalls near the central axis of the lake south of the Highway 107 bridge may be considered if nutrient removal is included as part of the wastewater treatment;
- Ensure routine maintenance and monitoring of onsite wastewater treatment systems. This may be facilitated through formation of a wastewater management district with HRM as the party responsible for management of the district; and
- Routine maintenance and monitoring of cluster wastewater treatment systems. This is already required for each system under current provincial regulations but may be more efficiently provided by a wastewater management district.

STORMWATER COLLECTION, TREATMENT AND DISPERSAL

Objectives for Stormwater Management Plans to rectify existing water quality issues and limit the risks of creating new risks should include:

- Minimize changes in runoff at source, including each building site;
- Maintain peak runoff flows at or below existing flows from all areas;
- Promote infiltration of the cleanest runoff (from rooftops, etc.) for groundwater recharge; and
- Provide treatment of all other runoff and additional infiltration facilities before the excess enters the local natural drainage systems.

Low impact development should be considered for all new developments and modifications of existing development. In any servicing situation, to achieve stormwater water quality objectives, the following should be considered:

- Low impact site development, minimizing the affected footprint and providing measures to minimize the collection of stormwater. Where it is necessary to collect stormwater, decrease the efficiency of the collection systems, particularly on private properties;
- Decrease the efficiency of local collection systems using swales with flow limiting culverts between them to encourage detention and infiltration. Filling of ditches should not be allowed; and
- Treatment of remaining runoff in centralized wet ponds and constructed wetlands with built in infiltration and detention capacity. Co-use of detention with other public use lands such as parkland or recreation fields will lower the overall costs of this requirement as the costs of land can be significant.

WATER

- Groundwater supplies to service individual properties as well as clusters systems to service ten (10) properties are feasible. Wells in bedrock are the most suitable for this purpose to protect against surface contamination. Treatment of these supplies may be required for removal of naturally occurring iron, manganese and possibly arsenic;
- Groundwater supplies for central systems to service some portion of existing development plus future development may be achievable. Locating a well field with source water that requires minimal treatment should be investigated; and
- Potential surface water supplies investigated in the Study Area included the Porters Lake system. This should be further investigated if suitable wells cannot be developed.

GENERAL

- Monitoring of construction activities with particular attention paid to assuring that erosion prevention and sediment control plans are implemented and components are maintained during construction and properly retired at the end of construction activities;
- Condominium associations are required for ongoing responsibility of clustered water and wastewater services where these are considered; and
- To ensure proper operation and maintenance of all onsite wastewater systems, wastewater management district(s) are recommended. They will need to be formed as there are none currently in operation in the community and should manage onsite wastewater treatment systems in the Study Area most likely at risk of failure as a minimum, described in section 3.11. HRM is the likely manager of these systems.

Future Development

AREAS SUITABLE FOR DEVELOPMENT

Certain areas within the Study Area are considered unsuitable for development on the basis of their capability to sustain onsite systems, regulatory restrictions or their environmental sensitivity. Generally development should avoid the areas designated as "No Go" areas, including:

- Areas that are already developed;
- Water bodies, watercourses and designated wetlands;
- Watercourse, wetland and coastal buffers;
- Provincial parks, reserves, and provincial crown lands;
- Cemeteries;
- All lands below elevation 2.5m;
- Significant wildlife habitat and endangered species as per map 5 of the Regional Municipal Planning Strategy;
- Areas of elevated archaeological potential as per map 11 of the Regional Municipal Planning Strategy; and
- Lands of high cultural significance as per category 5 on map 10 in the Regional Municipal Planning Strategy.

All areas outside the "No Go" areas are considered available for development with the exception of the lands tributary to Mill Lake, Sections 2, 3 and 5 of Porters Lake and the upper end and west side of

Chezzetcook Inlet. Figure ES1.2.7 illustrates the relative suitability and desirability for residential development of areas within the Study Area outside of the "No Go" areas. The low growth scenario requires approximately 234 hectares to accommodate the projected new development outside of the Core Area, approximately 3.5% of the area available for development in the Study Area. The medium growth scenario requires approximately 394 hectares (5.8%) and the high growth requires approximately 640 hectares (9.4%).

Location of Development

The assumption that growth in the areas outside of the Core Area will be based on the use of cluster systems creates a large degree of flexibility in the location of future development. Unlike central systems that require a certain level of density to be concentrated in one area to make the systems cost effective, cluster systems can be cost-effectively developed separately in a variety of areas allowing developments throughout the Study Area to come on-line as desired.

If a Wastewater Management District is established to improve monitoring, maintenance and cost-effectiveness through sharing of resources, the use of cluster systems is easily scale-able. Since each subdivision/condominium corporation will build and own the infrastructure, the Wastewater Management District will only need to add additional staff and their supporting equipment for which it will be compensated by the additional condominium corporations. No large investments in infrastructure or new plants will be required.

Form of Development

Any additional development should ensure minimal degradation of stormwater or preferably, improved stormwater quality in an effort to improve receiving water quality. Improving the design and construction as well as maintenance and monitoring of onsite wastewater and stormwater systems will produce improvements in water quality. Additional improvements may be made by improving the process of locating and laying out development and selecting appropriate types of development.

In keeping with the proposal developed by area residents, a Core Area or community centre, serviced by central services, is envisioned with a center located near the intersection of the William Porter Connector and Highway 7.

Area residents envisioned the rest of the Study Area being developed as open space subdivisions. It is recommended that classic open space subdivision designs be used to keep a significant portion of the Study Area free of development. Based on the *Conservation Design (CSD) Workshop Discussion Paper* distributed at a session hosted by HRM on 5 November 2010, classic open space design allows an overall density of one lot per 0.4 hectares (one lot per acre) with the requirement that the landowner preserves culturally and environmentally significant lands by retaining at least 60% of the parcel as open space. Within an overall development parcel, development may occur in the areas outside the "No Go" areas defined above.

Within individual house lots, responsible site planning, design and construction should be encouraged to mitigate the creation of impermeable surfaces (such as paved driveways, rooftops) through a variety of approaches such as the provision of multiuse land areas for recharge. Lawn areas, for example, can be

designed to act as surface runoff detention areas, as well as aesthetic and recreational areas. Driveways can be designed to be more permeable through the use of unit pavers, and roof drains can be designed to discharge into soft landscaped areas or "rain gardens". In other cases, it may be more desirable to have impermeable surfaces directing runoff to recharge areas depending on the situation. The point is that in each case the question of stormwater runoff and recharge needs to be addressed at the community level as well as on each property in the community. Responsible design also incorporates the use of native landscape, topography and native vegetation into the site development. Rather than stripping a site bare and completely reforming the topography, buildings should be placed in the landscape and the areas disturbed for construction should be limited to the smallest reasonable footprint.

MINIMUM LOT SIZE

Based on the screening level assessment for water supply by wells, the minimum lot size for residential development should generally be based on a requirement for a minimum of 5,971 square metres of permeable area for each 1 cubic metre per day of demand, which is approximately equivalent to the demand for one dwelling unit. This should be added to the area taken by all impermeable surfaces on the property and the total compared to the minimum lot size required for the onsite wastewater treatment and dispersal system. The larger size should be used to establish a minimum property size on a site by site basis.

This minimum area of 5,971 square metres of permeable surface plus impermeable surfaces is for areas with a soil depth exceeding 300 mm. In locations with soil depths of 150 to 299 mm, the minimum lot size should be 6,800 square metres and in locations with soil depths less than 149mm, the minimum lot size should be 9,000 square metres to meet Nova Scotia Environment technical guidelines for onsite sewage disposal systems[3].

Costs of Services

Table ES1.4 provides a cost summary for provision of services in the Study Area, including the Core Area (the community centre as defined by the residents' Focus Group). In this table a range of costs is presented on-site services to represent a range of site and geologic conditions as well as alternative technologies (see Appendix F -Table 7.1 for details).

An increase in residential development density cannot be achieved in the Core Area without providing some form of central services. It is interesting to note that the cost per service of central services is lowest for the high growth scenarios but is still more than the costs of clustered services and the costs of onsite systems to service a single unit. In areas outside of the Core Area, clustered systems may allow some increase in population density to be achieved to minimize development footprints and costs of other municipal services.

[3] Nova Scotia Environment, April 2009. *On-Site Sewage Disposal Systems Technical Guideline: Minimum Lot Size requirements For Development Utilizing On-Site Sewage Disposal Systems.* Table 2.4.

Table ES1.4: Cost of Services

	Design Number of Units Serviced	Wastewater Services	Stormwater	Water Supply	Overall Servicing Capital Costs	Capital Cost ($/ Unit Serviced)	Life Cycle Costs of Core Area Servicing Plan	Life Cycle Cost ($/ Unit Serviced)
Central Services in Porters Lake Core Area								
High Growth	1,267	$ 18,260,968	$ 3,837,724	$ 15,059,035	$ 37,157,727	$ 33,204	$ 50,301,215	$ 39,689
Medium Growth	711	$ 16,895,458	$ 3,837,724	$ 7,810,136	$ 32,267,656	$ 55,698	$ 39,417,734	$ 55,465
Low Growth	592	$ 12,125,745	$ 2,451,998	$ 6,371,586	$ 23,660,998	$ 39,080	$ 34,937,593	$ 59,007
On-site Services - Outside of Core Area								
Individual Systems - assumes systems are constructed in suitable areas (see Figure 4.1)	1	$ 14,400	$ 2,500	$ 15,200	$ 32,100	$ 32,100	$ 64,158	$ 64,158
Cluster Systems - assumes systems are constructed in suitable areas (see Figure 4.2)	10	$ 186,400	$ 25,000	$ 129,000	$ 340,400	$ 34,040	$ 875,651	$ 87,565