

Township of Bonnechere Valley

Final Planning Report

Lake Clear Lake Capacity: RV Land Use Study



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Appendix 1 HESL Lake Clear Capacity Assessment Report Package

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1.0 Introduction

The Township of Bonnechere Valley (Township) is a rural municipality, centrally located in Renfrew County (County) and roughly 130 kilometres (km) west of the City of Ottawa. The Township is approximately 589 square kilometres (km²) in area and is home to approximately 3,900 people (2021 Census).

Township residents enjoy a high quality of life, rich cultural history and a diversity of natural features, including forests, caves, rivers and freshwater lakes. In addition to its natural beauty which affords numerous outdoor recreation, tourism and cottage development opportunities, the Township boasts an affordable small-town feel while being close to larger commercial centres, such as Ottawa, Pembroke, Petawawa, Renfrew and Arnprior.

Lake Clear is one of the Township's many natural assets. Located in the southwestern part of the Township (roughly 15 km southwest of the community of Eganville), it is a relatively small lake and has an average depth of 10.4 metres (m). Lake Clear is surrounded by forested hills and is relatively undeveloped, with a mix of permanent and seasonal residential properties abutting its shoreline. The lake is known for its clear, clean water and is a popular destination for outdoor recreational activities such as swimming, boating, hiking and fishing.

At present, Lake Clear is an 'at-capacity lake' as it supports a natural lake trout population (a globally rare species) and, by definition, has reached its limit capacity for assimilating phosphorus without negatively impacting the quality of the water (specifically dissolved oxygen concentrations and related lake trout habitat requirements). As a result, new lot creation within 300 m of the shoreline is generally prohibited; and the Township's Zoning By-law similarly permits a limited range of land uses within 300 m of the shoreline, but permits new development on existing vacant lots of record, subject to certain conditions.

Within this context, an increasing number of consumers across Canada have turned to the recreation vehicle (RV) lifestyle as an alternative way to spend their leisure time. Along with this trend, the use of RVs on waterfront properties abutting Lake Clear has raised concerns about their potential impacts on lake water quality associated with septic systems and phosphorous loading, particularly given Lake Clear's status as an at-capacity lake. Concerns have also been raised about the compatibility of RVs with the surrounding environment and their effects on the municipal property tax base. As such, the Township retained:

1. Hutchinson Environmental Sciences Ltd. (HESL) to prepare an updated Lakeshore Capacity Assessment (LSCA) for Lake Clear (HESL Report); and
2. J.L. Richards & Associates Ltd. (JLR) to prepare the enclosed Planning Report (JLR Report) which reviews the existing land use planning framework for RVs within 300 m of the Lake Clear shoreline and outlines associated recommendations pursuant to the HESL Report, case study research, and best management practices (BMPs) (Study).

The intent of these combined efforts is to better balance the use of RVs to enjoy Lake Clear with the health and integrity of the lake itself.

The more specific scope of the Study is as follows:

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1. To review relevant background information, including:
 - a. land use and development patterns within 300 m of the Lake Clear shoreline available from the Township, digital satellite imagery and GIS mapping information from the County; and
 - b. the current land use planning framework regarding the use of RVs on properties abutting Lake Clear i.e., 2020 Provincial Policy Statement, County Official Plan, Township Zoning By-law, and administrative reports.
2. To research a select number of municipalities (i.e., the Townships of North Frontenac, Strong and Whitewater Region) that have similar issues regarding the use of RVs on properties abutting lakes within their respective jurisdictions and review their associated land use planning frameworks to determine potential application(s) to the Study.
3. To recommend 'good land use planning' measures regarding the use of RVs within 300 m of the Lake Clear shoreline.
4. To partner with Township staff in undertaking the above tasks and support Council's decision-making authority during the Study, which comprised the following major milestones:
 - a. The HESL Report (2023) and the JLR Report (2023) were jointly submitted to the Township on November 3/23;
 - b. Township staff and the JLR-HESL team facilitated Study briefings with:
 - i. Township Council on November 8/23;
 - ii. the Lake Clear Property Owners Association (LCPOA) on November 13/23; and
 - iii. Township Council on November 28/23;
 - c. On December 19/23, Council extended the public review / commenting period for the HESL Report (2023) and the JLR Report (2023) from December 31/23 to June 30/24;
 - d. During the public review / commenting period:
 - i. 21 emails were sent to the Township; five letters-to-the-editor were posted in the local newspaper media; and three letters (dated February 22/24, June 3/24 and July 12/24) were sent to the Township from the Ontario Ministry of Environment, Conservation and Parks (MECP)¹;
 - ii. Township staff and the JLR-HESL team met with MECP staff on April 5/24; and HESL met with MECP staff on April 18/24; and
 - iii. Township staff and the JLR-HESL team met with MECP and County staff on July 8/24.
5. To document the outcome of this phase of the Study and recommend next steps for the Township in the enclosed JLR Report (2024), which was presented to Township Council on October 2/24 and subsequently endorsed in principle by same on October 15/24.

¹ Note the emails, letters-to-the-editor and MECP letters submitted during the public review / commenting period are provided under separate cover.

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2.0 RV Trends and Issues

The Canadian RV Association and the RV Dealers Association of Canada reported that in 2018, there were just over 2.1 million households in Canada (approximately 15%) that owned an RV². This was slightly up from, but in line with, previous studies (i.e., 13% to 14% from 2012 and 2005). Furthermore, in 2022, over 50,000 RV shipments were recorded in Canada, a 16% increase from 2021³. The use of RVs also has favourable economic benefits, as documented in a 2020 study by The Portage Group for the Canadian RV Association⁴:

1. Vacations in RVs cost households 16% less on average than driving and staying in Airbnb rentals; 37% less than driving and staying in hotels; and 57% less than flying and staying in hotels.
2. The RV sector directly and indirectly supported an estimated 67,200 jobs and delivered \$4.8 billion in added economic value to the Canadian economy from an initial expenditure of \$6.2 billion in 2019.

At the same time however, the use of RVs on waterfront properties has raised concerns about their impacts on:

1. Lake water quality: RVs that still have running gear attached and are still mobile may be brought to a licensed sewage disposal area. But without a septic system permit, the sewage produced by using an RV is unregulated and undocumented. As such, there is a risk that whatever on-site sewage system is used may not properly attenuate phosphorous loading into the lake which is a parameter of concern for water quality.
2. Compatibility: Concerns have been raised about the compatibility of RVs with the surrounding environment which typically focus on aesthetics and noise from portable power generators.
3. Health and safety: A property with an RV may not have a civic address for first responders in an emergency and/or may not have an approved road access to the property.
4. Financial: The Municipal Property Assessment Corporation (MPAC) employs the following criteria for when an RV is considered an assessable structure:
 - a. if the RV is more than 2.6 m wide as it would require an oversize permit for road travel; or
 - b. if the RV has an enclosed structure attached to it (e.g., sunroom, porch, etc.).

If one of the above criteria is not satisfied, then the RV is not considered an assessable structure. This means that an otherwise vacant property containing an occupied RV would be assessed as vacant residential land and assessed using a vacant land tax rate. Comparatively, a single detached dwelling (permanent or seasonal) is taxed based on its assessed value which includes the value of the land, buildings and structures. This

² Source: [2021 RV trends from the Canadian Recreational Vehicle Association \(ontarioparks.com\)](https://www.ontarioparks.com)

³ Source: [6 Statistics About RVing In Canada That Might Surprise You - MountainviewToday.ca](https://mountainviewtoday.ca)

⁴ Source: [Economic Impact of the Canadian Recreation Vehicle Industry \(rvda.ca\)](https://rvda.ca)

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increases the assessed value for the property and therefore increases the property taxes which ultimately contributes to the municipal costs of providing services to ratepayers⁵.

3.0 Study Area

As shown on Figure 1, the Study area lies in the southwestern part of the Township, roughly 15 km southwest of the community of Eganville and within the Lake Clear Watershed. Its more specific extent covers 300 m of the Lake Clear shoreline, as shown on Figure 2.

4.0 Study Area Characteristics

4.1 Lake Clear

Lake Clear is relatively small, having a surface area of roughly 17 km². Known for its clear and clean water, Lake Clear is fed by several streams and springs. Its water level, which has a maximum depth of roughly 40 m and an average depth of 10.4 m, is maintained by a small dam at the eastern end of the lake. Lake Clear is shallow around the shoreline and gets deeper towards its center. The shoreline is irregular and rocky, with several bays and coves.

Lake Clear is home to a variety of fish species, including smallmouth bass, northern pike, yellow perch, and lake trout. As such, Lake Clear is identified as a 'lake trout lake', in that it contains suitable lake trout habitat (i.e., clear-deep-cold water with adequate levels of dissolved oxygen).

4.2 Shoreland Area

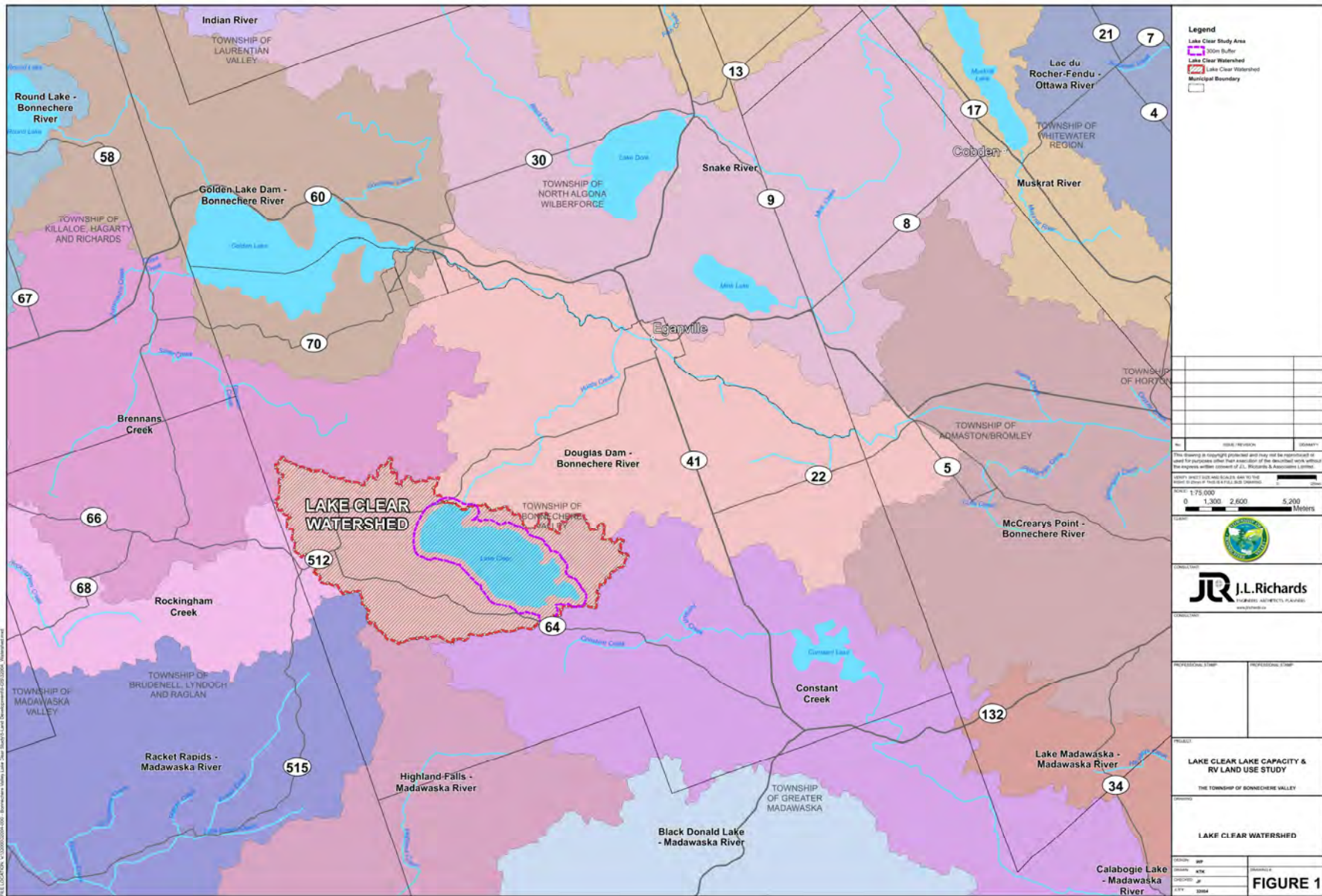
Lake Clear is surrounded by forested hills (comprised of a mix of deciduous and coniferous trees) and small cliffs, with some areas of exposed Canadian Shield granite outcroppings. In addition to being a popular destination for recreational activities such as swimming, boating, hiking and fishing, the shoreland area also contains a mix of land uses. As shown on Figure 3, based on available MPAC data, existing land uses within 300 m of the Lake Clear shoreline include residential (i.e., permanent and seasonal dwellings), farms, commercial operations (i.e., Opeongo Mountain Resort, Whispering Pines Resort), a public 'industrial' use (i.e., Township waste transfer station), Crown land and vacant land. Furthermore, the LCPOA counted 55 RVs in 2018, 46 of which appeared to be used for residency purposes⁶. This baseline data was then contrasted and compared to publicly available 'near-present' digital satellite imagery from Renfrew County (2020). Based on this review, Figure 3 suggests there are 51 RVs (+/-) situated on 27 privately owned parcels within 300 m of the Lake Clear shoreline (i.e., north shoreline: 16 RVs; south shoreline: 17 RVs; east shoreline: 12 RVs; west shoreline: 6 RVs).

⁵ Source: 'Recreational Vehicle Options Report to the Council of the Township of Bonnechere Valley', Renfrew County Planning Services, December 13, 2021.

⁶ Source: LCPOA. 2020. LCPOA proposal for controlling use of Recreational Vehicles on Lake Clear.

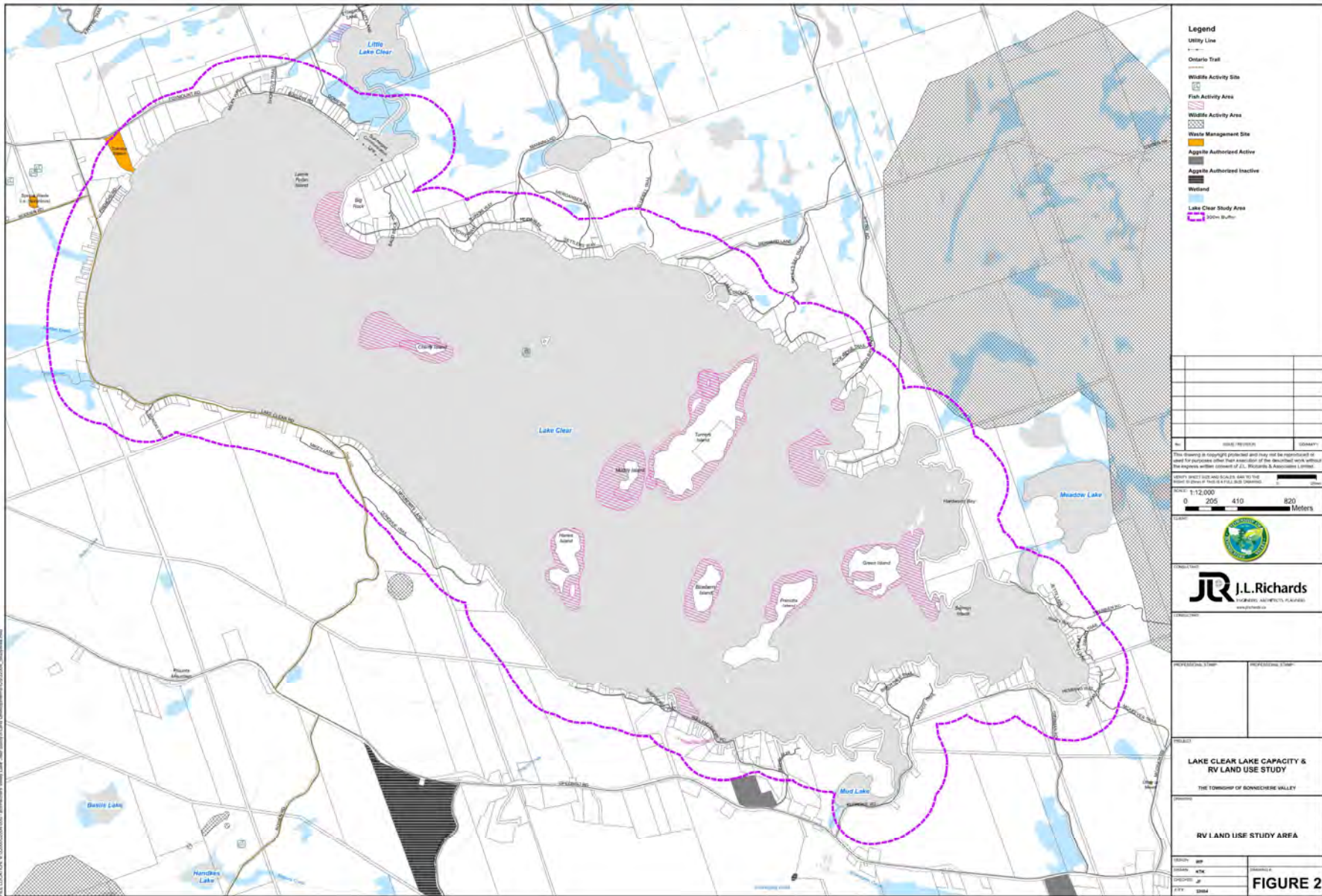
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5.0 Policy and Regulatory Context

5.1 Ontario Lakeshore Capacity Model

Ontario's Lakeshore Capacity Model was developed to determine suitable development capacity on lakes through an assessment of phosphorus and the associated modelling procedure for dissolved oxygen concentrations. For inland recreational lakes on the Precambrian Shield such as Lake Clear, phosphorus and dissolved oxygen concentrations are the parameters of concern for water quality. Ontario's revised Provincial Water Quality Objective (PWQO) allows for a 50% increase in phosphorus concentration from development over levels that would occur in the absence of any development on the lake (i.e., 'Background' plus 50%) to a maximum concentration of 20 micrograms per litre ($\mu\text{g/L}$). The dissolved oxygen guideline for protection of lake trout habitat is 7 milligrams per litre (mg/L) (minimum), measured between August 15 and September 15.

Phosphorus comes from natural and human sources. In the absence of significant agricultural or urban drainage, or point sources such as sewage treatment plants, the primary human sources of phosphorus are sewage systems from permanent and seasonal dwellings. Shoreline clearing, fertilizer use, erosion and overland runoff can also be sources of phosphorus inputs. When a lake's capacity to assimilate phosphorus is reached or exceeded, its water quality can degrade, resulting in depletion of dissolved oxygen and loss of cold water fish habitat.

In direct association with its status as a lake trout lake, Lake Clear is also an 'at-capacity lake'. For Lake Clear, average dissolved oxygen concentrations in the bottom layer of the lake have been measured below the 7 mg/L guideline. This means that at present, Lake Clear is considered to have reached its limit capacity for assimilating phosphorus without negatively impacting the quality of the water generally, and the quality of lake trout habitat more specifically.

5.2 2020 Provincial Policy Statement

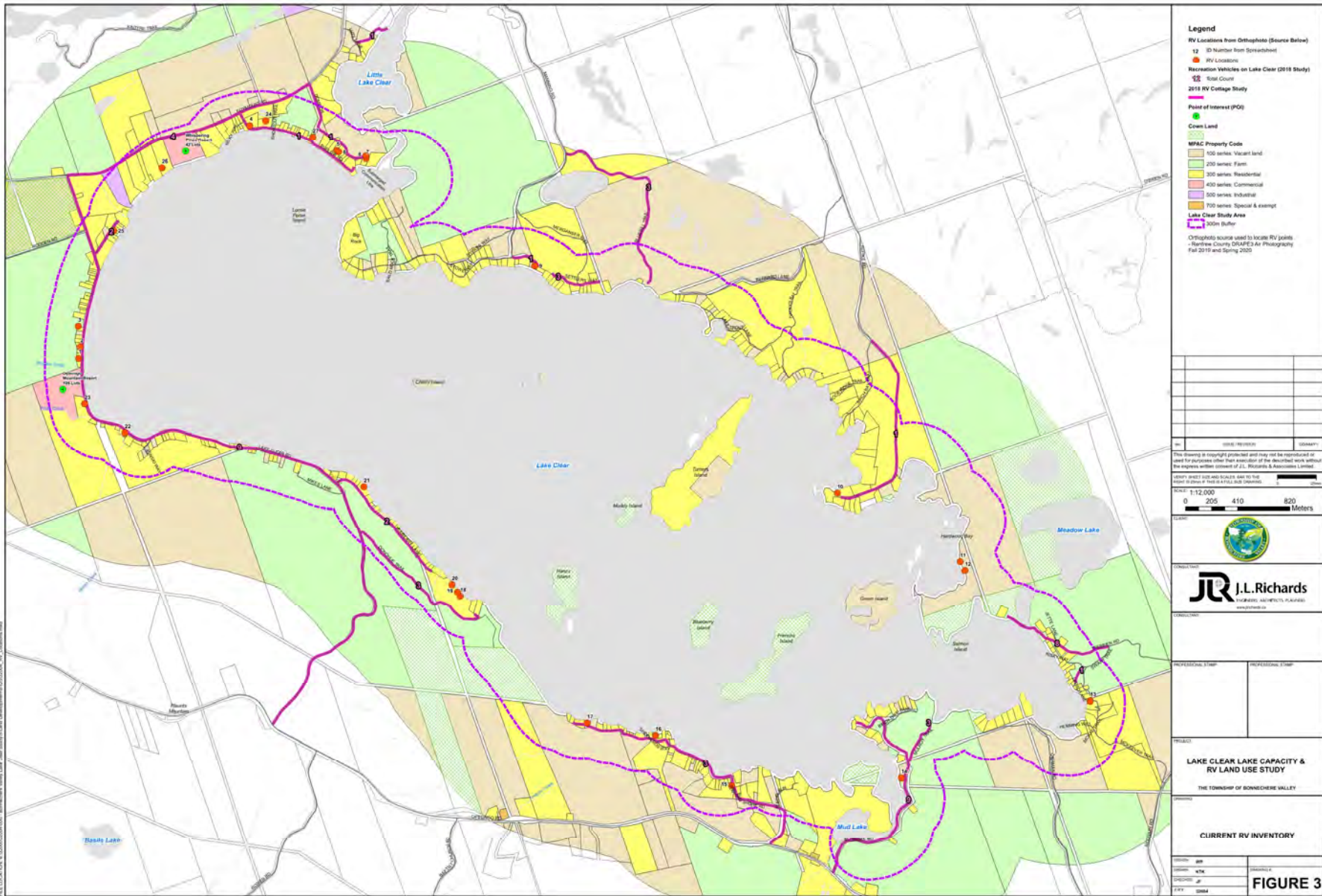
The 2020 Provincial Policy Statement (PPS) is issued under Section 3 of the Planning Act (Act) and provides policy direction on matters of provincial interest related to land use planning and development. The 2020 PPS provides for appropriate development while protecting resources of provincial interest, public health and safety, and the quality of the natural and built environment. The Act requires that all decisions made under it by an approval authority 'shall be consistent with' the 2020 PPS.

A summary of 2020 PPS policies pertinent to the Study is provided below:

1. Development that is compatible with the rural landscape and can be sustained by rural service levels should be promoted. This includes recreational dwellings and other resource-based recreational uses (Section 1.1.5).
2. In areas where municipal sewage services and municipal water services or private communal sewage services and private communal water services are not available, planned or feasible, individual on-site sewage services and individual on-site water services may be used so long as site conditions are suitable for the long-term provision of such services with no negative impacts (Section 1.6.6).

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3. The diversity, connectivity and function of natural features in an area should be maintained, restored or, where possible, improved (Section 2.1.2).
4. Planning authorities shall protect, improve or restore the quality and quantity of water by considering environmental lake capacity (Section 2.2.1).
5. Development shall be restricted in or near sensitive surface water features and sensitive ground water features such that these features and their related hydrologic functions will be protected, improved or restored (Section 2.2.2).
6. Development shall generally be directed to areas outside of hazardous lands which are impacted by flooding hazards and/or erosion hazards (Section 3.1.1).

As the 2020 PPS is a high-level policy document, it does not contain specific policies relative to the Study. Still, it is JLR's professional opinion that the Study is consistent with the intent of the 2020 PPS.

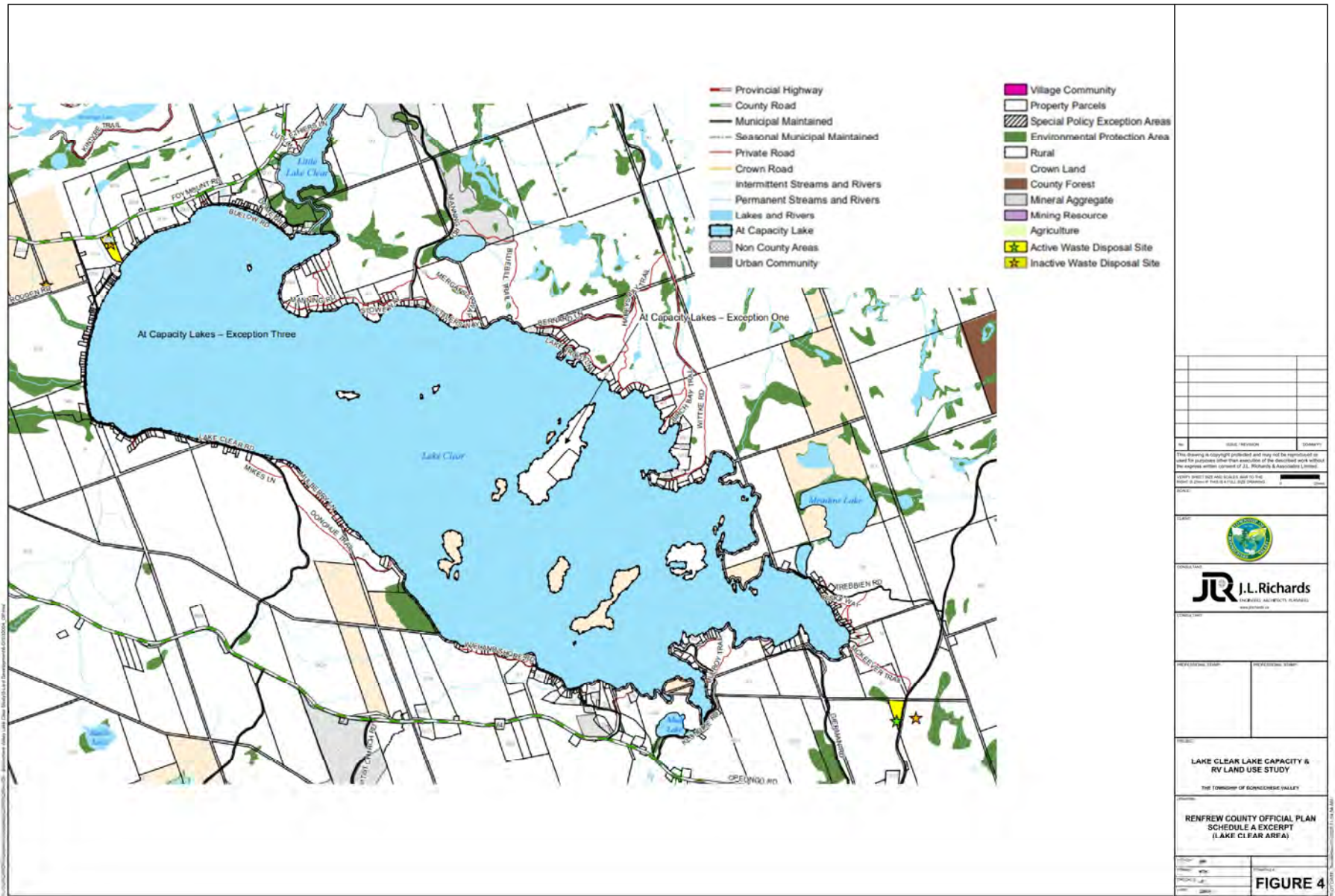
5.3 County Official Plan

The Township uses the County Official Plan as its municipal Official Plan for managing growth and development. A summary of County Official Plan policies pertinent to the Study is provided below:

1. The land use designations affecting the Study area are shown on Figure 4, and highlighted below:
 - a. **Crown Lands:** As per Section 2.2, the Province administers the use of Crown Lands in accordance with applicable management policies and plans. Should Crown Lands become private lands, the policies in the Rural designation shall apply.
 - b. **Rural:** As per Sections 2.2 and 5.0, the Rural designation guides rural type development on private and municipal lands. Permitted uses generally include agricultural, forestry, limited low density residential (including single detached seasonal dwellings), commercial, industrial, recreational (including resource-based recreational uses), institutional, and conservation uses, subject to location and development criteria. This infers a multi-layered land use policy framework which for Study context purposes, shall consider factors such as private servicing provisions; potential development impacts on natural heritage features (including surface water quality / quantity and shoreline integrity); compatibility of farm and non-farm land uses, relative to maintaining the character of rural areas; and the capability of the land to accommodate development, relative to the presence of natural and human-made hazards.

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- c. **Environmental Protection:** As per Section 8.0, the Environmental Protection designation controls development within identified natural heritage areas. Permitted uses are limited to conservation of soil and wildlife, passive outdoor recreation uses, dams and other water control devices, agricultural uses, forestry, and boat anchorages / moorings. Considerations to permit uses from an abutting land use designation shall be subject to satisfying location and development criteria as well as a Zoning By-law Amendment.
- d. **Waste Disposal (Active):** As per Section 12.0, the Township waste transfer station is designated Waste Disposal (Active). A land use compatibility assessment of all proposed developments should be undertaken within 500 m of the licensed perimeter of the waste transfer station.
- e. **At Capacity Lake:** Section 9.0 outlines policies for 'at-capacity lakes' such as Lake Clear. Highlights applicable to the Study are provided below:
 - i. Unless otherwise specified in the County Official Plan, the following general provisions shall apply to lands within 300 m of an At Capacity Lake:
 - 1. lot creation shall not be permitted unless:
 - a. it is required to separate existing habitable dwellings, each of which contains an existing sewage system and is on a lot that can support a Class 4 sewage system, provided that the land use would not change and there would be no net increase in phosphorus loading to the lake; or
 - b. new tile fields are setback at least 300 m from the shoreline of lakes and it can be demonstrated that there will be no impacts on lake water quality from either the septic system or other land uses (i.e., dwelling, accessory buildings, site alteration); development must be supported by a report prepared by a qualified professional that demonstrates the lake and the related hydrologic functions will be protected, improved or restored; mitigation measures and/or alternative development approaches may be required; site plan control or development agreements may be used by the Township to implement any recommended mitigation measures⁷; or
 - c. a site-specific soils investigation prepared by a qualified professional demonstrates that phosphorus can be retained in deep, native, acidic soils on-site; a report, prepared by a qualified professional, is required to demonstrate that there will be no negative impact on the lake water quality from the proposed development; site plan control or development agreements may be used by the Township to implement any recommended mitigation measures; and

⁷ The More Homes Built Faster Act, 2022 (Bill 23) exempts developments of up to ten units or less from site plan control.

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- d. where the above criteria can be met, the minimum lot area for new lots shall be 1 hectare (ha); note this may be reduced only where it is required to separate existing habitable dwellings, as noted above;
2. no new or enlarged tent or trailer parks or tourist establishments (uses not defined) shall be permitted;
 3. no further erection of multiple dwellings (use not defined) for rent or lease shall be permitted;
 4. development on existing lots with lakeshore frontage shall only be permitted under the following conditions:
 - a. no more than one single detached dwelling unit (use not defined) shall be permitted, and furthermore:
 - i. all buildings and structures and associated private waste disposal systems shall have a minimum setback of 30 m from the high water mark; or where a 30 m setback cannot be met, the setback shall be as remote from the high water mark as the lot will permit to the satisfaction of the Township and other applicable approval authorities;
 - ii. all new permits issued by the applicable approval authorities for private waste disposal systems which involve construction of tile beds will be conditional upon the use of a fill material known to have a good phosphorus retention capability;
 - iii. the portion of the lot between the shoreline and the single detached dwelling or private waste disposal system will be retained where possible in its natural state to serve as a buffer which will assist in minimizing the land-surface transport of nutrient laden silt to the lake; and the retention of the natural soil mantle and natural vegetation within 30 m of the shoreline will also be encouraged;
 - iv. dredging and/or filling activities involving the littoral zone shall be discouraged to avoid the re-suspension of lake sediments and the destruction of fish habitat; and any such dredging or filling shall require the prior approval of the Township and other applicable approval authorities; and

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- ii. In addition to (or despite) the above, the following specific provisions shall apply to lands within 300 m of Lake Clear:
 1. development shall be restricted to permanent and seasonal single detached dwellings, home occupations, small scale convenience stores, institutional community use, non-intensive farming and forest management uses;
 2. undeveloped lands may be placed in a holding category, wherein the principle of development has been established, and the following provisions shall apply:
 - a. development shall be encouraged on a comprehensive basis, where appropriate, to include plans and provisions for phasing and road access for future development, including adjacent land holdings;
 - b. the creation of new lots or the establishment of new roads, either under the consent process or by plan of subdivision, shall not be permitted;
 - c. a soils and hydrogeological report may be required for approval by the Township, in consultation with other applicable provincial review agencies;
 - d. waterfront access for proposed and potential future development shall be made available, either as separate water frontage for each lot, or in the case of a plan of subdivision, as a common access which is zoned in separate classification; and
 - e. a plan of subdivision shall be required to create new lots where the Township determines that the information provided is not adequate to assess the environmental impact of development.
2. The secondary (or additional) dwelling unit (ADU) policies in the County Official Plan were recently reviewed as part of Amendment No. 35 to the County Official Plan (OPA No. 35), pursuant to prior changes to the Act through the More Homes For Everyone Act, 2022 (Bill 109) and Bill 23. Part B, clause (c) in OPA No. 35 states that:
 - a. ADUs are considered a self-contained residential use with kitchen and bathroom facilities that are within or accessory to a permitted single detached, semi-detached, or row house dwelling (uses not defined but regards primary dwellings on a separately conveyable lot). ADUs are also permitted as separate, detached dwellings.
 - b. RVs shall not be considered ADUs, and ADUs shall not be permitted on 'at-capacity lakes' such as Lake Clear. Note these policies were original to the County Official Plan and carried forward in OPA No. 35.

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3. The County Official Plan enables the Township to develop measures for temporary uses and structures (such as RVs) on lots adjacent to inland lakes, provided such measures do not adversely affect lake water quality and public health.

Based on JLR's review of the County Official Plan, relative to lands in the Study area:

1. The general provisions for At Capacity Lakes indicate that the creation of new lots can be considered, but only under specific conditions. This excludes Lake Clear as consents or plans of subdivision are not permitted (note a plan of subdivision shall be required only in cases where the principle of future development of undeveloped lands has been established, and where the Township determines that the information provided is not adequate to assess the environmental impact of the proposed development).
2. For At Capacity Lakes, including Lake Clear, no more than one single detached dwelling unit (permanent or seasonal) is permitted on an existing lot of record, and which is subject to satisfying development criteria. Furthermore, ADUs are not permitted, and RVs are not considered ADUs.
3. As the residential uses referenced above are not defined in the County Official Plan, it is assumed that RVs are not considered primary single detached dwelling units (permanent or seasonal), given they are not considered ADUs.
4. While RVs are neither considered primary single detached dwellings nor ADUs in the County Official Plan, the Township is enabled to develop mitigative measures for RVs as temporary uses and structures on lots adjacent to inland lakes. It is assumed that this enabling policy also extends to lots adjacent to 'at-capacity' inland lakes such as Lake Clear, given the County Official Plan does not explicitly prohibit RVs as temporary uses and structures within this context.

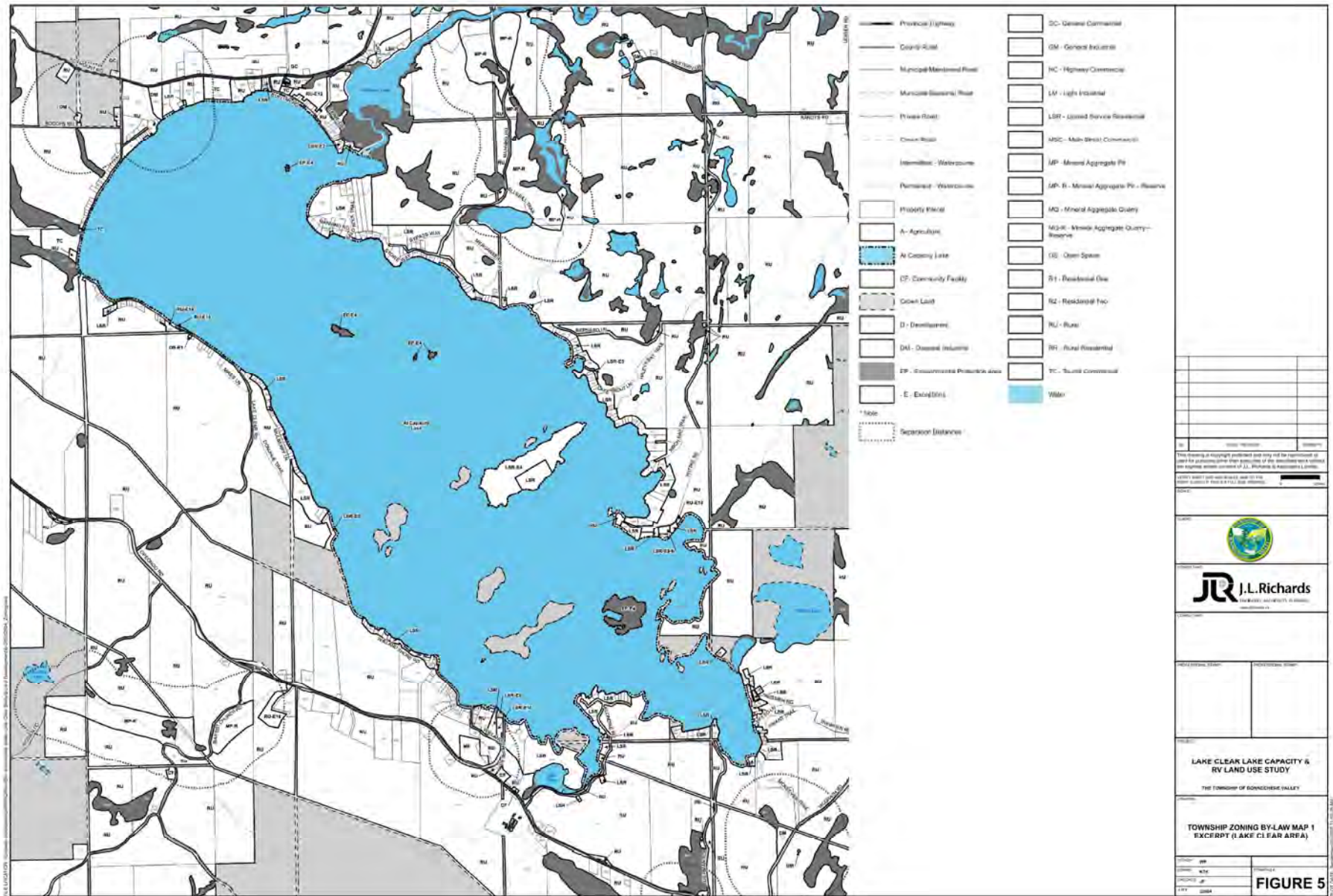
5.4 Township Zoning By-law No. 2022-042

Zoning By-law No. 2022-042 (Zoning By-law) is the primary means of implementing the County Official Plan in the Township. A summary of Zoning By-law provisions pertinent to the Study is provided below:

1. Section 1.9.16 states that, with respect to any lands to which the Zoning By-law applies, all uses are prohibited unless specifically permitted in established Zones.
2. The Zones affecting the Study area are shown on Figure 5. Permitted residential and residential-related uses are limited to the Zones noted below in Table 1. Their respective definitions, as provided in Section 2.0 of the Zoning By-law, are also provided:

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Table 1
Township Zoning By-law: Permitted Residential Uses (Study Area)

Zone	Permitted Residential Uses	Residential / Residential-Related Use Definition
LSR: Limited Service Residential	Limited Service Dwelling	A Single Detached Dwelling that (a) has no frontage on a municipally maintained street but has an alternative means of lot access; and (b) the owner is responsible for services, and for ensuring accessible road access.
TC: Tourist Commercial	Camping Establishment	A tourist establishment consisting of at least five camping lots and comprising land used or maintained as grounds for the camping or parking of RVs and tents.
	RV Campground / Trailer Park	A parcel of land under single ownership which is intended to provide accommodation on a temporary or seasonal basis, for RVs and/or tents plus accompanying towing or carrying vehicles. It may also include supportive / accessory uses.
RU: Rural	Single Detached Dwelling	A single dwelling unit which is freestanding, separate and detached from other main buildings or main structures and includes a prefabricated single dwelling unit but does not include a mobile home.
	Hunting and Fishing Camp	A building or structure (i.e., light frame construction without any interior wall / ceiling finishings) providing basic shelter and accommodation on an occasional basis for a person or group of persons engaged in hunting, fishing or other outdoor recreational activities.

3. Section 2.0 provides other definitions for general terms and land uses referenced in the Zoning By-law. Highlights are as follows:
 - a. **Primary Dwelling** means a single detached dwellings, townhouse dwellings or semi-detached dwellings, and excludes any other dwelling unit type referenced in the Zoning By-law (e.g., seasonal dwellings).
 - b. **Park Model Trailer** means a trailer constructed to CSA Z-241 standard that is built on a single chassis mounted on wheels, designed for relocation from time to time, designed as living quarters for seasonal camping with the possibility for connection to services, and has a gross floor area, including lofts, not greater than 50 square metres (m²)⁸ when in set-up mode and having a width greater than 2.6 m in transit mode. A park model trailer is deemed to be a building or structure for the purposes of the Zoning By-law.
 - c. **Recreation Vehicle** means any vehicle constructed to be attached and propelled by a motor vehicle and that is capable of being used by persons for living, sleeping or eating, even if the vehicle is jacked-up or its running gear is removed. It includes

⁸ A park model trailer must be under 50 m² to be considered an RV; those over 50 m² are considered 'manufactured dwellings' or 'ready-to-move dwellings' and – though not referenced in the Zoning By-law – are typically regarded as single detached dwellings.

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any vehicle designed, intended and used as accommodation exclusively for travel, recreation and vacation, and which is either capable of being drawn by a passenger vehicle or is self-propelled. RVs include travel trailers, park model trailers, tent trailers, vans, motor homes and tiny homes, and excludes mobile homes.

- d. **Secondary Dwelling** (or ADU) means a second self-contained residential dwelling ancillary and subordinate to a primary dwelling, in which food preparation, eating, living, sleeping and sanitary facilities are provided for the exclusive use of the occupants thereof, and which may also be located within structures accessory to a dwelling such as a garage or other detached structure.
4. Section 3.9.2 states that ADUs are not permitted on lots within 300 m of 'at-capacity lakes' such as Lake Clear. As such, no more than one building used as a dwelling, containing one or more dwelling units, shall be erected on any lot (i.e., one single detached dwelling unit on an existing lot of record in the Study area, as per the County Official Plan).
5. Section 3.17 is entitled, 'Mobile Homes and Recreational Vehicles' but only includes provisions for Mobile Homes.
6. Section 3.23 states that no truck, bus, coach, vehicle, tiny home and/or RV / trailer shall be used as a permanent dwelling unless the occupancy complies with Section 3.17 of the Zoning By-law (as noted above, Section 3.17 only includes provisions for Mobile Homes).
7. Section 3.24.1 states that in a Residential, Rural, or Agriculture Zone (i.e., properties zoned LSR Zone and RU Zone in the Study area), a maximum of one RV / trailer and one boat may be stored on a property with a primary dwelling, provided that:
 - a. No parking space required by the Zoning By-law is used.
 - b. The RV / trailer is not occupied for habitable purposes.
 - c. The RV / trailer and/or boat is not located within a front yard or exterior side yard for longer than 72 hours in any one calendar month.
 - d. The RV / trailer and/or boat is setback at least 1.2 m from any interior side yard or rear yard.
 - e. Notwithstanding the above, for properties in a Rural or Agricultural Zone (i.e., properties zoned RU Zone in the Study area) which are greater than 1 ha, a maximum of two RVs / trailers and three boats may be stored thereon.
8. Section 3.27.4 establishes the following minimum water setbacks applicable to the Study:
 - a. 30 m from the high water mark.
 - b. Notwithstanding the above, for an existing lot of record which has less than 64 m of lot depth or is situated between two existing dwellings separated by not more than 100 m, the minimum water setback is 20 m.

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Based on JLR's review of the Zoning By-law, relative to lands in the Study area:

1. RVs, which include travel trailers, park model trailers (under 50 m²), tent trailers, vans, motor homes and tiny homes, shall not be used as permanent dwellings unless compliant with Section 3.17 of the Zoning By-law. As noted above:
 - a. A park model trailer must be under 50 m² to be considered an RV; those over 50 m² are considered 'manufactured' or 'ready-to-move' dwellings. Though these dwelling types are not referenced in the Zoning By-law, they are typically regarded as single detached dwellings.
 - b. Section 3.17 does not include permanent occupancy provisions for RVs, which means RVs can only be used for temporary accommodation.
2. ADUs are not permitted on lots within 300 m of 'at-capacity lakes' such as Lake Clear; and as noted earlier, the County Official Plan excludes RVs as ADUs.
3. County Official Plan policy enabling the Township to develop measures for RVs as temporary uses and structures on lots adjacent to inland lakes (and 'at-capacity' inland lakes such as Lake Clear by extension) focuses at present on the storage of RVs (which includes restricting their occupancy while in storage) in the Residential, Rural, or Agriculture Zones. This applies to properties zoned LSR Zone and RU Zone in the Study area.
4. Within the Study area, RVs are permitted for temporary seasonal occupancy under the Camping Establishment and RV Campground / Trailer Park use classes in the TC Zone only. Therefore, occupying an RV for habitable purposes in the other Zones within the Study area does not comply with the Zoning By-law.

6.0 Updated Lake Clear Capacity Assessment

HESL was retained by the Township to prepare an updated LSCA for Lake Clear, given its status as an 'at-capacity lake'. HESL used Ontario's Lakeshore Capacity Model – which as noted earlier assesses phosphorus and dissolved oxygen concentrations⁹ – at six test sites to determine if Lake Clear is at capacity to allow the temporary or seasonal occupancy of RVs on properties zoned LSR Zone and RU Zone in the Study area. The HESL Report (2023) and HESL's responses to MECP's comments on same (dated June 26/24) are attached in Appendix 1.

6.1 Findings

A summary of the main findings in the HESL Report (2023) is provided below:

1. Lake water quality is good and there are no increasing trends in nutrient concentrations. However, cyanobacteria (i.e., blue-green algae) was observed during site investigations and climate change is increasing the amount of cyanobacteria in oligotrophic lakes such as Lake Clear. While both factors are known to promote cyanobacterial blooms, the future

⁹ Ontario's revised PWQO allows for a 50% increase in phosphorus concentration from development over levels that would occur in the absence of any development on the lake (i.e., 'Background' plus 50%) to a maximum concentration of 20 µg/L. The dissolved oxygen guideline for protection of lake trout habitat is 7 mg/L (minimum), measured between August 15 and September 15.

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effects of climate change and anthropogenic nutrient loading on algal blooms in Lake Clear cannot be quantitatively assessed based on available data. But based on what is generally known about climate change effects on lake stratification and the life cycle of cyanobacteria, it is expected that blooms will become more frequent in Lake Clear, even if nutrient loading remains unchanged. With respect to the potential risk for an increased cumulative effect from increased nutrients and climate change, available data suggests the combined effect is not greater than the sum of the individual effects.

2. The predicted 'existing' total phosphorus concentration of Lake Clear during the ice-free season is 8.64 µg/L. Assuming the vacant lots around Lake Clear are converted to extended seasonal use¹⁰ (as recommended by Ontario's Ministry of the Environment, Conservation and Parks), the predicted 'future' total phosphorus concentration is 8.99 µg/L. This concentration is ~26% higher than the predicted 'Background' (i.e., pre-development) concentration of 7.11 µg/L, meaning that the lake has additional development capacity based on the Lakeshore Capacity Modelling. According to the Lakeshore Capacity Model, the upper limit of this development capacity around Lake Clear (without exceeding the water quality objective for phosphorus) equates to an additional 146 permanent residences OR 291 extended seasonal residences OR 522 seasonal residences [or up to two RVs per each existing residential lot (permanent, extended seasonal and seasonal)].
3. At 6.20 mg/L, dissolved oxygen concentration levels are below the recommended 7 mg/L guideline for lake trout habitat. While this suggests that Lake Clear is at-capacity based on this criterion, the modelling also indicates that dissolved oxygen concentration levels were slightly below the recommended 7 mg/L guideline prior to development. The addition of two RVs to each existing residential lot is predicted to decrease dissolved oxygen concentration levels by approximately 7% (or ~0.4 mg/L).
4. The current use of RVs on Lake Clear is unregulated and therefore it is not known if they are properly serviced via appropriately sized tile beds or holding tanks that are pumped out regularly. The impact of RVs on lake water quality depends not only on the number of shoreline RVs but also on the effectiveness of RV wastewater management in minimizing nutrient loading to the lake.

6.2 Recommendations

A summary of the recommendations in the HESL Report (2023) is provided below:

1. The Township could consider allowing the use of up to two RVs on each of the existing 610 lots of record on Lake Clear which permits residential development (i.e., properties zoned LSR Zone and RU Zone in the Study area), if appropriate BMPs are developed and enforced to ensure that impacts to Lake Clear are minimized.
2. Sewage treatment systems to service the RVs should meet Ontario Building Code requirements. Systems designed to maximize the amount of phosphorus attenuation should be encouraged such as the Waterloo Biofilter with EC-P unit, EcoFlo Biofilter or

¹⁰ The Lakeshore Capacity Model incorporates phosphorus loading from residences based on either permanent (2.56 capita-years/year), extended seasonal (1.27 capita-years/year), or seasonal (0.69 capita-years/year) occupancy. In this context, a 'capita-year/year' represents one person living in a residence on an annual basis (e.g., the phosphorus loading from a residence with 2.56 capita-years/year would be the load expected to come from, on average, 2.56 people living in the residence over the course of one year).

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the use of a tank and bed system that incorporates soils that are high in phosphorus retention, aluminum and iron, and low in calcium carbonate.

3. A 30 m naturally vegetated shoreline buffer should be required on all existing lots of record, especially on lots with RVs that have the potential to generate additional stormwater and wastewater. Continued retention or establishment of natural vegetation over time should be encouraged through stewardship actions and enforced, as necessary.
4. Stormwater management features that maximize infiltration and limit stormwater runoff should be encouraged on all existing lots of record (and especially on those lots with RVs that have the potential to generate additional stormwater) to minimize development-related impacts on Lake Clear.
5. Water quality and the effectiveness of BMPs should be monitored. Water quality should continue to be monitored through the Lake Partner Program, and dissolved oxygen measurements should be collected annually at the end-of-summer (August 15 to September 15) so that water quality conditions can be tracked over time. The implementation and management of BMPs should be assessed through visual inspections.

7.0 Case Study Research

JLR researched municipal provisions enabled under the Act (i.e., Official Plans, Zoning By-laws) and the Municipal Act (i.e., Licensing By-laws) in Strong, North Frontenac, and Whitewater Region – given their similar rural contexts to the Township – to see how the use of RVs on properties abutting lakes have been addressed. The intent was to determine their potential application(s) to the Study, relative to the findings and recommendations in the HESL Report (2023). Highlights are noted below and in Table 2:

1. Official Plan provisions (relative to the County Official Plan in the Township):
 - a. Differentiate between residency in single detached dwellings (permanent or seasonal) on waterfront residential lots (including ‘at-capacity lakes’) and the temporary occupancy of RVs thereon. The North Frontenac Official Plan is explicit in allowing one RV to be stored or used on a temporary basis, regardless of whether the lot is vacant or occupied by a single detached dwelling.
 - b. Outline BMPs regarding the temporary occupancy of RVs on waterfront residential lots (e.g., shoreline buffers, on-site servicing, accessory structure standards), regardless of whether the lots are vacant or developed.
 - c. Enable the municipalities to prepare more detailed provisions and regulations regarding both the storage and temporary occupancy of RVs on waterfront residential lots, mainly through municipal zoning and licensing.

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Table 2

Case Study Research: Municipalities of Strong, North Frontenac and Whitewater Region (Official Plan, Zoning By-law, Licensing By-law)

Policy / Regulatory Provisions	Municipality		
	Strong	North Frontenac	Whitewater Region
Official Plan	<p>1. RVs may be permitted on lands designated Shoreline Area (generally all lands within 300 m of a lake) on a temporary basis, subject to municipal licensing.</p> <p>2. Lake Bernard is a 'lake trout lake' and an 'at-capacity lake': development is therefore limited to existing vacant lots and changes in land use that will not increase phosphorous loading.</p> <p>3. Lot creation provisions reflect the intent of the general provisions for At-Capacity Lakes in the Township, though less explicit regarding site assessment requirements.</p> <p>4. Development, which includes any main buildings and the filter bed and mantle for a private septic tank shall be set back a minimum of 20 m from the high water mark for existing lots; and 30 m for lots created after January 1, 1993. Vegetation disturbance within these setbacks shall be limited to minor alterations for access trails, docks, water pumping equipment and/or restoration work.</p>	<p>1. One RV may be stored or used on a temporary basis on a lot, regardless of whether the lot is vacant or occupied by a seasonal or permanent dwelling, subject to municipal licensing (note licensing provisions shall not apply to RVs where they are stored only and not used or for RVs in an RV Park or Campground). Additional RVs may be allowed on larger lots for hunters and fishers, subject to the Zoning By-law.</p> <p>2. RVs shall only be permitted where they are serviced with a potable water supply, and with an on-site sewage disposal system (which shall be in addition to any on-board holding tanks), as approved under the Building Code. This shall not apply to RVs which are stored on a lot and to RVs which are used on a lot and occupied by a seasonal or permanent dwelling for two weeks or less over one season.</p> <p>3. Decks may be permitted, subject to the Building Code and Zoning By-law. Extensions or additions to an RV shall not be permitted unless such structures have been pre-engineered for the RV by the manufacturer and are capable of being removed. No such structures shall be permitted which have the effect of rendering the RV as a permanent structure or dwelling on a lot.</p> <p>4. Accessory buildings and structures shall be permitted, subject to the Zoning By-law. This includes a private garage to store an RV over the winter.</p> <p>5. The setbacks for an RV shall be comparable to setbacks for residential uses. Regard shall be had for naturalizing / retaining shorelines in their natural state.</p> <p>6. Council may enact a Property Standards By-law to regulate the maintenance of properties, buildings and structures used for RVs.</p>	<p>1. Whitewater Region is part of Renfrew County and uses the County Official Plan as its municipal Official Plan for managing growth and development, similar to the Township.</p> <p>2. Whitewater Region does not have any 'at-capacity lakes' within its jurisdiction. As stated earlier, the County Official Plan enables the municipality to develop measures for temporary uses and structures (such as RVs) on lots adjacent to inland lakes, provided such measures do not adversely affect lake water quality and public health.</p>

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Table 2

Case Study Research: Municipalities of Strong, North Frontenac and Whitewater Region (Official Plan, Zoning By-law, Licensing By-law)

Policy / Regulatory Provisions	Municipality		
	Strong	North Frontenac	Whitewater Region
Zoning By-law	<p>1. Noteworthy definitions:</p> <ul style="list-style-type: none"> Hunt Camp: a partially furnished building having a maximum 75 m² area and which may include facilities for the preparation of food and overnight accommodation on a temporary basis during the hunting or fishing seasons, but shall not include any other dwelling unit type in the Zoning By-law; RV: a self-propelled vehicle used as temporary seasonal accommodation and equipped with sanitary and cooking facilities; Travel or Tent Trailers: a trailer for temporary accommodation, with or without cooking facilities and which has running gear and towing equipment that is permanently attached, and is not permanently affixed to the ground. <p>2. Hunt Camps:</p> <ul style="list-style-type: none"> a permitted accessory building to recreational and resource management uses on minimum 10 ha lots in the Open Space (OS) Zone and RU Zone, provided the lot has access onto an unimproved municipal road allowance, a private road or a maintained municipal road; and the building area does not exceed 60 m². <p>3. RVs and Travel or Tent Trailers:</p> <ul style="list-style-type: none"> can be located on any lot in the RU Zone, LSR Zone or SR Zone and may be occupied, subject to municipal licensing (note this excludes park model trailers); attached accessory structures shall not exceed the ground floor area of the RV; a minimum 30 m setback from the high water mark of Lake Bernard (i.e., an 'at-capacity lake'); <p>4. Shoreline Buffers in the LSR and SR Zones: 75% vegetated buffer required within the front yard (note up to 10% can be landscaped access to the shoreline).</p>	<p>1. Noteworthy definitions:</p> <ul style="list-style-type: none"> Dwelling Unit: means a building occupied as the home or residence of one or more persons, where food preparation and sanitary facilities are provided but shall not include a hotel, motel, accommodation unit or unit in an institution; Park Model Trailer: similar definition to the Township excepting a maximum 19 m² area (note a maximum 50 m² area is in the Township definition); RV: a similar definition to the Township excepting RVs only includes travel trailers, motor homes or campers (note in the Township definition, RVs exclude mobile homes but include travel trailers, park model trailers, tent trailers, vans, motor homes and tiny homes). <p>2. On lands within 300 m of the high-water mark of an at capacity lake, ADUs are not permitted and only 1 dwelling unit per lot is allowed (permanent or seasonal and excluding RVs).</p> <p>3. All structures shall maintain a minimum 30 m setback from the high water mark of all waterbodies.</p> <p>4. The area from the high water mark extending inland to a depth of a minimum of 15 m for the entire width of the lot shall retain natural vegetation, except for shoreline maintenance and to provide shoreline / dock access.</p> <p>5. Provisions for the placement of RVs on lots shall be subject to municipal licensing.</p>	<p>1. Similar RV definition to the Township except:</p> <ul style="list-style-type: none"> there are specific references to the running gear and towing equipment being permanently attached and the RV not being permanently affixed to the ground (note this is excluded in the Township definition); while there is reference to 'similar transportable accommodation', the provisions below exclude park model trailers (note this is included in the Township definition). <p>2. One RV can be located on any vacant lot in the Rural (RU) Zone and Waterfront (WV) Zone and may be occupied provided it can be located on a lot with frontage on a private road, and is subject to municipal licensing.</p> <p>3. Attached accessory structures shall not exceed the ground floor area of the RV.</p> <p>4. Unattached accessory structures or buildings shall not exceed 11.25 m².</p>

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Table 2
Case Study Research: Municipalities of Strong, North Frontenac and Whitewater Region (Official Plan, Zoning By-law, Licensing By-law)

Policy / Regulatory Provisions	Municipality		
	Strong	North Frontenac	Whitewater Region
Licensing By-law	<p>1. Noteworthy definitions:</p> <ul style="list-style-type: none"> Trailer: further to the Travel or Tent Trailer definition (above), examples include a tent trailer, a camper trailer, a recreational trailer, a fifth wheel, a bus converted into a motor home and park model trailer; The By-law excludes trailers in storage and trailers assessed under Ontario's Assessment Act. <p>2. No person shall:</p> <ul style="list-style-type: none"> use a trailer for more than 30 days, except in a designated Camping Establishment, without an annual license (expires December 31); have a trailer without a license even if it was legally in place prior to the effective date of this By-law; add to a trailer (e.g., porches, roofs, decks); occupy a trailer from December to April; locate more than 1 trailer on a residential lot. <p>3. RV use setbacks are the same as for the main dwelling in the Zoning By-law.</p> <p>4. Trailers shall be connected to a sewage disposal system that complies with the Building Code and is enforced by the Conservation Authority unless the unit contains an on-board holding tank (in which case it shall be emptied at a provincially licensed facility).</p> <p>5. A license is not transferrable to a new lot owner.</p> <p>6. No license shall be issued if the trailer contravenes any federal, provincial or municipal regulation; any trailer in contravention of this By-law shall be removed at the expense of the lot owner, and the lot owner shall be liable to a fine pursuant to the Provincial Offences Act.</p> <p>7. Any person designated by Council to enforce this By-law may, at any reasonable time and upon producing proper identification, enter and inspect any property licensed under or in contravention of the provisions of this By-law.</p>	<p>1. Similarities with Strong:</p> <ul style="list-style-type: none"> definitions and exclusions (except RVs used up to 28 days per visit are excluded); license renewal periods (expires December 31); enforcement provisions (except contraveners have up to 14 days to remove the RV). <p>2. Permitted accessory structures (subject to zoning and Building Code compliance):</p> <ul style="list-style-type: none"> unattached decks not exceeding 10 m²; gazebos not exceeding 10 m² and up to 8 m high; docks and pump houses; must be capable of being removed. <p>3. RV use setbacks and standards (for waterfront lots):</p> <ul style="list-style-type: none"> 30 m from a high water mark; 10 m from easements, rights-of-way and rear yards; 5 m from a side yard; 3 m from all other RVs, buildings or structures; the owner shall obtain a civic address (vacant lot); temporary RV use (see above) subject to approval by the Chief Building Official and provided there is a main dwelling on the lot. <p>4. (A) RV storage – units (for waterfront lots):</p> <ul style="list-style-type: none"> 1 RV on a lot less than 2 acres (no license); 2 RVs on a lot greater than 2 acres (no license); 1 additional RV on a lot greater than 2 acres from October 15 to May 15 (with a license). <p>(B) RV storage – setbacks (for waterfront lots):</p> <ul style="list-style-type: none"> 30 m from a high water mark; 5 m rear yard and 3 m side yard. <p>5. RVs shall be serviced with an approved (a) potable water supply, and (b) a Class 1 (outhouse)-Class 2 (grey water pit) system or a Class 4 (septic) system.</p> <p>6. Exemptions (with prior notice to Chief Building Official):</p> <ul style="list-style-type: none"> 1 RV per acre (up to 25 RVs) for up to 7 days, 3 times a year for special events (e.g., hunting, fishing); Council approval is required for larger events. 	<p>1. Similarities with Strong:</p> <ul style="list-style-type: none"> definitions and exclusions; prohibitions [except the license trigger is at 10 days of occupancy (not 30 days); the annual license expires October 31 (not December 31); and the restricted occupancy provision is more specific i.e., November 30 to April 30 (not December to April); no more than 1 RV on a residential lot (except By-law 'variance applications' to Committee of Adjustment can be filed if a second RV is proposed; and development agreements may be imposed); RV use setbacks are the same as for the main dwelling in the Zoning By-law; similar sewage disposal system requirements; a license is not transferrable to a new lot owner; similar inspection and enforcement provisions. <p>2. Similarities with North Frontenac:</p> <ul style="list-style-type: none"> the owner shall obtain a civic address (vacant lots); similar sewage disposal system requirements; similar inspection and enforcement provisions. <p>3. A license may be issued for an RV within identified Flood Fringe and Floodway areas so long as the owner enters into a development agreement relating to:</p> <ul style="list-style-type: none"> restricting occupancy before June 1; restricting additions to the RV; removing the RV before or on November 30. <p>4. Additional RV occupancy compliance provisions:</p> <ul style="list-style-type: none"> the lot shall have an entrance permit; garbage and recycling disposal shall comply with municipal standards; the lot / use shall comply with the municipal Property Standards By-law and the Clean Yards By-law; electrical service shall connect to on-site services; or via renewable energy sources; or via fuel burning generator which shall not operate between 1900-0800 hours and/or within 30 m of any dwelling.

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2. Zoning By-law regulations (relative to the Township Zoning By-law):
 - a. Differ regarding whether park model trailers are considered RVs for the purposes of applying temporary RV occupancy provisions.
 - b. The Strong Zoning By-law allows RVs on any lot in the Rural (RU) Zone, Limited Service Shoreline Residential (LSR) Zone or Shoreline Residential (SR) Zone and further enables RV occupancy pursuant to municipal licensing; similar provisions are in the Whitewater Zoning By-law but RV occupancy is limited to vacant lots only and subject to municipal licensing.
 - c. While building on enabling Official Plan policy, the zoning provisions are more general in nature (e.g., permitted zones, accessory structure standards, setbacks from the high water mark), and rely on municipal licensing.
3. Licensing By-law regulations (note the Township does not have a Licensing By-law):
 - a. All By-laws exclude RVs in storage and those assessed under Ontario's Assessment Act; and include similar themes regarding sewage disposal system requirements and inspection and enforcement provisions.
 - b. The Strong and Whitewater Region By-laws:
 - i. include similar themes regarding prohibitions for RV use (e.g., length of stays, occupancy during the year, restricting additions to RVs, non-transferability of RV licenses); and
 - ii. both cross-reference the Zoning By-law in applying setbacks for RVs.

While both By-laws also include similar limits on the number of RVs allowed on a lot (i.e., one), the Whitewater Region By-law allows up to two RVs on a lot, subject to the owner obtaining approval from the Committee of Adjustment.
 - c. The Whitewater Region and North Frontenac By-laws:
 - i. require the lot owner to obtain a civic address for the RV if its proposed location is on a vacant lot; and
 - ii. include special allowances for RVs i.e., RVs may be allowed within identified Flood Fringe and Floodway areas (Whitewater Region); and one RV per acre (up to 25 RVs) for up to 7 days, 3 times a year may be allowed for special events such as hunting and fishing (North Frontenac).
 - d. The North Frontenac By-law includes specific 'zoning-related' setbacks for RV use and storage.

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8.0 The Proposed Planning Framework: Three Tools

The following are the main findings from JLR's review of Township planning documents, the HESL Report (2023) and the case study research, relative to the Study:

1. While RVs are neither considered primary single detached dwellings nor ADUs in the County Official Plan, the Township is enabled to develop mitigative measures for RVs as temporary uses and structures on lots adjacent to inland lakes. It is assumed that this enabling policy also extends to lots adjacent to 'at-capacity' inland lakes such as Lake Clear, given the County Official Plan does not explicitly prohibit RVs as temporary uses and structures within this context.
2. Despite the enabling policy noted above, the Township Zoning By-law focuses at present on the storage of RVs (which includes restricting their occupancy while in storage) in the Residential, Rural, or Agriculture Zones. This applies to properties zoned LSR Zone and RU Zone in the Study area. Furthermore, RVs are currently permitted for temporary seasonal occupancy under the Camping Establishment and RV Campground / Trailer Park use classes in the TC Zone only. Therefore, occupying an RV for habitable purposes in the other Zones within the Study area does not comply with the Zoning By-law.
3. According to the Lakeshore Capacity Model in the HESL Report (2023), the upper limit of development potential around Lake Clear could accommodate up to two RVs on each of the existing 610 lots of record which permits residential development (i.e., properties zoned LSR Zone and RU Zone), if appropriate BMPs and periodic monitoring protocols are developed and enforced to ensure that impacts to Lake Clear are minimized.
4. The case study research of the municipalities of Strong, North Frontenac and Whitewater Region indicates that Official Plan policy in their respective jurisdictions differentiate between residency in single detached dwellings (permanent or seasonal) on waterfront residential lots (including 'at-capacity lakes') and the temporary occupancy of RVs thereon. Official Plan policy enables these municipalities to prepare more detailed provisions and regulations regarding both the storage and temporary occupancy of RVs on waterfront residential lots generally through municipal zoning and more specifically through municipal licensing.
5. As stated earlier, the intent of the Study is to better balance the use of RVs to enjoy Lake Clear with the health and integrity of the lake itself. Within this context, it is recognized that, based on the Lakeshore Capacity Model results in the HESL Report (2023), the Township could consider allowing the use of over 1,200 RVs on the existing lots of record abutting Lake Clear which permits residential development. However, the Study must not only consider the ecological integrity of Lake Clear (including the dissolved oxygen concentrations that support lake trout habitat), but also its neighbourhood character, the ability of property owners and visitors to continue to enjoy its amenities, and the likelihood of this full build-out scenario model actually being realized, based on landowner preferences. Therefore, when considering the Study goal of better balancing the use of RVs around Lake Clear, matters regarding scale, form, function and use, relative to the local context, are equally critical factors.

Based on the above, JLR proposes the use of the following three land use policy and regulatory tools as part of the planning framework to address Study issues [note proposed amendments to

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existing Township planning documents are shown in ~~strikethrough~~ font (for deletions) and *italicized* font (for insertions)]:

1. That the Township amend the County Official Plan as follows:
 - a. The following clause under Section 9.4.3 (At Capacity Lakes – Special Policy Exceptions – Exception Three (geographic Township of Sebastopol – Lake Clear) be amended to read as follows:

*“Land use development shall be restricted to permanent and seasonal ~~single-family~~ **single detached** dwellings, home occupations, small scale convenience stores, institutional community use, non-intensive farming and forest management uses. ***This shall include Recreation Vehicles which may be stored or used on a temporary seasonal basis on existing lots of record, regardless of whether the said lots are vacant or occupied by permanent or seasonal single detached dwellings, and which shall be subject to the other applicable ancillary provisions of the County Official Plan, the Township Zoning By-law, the Township Licensing By-law and the following:****

(a) Recreation Vehicles shall only be permitted where they are serviced with a potable water supply, and with an on-site sewage disposal system (which shall be in addition to any on-board holding tanks), as approved under the Ontario Building Code. This shall not apply to:

- 1. Recreational Vehicles which are stored;***
- 2. Recreational Vehicles on vacant lots and which the said Recreational Vehicles are occupied for up to but not more than seven consecutive days from May 01 to November 29 of any given year, in which case the on-board holding tank shall be emptied at a provincially licensed facility; and***
- 3. Recreational Vehicles on lots occupied by permanent or seasonal single detached dwellings and which the said Recreational Vehicles are occupied for hunters, fishers or special gatherings from May 01 to November 29 of any given year, in which case the on-board holding tank shall be emptied at a provincially licensed facility.”***

2. That the Township amend the Township Zoning By-law as follows:
 - a. The following definition under Section 2 (Definitions) be amended to read as follows:

“RECREATIONAL ~~RECREATION~~VEHICLE means any vehicle constructed to be attached and propelled by a motor vehicle and that is capable of being used by persons for living, sleeping or eating, even if the vehicle is jacked-up or its running gear is removed. It includes any vehicle designed, intended and used as temporary seasonal accommodation exclusively for travel, recreation and vacation, and which is either capable of being drawn by a passenger vehicle or is self-propelled. RVs include travel trailers, park model trailers, tent trailers, ~~vans,~~ motor homes and tiny homes, and excludes mobile homes.”

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- b. The following be inserted before clause 3.17.1 under Section 3.17 (Mobile Homes and Recreational Vehicles):

“3.17.1 Mobile Homes”

- c. The numbering for clauses 3.17.1 to 3.17.3 inclusive under Section 3.17 (Mobile Homes and Recreational Vehicles) be amended as per 2(b) above.

- d. The following be added to Section 3.17 (Mobile Homes and Recreational Vehicles):

“3.17.2 Recreational Vehicles

- a) ***The temporary seasonal occupancy of one Recreational Vehicle shall be permitted for up to seven consecutive days from May 01 to November 29 of any given year on an existing vacant lot of record abutting Lake Clear which is zoned Limited Service Residential (LSR) Zone or Rural (RU) Zone, subject to the following:***

- i. ***the setback provisions for the Recreational Vehicle shall be the same as for a Single Detached Dwelling;***
- ii. ***additions and accessory structures to the Recreational Vehicle (i.e., decks, porches, sunrooms, docks, sheds and similar) shall not be permitted without compliance to Section 3.17.2 (a-iv);***
- iii. ***the Recreational Vehicle and all associated private waste disposal systems shall have a minimum 30 metre setback from the high water mark, and the vegetation within this setback shall be retained in its natural state, except for maintenance and/or restoration work;***
- iv. ***in addition to Section 3.17.2 (a-i) and notwithstanding Section 3.17.2 (a-ii and a-iii):***

1. ***additions to the Recreational Vehicle (i.e., decks, porches, sunrooms, and similar) shall be permitted, subject to the Township Licensing By-law and the following:***

- a. ***the said addition(s) shall not, based on their cumulative area, exceed the ground floor area of the Recreational Vehicle;***
- b. ***the said addition(s) shall be pre-engineered for the Recreational Vehicle by the manufacturer;***
- c. ***the said addition(s) shall be capable of being removed; and***
- d. ***the said addition(s) shall comply with the Ontario Building Code;***

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2. **accessory structures to the Recreational Vehicle (i.e., docks, sheds and similar) shall be permitted, subject to the Township Licensing By-law and the following:**
 - a. **the accessory structure(s) provisions shall be the same as for a Single Detached Dwelling;**
 3. **all buildings and structures and associated private waste disposal systems shall have a minimum 30 metre setback from the high water mark, and the vegetation within this setback shall be retained in its natural state, except for:**
 - a. **maintenance and/or restoration work; and**
 - b. **up to 10% of the minimum required 30 metre setback from the high water may be used for shoreline access, provided the said access area is landscaped; and**
 4. **the temporary seasonal occupancy of the Recreational Vehicle for more than three consecutive days up to seven consecutive days inclusive shall be subject to the Township Licensing By-law and the following:**
 - a. **the said occupancy shall be permitted once per season (i.e., Spring, Summer and Fall) from May 01 to November 29 of any given year.**
- b) The temporary seasonal occupancy of one Recreational Vehicle shall be permitted for more than seven consecutive days from May 01 to November 29 of any given year on an existing vacant lot of record abutting Lake Clear which is zoned Limited Service Residential (LSR) Zone or Rural (RU) Zone, subject to the Township Licensing By-law and the following:**
- i. **the setback provisions and accessory structure provisions (i.e., for docks, sheds and similar) for the Recreational Vehicle shall be the same as for a Single Detached Dwelling;**
 - ii. **additions to the Recreational Vehicle (i.e., decks, porches, sunrooms, and similar):**
 1. **shall not, based on their cumulative area, exceed the ground floor area of the Recreational Vehicle;**
 2. **shall be pre-engineered for the Recreational Vehicle by the manufacturer;**
 3. **shall be capable of being removed; and**
 4. **shall comply with the Ontario Building Code;**

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- iii. all buildings and structures and associated private waste disposal systems shall have a minimum 30 metre setback from the high water mark, and the vegetation within this setback shall be retained in its natural state, except for:
 - 1. maintenance and/or restoration work; and*
 - 2. up to 10% of the minimum required 30 metre setback from the high water may be used for shoreline access, provided the said access area is landscaped.**
- c) The temporary seasonal occupancy of one Recreational Vehicle per 0.4 ha of lot area to a maximum of two Recreational Vehicles shall be permitted for more than seven consecutive days from May 01 to November 29 of any given year on an existing vacant lot of record abutting Lake Clear which is zoned Limited Service Residential (LSR) Zone or Rural (RU) Zone, subject to the Township Licensing By-law and the following:*
- i. Section 3.17.2 (b);*
 - ii. a minimum separation distance of 6 metres shall be maintained between the Recreational Vehicle and all other buildings or structures located on the lot; and*
 - iii. approval of a minor variance shall be obtained from the Committee of Adjustment.*
- d) The temporary seasonal occupancy of one Recreational Vehicle per 0.4 ha of lot area to a maximum of two Recreational Vehicles shall be permitted for more than three consecutive days up to seven consecutive days inclusive once per season (i.e., Spring, Summer and Fall) from May 01 to November 29 of any given year for hunters, fishers or special gatherings on an existing lot of record abutting Lake Clear which is zoned Limited Service Residential (LSR) Zone or Rural (RU) Zone and occupied by a permanent or seasonal Single Detached Dwelling, subject to the Township Licensing By-law and the following:*
- i. the setback provisions for the Recreational Vehicle shall be the same as for the Single Detached Dwelling;*
 - ii. a minimum separation distance of 6 metres shall be maintained between the Recreational Vehicle and all other buildings or structures located on the lot; and*
 - iii. additions and accessory structures to the Recreational Vehicle (i.e., decks, porches, sunrooms, docks, sheds and similar) shall not be permitted.”*

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3. That the Township prepare a Licensing By-law regarding the licensing of RVs on existing lots of record abutting Lake Clear which are zoned Limited Service Residential (LSR) Zone or Rural (RU) Zone, as follows:
 - a. Application:
 - i. This By-law applies to the occupancy of Recreational Vehicles on existing lots of record abutting Lake Clear which are zoned Limited Service Residential (LSR) Zone or Rural (RU) Zone in the Township Zoning By-law. Matters regarding legal non-conformity or non-compliance are not applicable to this By-law and no person shall use a Recreational Vehicle on a subject lot unless the said Recreational Vehicle complies with this By-law.
 - ii. Notwithstanding (i), this By-law does not apply to:
 1. Assessed Recreational Vehicles under Ontario's Assessment Act; or
 2. The occupancy of a Recreational Vehicle on a subject lot for up to but not more than three consecutive days from May 01 to November 29 of any given year, provided there are no additions and/or accessory structures to the said Recreation Vehicle (i.e., decks, porches, sunrooms, docks, sheds and similar); or
 3. A Stored Recreational Vehicle.
 - b. Definitions:
 - i. Recreational Vehicle means any vehicle constructed to be attached and propelled by a motor vehicle and that is capable of being used by persons for living, sleeping or eating, even if the vehicle is jacked-up or its running gear is removed. It includes any vehicle designed, intended and used as temporary seasonal accommodation exclusively for travel, recreation and vacation, and which is either capable of being drawn by a passenger vehicle or is self-propelled. RVs include travel trailers, park model trailers, tent trailers, motor homes and tiny homes, and excludes mobile homes.
 - ii. Stored Recreational Vehicle means a Recreational Vehicle located on a lot which is not connected to hydro, water or sewage hook-up and the stabilizers shall not be used or in accordance with manufacturer's recommendations.
 - iii. Township means the Corporation of the Township of Bonnechere Valley.
 - iv. Use, Occupy or Occupancy means to inhabit and maintain on a temporary basis.
 - v. Zoning By-law means the Township Zoning By-law, as amended.

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c. Scope:

- i. No person shall use nor shall an owner of a subject lot permit a person to use a Recreation Vehicle on the said subject lot without purchasing an annual License from the Township, which shall apply under the following circumstances:
 1. where occupancy is for up to seven consecutive days in any given year and there are existing or proposed additions and/or accessory structures to the said Recreation Vehicle;
 2. where occupancy is for more than seven consecutive days in any given year; and
 3. where there are two Recreational Vehicles available for occupancy for more than seven consecutive days in any given year.
- ii. No person shall construct any additions to, or accessory structures for, a Recreational Vehicle on a subject lot without first obtaining a Building Permit from the Township.

d. Licensing – Vacant Lot of Record:

- i. A License issued pursuant to this By-law authorizes the occupancy of either:
 1. one Recreational Vehicle on a subject vacant lot; or
 2. one Recreational Vehicle per 0.4 ha of lot area to a maximum of two Recreational Vehicles on a subject vacant lot.

The issuance of a License does not grant the Licensee the authority to occupy the Recreational Vehicle on a permanent basis. The issuance of a License is not intended and shall not be construed as permission or consent by the Township for the holder of the License to contravene or to fail to observe or comply with any law of Canada, Ontario or any By-law of the Township.

- ii. The Township may impose conditions on a License, and may refuse to issue a License if any of the conditions cannot be met by the owner of the subject vacant lot.
- iii. A Recreational Vehicle shall be serviced with:
 1. a potable water supply;
 2. an approved Class 4 (septic) system approved under the Ontario Building Code; and
 3. electrical service connecting to:

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- a. on-site services; or
 - b. renewable energy sources; or
 - c. a fuel burning generator which shall not operate between the hours of 19:00 and 08:00 and/or within 30 metres of any adjacent Single Detached Dwelling.
- iv. The owner of the subject vacant lot shall be responsible for obtaining:
1. a civic address for same from the Township; and
 2. an entrance permit, where applicable, pursuant to Township policies and by-laws.
- e. Licensing Exemptions – Vacant Lot of Record:
- i. In circumstances where there is one Recreational Vehicle on a subject vacant lot, its occupancy shall be permitted for more than three consecutive days up to seven consecutive days inclusive once per season (i.e., Spring, Summer and Fall) of any given year, subject to:
 1. the owner of the subject lot informing the Chief Building Official in writing at least fourteen days prior to occupancy of the details [i.e., civic address, occupancy dates, and the number of occupants] to demonstrate compliance with the Zoning By-law and for Township emergency preparedness purposes; and
 2. the Recreational Vehicle having a fully and properly functioning on-board holding tank, which shall be emptied at a provincially licensed facility.
- f. Licensing Exemptions – Developed Lot of Record:
- i. The occupancy of one Recreational Vehicle per 0.4 ha of lot area to a maximum of two Recreational Vehicles shall be permitted for more than three consecutive days up to seven consecutive days inclusive once per season (i.e., Spring, Summer and Fall) of any given year for hunters, fishers or special gatherings on a subject lot which is occupied by a permanent or seasonal Single Detached Dwelling, subject to:
 1. the owner of the subject lot informing the Chief Building Official in writing at least fourteen days prior to occupancy of the details [i.e., civic address, occupancy dates, the number of occupants, and the number and location of the Recreational Vehicle(s)] to demonstrate compliance with the Zoning By-law and for Township emergency preparedness purposes; and
 2. the Recreational Vehicle having a fully and properly functioning on-board holding tank, which shall be emptied at a provincially licensed facility.

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- g. Occupancy Period:
 - i. No person shall occupy any Recreational Vehicle to which this By-law applies from November 30 to April 30 of any given year.
- h. Licensing Fees:
 - i. All Applications submitted for consideration shall be subject to an Application Fee (non-refundable deposit) as set out in the Township Fees and Charges By-law. If the License is refused, then the fee is non-refundable. This fee covers the review of the Application, initial location inspection and placement inspection.
 - ii. The Licensing Fees for every Recreational Vehicle to which this By-law applies shall be as set out in the Township Fees and Charges By-law.
 - iii. The License shall come into effect on January 01 and shall expire on December 31 of each year. The Licensing Fees shall be invoiced by January 15 of each year and shall be payable by February 28.
 - iv. No License shall be issued unless the prescribed fee has been paid. The annual license fee will be pro-rated for a new Recreational Vehicle License issued from the first day of the month if the Application is received during the year.
 - v. A refund may be obtained by submitting a request in writing to the Chief Building Official indicating a Recreational Vehicle will no longer be occupied on a subject lot, and specifying the date on which it is going to be removed. The amount of the refund will be calculated from the first day of the month following the date on which the owner advised the Recreational Vehicle will be removed and it is confirmed by the Chief Building Official that the Recreational Vehicle is no longer located on the subject lot.
 - vi. The Chief Building Official will issue a License for a Recreational Vehicle provided that a complete Application is submitted to the Township, all pre-conditions as specified in this By-law are satisfied, the Licensing Fee is paid in full and the occupancy of the subject lot for a Recreational Vehicle conforms with all other applicable law, including the Zoning By-law.
 - vii. Applications for a new License or to annually renew a License will be refused where any terms or conditions of a previous License were breached and/or if the provisions of this By-law cannot be met.
- i. Inspections:
 - i. Any person designated by Township Council to enforce this By-law may, at any reasonable time and upon producing proper identification, enter and inspect any subject lot that is Licensed under or in violation of this By-law.

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- j. Violations and Penalties:
 - i. Any person who violates this By-law is guilty of an offence and is liable to pay an Administrative Monetary Penalty.
 - ii. Where any condition of a License is breached by any person, regardless of whether the Township has commenced a judicial prosecution, the Township may revoke the License upon written notice of revocation being served on the owner of the subject lot or such notice being posted conspicuously on the subject lot for which the License was issued.
 - iii. Where a License is revoked by the Township, the Licensee shall be jointly and severally responsible for removing the Recreational Vehicle from the subject lot within fourteen days of receipt of the notice of revocation.
 - iv. Where the Licensee fails to remove the Recreational Vehicle in accordance with this By-law, the Township may enter upon the subject lot and remove the Recreational Vehicle without further notice to the Licensee.
 - v. The Licensee shall be jointly and severally liable for all costs incurred by the Township to remove any Recreational Vehicle from a subject lot where the Recreational Vehicle is in violation of this By-law. All costs incurred by the Township shall be recovered from the Licensee by action or placement of the said incurred costs on the tax roll for the subject lot where the Recreational Vehicle was located and collected in the same manner as municipal property taxes.

- k. Application:
 - i. Should any section, subsection or part thereof of this By-law be declared by any Court of Law to be illegal or ultra vires, such section or subsection or part thereof shall be severable and all parts hereof are declared to be separate and independent.
 - ii. This By-law shall come into force and take effect immediately upon the date of passing.

9.0 The Proposed Planning Framework: Feedback

The JLR-HESL team partnered with Township staff and supported Council's decision-making authority as part of the Study, which comprised the following major milestones:

1. The HESL Report (2023) and the JLR Report (2023) were jointly submitted to the Township on November 3/23.
2. Township staff and the JLR-HESL team facilitated Study briefings with:
 - a. Township Council on November 8/23;

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- b. the LCPOA on November 13/23; and
 - c. Township Council on November 28/23.
3. On December 19/23, Council extended the public review / commenting period for the HESL Report (2023) and the JLR Report (2023) from December 31/23 to June 30/24.
4. During the public review / commenting period:
- a. 21 emails were sent to the Township; five letters-to-the-editor were posted in the local newspaper media; and three letters (dated February 22/24, June 3/24 and July 12/24) were sent to the Township from the MECP¹¹;
 - b. Township staff and the JLR-HESL team met with MECP staff on April 5/24; and HESL met with MECP staff on April 18/24; and
 - c. Township staff and the JLR-HESL team met with MECP and County staff on July 8/24.

Table 3 outlines the responses from the JLR-HESL team to the feedback received on the HESL Report (2023) and the JLR Report (2023) during the public review / commenting period. For ease of reference, the feedback is grouped into key themes with a summary of comments highlighting each.

Table 3		
Planning Framework: JLR-HESL Team Responses to Public and Stakeholder Feedback		
Theme	Summary of Comments	JLR-HESL Team Responses
Study Intent	The Township commissioned the Study for the purpose of creating a by-law that would allow RVs to be located on waterfront properties.	The HESL Report (2023) and the JLR Report (2023) are linked. The proposed planning framework in the JLR Report (2023) builds on the Lakeshore Capacity Model in the HESL Report (2023). Had this model indicated otherwise, the planning framework proposed by JLR would have followed suit, in accordance with the Study intent.
	The JLR Report (2023) was written with a particular purpose in mind, as stated in the introduction: 'The intent of these combined efforts is to better balance the use of RVs to enjoy Lake Clear with the health and integrity of the lake itself.' The exclusion of RVs did not seem to be under consideration.	
	The JLR Report (2023) identifies all of the environmental and financial issues related to at-capacity lakes and clearly notes that the current use of RVs is in contravention of the Township's own by-laws, the Official Plan and the Provincial Policy Statement. It then jumps to conclude that 2 RVs per lot would be acceptable. The facts do not support such a recommendation.	The policy and regulatory contraventions regarding RV use around Lake Clear reflect the current planning context. As noted, the proposed planning framework in the JLR Report (2023) builds on the Lakeshore Capacity Model in the HESL Report (2023).

¹¹ Note the emails, letters-to-the-editor and MECP letters submitted during the public review / commenting period are provided under separate cover.

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Table 3
Planning Framework: JLR-HESL Team Responses to Public and Stakeholder Feedback

Theme	Summary of Comments	JLR-HESL Team Responses
Background Study Data	<p>During the Study briefing with the LCPOA on November 13/23, the JLR-HESL team was informed by the LCPOA that any background information provided to the Township from the LCPOA was not sanctioned by the LCPOA; and it was clear at this meeting that the JLR-HESL team was basing some of the recommendations on old data.</p>	<p>The 2018 data from the LCPOA on RV numbers was contrasted and compared to publicly available 'near-present' digital satellite imagery from Renfrew County (2020) for contextual baseline purposes only.</p> <p>The Study-related land use policy and regulatory reviews in the JLR Report (2023) reflect the current planning contexts affecting both Lake Clear and the case study municipalities.</p> <p>The HESL Report (2023) adheres to Provincial recommendations regarding the use of the Lakeshore Capacity Model to determine the Provincial Water Quality Objective for phosphorus and the amount of shoreline development that can occur to maintain phosphorus levels within the phosphorus threshold. Similarly, dissolved oxygen is modelled on the basis of lake morphology and total phosphorus concentrations using industry-accepted techniques. The foregoing is further supported by research of existing data and a field investigation on September 7/22, also in accordance with Provincial recommendations.</p>
	<p>The JLR Report (2023) addressed how three other municipalities deal with RVs, but nothing really about our immediate municipal neighbours. This is a better benchmark for what should be allowed locally.</p>	<p>JLR researched municipal provisions enabled under the Act and the Municipal Act in Strong, North Frontenac, and Whitewater Region – given their similar rural contexts to the Township – to see how the use of RVs on properties abutting lakes have been addressed.</p> <p>The intent of the case study research was not to establish near-proximate benchmarks, but rather to determine a potential planning approach for the Township, relative to the findings and recommendations in the HESL Report (2023).</p>

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Theme	Summary of Comments	JLR-HESL Team Responses
	The JLR Report (2023) states that 'Lake Clear is 1.5 km long and .5 km wide' which is incorrect.	This statement is updated in the enclosed JLR Report (2024).
Lake Quality	There has been a noticeable increase in algae in the lake.	<p>Both observations are reflected in the HESL Report (2023) findings, in that there are no increasing trends in nutrient concentrations; and blue-green algae was observed during the field investigations for which climate change is posited as the contributing factor (Reinl et al. 2021).</p> <p>Regarding the presence of blue-green algae in Lake Clear more specifically, the HESL Report (2023) states that the future effects of climate change and anthropogenic nutrient loading on algal blooms cannot be quantitatively assessed based on available data. It is expected however, that blooms will become more frequent in Lake Clear even if nutrient loading remains unchanged; and increased nutrient loading would be expected to promote more frequent and/or more severe blooms. But based on available data (Rigosi et al. 2014), it was found that the combined effect of increased nutrients and climate change was not greater than the sum of the individual effects.</p>
	The lake's improved water quality over the past 30+ years underscore the effectiveness of collective efforts in environmental stewardship.	
Engagement	JLR was to have consulted with the LCPOA on three occasions during the Study. Regrettably, these consultations did not take place. Also, the November 13/23 Study briefing with the LCPOA did not provide enough time for the LCPOA to review the reports.	<p>During the Study briefing with the LCPOA on November 13/23, JLR acknowledged and apologized for not engaging the LCPOA on three occasions during the Study.</p> <p>To give the public more time to review the reports, the JLR-HESL team worked with Township staff to secure two Council-approved extensions to the public review / commenting period i.e., the first – a one-month extension to December 31/23; and the second – an additional six-month extension to June 30/24.</p>
	The initial extension for the public review / commenting period (i.e., from November 28/23 to December 31/23) is too short, particularly as it falls during the holiday season and at a time when most Lake Clear property owners are not at the lake. The review period should be extended to Spring 2024 at least.	

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Table 3
Planning Framework: JLR-HESL Team Responses to Public and Stakeholder Feedback

Theme	Summary of Comments	JLR-HESL Team Responses
		<p>The proposed planning framework would be subject to future public and review agency consultations and statutory public meetings, as required by the Act (i.e., for the proposed amendments to the County Official Plan and Township Zoning By-law) and the Municipal Act (i.e., for the proposed Licensing By-law).</p>
<p>Too Many RVs?</p>	<p>The recommendation that the Township could consider allowing the use of up to two RVs on each of the existing 610 lots of record on Lake Clear (which equals over 1,200 RVs) is objectionable.</p> <hr/> <p>It is unreasonable to think that Lake Clear property owners will put two RVs on their property just because it is in an RV by-law.</p> <hr/> <p>The 'Lakeshore Capacity Assessment Handbook' (MOE 2010) has the following estimates on the amount of phosphate (the contaminant that affects lake water quality) that is produced by a dwelling: a permanent home produces 1.69 kg per year; a seasonal RV produces 0.12 kg per year, 14 times less than a permanent home. Applying this to the existing 610 lots of record on Lake Clear: 610 permanent homes X 1.69 kg = 1030.9 kg of phosphate per year; and 1200 RVs X 0.12 kg = 146.9 kg of phosphate per year (7 times less).</p> <hr/> <p>RVs pose little to no risk to Lake Clear's lake trout population. RVs are essentially vehicles with a bed and bath, not fixed permanent structures designed for long term occupation. With some controls and enforcement they need not endanger lake quality and capacity in the least.</p>	<p>The intent of the Lakeshore Capacity Model is to provide the upper limit of development potential around Lake Clear without exceeding the water quality objective for phosphorus. Under this full build-out scenario, the model results indicate that the Township could consider allowing the use of up to two RVs on each of the existing 610 lots of record on Lake Clear. But this is a modelled scenario under full build-out conditions. It can be reasonably assumed that the actual number of RVs and the duration of RV use around Lake Clear would be much lower, based on landowner preferences and the proposed planning framework.</p> <hr/> <p>See Appendix 1 (HESL's responses to MECP's comments on the HESL Report (2023)) in the enclosed JLR Report (2024): development is currently permitted on vacant lots of record, but RVs cannot be used on vacant lots of record. Short term impacts (e.g., runoff from construction sites) and long-term impacts (e.g., stormwater generated from impermeable surfaces) associated with cottage development are typically greater than those associated with the use of RVs.</p>

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Table 3
Planning Framework: JLR-HESL Team Responses to Public and Stakeholder Feedback

Theme	Summary of Comments	JLR-HESL Team Responses
Enforcement	<p>The proposed regulations are based on licensing, monitoring and enforcement. The reality is that the Township does not have the resources to enforce its By-laws and when municipal action is taken, it is complaint driven – neighbour against neighbour.</p>	<p>The use of RVs around Lake Clear has existed for years; and the only current planning tool available to the Township to address this issue is the Zoning By-law, which states that RVs cannot be used for temporary seasonal occupancy.</p>
	<p>Some property owners have completely denuded their shorelines and have done so with impunity; there is no septic reinspection program on this lake and we know that some systems are outdated, malfunctioning and even below the water table; there is no protection against invasive species, no regulations around fishing derbies, and no requirements for boat decontamination by visiting boaters.</p>	<p>The Lakeshore Capacity Model in the HESL Report (2023) indicates that the Township can consider allowing the use of RVs on existing lots of record around Lake Clear if appropriate BMPs are developed and enforced to ensure that impacts to Lake Clear are minimized.</p> <p>The Township has three choices moving forward: maintain the status quo; enforce the current planning regime; or develop a planning framework in response to the findings in the HESL Report (2023).</p>
	<p>RVs used as cottage replacements are not subject to any of the same rules that cottages are, they are often closer to the shoreline than the setbacks for cottages permit, they lack any oversight of disposal of sewage and gray water and there are no consequences for multiple RVs on one lot.</p>	<p>The spectrum of municipal by-law enforcement is made easier when appropriate tools are in place to facilitate resident applications and renewals; municipal reviews, approvals and refusals of said applications; and municipal property inspection and response protocols to resident complaints. Enforcement is also made easier with public compliance.</p>
	<p>We would suggest that some of the recommendations pertaining to permits for short term RV use are simply not practical nor would they be enforceable by the limited staffing in a small municipality. Our observations are that in most cases when RVs are sited, they remain for most or all of the summer season.</p>	<p>The proposed planning framework offers three supporting tools – Official Plan policy, Zoning By-law provisions and Licensing By-law regulations – that incorporate BMPs, balance and flexibility through graded scales of compliance requirements.</p>
	<p>A simplified permit system recognizing the reality of most RV's seasonal locating could be designed to meet the criteria of fairness and enforceability.</p>	<p>The need to continue to build understanding and capacity about the proposed planning framework would be critical: public and review agency consultations and statutory public meetings would be required by the Act (i.e., for the proposed amendments to the County Official Plan and Township Zoning By-law) and the Municipal Act (i.e., for the proposed Licensing By-law).</p>

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Table 3
Planning Framework: JLR-HESL Team Responses to Public and Stakeholder Feedback

Theme	Summary of Comments	JLR-HESL Team Responses
		<p>Further to the above – and if the proposed planning framework is ultimately approved and implemented by the Township – the need to continue to build understanding and capacity through public awareness and education would remain critical.</p> <p>As noted, the intent of the Study is to address the use of RVs around Lake Clear within a context that has existed for years. As such, a multi-faceted approach is needed – the use of the tools in the proposed planning framework, coupled with on-going public engagement, awareness and education – to help with future public compliance and municipal enforcement efforts.</p>
<p>'At-Capacity Lake'</p>	<p>The 'at capacity' designation, while designed to give a lake special protection, was not intended to freeze all development around a lake. If that were the case, not a single addition to an existing home, no new garages, boat houses or lot developments of any kind would have been allowed since 1984 when the designation was placed into the first Official Plan for the area around Lake Clear.</p> <p>Perhaps a review of lake properties that contain bunkies and living quarters in garages would be better? Perhaps these dwellings and large residential homes are doing more damage to the lake than a handful of seasonal RVs.</p> <p>Council should take the information it received from the actual testing of the water in Lake Clear and conclude that our lake is NOT at capacity regarding the number of dwellings around it, and will allow for new development where current pollution standards can be met.</p> <p>Does it matter if the issue is a cottage or a trailer or a tent? The issue is about water</p>	<p>The intent of the Study is not to change the status of Lake Clear as an 'at-capacity lake' or address ADUs around Lake Clear. Rather, its intent is to address the use of RVs around Lake Clear within a context that has existed for years; and to do so on the basis of a Lakeshore Capacity Assessment, case study research and tools enabled under the Act (Official Plans and Zoning By-laws) and the Municipal Act (Licensing By-laws).</p>

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Table 3
Planning Framework: JLR-HESL Team Responses to Public and Stakeholder Feedback

Theme	Summary of Comments	JLR-HESL Team Responses
	runoff to the lake. With good planning and governance there should not be any run off to the lake.	
Lakeshore Capacity Modelling: .1 General	More modelling work is needed to narrow the range of factors that affect Lake Clear’s development capacity. For example, to produce meaningful scientific predictions, the modelling needs to be conducted using the entire range of soil types and soil pH that exist around the lake. And this is only one factor; there are many other factors included in the model which should be tested across the range of all of them, to determine which ones have the greatest effect on lake water quality and development capacity.	As noted, the HESL Report (2023) adheres to Provincial recommendations regarding the use of modelling, background research and field investigations.
.2 Measurements	The dissolved oxygen profile collected at the deepest part of the lake had a calculated mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) of 6.58 mg/L, which was below the 7 mg/L dissolved oxygen criterion for lake trout. This MVWHDO value is significantly greater than historic profiles collected by the MECP in 2003 (3.57 mg/L), 2010 (2.15 mg/L), 2011 (4.33 mg/L), 2018 (3.33 mg/L). The HESL Report (2023) does not explain this discrepancy and no calculations are provided to confirm how they arrived at the result.	The dissolved oxygen data collected in the epilimnion (see Figure 4 in the HESL Report (2023)) are comparable to the MECP data (see Figure 3 in the HESL Report (2023) i.e., ~9 mg/L), while the minimum off-bottom concentration was ~1 mg/L. Given this range and the maximum and minimum values recorded, an issue with instrument calibration or functionality cannot explain the differences in the data. The difference between the maximum and minimum MVWHDO concentrations for MECP data (4.33 mg/L - 2.15 mg/L = 2.18 mg/L) is comparable to the difference between the maximum MECP MVWHDO concentration and the values in the HESL Report (2023): 6.58 mg/L - 4.33 mg/L = 2.25 mg/L. Differences may be due to interannual variability.
	The MVWHDO value is significantly higher than the values calculated by the MECP using historical profiles. Some interannual variation is normal but typically not to the extent reported in the HESL Report (2023).	It should be noted that two of the four MECP profiles that resulted in the lowest MVWHDO concentrations (September 16, 2010 [2.15 mg/L] and September 16, 2010 [3.33 mg/L]) were collected outside

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Table 3
Planning Framework: JLR-HESL Team Responses to Public and Stakeholder Feedback

Theme	Summary of Comments	JLR-HESL Team Responses
.3 Model Inputs		<p>of the date range recommended in MOE (2010) i.e., August 15 to September 15. In any case, given that the MVWHDO concentrations are all less than the Lake Trout criterion of 7 mg/L, the importance of the issue is unclear.</p> <p>Note the MVWHDO calculations are in Appendix 1 (HESL's responses to MECP's comments on the HESL Report (2023)) in the enclosed JLR Report (2024).</p>
	<p>There is a difference between the long-term average MVWHDO value (3.92 mg/L) and MECP's value (4.20 mg/L). The MVWHDO calculations are not included in the HESL Report (2023), so it is not possible to determine the source of the discrepancy.</p>	<p>The long-term average MVWHDO concentration is well below 7 mg/L and the difference between the averages is negligible (0.3 mg/L).</p> <p>Note the MVWHDO calculations are in Appendix 1 (HESL's responses to MECP's comments on the HESL Report (2023)) in the enclosed JLR Report (2024).</p>
	<p>The model only included the 2023 dissolved oxygen profile. All available profiles should be included in the analysis, particularly when the individual model used (2023) varies so significantly from historic data.</p>	<p>As noted by MECP, the Molot dissolved oxygen model (Molot et al. 1992) cannot be used with MECP's MVWHDO data. HESL did not collect the MECP data, so it is difficult to comment on the accuracy of that dataset. Reliance on the HESL MVWHDO data provides some indication of the relative modelled change in future MVWHDO concentrations.</p>
	<p>The values used for wetland area and cleared area in the phosphorus model are not consistent with MECP datasets. HESL assumed a value of 0% wetland in the watershed, which is unrealistic, and a 9.9% cleared area. According to Eastern Region's GIS data, the Lake Clear Watershed has approximately 5.5% wetland area and 19.1% cleared area. Both cleared and wetland areas are important model input parameters as they are associated with calculating the modelled phosphorus load from the watershed.</p>	<p>HESL does not have access to these MECP datasets. The Ontario Watershed Information Tool was used to calculate % wetland and % cleared land. It is clearly stated in Table 9 and Appendix B of the HESL Report (2023) that % wetland was set to zero because a phosphorus export of 10.3 mg-phosphorus/m²/year was used. It was selected because it is recommended for sedimentary watersheds in Lakeshore Capacity Study: Trophic Status (MMA 1986).</p>

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Lake Clear Lake Capacity: RV Land Use Study

Table 3
Planning Framework: JLR-HESL Team Responses to Public and Stakeholder Feedback

Theme	Summary of Comments	JLR-HESL Team Responses
.4 Upstream Lakes		<p>A description of soils in the watershed and lake pH to justify the selection is presented in Section 4.2.1.1 of the HESL Report (2023). Utilization of the wetland-based phosphorus runoff calculation derived from Paterson et al. (2006) and included in MOE (2010) are designed for lakes in Pre-Cambrian Shield watersheds.</p> <p>Percent cleared land was assumed equivalent to the 'Agricultural and Undifferentiated Rural Land Use' provided by the Ontario Watershed Information Tool. It should be noted that the categorization of >15% or <15% cleared land was originally determined to differentiate between agricultural or non-agricultural watersheds. Dillon and Kirchner (1975) noted: 'The term pasture implying cleared land used for grazing livestock or left fallow', and that, '[a] particular land use was not considered unless it compromised at least 15% of the watershed area'.</p>
	<p>There were several minor input discrepancies including the values for lake area, mean annual runoff, and total phosphorus in the phosphorus model.</p>	<p>As noted, the differences are minor. HESL used publicly available data whereas MECP used internal datasets. Lakeshore Capacity Model inputs, sources and related notes are presented in Table 9 of the HESL Report (2023).</p>
	<p>The phosphorus model did not separately model the lakes upstream of Lake Clear. Both Meadow Lake and Hermitage Lake are large enough that they should have been modelled as independent upstream sources flowing into Lake Clear.</p>	<p>As noted in Appendix 1 (HESL's responses to MECP's comments on the HESL Report (2023)) in the enclosed JLR Report (2024), eight scenarios were modelled, including the addition of Meadow and Hermitage Lakes. The change does not appreciably affect the predicted development capacity.</p> <p>The HESL Report (2023) accounts for upstream anthropogenic phosphorus inputs on the upstream lakes (Hermitage, Meadow) as can be seen in the 300 m buffer of Lake Clear and watercourses in the map used to quantify existing development (Figure 1).</p>

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Lake Clear Lake Capacity: RV Land Use Study

Table 3
Planning Framework: JLR-HESL Team Responses to Public and Stakeholder Feedback

Theme	Summary of Comments	JLR-HESL Team Responses
	<p>The phosphorus model run sheet indicates that from a phosphorus perspective, Lake Clear can sustain an additional 522 seasonal residences (or RVs) before reaching the background + 50% objective. However, Table 2 states that the lake can withstand 2 RVs per existing lot, which would equate to approximately 1564 RVs or seasonal residences (not considering the minor per lot stormwater load). This is a significant discrepancy, and there are no model run sheets to document the 2 RVs per lot conclusion.</p>	<p>In the Lakeshore Capacity Model, the 'number of allowable residences to reach capacity' does not account for phosphorus retention in the soil (i.e., it assumes $R_s = 0$). If an R_s value of 0.69 is assumed for future RV use (which is conservative as most wastewater will likely be deposited from holding tanks into licensed collection facilities), there is capacity for 2 RVs on each of the 610 developed lots (i.e., 1220 RVs).</p>
MECP's Position	<p>The February 22/24 letter from the MECP to the Township expresses concerns with the HESL Report (2023) and as such, the MECP cannot support the proposed planning framework on this basis.</p>	<p>Township staff and the JLR-HESL team met with MECP staff on April 5/24 to discuss the MECP's concerns with the HESL Report (2023) and the proposed planning framework.</p> <p>A second meeting involving HESL and MECP staff was held on April 18/24 to further discuss the MECP's concerns with the HESL Report (2023).</p>
	<p>The June 3/24 letter from the MECP to the Township acknowledges the intent of the Study but expresses concerns that expanding the use of RVs beyond historic anomalies may represent a significant increase in phosphorus loadings from new sewage systems. As such, the MECP requests further discussion with Township staff and the JLR-HESL team on this matter.</p>	<p>Following receipt of the June 3/24 letter from the MECP, HESL prepared a letter of response to MECP's comments on the HESL Report (2023), which is highlighted above and attached in Appendix 1; and Township staff and the JLR-HESL team met with MECP and County staff on July 8/24.</p>
	<p>The July 12/24 letter from the MECP to the Township supports the proposed regulations. As excerpted from this letter: '... MECP better understands the various scenarios and protections afforded by [the] proposals for regulation and licensing ... We do acknowledge that scenario three [RV use on vacant lots of record] was a sticking point for us, but we recognize that the zoning for these properties already permit a single dwelling and that not every owner of a vacant lot of record will want an RV or be interested in the regulated / licensed environment. We</p>	<p>The JLR-HESL team appreciates its collaborations with the MECP (and County) on the Study.</p>

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Lake Clear Lake Capacity: RV Land Use Study

Table 3
Planning Framework: JLR-HESL Team Responses to Public and Stakeholder Feedback

Theme	Summary of Comments	JLR-HESL Team Responses
	<p>understand that the implementation of the bylaw will likely result in a decrease in the number of RVS under scenario 1 [RV use and storage on existing lots with a single dwelling] and 2 [vacant lots of record currently occupied by illegal and unregulated RVs]. This is further bolstered by the other protections afforded by some of the proposed recommendations ... These too will be a net benefit compared to existing conditions.'</p>	
Expand the Regulations	<p>The proposed regulations should be applied to all of our waterbodies.</p>	<p>The Study applies specifically to Lake Clear.</p>
	<p>Instead of individual tariffs or licensing fees, why not tie the fee as a surtax to the landowner's taxes? If the trailer moves, it will then be up to the owner to notify the Township to receive a reduction in taxes.</p>	<p>Licensing is a common tool used by municipalities across Ontario and in the case study municipalities regarding the use of RVs around lakes. Determining the merits, linkages or possible applications of other municipal financial tools, including those under Ontario property assessment law, is beyond the scope of the Study and can be considered further in the future.</p>
	<p>I do not agree with limiting RV use to only three seasons. If people want to use the RV in winter, let them.</p>	<p>There are public health and safety risks associated with residing in RVs over winter; and the provincially licensed waste disposal facility in Eganville is closed during the winter months. Still, and as acknowledged by JLR during the Township Council presentation of the enclosed JLR Report (2024) on October 2/24, this matter can be reviewed further in the future, given advances in RV design and occupational technologies.</p>
	<p>The proposed regulations should allow more RVs to be used on large lots e.g., greater than 10 or 25 acres.</p>	<p>MECP support for the planning framework, as currently proposed, is an important milestone for the Study and Township, especially when the water quality and capacity status of Lake Clear remains its main concern.</p> <p>The proposed planning framework is a living document and would be subject to subsequent review and possible refinements as part of the public and</p>
	<p>Fall hunting rifle season is 14 days so I am not sure allowing only 7 days is fair.</p>	
<p>Similar to optional electrical service, ecological methods could be explored in lieu</p>		

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Lake Clear Lake Capacity: RV Land Use Study

Table 3
Planning Framework: JLR-HESL Team Responses to Public and Stakeholder Feedback

Theme	Summary of Comments	JLR-HESL Team Responses
	<p>of approved Class 4 (septic) system such as composting toilets or grey water disposal systems rather than a full blown septic tank and weeping bed.</p>	<p>review agency consultations and statutory public meetings, as required by the Act (i.e., for the proposed amendments to the County Official Plan and Township Zoning By-law) and the Municipal Act (i.e., for the proposed Licensing By-law).</p> <p>Further to the above – and if the proposed planning framework is ultimately approved and implemented by the Township – the need to continue to monitor the extent and effectiveness of its component parts, relative to the intent of the Study and the local context, would remain critical.</p>
<p>Move Forward</p>	<p>Landowners have the right to enjoy their property as they choose – no matter if it is a cottage, permanent home, trailer or tent – so long as they follow the local rules.</p> <p>I am hoping the trailer issue is done and we can all get on with our life.</p> <p>In a Township as large as ours and with limited resources and high inflation, would municipal funds not be more appropriately spent on things that benefit the entire Township like infrastructure?</p> <p>The proposed planning framework provides a solid starting point for resolving the longstanding issue while accommodating the use of RVs with appropriate environmental safeguards.</p>	<p>As noted, the intent of the Study is to address the use of RVs around Lake Clear within a context that has existed for years; and to do so through a Lakeshore Capacity Assessment; case study research; a review of tools enabled under the Act (Official Plans and Zoning By-laws) and the Municipal Act (Licensing By-laws); and the development of a proposed planning framework as a basis upon which to move forward.</p>

10.0 Study Closure: Recommendations and Next Steps

Lake Clear is an ‘at-capacity’ lake, and RVs are being used for temporary seasonal occupancy on shorelands not zoned TC Zone in the Township Zoning By-law, which is non-compliant with current land use policies and regulations. The intent of the Study was to partner with the Township in preparing ‘good land use planning’ measures regarding the private use of RVs within 300 m of the Lake Clear shoreline.

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Lake Clear Lake Capacity: RV Land Use Study

The proposed planning framework in Section 8.0 of the enclosed JLR Report (2024) builds on the HESL Report (2023), background research as well as municipal, public and stakeholder inputs and feedback, in employing three supporting tools – Official Plan policy, Zoning By-law provisions and Licensing By-law regulations – that incorporate BMPs and flexibility through graded scales of compliance requirements. It is our professional planning opinion that the enclosed JLR Report (2024) and the proposed planning framework enclosed herein balances the private use of RVs to enjoy Lake Clear with the health and integrity of the lake itself and, as such, represents good land use planning.

The enclosed JLR Report (2024) was presented to Township Council on October 2/24 and subsequently endorsed in principle by same on October 15/24. It is important to reiterate however, that the proposed planning framework is a living document and would be subject to subsequent review and possible refinements as part of the public and review agency consultations and statutory public meetings, as required by the Act (i.e., for the proposed amendments to the County Official Plan and Township Zoning By-law) and the Municipal Act (i.e., for the proposed Licensing By-law). Furthermore, if the proposed planning framework is ultimately approved and implemented by the Township, the need to continue to monitor the extent and effectiveness of its component parts, relative to the intent of the Study and the local context, would remain equally critical.

J.L. RICHARDS & ASSOCIATES LIMITED

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WDP:jf

This report has been prepared for the exclusive use of the Township of Bonnechere Valley for the stated purpose. Its discussions and conclusions cannot be properly used, interpreted or extended to other purposes without a detailed understanding and discussions with the client as to its mandated purpose, scope and limitations.

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Appendix 1

HESL Lake Clear Capacity Assessment Report Package



June 26, 2024

Project No. 220081

Annette Gilchrist
CAO/Clerk/Treasurer
Township of Bonnechere Valley
PO Box 100
Eganville, ON K0J 1T0

Dear Ms. Gilchrist:

Re: Lake Clear Capacity Assessment – Response to Ministry of Environment, Conservation and Parks Comments

Hutchinson Environmental Sciences Ltd. (HESL) and our project partners, J.R. Richards and Associates Ltd., were retained by the Township of Bonnechere Valley to complete a capacity assessment of Lake Clear. The Township is considering amending the Official Plan to allow Recreational Vehicles on lakeshore lots, but Lake Clear is designated as an “at-capacity lake” in the County of Renfrew’s Official Plan. *Lake Clear Capacity Assessment* (HESL 2023¹) was reviewed by the Ministry of Environment, Conservation and Parks ((MECP) Baxter, S. 2024²). MECP provided background information, a synopsis of *Lake Clear Capacity Assessment*, a review of the report (including seven general comments), results of MECP’s lakeshore capacity modelling, conclusions, and recommendations. This letter presents MECP’s comments and our responses (Table 1), a brief discussion of MECP’s model and related implications, and conclusions.

¹ HESL. 2023. *Lake Clear Capacity Assessment. Prepared for the Township of Bonnechere Valley.*

² Baxter, S. *Lake Clear Capacity Assessment, Township of Bonnechere Valley; County of Renfrew, ECHO #1-269271162*



1. MECP's Comments and HESL's Responses

Table 1. MECP's Comments and HESL's Responses.

Topic	MECP Comment	Page Number	HESL Response
Mean Volume Weighted Hypolimnetic Dissolved Oxygen Measurements	Hutchinson indicates that the dissolved oxygen profile they collected at the deepest part of the lake had a calculated MVWHDO of 6.58 mg/L, which was below the 7 mg/L MNRF dissolved oxygen criterion for lake trout. This MVWHDO value is significantly greater than historic profiles collected by the MECP in 2003 (3.57 mg/L), 2010 (2.15 mg/L), 2011 (4.33 mg/L), 2018 (3.33 mg/L). Hutchinson does not explain this discrepancy and no calculations are provided to confirm how they arrived at their result.	3	The dissolved oxygen data collected by HESL in the epilimnion (Figure 4 in HESL 2023) are comparable to the MECP data (Figure 3 in HESL 2023; i.e., ~9 mg/L), while HESL's minimum off-bottom concentration was ~1 mg/L. Given this range and the maximum and minimum values recorded, an issue with instrument calibration or functionality cannot explain the differences in the data. The difference between the maximum and minimum MVWHDO concentrations for MECP data (4.33 mg/L - 2.15 mg/L = 2.18 mg/L) is comparable to the difference between the maximum MECP MVWHDO concentration and HESL value (6.58 mg/L - 4.33 mg/L = 2.25 mg/L). Differences may be due to interannual variability.
	First, the MVWHDO value calculated by Hutchinson for their 2023 profile is significantly higher than the values calculated by the MECP using our historical profiles. In my experience, some interannual variation is normal but typically not to the extent reported by Hutchinson.	4	It should be noted that two of the four MECP profiles that resulted in the lowest MVWHDO concentrations (September 16, 2010 [2.15 mg/L] and September 16, 2010 [3.33 mg/L]) were collected outside of the date range recommended in MOE (2010 ³) (i.e., August 15 to September 15). In any case, given that the MVWHDO concentrations are all less than MNRF Lake Trout criterion of 7 mg/L, the importance of the issue is unclear. MVWHDO calculations have been added to Appendix A of this letter.
	Second, there is a difference between the long-term average MVWHDO value calculated by Hutchinson (3.92 mg/L) and my value (4.20 mg/L). Hutchinson does not provide their MVWHDO calculations, so it is not possible to determine the source of the discrepancy.	4	The long-term average MVWHDO concentration is well below 7 mg/L and the difference between the averages is negligible (0.3 mg/L). MVWHDO calculations have been added to Appendix A of this letter.

³ Ministry of the Environment (MOE). 2010. Lakeshore Capacity Assessment Handbook – Protecting Water Quality in Inland Lakes on Ontario's Precambrian Shield.



	<p>Seventh, Hutchinson's DOM model only included the 2023 dissolved oxygen profile. When running the DOM, all available profiles should be included in the analysis, particularly when the individual model used (2023) varies so significantly from historic data.</p>	5	<p>As noted by MECP, the Molot dissolved oxygen model (i.e., Molot et al. 1992⁴) cannot be used with MECP's MVWHDO data. HESL did not collect the MECP data, so it is difficult to comment on the accuracy of that dataset. Reliance on the HESL MVWHDO data provides some indication of the relative modelled change in future MVWHDO concentrations.</p>
Lakeshore Capacity Model Inputs	<p>Third, the values used for wetland area and cleared area in the phosphorus model are not consistent with MECP datasets. Hutchinson assumed a value of 0% wetland in the watershed, which is unrealistic, and a 9.9% cleared area. According to Eastern Region's GIS data, the Lake Clear Watershed has approximately 5.5% wetland area and 19.1% cleared area. Both cleared and wetland areas are important model input parameters as they are associated with calculating the modelled phosphorus load from the watershed.</p>	4	<p>HESL does not have access to these MECP datasets. The Ontario Watershed Information Tool was used to calculate % wetland and % cleared land. It is clearly stated in Table 9 and Appendix B that % wetland was set to zero because a phosphorus export of 10.3 mg-phosphorus/m²/year was used. It was selected because it is recommended for sedimentary watersheds in Lakeshore Capacity Study: Trophic Status (MMA 1986⁵). A description of soils in the watershed and lake pH to justify the selection is presented in Section 4.2.1.1. Utilization of the wetland-based phosphorus runoff calculation derived from Paterson et al. (2006⁶) and included in MOE (2010) are designed for lakes in PreCambrian Shield watersheds.</p> <p>Percent cleared land was assumed equivalent to the "Agricultural and Undifferentiated Rural Land Use" provided by the Ontario Watershed Information Tool. It should be noted that the categorization of >15% or <15% cleared land was originally determined to differentiate between agricultural or non-agricultural watersheds. Dillon and Kirchner (1975⁷) noted "The term pasture implying cleared land used for grazing</p>

⁴ Molot, L.A., Dillon, P.J., Clark, B.J., and Neary, B.P. 1992. Predicting end-of-summer oxygen profiles in stratified lakes. *Canadian Journal of Fisheries and Aquatic Sciences*, 49: 2363–2372.

⁵ Ministry of Municipal Affairs (MMA). 1986. *Lakeshore Capacity Study: Trophic Status*. Prepared by: Dillon, P.J., Nicholls, K.H., Scheider, W.A., Yan, N.D. and Jefferies, D.S. May 1986. Printed by the Queen's Printer for Ontario. 89 pages.

⁶ Paterson, A.M., Dillon, P.J., Hutchinson, N.J., Futter, M.N., Clark, B.J., Mills, R.B., Reid, R.A., Scheider, W.A. 2006. A Review of the Components, Coefficients and Technical Assumptions of Ontario's Lakeshore Capacity Model, *Lake and Reservoir Management*, 22:1, 7-18.

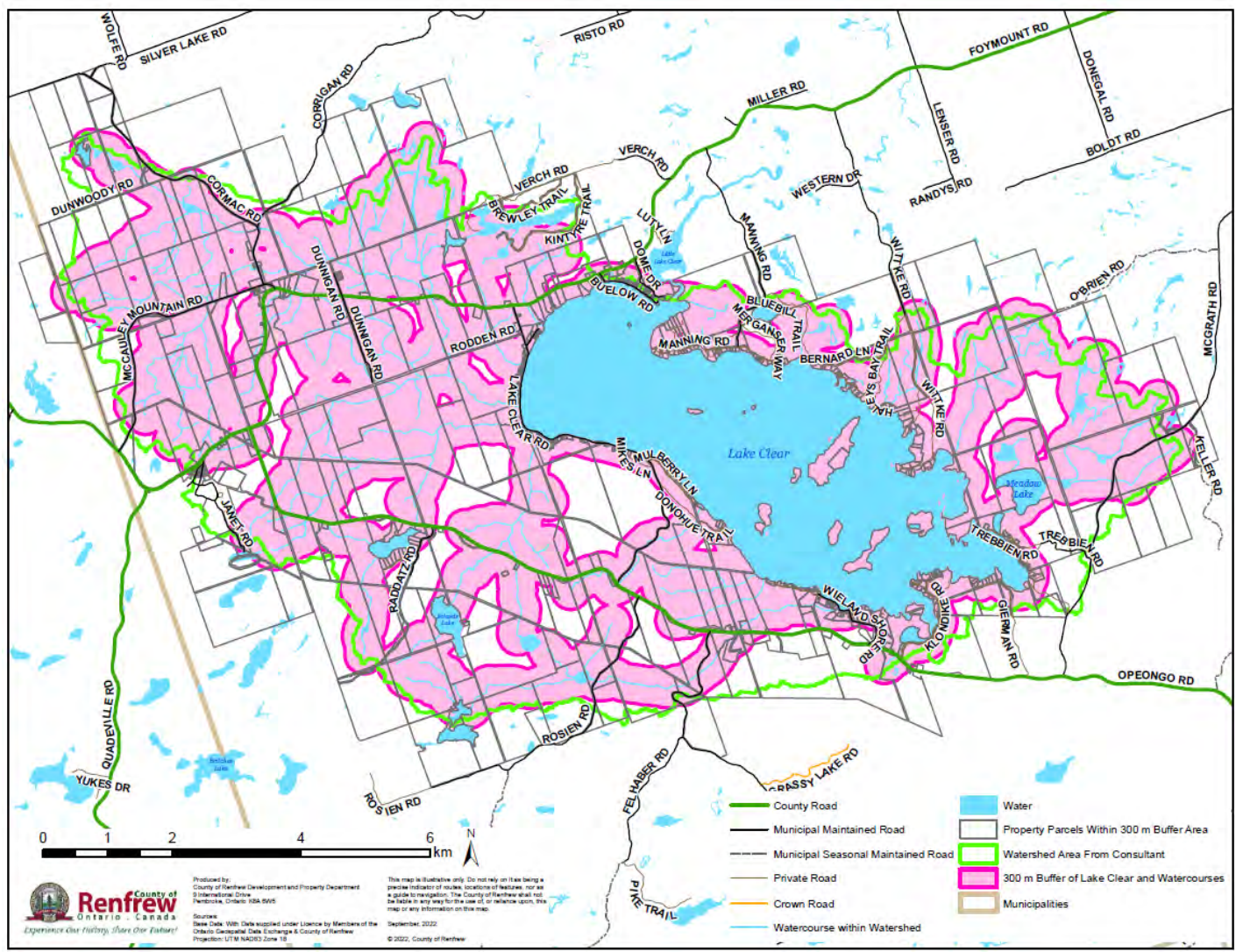
⁷ Dillon, P.J. and Kirchner, W.B. The effects of geology and land use on the export of phosphorus from watersheds. *Water Research*, 9:2, 135-148.



			livestock or left fallow", and that, "[a] particular land use was not considered unless it compromised at least 15% of the watershed area".
	Fifth, there were several minor input discrepancies including the values for lake area, mean annual runoff, and TP so in the phosphorus model.	5	As noted, the differences are minor. HESL used publicly available data whereas MECP used internal datasets. LCM inputs, sources and related notes are presented in Table 9.
Upstream Lakes	Fourth, in the phosphorus model, Hutchinson did not separately model the lakes upstream of Lake Clear. Both Meadow Lake and Hermitage Lake are large enough that they should have been modelled as independent upstream sources flowing into Lake Clear.	5	A number of modelling scenarios are presented and discussed in Section 3, including the addition of Meadow and Hermitage Lakes. The change does not appreciably affect the predicted development capacity. It should be noted that the LCM included in our 2023 report did account for upstream anthropogenic phosphorus inputs on the upstream lakes (Hermitage, Meadow) as can be seen in the 300-m buffer of Lake Clear and watercourses in the map used to quantify existing development (Figure 1).
	Sixth, Hutchinson's phosphorus model run sheet (appendix B) indicates that from a phosphorus perspective, Lake Clear can sustain an additional 522 seasonal residences (or RVs) before reaching the background + 50% objective. However, in Table 2 of the reviewed report, Hutchinson reports that the lake can withstand 2 RVs per existing lot, which would equate to approximately 1564 RVs or seasonal residences (not considering the minor per lot stormwater load). This is a significant discrepancy, and the reviewed report does not include model run sheets to show how Hutchinson arrived at their 2 RVs per lot conclusion.	5	In the LCM, the "Number of allowable residences to reach capacity" does not account for phosphorus retention in the soil (i.e. it assumes $R_s = 0$). If an R_s value of 0.69 is assumed for future RV use, which is conservative as most wastewater will likely be deposited from holding tanks into licenced collection facilities, there is capacity for 2 RVs on each of the 610 developed lots (i.e. 1220 RVs).



Figure 1. Map of Lake Clear and 300-m zone surrounding the lake and tributaries used to derive development counts (provided to HESL by Renfrew County's GIS technician on 28 September 2022).



2. MECP’s Model

The MECP’s Lakeshore Capacity Model (LCM) overpredicted measured phosphorus concentrations by 50.1% which is well beyond the range considered acceptable for model prediction (i.e., <20%). However, when a soil retention factor of 0.69 was used, the error decreased to 15%. The MECP determined that they would not support the addition of two RVs per lot because the modelled phosphorus concentration (14.08 µg/L) was greater than the Provincial Water Quality Objective (11.05 µg/L) when two RVs were added to each of the existing 782 lots of record. HESL utilized 610 for a similar calculation and a phosphorus retention rate of 0.69. It appears that MECP included vacant lots of record and did not include a soil retention factor for future RVs during the calculation of future phosphorus concentrations; the latter factor considerably influenced their results.

3. Modelling Scenarios

Eight scenarios (Table 2) were modelled to assess how the selection of LCM parameter values influences the model output (i.e., the predicted lakeshore capacity, as number of lots). The capacity (as # RVs; i.e., 0.69 capita-years per year) is reported here as expressed by the LCM in its default form; i.e., with the assumption that there is no attenuation of phosphorus by soils for new development (as assumed by MECP) and assuming 69% attenuation for new development (as assumed in our original report).

All models that were calibrated assuming zero-percent attenuation of phosphorus by soils (Rs = 0) resulted in poor model performance (absolute error >20%). All modifications to the LCM presented to address MECP’s comments (i.e., modelling upstream lakes separately and using the MECP values for wetland and cleared land coverage) resulted in a higher background phosphorus concentration, and thus higher development capacity, than the results in our 2023 report (

Table 3).

Table 2. Various LCM scenarios modelled to assess the importance of parameter values.

Scenario	Description of Parameter Set	Notes
#1	HESL trial model run assuming no attenuation of P by soils	Unacceptably low accuracy.
#2	Version in HESL (2023¹)	–
#3	MECP data for wetlands & cleared land; no P attenuation by soils	Unacceptably low accuracy.
#4	HESL model with MECP data for wetlands & cleared land	–
#5	Upstream lakes included; no P attenuation by soils	Wetlands (%) and cleared land (%) for Hermitage and Meadow Lakes determined using OWIT
#6	HESL model with upstream lakes included	Wetlands (%) and cleared land (%) for Hermitage and Meadow Lakes determined using OWIT
#7	MECP data for wetlands & cleared land; no P attenuation by soils; upstream lakes included	assumed %wetlands and %cleared land the same for upstream lakes and Lake Clear
#8	MECP data for wetlands & cleared land; upstream lakes included	assumed %wetlands and %cleared land the same for upstream lakes and Lake Clear



Table 3. Predicted development capacity based on various choices for LCM inputs.

	#1	#2	#3	#4	#5	#6	#7	#8
Error (%)	41.4	6.3	48.5	13.5	33.1	-0.6	40.4	6.7
Acceptable accuracy?	No	Yes	No	Yes	No	Yes	No	Yes
Rs (%)	0	69	0	69	0	69	0	69
Wetlands (%)	0	0	5.5	5.5	0	0	5.5	5.5
Cleared Land (%)	9.9	9.9	19.1	19.1	9.9	9.9	19.1	19.1
Future Upstream Loading	0	0	0	0	29.8	28.0	32.7	30.8
Background+50% Load (kg/y)	1602	1602	1741	1741	1643	1643	1787	1787
Future Load (kg/y)	1903	1350	1996	1443	1923	1375	2018	1471
# RVs (Rs=0.00)	–	522	–	619	–	557	–	657
# RVs (Rs=0.69)	–	1784	–	2113	–	1904	–	2243

4. Conclusions

MECP's review of the Lake Capacity Assessment does not change the fundamental conclusions of the Lake Capacity Assessment:

- 1) The lake is over capacity in terms of measured MVWHDO.

Prohibiting additional development on an at-capacity Lake Trout lake is, however, based on the premise that additional development will increase phosphorus loading and lower dissolved oxygen concentrations. To our knowledge, there is no documented evidence that shoreline development and associated septic service has resulted in harm to Lake Trout habitat.

The determination of current MVWHDO concentrations does not provide an indication of historical concentrations. It is unclear if development should be limited on a Lake Trout lake if MVWHDO concentrations have always been <7 mg/L due to natural lake characteristic such as morphometry, especially if there is limited documentation that shoreline development can reduce MVWHDO and recognizing that many lakes with <7 mg/L do support healthy Lake Trout populations. It is also unclear how Lake Trout in Lake Clear would react under similar laboratory settings tested during the foundational research that led to development of the Lake Trout habitat criterion (i.e., Evans 2007⁸) and how well resident populations in Lake Clear have adapted to dissolved oxygen concentrations in the lake over thousands of years.

- 2) The lake is under capacity based on the revised PWQO for total phosphorus and Lakeshore Capacity Model results when an appropriate phosphorus attenuation factor is utilized.

Refer to Table 3. For a given rate of phosphorus attenuation by soil, different modelling scenarios result in comparable capacity estimates.

⁸ Evans, D.O. 2007. Effects of Hypoxia on Scope-for-Activity and Power Capacity of Lake Trout (*Salvelinus namaycush*), *Canadian Journal of Fisheries and Aquatic Sciences*, 64(2): 345-361.



- 3) A number of Best Management Practices (BMPs) have been recommended to minimize impacts associated with existing and future development, and the Township has resources to ensure implementation. Recommended BMPs include implementation of sewage treatment systems that are designed to maximize phosphorus attenuation, development and retention of 30 m naturally vegetated shoreline buffers, implementation of stormwater management features to maximize infiltration, and continued monitoring and inspection of BMPs.
- 4) A phosphorus load ($0.69 \text{ capita-yr/yr} \times 0.66 \text{ kg/capita/yr} = 0.50 \text{ kg-P/lot/yr}$) was used for future RVs which is the same load used for seasonal residence. Many RVs will be serviced with a holding tank which should result in the complete removal of effluent and the associated nutrient load from the study area.
- 5) *Planning Report – Lake Clear Lake Capacity: RV Land Use Study* (JLR 2023⁹) proposes three tools – Official Plan, Zoning By-law and Licensing By-law – that include BMPs and graded scales of provisions and compliance requirements depending on the extent of RV use and RV use allowances depending on lot size. As such, the proposed Official Plan policies and Zoning By-law regulations support with the provisions in the proposed Licensing By-law, which contain a number of compliance requirements such as determining occupancy periods, requiring approved septic servicing and shoreline vegetated buffers, licensing fees, inspections, violations and penalties which will minimize potential impacts associated with RV use. Furthermore, the development of up to 2 RVs per lot in HESL’s report was used to showcase the upper limit of development potential based on the LCM. It can be reasonably assumed however, that the actual number of RVs and the duration of RV use will be much lower than this full build-out scenario, based on landowner preferences and the proposed policy-regulatory provisions noted therein.
- 6) Development is currently permitted on vacant lots of record, but RVs cannot be used on vacant lots of record. Short term impacts (e.g., runoff from construction sites) and long-term impacts (e.g., stormwater generated from impermeable surfaces) associated with cottage development are typically greater than those associated with the use of RVs.
- 7) Currently the use of RVs on Lake Clear is unregulated and therefore it is not known if they are properly serviced via appropriately sized tile beds or holding tanks that are pumped out regularly.

Sincerely,
per. Hutchinson Environmental Sciences Ltd.



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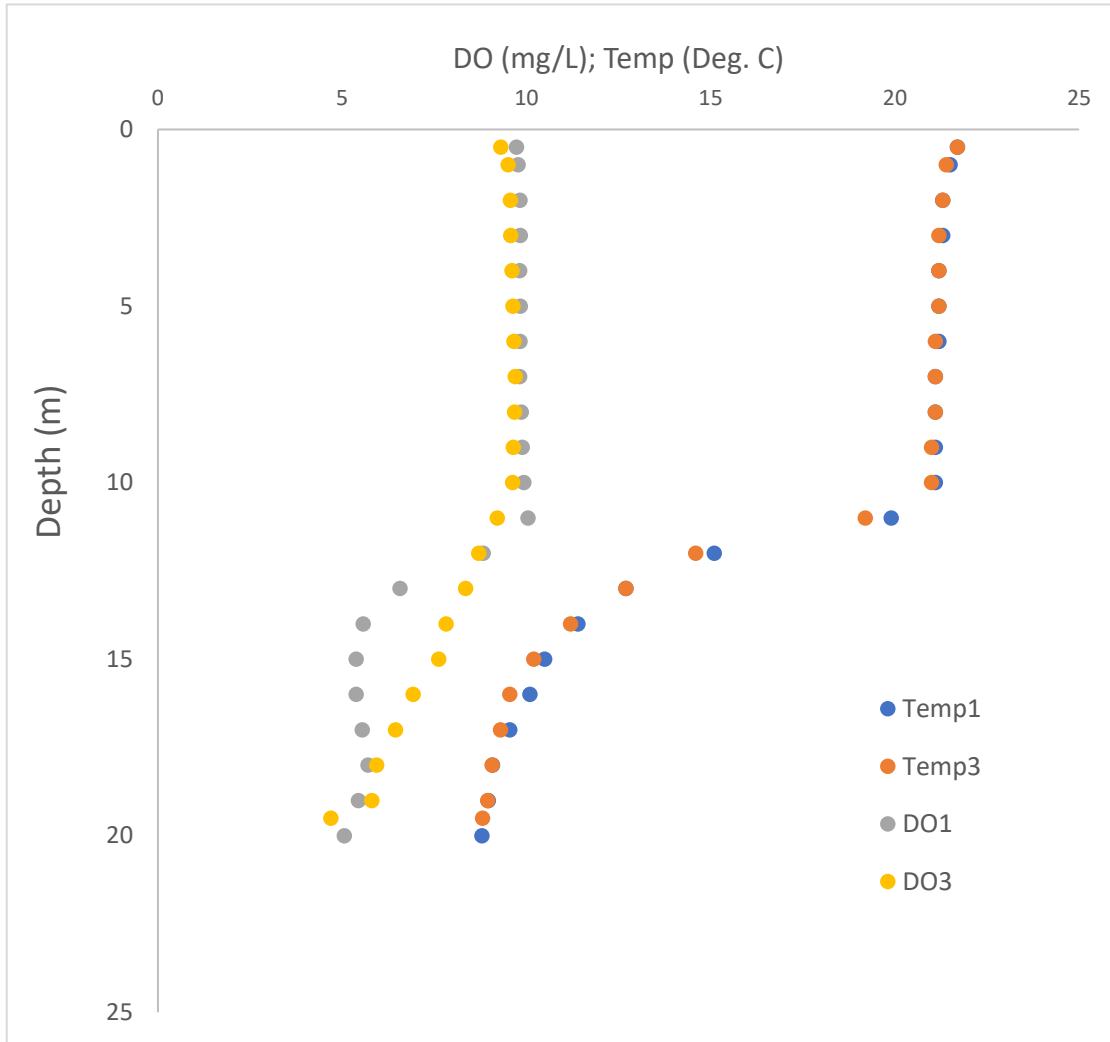


Appendix A – Mean Volume Weighted Hypolimnetic Dissolved Oxygen Calculations



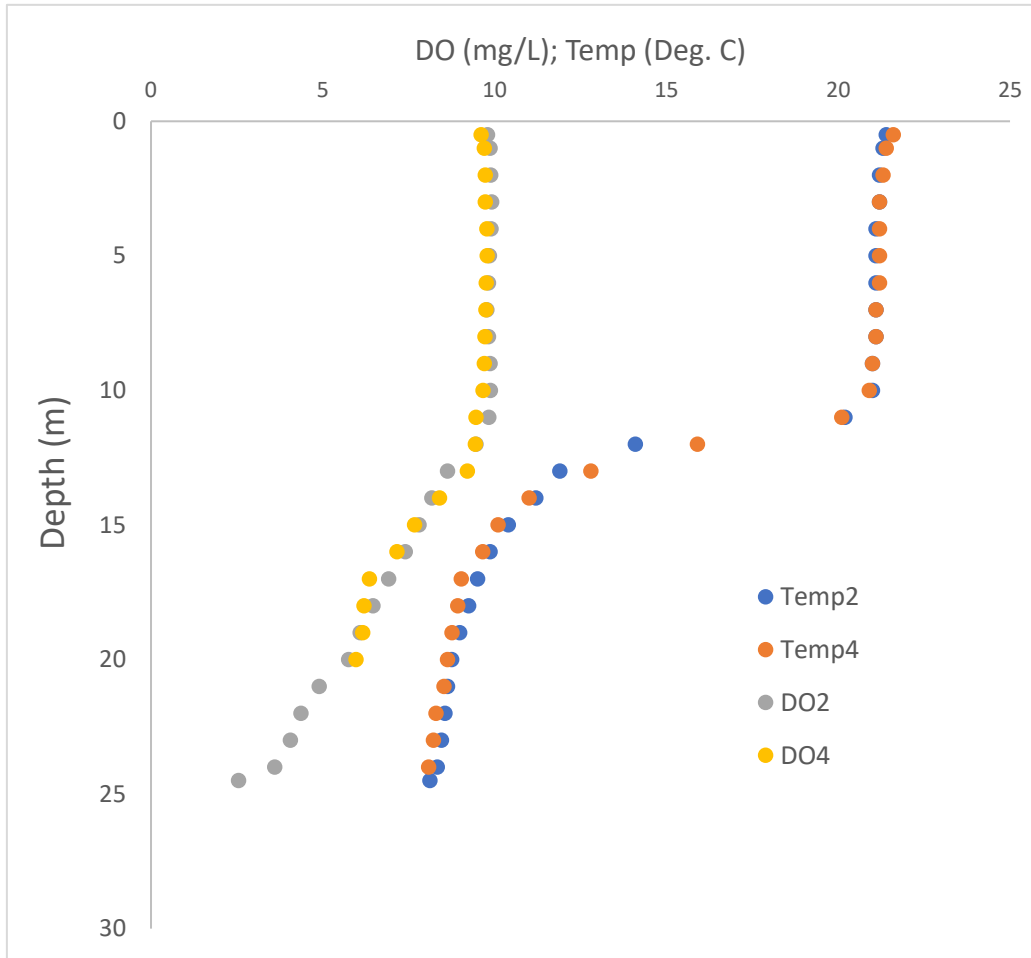
Shallow Sites

Z (m)	Temp1 (C)	DO1 (mg/L)	Temp3 (C)	DO3 (mg/L)	Temp (avg)	DO (avg)	deltaT (C)	stratum	Top (m)	Bot (m)	Area (m2)	Volume (m3)	DO-avg (mg/L)	Weight	DO (weighted)
0.5	21.7	9.73	21.7	9.31	21.7	9.52		epi	0	1	17304533	16464795	9.52		
1	21.5	9.78	21.4	9.51	21.45	9.65	0.50	epi							
2	21.3	9.83	21.3	9.57	21.3	9.70	0.15	epi	1	2	15639098	14490740	9.67		
3	21.3	9.84	21.2	9.58	21.25	9.71	0.05	epi	2	3	14216808	13905590	9.71		
4	21.2	9.82	21.2	9.61	21.2	9.72	0.05	epi	3	4	13062181	12598068	9.71		
5	21.2	9.84	21.2	9.64	21.2	9.74	0.00	epi	4	5	12193750	12163731	9.73		
6	21.2	9.83	21.1	9.66	21.15	9.75	0.05	epi	5	6	11339749	11723643	9.74		
7	21.1	9.82	21.1	9.7	21.1	9.76	0.05	epi	6	7	10485748	10187757	9.75		
8	21.1	9.86	21.1	9.68	21.1	9.77	0.00	epi	7	8	9973267	9946964	9.77		
9	21.1	9.89	21	9.65	21.05	9.77	0.05	epi	8	9	9497054	9704087	9.77		
10	21.1	9.93	21	9.63	21.05	9.78	0.00	epi	9	10	9020841	9458958	9.78		
11	19.9	10.05	19.2	9.21	19.55	9.63	1.50	meta	10	11	8544628	9211386	9.71		
12	15.1	8.83	14.6	8.71	14.85	8.77	4.70	meta	11	12	8068415	8961152	9.20		
13	12.7	6.57	12.7	8.35	12.7	7.46	2.15	meta	12	13	7592202	7081839	8.12		
14	11.4	5.57	11.2	7.82	11.3	6.70	1.40	meta	13	14	6671013	6550464	7.08	Weight	DO (weighted)
15	10.5	5.38	10.2	7.62	10.35	6.50	0.95	hypo	14	15	5644088	6000950	6.60	0.252	1.660
16	10.1	5.38	9.55	6.93	9.825	6.16	0.53	hypo	15	16	4617162	5426791	6.33	0.228	1.440
17	9.55	5.55	9.3	6.45	9.425	6.00	0.40	hypo	16	17	3590237	4816306	6.08	0.202	1.227
18	9.08	5.7	9.07	5.94	9.075	5.82	0.35	hypo	17	18	2563311	4143956	5.91	0.174	1.027
19	8.97	5.44	8.95	5.81	8.96	5.63	0.11	hypo	18	19	1536386	1204463	5.72	0.051	0.289
19.5			8.81	4.7	8.81	4.70	0.30	hypo	19	20	1168652	1153012	4.70	0.048	0.227
20	8.8	5.06			8.8	5.06	0.01	hypo	20	21	1067558	1100699	5.06	0.046	0.234
													MVWHDO:	6.10	



Mid-Depth Sites

Z (m)	Temp2 (C)	DO2 (mg/L)	Temp4 (C)	DO4 (mg/L)	Temp (avg)	DO (avg)	deltaT (C)	stratum	Top (m)	Bot (m)	Area (m2)	Volume (m3)	DO-avg (mg/L)	Weighting	DO-weighted
0.5	21.4	9.79	21.6	9.61	21.5	9.7		epi	0	1	17304533	16464795	9.7		
1	21.3	9.87	21.4	9.7	21.35	9.785	0.3	epi							
2	21.2	9.89	21.3	9.73	21.25	9.81	0.1	epi	1	2	15639098	14490740	9.7975		
3	21.2	9.91	21.2	9.73	21.2	9.82	0.05	epi	2	3	14216808	13905590	9.815		
4	21.1	9.9	21.2	9.77	21.15	9.835	0.05	epi	3	4	13062181	12598068	9.8275		
5	21.1	9.85	21.2	9.78	21.15	9.815	0	epi	4	5	12193750	12163731	9.825		
6	21.1	9.82	21.2	9.76	21.15	9.79	0	epi	5	6	11339749	11723643	9.8025		
7	21.1	9.77	21.1	9.75	21.1	9.76	0.05	epi	6	7	10485748	10187757	9.775		
8	21.1	9.82	21.1	9.72	21.1	9.77	0	epi	7	8	9973267	9946964	9.765		
9	21	9.87	21	9.7	21	9.785	0.1	epi	8	9	9497054	9704087	9.7775		
10	21	9.88	20.9	9.66	20.95	9.77	0.05	epi	9	10	9020841	9458958	9.7775		
11	20.2	9.83	20.1	9.46	20.15	9.645	0.8	epi	10	11	8544628	9211386	9.7075		
12	14.1	9.46	15.9	9.44	15	9.45	5.15	meta	11	12	8068415	8961152	9.5475		
13	11.9	8.63	12.8	9.21	12.35	8.92	2.65	meta	12	13	7592202	7081839	9.185		
14	11.2	8.17	11	8.4	11.1	8.285	1.25	meta	13	14	6671013	6550464	8.6025	Weighting	DO-weighted
15	10.4	7.8	10.1	7.67	10.25	7.735	0.85	hypo	14	15	5644088	6000950	8.01	0.218721	1.751952693
16	9.87	7.4	9.65	7.16	9.76	7.28	0.49	hypo	15	16	4617162	5426791	7.5075	0.197794	1.484937886
17	9.5	6.92	9.03	6.36	9.265	6.64	0.495	hypo	16	17	3590237	4816306	6.96	0.175543	1.221780423
18	9.24	6.46	8.93	6.2	9.085	6.33	0.18	hypo	17	18	2563311	4143956	6.485	0.151038	0.979478633
19	8.98	6.09	8.76	6.16	8.87	6.125	0.215	hypo	18	19	1536386	1204463	6.2275	0.0439	0.273386491
20	8.75	5.75	8.63	5.97	8.69	5.86	0.18	hypo	19	20	1168652	1153012	5.9925	0.042025	0.251832467
21	8.63	4.89	8.53	5.85	8.58	5.37	0.11	hypo	20	21	1067558	1100699	5.615	0.040118	0.225262128
22	8.55	4.36	8.29	5.81	8.42	5.085	0.16	hypo	21	22	966465	1047384	5.2275	0.038175	0.199558315
23	8.45	4.06	8.22	5.69	8.335	4.875	0.085	hypo	22	23	865371	992885	4.98	0.036188	0.180217991
24	8.33	3.6	8.08	5.41	8.205	4.505	0.13	hypo	23	24	764277	936959	4.69	0.03415	0.1601634
25	8.12	2.55			8.12	2.55	0.17	hypo	24	25	663183	613186	2.55	0.022349	0.056990473
													MVWHDO:	6.79	

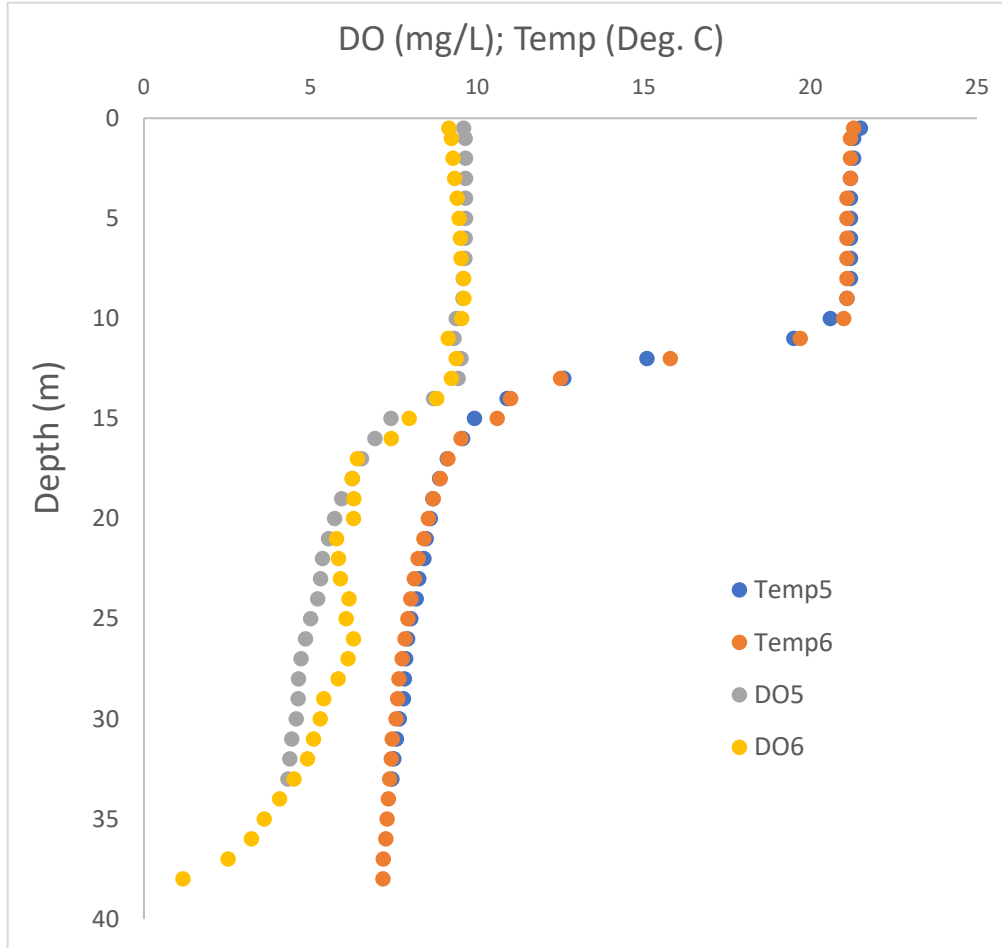


Deep Sites

Z (m)	Temp5 (C)	DO5 (mg/L)	Temp6 (C)	DO6 (mg/L)	Temp (avg)	DO (avg)	deltaT (C)	stratum	Top (m)	Bot (m)	Area (m2)	Volume (m3)	DO-avg (mg/L)	Weighting	DO-weighted
0.5	21.5	9.59	21.3	9.15	21.4	9.37		epi	0	1	17304533	16464795	9.37		
1	21.3	9.64	21.2	9.23	21.25	9.435	0.3	epi							
2	21.3	9.65	21.2	9.28	21.25	9.465	0	epi	1	2	15639098	14490740	9.45		
3	21.2	9.65	21.2	9.32	21.2	9.485	0.05	epi	2	3	14216808	13905590	9.48		
4	21.2	9.65	21.1	9.4	21.15	9.525	0.05	epi	3	4	13062181	12598068	9.51		
5	21.2	9.65	21.1	9.46	21.15	9.555	0	epi	4	5	12193750	12163731	9.54		
6	21.2	9.64	21.1	9.5	21.15	9.57	0	epi	5	6	11339749	11723643	9.56		
7	21.2	9.63	21.1	9.52	21.15	9.575	0	epi	6	7	10485748	10187757	9.57		
8	21.2	9.58	21.1	9.59	21.15	9.585	0	epi	7	8	9973267	9946964	9.58		
9	21.1	9.57	21.1	9.6	21.1	9.585	0.05	epi	8	9	9497054	9704087	9.59		
10	20.6	9.37	21	9.54	20.8	9.455	0.3	epi	9	10	9020841	9458958	9.52		
11	19.5	9.3	19.7	9.13	19.6	9.215	1.2	meta	10	11	8544628	9211386	9.34		
12	15.1	9.52	15.8	9.37	15.45	9.445	4.15	meta	11	12	8068415	8961152	9.33		
13	12.6	9.43	12.5	9.23	12.55	9.33	2.9	meta	12	13	7592202	7081839	9.39		
14	10.9	8.69	11	8.79	10.95	8.74	1.6	meta	13	14	6671013	6550464	9.04		
15	9.92	7.41	10.6	7.96	10.26	7.685	0.69	hypo	14	15	5644088	6000950	8.21	0.184098	1.511904895
16	9.56	6.93	9.52	7.42	9.54	7.175	0.72	hypo	15	16	4617162	5426791	7.43	0.166484	1.236975199
17	9.1	6.53	9.12	6.4	9.11	6.465	0.43	hypo	16	17	3590237	4816306	6.82	0.147755	1.007691346
18	8.87	6.25	8.89	6.25	8.88	6.25	0.23	hypo	17	18	2563311	4143956	6.36	0.127129	0.808221849
19	8.67	5.93	8.68	6.3	8.675	6.115	0.205	hypo	18	19	1536386	1204463	6.18	0.036951	0.228447637
20	8.59	5.72	8.54	6.29	8.565	6.005	0.11	hypo	19	20	1168652	1153012	6.06	0.035372	0.214355945
21	8.47	5.54	8.4	5.78	8.435	5.66	0.13	hypo	20	21	1067558	1100699	5.83	0.033767	0.196948375
22	8.4	5.36	8.23	5.84	8.315	5.6	0.12	hypo	21	22	966465	1047384	5.63	0.032132	0.180902018
23	8.25	5.3	8.11	5.9	8.18	5.6	0.135	hypo	22	23	865371	992885	5.60	0.03046	0.170575267
24	8.17	5.21	8.01	6.15	8.09	5.68	0.09	hypo	23	24	764277	936959	5.64	0.028744	0.16211708
25	8.01	5	7.92	6.07	7.965	5.535	0.125	hypo	24	25	663183	613186	5.61	0.018811	0.105484973
26	7.91	4.85	7.84	6.29	7.875	5.57	0.09	hypo	25	26	602077	594891	5.55	0.01825	0.101333968
27	7.85	4.71	7.75	6.13	7.8	5.42	0.075	hypo	26	27	565899	576394	5.50	0.017683	0.097166426
28	7.82	4.64	7.65	5.83	7.735	5.235	0.065	hypo	27	28	529720	557672	5.33	0.017108	0.091144692
29	7.79	4.63	7.61	5.4	7.7	5.015	0.035	hypo	28	29	493542	538702	5.13	0.016526	0.084697685

30	7.66	4.57	7.57	5.29	7.615	4.93	0.085	hypo	29	30	457364	519452	4.97	0.015936	0.079240881
31	7.58	4.44	7.45	5.09	7.515	4.765	0.1	hypo	30	31	421186	499887	4.85	0.015336	0.074339347
32	7.5	4.38	7.42	4.91	7.46	4.645	0.055	hypo	31	32	385008	479959	4.71	0.014724	0.069277603
33	7.44	4.32	7.37	4.5	7.405	4.41	0.055	hypo	32	33	348829	321819	4.53	0.009873	0.044699146
34			7.34	4.07	7.34	4.07	0.065	hypo	33	34	295682	293972	4.24	0.009019	0.038238505
35			7.3	3.61	7.3	3.61	0.04	hypo	34	35	242466	264939	3.84	0.008128	0.031210893
36			7.26	3.23	7.26	3.23	0.04	hypo	35	36	189250	234170	3.42	0.007184	0.024568941
37			7.18	2.52	7.18	2.52	0.08	hypo	36	37	136035	101696	2.88	0.00312	0.008969553
38			7.17	1.17	7.17	1.17	0.01	hypo	37	38	98053	92802	1.85	0.002847	0.005252702
								hypo	38	39	80766	83550	1.17	0.002563	0.002998896

MVWHDO: 6.58



MECP - 2003-09-05

Z (m)	Temp (C)	DO (mg/L)	deltaT (C)	stratum	Top (m)	Bot (m)	Volume (m3)	DO-avg (mg/L)	Weight	DO-weighted
0	19.4	8.95		epi	0	1	16464795	8.93		
1	19.5	8.91	0.1	epi	1	2	14490740	8.92		
2	19.5	8.92	0	epi	2	3	13905590	8.94		
3	19.5	8.96	0	epi	3	4	12598068	8.95		
4	19.5	8.94	0	epi	4	5	12163731	8.95		
5	19.5	8.96	0	epi	5	6	11723643	8.94		
6	19.5	8.92	0	epi	6	7	10187757	8.94		
7	19.5	8.96	0	epi	7	8	9946964	8.97		
8	19.5	8.98	0	epi	8	9	9704087	8.95		
9	19.5	8.92	0	epi	9	10	9458958	8.94		
10	19.5	8.95	0	epi	10	11	9211386	8.93		
11	19.5	8.9	0	meta	11	12	8961152	8.11		
12	13.2	7.31	6.3	meta	12	13	7081839	6.82		
13	11.2	6.32	2	meta	13	14	6550464	5.82		
14	10.1	5.31	1.1	hypo	14	15	6000950	4.96	0.185	0.918
15	9.6	4.61	0.5	hypo	15	16	5426791	4.26	0.167	0.712
16	9	3.9	0.6	hypo	16	17	4816306	3.71	0.149	0.551
17	8.9	3.52	0.1	hypo	17	18	4143956	3.42	0.128	0.437
18	8.8	3.31	0.1	hypo	18	19	1204463	3.30	0.037	0.122
19	8.7	3.28	0.1	hypo	19	20	1153012	3.24	0.036	0.115
20	8.5	3.2	0.2	hypo	20	21	1100699	3.06	0.034	0.104
21	8.5	2.91	0	hypo	21	22	1047384	2.89	0.032	0.093
22	8.4	2.86	0.1	hypo	22	23	992885	2.82	0.031	0.086
23	8.3	2.77	0.1	hypo	23	24	936959	2.67	0.029	0.077
24	8.3	2.57	0	hypo	24	25	613186	2.55	0.019	0.048
25	8.2	2.52	0.1	hypo	25	26	594891	2.49	0.018	0.046
26	8.2	2.45	0	hypo	26	27	576394	2.42	0.018	0.043
27	8.1	2.39	0.1	hypo	27	28	557672	2.34	0.017	0.040
28	8.1	2.29	0	hypo	28	29	538702	2.28	0.017	0.038
29	8.1	2.27	0	hypo	29	30	519452	2.13	0.016	0.034
30	7.9	1.98	0.2	hypo	30	31	499887	1.93	0.015	0.030
31	7.9	1.88	0	hypo	31	32	479959	1.80	0.015	0.027
32	7.8	1.72	0.1	hypo	32	33	321819	1.67	0.010	0.017
33	7.7	1.61	0.1	hypo	33	34	293972	1.40	0.009	0.013
34	7.7	1.18	0	hypo	34	35	264939	1.13	0.008	0.009
35	7.6	1.07	0.1	hypo	35	36	234170	0.68	0.007	0.005
36	7.6	0.29	0	hypo	36	37	101696	0.29	0.003	0.001
									MVWHDO:	3.57

MECP - 2010-09-16

Z (m)	Temp (C)	DO (mg/L)	deltaT (C)	stratum	Top (m)	Bot (m)	Volume (m3)	DO-avg (mg/L)		
0	17.66	8.91		epi	0	1	16464795	8.905		
1	17.68	8.9	0.02	epi	1	2	14490740	8.89		
2	17.7	8.88	0.02	epi	2	3	13905590	8.87		
3	17.71	8.86	0.01	epi	3	4	12598068	8.855		
4	17.71	8.85	0	epi	4	5	12163731	8.85		
5	17.7	8.85	0.01	epi	5	6	11723643	8.84		
6	17.71	8.83	0.01	epi	6	7	10187757	8.82		
7	17.71	8.81	0	epi	7	8	9946964	8.81		
8	17.71	8.81	0	epi	8	9	9704087	8.815		
9	17.71	8.82	0	epi	9	10	9458958	8.805		
10	17.7	8.79	0.01	epi	10	11	9211386	8.78		
11	17.68	8.77	0.02	epi	11	12	8961152	8.44		
12	16.92	8.11	0.76	meta	12	13	7081839	7.23		
13	13.61	6.35	3.31	meta	13	14	6550464	5.015	Weight	DO-weighted
14	11.52	3.68	2.09	hypo	14	15	6000950	3.415	0.18568	0.63410
15	11.44	3.15	0.08	hypo	15	16	5426791	2.825	0.16792	0.47436
16	11.08	2.5	0.36	hypo	16	17	4816306	2.435	0.14903	0.36288
17	11.01	2.37	0.07	hypo	17	18	4143956	2.195	0.12822	0.28145
18	10.69	2.02	0.32	hypo	18	19	1204463	1.88	0.03727	0.07006
19	10.55	1.74	0.14	hypo	19	20	1153012	1.63	0.03568	0.05815
20	10.51	1.52	0.04	hypo	20	21	1100699	1.5	0.03406	0.05109
21	10.46	1.48	0.05	hypo	21	22	1047384	1.43	0.03241	0.04634
22	10.34	1.38	0.12	hypo	22	23	992885	1.36	0.03072	0.04178
23	10.1	1.34	0.24	hypo	23	24	936959	1.305	0.02899	0.03783
24	10.02	1.27	0.08	hypo	24	25	613186	1.205	0.01897	0.02286
25	9.85	1.14	0.17	hypo	25	26	594891	1.085	0.01841	0.01997
26	9.75	1.03	0.1	hypo	26	27	576394	0.965	0.01783	0.01721
27	9.56	0.9	0.19	hypo	27	28	557672	0.7	0.01726	0.01208
28	9.42	0.5	0.14	hypo	28	29	538702	0.42	0.01667	0.00700
29	9.37	0.34	0.05	hypo	29	30	519452	0.265	0.01607	0.00426
30	9.34	0.19	0.03	hypo	30	31	499887	0.185	0.01547	0.00286
31	9.26	0.18	0.08	hypo	31	32	479959	0.135	0.01485	0.00200
32	9.11	0.09	0.15	hypo	32	33	321819	0.075	0.00996	0.00075
33	9.05	0.06	0.06	hypo	33	34	293972	0.055	0.00910	0.00050
34	8.99	0.05	0.06	hypo	34	35	264939	0.05	0.00820	0.00041
35	8.67	0.05	0.32	hypo	35	36	234170	0.05	0.00725	0.00036
									MVWHDO:	2.15

MECP - 2011-09-12

Z (m)	Temp (C)	DO (mg/L)	deltaT (C)	stratum	Top (m)	Bot (m)	Volume (m3)	DO-avg (mg/L)		
0	20.89	8.98		epi	0	1	16464795	9.03		
1	20.84	9.08	0.05	epi	1	2	14490740	9.11		
2	20.54	9.13	0.3	epi	2	3	13905590	9.16		
3	20.12	9.19	0.42	epi	3	4	12598068	9.18		
4	20.02	9.16	0.1	epi	4	5	12163731	9.14		
5	19.98	9.12	0.04	epi	5	6	11723643	9.11		
6	19.93	9.1	0.05	epi	6	7	10187757	9.11		
7	19.86	9.11	0.07	epi	7	8	9946964	9.06		
8	19.76	9.01	0.1	epi	8	9	9704087	8.99		
9	19.68	8.97	0.08	epi	9	10	9458958	8.95		
10	19.66	8.92	0.02	epi	10	11	9211386	8.85		
11	19.22	8.78	0.44	meta	11	12	8961152	8.45		
12	14.42	8.11	4.8	meta	12	13	7081839	7.79		
13	12.01	7.47	2.41	meta	13	14	6550464	7.15	Weight	DO-weighted
14	10.65	6.82	1.36	hypo	14	15	6000950	6.41	0.1851	1.1865
15	10.01	6.00	0.64	hypo	15	16	5426791	5.58	0.1674	0.9332
16	9.62	5.15	0.39	hypo	16	17	4816306	4.75	0.1486	0.7049
17	9.22	4.34	0.4	hypo	17	18	4143956	4.13	0.1278	0.5279
18	9.07	3.92	0.15	hypo	18	19	1204463	3.68	0.0372	0.1367
19	8.96	3.44	0.11	hypo	19	20	1153012	3.33	0.0356	0.1184
20	8.87	3.22	0.09	hypo	20	21	1100699	3.19	0.0340	0.1083
21	8.77	3.16	0.1	hypo	21	22	1047384	3.08	0.0323	0.0995
22	8.66	3.00	0.11	hypo	22	23	992885	2.95	0.0306	0.0902
23	8.55	2.89	0.11	hypo	23	24	936959	2.84	0.0289	0.0821
24	8.49	2.79	0.06	hypo	24	25	613186	2.77	0.0189	0.0523
25	8.39	2.74	0.1	hypo	25	26	594891	2.70	0.0183	0.0495
26	8.31	2.66	0.08	hypo	26	27	576394	2.48	0.0178	0.0440
27	8.19	2.29	0.12	hypo	27	28	557672	2.24	0.0172	0.0385
28	8.14	2.19	0.05	hypo	28	29	538702	2.11	0.0166	0.0350
29	8.06	2.02	0.08	hypo	29	30	519452	1.94	0.0160	0.0311
30	7.98	1.86	0.08	hypo	30	31	499887	1.79	0.0154	0.0275
31	7.86	1.71	0.12	hypo	31	32	479959	1.64	0.0148	0.0242
32	7.69	1.56	0.17	hypo	32	33	321819	1.44	0.0099	0.0142
33	7.63	1.31	0.06	hypo	33	34	293972	1.08	0.0091	0.0098
34	7.59	0.85	0.04	hypo	34	35	264939	0.76	0.0082	0.0062
35	7.58	0.66	0.01	hypo	35	36	234170	0.58	0.0072	0.0042
36	7.54	0.50	0.04	hypo	36	37	101696	0.50	0.0031	0.0016
MVWHDO:									4.33	

MECP - 2018-09-26

Z (m)	Temp (C)	DO (mg/L)	deltaT (C)	stratum	Top (m)	Bot (m)	Volume (m3)	DO-avg (mg/L)		
0	18.12	9.05		epi	0	1	16464795	9.01		
1	18.09	8.97	0.03	epi	1	2	14490740	8.96		
2	18.08	8.95	0.01	epi	2	3	13905590	8.95		
3	18.06	8.94	0.02	epi	3	4	12598068	8.94		
4	18.06	8.94	0	epi	4	5	12163731	8.93		
5	18.03	8.92	0.03	epi	5	6	11723643	8.92		
6	18.02	8.91	0.01	epi	6	7	10187757	8.91		
7	18.01	8.9	0.01	epi	7	8	9946964	8.90		
8	17.99	8.9	0.02	epi	8	9	9704087	8.90		
9	17.97	8.9	0.02	epi	9	10	9458958	8.83		
10	17.69	8.75	0.28	meta	10	11	9211386	8.46		
11	15.91	8.16	1.78	meta	11	12	8961152	7.26		
12	14.31	6.35	1.6	meta	12	13	7081839	6.02		
13	11.61	5.68	2.7	meta	13	14	6550464	5.23	Weight	DO-weighted
14	10.27	4.77	1.34	hypo	14	15	6000950	4.60	0.1846	0.8490
15	9.63	4.43	0.64	hypo	15	16	5426791	4.23	0.1669	0.7060
16	9.01	4.03	0.62	hypo	16	17	4816306	3.60	0.1481	0.5333
17	8.6	3.17	0.41	hypo	17	18	4143956	3.06	0.1275	0.3894
18	8.43	2.94	0.17	hypo	18	19	1204463	2.87	0.0370	0.1063
19	8.27	2.8	0.16	hypo	19	20	1153012	2.76	0.0355	0.0979
20	8.14	2.72	0.13	hypo	20	21	1100699	2.67	0.0339	0.0904
21	8.05	2.62	0.09	hypo	21	22	1047384	2.62	0.0322	0.0842
22	7.96	2.61	0.09	hypo	22	23	992885	2.62	0.0305	0.0799
23	7.92	2.62	0.04	hypo	23	24	936959	2.56	0.0288	0.0738
24	7.79	2.5	0.13	hypo	24	25	613186	2.39	0.0189	0.0451
25	7.71	2.28	0.08	hypo	25	26	594891	2.26	0.0183	0.0413
26	7.64	2.23	0.07	hypo	26	27	576394	2.22	0.0177	0.0394
27	7.57	2.21	0.07	hypo	27	28	557672	2.19	0.0172	0.0375
28	7.54	2.16	0.03	hypo	28	29	538702	2.08	0.0166	0.0345
29	7.49	2	0.05	hypo	29	30	519452	1.90	0.0160	0.0304
30	7.44	1.8	0.05	hypo	30	31	499887	1.76	0.0154	0.0270
31	7.38	1.71	0.06	hypo	31	32	479959	1.65	0.0148	0.0244
32	7.31	1.59	0.07	hypo	32	33	321819	1.51	0.0099	0.0149
33	7.28	1.42	0.03	hypo	33	34	293972	1.21	0.0090	0.0109
34	7.19	0.99	0.09	hypo	34	35	264939	0.87	0.0081	0.0070
35	7.17	0.74	0.02	hypo	35	36	234170	0.54	0.0072	0.0039
36	7.12	0.34	0.05	hypo	36	37	101696	0.29	0.0031	0.0009
37	7.04	0.24	0.08	hypo	37	38	92802	0.24	0.0029	0.0007

MVWHDO: 3.33



Hutchinson

Environmental Sciences Ltd.

Lake Clear Capacity Assessment

Prepared for: Township of Bonnechere Valley
Job #: 220081

October 17, 2023

Final Report

Signatures

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Executive Summary

Lake Clear is considered to be an “at-capacity lake” in the County of Renfrew’s Official Plan as it supports a natural Lake Trout (*Salvelinus namaycush*) population and Mean Volume-Weighted Hypolimnetic Dissolved Oxygen concentrations have been measured below the Provincial criterion of 7 mg/L for the protection of Lake Trout habitat. Hutchinson Environmental Sciences Ltd. (HESL) was retained to complete a Lakeshore Capacity Assessment of Lake Clear as the Township of Bonnechere Valley is considering developing a By-law to allow Recreational Vehicles (RVs) to be located on waterfront properties. A Lakeshore Capacity Assessment is required to determine if Lake Clear is at capacity for development through a) completion of a Lakeshore Capacity Model to determine development capacity with respect to the Provincial Water Quality Objective for phosphorus, and b) updated evaluation of MVWHDO concentrations with respect to the 7 mg/L criterion. A background review and field investigations were completed to characterize water quality conditions in Lake Clear. Additional discussion on lake water quality parameter concentrations and trends, and waterfront Best Management Practices was also included to help inform conclusions and recommendations.

Lake Clear is under capacity according to Lakeshore Capacity Modelling results and the total phosphorus (TP) Provincial Water Quality Objective. It is over capacity with respect to Mean Volume-Weighted Hypolimnetic Dissolved Oxygen as concentrations are <7 mg/L but modelling indicates that oxygen concentrations were slightly below 7 mg/L prior to development. Water quality is good and there are no increasing trends in nutrients. Small amounts of cyanobacteria (i.e. blue-green algae) were however observed during site investigations.

Shoreline development, including RV use, can impact a lake through stormwater and wastewater inputs as well as associated recreational uses such as boating. Impacts can be largely mitigated through implementation of BMPs such as properly designed and maintained sewage treatment systems, the retention or establishment of naturally vegetated shoreline buffers and stormwater management features that maximize infiltration and minimize runoff. Currently the use of RVs of Lake Clear is unregulated and therefore it is not known if they are properly serviced via appropriately sized tile beds or holding tanks that are pumped out regularly. We underscore that the impact of RVs on the lake’s water quality depends not only on the number of shoreline RVs but also the effectiveness of RV wastewater management in minimizing nutrient loading to the lake.

The following recommendations were developed to help the Township develop science-based planning policy for RV use on Lake Clear:

- Permit the use of 1 or 2 RVs/lot on Lake Clear if appropriate BMPs are developed and enforced to ensure that impacts to Lake Clear are minimized. The modelled impact of two additional RVs/lot results in TP concentrations that are less than the PWQO for TP. The lake is at capacity based on MVWHDO but based on modelling results, it appears that MVWHDO concentrations have always been below the 7 mg/L criterion, and BMPs can be utilized to minimize impacts.
- Sewage treatment systems to service the RVs should meet Ontario Building Code requirements. Systems designed to maximize the amount of phosphorus attenuation should be encouraged such as the Waterloo Biofilter with EC-P unit, EcoFlo Biofilter or the use of a tank and bed system



that incorporates soils that are high in phosphorus retention, aluminum and iron, and low in calcium carbonate.

- A 30 m naturally vegetated shoreline buffer should be required on all lots, especially lots with RVs that have the potential to generate additional stormwater and wastewater. Continued retention or establishment of natural vegetation over time should be encouraged through stewardship actions and enforced as necessary.
- Stormwater management features that maximize infiltration and limit stormwater runoff should be encouraged on all lots, especially those with RVs that have the potential to generate additional stormwater, to minimize development-related impacts on Lake Clear.
- Water quality and the effectiveness of BMPs should be monitored. Water quality should continue to be monitored through the Lake Partner Program, and dissolved oxygen measurements should be collected annually at the end-of-summer (August 15 – September 15) so that Mean Volume-Weighted Hypolimnetic Dissolved Oxygen concentrations can be calculated and tracked over time. The implementation and management of BMPs should be assessed through visual inspections.



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Appendices

- Appendix A. Temperature & Dissolved Oxygen Profiles
- Appendix B. Lakeshore Capacity Model Results



Acronyms

A0	lake area
BMP	best management practice
CWQG	Canadian water quality guideline
DO	dissolved oxygen
HESL	Hutchinson Environmental Sciences Ltd.
LCM	Lakeshore Capacity Model
LPP	Lake Partner Program
MD	maximum distance (fetch)
MECP	Ministry of the Environment, Conservation and Parks
MNRF	Ministry of Natural Resources and Forestry
MOE	Ministry of the Environment
MOECC	Ministry of the Environment and Climate Change
MPAC	Municipal Property Assessment Corporation
MVWHDO	mean volume-weighted hypolimnetic dissolved oxygen
OWIT	Ontario Watershed Information Tool
PWQO	Provincial Water Quality Objective
Rs	LCM coefficient for phosphorus retention by soil
RV	recreational vehicle
TP	total phosphorus
TP _{FUTURE}	total phosphorus concentration assuming vacant lots developed as extended seasonal (LCM prediction)
TP _{LAKE}	total phosphorus concentration during the ice-free season (LCM prediction)
TP _{SO}	total phosphorus concentration at spring overturn (LCM prediction)
VSA	volume-to-sediment-area ratio
z	depth



1. Introduction

Lake Clear (45.44°N, 77.20°W) is a relatively small (17 km²), deep (~40 m), oligotrophic lake located in the Township of Bonnechere Valley (County of Renfrew), approximately 120 km west of Ottawa. Popular recreational uses of the lake include swimming, canoeing, kayaking, and fishing, and based on a resident survey, water quality is considered the main issue faced by the lake and the top element affecting personal enjoyment of the lake, with algae/aquatic vegetation the main concern (Love Your Lake 2022). Lake Clear's drainage basin is small (76 km²) and predominantly (~80%) forested, with agriculture and undifferentiated rural land use comprising 10% of the catchment (Ministry of Natural Resources and Forestry [MNRF] 2023). Although shoreline development density is modest, Lake Clear is considered to be an "at-capacity lake" in the County of Renfrew's Official Plan (County of Renfrew 2020); it has been designated as a "Natural Lake Trout Lake" in *Inland Ontario Lakes Designated for Lake Trout Management* (MNRF 2015) and Mean Volume Weighted Hypolimnetic Dissolved Oxygen (MVWHDO) concentrations have been measured below the Provincial criterion of 7 mg/L to protect Lake Trout (*Salvelinus namaycush*) habitat (Ministry of Environment and Climate Change [MOECC] 2016).

Hutchinson Environmental Sciences Ltd. (HESL) has been retained to complete a Lakeshore Capacity Assessment of Lake Clear as the Township of Bonnechere Valley is considering developing a By-law to allow Recreational Vehicles (RVs) to be located on waterfront properties. A Lakeshore Capacity Assessment is required to determine if Lake Clear is in fact at capacity for development through a) completion of a Lakeshore Capacity Model to determine development capacity with respect to the Provincial Water Quality Objective (PWQO) for phosphorus, and b) updated evaluation of MVWHDO concentrations with respect to the 7 mg/L criterion. Best Management Practices associated with shoreline development and RVs are also discussed to inform the development of the By-law and minimize impacts associated with development and RV use on Lake Clear, and, if there is capacity, how development impacts associated with RVs can be minimized.

Ontario's Lakeshore Capacity Model (Ministry of Environment [MOE] 2010) was developed to determine suitable development capacity on lakes through an assessment of phosphorus and the associated modelling procedure of Molot et al (1992) for dissolved oxygen (DO) concentrations. For recreational lakes on the Precambrian Shield, phosphorus and DO concentrations are the parameters of concern for water quality. The revised PWQO for inland lakes on the Precambrian Shield (MOE 2010) allows for a 50% increase in phosphorus concentration from development over levels that would occur in the absence of any development on the lake (i.e., "Background" + 50%) to a maximum concentration of 20 µg/L. The DO guideline for protection of Lake Trout habitat is 7 mg/L as End-of-Summer MVWHDO (i.e. measured between August 15 and September 15).

The Province of Ontario recommends the use of the Lakeshore Capacity Model (LCM) to determine the PWQO for phosphorus and the amount of shoreline development that can occur to maintain phosphorus levels within the phosphorus threshold (MOE 2010). The LCM is a steady-state mass balance model that estimates hydrologic and phosphorus loading from natural (watershed runoff and atmospheric deposition) and human (septic systems and land disturbance) sources and links them together considering lake dynamics to predict total phosphorus (TP) concentrations in lakes. Dissolved oxygen is modelled on the basis of lake morphometry and TP concentrations using the techniques described in Molot et al. (1992) and



Clark et al. (2002) and is commonly used to link phosphorus concentrations with MVWHDO as part of existing and future development scenarios.

A background review and field investigations were completed to characterize water quality conditions in Lake Clear and allow for the determination of development capacity through Lakeshore Capacity Modelling and DO modelling. Additional discussion on lake water quality parameter concentrations and trends, and waterfront Best Management Practices was also included to help inform conclusions and recommendations.

2. Background Review

HESL assembled and reviewed the following existing data for Lake Clear:

- MECP's Lake Partner Program data: TP (2002–2020), calcium (2008–2020), and chloride (2015–2020) concentrations and Secchi depths (1996–2020);
- MECP water quality data (2003, 2010, 2011, 2018): TP, ammonia, nitrite, nitrate, total Kjeldahl nitrogen, dissolved organic carbon, alkalinity, conductivity, calcium, hardness, total suspended solids, total dissolved solids; and
- MECP temperature and dissolved oxygen profiles (2003, 2010, 2011, 2018).

Summaries and visualizations of the existing data are presented in Section 4.

3. Field Investigation

HESL performed a field survey of Lake Clear on 7 September 2022. MOE (2010) recommends that dissolved oxygen measurements are collected between August 15 and September 15 for use in MVWHDO calculations. Six sites were selected that correspond to the deepest areas in the western, central, and eastern areas of the lake (Figure 1; Table 1).

Table 1. Coordinates and Depths of HESL Sites.

Site	Depth (m)	Latitude	Longitude
LC-1	20.7	45.4469	-77.2223
LC-2	25.4	45.4350	-77.2009
LC-3	20.1	45.4442	-77.1876
LC-4	25.2	45.4404	-77.1739
LC-5	35.2	45.4320	-77.1736
LC-6	38.1	45.4364	-77.1609



The Secchi depth was determined using a black-and-white 20-cm disc at each site. Water samples were then collected from the epilimnion by weighted bottle (integrated from the surface to Secchi Depth) and from ~1-m above the lakebed (“1-mob”) using a Kemmerer sampling device. Water column profiles of temperature, DO, specific conductance, and pH were measured at a 1-m interval using a YSI sonde. The sonde was calibrated by Pine Environmental Services and the DO sensor was corrected for barometric pressure in the field prior to use. Water samples were shipped to ALS Laboratories for determination of chlorophyll-a, total nitrogen, nitrate, ammonium, dissolved organic carbon, calcium, and chloride (epilimnetic samples only), TP and total suspended solids (both epilimnetic and 1-mob samples), and total iron (1-mob samples only).



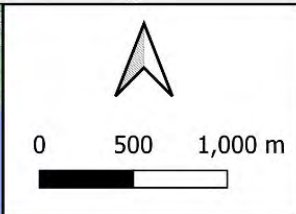
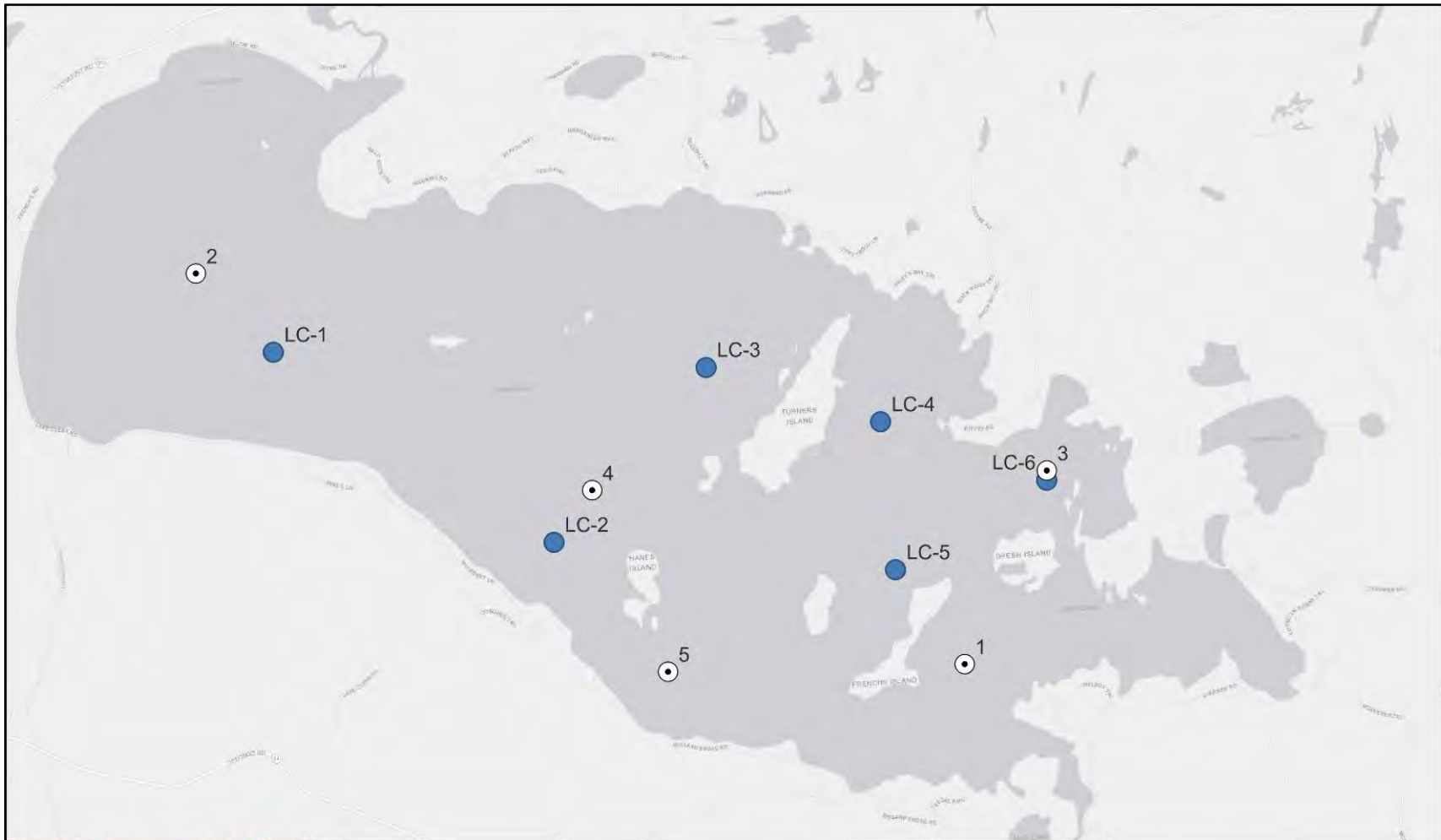


Figure 1. HESL and LPP Sites on Lake Clear
 Lake Clear Capacity Assessment
 Project No. 210020
 2023-02-24

- Legend**
- LPP sites
 - HESL sites



4. Analysis

4.1 Water Quality

4.1.1 Water Clarity

Lake Clear has high transparency: the average Secchi depth ranged between 6.7 m and 7.2 m across 4 sites based on long-term monitoring via the LPP (Table 2). The longest period of record is for the “N. end, deep spot” (45.4517°, -77.2281); here there was an increasing trend (~5 cm/year) in the annual average Secchi depth over the period 1996–2020 ($R^2 = 0.23$; $p = 0.03$; data not shown), indicating increasing water transparency. MECP has reported Secchi depths in the range of 4.5–5.0 m and of 5.5 m, for 2003 and 2011, respectively (MOE 2016). Secchi depths measured during the HESL survey on 7 September 2022 were between 7.7 m and 8.2 m (avg. = 8.0 m), higher than the long-term averages, but still within the range historically observed via LPP monitoring. Consistent with the high clarity, the concentration of total suspended solids has been relatively low in Lake Clear, averaging 1.4 mg/L according to MECP monitoring (range: 0.8–3.0 mg/L; Table 3) and confirmed to be <3 mg/L based on the recent HESL survey (Table 4).

Table 2. Summary of Secchi Depth (1996–2020), TP (2002–2020), Calcium (2008–2020), and Chloride (2015–2020) from Lake Partner Program Monitoring.

*Site #	Secchi Depth (m)				TP (µg/L)				Calcium (mg/L)				Chloride (mg/L)			
	min.	avg.	max.	<i>n</i>	min.	avg.	max.	<i>n</i>	min.	avg.	max.	<i>n</i>	min.	avg.	max.	<i>n</i>
1	3.1	6.9	10.4	79	5.3	9.0	12.7	19	33.5	37.7	41.1	12	11.8	13.4	14.2	6
2	4.6	6.7	8.6	89	5.4	8.6	11.4	16	30.8	35.6	38.9	9	13.1	13.7	14.0	4
3	0.6**	6.9	9.1	54	5.0	7.4	12.4	15	34.5	36.4	40.1	9	13.3	13.6	13.8	4
4	4.6	7.2	10.1	89	5.4	9.0	13.0	15	34.1	37.0	40.1	12	13.0	13.5	14.1	5
5	5.8	7.0	8.2	96	6.7	8.5	11.0	10	33.3	36.2	38.5	10	12.0	13.7	14.7	6

*Site numbers correspond to the following descriptions: (1) “E. end, centre”, (2) “N. end, deep spot”, (3) “E end, Hardwood Bay”, (4) “Hanes Island West”, and (5) “South End”. **The Secchi Depth of 0.6 m is an outlier (very low) and almost certainly due to an observer error or data entry error.

4.1.2 Nutrients

Nutrients are relatively low in the upper mixed layer of Lake Clear. Average TP concentrations were 7.4–9.0 µg/L (overall range: 5.0–13.0 µg/L; Table 2) for the period 2002–2020 based on LPP monitoring); the average concentrations are below the interim PWQO of 10 µg/L for “a high level of protection against aesthetic deterioration” (MOEE 1994). There was no significant temporal trend in the annual average TP concentration for any of the LPP sites (all $R^2 < 0.2$; all $p > 0.1$; data not shown). Data provided by the MECP have a comparable median TP concentration of 6.0 µg/L, though with much higher average (15.9 µg/L) and maximum (79.0 µg/L) concentrations than recorded in the LPP dataset (Table 2).

Surface nitrogen concentrations are also relatively low, with almost no nitrite, little ammonium, and nitrate well below the Canadian Water Quality Guideline of 3 mg-N/L (Table 3). Similarly, chloride has never been measured above the CWQG of 120 mg/L, averaging only approximately 13–14 mg/L.



Most water-quality parameters did not differ appreciably between the euphotic zone and directly above the lakebed (compare Table 3 with Table 5); however, nitrate and TP were both much higher “off bottom” (averages of 46.8 µg/L and 0.188 mg-N/L, respectively) than in the upper mixed layer (averages of 15.9 µg/L and 0.021 mg-N/L, respectively).

The TP and total iron concentrations of 1-mob samples from the 7 September 2022 survey were significantly and positively correlated among sites (Pearson’s $r = 0.81$; $p < 0.05$), and the minimum DO concentration at each site was negatively correlated with the 1-mob concentrations of iron ($r = -0.92$; $p < 0.01$) and phosphorus ($r = -0.73$; $p = 0.10$); these correlations suggest that phosphorus is liberated from ferric oxyhydroxides in the sediments under anoxic conditions (i.e., that internal phosphorus loading is occurring due to oxygen depletion above the lakebed).



Table 3. Summary of Euphotic Zone Chemistry based on MECP Monitoring (2003–2018).

	<i>n</i>	Min.	10th%ile	25th%ile	Avg.	Median	75th%ile	90th%ile	Max.
Ammonia, Total (mg-N/L)	8	0.006	0.014	0.020	0.063	0.030	0.041	0.128	0.307
Calcium	7	30.8	32.5	33.7	34.7	34.5	36.2	37.6	38.2
Chloride	2	12.8	12.9	13.0	13.1	13.1	13.3	13.3	13.4
Conductivity (µS/cm)	8	245	245	248	262	256	271	289	292
Dissolved Inorganic Carbon	8	23.9	24.5	24.8	26.3	26.7	27.8	27.9	28.0
Dissolved Organic Carbon	8	3.2	3.2	3.4	5.7	3.6	4.6	9.7	18.4
Hardness	7	105	108	112	115	115	120	122	124
Magnesium	7	6.4	6.7	7.0	7.0	7.1	7.2	7.4	7.5
Nitrate + Nitrite (mg-N/L)	8	0.005	0.006	0.009	0.021	0.019	0.024	0.041	0.049
Nitrite (mg-N/L)	8	0.001	0.001	0.001	0.002	0.001	0.003	0.005	0.006
pH	8	8.01	8.08	8.19	8.29	8.32	8.39	8.46	8.57
Potassium	2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Sodium	2	7.5	7.5	7.6	7.7	7.7	7.9	7.9	8.0
Sulphate	2	4.8	4.9	4.9	5.1	5.1	5.2	5.3	5.3
Total Alkalinity	8	99	103	106	110	109	115	119	120
Total Dissolved Solids	5	159	160	162	165	163	170	172	173
Total Kjeldahl Nitrogen	8	0.03	0.16	0.26	0.50	0.29	0.48	1.02	1.76
TP (µg/L)	8	4.0	4.0	4.8	15.9	6.0	9.3	34.9	79.0
Total Suspended Solids	5	0.8	0.8	0.9	1.4	1.0	1.2	2.3	3.0

Note: Units are mg/L except for pH (unitless) and where otherwise specified. Data are for site "Lake Clear – Main Basin".



Table 4. Water quality of Lake Clear on 7 Sep 2022 based on HESL Survey.

	Units	Median	LC-1	LC-2	LC-3	LC-4	LC-5	LC-6
Site Depth	m	25.3	20.7	25.4	20.1	25.2	35.2	38.1
Secchi Depth	m	7.9	8.2	7.7	8.1	7.9	7.9	7.9
Ammonia, Total	mg-N/L	<0.0050	<0.0050	0.0316	<0.0050	<0.0050	<0.0050	0.0081
Calcium	mg/L	30.8	30.6	30.9	30.6	30.6	31.2	31.0
Chloride	mg/L	15.3	15.3	15.3	15.3	15.3	16.1	15.3
Chlorophyll-a	µg/L	0.95	0.84	1.17	0.62	0.62	1.33	1.06
Dissolved Organic Carbon	mg/L	4.14	4.45	4.15	4.05	4.29	3.99	4.12
Dissolved Reactive P	µg/L	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Iron	µg/L	(29)	(14)	(55)	(11)	(15)	(42)	(64)
Nitrate	mg-N/L	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total Kjeldahl Nitrogen	mg-N/L	0.258	0.260	0.277	0.238	0.255	0.251	0.267
TP	µg/L	5.6 (17.8)	7.5 (8.0)	4.6 (73.3)	5.1 (8.0)	6.4 (4.2)	4.8 (27.5)	6.1 (35.7)
Total Suspended Solids	mg/L	<3.0 (<3.5)	<3.0 (<3.0)	3.9 (3.5)	<3.0 (<3.0)	<3.0 (<3.0)	<3.0 (4.1)	<3.0 (4.5)

Note: Numbers in parentheses are from 1-m-off-bottom samples; other values are from integrated samples (surface to Secchi depth).



Table 5. Summary of Off-Bottom Chemistry based on MECP Monitoring (2003–2018).

	<i>n</i>	Min.	10th%ile	25th%ile	Avg.	Median	75th%ile	90th%ile	Max.
Ammonia, Total (mg-N/L)	5	0.007	0.025	0.052	0.047	0.052	0.056	0.063	0.067
Calcium	5	33.4	35.5	38.7	38.2	38.9	39.1	40.1	40.7
Chloride	1	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
Conductivity (µS/cm)	5	262	262	263	268	267	273	273	273
Dissolved Inorganic Carbon	5	26.5	26.9	27.6	28.0	27.7	28.3	29.3	29.9
Dissolved Organic Carbon	5	3.0	3.1	3.2	3.3	3.3	3.3	3.6	3.8
Hardness	5	111	117	125	124	126	127	129	130
Magnesium	5	6.6	6.8	7.0	7.0	7.0	7.1	7.2	7.2
Nitrate + Nitrite (mg-N/L)	5	0.133	0.142	0.156	0.188	0.172	0.195	0.248	0.283
Nitrite (mg-N/L)	5	0.001	0.001	0.002	0.004	0.003	0.003	0.007	0.010
pH	5	7.89	7.93	7.99	8.13	8.18	8.28	8.31	8.33
Potassium	1	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Sodium	1	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Sulphate	1	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Total Alkalinity	5	112	114	116	116	117	118	119	119
Total Dissolved Solids	3	174	175	176	176	177	177	177	177
Total Kjeldahl Nitrogen	5	0.20	0.24	0.30	0.29	0.32	0.32	0.33	0.33
TP (µg/L)	5	24.0	30.8	41.0	46.8	50.0	53.0	60.8	66.0
Total Suspended Solids	3	1.1	1.2	1.3	1.8	1.5	2.1	2.5	2.7

Note: Units are mg/L except for pH (unitless) and where otherwise specified. Samples were collected from 1-m off bottom from site "Lake Clear – Main Basin".



4.1.3 Phytoplankton

Chlorophyll-a concentrations on 7 September 2022 were approximately 1 µg/L (Table 4), indicative of low phytoplankton biomass. FluoroProbe fluorescence measurements made on this date indicate a phytoplankton community of mixed composition but dominated by algae with very little cyanobacteria (i.e. blue-green algae) (Figure 2). Although cyanobacteria made only a minor contribution to the phytoplankton biomass, HESL did observe macroscopic colonies in the water column at multiple sites during the field survey; the colonies were examined using a compound microscope and identified as a species of the genus *Gloeotrichia* (Photographs 1 and 2); this potentially toxic, colonial cyanobacterium is known to bloom in low-nutrient lakes (Carey et al. 2012).

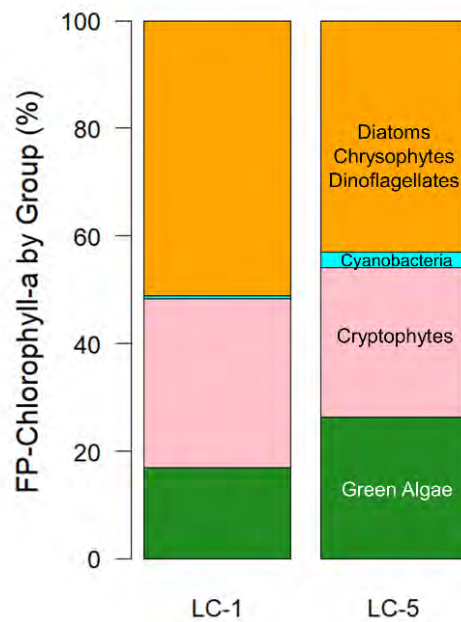


Figure 2. Phytoplankton community composition of Lake Clear on 7 September 2022, as inferred from pigment fluorescence measured by a FluoroProbe.





Photographs 1 & 2. View of the lake's surface at site LC-5 on 7 September 2022 (left) and one of the *Gloeotrichia* colonies collected from the lake, as viewed using compound microscopy (right).

4.1.4 Stratification and Dissolved Oxygen

Late-summer water column profiles of temperature and DO were obtained from MECP (Figure 3) and also measured by HESL during the 7 September 2022 survey (Figure 4). The water column of Lake Clear was always stably stratified in September, with an upper mixed layer (epilimnion), of approximately 10 m depth, separated from the hypolimnion by a strong thermal gradient (i.e., a distinct thermocline). Based on the commonly used 1°C-per-m criterion for defining the thermocline, the top of the hypolimnion was at a depth of 14–15 m. MECP recorded hypolimnetic anoxia (DO < 1 mg/L) on all survey dates, with DO concentrations of 0.29, 0.05, 0.50, and 0.24 mg/L measured immediately above the lakebed (i.e., at 35–37 m) at their deep-water sampling location on 5 September 2003, 16 September 2010, 12 September 2011, and 26 September 2018, respectively. HESL recorded hypoxic (but not anoxic) conditions immediately above the lakebed at the deepest site on 7 September 2022 (1.17 mg/L at 38 m at LC-6), somewhat higher than the concentrations reported by MECP. Off-bottom DO concentrations recorded by HESL at the other sites on 7 September 2022 ranged from 2.55 mg/L to 5.41 mg/L.



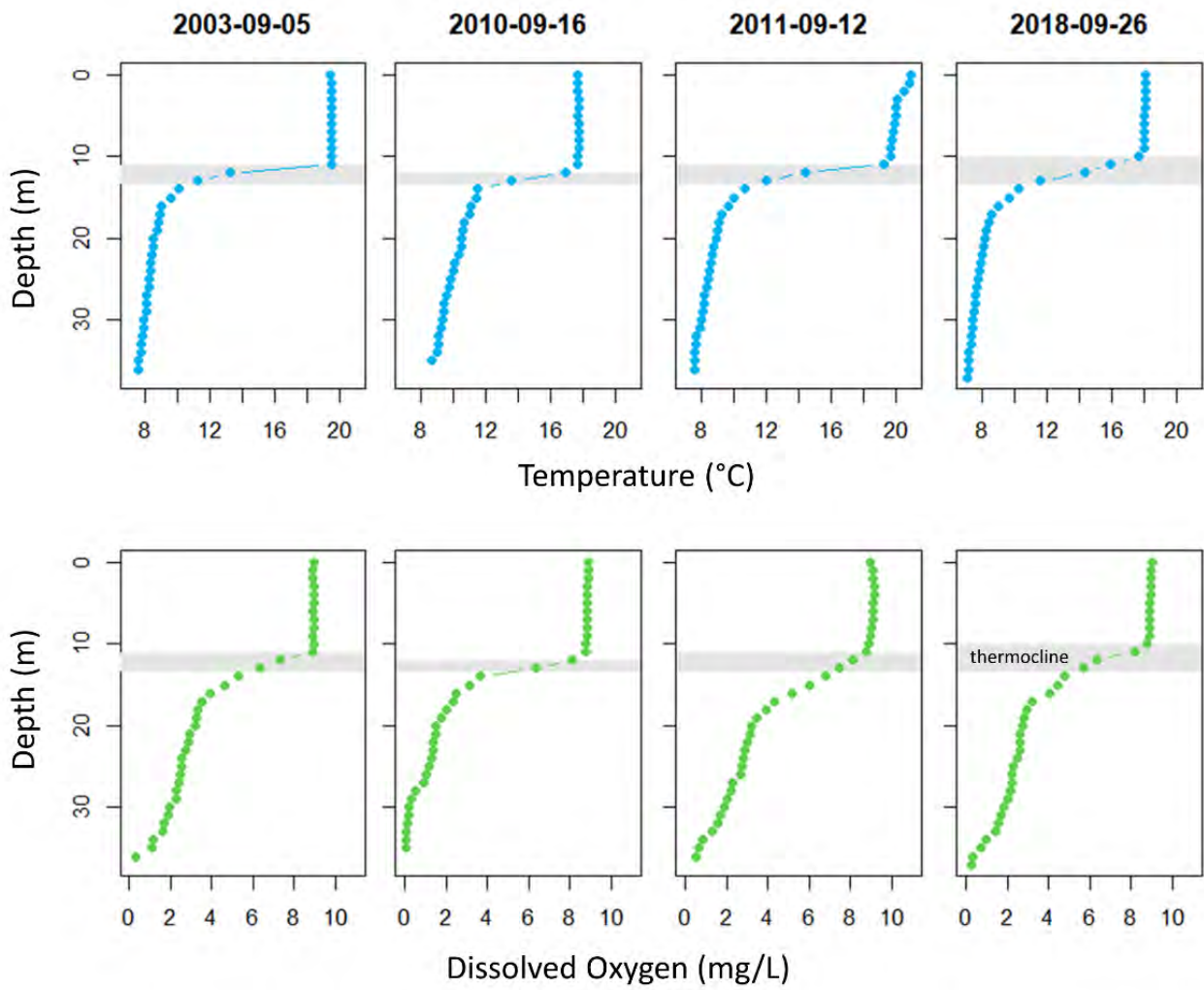


Figure 3. MECP Temperature and Dissolved Oxygen Profiles.



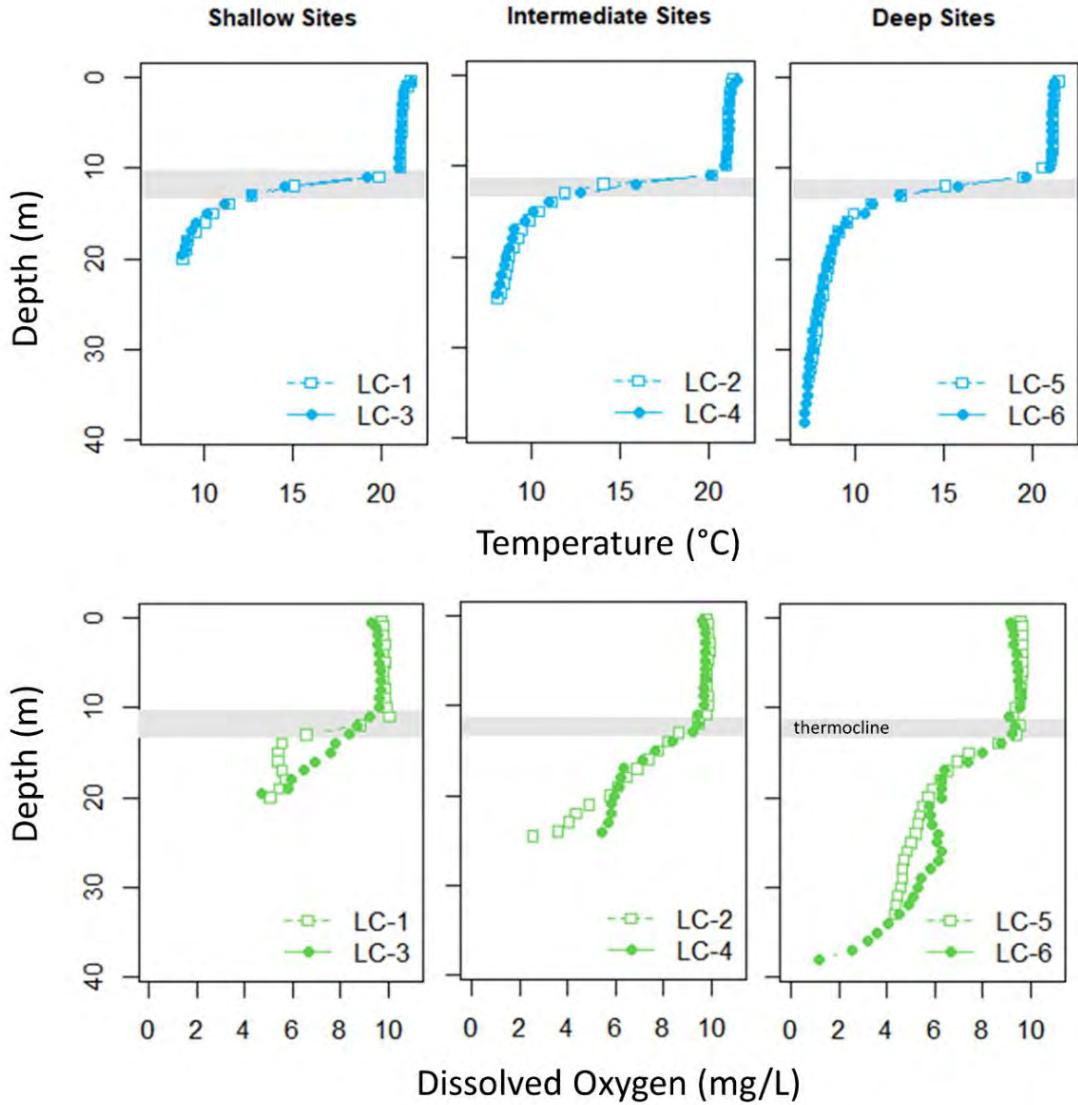


Figure 4. Temperature and Dissolved Oxygen Profiles Measured by HESL on 7 September 2022.



Based on our survey, it is clear that hypolimnetic DO can exhibit considerable spatial (horizontal) variation within Lake Clear, even among locations of comparable depth (i.e., compare the sets of DO profiles in each panel of Figure 4). For this reason, we calculated MVWHDO based on profiles from all six sampling stations by averaging 2 profiles within each of 3 depth ranges (shallow, medium, deep). MVWHDO was calculated separately for each depth range, then weighted by the respective area (based on bathymetry) in order to calculate the MVWHDO for the entire lake (Table 6). The MVWHDO for Lake Clear on 7 September 2022 was determined to be 6.20 mg/L. The MVWHDO would be estimated as 6.58 mg/L (i.e., overestimated by 6%) if calculations were made based only on data from the deepest location of the lake (Table 6). This is because the rate of hypolimnetic oxygen depletion is a function of both the oxygen demand of the sediments and the volume of the hypolimnion; thus, (volumetric) oxygen demand is greater in shallow areas where the hypolimnion is thinner (assuming comparable areal sediment oxygen demand among depths). The MVWHDO of Lake Clear was higher in 2022 than it has been in previous years (Table 7) but all concentrations are less than the Provincial criterion of 7 mg/L that is protective of Lake Trout habitat.

Table 6. Calculation of the MVWHDO of Lake Clear on 7 September 2022.

Sites	Hypolimnion (m)	Min. DO (mg/L)	Depth Range (m)	Area in Depth Range (m ²)	Area (fraction)	MVWHDO (mg/L)	Area × MVWHDO
LC-1, LC-3	14–21	4.70	14–21	4,678,423	0.8288	6.10	5.06
LC-2, LC-4	15–25	2.55	21–25	364,388	0.0646	6.79	0.44
LC-5, LC-6	15–39	1.17	≥25	602,077	0.1067	6.58	0.70
Lake MVWHDO (mg/L):							6.20

Table 7. All Available MVWHDO Estimates for Lake Clear.

Data Collector	Date	Depth Range (m)	Min. DO (mg/L)	MVWHDO (mg/L)
MECP	2003-09-05	14–37	0.29	3.57
	2010-09-16	14–36	0.05	2.15
	2011-09-12	14–37	0.50	4.33
	2018-09-26	14–38	0.24	3.33
HESL	2022-09-07	14–39	1.17	6.20
Average:				3.92



4.2 Lakeshore Capacity Modelling

4.2.1 Model Calibration

The LCM was used to predict natural and anthropogenic phosphorus loads and concentrations for Lake Clear. Lake/catchment-specific input data for the LCM were determined from government sources and the HESL lake survey (Table 9). Municipal Property Assessment Corporation (MPAC) data were provided by the County of Renfrew to determine development inputs. The LCM incorporates P loading from homes/cottages based on either permanent (2.56 capita-years/year), extended seasonal (1.27 capita-years/year), or seasonal (0.69 capita-years/year) occupancy¹, whereas MPAC classifies residences as either permanent or seasonal. Because the actual duration of occupancy of non-permanent residences is not known, the lots categorized as seasonal by MPAC were modelled as extended seasonal as per a conservative approach to lakeshore development and generally consistent with MECP guidance for non-permanent properties with year-round road access². In addition, satellite imagery (Google Earth) and an online campsite map³ were consulted to determine the number and type of dwellings associated with the Whispering Pines Resort and the Opeongo Mountain Resort, respectively.

4.2.1.1 Phosphorus Retention by Soil

The coefficient for phosphorus retention by soil (R_s) is of particular importance to the LCM. R_s represents the fraction of the septic-system phosphorus load that reaches the lake; thus, the increase in TP concentration above the background concentration predicted by the LCM is linearly dependent on the magnitude of R_s . MECP guidance is to assume R_s is zero unless site-specific soil assessment supports a higher value of R_s (MOE 2010). However, research has shown that septic system phosphorus is immobilized in soils. Mechanistic evidence (Stumm and Morgan 1970; Jenkins et al. 1971; Isenbeck-Schroter et al. 1993) and direct observations made in septic systems (Willman et al. 1981; Zanini et al., 1998; Robertson et al. 1998; Robertson 2003) show strong adsorption of phosphate on charged soil surfaces and mineralization of phosphate with iron and aluminum in soil. Robertson et al. (2019) summarized phosphorus concentrations in groundwater plumes from 24 septic systems throughout Ontario that were monitored over a 30-year period. Phosphorus removal averaged 97% at the non-calcareous sites and 69% at the calcareous sites. Trophic status modelling supports the mechanistic and geochemical evidence: Dillon et al. (1994) reported that only 28% of the potential loading of phosphorus from septic systems around Harp Lake, Muskoka, could be accounted for in the measured phosphorus budget of the lake; the authors attributed the variance between measured and modelled estimates of phosphorus to retention of septic phosphorus in tills that were found in the catchment (Mollard et al. 1980; Gartner Lee Ltd. 2005).

The soils surrounding Lake Clear (and its islands) are predominantly of the Tweed type, with Westmeath and Eganville soils also covering parts of the shoreline (Figure 5; Gillespie et al. 1964). The parent material of these soils is calcareous (Table 8; Gillespie et al. 1964) and the Tweed series that dominates the

¹ In this context, a capita-year/year represents 1 person living in a residence on an annual basis; e.g., the P loading from a residence with 2.56 capita-years/year would be the P load expected to come from, on average, 2.56 people in a year.

² "In cases where usage rates are unknown and where there is no winter road access, MOE recommends using the seasonal rate of 0.69 capita years per year as a default. The extended seasonal rate of 1.27 capita years per year should be used for other non-permanent developments that have reliable year-round access." – MOE (2010)

³ <https://www.omresort.ca/images/Map-Opeongo-Mountain-Resort.pdf>



shoreline was described as being “associated with surface outcrops of crystalline limestone” and >25% coverage of bare rock; therefore a value of 0.69 was assumed for Rs, consistent with the aforementioned findings of Robertson et al. (2019). Calcareous inputs were also confirmed through observation of basic lake pH (i.e. pH > 8; see Table 3).

Table 8. Soils Surrounding Lake Clear.

Shoreline Distance (m)	Proportion of Total		Soil Type	Phases	Soil Parent Material
	Excl. Islands	Incl. Islands			
5,692	18.1%	13.4%	Eganville	loam	Calcareous loam till.
6,233	19.8%	14.6%	Westmeath	gravelly sandy loam	Calcareous fine to medium gravel.
19,488	62.0%	45.7%	Tweed	sandy loam	Calcareous till.
11,194	-	26.3%	Tweed	sandy loam	Calcareous till.

Note: Soil data are from Gillespie et al. (1964); linear shoreline coverage for each soil type was calculated using Google Earth.



MAP SYMBOL	SOIL TYPE, PHASES	SOIL PARENT MATERIAL	GREAT GROUP
Egl	EGANVILLE loam	Calcareous loam till.	Grey-Brown Podzolic
Tws	TWEED sandy loam	Calcareous till.	Brown Forest
Wgs	WESTMEATH gravelly sandy loam	Calcareous fine to medium gravel.	Podzol

Figure 5. Soils Surrounding Lake Clear.

Note: Map was composed from images in Gillespie et al. (1964).



Table 9. Lakeshore Capacity Model Input Data and Sources.

Category	Input Value	Parameter	Data Source	Note
Shoreline Development	208	Lots occupied all year (1.73 kg-P/lot/y) ¹	MPAC, Google Earth, Opeongo map	Includes 19 farms with residents and the main buildings of each of the 2 resorts.
	267	Lots occupied on an extended seasonal basis (0.88 kg-P/lot/y) ²	MPAC	
	135	Seasonal lots (0.50 kg-P/lot/year) ³	Opeongo map	40 from Whispering Pines + 95 seasonal rentals at Opeongo
	46	RVs on existing lots (0.46 kg-P/lot/year)	LCPOA	Same P export as seasonal lots but without stormwater load (largely accounted for in seasonal lot loading as most RVs are on developed lots).
	8	Campgrounds/tent trailers/RV parks (0.28 kg-P/lot/year) ⁴	MPAC, Opeongo map	8 rentals of Opeongo Mountain Resort.
	170	Vacant lots of record (0.88 kg-P/lot/year) ⁵	MPAC	Vacant lots with RVs included under "RVs on existing lots" (above).
	0.69	Retention by Soil	Gillespie et al. (1964); Robertson et al. (2019)	For calcareous soils.
Catchment	1,727 ha	Lake area	Fish ON-Line (MNRF)	
	7,566 ha	Catchment area	OWIT (MNRF)	Ontario Watershed Information Tool
	10.3 mg/m ² /y	Natural P loading	MMA (1986)	P export coefficient for sedimentary watersheds with <15% cleared land
	5.7%	Wetland coverage	OWIT (MNRF)	Wetland export not included in calculation of natural P loading; natural loading based on 10.3 mg/m ² /yr (see above) because of calcareous parent material.
	9.9%	Cleared land	OWIT (MNRF)	Ontario Watershed Information Tool
Hydrological Flow	0.352 m/y	Mean annual runoff	Canada Dept. of Fisheries & Environment	From database recommended for use with LCM.
Sedimentation	7.2 m/y	Settling velocity	MECP and HESL survey data (Section 4.1.4)	Standard settling velocity used in LCM for anoxic hypolimnion.



Monitoring Data	8.72 µg/L	Average TP during spring-overturn	Lake Partner Program (MECP)	Station 2453; Sites #1–5; annual averages (May–June) for 2002– 2020.
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¹2.56 capita-y/y × 0.66 kg-P/capita/y + stormwater load of 0.04 kg-P/lot/y; ²1.27 capita-y/y × 0.66 kg-P/capita/y + stormwater load of 0.04 kg-P/lot/y; ³0.69 capita-y/y × 0.66 kg-P/capita/y + stormwater load of 0.04 kg-P/lot/y; ⁴0.37 capita-y/y × 0.66 kg-P/capita/y + stormwater load of 0.04 kg-P/lot/y; ⁵Assumes vacant lots will be converted to extended seasonal.

In addition to the baseline scenario described above (i.e., for the existing lakeshore development density), 4 additional scenarios were modelled based on densities of 1 to 4 RVs per lot (of any type; i.e., permanent + extended seasonal + seasonal lots). In the case of shoreline RVs, the relevant factors are the number of RVs and the method of wastewater treatment and disposal. The modelling assumes that the LCM's recommended phosphorus loading rate for seasonal dwellings of 0.46 kg/year is applicable for the RVs (i.e., 0.69 capita years/year × 0.66 kg-P/capita/year); stormwater loading (0.04 kg/lot/year) is not included for the RVs because it is already accounted for in the model (i.e., because the RVs are assumed to reside on existing lots). The predicted effect of additional RVs on lake TP was also used to predict changes in MVWHDO, as described in Section 4.3.

4.2.2 Model Accuracy

The predicted spring-overturn TP concentration of Lake Clear is 9.27 µg/L, 6.3% higher than the measured spring-overturn concentration of 8.72 µg/L; model output is considered valid if error is ≤20% (MOE 2010).

4.2.3 Predicted Phosphorus Concentrations

The predicted existing TP concentration of Lake Clear during the ice-free season ("TP_{lake}") is 8.64 µg/L. Assuming the vacant lots are converted to extended seasonal use (as recommended by MECP), the predicted future TP concentration ("TP_{future}") is 8.99 µg/L. This concentration is ~26% higher than the predicted background (pre-development) concentration of 7.11 µg/L meaning that the lake has additional development capacity based on Lakeshore Capacity Modelling. Without exceeding the PWQO of 10.67 µg/L, the TP load could be increased by 534 kg/y; this is the load that is estimated to come from 146 permanent residences (or 291 extended seasonal residences or 522 seasonal cottages/RVs).

4.3 Dissolved Oxygen Modelling

The empirical models of Molot et al. (1992) were used to predict end-of-summer DO concentrations for Lake Clear and how these would be affected by increases in lake TP concentration from the addition of RVs to existing lakeshore lots.

4.3.1 Modeling Methodology

The lake-specific parameters of the models presented in Molot et al. (1992) are bathymetry, lake area, fetch, and spring TP concentration.

Spring-overturn DO concentration was estimated at a 1-m depth interval based on the relationship:

$$\log_{10}DO(z) = 1.07 - 6.95 \div A_0 - 0.0043 \times z \div MD \quad (1)$$



where A_0 is the area of Lake Clear (1727 ha), z is depth (0–40 m), and MD is fetch (“maximum distance across the lake in any direction on a line through the sampling station”; 8.5 km).

Mean end-of-summer DO concentration was then estimated at a 1-m depth interval for the hypolimnion (14–40 m) based on the relationship:

$$\log_{10}DO(z) = 1.83 - 1.91 \div VSA_z - 7.06 \div DO_z - 0.0013 \times TP^2 \quad (2)$$

where VSA_z is the ratio of the volume of water to sediment area for each 1-m contour, DO_z is the spring oxygen concentration estimated via equation 1, and TP is the spring TP concentration (either measured or predicted by the LCM).

MVWHDO was calculated from the predicted depth-specific DO concentrations based on the same bathymetric data (contour volumes) used in Section 4.1.4.

4.3.2 Predicted Dissolved Oxygen

Based on the models of Molot et al. (1992) and the *measured* long-term spring-overturn TP concentration of 8.72 µg/L, the predicted end-of-summer MVWHDO of Lake Clear is 6.34 mg/L. Based on the *modelled* TP_{SO} of 9.27 µg/L the predicted MVWHDO is 6.15 mg/L (Table 10). Both MVWHDO estimates are within 2% of the measured value of 6.20 mg/L (Table 6), representing very close agreement between modelled and observed data. Based on the modelled TP_{SO} without anthropogenic phosphorus loading (7.73 µg/L), MVWHDO would have been 6.7 mg/L in the absence of lakeshore development, according to the model, which is notable as it is less than the Provincial criterion of 7 mg/L.

The effect of RVs on Lake Clear’s MVWHDO is dependent on the RV density, with the predicted MVWHDO ranging from 5.95 mg/L (-3%) at only 1 RV/lot to 5.32 mg/L (-13%) at 4 RVs/lot (Table 10). At 6.2 mg/L, the current late-summer MVWHDO of Lake Clear is already below the 7 mg/L recommended by MNRF for protection of Lake Trout habitat.

Table 10. Predicted TP and MVWHDO as a Function of Additional RV Density on Existing Lots.

RVs (#/lot)	TP _{SO} (µg/L)	TP _{lake} (µg/L)	TP _{future} (µg/L)	TP _{lake} :TP _{bk} (%)	TP _{future} :TP _{bk} (%)	MVWHDO (mg/L)	Decrease in MVWHDO (%)
0	9.27	8.64	8.99	122	126	6.15	–
1	9.85	9.21	9.73	130	137	5.95	3.3
2	10.43	9.78	10.46	138	147	5.74	6.6
3	11.01	10.36	11.2	146	158	5.53	10.0
4	11.58	10.93	11.93	154	168	5.32	13.4

4.4 Summary

The development capacity of Lake Clear has been assessed with respect to concentrations of TP and MVWHDO using the LCM and the oxygen models of Molot et al. (1992). Based on these models:



- 146 permanent residences (or 291 extended seasonal residences or 522 seasonal cottages/RVs) could be added to Lake Clear's shoreline without exceeding the phosphorus PWQO of background+50%;
- Alternatively, 2 RVs could be added to each existing lot (permanent, extended seasonal, and seasonal) without exceeding the phosphorus PWQO (assuming extended seasonal development of vacant lots);
- At 6.20 mg/L, MVWHDO is currently below the 7 mg/L concentration recommended by MNRF for Lake Trout habitat and is therefore at capacity based on that criterion. Based on the modelled TP_{SO} without anthropogenic phosphorus loading (7.73 µg/L), MVWHDO would have been 6.7 mg/L in the absence of lakeshore development which is less than the Lake Trout criterion of 7 mg/L;
- The addition of 2 RVs to each existing lot is predicted to decrease MVWHDO by approximately 7% (~0.4 mg/L) based on additional phosphorus loading to the lake.

These predictions are highly dependent on the assumed rate of attenuation of septic system phosphorus by soil. We calibrated the LCM using a retention coefficient (Rs) of 0.69, based on the findings of Robertson et al. (2019) and the calcareous nature of the soil parent material in the area surrounding Lake Clear. In practice, the degree to which septic system phosphorus is immobilized by soil will depend largely on the type of sewage treatment and on the specific properties of the soil between the infiltration bed and the lake. Non-native (imported) iron-rich soils can be used in the construction of septic drain fields to enhance phosphorus immobilization. Holding tanks are commonly used in RVs and in theory result in the complete removal of effluent and the associated nutrient load from the study area. The importance of properly designed and maintained sewage treatment systems are further discussed in Section 5.1.

5. Waterfront Best Management Practices

Waterfront Best Management Practices (BMPs) are commonly implemented to minimize impacts of development on adjacent water quality and ecological features. The scientific underpinning of common waterfront development BMPs is described in the following paragraphs to provide an understanding of how the underlying mechanisms relate to reducing development-related impacts; information which can be used to help guide RV policy development.

5.1 Sewage Treatment Systems

Research over the past 20 years has consistently shown that a large proportion of septic system phosphorus is immobilized in soils as discussed in Section 4.2.1.1. Proper septic system design and maintenance is important to maximizing phosphorus attenuation in on-site soils and minimizing impacts to Lake Clear. 60% of respondents identified faulty or poorly maintained septic systems as an issue faced by Lake Clear and 55% ranked a septic reinspection program the top action to benefit the lake (Love Your Lake 2022). Proper sewage servicing of existing residences and cottages, as well as future RVs is required to protect the health of Lake Clear.



The County of Renfrew Official Plan (County of Renfrew 2020) contains a number of policies focused on sewage treatment systems on at-capacity lakes:

9.3(2) The following provisions shall apply to all lands abutting (within 300 metres) of an At Capacity Lake

a) Lot creation shall not be permitted within 300 metres of any at capacity lake unless:

(iii) A site-specific soils investigation prepared by a qualified professional demonstrates that phosphorus can be retained in deep, native, acidic soils on-site. A report, prepared by a qualified professional, is required to demonstrate that there will be no negative impact on the lake water quality as a result of any development. Site plan control may be utilized by the local municipality to implement any recommended mitigation measures.

(d) Development on existing lots with lakeshore frontage shall only be permitted under the following conditions:

(ii) All buildings and structures and associated private waste disposal systems shall have a minimum setback of 30 metres from the high water mark of the lake, or in the case of existing lots, where this setback cannot be met, the setback shall be as remote from the high water mark as the lot will permit to the satisfaction of the Local Council and the applicable approval authority for the private waste disposal system.

(iii) All new permits issued by the applicable approval authority for private waste disposal systems which involve construction of tile beds will be conditional upon the use of a fill material known to have a good phosphorus retention capability.

5.2 Shoreline Buffers

Shorelines link terrestrial and aquatic ecosystems, acting as a transition zone between land and water. They are biological hotspots and highly productive habitats that provide a myriad of ecological services, including maintenance of water quality, flood protection, and wildlife habitat (HESL 2021b). Residential development is often concentrated around shorelines, and most development-related impacts to freshwater habitats occur in the nearshore environment. Natural shoreline vegetation is commonly cleared during development and replaced partially or completely by manicured lawn. If not properly managed, waterfront development can degrade sensitive shoreline habitats, and alter the ecological integrity of adjacent lakes and rivers. Based on a recent survey, 16% of Lake Clear's shoreline is developed, 79% is natural, and the remaining shoreline is manicured, degraded, or regenerative (Love Your Lake 2022). It has been observed that 15% of Lake Clear's properties are mown to the water's edge and recommended that riparian buffer width be increased on 34% of Lake Clear's shoreline (Love Your Lake 2022).

Shoreline buffers can play an important role in protecting lake health. The physical separation they provide between upland human activity and the aquatic environment can aid in mitigating the effects of development and site alteration on water quality and wildlife habitat, while providing erosion and flood control. In general, larger buffers are better at consistently providing a range of protective functions. A 15 m buffer has been found to be the minimum size necessary to maintain physical and chemical functions while 30 m is the



minimum necessary to maintain biological functions (Beacon et al. 2012; Castelle et al. 1994; HESL 2021b). Efficient removal of some pollutants (notably sediment) can occur in buffers of 10-20 m width, but other pollutants (such as nutrients) may require buffer widths of 30 m or more for effective attenuation. Water quality improvements generally increase with buffer size (e.g., 10 m removes 65% of sediment from overland runoff while 30 m removes 85% of sediment from overland runoff; Sweeney and Newbold 2014). Larger buffers are also better at protecting the diversity of aquatic and terrestrial species that rely on shorelines.

In Section 2.2 (11) of the County of Renfrew Official Plan (County of Renfrew 2020) it is stipulated that, with certain exceptions, buildings and septic systems are to be set back at least 30 m from the water:

Generally all buildings and structures and associated private waste disposal systems will be set back a minimum horizontal distance of 30 metres (or approximately 100 feet) from the normal high water mark of a water body.

It has been reported (Love Your Lake 2022) that 69% of the properties on Lake Clear are within 30 m of shore (i.e., do not meet the policy requirement).

Section 9.3 (2) discusses shoreline buffer requirements on at-capacity lakes:

2(d)(iv) The property between the shoreline of the lake and the dwelling or private waste disposal system will be retained where possible in its natural state to serve as a buffer which will assist in minimizing the land-surface transport of nutrient laden silt to the lake. The retention of the natural soil mantle and natural vegetation within 30 metres of the shoreline of the lake will be encouraged.

The scientific literature demonstrates that a 30 m buffer provides a range of ecological services, and this buffer size is commonly recommended in the peer-reviewed literature focused on shoreline development. Existing planning policy recommends that 30 m naturally vegetated buffers and such buffers should be continue to be required on all lots on Lake Clear.

Stormwater management features that include provisions to maximize infiltration and limit stormwater runoff should also be utilized to minimize development-related impacts on Lake Clear. Specific options include proper re-contouring, discharging of roof leaders, use of soak away pits and other measures to promote infiltration, grassed and vegetated swales, filter strips, roof leaders and French drains. Stormwater management options are often site specific, and the best approach will be dictated by site characteristics and the nature of the proposed development.

6. Conclusions

A Lakeshore Capacity Assessment was completed to determine the development capacity of Lake Clear and inform the development of planning policy for the establishment and use of RVs on the lake. The assessment included Lakeshore Capacity Modelling and comparison with the TP PWQO, measured and modelled MVWHDO concentrations and comparison with the Provincial criterion of 7 mg/L to protect Lake Trout habitat, and examination of water quality data to provide a holistic assessment of lake health and capacity.



Lake Clear is under capacity according to Lakeshore Capacity Modelling results and the TP PWQO. It is over capacity with respect to MVWHDO as concentrations are <7 mg/L but modelling indicates that MVWHDO concentrations were slightly below 7 mg/L prior to development. Water quality is good and there are no increasing trends in nutrient concentrations. Cyanobacteria (i.e. blue-green algae) was however observed during site investigations and climate change is increasing the amount of cyanobacteria in oligotrophic lakes (Reinl et al. 2021). While both factors are known to promote cyanobacterial blooms, the future effects of climate change and anthropogenic nutrient loading on algal blooms in Lake Clear cannot be quantitatively assessed based on available data. However, based on what is generally known about climate change effects on lake stratification and the life cycle of cyanobacteria such as *Gloeotrichia* (Cottingham et al. 2021), it is expected that blooms will become more frequent in Lake Clear even if nutrient loading remains unchanged; increased nutrient loading would be expected to promote more frequent and/or more severe blooms. With respect to the potential for interactive effects between increased nutrients and climate, a large-scale (>1,000 lake) US study (Rigosi et al. 2014) found no synergistic effect of temperature and nutrients on cyanobacterial biovolume in oligotrophic lakes (i.e., the combined effect of increased nutrients and increased temperature was not greater than the sum of the individual effects).

Shoreline development, including RV use, can impact a lake through stormwater and wastewater inputs as well as associated recreational uses such as boating. Impacts can be largely mitigated through implementation of BMPs such as properly designed and maintained sewage treatment systems, the retention or establishment of naturally vegetated shoreline buffers and stormwater management features that maximize infiltration and minimize runoff. Currently the use of RVs of Lake Clear is unregulated and therefore it is not known if they are properly serviced via appropriately sized tile beds or holding tanks that are pumped out regularly. We underscore that the impact of RVs on the lake's water quality depends not only on the number of shoreline RVs but also the effectiveness of RV wastewater management in minimizing nutrient loading to the lake.

6.1 Recommendations

The following recommendations were developed to help the Township develop science-based planning policy for RV use on Lake:

- Permit the use of 1 or 2 RVs on each of the 610 existing lots modelled in this study (i.e., permanent + extended seasonal + seasonal occupancy lots; see Table 9) if appropriate BMPs are developed and enforced to ensure that impacts to Lake Clear are minimized. The modelled impact of two additional RVs/lot results in TP concentrations that are less than the PWQO for TP. The lake is at capacity based on MVWHDO but based on modelling results, it appears that MVWHDO concentrations have always been below the 7 mg/L criterion, and BMPs can be utilized to minimize impacts.
- Sewage treatment systems to service the RVs should meet Ontario Building Code requirements. Systems designed to maximize the amount of phosphorus attenuation should be encouraged such as the Waterloo Biofilter with EC-P unit, EcoFlo Biofilter or the use of a tank and bed system that incorporates soils that are high in phosphorus retention, aluminum and iron, and low in calcium carbonate.



- A 30 m naturally vegetated shoreline buffer should be required on all lots, especially lots with RVs that have the potential to generate additional stormwater and wastewater. Continued retention or establishment of natural vegetation over time should be encouraged through stewardship actions and enforced as necessary.
- Stormwater management features that maximize infiltration and limit stormwater runoff should be encouraged on all lots, especially those with RVs that have the potential to generate additional stormwater, to minimize development-related impacts on Lake Clear.
- Water quality and the effectiveness of BMPs should be monitored. Water quality should continue to be monitored through the Lake Partner Program, and dissolved oxygen measurements should be collected annually at the end-of-summer (August 15 – September 15) so that Mean Volume-Weighted Hypolimnetic Dissolved Oxygen concentrations can be calculated and tracked over time. The implementation and management of BMPs should be assessed through visual inspections.



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Appendix A. Temperature & Dissolved Oxygen Profiles



HESL Profiles - 7 September 2022

m	LC-1		LC-2		LC-3		LC-4		LC-5		LC-6	
	Deg. C	mg-O2/L	Deg. C	mg-O2/L	Deg. C	mg-O2/L	Deg. C	mg-O2/L	Deg. C	mg-O2/L	Deg. C	mg-O2/L
0.5	21.7	9.73	21.4	9.79	21.7	9.31	21.6	9.61	21.5	9.59	21.3	9.15
1.0	21.5	9.78	21.3	9.87	21.4	9.51	21.4	9.70	21.3	9.64	21.2	9.23
2.0	21.3	9.83	21.2	9.89	21.3	9.57	21.3	9.73	21.3	9.65	21.2	9.28
3.0	21.3	9.84	21.2	9.91	21.2	9.58	21.2	9.73	21.2	9.65	21.2	9.32
4.0	21.2	9.82	21.1	9.90	21.2	9.61	21.2	9.77	21.2	9.65	21.1	9.40
5.0	21.2	9.84	21.1	9.85	21.2	9.64	21.2	9.78	21.2	9.65	21.1	9.46
6.0	21.2	9.83	21.1	9.82	21.1	9.66	21.2	9.76	21.2	9.64	21.1	9.50
7.0	21.1	9.82	21.1	9.77	21.1	9.70	21.1	9.75	21.2	9.63	21.1	9.52
8.0	21.1	9.86	21.1	9.82	21.1	9.68	21.1	9.72	21.2	9.58	21.1	9.59
9.0	21.1	9.89	21.0	9.87	21.0	9.65	21.0	9.70	21.1	9.57	21.1	9.60
10.0	21.1	9.93	21.0	9.88	21.0	9.63	20.9	9.66	20.6	9.37	21.0	9.54
11.0	19.9	10.05	20.2	9.83	19.2	9.21	20.1	9.46	19.5	9.30	19.7	9.13
12.0	15.1	8.83	14.1	9.46	14.6	8.71	15.9	9.44	15.1	9.52	15.8	9.37
13.0	12.7	6.57	11.9	8.63	12.7	8.35	12.8	9.21	12.6	9.43	12.5	9.23
14.0	11.4	5.57	11.2	8.17	11.2	7.82	11.0	8.40	10.9	8.69	11.0	8.79
15.0	10.5	5.38	10.4	7.80	10.2	7.62	10.1	7.67	9.9	7.41	10.6	7.96
16.0	10.1	5.38	9.9	7.40	9.6	6.93	9.7	7.16	9.6	6.93	9.5	7.42
17.0	9.6	5.55	9.5	6.92	9.3	6.45	9.0	6.36	9.1	6.53	9.1	6.40
18.0	9.1	5.70	9.2	6.46	9.1	5.94	8.9	6.20	8.9	6.25	8.9	6.25
19.0	9.0	5.44	9.0	6.09	9.0	5.81	8.8	6.16	8.7	5.93	8.7	6.30
19.5	-	-	-	-	8.8	4.70	-	-	-	-	-	-
20.0	8.8	5.06	8.8	5.75	-	-	8.6	5.97	8.6	5.72	8.5	6.29
21.0	-	-	8.6	4.89	-	-	8.5	5.85	8.5	5.54	8.4	5.78
22.0	-	-	8.6	4.36	-	-	8.3	5.81	8.4	5.36	8.2	5.84
23.0	-	-	8.5	4.06	-	-	8.2	5.69	8.3	5.30	8.1	5.90
24.0	-	-	8.3	3.60	-	-	8.1	5.41	8.2	5.21	8.0	6.15
24.5	-	-	8.1	2.55	-	-	-	-	-	-	-	-
25.0	-	-	-	-	-	-	-	-	8.0	5.00	7.9	6.07
26.0	-	-	-	-	-	-	-	-	7.9	4.85	7.8	6.29
27.0	-	-	-	-	-	-	-	-	7.9	4.71	7.8	6.13
28.0	-	-	-	-	-	-	-	-	7.8	4.64	7.7	5.83
29.0	-	-	-	-	-	-	-	-	7.8	4.63	7.6	5.40
30.0	-	-	-	-	-	-	-	-	7.7	4.57	7.6	5.29
31.0	-	-	-	-	-	-	-	-	7.6	4.44	7.5	5.09
32.0	-	-	-	-	-	-	-	-	7.5	4.38	7.4	4.91
33.0	-	-	-	-	-	-	-	-	7.4	4.32	7.4	4.50
34.0	-	-	-	-	-	-	-	-	-	-	7.3	4.07
35.0	-	-	-	-	-	-	-	-	-	-	7.3	3.61
36.0	-	-	-	-	-	-	-	-	-	-	7.3	3.23
37.0	-	-	-	-	-	-	-	-	-	-	7.2	2.52
38.0	-	-	-	-	-	-	-	-	-	-	7.2	1.17

Appendix B. Lakeshore Capacity Model Results



Lakeshore Capacity Model

Lake Clear

Anthropogenic Supply			Sedimentation	
Shoreline Development Type	Number	Usage (capita years/yr)	Is the lake anoxic?	
Permanent	208	2.56	y	
Extended Seasonal	267	1.27	Settling velocity (v)	7.2 m/yr
Seasonal	135	0.69	In lake retention (Rp)	0.79
Resort	0	1.18	Monitoring Data	
Trailer Parks	46	0.69	Years of spring TP data	19
Youth Camps	0	0.125	Average Measured TPso	8.72 µg/L
Campgrounds/Tent trailers/RV parks	8	0.37	Measured vs. Predicted TPso	6.3 %
Vacant Lots of Record	170	1.27	Is the model applicable?	y
Retention by soil (Rs) (0-1)	0.69		Over or under predicted?	over
Catchment			Modeling Results	
			Upstream Lakes	
Lake Area (Ao)	1727.0	ha	TPlake	8.64 µg/L
Catchment Area (Ad)	7566.0	ha	TPout	8.26 µg/L
Wetland	0.0	%	TPso	9.27 µg/L
Cleared	9.9	%	TPfuture	8.99 µg/L
			% wetland set to zero; used 10.3 mg-P/m2/yr as recommended for sedimentary watersheds	
Hydrological Flow			Phosphorus Thresholds	
Mean annual runoff	0.352	m/yr	TPbk	7.11 µg/L
Lake outflow discharge (Q)	32711360	m3/yr	TPbk+40	9.96 µg/L
Areal water loading rate (qs)	1.89	m/yr	TPbk+50	10.67 µg/L
Inflow 1		m3/yr	TPbk+60	11.38 µg/L
Inflow 2		m3/yr	*if TPbk+40% < TPlake < TPbk+60% cell is orange	
Inflow 3		m3/yr	*if TPlake > TPbk+60% cell is red	
Natural Loading			No. of allowable residences to reach capacity:	
Atmospheric Load	288.41	kg/yr	# Permanent OR	146
Runoff Load	779.30	kg/yr	# Extended seasonal OR	291
			# Seasonal cottages OR	522
Upstream Loading			Loads	
Background Upstream Load 1		kg/yr	Natural Load w/no development	1067.71 kg/yr
Background Upstream Load 2		kg/yr	Background + 50% Load	1601.56 kg/yr
Background Upstream Load 3		kg/yr	Current Load	1296.91 kg/yr
Current Total Upstream Load 1		kg/yr	Future Load	1349.72 kg/yr
Current Total Upstream Load 2		kg/yr	Outflow Loads	
Current Total Upstream Load 3		kg/yr	Background Outflow Load	222.38 kg/yr
Future Upstream Load 1		kg/yr	Current Outflow Load	270.12 kg/yr
Future Upstream Load 2		kg/yr	Future Outflow Load	281.12 kg/yr
Future Upstream Load 3		kg/yr		
Anthropogenic Loading				
Current Anthropogenic Load	229.20	kg/yr		
Future Anthropogenic Load	282.01	kg/yr		
Areal Load Rate				
Current Total Areal Loading Rate (L _T)	75.10	mg/m2/yr		
Future Total Areal Loading Rate (L _{FT})	78.15	mg/m2/yr		



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