NATURAL ENVIRONMENT REPORT
LEVEL 1 & 2 ASSESSMENT
Child's Pit / Quarry
Town of Bracebridge
Fowler Construction
June 2020

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

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ENVIRONMENTAL SOLUTIONS INC.

June 19, 2020
RS# 2011-078

John McBride
Director of Operations
Fowler Construction
1206 Rosewarne Dr,
Bracebridge, ON P1L 1T9
via e-mail to: jmcbride@fowler.ca

SUBJECT: Natural Environment Report: Level 1 and Level 2 Assessments, Childs Pit / Quarry

Dear Mr. McBride:

RiverStone Environmental Solutions Inc. is pleased to provide you with the attached report. A summary of the key results and all of our recommendations are provided at the beginning of the report. Detailed descriptions of the work completed, and the findings are provided in the subsequent sections.

Best regards,

RiverStone Environmental Solutions Inc.

Bev Wicks, PhD
Senior Ecologist / Principal

ENVIRONMENTAL ASSESSMENT NON-TECHNICAL SUMMARY

Type of Study Natural Environment Report: Level 1 and Level 2 Assessments		**Date** June 19, 2020
	Legal Description Part of Lots 14,15 and 16 Concession 9, Lots 15 and 16 Concession 10, Township of Macaulay, Town of Bracebridge	**Development Proposed** Category 1, Class A license (Pit Below Water) and a Category 2, Class A license (Quarry Below Water) licence under the ARA Town of Bracebridge Zoning By-law amendment under the Planning Act
	Planning Authorities Province of Ontario, District Municipality of Muskoka, Town of Bracebridge	**Owner/Agent** Fowler Construction

Report Summary

Biologists with RiverStone have been working with Fowler Construction since September 2011 on the proposed development of a Category 1, Class A license (Pit Below Water) and a Category 2, Class A license (Quarry Below Water)adjacent to their Childs Pit / Quarry near Bracebridge Ontario. To satisfy environmental requirements under the *Aggregate Resources Act*, RiverStone has prepared this Natural Environment Report: Level 1 and Level 2 Assessments. During the field investigations, it was determined that several significant natural heritage features and functions occurred within the study area. The features identified include fish habitat, habitat of endangered and threatened species, significant wildlife habitat, and wetlands. As per the requirements of the Level 2 assessment, the potential impacts of the proposed pit and quarry on the identified features were evaluated. The recommendations contained within this report (summarized below) are intended to mitigate the potential negative impacts on the identified features and their associated ecological functions. The key findings contained in this Natural Environment Report are as follows:

- The five tributaries of Sage Creek, Sage Creek and the North Branch of the Muskoka River can be protected by implementing the recommended mitigation measures.
- The fish habitat identified in the study area corresponds to a coldwater fish community in Sage Creek, and a fishery in the Muskoka River. Fish and fish habitat will not be affected by the proposed development provided the recommendations contained in this report are implemented (i.e., monitoring program, maintenance of riparian buffers, blast monitoring, control of water quality and quantity, and compliance with the federal and provincial legislation relating to fish and fish habitat).
- Potential habitat for endangered and threatened species was identified and can be addressed through avoidance measures.
- Significant wildlife habitat was identified within the study area and can be addressed through avoidance and mitigation measures.

RECOMMENDATIONS

Water Quality and Quantity

- **The ECA (see s9.3.2 of Golder 2020) be designed to protect the quality and quantity of water discharged to MR-North to protect fish and fish habitat.**

- **The tributaries to Sage Creek and the associated wetlands should be excluded from the extraction area to the extent possible (Figure 6). In addition, an appropriate vegetated buffer/catchment area be established surrounding each tributary. The buffer/catchment area should be well-marked prior to the commencement of pit and quarry operations, and the buffer should remain in its natural state.**

- **Quarry discharge outlets, stormwater management ponds, and/or mitigation measures must be designed to maintain the chemical and thermal water quality properties supporting Brook Trout spawning and summer refugia habitat identified in Sage Creek and its tributaries through the Brook Trout Monitoring Program. The design and monitoring of these elements will be approved through a Permit to Take Water or Environmental Compliance for Industrial Sewage Works from MOECP.**

- **Appropriate sediment and erosion control measures should be used to prevent the erosion of unstable soils and the movement of sediment into watercourses; these measures should be in place prior to soil exposure and should be maintained whenever exposed soils are present.**

- **All stockpiled aggregates should be stored in a location that will prevent the movement of sediment laden runoff into the buffers, watercourses, and wetlands.**

- **All stockpiled topsoil/overburden should be stabilized as quickly as possible to minimize the potential for runoff.**

- **A qualified person should be retained to certify the adequacy of sedimentation and erosion controls for all Phases of pit and quarrying, and to inspect and ensure necessary repairs following winter thaws, spring freshets, and heavy rainfall events.**

- **The surface/ground water monitoring program be implemented as per the *Level 1 and 2 Hydrogeological and Hydrological Assessments (Golder 2020).***

- **Vegetated catchment areas/buffers surrounding tributaries and Sage Creek should be protected from rock shatter and/or physical disruption through proper blast design, blast orientation, and monitoring.**

Floodback and Post-Rehabilitation Conditions

- **The final design of the quarry lakes must provide for overflow channels directed towards Sage Creek and the MR-North tributary. The final design of the channels should be developed with the assistance of a qualified professional and should provide end uses for fish and wildlife.**

- **Analysis of monitoring data must be undertaken prior to cessation of extraction to establish ecologically based flow requirements for the MR-North tributary between the limit of extraction and the North Branch of the Muskoka River to ensure adequate flow during the flood back period.**

Fish and Fish Habitat

- **Baseflow must be maintained to the downstream portions of the MR-North tributary located downstream of the existing licence.**
- **Fisheries and Oceans Canada (DFO) be notified immediately if a situation occurs or if there is imminent danger of an occurrence that could cause serious harm to fish. If there is an occurrence, corrective measures must be implemented.**
- **Prior to extraction commencing in Phase B, a Brook Trout monitoring plan be developed for Sage Creek. The plan should include electrofishing surveys with a standard effort to assess population stability as well as fall spawning surveys. Details of this plan should be prepared by a qualified professional once extraction has approached the Sage Creek and Tributary catchment areas.**
- **Updated baseline monitoring in Sage Creek and its tributaries must commence three (3) years prior to site clearing in Phase B. The baseline monitoring program is to be comprised of three (3) years of fish population monitoring (i.e., spawning surveys, fish population surveys) and a minimum of three longitudinal temperature and (electrical) conductivity surveys along Sage Creek.**
- **Based on the results of the baseline monitoring program, an appropriate long-term ecological monitoring program is to be developed for the purpose of demonstrating that no significant negative effects on fish habitat take place during the operational period of the quarry.**
- **Blast designs should be in accordance with Fisheries and Oceans Canada (DFO) *Guidelines for the use of explosives in or near Canadian fisheries waters* provided in Appendix 9.**
- **A qualified professional should be retained to prepare a blasting plan that is compliant with DFO regulations.**

Habitat of Endangered and Threatened Species

- **Specialized barrier fencing for reptiles must be erected at the limit of extraction for each phase. This fencing is to be consistent with provincial guidance documents.**
- **The specialized barrier fencing for reptiles is to be installed to match the proposed phasing. Clearing and stripping should be completed for a given phase followed by the installation of the barrier fencing around the new perimeter. This fencing should be removed and re-installed as extraction progresses to match the proposed phasing.**

- **Removal of trees within the extraction limit should only occur between October 15 and April 15 to avoid the active season for Endangered Bat species.**

- **Removal of vegetation should occur in a phased manner that matches the phasing plan.**

Significant Wildlife Habitat

- **Wetland communities of no less than 14.9 ha must be provided in the Rehabilitation Plan (see Section 5.7.1 for additional details).**

- **Water depths within a portion of the created wetland should be variable and include deep pockets of sufficient depth to prevent freezing completely to the bottom (these areas will have the potential to function as turtle hibernation habitat). Substrates within these deep pockets should be primarily comprised of muck and other fine sediments.**

- **Wetland removal within the proposed extraction area must not occur during the turtle hibernation season (Oct 1 to May 15).**

- **Prior to commencing extraction activities in Phase A, removal of wetlands within the proposed extraction area should occur in two stages to minimize impacts on species using the features. Stage 1 is to occur in July and involves the draining of the wetland feature only (i.e., mechanical clearing of vegetation, grubbing, stripping etc. should not occur until Stage 2). Draining the wetland first will remove the function of this community for turtles at a time that allows for individuals within the wetland to move to alternative habitats prior to the fall hibernation season. The wetland must be maintained in a dry state for one hibernation season (one winter) prior to proceeding to Stage 2. Stage 2 should begin no earlier than June of the year following the completion of Stage 1.**

- **Following the Stage 1 drawdown described above, every effort should be made to collect and relocate any turtles found in the wetland feature, as some individuals may choose to remain.**

- **The specialized barrier fencing for reptiles is to be installed to match the proposed phasing. Clearing and stripping should be completed for a given phase followed by the installation of the barrier fencing around the new perimeter. This fencing should be removed and re-installed as extraction progresses to match the proposed phasing.**

- **Tree removal within the remaining portions of the licence should proceed in a phased manner to minimize the extent of vegetation removal to the extent possible.**

- **Removal of trees within the extraction limit should only occur between October 15 and April 15.**

Other Natural Features and Functions

- **A variable width protective buffer should be established around the wetland, associated with Sage Creek Tributary 6 (Figure 6). Generally, this buffer will be 30 m with the exception of the area adjacent to the existing road. Barriers delineating the features and buffer should be installed. Should extraction activities require the relocation of the existing road, the section of the road located within the buffer setback area shall be restored to a natural state**

- **Buffers should be protected from rock shatter and/or physical disruption through proper blast design, blast orientation, and monitoring.**

Rehabilitation

- **Prior to removing any portion of the fen community, including alterations to the water balance in that community, a new 4.2 ha wetland should be created adjacent to the Muskoka River (see Site Plans prepared by MHBC).**

- **Approximately 50% of the wetland should have maximum depth of 2.5 m (wet depth) during average water levels and contain a minimum sustained water depth of 1.0 m during annual low water conditions.**

- **Slopes surrounding the wetland should be variable but to permit access by a variety of species, slopes should not exceed 3:1.**

- **Basking structures constructed from natural features (e.g., rock piles, logs, rootwads, etc.) are to be placed in the wetland and along its edges. The diameter of logs should vary to permit use by small and large turtles.**

- **Where used, logs and rootballs are to be placed at a variety of angles and water depths. The majority of these features are to extend from the wetland edge into the open water areas. Only a small number of logs or rootballs should be placed parallel to the shoreline.**

- **Where possible, logs features that are installed, should contain limbs. Where available, full trees (canopy and root ball) should be used as basking structures.**

- **Substrates within the wetland should be dominated by 'muck' organics, especially in the deeper sections of the wetland.**

- **The wetland is to be planted with a variety of aquatic and emergent vegetation. Where possible, species that will produce floating mats of vegetation should be prioritized. A list of suitable wetland vegetation is provided in Table 7.**

- **Wetland communities of no less than 14.9 ha be provided in the Rehabilitation Plan in Phase A2.**

- **The edge of created wetlands should be variable.**

- **Water depths within the wetland should be variable; however, a minimum of 25% of the area should be constructed to provide minimum water depths of 1 m during low water conditions.**

- **Slopes, substrates, and basking structures are to be included in the 14.9 rehabilitation wetland as per the above recommendations for the 4.2 ha wetland proposed for construction adjacent to the Muskoka River.**

- **Following the closure of the quarry/pit site, terrestrial rehabilitation will be required in some areas. The list of plant species provided below (Table 8) should be included in the progressive rehabilitation plan to allow for naturalization that blends with the adjacent natural features buffers.**

- **Rehabilitation of the terrestrial portions of the quarry should include the creation of cliff and talus slope areas along the eastern edge of the extraction area.**

- **Rehabilitation of Phase A2 should include both wetland and terrestrial communities.**

- **Where possible, terrestrial communities within the Phase A2 area should be rehabilitated using fines and other organic material available on site to provide variations in the topography and therefore encourage growth of new plant life.**

- **Where planting is to occur within the rehabilitation plan, terrestrial species outlined in Table 8 should be used.**

- **To permit wildlife to access both the restored terrestrial communities and wetlands located in Phase A, areas of no more than 3:1 slope should be included along the eastern boundary of the extraction limit as well as along the boundary between Phase A and Phase B.**

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1 BACKGROUND

RiverStone Environmental Solutions Inc. (hereafter RiverStone) was retained by Fowler Construction Company Ltd. (hereafter Fowler Construction) to prepare a Level 1 and 2 Natural Environment Report (NER) to support an application under the *Aggregate Resources Act* (ARA) and a Town of Bracebridge Zoning By-law amendment under the Planning Act. The expansion application relates to additional lands owned by Fowler Construction at the site known as Childs Pit/Quarry (License No. 918881) which is currently licenced and operating as a pit and quarry. It is our understanding that this assessment is required to provide the Ministry of Natural Resources and Forestry (MNRF) and the Town of Bracebridge with the information necessary to assess any impacts on the natural environment that may result from aggregate extraction in additional areas.

The proposed extension is directly south and adjacent to the current licenced area for Childs Pit / Quarry. The area proposed for inclusion in the extension is 163.1 ha and the proposed extraction area is 143.2 ha. The licence would also include setback reductions of 1.3 ha from the existing Childs Pit / Quarry, along the shared boundaries. It is legally described as Lots 15 and 16, Concession 10 and Part of Lots 14, 15, 16, and 17, Concession 9, Geographic Township of Macaulay, Town of Bracebridge, District of Muskoka.

This Natural Environment Level 1 and Level 2 Report has been prepared to address the requirements under the (ARA) for the current application and support applications under the Planning Act related to a proposed expansion. For the purposes of this NER, the "property" is defined as land owned by Fowler Construction for which the new licence is proposed (**Figure 1**). The "study area" for natural environment investigations includes the property (as defined above), adjacent lands to a distance of 120 m from the proposed licence boundaries, and (where appropriate) consideration of the surrounding landscape context.

1.1 Study Purpose

This Level 1 and Level 2 NER has been prepared as part of the requirements under the ARA and its associated regulation (O. Reg. 244/97) and policy standards. Per s. 7 of O. Reg. 244/97 pursuant to the ARA, licence applications must be made in accordance with the Provincial Standards (i.e., *Aggregate Resources of Ontario: Provincial Standards, Version 1.0*). Per the Provincial Standards a Category 1, Class A license (Pit Below Water) and a Category 2, Class A license (Quarry Below Water) licence application, must be supported by a NER, which may be either a Level 1 or Level 2 assessment depending upon the natural features present on or within 120 of the site. Under the ARA, a "site" is defined as "the land or land under water to which a licence or permit or an application therefor relates".

Per MNRF's Natural Environment Report Standards policy document (No. A.R. 2.01.07; OMNR 2006), the purpose of a Level 1 NER is to describe the existing natural environmental conditions on and within 120 m of the property (i.e., study area), and to determine whether any of the following features are present:

- Significant wetlands
- Significant habitat of endangered and threatened species
- Significant Areas of Natural and Scientific Interest (ANSIs)
- Significant woodlands (south and east of the Canadian Shield only)
- Significant valleylands (south and east of the Canadian Shield only)

- Significant wildlife habitat
- Fish habitat

When any of the above listed features are identified during the Level 1 assessment, a Level 2 NER is required to assess the potential for negative impacts on the identified feature(s) of significance. If potential impacts are identified, then the Level 2 assessment should provide recommendations for appropriate preventative, mitigative, and remedial measures. As certain features of significance as noted above have been documented within the study area, this NER will satisfy the requirements for both a Level 1 and Level 2 assessment. Given that the existing and proposed licence areas are located in Ecoregion 5E (i.e., on the Canadian Shield), significant woodlands and significant valleylands are not considered further herein.

In addition to satisfying the requirements for a Level 1 and 2 assessment under the ARA, this NER also includes an assessment of whether the activities proposed on the property conform to the natural heritage policies of the District of Muskoka Official Plan (Consolidation dated June 28, 2019), the Town of Bracebridge Official Plan (April 17, 2013), and other applicable environmental legislation and policies including the 2020 Provincial Policy Statement (PPS), *Endangered Species Act* (ESA), and *Fisheries Act* (see **Section 2.2**).

2 APPROACH AND METHODS

2.1 Personnel and Qualifications

Field investigations conducted between 2011-2013 were completed by Rob Willson, M.Sc. (species at risk, breeding birds, wetlands), Al Shaw, M.Sc. (water quality, fisheries), Bev Wicks, Ph.D. (water quality, ARA), Glenn Cunnington, M.Sc. (species at risk), Jeremy Prahl, B.Sc. (fisheries), and Laura Alward, Dipl. ET (vegetation communities, wetlands). Updated surveys conducted between 2016-2020 were completed by Matt Brown, B.Sc. (species at risk), Tristan Knight, MES (breeding birds, wetlands, vegetation, SWH), James Eyres, Dipl. E.T. (anurans, turtles, wildlife), Lasha Wilson, B.Sc. (Wildlife, Breeding Birds), and Craig Mann, H.BSc.F. (vegetation, fisheries).

The curricula vitae for the primary investigators are provided in **Appendix 1**.

2.2 Guiding Environmental Legislation and Policy

As described in **Section 1.1**, the primary policies directing this assessment are the ARA, District OP, and Town OP. The application being considered is a Category 1, Class A licence (Pit Below Water) and Category 2, Class A licence (Quarry Below Water), extracting greater than 20,000 tonnes per year. To assess whether the application satisfies other relevant federal, provincial, and municipal requirements with respect to the natural environment, the following policies (e.g., statutes, regulations, plans, guidance documents, etc.) were considered during both the field investigations and impact assessment:

- Federal *Migratory Birds Convention Act*, S.C. 1994, c. 22, including:
    - Migratory Birds Regulations.
- Federal *Fisheries Act*, R.S.C. 1985, c. F-14, amended on 2019-08-28 including:
    - *Applications for Authorization under Paragraph 35(2)(b) of the Fisheries Act Regulations*, S.O.R/2013-191

  - Fish and Fish Habitat Protection Policy Statement (August 2019)
- Federal *Species at Risk Act*, S.C. 2002, c. 29.
- Provincial *Aggregate Resources Act* (ARA), R.S.O. 1990, c. A.8, including:
  - Ontario Regulation 244/97: General
  - Provincial Standards of Ontario - Category 2 - Class A Quarry Below Water
  - Natural Environment Report Standards (A.R. 2.01.07)
- *Provincial Policy Statement*, 2020, pursuant to the *Planning Act*, R.S.O. 1990, c. P.13, including:
  - Significant Wildlife Habitat Technical Guide (OMNR 2000)
  - Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005 (OMNR 2010b)
  - Significant Wildlife Habitat Criteria Schedules for Ecoregion 5E, January 2015 (OMNRF 2015a)
- Provincial *Endangered Species Act* (ESA), S.O. 2007, c. 6, including:
  - Ontario Regulation 230/08: Species at Risk in Ontario List
  - Ontario Regulation 242/08: General
- District of Muskoka Official Plan (Consolidation dated June 28, 2019)
- Town of Bracebridge Official Plan (April 17, 2013)
- Town of Bracebridge Zoning By-law 2016-088 (November 30, 2016)

2.3 Information Sources Used to Assess Site Conditions

Information pertaining to the natural features and functions of the property and the surrounding lands was obtained from the following sources:

- **Town of Bracebridge Official Plan** (April 2013) for natural feature and natural hazard mapping, including:
  - Schedule A – Land Use
  - Appendix A – Environmental features and development constraints
- **Town of Bracebridge Zoning By-law 2016-088 (November 2016)** for natural feature mapping
- **District of Muskoka Official Plan** (June 2019) for natural feature mapping, including:
  - Schedule 5.1 – Land Use Designations
  - Schedule 5.2.2 – Streams and Evaluated Wetlands
  - Schedule 5.2.3 – Areas of Natural and Scientific Interest
- **MNRF Natural Areas Mapping and Natural Heritage Information Centre (NHIC) database** regarding information on occurrences of species at risk (SAR) and provincially tracked species (squares: 17PL20, 17PL30, 17PK29, 17PK39; accessed March 4, 2020, at: http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US

- **Online databases of the Ontario Breeding Bird Atlas (OBBA) project and the Atlas of the Breeding Birds of Ontario, 2001–2005** (Cadman et al. 2007a) regarding birds that were documented to be breeding in the vicinity of the study area during the 2001–2005 period (atlas square numbers: 17PL20, 17PL30, 17PK29, 17PK39)
- **Atlas of the Mammals of Ontario** (Dobbyn 1994) regarding records of mammals in the vicinity of the property.
- **Aquatic Species at Risk Maps** mapping generated by Fisheries and Oceans Canada (accessed March 4, 2020 at: http://www.dfo-mpo.gc.ca/species-especes/fpp-ppp/index-eng.htm)
- **Physiography of Southern Ontario** (Chapman and Putnam 2007) for information pertaining to the physiography and soils within the vicinity of the property.
- **Reid and Bergsma (1994)** regarding Natural Heritage Areas in the District Municipality of Muskoka; specifically, the Sage Creek Subaquatic Fan Natural Heritage Site
- **Henson and Brodribb (2005a)** regarding terrestrial biodiversity within the ecodistrict of interest
- **Phair et al. (2005)** regarding aquatic biodiversity within the tertiary watershed of interest
- **Glenside Ecological Services Limited (2009)** regarding species at risk habitat in the District Municipality of Muskoka
- **Great Lakes Conservation Blueprint for Terrestrial Biodiversity, Volume 2** (Henson and Brodribb 2005b) regarding terrestrial biodiversity within Ecodistrict 5E-8 (Huntsville).
- **Great Lakes Conservation Blueprint for Aquatic Biodiversity, Volume 2** (Phair et al. (2005) regarding aquatic biodiversity within tertiary watershed 2EC (Black River-Lake Simcoe).
- **Digital Ontario Base Maps** (OBMs; 1:10,000)
- **Historical and Current Aerial Photographs** of the study area.
- **Site Investigations** by RiverStone staff (see **Section 2.5**).

2.4 Technical Documents Reviewed

The following technical documents were reviewed and considered in preparation of this report

- **Level 1 and Level 2 Hydrogeological and Hydrological Assessments** for the Childs Pit/Quarry Extension, Town of Bracebridge, Ontario (June 2020), Golder Associates Ltd.
- **Planning Justification Report & Aggregate Resources Act Summary Statement** (June 2020), MHBC Planning Ltd.
- **Blast Impact Analysis** (May 2020), Explotech Engineering Ltd.
- **Aggregate Resources Act Site Plans** (June 2020), Prepared by MHBC

2.5 Site Investigations

The background biophysical information gathered as outlined in **Section 2.3** helped direct field data collection activities associated with multiple site investigations carried out by Riverstone staff. **Table 1** below details the site investigations and field surveys completed to support the NER between 2011 and 2018.

Table 1. Site visits and primary tasks.

Date	Primary tasks	Staff	Hours spent on site
Sep 22, 2011	Habitat assessment for species of conservation interest	Glenn Cunnington Laura Alward	6.25 6.25
Oct 5, 2011	Turtle surveys; habitat assessment for species of conservation interest; Ecological Land Classification	Rob Willson Laura Alward	6.0 6.0
Oct 11, 2011	Species at risk site assessment	Rob Willson	3.0
Nov 3, 2011	Search for groundwater seeps and electroshocking of Sage Creek; Ecosystem Land Classification, stream permanency	Al Shaw Laura Alward Jeremy Prahl	7.0 7.0 7.0
May 2, 2012	Turtle Surveys; habitat assessment for species of conservation interest; install temperature data loggers, stream permanency	Glenn Cunnington Rob Willson	5.75 5.75
May 10, 2012	Turtle and Red-shouldered Hawk Surveys; habitat assessment for species of conservation interest	Glenn Cunnington Laura Alward	4.0 4.0
May 15, 2012	Turtle Surveys; habitat assessment for species of conservation interest	Glenn Cunnington Rob Willson	3.5 3.5
May 17, 2012	Turtle Surveys; habitat assessment for species of conservation interest; Ecological Land Classification	Glenn Cunnington Laura Alward	2.5 2.5
Jun 10, 2012	Morning breeding bird surveys; habitat assessment for species of conservation interest	Rob Willson	4.5
Jun 24, 2012	Morning breeding bird surveys; habitat assessment for species of conservation interest	Rob Willson	4.25
July 4, 2012	Evening survey for Whip-poor-will and Common Nighthawk	Glenn Cunnington Laura Alward	2.5 2.5
July 5, 2012	Evening survey for Whip-poor-will and Common Nighthawk	Glenn Cunnington Laura Alward	2.5 2.5
July 18, 2012	Review of groundwater characteristics in tributaries to Sage Creek with hydrogeologist, stream permanency	Al Shaw	2.5
Sept 13, 2012	Ecological Land Classification; collect data from temperature data loggers	Laura Alward	4.5
May 23, 2013	Collect data from temperature data loggers	Laura Alward	0.75
Aug 14, 2013	Collect data from temperature data loggers	Laura Alward	1.0
June 9, 2016	Deploy bat detectors	Matt Brown	2.25

Date	Primary tasks	Staff	Hours spent on site
June 14, 2016	Re-positions bat detectors	Matt Brown	4.5
June 20, 2016	Retrieve bat detectors	Matt Brown	5.25
August 18, 2016	General site reconnaissance, survey of fen and other wetlands	Tristan Knight	7.0
September 28, 2016	Snake visual encounter surveys	Tristan Knight and Matt Brown	11.0
October 12, 2016	Snake visual encounter surveys	Tristan Knight and Matt Brown	8.0
April 26, 2017	Anuran calling surveys #1	Tristan Knight and James Eyres	7.75
May 30, 2017	Anuran calling surveys #2	Tristan Knight and Lasha Wilson	7.25
May 31, 2017	Turtle basking survey #1, incidental wildlife	James Eyres and Lasha Wilson	10.75
June 1, 2017	Turtle basking survey #2, incidental wildlife	James Eyres and Lasha Wilson	6.25
June 6, 2017	Turtle basking survey #3, incidental wildlife	James Eyres and Lasha Wilson	6.5
June 9, 2017	Turtle basking survey #4, incidental wildlife	James Eyres and Lasha Wilson	6.25
June 14, 2017	Turtle basking survey #5, incidental wildlife	James Eyres and Lasha Wilson	6.5
June 21, 2017	Breeding bird survey #1.1, incidental wildlife	Lasha Wilson	6.0
June 27, 2017	Breeding bird survey #1.2, incidental wildlife	Lasha Wilson	5.5
June 28, 2017	Anuran calling surveys #3	James Eyres and Craig Mann	6.0
July 4, 2017	Breeding bird survey #2.1, incidental wildlife	Lasha Wilson	5.0
July 5, 2017	Breeding bird survey #2.2, incidental wildlife	Lasha Wilson	5.5
August 28, 2017	Review of fish habitat and tributaries of Sage Creek	Tristan Knight, Bev Wicks	6.0
September 13, 2017	Site verification and review of Ecological Land Classification communities,	Craig Mann	9.0
September 21, 2018	Site meeting with Golder, review drainage features	Craig Mann, Kevin Trimble, Bev Wicks	13.5
April 20, 2020	Electroshocking of watercourse in the north portion of property and connecting watercourses	Craig Mann, Jenn LeMesurier	16.0

Evidence for the presence of a species (or use of an area by a species) was determined from visual and/or auditory documentation (e.g., song, call) and/or observation of nests, tracks, burrows, browse, skins, and scats (where applicable). Plant nomenclature is generally consistent with the Southern Ontario Vascular Plant Species List compiled by D. Bradley of the NHIC (revised edition, 2010; based on the Ontario Plant List by Newmaster et al. [1998]). Natural features of conservation interest (e.g., SAR habitat, etc.) were digitized and delineated in the field with a high accuracy GPS. Features of interest were photographed, and all information collected was catalogued for future reference. Representative photographs detailing onsite conditions are provided in **Appendix 2**.

Overall, the level of effort expended during the site investigations was considered adequate to document the natural features and functions with recognized conservation status occurring within the study area given the location and areal extent of the proposed activities and disturbances, keeping in mind the habitat-based approach described in **Section 2.5.3**.

2.5.1 Terrain, Drainage, and Soils

Geology is a significant factor in the formation of soil, the physical characteristics of a watershed, and ultimately surface water quality. The bedrock and overlying deposits influence surface runoff and infiltration, directly influencing the nutrient balance of receiving water bodies. Knowledge of the existing terrain in a given study area is important in understanding how a property and its associated natural environment will respond to development pressures. Drainage direction and the presence or absence of surface water features was determined based on a review of background information sources (e.g., Ontario Base Maps, etc.), on-site observations, and review of the hydrogeologic assessment which includes surface catchment analysis (Golder, 2020).The geophysical setting of this property was reviewed using OBMs, geological and soils mapping, and aerial photographs (**Figure 2** and **Figure 3**).

2.5.2 Surface Water and Groundwater

Surface water and groundwater investigations were principally performed by **Level 1 and Level 2 Hydrogeological and Hydrological Assessments for Childs Pit / Quarry, Bracebridge, Ontario** (June 2020), Golder Associates Ltd. The results of Golder's analysis are incorporated where applicable herein.

2.5.3 Habitat-based Approach

RiverStone's primary approach to site assessment is habitat-based. This means that our field investigations first focus on evaluating the potential for features within an area of interest to function as habitat for species considered potentially present, rather than searching for live specimens. An area is considered potential habitat if it satisfies a number of criteria, usually specific to a species, but occasionally characteristic of a broader group (e.g., several turtles of conservation interest use sandy shorelines for nesting, numerous fish species use areas of aquatic vegetation for nursery habitat). Physical attributes of a site that can be used as indicators of its potential to function as habitat for a species include structural characteristics (e.g., physical dimensions of rock fragments or trees, water depth), ecological community (e.g., meadow marsh, rock barren, coldwater stream), and structural connectivity to other habitat features required by the species. Species-specific habitat preferences and/or affinities are determined from status reports produced by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Cadman et al. (2007b), published and unpublished documents, and direct experience.

In instances where habitat features are such that either (i) a species presence cannot be easily determined through an assessment of habitat feature alone, or (ii) habitat features are such that they suggest a species may be present in an area where development is proposed and impacts are likely, RiverStone adds an additional level of rigor to our work by completing further species-specific assessments (e.g., Whip-poor-will call surveys, acoustic surveys for Bats, etc.) in accordance with applicable standard methods and protocols.

2.5.4 Vegetation

2.5.4.1 Vegetation Community Characterization

All vegetation communities within the property were mapped according to the Great Lakes-St. Lawrence (GLSL) Ecosite Fact Sheets (Wester et al. 2015), otherwise known as the "Provincial" Ecological Land Classification (ELC) system. The GLSL Ecosite factsheets represent refinements and a synthesis of several different protocols for describing vegetation communities (primarily forests) within Ecoregions 4 and 5 previously prepared by MNRF in the 1990's. ELC defines ecological units or "Ecosites" based on a hierarchy of influence involving several physical factors including climate (temperature, precipitation), flooding, disturbance regimes, and substrate (depth, texture, moisture, nutrients). ELC provides a common language to describe vegetation communities, which in turn facilitates the identification of vegetation communities likely to support features or functions of conservation interest.

Each Ecosite code consists of three (3) components. The first component is a 1-digit geographic range code; all Ecosites within the GLSL geographic range begin with the letter "G". The second component is a 3-digit Ecosite number that corresponds to a specific vegetation community. The third component is a 1- or 2-digit vegetation cover modifier indicating whether the dominant vegetation is tall treed (Tt), low treed (Tl), shrub (S), not woody (N), or not vegetated (X). For example, "G153N" refers to a rock barren community that is dominated by non-woody vegetation occurring within the Great-Lakes St. Lawrence geographic range.

The boundaries of wetland communities identified via ELC mapping were delineated in accordance with the "50% wetland vegetation rule" specified by the Ontario Wetland Evaluation System (OWES).

2.5.4.2 Vascular Plant Survey

A vascular plant survey consisting of a comprehensive area search ("wandering transects") occurred throughout the property. Additional effort was applied in areas with the greatest potential to support Species at Risk and provincially rare vascular plant species. Nomenclature and common names for the recorded vascular plant species are generally consistent with the Southern Ontario Vascular Plant Species List (Bradley 2013).

2.5.5 Wildlife

2.5.5.1 Anuran Calling Surveys

Anuran calling surveys were conducted in 2017 in accordance with the Marsh Monitoring Program for Surveying Amphibians(Bird Studies Canada 2009). This protocol involves the completion of three (3) surveys once per month between April and June from 30 minutes after sunset until approximately midnight. Appropriate weather conditions include no or very light precipitation and wind speed ≤3 on the Beaufort wind scale. As the study area is located within the central region (between the 43rd and

47th parallels), each survey must occur during the second half of the month (i.e., April 15-30, May 15-31, and June 15-30). A total of eleven (11) anuran calling stations were established by RiverStone and situated systematically across the study area to cover potentially significant anuran breeding habitats (**Figure 5**). Each station was surveyed for at least three (3) minutes.

2.5.5.2 Breeding Birds

Breeding Birds Surveys

Breeding bird surveys were conducted in 2012 and 2017 in accordance with the Ontario Breeding Bird Atlas (OBBA) protocol (Bird Studies Canada et al. 2001). Surveys were conducted within the appropriate season (May 24–July 10), time of day (between dawn and 5 hours after dawn), and weather conditions (no rain, wind speed ≤3 on the Beaufort Wind Scale). The study area was surveyed through wandering transects in 2012, with additional surveys consisting of twenty (20) point count stations surveyed in 2017 (**Figure 5**). Given the number of stations and the size of the study area, completion of each round of surveys required two (2) separate site visits. Surveys occurred for a minimum duration of 10 minutes at each station. The OBBA provides four breeding categories to accompany each observation:

> ***Observed:*** Species observed during its breeding season (no evidence of breeding).
>
> ***Possible Breeding:*** Includes any of the following observation types: 1) species observed in its breeding season in suitable nesting habitat, and 2) singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat.
>
> ***Probable Breeding:*** Includes any of the following observation types: 1) pair observed in their breeding season in suitable nesting habitat, 2) permanent territory presumed through registration of territorial song on at least two (2) days, a week or more apart, at the same place, 3) courtship or display between a male and a female or two (2) males, including courtship feeding or copulation, 4) visiting probable nest site, 5) agitated behaviour or anxiety calls of an adult, 6) brood patch on adult female or cloacal protuberance on adult male, and 7) nest-building or excavation of nest hole.
>
> ***Confirmed Breeding:*** Includes any of the following observation types: 1) distraction display or injury feigning, 2) used nest or egg shell found (occupied or laid within the period of the study), 3) recently fledged young or downy young, including young incapable of sustained flight, 4) adults leaving or entering nest site in circumstances indicating occupied nest, 5) adult carrying faecal sac, 6) adult carrying food for young, 7) nest containing eggs, and 8) nest with young seen or heard.

Nightjar Surveys

Nightjar surveys were conducted in 2012 in accordance with Cuthrell (2010). This protocol requires the completion of two (2) evening surveys (preferably within different lunar cycles) 30 minutes after sunset until moonset during periods when the moon is at least 90% illuminated. Each station is surveyed for at least three (3) minutes and only under appropriate weather conditions (i.e., temperature >10°C, no precipitation, little to no cloud cover, wind speed ≤3 on the Beaufort wind scale). A 5.3 km survey route was established by RiverStone through the study area to ensure that potential habitats that could support these species were appropriately surveyed (**Figure 5**). The two (2) surveys were completed on July 4 and 5, 2012.

2.5.5.3 Bat Maternal Roost Habitat Surveys and Acoustic Monitoring

Targeted surveys for Bats focused on identifying the presence of maternal roosts. Surveys followed the protocols outlined in OMNR (2010a) and OMNR (2011) as modified by Parry Sound District MNRF (MNRF 2016 Draft). Vegetation mapping using Ecological Land Classification (ELC) was used to guide the completion of onsite surveys (Protocol Step 1). Snags/cavity tree surveys were conducted during leaf off conditions and scoped based on vegetation mapping prepared in 2012 and updated in 2016 (Protocol Step 2). Acoustic surveys were then completed within the study area; however, as snag/cavity tree surveys did not yield any areas with significant numbers of snags, acoustic survey equipment was placed in areas where some snags were documented as well as in proximity to where development was proposed (Protocol Step 3). Acoustic equipment (Wildlife Acoustics SM4, Full Spectrum) was placed at ten (10) sites from June 9–June 20, 2016 (**Figure 5**). Individual sites were sampled for a minimum of five (5) nights with the location of individual acoustic equipment being moved to secondary sampling station at that time. This approach allowed for an increase in the total number of sites being sampled during the ten (10) nights of sampling completed within the property. Timing of surveys was selected as it corresponded with the roosting period for maternal colonies as outlined in (COSEWIC 2013). Acoustic monitoring was completed between sunset and sunrise each day using a SM3BAT digital song meter (Wildlife Acoustics) and an ultrasonic microphone (SMM-U1). Weather conditions were fair throughout the survey period (Protocol Step 4).

2.5.5.4 Turtles

Visual Encounter Surveys

Visual encounter surveys for turtles were conducted in 2011-2012 with updated surveys completed in 2017.
As provincially approved survey protocols for turtles were not in place in 2011-2012, RiverStone completed visual encounter surveys for these species at that time using visual encounter surveys in communities with the potential to function as overwintering habitat. In the fall of 2011, two (2) surveys were completed with a focus on general review of the habitat and seeking to identify individuals basking prior to hibernation. In the spring of 2012, four (4) wandering transects were completed through communities identified as potential turtle hibernation habitat in the fall of 2011.

Surveys completed in 2017 were done in accordance with both the *Occurrence Survey Protocol for Blanding's Turtle (Emydoidea blandingii) in Ontario* (OMNR 2014) and the *Occurrence Survey Protocol for Spotted Turtle (Clemmys guttata) in Ontario* (OMNR 2013). Notwithstanding a few small methodological differences, the Blanding's Turtle and Spotted Turtle protocols overlap considerably, allowing surveyors to complete both protocols at the same time. Both protocols involve conducting five (5) separate surveys spread out over a minimum three (3) week period between ice-out (i.e., April) and June 15 under appropriate weather conditions (e.g., generally sunny conditions, no rain). Although Spotted Turtle surveys can occur at temperatures of at least 6°C, all turtle visual encounter surveys were completed when air temperatures were at least 10°C since this is a requirement of the Blanding's Turtle survey protocol. Where possible, surveys were timed to target warm days following cool or inclement weather, which would increase the chances of encountering basking turtles. Vegetation communities and habitats with a potential to function as habitat (i.e., overwintering, basking, feeding) for species at risk turtles were surveyed.

2.5.5.5 Snakes

Visual Encounter Surveys

While incidental observations of snakes were recorded during the site investigations, targeted visual encounter surveys to determine presence and absence of snakes were completed in the fall of 2016 (**Figure 5**). The goal of these surveys was to identify locations snakes may be using for overwintering (i.e., hibernacula). These surveys are designed to target snakes late in the season when vegetative cover is minimal and thermal conditions result in snakes heading to or congregating at overwintering sites. During this period, surveys focus on observations of snakes coming in and out of overwintering sites to basking and discarded snake sheds. Visual encounter surveys were completed during the fall of 2016 to identify hibernacula within the study area. Surveys were completed when air temperatures were between 10-25ºC between 0900-1700h on days with less than 50% cloud cover and low winds (i.e., less than 24 kph) (OMNRF 2016).

2.5.5.6 Fish and Fish Habitat

Fish habitat was assessed during the site investigations included direct fish habitat (spawning, rearing, feeding, and cover habitat), and indirect fish habitat, which includes intermittent watercourses and drainage features that contribute food, water, or nutrients for fish, but which fish do not use directly.

Fish and aquatic habitat conditions were assessed based on background information sources in general accordance with the Ontario Stream Assessment Protocol (OSAP) (Stanfield 2010). More specifically, a modified-version of the OSAP Section 4, Module 1 (Rapid Assessment Methodology for Channel Structure) was employed; modifications to this OSAP module reflect the level of detail required given site conditions and the nature of the proposed works. OSAP is the most comprehensive and widely applied habitat assessment protocol for wadeable watercourses and was developed by MNRF. OSAP provides standard assessment techniques to characterize watercourses and their attendant fish and aquatic habitat at discrete locations. Useful site -specific information to collect includes channel structure, instream cover, substrate type, stability, type and density of riparian vegetation, and location of groundwater upwellings.

The flow characteristics (stream permanency) of watercourses were assessed. To determine stream permanency, observations of flow duration, instream vegetation, established channel, water temperature, and the presence of aquatic invertebrates were evaluated. Detailed methods are found in the Stream Permanency Handbook (Bergmann et al. 2005).

An assessment of the fish community using single pass electrofishing was completed on the property within Sage Creek and tributaries associated with the Muskoka River. The sampling reaches were not blocked at either end during the assessment. The purpose of the Sage Creek assessment was to document the fish community present to assist in determining the thermal regime of the creek. A coldwater fish community (i.e., presence of Brook Trout) would suggest that groundwater is a component of the baseflow, placing additional emphasis on protecting coldwater inputs. The purpose of the sampling of the Muskoka River tributaries was to determine if these features were fish habitat.

2.6 Identification of Natural Features of Conservation Interest

“Natural features of conservation interest” represent natural heritage features and habitats that have recognized status within the relevant planning jurisdiction in which an activity is proposed. For the purposes of the proposed ARA licence applications considered herein, natural heritage features and

habitats considered to be "of conservation interest" include those identified per ARA policies (see **Section 1.1**). The appropriate process for identifying such features is outlined below. As noted previously given that the study area is located in Ecoregion 5E (i.e., on the Canadian Shield), significant woodlands and significant valleylands are not considered further herein.

2.6.1 Significant Wetlands

MNRF's Natural Environment Report Standards policy document (No. A.R. 2.01.07; OMNR 2006) describes a "Significant Wetland" as follows:

> *A significant wetland is an area identified as provincially significant by the Ministry of Natural Resources (MNR) using evaluation procedures established by the Province, as amended from time to time.*

The presence or absence of Significant Wetlands within the study area was ascertained via assembly and review of relevant background information sources (per **Section 2.3**) and was further based on communications with MNRF.

2.6.2 Significant Habitat of Endangered and Threatened Species

MNRF's Natural Environment Report Standards policy document (No. A.R. 2.01.07; OMNR 2006) describes "Significant Habitat of Endangered and Threatened Species" as follows:

> *…the habitat, as approved by the Ministry of Natural Resources, that is necessary for the maintenance, survival, and/or the recovery of naturally occurring or reintroduced populations of endangered species or threatened species, and where those areas of occurrence are occupied or habitually occupied by the species during all or any part(s) of its life cycle.*

The term "significant" in the context of identifying the habitats of endangered and threatened species in Ontario relates to obsolete language included in previous, superseded versions of the PPS (2005) and ESA. Neither the current PPS (2020) nor ESA (2007) contain the terms "significant" in the context of identifying endangered and threatened species habitat. As such, all potential or confirmed habitats of endangered or threatened species within the study area are identified as appropriate without reference or consideration as to their "significance".

The presence or absence of endangered and threatened species habitat was ascertained via assembly and review of relevant background information sources (per **Section 2.3**) and the results of targeted and habitat-based assessments on-site (per **Section2.5.3**). The results of these assessments, as well as descriptions of the methodology and rationale employed are provided in **Appendix 3**.

2.6.3 Significant Areas of Natural and Scientific Interest (ANSI's)

MNRF's Natural Environment Report Standards policy document (No. A.R. 2.01.07; OMNR 2006) defines a "Significant Area of Natural and Scientific Interest" as follows:

> *A significant ANSI is an area identified as 'provincially' significant by MNR.*
>
> *ANSIs are ranked by the MNR as being of either provincial or regional significance. For the purposes of the Natural Environment report, significant ANSIs include only those ANSIs identified as provincially significant.*

The presence or absence of significant ANSI's within the study area was ascertained via assembly and review of relevant background information sources (per **Section 2.3**) and was further based on communications with MNRF.

2.6.4 Significant Wildlife Habitat

MNRF's Natural Environment Report Standards policy document (No. A.R. 2.01.07; OMNR 2006) defines "significant wildlife habitat" as follows:

> *'Significant' wildlife habitat is that which is ecologically important in terms of features, functions, representation or amount, contributing to the quality and diversity of an identifiable geographic area or natural heritage system.*

As outlined in the SWH Technical Guide (OMNR 2000) and supporting Ecoregion Criteria Schedules (OMNRF 2015a, 2015b, 2015c), SWH is composed of four principal components:

1. Seasonal Concentration Areas of Animals;
2. Rare Vegetation Communities or Specialized Habitats;
3. Habitat of Species of Conservation Concern; and
4. Animal Movement Corridors.

The process for identifying SWH is outlined in s. 9.2.3 of the *Natural Heritage Reference Manual* (OMNR 2010b). **Step 1** requires the answers to two questions:

A. Does the development proposed involve a trigger for significant wildlife habitat; and
B. Has any confirmed significant wildlife habitat been identified.

Triggers for significant wildlife habitat (question A) are outlined in s.9 of the Natural Heritage Reference Manual (OMNR 2010b) and include:

- Creation of more than three (3) lots through either consent or plan of subdivision;
- Changes in land use, not including the creation of a lot, that require approval under the Planning Act;
- Shoreline consent along a large inland lake, small inland lake or large river that is within 120 m along the shoreline of an existing lot of record or lot described in an application for subdivision or consent; and,
- Construction for recreational uses (e.g., golf courses, serviced playing fields, serviced campgrounds, and ski hills) that require large-scale modification of terrain, vegetation, or both.

If the development proposed involves a trigger (question A), the assessment of SWH proceeds to **Step 2**.

Confirmed SWH (question B) are areas that have been identified in existing planning documents (e.g., Official Plans) or by the MNRF. Where confirmed SWH is present, and the development proposed does not involve a trigger (question A), the assessment of SWH proceeds to **Step 4**.

Step 2 of the SWH assessment involves undertaking a more thorough analysis of features, functions, and habitats within the property and adjacent lands via Ecological Land Classification (see **Section 2.5.4**). The list of ELC codes generated for the property, adjacent lands, and additional lands is compared to those codes considered candidate SWH in the relevant Ecoregion Criterion Schedule (i.e., 5E, 6E, or 7E) in step 3. Where a positive match between an ELC Ecosite and candidate SWH exists, the area is considered candidate SWH.

Two options are available for candidate SWH: 1) the area may be protected without further study, or 2) the area may be evaluated to ascertain whether confirmed SWH is present. Evaluation may involve generating more detailed maps of vegetation cover or conducting surveys of the wildlife population within the candidate SWH including reproductive, feeding, and movement patterns. If the area is confirmed SWH, the final step in the process is the completion of an impact assessment to demonstrate that no negative impacts to the confirmed SWH or its function will occur. The impact assessment process is assisted by SWH Mitigation Support Tool (OMNRF 2014).

The results of our assessment are provided in **Appendix 4** with further details in **Section 3.7.3**. Where targeted on-site assessments were required to evaluate SWH, survey methods are outlined in **Sections 2.5.4** and **2.5.5**.

2.6.5 Fish Habitat

MNRF's Natural Environment Report Standards policy document (No. A.R. 2.01.07; OMNR 2006) defines "Fish Habitat" as follows:

> *Section 34 of the federal* Fisheries Act *defines 'fish habitat' as 'spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes'.*

The definition of "Fish Habitat" was revised during amendments to the *Fisheries Act* in 2013. The current *Fisheries Act* defines "fish habitat" as:

> *"…. water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas."*

The presence or absence of fish habitat was ascertained via assembly and review of relevant background information sources (per **Section 2.3**) and the results of targeted and habitat-based assessments on-site (per **Section 2.5.5.6**).

3 BIOPHYSICAL FEATURES AND FUNCTIONS

3.1 General Conditions

As illustrated by the 2008 aerial photography shown on **Figure 2**, the general area for the proposed new licence is composed of a mix of forested lands, wetlands, a large active pit and quarry, and adjacent rural residential properties. The north branch of the Muskoka River flows adjacent to a portion of the study area. The proposed expansion site is largely forested with a permanent coldwater creek, Sage Creek, located in the southern portion of the lands. Several other permanent and intermittent creeks, and some wetland features were also identified. There are several linear openings throughout the area including many gravel roads and a large hydro corridor (**Figure 4**). As well, there

are numerous trails throughout the property created by recent forest harvesting activities and for accessing all areas of the property.

3.2 Bedrock and Surficial Geology

The study area is located in the Georgian Bay Fringe physiographic region (Chapman and Putnam 1984). This region is described as having very shallow soil and bare rock knobs. The overburden that is present is typically a sandy soil and is identified as bedrock drift deposits that are thin and discontinuous. In general, the Georgian Bay Fringe has low relief and ranges in ground elevation from 350 m in the east to 177 m AMSL along Georgian Bay.

The surficial geologic conditions on the site are dominated by ice-contact stratified deposits of sands, silty sands and some gravel at varying depths across the study area **(Golder 2020)**. Overburden is relatively thin in the eastern portions of the study area and thicker in the north and western areas closer to the Muskoka River valley.

The Sage Creek Subaquatic Fan is located along the north branch of the Muskoka River on the eastern bank (**Figure 4**) and was recommended as a Natural Heritage Site in the Natural Heritage Evaluation of Muskoka by Reid and Bergsma (1994). The reason for the site's designation is that it is representative of "at least one landform type, process, or phase of development not adequately represented within existing protected areas" (Reid and Bergsma 1994). This geological feature is approximately 90 ha in size and contains sand and gravel deposits that have been shaped by glaciolacustrine processes resulting from the reduction of water levels in the Huron basin (Reid and Bergsma 1994).

3.3 Topography

The topography in the study area is depicted on **Figure 3**. The height of land occurs at approximately 335 m ASL with the lowest elevations at 295 m ASL, generally sloping from east to west towards the Muskoka River. A portion of the study area in the south slopes towards the steep ravine associated with the Sage Creek Valley.

3.4 Drainage, Surface Water, and Groundwater Conditions

The study area is situated in the Muskoka River watershed, with the main proximate surface water features being the North Branch of the Muskoka River to the west and Sage Creek to the south. The headwaters for Sage Creek occur in the Gilleach and Big Stephen Lakes approximately 4.81 km upstream of its confluence with the North Branch of the Muskoka River to the southwest of the study area (**Figure 4**). The catchment area of Sage Creek is 5,417 ha the Muskoka River is 148,820 ha (Golder, 2020).

Overland drainage proximate to the property is dominated by the North Branch of the Muskoka River, essentially flowing north to south, and Sage Creek, flowing east to west along the southern portion of the property and discharging into the Muskoka River. Overland flow from the property eventually reaches one of these watercourses. Golder (2020) identified six micro-drainage areas on the site, with part of the proposed licensed area draining into Sage Creek and part northwards to the Muskoka River via Muskoka Tributary North (see Figures 8& 9, Golder 2020).

Golder (2020) provides detailed descriptions of the hydrogeology and groundwater conditions in the study area. In general, the absence of large quantities of permeable overburden is noted, with groundwater for domestic wells drilled through to the bedrock. Groundwater flow in bedrock aquifers

is directed through fractures and both the shallow and deep bedrock have relatively low permeability, which limits groundwater flow. Shallow groundwater elevation ranges from approximately 295 m ASL in the southwest corner of the extension site, to 325 m ASL toward the northeast corner (see Figure 20 in **Golder 2020)**.

3.5 Vegetation

The study area lies within Ecodistrict 5E-8. The deciduous and mixed-forest communities found on the site are characteristic of this region (Henson and Brodribb 2005a). Ecological communities were characterized and delineated through a combination of aerial photo analysis and field investigations. These communities are mapped on **Figure 4**.

3.5.1 Vegetation Communities and Dominant Flora

Ecological land classification and floral surveys were conducted on the site on six occasions over three seasons. One (1) anthropogenic meadow community, ten (10) upland forest communities, and seven (7) wetland communities were identified on the site. A general summary of the vegetation communities present within the site is provided below.

3.5.2 Upland Communities

Dry, Sandy – Meadow – G030N

Two (2) areas of meadow are located in the southeast corner of the property. These communities are likely remnants of historic pastureland that have been maintained through clearing over the years. Presently they have been left to grow naturally. Vegetation species observed in this community include: Timothy (*Phelum pretense*), Orchard Grass (*Dactylis glomerata*), Common Milkweed (*Asclepias syriaca*), Common Yarrow (*Achillea millefolium*), Canada Goldenrod (*Solidago canadensis*), Cow Vetch (*Vicia cracca*) and regenerating White Spruce (*Picea glauca*), Balsam Fir (*Abies balsamea*), and Trembling Aspen (*Populus tremuloides*).

Dry, Sandy – Aspen-Birch Hardwood Forest – G040Tt

This vegetation community is in the southwest corner of the property on relatively level terrain. Due to the age of the community, lack of stumps and levelness it is assumed that this area was historically cleared and graded. Soil conditions are sandy and well drained. Vegetation species observed in the community include: Largetooth Aspen (*Populus grandidentata*), Trembling Aspen, White Pine (*Pinus strobus*), White Birch (*Betula papyrifera*), Balsam Fir, Sugar Maple (*Acer saccharum*), Spinulose Wood Fern (*Dryopteris carthusiana*), and Wild Sarsaparilla (*Aralia nudicaulis*)

Dry, Sandy – Oak Hardwood Forest – G041Tt

This vegetation community is in areas of thin soil with inclusions of bedrock outcrops. There are two (2) locations with this community on the property; in the northeast corner and the southwest corner to the east of the hydro corridor. Tree species present in the overstory consist of Red Oak (*Quercus rubra*), White Ash (*Fraxinus americana*), Sugar Maple, White Birch (*Betula papyrifera*) and White Pine (*Pinus strobus*). The shrub and herb layers are sparse with Downy Serviceberry (*Amelanchier arborea*), regenerating Red Oak, Wintergreen (*Gaultheria procumbens*), Northern Bracken Fern (*Pteridium aquilinum var. latiusculum*), Rose Twistedstalk (*Streptopus lanceolatus*), Wild Sarsaparilla, Eastern Teaberry (*Gaultheria procumbens*), Rough-leaved Rice Grass (*Oryzopsis asperifolia*), and Common Hairgrass (*Deschampsia flexuosa*)

Dry, Sandy – Mixedwood Forest – G043Tt

This vegetation community is located in the southwest corner of the property in an area with sandy, dry soil conditions and in the north central portion of the property in an area of deeper, dryer soils. This community is comprised of a mixture of deciduous trees within the canopy that consists of Sugar Maple, White Pine, White Birch, Yellow Birch (*Betula alleghaniensis*), and Balsam Fir. In the shrub and groundcover layers, Balsam Fir, Beaked Hazel (*Corylus cornuta*), New York Fern (*Thelypteris noveboracensis*), Northern Long-awned Wood Grass (*Brachelytrum erectrum*), Wild Sarsaparilla, Wild Lily -of-the-valley (*Maianthemum canadense*), Northern Starflower (*Lysimachia borealis*), Long-stalked Sedge (*Carex pedunculata*), and Rough-leaved Rice Grass (*Oryzopsis asperifolia*) are present.

Dry to Fresh, Coarse – Hemlock-Cedar Conifer Forest – G051Tt

This vegetation community primarily occurs in upland areas with deeper, loamy soils in the central portion of the property. The community is dominated by Eastern Hemlock with associated species of Yellow Birch, Red Maple (*Acer rubra*), Sugar Maple, Balsam Fir with shrub cover consisting of Eastern Hemlock. Ground cover is sparse with Wintergreen, Spinulose Wood Fern, and Wild Sarsaparilla being observed.

Dry to Fresh, Coarse – Red Pine-White Pine Mixedwood Forest – G054Tt

This vegetation community consist of a mixture of Sugar Maple, White Pine, White Birch, Yellow Birch, Balsam Fir trees through the south portion of the property. Bedrock dominated topography throughout this community has created a mix of bedrock outcrops with low lying areas between that have created inclusions of rock barren and hardwood swamp. Shrub and ground cover species present include New York Fern, Northern Long-awned Wood Grass (*Brachelytrum erectrum*), Long-stalked Sedge (*Carex pedunculata*), and Rough-leaved Rice Grass (*Oryzopsis asperifolia*)

Dry to Fresh, Coarse – Aspen-Birch Hardwood Forest – G055Tt

This community is located adjacent the Muskoka River and occurs in the southwest portion of the property. Soil conditions are moister with coarse fragments compared to communities directly to the north. Vegetation species observed in this community include: Largetooth Aspen, Trembling Aspen, Red Maple, White Spruce, White Pine, White Birch, Balsam Fir, Mountain Maple (*Acer spicatum*), Bush Honeysuckle (*Diervilla lonicera*), Northern Bracken Fern, Goldthread (*Coptis trifolia*), Spinulose Wood Fern, and Wild Sarsaparilla.

Dry to Fresh, Coarse – Maple Hardwood Forest – G058Tt

This community is a Sugar Maple dominated community that covers the majority of upland areas at upper elevations. Soil conditions are moderate with bedrock influenced topography resulting in inclusions of bedrock outcrops and hardwood swamp. In addition to Sugar Maple, vegetation present include scattered species of American Ash, Red Maple, Black Cherry, Red Oak. Yellow Birch, Ironwood (*Ostrya virginiana*), American Beech, Red Raspberry (*Rubus idaeus*), Common Blackberry (*Rubus allegheniensis*), Northern Long-awned Wood Grass, and New York Fern.

Dry to Fresh, Coarse – Mixedwood Forest – G059Tt

This vegetation community is very similar to G058 with vegetation, topography and soil conditions being relative consistent. However, Sugar Maple is not the dominant species but is disbursed within other tolerance hardwood and coniferous species. This community is spread throughout the central and

south portions of the property. Species present include: Sugar Maple, Red Oak, Red maple, Eastern Hemlock, Balsam Fir, American Beech, White Ash, White Pine, Largetooth Aspen, Downy Serviceberry, Northern Bracken Fern, Northern Starflower, Wild Lily-of-the-valley, Wintergreen, Wild Sarsaparilla, Rough-leaved Rice Grass, and Common Hairgrass.

3.5.3 Wetland Communities

Organic Rich Conifer Swamp – G129Tt

This vegetation community is located in one (1) spot in the east-central portion of the property and extends onto adjacent lands. Organic soil conditions along with wetland vegetation was present. Vegetation species present include: Black Spruce (*Picea mariana*), Eastern Hemlock, Red Maple, Nannyberry (*Viburnum lentago*), Interrupted Fern (*Osmunda claytoniana*), Royal Fern (*Osmunda regalis*), Creeping Snowberry (*Gaultheria hispidula*), and Bunchberry (*Cornus canadensis*).

Intolerant Hardwood Swamp – G130Tt

Hardwood swamp is present as one (1) large community in the central portion of the property along with several inclusions throughout the central portion. These communities are likely a result of bedrock dominated topography creating depressions that hold water. Vegetation species observed in this community include: Black Ash (*Fraxinus nigra*), Red Maple, Yellow Birch, Balsam Fir, Eastern Hemlock, Speckled Alder (*Alnus incana ssp. rugosa*), Mountain Holly (*Ilex mucronatus*), Interrupted Fern, Long Beech Fern (*Phegopteris connectilis*), Northern Bugleweed (*Lycopus uniflorus var. uniflorus*), Sensitive Fern (*Onoclea sensibilis*), Dwarf Red Blackberry (*Rubus pubescens*), Bare-stem Miterwort (*Mitella nuda*), Northern Starflower, Fringe Sedge (*Carex crinita*), and Narrowleaf Cattail (*Typha angustifolia*).

Mineral Thicket Swamp – G134S

Thicket swamp vegetation community on the property are confined to a narrow strip along the shore of Sage Creek, a tributary to the Muskoka River in the south portion of the property. Species observed in this community include: Speckled Alder, Mountain Holly, Northern Wild Raisin (*Viburnum cassinoides*), Common Elderberry (*Sambucus canadensis*), White Meadowsweet (Spiraea *alba*), Canada Blue-joint (*Calamagrostis canadensis*), Narrow-leaved Burreed (*Sparganium emersum*), Blue Flag Iris (*Iris versicolor*), Royal Fern, Sensitive Fern, and Fringed Sedge (*Carex crinita*)

Poor Fen – G139N

Poor fen vegetation community is located in the northwest corner of the property and continues off the property to the north and west. This community is part of a larger wetland with open water in the centre and transitioning to rich fen to the outside. Vegetation species observed in this community include: Leatherleaf (*Chamaedaphne calyculata*), Sweet Gale (*Myrica gale*), Labrador Tea (*Ledum groenlandicum*), Sphagnum Moss (*Sphagnum spp.*), Few-seeded Sedge (*Carex oligisperma*), Virginia Cottongrass (*Eriophorum virginicum*), and Pitcher-plant (*Sarracenia purpurea*).

Open Moderately Rich Fen – G140S

Open moderately rich fen is located to in the northwest corner of the property and transitions from the poor fen community. This community is similar to a poor fen; however, tree species are present along with fen shrub species. Vegetation species observed in this community include: Tamarack (*Larix*

laricina), Black Spruce, Leatherleaf, Sweet Gale, Labrador Tea, Black Chokeberry (*Aronia melanocarpa*), Sphagnum Moss (*Sphagnum spp*.), and Few-seeded Sedge.

Mineral Meadow Marsh – G142N

Mineral meadow marsh is present on the property in the northeast corner. This community was likely historically flooded by beaver and is presently seasonally wet. Observations of this community in the spring and fall suggest that there is limited areas of open water and that water depths within the community are typically less than 0.3 m. Species present in this community include: Fowl Glyceria (*Glyceria striata*), Narrow-leaved Burreed (*Sparganium emersum*), Three-way Sedge (*Dulichium arundinaceum*), and Small-fruited Bulrush (*Scirpus microcarpus*)

Mineral Rich Conifer Swamp – G224Tt

Located in the central portion of the property is an Eastern Hemlock dominated swamp. This swamp is likely the result of bedrock influenced topography that has created low lying conditions between bedrock high points. During high water conditions, this community drains to the north through a series of low troughs. In addition to Eastern Hemlock, species observed in this community include: Black Spruce, Yellow Birch, Interrupted Fern, Spinulose Wood Fern, Sphagnum Moss, Wild Sarsaparilla, Northern Starflower, Bluebead Lily (*Clintonia borealis*), Creeping Snowberry, Goldthread, and Three-seeded Sedge.

3.5.4 Vascular Plants

A total of two-hundred and forty-six (246) vascular plant species were recorded on the property during field investigations. No species at risk vascular plant was recorded (either provincially or federally), one (1) provincially rare species (i.e., S1, S2, S3) Lopsided Rush (*Juncus secundus*) S3 and three (3) locally rare species were noted to be on the property: Bent Northern Sedge (*Carex deflexa*), Common Hop Sedge (*Carex lupulina*), Marsh Willow-herb (*Epilobium palustre*). A list of vascular plant species documented by RiverStone is provided in **Appendix 5**.

3.6 Wildlife

Appendix 6 contains a list of the fauna documented by RiverStone within the study area during the various site investigations. A total of sixty-two (62) bird species, eighteen (18) mammal species, and thirteen (13) herpetofauna species (amphibians and reptiles) were documented.

3.6.1 Anurans

Anuran (i.e., frog and toad) calling surveys were completed by staff from RiverStone on April 26, May 30, and June 26, 2017. Anuran calling survey stations established by RiverStone are shown on **Figure 5**. The full results of RiverStone's anuran calling surveys are found in **Appendix 7**.

A total of five (5) anuran species were recorded during anuran calling surveys completed by RiverStone (**Appendix 7**). Of the eleven (11) stations surveyed on the first visit, it was determined that stations 5, 6 and 8 no longer provided adequate anuran breeding habitat and were not surveyed during the second survey. An additional four (4) stations, 1, 4, 9, and 11 were determined to no longer provide breeding habitat and were not visited during the third survey. Two (2) of the stations surveyed were found to contain three (3) or more species of calling anurans (**Appendix 7**). Spring Peeper (*Pseudacris crucifer*) and Wood Frog (*Lithobates sylvaticus*) were the most abundant anuran species recorded at (6 of 11 stations), with Gray Treefrog (*Hyla versicolor*) and American Toad (*Anaxyrus americanus*)

heard calling at two (2) stations. Green Frog (*Lithobates clamitans*) were only documented at one (1) station. The most productive station was #3 with four (4) different species (Spring Peeper, Wood Frog, Gray Treefrog, and Green Frog) heard calling. This was the only station with calls being heard during the third survey.

3.6.2 Breeding Birds

3.6.2.1 Breeding Bird Surveys

Breeding bird surveys in accordance with the OBBA were undertaken by RiverStone on June 10 and June 24, 2012 with additional breeding bird surveys undertaken on June 10 and June 24, 2017. The full results of these surveys are provided in **Appendix 8**.

A total of sixty-two (62) bird species were recorded during the breeding bird surveys and incidentally during site investigations. The assemblage and abundance of birds recorded during the OBBA surveys generally reflects the prevailing structure and composition of on-site vegetation communities. Bird species that breed and forage in deciduous forests and swamps were generally the most widely documented, and included Red-eyed Vireo (*Vireo olivaceus*), Veery (*Catharus fuscescens*), Great Crested Flycatcher (*Myiarchus crinitus*), Ovenbird (*Seiurus aurocapilla*), Yellow-bellied Sapsucker (*Sphyrapicus varius*), and American Redstart (*Setophaga ruticilla*). Areas with a greater abundance of woody understory vegetation and/or shrubs (i.e., thicket swamps or forest edges) contained species such as Common Yellowthroat (*Geothlypis trichas*), Chestnut-sided Warbler (*Setophaga pensylvanica*), and Song Sparrow (*Melospiza melodia*).

Two (2) significant bird species were recorded during the OBBA surveys. Eastern Wood-pewee (*Contopus virens*) is provincially designated special concern, was recorded at a total of five (5) stations and Canada Warbler (*Cardellina canadensis*) is provincially designated special concern, was recorded at one (1) station during breeding bird surveys in 2017 (**Appendix 8**) and was also noted during surveys in 2012 (**Appendix 6**). All observations of Canada Warbler were associated with the Sage Creek valley.

Twenty (20) additional bird species observed during breeding bird surveys and incidentally (*i.e., during non-bird related site investigations)* are listed as "areas sensitive" in the Significant Wildlife Technical guide (OMNR 2000). These species include, Broad-winged Hawk (*Buteo platypterus*), Veery (*Catharus fuscescens*), Hermit Thrush (*Catharus guttatus*), Brown Creeper (*Certhia americana*), Pileated Woodpecker (*Dryocopus pileatus*), Least Flycatcher (*Empidonax minimus*), Hairy Woodpecker (*Picoides villosus*), Scarlet Tanager (*Piranga olivacea*), Red-breasted Nuthatch (*Sitta canadensis*), White-breasted Nuthatch (*Sitta carolinensis*), Yellow-bellied Sapsucker (*Sphyrapicus varius*), Winter Wren (*Troglodytes troglodytes*), Blue-headed Vireo (*Vireo solitarius*), Blackburnian Warbler (*Dendroica fusca*), Magnolia Warbler (*Dendroica magnolia*), Black-and-white Warbler (*Mniotilta varia,* Ovenbird (*Seiurus aurocapillus*), Northern Waterthrushbird (*Seiurus noveboracensis*), Black-throated Blue Warbler (*Setophaga caerulescens*), and Black-throated Green Warbler *(Setophaga virens)*(**Appendix 6**).

3.6.2.2 Nightjars

Nightjar surveys occurred on the evenings of July 4 and July 5, 2012. The area of the nightjar survey is shown on **Figure 5**. No Whip-poor-will or Common Nighthawk were recorded during the evening surveys and neither species was observed incidentally during site investigations. Additional surveys were not completed due to the lack of potential habitat on the property. Based on the lack of habitat

and no calling being heard during targeted surveys, the likelihood that this species currently breeds within the study area is low.

3.6.3 Bats

Specific snags/cavity tree surveys were not completed due to the large size of the property. However, clusters of snags/cavity trees were noted during site visits in leaf off conditions in all treed vegetation communities to direct locations of acoustic monitoring stations.

RiverStone completed acoustic monitoring surveys at ten (10) locations within the study area in June of 2016; each location was surveyed for a minimum of five (5) nights to allow for better coverage of the study area given the number of available acoustic monitors. Acoustic detectors were deployed in areas where higher densities of snags were observed, as well as areas proposed for extraction. Locations of the equipment deployed are provided on **Figure 5**. Acoustic detections of "bat passes" are often used as a measure of relative abundance of bats in the study area (Miller 2001). Based on this, overall abundance of bats in the study area was found to be quite low (**Table 2**). Two (2) species of endangered bats were detected during the acoustic monitoring; these species were documented at multiple locations within the study area (**Table 2**). Because the spectrogram and vocalization characteristics for these Little Brown Bat and Northern Long-eared Bat are quite similar, and they use similar roosting sites, the recordings for these (2) species have been aggregated.

Table 2. Results of acoustic surveys for bats in 2016. See **Figure 5** for the location of surveys stations. Species at Risk are identified in **bold** text.

Survey Station	Start Date	End Date	Species Detection (# passes)
Bat 1	June 15 (PM)	June 20 (AM)	Hoary (3) Silver-Haired (4)
Bat 2	June 9 (PM)	June 15 (AM)	Silver-Haired (4) **Little Brown/Northern Long-eared (6)**
Bat 3	June 15 (PM)	June 20 (AM)	Big Brown (1) Eastern Red (2) Hoary (1) Silver-Haired (4) **Little Brown/Northern Long-eared (4)**
Bat 4	June 9 (PM)	June 15 (AM)	Big Brown (1) Hoary (4) Silver-Haired (1) **Little Brown/Northern Long-eared (6)**
Bat 5	June 15 (PM)	June 20 (AM)	Big Brown (2) Hoary (4) Silver-Haired (5) **Little Brown/Northern Long-eared (3)**

Survey Station	Start Date	End Date	Species Detection (# passes)
Bat 6	June 9 (PM)	June 15 (AM)	Big Brown (1) Hoary (1) Silver-Haired (4)
Bat 7	June 9 (PM)	June 15 (AM)	Hoary (1) Silver-Haired (4) **Little Brown/ Northern Long-eared (4)**
Bat 8	June 15 (PM)	June 20 (AM)	No bats detected.
Bat 9	June 15 (PM)	June 20 (AM)	Big Brown (1) Eastern Red (1) Hoary (9) **Little Brown/Northern Long-eared (1)**
Bat 10	June 9 (PM)	June 15 (AM)	Big Brown (1) Hoary (4) **Little Brown/Northern Long-eared (22)**

3.6.4 Turtles

3.6.4.1 Visual Encounters

Visual encounter surveys for basking turtles were completed in 2012 and 2017. A total of four (4) visual encounter surveys were completed for endangered and threatened turtles on the property in 2012 and five (5) surveys in 2017. Based on initial recognisance survey of the property, it was determined that the fen community in the northwest portion of the property (**Figure 4**) was the only community with the appropriate characteristics to support turtles. The wetland community located in the northeastern corner of the property, east of the existing haul route (**Figure 4**) did not contain sufficient water depths to provide overwintering or summer refugia habitat for turtles. As such, targeted surveys for turtles were not completed in this community.

Although observations of non-target Turtles (e.g., Painted Turtle) were also recorded, less effort was focused on these species, and the type of survey methodology employed (i.e., primarily transects along and through potential habitats) is less suited to identifying conspicuously basking individuals. Details pertaining to survey days in 2012 and 2017 are provided in **Table 3** with photos of representative site conditions within the surveyed community provided in **Appendix 2**. Painted Turtles and Snapping Turtles were observed during surveys with no Blanding's Turtle or Spotted Turtles encountered. Snapping Turtle is provincially designated Special Concern.

Table 3. Details of the visual encounter surveys for turtles completed in the study area in 2012 and 2017 by RiverStone. Locations of survey areas are provided on **Figure 5**.

Date	Feature	Weather Conditions		Species Observed by Station
May 2, 2012	Fen	Air Temp. Start (°C)	N/A	3 Painted Turtles
		Water Temp. (°C)	N/A	
		Beaufort Wind	1	

Date	Feature	Weather Conditions		Species Observed by Station
		Cloud Cover (%)	100	
		Survey Length (min)	N/A	
May 10, 2012	Fen	Air Temp. Start (°C)	12	6 Painted Turtles
		Water Temp. (°C)	N/A	
		Beaufort Wind	3	
		Cloud Cover (%)	20	
		Survey Length (min)	120	
May 15, 2012	Fen	Air Temp. Start (°C)	N/A	2 Painted Turtles
		Water Temp. (°C)	N/A	
		Beaufort Wind	1	
		Cloud Cover (%)	N/A	
		Survey Length (min)	N/A	
May 17, 2012	Fen	Air Temp. Start (°C)	12	5 Painted Turtles
		Water Temp. (°C)	N/A	
		Beaufort Wind	2	
		Cloud Cover (%)	40	
		Survey Length (min)	60	
May 31, 2017	Fen	Air Temp. Start (°C)	16	Area #1 – 8-10 Painted Turtles
		Water Temp. (°C)	N/A	Area #2 - No Turtles Observed
		Beaufort Wind	3	
		Cloud Cover (%)	40	
		Survey Length (min)	120	
June 1, 2017	Fen	Air Temp. Start (°C)	9-15	Area #1 – 3 Painted Turtles
		Water Temp. (°C)	19	
		Beaufort Wind	3	Area #2 – Not surveyed, lack of habitat
		Cloud Cover (%)	40	
		Survey Length (min)	120	
June 6, 2017	Fen	Air Temp. (°C)	15-22	Area #1 – Painted Turtles – Snapping Turtles
		Water Temp. (°C)	14-23	
		Beaufort Wind	1-2	Area #2 - Not surveyed, lack of habitat
		Cloud Cover (%)	0	
		Survey Length (min)	120	
June 9, 2017	Fen	Air Temp. Start (°C)	23	Area #1 – 2 Painted Turtles – 3 Snapping Turtles
		Water Temp. (°C)	21	
		Beaufort Wind	3	Area #2 - Not surveyed, lack of habitat
		Cloud Cover (%)	50	
		Survey Length (min)	120	
June 14, 2017	Fen	Air Temp. Start (°C)	20-24	Area #1 – Snapping Turtle – Snapping Turtle
		Water Temp. (°C)	19	
		Beaufort Wind	2	Area #2 - Not surveyed, lack of habitat
		Cloud Cover (%)	10	
		Survey Length (min)	120	

3.6.5 Snakes

3.6.5.1 Visual Encounters Surveys

RiverStone staff completed visual encounter surveys for snakes on September 28 and October 12, 2017. These surveys targeted six (6) locations in the southwest and southeast portions of the study area (**Figure 5**). Weather conditions during the September 28 survey had an air temperature of 18-21ºC with 10% clouds and a Beaufort of 3 and the October 12 survey had air temperatures of 16–28ºC with 0-10% clouds and a Beaufort of 1-2.

No basking snakes or snake-skin sheds were observed during the September 28 survey. The October 12th survey identified two (2) Eastern Gartersnakes (*Thamnophis sirtalis sirtalis*), one (1) Northern Ring-necked Snake (*Diadophis punctatus*). An additional eight (8) snake skins that had been shed were observed in the vicinity of the snake observations. Results of these surveys suggest that there is a low likelihood that any significant snake hibernacula are present within the study area.

3.7 Natural Features of Conservation Interest (PPS and ARA)

Based on the biophysical information collected during background information gathering (per **Section 2.3**) and the multiple site investigations completed by RiverStone between 2011–2020 (per **Section2.5**), **Table 4** below summarizes the status of natural features of conservation interest within the study area:

Table 4. Status of Natural Features of Conservation Interest at Childs Pit / Quarry.

Features of Conservation Interest	Status of Feature of Conservation Interest within the Property	Status of Feature of Conservation Interest within the Study Area
Significant Wetlands	*Absent*.	*Absent*.
Habitat of Endangered and Threatened Species	*Present*. See **Section 3.7.2.**	*Present*. See **Section 3.7.2.**
Significant Areas of Natural and Scientific Interest (ANSI)	*Absent*.	*Absent*.
Significant Wildlife Habitat	*Present*. See **Section 3.7.4**	*Present*. See **Section 3.7.4.**
Fish Habitat	*Present*. See **Section 3.7.5.**	*Present*. See **Section 3.7.5.**

[1] - Shaded rows denote features of conservation interest for which negative impacts stemming from implementation of the proposed licence are possible.

3.7.1 Significant Wetlands

Based on the background information reviewed (see **Section 2.3**), and data available from Land Information Ontario (LIO), no provincially significant wetlands are present in the study area.

3.7.2 Habitat of Endangered and Threatened Species

The results of RiverStone's desktop, habitat-based, and targeted assessments for endangered and threatened species and their habitat are provided in **Appendix 3**. The preliminary screening identified the potential for twelve (12) endangered or threatened species to be present within the study area based on existing records and/or range maps. This initial list of species was further refined to those that had

the potential to be present or use communities within the study area (**Appendix 3**). Based on the results of this assessment, targeted surveys were completed for several species groups.

Per the results of the targeted surveys (**Section 3.6**) and **Appendix 3**, endangered and threatened species that have the potential to be impacted by the proposed ARA application considered herein are identified below in **Table 5**. An impact assessment is provided for each species in **Section 5.4.1**.

Table 5. Endangered and threatened species with the potential to be impacted by activities within the proposed licence area.

Species	Status per the *Endangered Species Act* (O. Reg. 230/08)-	Documented locations in the study area based on site investigations and field surveys
Eastern Hog-nosed Snake (*Heterodon platirhinos*)	Threatened	Not documented within the study area.
Little Brown Bat (*Myotis lucifugus*) /	Endangered	Bat acoustic surveying stations: Bat 2, Bat 3, Bat 4, Bat 5, Bat 7, Bat 9.
Northern Long-eared Bat (*Myotis septentrionalis*)	Endangered	Bat acoustic surveying stations: Bat 2, Bat 3, Bat 4, Bat 5, Bat 7, Bat 9.

3.7.3 Significant Areas of Natural and Scientific Interest (ANSI)

Based on the background information reviewed (see **Section 2.3**), and data available from Land Information Ontario (LIO), no Areas of Natural and Scientific Interest (ANSI) were identified within the property or study area.

3.7.4 Significant Wildlife Habitat

The results of RiverStone's desktop, habitat-based, and targeted assessments of potential features and communities that could function as significant wildlife habitat (SWH) per provincial policies is provided in **Appendix 4**. Three (3) communities or features with the potential to be SWH were identified. Based on the initial steps of our desktop analysis, twelve (12) special concern species had the potential to occur within the study area. Following review of the aerial photographs and onsite assessments, four (4) special concern species were documented or had the potential to use features found in the study area.

The following SWH features or communities have the potential to be impacted by the proposed ARA application considered herein. An impact assessment is provided for each SWH feature in **Section 5.4.2**.

- Seasonal Concentration Areas of Animals
    - Turtle Wintering Areas
- Specialized Habitats for Wildlife
    - Turtle and Lizard Nesting Areas
    - Seeps and Springs
- Habitat of Species of Conservation Concern
    - Special Concern and Rare Wildlife Species
        - Snapping Turtle (*Chelydra serpentina*)
        - Eastern Ribbonsnake (*Thamnophis sauritus*)

- Canada Warbler (*Wilsonia canadensis*)
- Eastern Wood-pewee (*Contopus virens*)

3.7.5 Fish and Fish Habitat

Fish habitat documented during site investigations included direct fish habitat (spawning, rearing, feeding, and cover habitat), and indirect fish habitat, including intermittent and permanent watercourses that contribute food, water, and/or nutrients to downstream habitats, but which fish do not use directly.

3.7.5.1 Sage Creek

In addition to the North Branch of the Muskoka River which is located to the west of the study area, the southern portion of the study area contains Sage Creek. Sage Creek generally flows from east to west through the southern portion of the property, extending from Bonnie Lake Road through to its confluence with the North Branch of the Muskoka River. Sage Creek drains approximately 5,417 ha to the east of Bonnie Lake Road, along with the majority of Lots 14-17, Concession 9 and Lot 17 Concession 10 in the study area. Information provided by the MNRF indicates that Sage Creek is likely coldwater, although no temperature monitoring or fish community data has been collected to confirm (Steve Scholten pers. comm. 2011).

A scientific collection permit was obtained for Sage Creek from the MNRF and the fish community was sampled by backpack electrofishing in the fall of 2011. Four reaches were sampled with a total of six species and 59 individuals collected over approximately 40 min of effort (**Table 6**). The downstream end of the upper reach had a significant elevation change, dropping approximately 3 m over a series of waterfalls acting as a barrier to upstream movement. The upper reach was approximately 4.5 m in width, depth ranging from 0.15 m to 0.55 m and characterized by large cobble and boulder substrates. Banks were partially undercut on the northern shoreline providing cover habitat. Brook trout were collected in this upper reach, suggesting the population has established above the barrier.

The central reach below the waterfalls was sampled in two locations, with Brook Trout collected at the second. This reach was characterized as being noticeably wider than the upper reach (approximately 6.0 m) with slightly smaller boulder and cobble substrates. The lengths of both central reaches were characterized by a uniform width and were comprised primarily of riffle habitats (**Appendix 2**). Small pools were common downstream of larger boulders providing holding habitats for many of the fish collected in the creek. No barriers to fish movement were observed within either central reach.

The lower reach of Sage Creek varied from the central and upper reaches primarily in width and riparian vegetation. The lower reach width varied between 4.0 m to over 6.0 m. The variable width originates from a bedrock constriction causing a meander in the creek and the presence of a wetland fringe on the northern shoreline (**Appendix 2**). The wetland fringe is dominated by speckled alder, extending from the creek edge to the access road.

Table 6. 2011 fish community sampling results from for Sage Creek. Location of sampling reaches are provided on **Figure 5**.

Site	Species Collected (# of individuals)	Effort (sec)	Staff
Upper Reach #1	Brook Trout (3) Common White Sucker (7)	600	Al Shaw Jeremy Prahl

Site	Species Collected (# of individuals)	Effort (sec)	Staff
	Creek Chub (16) Blacknose dace (1)		
Central Reach #1	Common White Sucker (8) Creek Chub (2) Rock Bass (1)	537	Al Shaw Jeremy Prahl
Central Reach #2	Brook Trout (3) Common White Sucker (3) Creek Chub (5) Blacknose Dace (1) Common Shiner (1) Pumpkinseed (1)	661	Al Shaw Jeremy Prahl
Lower Reach #1	Brook Trout (5) Creek Chub (2)	694	Al Shaw Jeremy Prahl

3.7.5.2 Tributaries of Sage Creek

Results of RiverStone's onsite investigation identified five (5) tributaries located within the proposed licenced area that all drain into Sage Creek. All five (5) tributaries were observed at various times of the year for key characteristics to determine their importance in terms of flow permanency, fish habitat and ultimately the need for protection. These characteristics include barriers to fish movement, flow permanency and thermal status (i.e., coldwater, warmwater).

Tributary 6 (SC-6, see **Figure 4**) is located furthest east, drains into the upper reach of Sage Creek on the southeastern boundary of the proposed licenced area. The creek drains a small wetland feature located approximately 400 m to the north. Based on our observations of water within the creek in fall, spring and summer, the creek is permanently flowing. Although during dry summer months flow was very low. Individual air and temperature readings (July 18, 2012) along with the small watershed area and permanent flow confirm that the creek is coldwater. The channel is braided with a poorly defined channel in close proximity to its confluence with Sage Creek (**Appendix 2**). Upstream, a barrier to fish movement created by steep slopes is encountered. Within the steep reach, water drains as sheet flow over flat bedrock, with the occasional pool. The small wetland feature upstream of the steep reach is relatively small with little open water. The wetland was observed to be the source of water for the creek. Based on our assessment, the creek is a permanently flowing, coldwater tributary, offering direct and indirect fish habitat.

Tributary 4 (SC-4, see **Figure 4**) enters Sage Creek downstream of Tributary 6. The creek channel is approximately 300 m in length. Based on our observations, flow is intermittent and is not observed during the summer months. If groundwater is a component of the baseflow for this Tributary, it is not sufficient to maintain flow throughout the year. The channel is steep between its confluence with Sage Creek and the road (**Appendix 2**). The road has created a small impoundment on the upstream (northern) side. The outlet on the southern side of the road is highly perched, before flowing down steep terrain toward Sage Creek. Upstream of the impoundment, the creek is steep, with occasional pools following exposed flat bedrock and boulders. Based on our assessment, Tributary 4 is an intermittent flowing coolwater tributary, offering indirect fish habitat.

Tributary SC-A (SC-A, see **Figure 4**) outlets into the central portion the assessed reaches of Sage Creek, downstream of Tributary 4. This feature is comprised of a series of channels that all merge and

outlet into a dug pond upstream of Sage Creek adjacent to the existing road (**Figure 5**). A single culvert conveys flows from Tributary SC-A under the road and down to Sage Creek. This culvert is perched at its outlet and represents a barrier to fish passage. Based on conditions observed along this feature, Tributary SC-A is best described as intermittent.

Tributary 3B (SC-3B, see **Figure 4**) outlets into SC-3 prior to its confluence with Sage Creek. This feature is best described as intermittent with its headwaters located within forest communities in an area of moderate to low slopes. As this feature makes its way towards Sage Creek, the slopes increase to as steep as 40%. Substrates within the feature are consistent with the surrounding forest floor and includes considerable leaf litter. Where pooled water was observed, depths did not exceed 0.1 m. This feature would only be considered contributing habitat by providing baseflow to Tributary 3B.

Tributary 3 (SC-3, see **Figure 4**) also discharges to the lower reaches of Sage Creek. The channel is well defined immediately upstream of its confluence with Sage Creek, averaging approximately 0.3 m in width with varying depth up to 0.3 m. Substrates within this tributary were sandy, with no areas of bedrock observed within the channel. To the north of the road, the channel becomes quite steep, maintaining its defined channel. Based on our assessment, flow within the channel is permanent, originating approximately 400 m upstream of Sage Creek. Temperature readings throughout the year characterize the creek as coldwater, likely fed by groundwater. Habitat within the channel is classified as direct habitat from Sage Creek to the road, then indirect upstream through the remainder of the tributary. The reach adjacent to Sage Creek can be directly accessed without barriers. This reach may offer refuge from Sage Creek during the spring freshet. During the summer site visit (July 18, 2012) Tributary 3 into Sage Creek was closely reviewed, given the prolonged drought conditions. The contribution of coldwater to Sage Creek was not significant in terms of volume; however, the thermal difference was quite evident. Based on our assessment, Tributary 3 is a permanent flowing coldwater tributary, offering direct and indirect fish habitat.

3.7.5.3 Tributary of Muskoka River

During onsite investigations a single watercourse was identified in the northern portion of the property. The Muskoka Tributary North (MR-North, see **Figure 4**), conveys flows from south of the existing haul route, northward through a wetland community located in the northeastern portion of the property. The watercourse extends into the existing licence located north of the property before turning west and outletting into the North Branch of the Muskoka River. The total catchment area of this watercourse is 182.7 ha (Golder, 2020), with 50.7 ha on the property. During site investigations this watercourse was found to be intermittent upstream of the existing haul route. North of the haul route, the watercourse flows through braided channels into a Mineral Meadow Marsh. At the outlet from the marsh the watercourse becomes a more defined channel through the narrow band of wetland. This watercourse downstream of the marsh is a permanent feature. Electrofishing completed in spring of 2020 did not identify any fish within the portions of the Muskoka Tributary North located within the property or immediately downstream. Based on this data, the Muskoka Tributary North is best described as a permanent feature that contributes base flow to portions of this feature located north of the property and eventually contributes base flow to the Muskoka River. It should be noted that MR-North within the existing license area has already been approved for extraction. As such, the connectivity of the portion of this feature on the proposed licence lands will be disconnected from the Muskoka River once extraction in the existing licence occurs in this area. The remaining portions of this feature located within the proposed licence will drain into the existing pit / quarry to be collected in the existing licence sump and discharged in accordance with MECP permits.

3.8 Other Natural Features

3.8.1 Muskoka Heritage Areas

3.8.1.1 Sage Creek Subaquatic Fan

The Sage Creek Subaquatic Fan is located along the north branch of the Muskoka River on the eastern bank and was recommended as a Natural Heritage Site in the Natural Heritage Evaluation of Muskoka by Reid and Bergsma (1994). The reason for the site's designation is that it is representative of "at least one landform type, process, or phase of development not adequately represented within existing protected areas" (Reid and Bergsma 1994). This geological feature is approximately 90 ha in size and contains sand and gravel deposits that have been shaped by glaciolacustrine processes resulting from the reduction of water levels in the Huron basin (Reid and Bergsma 1994). The Sage Creek Subaquatic Fan is located in the southwestern corner of the study area adjacent to both Sage Creek and the North Branch of the Muskoka River (**Figure 4**).

4 PHASING AND OPERATIONS PLAN

Fowler Construction is applying for a new licence to expand the existing pit/quarry operations into the southern portion of their lands, as shown on **Figure 7**. The area to be licensed is 163.1 ha with an extraction area of 143.2 ha (**Figure 7**).

The Site Plan was prepared by MHBC, in consultation with Riverstone. Natural heritage considerations were added to the Site Plans as part of an iterative process between MHBC, RiverStone, and Golder. The proposed expansion would include a reduced setback along the common boundaries and is to be implemented in three phases. In general, extraction from the existing pit located on the adjacent licenced property will enter the proposed expansion area from the north with extraction progressing through each of the phases generally proceeding in a southerly direction. The proposed expansion will use the same entrance and exit that is located on Bonnie Lake Road and follow the same operational hours.

5 IMPACT ASSESSMENT AND RECOMMENDATIONS

Based on the results of the background information collected and field investigations as detailed in **Section 3**, in concert with the proposed extraction and phasing plan outlined in **Section 4** and the Rehabilitation Plan that forms part of the ARA Site Plans, the following sections provide an assessment of potential impacts to identified natural features of conservation interest and the natural environment overall. Key natural features of conservation interest along with recommended setbacks are shown on **Figure 7**.

5.1 Impact Assessment Approach

To carry out an ecological assessment of potential impacts associated with the proposed above water pit extraction activities within the property, RiverStone has employed the following approach:

1. *Predict* impacts to natural features and species of conservation interest based on the proposed pit extraction plan, including both direct and indirect impacts over all project life stages (i.e., operation to post-rehabilitation).
2. *Evaluate the significance* of the predicted impacts to natural features and species of conservation interest based on their spatial extent, magnitude, timing, frequency (how often), and duration (how long).

3. *Assess the probability or likelihood* that the predicted impacts will occur at the level of significance expected (e.g., high, medium, low probability).
4. Where the potential for negative impacts exists, ecologically meaningful *mitigation measures* are offered to avoid such impacts first, and where impacts cannot be fully avoided to minimize and/or compensate such impacts as appropriate.

Direct impacts are those in which there is a direct cause-effect relationship between a proposed activity within the pit/quarry extraction area on a natural feature or species. In the context of the ARA application considered herein, direct impacts largely pertain to the necessary removal of vegetation and habitats within the extraction area. Indirect impacts may include disturbance effects on wildlife communities on adjacent lands, or alteration of local water balance to off-site features. The major project phases for which impacts must be assessed include the operational phase and a post-rehabilitation phase. The operational phase has active extraction operations as well as maintenance of dewatered conditions with excess water being pumped out of the pit and quarry in accordance with MOECP permit to take water (PTTW) and environmental compliance approval conditions. The flood back phase is the period after cessation of extraction, during which the water table is allowed to return to natural (unmanaged) conditions and final rehabilitation commitments are fulfilled. The post-rehabilitation phase occurs when all rehabilitation activities are complete.

The natural constraints identified per requirements of the ARA,PPS, and District of Muskoka and Town of Bracebridge Official Plans, during this study that occur within or in proximity to the property are listed in **Table 4** in **Section 3.6.5**, and include 1) potential habitat of endangered and threatened species, 2) fish habitat, 3) significant wildlife habitat, 4) wetlands, and 5) a Muskoka Heritage Area.

The development of the Operational Plan for the licence expansion area, including the boundary of the licenced area, occurred following our assessment of the natural features and recommended areas for protection and buffering (see **Figure 6**). The complete Operational Plan provided as part of the Site Plan is presented conceptually to demonstrate compliance with the recommendations for protection of natural features on **Figure 7**.

The following assessment evaluates the potential for negative impacts resulting from the activities proposed as part of the ARA application, as well as mitigation measures to address the potential for negative impacts.

5.2 Water Quality and Quantity

5.2.1 Operational Conditions

The potential for surface water quality/quantity impacts was considered through the various phases of the proposed application. The baseline or existing conditions, against which the proposed application is assessed for potential impacts, include the existing licensed operation of the Childs Pit / Quarry to the interim quarry floor. This corresponds to Scenario 1 in the accompanying Golder Level 1 and Level 2 Hydrogeological and Hydrological Assessment. The largest surface water features considered herein are the Muskoka River North and Sage Creek which occur on lands adjacent to the property. Golder (2020) determined that "…runoff from the existing and proposed [catchment] areas are expected to increase flow by approximately 0.02% to the Muskoka River and 0.06% to Sage Creek during full development operations...". The overall flow changes to Sage Creek and the Muskoka River during the operational life of the pit and quarry will be negligable in light of the large surface flow contributions from upstream of the property to both systems.

The relative contribution of groundwater from the saturated zone on the property to Sage Creek is expected to gradually drop over the lifespan of the pit and quarry. At full build-out (end of scenario 2), this reduction will represent approximately 20% of the total catchment area of Sage Creek (Golder 2020). Groundwater discharge to Sage Creek adjacent to the site is expected to continue, but be gradually reduced during the operational phase. Groundwater and surface runoff from upstream of the site are expected to remain unchanged as a result of the proposed expansion. To the extent that upwelling points may exist in Sage Creek, groundwater exfiltration will continue, throughout the life of the pit and quarry, but pressures or volumes may be influenced.

There are numerous smaller surface water catchments located in the proposed extraction areas (**Figure 7**). In developing the design of the pit and quarry these surface water catchments located within the property and the proposed extraction areas were considered in detail. A drainage divide occurs on the property and separates the catchments that flow to the north outletting to the North Branch of the Muskoka River and those that drain to the south into Sage Creek (Golder 2020, Figure 9). During the development of the property and pit and quarry activities a minor change is proposed in the location of the catchment divide to allow for the proposed pit and quarry operations. Golder (2020) has determined this change would have negligible impacts on the water balance for the two major surface water features, namely the Muskoka River and Sage Creek.

In the northern catchment area, the existing licenced pit/quarry intercepts a large portion of the surface water catchment for MR-North. The majority of this surface water feature will ultimately become part of the quarry lake. The expansion licence will result in removal of the remaining headwaters of this same tributary, equivalent to an additional 31% of this feature's total catchment area. The residual portion of MR-North following extraction of the current and the proposed licence will be restricted to the reach between the extraction limit of existing Child's Pit/Quarry licence and its confluence with the North Branch of the Muskoka River. Water to this residual reach will be maintained via pit/quarry discharge through active pumping or passive discharge at flood back (Golder 2020, Figure 8). In this residual reach of MR-North Golder predicts that during active operations average annual discharge will gradually increase to 156% compared to baseline due to the increased catchment area, change in land use, and groundwater inflow to the pit and quarry that will be discharged to this feature. As part of this, RiverStone recommends that:

- **The ECA (see s9.3.2 of Golder 2020) be designed to protect the quality and quantity of water discharged to MR-North to protect fish and fish habitat.**

In the southern catchment five additional surface water features drain into Sage Creek to the south were identified. Two tributaries are permanent (SC-3 and SC-6) and three have intermittent characteristics (SC-3B, SC-A, SC-4) all providing baseflow to Sage Creek. In the design of the new pit and quarry licence, extraction elevations have been carefully managed in the Sage Creek catchment to maintain the drainage areas and ensure continuous uninterrupted gravity drainage to Sage Creek and the associated tributaries. During active operations it was determined (Golder, 2020) that the estimated annual average discharge would increase from approximately 3.1 L/s to 4.2 L/s for SC3 and from 5.4 L/S to 6.5 L/s for SC6 due to decreased evapotranspiration (forested to bedrock) and reduced infiltration**.** Detailed analysis was not completed for the three intermittent tributaries and they will continue to convey seasonal run-off on an intermittent basis.

The potential for groundwater impacts were reviewed by Golder (2020) and data collected in their study suggests that hydraulic gradients were typically downward. Additionally, all the local watercourses are primarily fed by surface waters, and not supported by significant groundwater. That

said, Golder predicted the change in land use and the extent of the groundwater level drawdown cone beneath the smaller tributaries may cause changes in these surface water drainage features. Golder (2020) also determined that SC-6 and SC-3 catchments would experience a decrease of groundwater discharge from 58.7 m^3/d to 30.3 m^3/d and from approximately 12.2 m^3/d to 0.2 m^3/d to the SC-6 and SC-3 catchments respectively, during full operations. Relative to baseline conditions groundwater discharge is expected to decrease from approximately 58.7 m^3/d to 42.3 m^3/d and increase from approximately 12.2 m^3/d to 16.9 m^2/d in SC-6 and SC-3 catchments respectively after rehabilitation. The fish habitat implications of this change from existing conditions are discussed in **Section 5.3.**

Golder undertook detailed flow monitoring and water quality sampling in surface water features on the property and determined that surface water flows contributed a greater volume than groundwater to these watercourses. Measured flows for Sage Creek and the associated tributaries are provided in Table 8 of the Golder (2020) report. These data were consistent with the field observations made by Riverstone staff, except for SC-6, which we identified as a permanent feature with the potential to provide direct fish habitat. This difference could result from the infrequent point in time observations collected by RiverStone or yearly variation. The Golder (2020) hydrographs for these tributaries indicate that water levels and discharge following precipitation does not show significant lag time which is consistent with the steep slopes found in the catchment areas.

The baseline water quality data collected from the surface water features during the hydrological study (Appendix H of the Golder 2020 report) were compared to the Provincial Water Quality Objectives (PWQO) and details regarding any detected exceedances described. During active operations the water quality of Sage Creek and the five tributaries must be protected from dust, spills, accidents, increased potential for erosion, and physical damage. A riparian buffer has been provided and water leaving the pit and quarry must be controlled. Once active operations and extraction commences in the Sage Creek catchment area, the new topography sloping towards Sage Creek will be developed. To ensure the water quality in sensitive downstream receivers is maintained following stripping of vegetation and soil and during active extraction in the Sage Creek catchment areas additional mitigation and controls including, swales, stormwater ponds, thermal mitigation etc. will be required. Protection of water quality from operational related impacts can be partially mitigated by the riparian buffers shown in **Figure 6**. Additional mitigation may be required to ensure the quality of water leaving the pit and quarry meets MOECP requirements for total suspended solids and maintains both the chemical and thermal properties of water prior to discharge to either the tributaries or Sage Creek.

The proposed operations will involve a continuation of water management and monitoring from the existing licensed pit and quarry. During operations, there will be a requirement to continue to dewater the work area to the North Branch of the Muskoka River. This discharge water will need to be of appropriate quality to ensure no negative impacts of aquatic life as approved by MOECP.

The water quality and quantity in the Muskoka River, Sage Creek, and the SC-3 and SC-6 tributaries are important in supporting coldwater fish and fish habitat as defined under the *Federal Fisheries Act*, thus mitigation measures need to be carefully designed and monitored and will require approval under the appropriate legislation prior to extraction activities moving forward. As detailed by Golder (2020), adverse effects on these surface waters are not expected during operations if appropriate mitigation is developed and implemented.

Golder has recommended a surface and ground water monitoring program designed to identify any potential effects of extraction and operations and allow for mitigative actions. RiverStone has reviewed

the Golder Proposed Monitoring Programs and provides the following additional recommendations to further address water quality and quantity:

- **The tributaries to Sage Creek and the associated wetlands should be excluded from the extraction area to the extent possible (Figure 6). In addition, an appropriate vegetated buffer/catchment area be established surrounding each tributary. The buffer/catchment area should be well-marked prior to the commencement of pit and quarry operations, and the buffer should remain in its natural state.**

- **Quarry discharge outlets, stormwater management ponds, and/or mitigation measures must be designed to maintain the chemical and thermal water quality properties supporting Brook Trout spawning and summer refugia habitat identified in Sage Creek and its tributaries through the Brook Trout Monitoring Program. The design and monitoring of these elements will be approved through a Permit to Take Water or Environmental Compliance for Industrial Sewage Works from MOECP.**

- **Appropriate sediment and erosion control measures should be used to prevent the erosion of unstable soils and the movement of sediment into watercourses; these measures should be in place prior to soil exposure and should be maintained whenever exposed soils are present.**

- **All stockpiled aggregates should be stored in a location that will prevent the movement of sediment laden runoff into the buffers, watercourses, and wetlands.**

- **All stockpiled topsoil/overburden should be stabilized as quickly as possible to minimize the potential for runoff.**

- **A qualified person should be retained to certify the adequacy of sedimentation and erosion controls for all Phases of pit and quarrying, and to inspect and ensure necessary repairs following winter thaws, spring freshets, and heavy rainfall events.**

- **The surface/ground water monitoring program be implemented as per the *Level 1 and 2 Hydrogeological and Hydrological Assessments (Golder 2020)*.**

The results of the monitoring programs should be reviewed by the appropriate professionals, as the results are received, and Fowler should be notified immediately if a problem is identified.

- **Vegetated catchment areas/buffers surrounding tributaries and Sage Creek should be protected from rock shatter and/or physical disruption through proper blast design, blast orientation, and monitoring.**

5.2.2 Floodback and Post-Rehabilitation Conditions

When active extraction ceases, quarry dewatering will be stopped to allow the water table to return to natural levels. The quarry lakes will gradually flood to an expected level of 295 masl. This floodback period will result in a temporary reduction of flow from the north quarry lake into MR-North until the quarry has completely flooded back and begins to overflow through a passive outlet. In addition, analysis of operational monitoring data and watershed conditions prior to cessation of pumping, will be used to determine ecological flow targets, and develop strategies to mitigate any temporary conditions. For example, temporary flow augmentation to MR-North may offset initial impacts associated with

cessation of dewatering. No measurable changes are anticipated further downstream in the North Branch of the Muskoka River

Once the flood back of the quarry and final rehabilitation are complete, a new steady state will develop in which the water table is within its natural range of annual variations, and excess water in the quarry lake drains passively into the tributaries. Golder predicts that the overland drainage patterns will not be significantly impacted for the North Branch of the Muskoka River, Sage Creek, SC-3, and SC-6 following rehabilitation. MR-North will be impacted as the water from the original feature will become part of the rehabilitated quarry lake with only the reach between the lake outfall and the Muskoka River remaining. During rehabilitation Golder (2020) predicts for the existing Childs Pit / Quarry and the expansion an increase in average annual discharge from 3.1 to 4.1 L/s for SC-3, and from 5.4 L/s to 6.0 L/s at SC-6, and a decrease of 0.11 % at Sage Creek.

In the period between this assessment and cessation of pumping, a number of other changes unrelated to the pit and quarry may occur in the watershed, including upstream land use changes, and climate change. The final rehabilitation plan also describes shallow shoreline and discharge features that will create aquatic habitat and connect the quarry lake to the surrounding ecosystem. Several areas of the quarry will be extracted to just above the expected water level (e.g., the quarry floor on the east half of Phase A will average 300 m ASL). A series of wetland areas will be created along the edges between submerged quarry floors and above water floors (north and west edges of Phase A2) that can be backfilled to create a gradation of shallow submerged, seasonally submerged, and emergent wetland and shoreline habitats. Berms will be created in portions of the wetlands to limit wind exposure and provide backwater areas and islets for a variety of wetland and terrestrial communities. In addition, nursery and refuge habitats for fish will result along with structural fish habitat along the boundary between littoral and deep-water zones.

To further guide the rehabilitation plan, RiverStone recommends that:

- **The final design of the quarry lakes must provide for overflow channels directed towards Sage Creek and the MR-North tributary. The final design of the channels should be developed with the assistance of a qualified professional and should provide end uses for fish and wildlife.**

- **Analysis of monitoring data must be undertaken prior to cessation of extraction to establish ecologically based flow requirements for the MR-North tributary between the limit of extraction and the North Branch of the Muskoka River to ensure adequate flow during the flood back period.**

5.3 Fish and Fish Habitat

The potential for negative impacts to fish and fish habitat comes primarily from land use change or construction practices that modify water quantity (baseflow), quality (chemical and thermal properties), or alters the physical structure within riparian buffers.

5.3.1 Muskoka Tributary North

Results of the onsite assessments concluded that the portion of the MR-North located on the property was not direct fish habitat. Removal of this feature as part of the proposed new licence will not therefore result in direct impacts to fish or fish habitat within the property. Removal of this watercourse, if not mitigated, could however, result in a change in the amount of baseflow contributed to the portions of the MR-North tributary located within the existing licence. Based on data provided

by Golder (2020), the proposed extraction plan on the extension lands will result in the removal of 31% of the catchment area of this tributary. To ensure that removal of the portion of the MR-North located on the property does not result in impacts to fish or fish habitat downstream, RiverStone recommends:

- **Baseflow must be maintained to the downstream portions of the MR-North tributary located downstream of the existing licence.**

Removal of the portions of the MR-North tributary that are located within the existing approved licence will be addressed through the approvals process required for that licence and is not addressed as part of the proposed licence application outlined herein.

5.3.2 Sage Creek and Tributaries

Our assessment concluded that Sage Creek is direct coldwater habitat for Brook Trout in addition to other fish species. Brook trout are recognized as species that is sensitive to change in water quality and requires cold clear waters, thus this species is further discussed here. Habitat for all life stages of Brook Trout are available within the reaches of Sage Creek included in this study. This species of fish has a strong association between spawning sites and groundwater upwellings, in addition to its cold-water thermal requirements. Spawning occurs in the fall from September through November in gravel substrates, with eggs developing over the winter before hatching in the spring. During this period, the eggs and developing embryos are sensitive to sedimentation and changes in dissolved oxygen. Throughout the warmer summer months Brook Trout seek out areas of groundwater upwellings or colder-cooler waters to survive waters that may become too warm for long term survival. Two of the five tributaries to Sage Creek are permanent and contribute cold-water to Sage Creek throughout the year and may provide refugia for Brook Trout near their confluence with Sage Creek.

The fish and fish habitat in Sage Creek and its tributaries can be protected by maintaining the catchment area of the creeks, maintaining appropriate buffers, or by proposing alternative mitigation measures. Buffering requirements relate directly to the maintenance of nutrient supplies and groundwater contributions. Many of the mitigation measures required to protect fish and fish habitat are also necessary to protect water quality and have been recommended above.

In addition to those recommendation above and to avoid contravention of the *Fisheries Act*, RiverStone recommends that:

- **Fisheries and Oceans Canada (DFO) be notified immediately if a situation occurs or if there is imminent danger of an occurrence that could cause serious harm to fish. If there is an occurrence, corrective measures must be implemented.**

- **Prior to extraction commencing in Phase B, a Brook Trout monitoring plan must be developed for Sage Creek. The plan should include electrofishing surveys with a standard effort to assess population stability as well as fall spawning surveys. Details of this plan should be prepared by a qualified professional once extraction has approached the Sage Creek and Tributary catchment areas.**
- **Updated baseline monitoring in Sage Creek and its tributaries must commence three (3) years prior to site clearing in Phase B. The baseline monitoring program is to be comprised of three (3) years of fish population monitoring (i.e., spawning surveys, fish population surveys) and a**

minimum of three longitudinal temperature and (electrical) conductivity surveys along Sage Creek.

- **Based on the results of the baseline monitoring program, an appropriate long-term ecological monitoring program is to be developed for the purpose of demonstrating that no significant negative effects on fish habitat take place during the operational period of the quarry.**

DFO has produced a series of standard recommendations to avoid causing harm to fish and fish habitat. These recommendations can be broken down into five (5) groups: Project Planning, Erosion and Sediment Control, Shoreline Re-vegetation and Stabilization, Fish Protection, and Operation of Machinery. The following standard recommendations and practices developed by DFO (**Section 5.2.1** to **5.2.5**) to avoid causing harm to fish and fish habitat, and additional recommendations provided by RiverStone are applicable to all works associated with the proposed project.

In addition to the need to maintain the quantity and quality of water for the purposes of protecting the aquatic life in the surface water features, it is also necessary to consider the potential for impacts directly related to blasting. There is evidence that detonation of explosives in close proximity to fish habitat can cause the "disturbance, injury and/or death to fish and marine mammals, and/or the harmful alteration, disruption or destruction of their habitats, sometimes at a considerable distance from the point of detonation" (Wright and Hopky 1998). Due to the proximity of extraction areas to fish bearing waters, RiverStone recommends that:

- **Blast designs should be in accordance with Fisheries and Oceans Canada (DFO) *Guidelines for the use of explosives in or near Canadian fisheries waters* provided in Appendix 9.**
- **A qualified professional should be retained to prepare a blasting plan that is compliant with DFO regulations.**

5.3.3 North Branch Muskoka River

Based on the Golder (2020) report the new licence will not result in measurable impacts to groundwater contribution to the Muskoka River nor are annual flow rates expected to change. The land use change associated with the surrounding landscape and pit and quarry dewatering have the potential to impact this receiver if not mitigated appropriately. Mitigation to address any redirected surface water flows/quarry discharge from the northern catchment will be addressed through the existing Childs Pit / Quarry licence. The potential for impacts to the Muskoka River from changes in the southern catchment on the property will be addressed with the measures included above for Sage Creek and its associated tributaries.

5.4 Natural Features of Conservation Interest

5.4.1 Habitat of Endangered and Threatened Species

As outlined in **Section 3.7.2**, three (3) endangered or threatened species were determined to be present or have the potential to be present within the study area.

5.4.1.1 Eastern Hog-nosed Snake

Eastern Hog-nosed Snakes naturally exist at low densities within a given population. The highly cryptic nature of this species coupled with low population densities make detecting this species difficult. Within the study area, outside of the proposed extraction, and the greater landscape, the

mosaic of ecological communities is suitable to function as habitat for the species. Additionally, the greater landscape contains considerable areas with limited road density, suggesting these habitats are available to Eastern Hog-nosed Snakes.

While recognizing the limitations in detecting this species during surveys, Eastern Hog-nosed Snakes were not documented within the study area during site investigations completed between 2011–2018. Given the extent of suitable habitat for this species in the study area and the surrounding landscape, and the location of the proposed licence, pit and quarry activity within the proposed extraction area is anticipated to have a low likelihood of impacting Eastern Hog-nosed Snakes. Additionally, the long-life span of the proposed pit and quarry activities, coupled with the proposed phasing will reduce the likelihood of impacts to individuals of this species. Recognizing the difficulties in detecting this snake through field surveys, and to reduce the potential for impacts to individuals in the unlikely event they travel through the study area, RiverStone recommends that:

- **Specialized barrier fencing for reptiles must be erected at the limit of extraction for each phase. This fencing is to be consistent with provincial guidance documents.**

- **The specialized barrier fencing for reptiles is to be installed to match the proposed phasing. Clearing and stripping should be completed for a given phase followed by the installation of the barrier fencing around the new perimeter. This fencing should be removed and re-installed as extraction progresses to match the proposed phasing.**

5.4.1.2 Little Brown Bat and Northern Long-eared Bat

Little Brown Bat and Northern Long-eared Bat were documented at seven (7) bat acoustic surveying stations (Bat 2, Bat 3, Bat 4, Bat 5, Bat 7, Bat 9, Bat 10) (**Figure 5**). The number of detections (i.e., "bat passes") at these stations are very low with most stations having less than five (5) detections. In reviewing the data further, it was noted that detections of these two bat species at all sites occurred sporadically throughout the survey periods and generally during the middle of the night. This timing suggests that a maternal roosting colony of these species is not present within the study area. Based on this assessment there is a low likelihood of impacts to potential roosting habitat for Little Brown or Northern Long-eared Bats by the proposed pit and quarry development. To further reduce the potential for impacts to these species, RiverStone recommends that,

- **Removal of trees within the extraction limit should only occur between October 15 and April 15 to avoid the active season for Endangered Bat species.**

- **Removal of vegetation should occur in a phased manner that matches the phasing plan.**

5.4.2 Significant Wildlife Habitat

Neither MNRF, the District of Muskoka Official Plan, nor the Town of Bracebridge Official Plan have identified SWH within the study area; therefore, no municipally-confirmed SWH is present within this area. RiverStone completed a habitat-based assessment of SWH features within the study area in accordance with the Ecoregion 5E Criteria Schedules (OMNRF 2015a). Results of this habitat-based assessment led to the completion of a number of targeted on-site surveys to address remaining information gaps to assess SWH. Based on the results of RiverStone's SWH assessment (see **Appendix 4**) and the targeted surveys (see **Sections 2.5.4** and **2.5.5**), the following SWH features were identified.

5.4.2.1 Seasonal Concentration Areas of Animals

Turtle Wintering Areas

Turtles overwinter in ponds, streams, and lakes. Ideal overwintering habitats provide low temperatures and high dissolved oxygen conditions but must not freeze to the bottom. Some species of Turtles, (e.g., Snapping Turtles) are able to overwinter in areas with limited dissolved oxygen. Based on the results of targeted onsite spring surveys, the fen community located in the northwestern portion of the study area (**Figure 4**) was determined to provide overwintering habitat for both Snapping Turtles and Painted Turtles (**Table 3**); the meadow marsh wetland located in the northeastern portion of the study area was not identified as a potential Turtle Wintering Area due to limited water depths within this community.

The primary wetland to be removed is comprised of two fen communities and is located in the northwest corner of the proposed licence expansion area; approximately fifty percent of the total area of the wetland falls within the existing licenced area (**Figure 4**). Approved extraction activities within the existing licenced area will result in the removal of portions of this feature and result in reductions to the ecological function of the wetland as significant wildlife habitat. The proposed licence expansion will result in the removal of the remaining half of the wetland, approximately 2.5 ha. At some point during the wetland removal, the area will cease to function as hibernation habitat (SWH) for turtles.

To mitigate the loss of the 4.2 ha of wetland community associated with the candidate SWH, 14.9 ha of new wetland will be created in the Rehabilitation Plan. This created wetland will ensure no net loss of SWH wetland from the property. Additional wetland offsets are discussed in **Section 5.6.1**. The general design of the constructed wetland to offset the loss of the fen will be such that approximately 25% of the wetland surface area will contain water depths greater than 1 m to provide a mixture of vegetation and open water. A 20 m buffer of undisturbed native vegetation will surround the wetland and will potentially provide habitat for snakes (e.g., Ribbonsnakes).

Adherence to the mitigation recommendations for species of conservation interest provided in **Section 5.4** will reduce the likelihood of negative impacts. Additionally, RiverStone recommends the following to offset potential negative impacts on the candidate SWH and its ecological function:

- **Wetland communities of no less than 14.9 ha must be provided in the Rehabilitation Plan (see Section 5.7.1 for additional details).**

- **Water depths within a portion of the created wetland should be variable and include deep pockets of sufficient depth to prevent freezing completely to the bottom (these areas will have the potential to function as turtle hibernation habitat). Substrates within these deep pockets should be primarily comprised of muck and other fine sediments.**

- **Wetland removal within the proposed extraction area must not occur during the turtle hibernation season (Oct 1 to May 15).**

- **Prior to commencing extraction activities in Phase A, removal of wetlands within the proposed extraction area should occur in two stages to minimize impacts on species using the features. Stage 1 is to occur in July and involves the draining of the wetland feature only (i.e., mechanical clearing of vegetation, grubbing, stripping etc. should not occur until Stage 2). Draining the wetland first will remove the function of this community for turtles at a time that allows for individuals within the wetland to move to alternative habitats prior to the fall**

hibernation season. The wetland must be maintained in a dry state for one hibernation season (one winter) prior to proceeding to Stage 2. Stage 2 should begin no earlier than June of the year following the completion of Stage 1.

- **Following the Stage 1 drawdown described above, every effort should be made to collect and relocate any turtles found in the wetland feature, as some individuals may choose to remain.**

5.4.2.2 Specialized Habitats for Wildlife

Turtle and Lizard Nesting Areas

Several Painted Turtle and Snapping Turtle individuals were recorded within the fen community located in the northwestern portion of the study area. This feature contains a mixture of open water and vegetation mats which provide suitable basking, feeding, and (presumed) overwintering habitat. Observations of predated turtle nests within the study area were recorded north of the fen community within the existing licence boundary. These nests were excavated in overburden piles and disturbed soils within 10 m of the edge of the Fen. Given the extent of forest cover within the study area, potential nesting habitat was limited to areas of disturbed soil associated with the existing approved licence area. As the existing turtle nesting habitat is present as a result of the approved quarry activities, the observed nesting areas should not be considered significant.

Seeps and Springs

Although no springs (i.e., areas of groundwater discharge where flow is visible) were identified anywhere within the study area, water temperatures and flows from several of the Sage Creek tributaries suggest that these features have groundwater contributions. Recommendations provided above in **Section 5.3** to address impacts to fish and fish habitat associated with these tributaries will also address potential for impacts to the ecological form and function of seeps and springs within the study area.

5.4.2.3 Habitat of Species of Conservation Concern

Special Concern and Rare Wildlife Species

Snapping Turtle

Snapping Turtle was observed on multiple occasions in the fen community located in the northwestern portion of the study area. Habitat for this species within the study area for this species is largely restricted to the fen community and the aquatic communities associated with the Muskoka River and Sage Creek. To protect Snapping Turtle and its habitat during implementation of the proposed pit extraction activities, RiverStone recommends that the measures outlined to protect turtle overwintering habitat (see **Section 5.4.2.1**) be implemented. In addition, RiverStone recommends that:

- **The specialized barrier fencing for reptiles is to be installed to match the proposed phasing. Clearing and stripping should be completed for a given phase followed by the installation of the barrier fencing around the new perimeter. This fencing should be removed and re-installed as extraction progresses to match the proposed phasing.**

Eastern Ribbonsnake

Eastern Ribbonsnakes are known to use habitats associated with wetlands, watercourses, ponds, and wet meadows (COSEWIC 2012b). Typically, this species is found in proximity to the water's edge of these communities where they actively forage for amphibians and small fish (COSEWIC 2012b). Within the study area, habitat for this species is primarily associated with the wetland communities and the riparian areas along the Muskoka River and Sage Creek. Recommendations provided within this report that address impacts to wetlands (**Section 5.6.1**) and watercourses (**Section 5.3**) are sufficient to address impacts to potential habitat for Eastern Ribbonsnakes within the study area.

Canada Warbler

Canada Warblers are found in a variety of forest communities; however, they preferentially select forested areas with a well-developed shrub layer (COSEWIC 2008). This species is most commonly found in moist, mixed aged forests and in ravines (COSEWIC 2008). Observations of this species within the project area are associated with the Sage Creek ravine. This area will be protected in the long-term through the approved Land Conveyance to the Muskoka Conservancy (**Figure 7**). To minimize potential for impacts to this species and its habitat within the study area, RiverStone recommends:

- **Tree removal within the remaining portions of the licence should proceed in a phased manner to minimize the extent of vegetation removal to the extent possible.**
- **Removal of trees within the extraction limit should only occur between October 15 and April 15.**

Eastern Wood-pewee

Eastern Wood-pewee breed in open forest communities that have limited understory (COSEWIC 2012a). This species is most abundant in intermediate to mature aged forests; however, the size of individual forest patches has not been identified as a factor in determining habitat use. The presence of perches (i.e., dead branches) within forests that can be used for foraging is required for this species to utilize a given forest patch (COSEWIC 2012a).

Although the proposed licence excludes portions of forest on the property, the proposed extraction would result in the loss of portions of a forest community that was identified as containing Eastern Wood-pewee. Given the extent of possible nesting habitat within the landscape surrounding the study area the loss of forest habitat is not anticipated to result in negative impacts to this species. Avoidance of vegetation removal during the active nesting season for this and other avian species (see recommendations for Canada Warbler) will further reduce the potential for negative effects arising from the proposed licence.

5.5 Areas with Recognized Conservation Significance

Sage Creek Subaquatic Fan is located along the north branch of the Muskoka River with portions of the feature extending onto the property (**Figure 4**). According to Reid and Bergsma (1994) the Sage Creek Subaquatic Fan is 90 ha in size. Mapping from the District of Muskoka has identified an area approximately 200 ha in area as the Sage Creek Subaquatic Fan (**Figure 4**). Of the 200 ha area mapped by the District, approximately 63 ha fall within the existing approved licence. A total of 18 ha of the District mapped Subaquatic Fan are within the proposed licence area, of which only 11 ha are

proposed for extraction. The remaining ~125 ha of the District mapped Subaquatic Fan are not identified for extraction.

It should be noted that according to Reid and Bergsma (1994), the Sage Creek Subaquatic Fan was identified as having less value than a Muskoka Heritage Area and is thus designated as a "site" rather than area. The designation of the Fan was not related to ecological features (i.e., biotic) but instead as a representative landform feature (i.e., physiographic). Based on this, removal of portions of the Sage Creek Subaquatic Fan are not anticipated to result in negative impacts to the natural environment as it relates to Muskoka Heritage Areas.

5.6 Other Natural Features and Functions

5.6.1 Wetlands

Results of the onsite assessments identified several wetland communities within the property (**Figure 4**). The proposed extraction plan will result in the removal of seven (7) wetland communities that cover a total of 14.87 ha which represents approximately 7% of the proposed extraction area (202 ha). Wetland communities to be removed include Conifer Swamp, Hardwood Swamp, Fen, and Meadow Marsh. Based on the results of targeted onsite assessments (see Section 3), the majority of wetlands being removed do not function as significant wildlife habitat, and are not habitat for endangered or threatened species. These wetlands are generally in locations of minor depressions in topography where water pools for periods of time during the year creating the moist soils that favour wetland species.

Several of the wetland communities that are proposed for removal extend off the property to the east on adjacent lands. RiverStone understands from communications with the hydrogeologists, that these wetland communities are not fed by the shallow groundwater table present in the bedrock and as such, removal of a portion of these communities will not result in negative impacts to the remaining portions of these wetlands that extend off of the property.

A small wetland is present in the southern portion of the proposed licence expansion area (**Figure 4**). This wetland is adjacent to the existing internal haul road that services the existing licenced area on the property. A small outlet from this wetland contributes flow to Sage Creek via Tributary 6 (SC-6). As this feature contributes flow to Sage Creek, RiverStone recommends the following mitigation measures to ensure no negative impacts on wetlands:

- **A variable width protective buffer should be established around the wetland, associated with Sage Creek Tributary 6 (Figure 6). Generally, this buffer will be 30 m with the exception of the area adjacent to the existing road. Barriers delineating the features and buffer should be installed. Should extraction activities require the relocation of the existing road, the section of the road located within the buffer setback area shall be restored to a natural state.**

- **Buffers should be protected from rock shatter and/or physical disruption through proper blast design, blast orientation, and monitoring.**

5.7 Rehabilitation

5.7.1 Wetlands

As outlined above, the proposed pit and quarry activities will result in the removal of wetlands from within the licence area. To address potential ecological impacts associated with the loss of the fen community and the associated ecological function of that community, RiverStone recommends that:

- **Prior to removing any portion of the fen community, including alterations to the water balance in that community, a new 4.2 ha wetland should be created adjacent to the Muskoka River (see Site Plans prepared by MHBC).**
- **Approximately 50% of the wetland should have maximum depth of 2.5 m (wet depth) during average water levels and contain a minimum sustained water depth of 1.0 m during annual low water conditions.**
- **Slopes surrounding the wetland should be variable but to permit access by a variety of species, slopes should not exceed 3:1.**
- **Basking structures constructed from natural features (e.g., rock piles, logs, rootwads, etc.) are to be placed in the wetland and along its edges. The diameter of logs should vary to permit use by small and large turtles.**
- **Where used, logs and rootballs are to be placed at a variety of angles and water depths. The majority of these features are to extend from the wetland edge into the open water areas. Only a small number of logs or rootballs should be placed parallel to the shoreline.**
- **Where possible, logs features that are installed, should contain limbs. Where available, full trees (canopy and root ball) should be used as basking structures.**
- **Substrates within the wetland should be dominated by 'muck' organics, especially in the deeper sections of the wetland.**
- **The wetland is to be planted with a variety of aquatic and emergent vegetation. Where possible, species that will produce floating mats of vegetation should be prioritized. A list of suitable wetland vegetation is provided in Table 7.**

Table 7. Vegetation species suitable for wetland creation and rehabilitation at the Childs Pit / Quarry Site.

Floating/Submerged	Emergent	Riparian
• White Water Lily (*Nymphaea Odorata*) • Yellow Pond Lily (Nuphar lutea ssp. Viriegata) • American Eel-grass (*Vallisneria americana*)	• Broadleaf Cattail (*Typha latifolia*) • Harlequin Blue Flag (*Iris versicolor*) • Canada Blue-joint (*Calamagrostis canadensis*) • Narrow-leaved Burreed (*parganium emersum*) • Pickerelweed (*Pontederia cordata*)	• Tamarack (*Larix laricina*) • Black Spruce (*Picea mariana*) • Speckled Alder (Alnus incana) • Mountain Holly (*Ilex mucronatus*) • Northern Wild Raisin (*Viburnum cassinoides*) • Common Elderberry (*Sambucus canadensis*) • Leatherleaf

	(*Chamaedaphne calyculata*) • Sweet Gale (*Myrica gale*) • White Meadowsweet (Spiraea *alba*) • Sensitive Fern (*Onoclea sensibilis*)

To ensure that there is no negative impacts to wetlands in the long-term, RiverStone recommends that the rehabilitation plan contain new areas of wetlands.

- **Wetland communities of no less than 14.9 ha be provided in the Rehabilitation Plan in Phase A2.**
- **The edge of created wetlands should be variable.**
- **Water depths within the wetland should be variable; however, a minimum of 25% of the area should be constructed to provide minimum water depths of 1 m during low water conditions.**
- **Slopes, substrates, and basking structures are to be included in the 14.9 rehabilitation wetland as per the above recommendations for the 4.2 ha wetland proposed for construction adjacent to the Muskoka River.**

5.7.2 Terrestrial

The proposed pit and quarry and associated facilities will result in the felling of both deciduous and coniferous trees, and vegetation will be removed or substantially modified within the area of extraction. As previously discussed, this will result in the partial loss of some ecological communities identified on the property. Consequently, the ecological function of these areas will be negatively impacted during site preparations and during the life of the pit and quarry. It is likely that some wildlife species will be displaced to adjacent areas, potentially resulting in small declines in the local populations of birds and small mammals. Although there are impacts, it is important to recognize that they are largely limited to natural features and functions that have not been identified as having high natural heritage value in the Muskoka Parry Sound District. To mitigate some of the ecological impacts associated with the loss of forest and vegetation cover in the short term, and to ensure compliance with the relevant policy and legislation RiverStone recommends the following:

- **Following the closure of the quarry/pit site, terrestrial rehabilitation will be required in some areas. The list of plant species provided below (Table 8) should be included in the progressive rehabilitation plan to allow for naturalization that blends with the adjacent natural features buffers.**
- **Rehabilitation of the terrestrial portions of the quarry should include the creation of cliff and talus slope areas along the eastern edge of the extraction area.**
- **Rehabilitation of Phase A2 should include both wetland and terrestrial communities.**
- **Where possible, terrestrial communities within the Phase A2 area should be rehabilitated using fines and other organic material available on site to provide variations in the topography and therefore encourage growth of new plant life.**

- **Where planting is to occur within the rehabilitation plan, terrestrial species outlined in Table 8 should be used.**

- **To permit wildlife to access both the restored terrestrial communities and wetlands located in Phase A, areas of no more than 3:1 slope should be included along the eastern boundary of the extraction limit as well as along the boundary between Phase A and Phase B.**

With respect to the impact that the proposed activities could have on the terrestrial communities, there are two key components. The first is the pit and quarry design and the extent to which the extraction area will encroach or alter the terrestrial features. Throughout the active areas of the pit and quarry (i.e., extraction, haul routes, storage areas, etc.), all ecological communities within the licenced area identified on **Figure 4** will be lost. The loss of these ecological communities cannot be mitigated in the short-term, but once operations cease and with final rehabilitation, they will be replaced with other ecological communities, primarily aquatic.

Table 8. Vegetation species suitable for pit and quarry rehabilitation.

Trees and Shrubs	Herbaceous Species
• White Spruce (*Picea glauca*) • Eastern White Cedar (*Thuja occidentalis*) • Tamarack (*Larix laricina*) • Largetooth Aspen (*Populus grandidentata*) • Trembling Aspen (*Populus tremuloides*) • Pin Cherry (*Prunus pensylvanica*) • Red Maple (*Acer rubrum*) • White Birch (*Betula papyrifera*) • Choke Cherry (*Prunus virginiana)* • Red-osier Dogwood (*Cornus stolonifera*) • Staghorn Sumac (*Rhus typhina*) • Narrow-leaved Meadowsweet (*Spirea alba*) • Red Raspberry (*Rubus idaeus*) • Smooth Serviceberry (*Amelanchier laevis*) • Common Blackberry (*Rubus allegheniensis*)	• Canada Bluegrass (*Poa compressa*) • Timothy (*Phleum pratense*) • Perennial Rye (*Lolium perenne*) • Alfalfa (*Medicago sativa*) • Red Clover (*Trifolium pratense*) • Rough Hair Grass (*Agrostis scabra*) • Poverty Oat Grass (*Danthonia spicata*) • Little Bluestem (*Schizachyrium scoparium*) • Sideoats Grama *(Bouteloua curtipendula*) • New England Aster (*Aster novae-angliae*) • Lanceleaf Coreopsis (*Coreopsis lanceolata*) • Flat Topped White Aster (*Aster umbellatus var. umbellatus*) • Philadelphia Fleabane (*Erigeron philadelphicus ssp. philadelphicus*) • Black-eyed Susan (*Rudbeckia hirta*) • Canada Goldenrod (*Solidago canadensis*) • Gray Goldenrod (*Solidago nemoralis ssp. Nemoralis*) • Canada Milkvetch (*Astragalus canadensis*)

6 COMPLIANCE WITH ENVIRONMENTAL LEGISLATION AND POLICIES

The following commentary summarizes the federal, provincial, and municipal environmental legislation and policies that are relevant to the proposal being evaluated herein and describes how the recommendations provided in this report will permit the proposed land-use changes to comply with these provisions.

6.1 Federal *Species at Risk Act*, S.C. 2002, c. 29

The federal *Species at Risk Act* (SARA) was promulgated in 2002 to protect indigenous species from disappearing, and to recover those identified as extirpated, endangered, or threatened on federal lands. On private lands or those owned by the province, only aquatic species listed as endangered, threatened

or extirpated, and migratory birds are protected under SARA. The official list of species at risk under SARA is contained in Schedule 1 of the Act.

The key requirements of SARA – including prohibitions on killing/harming a listed species (s. 32), destroying its "residence" (s. 32), and destroying its "critical habitat (s. 58) – are largely restricted to federal lands. As the property is located on private lands, these provisions are not applicable to the proposed quarry application considered herein. Notwithstanding the above, endangered and threatened species listed on Schedule 1 that are either fish or migratory birds are afforded protection from killing/harming and from having their "residence "damaged or destroyed. For birds, a "residence" includes a nest.

The only bird species listed as endangered or threatened under Schedule 1 that was documented to be present within the proposed license area is Canada Warbler. Per the assessment in **Appendix 3**, this species is not believed to be breeding within the proposed extraction area or other areas on the property. Further, no fish species listed endangered or threatened under Schedule 1 are present within the study area (or in any watercourse reaches immediately downstream) based on publicly-available DFO aquatic SAR mapping. Given this, RiverStone has determined that the proposed extraction activities are consistent with the requirements of SARA (also see RiverStone's recommendations related to protection of migratory bird nests in **Section6.2**).

6.2 Federal *Migratory Birds Convention Act,* S.C. 1994, c. 22

Section 6 of the Migratory Birds Regulations under the *Migratory Birds Convention Act, 1994* (MBCA) prohibits the disturbance or destruction of nests, eggs, or nest shelters of a migratory bird. The provincial *Fish and Wildlife Conservation Act, 1997* (FWCA) extends the protection of bird nests and eggs to species that are not listed under the Migratory Birds Regulations (e.g., Corvids).

As recommended in **Section 5**, all clearing of vegetation required within the proposed extraction area should be restricted to times outside of the period April 15 to October 15 inclusive. If development and site alteration must occur during this period, a nest survey should be conducted by a qualified avian biologist prior to commencement of construction activities to identify and locate active nests of migratory bird species covered by the MBCA or FWCA. If a nest is located or evidence of breeding noted, then a mitigation plan should be developed to address any potential impacts on migratory birds or their active nests. Mitigation may require establishing appropriate buffers around active nests or delaying construction activities until the conclusion of the nesting season.

6.3 Federal Fisheries Act (R.S.C., 1985, amended 2019-08-28)

The *Federal Fisheries Act* states that:

34.4 (1) No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish.

35. (1) No person shall carry on any work, undertaking or activity that results in harmful alteration, disruption or destruction of fish habitat.

DFO further states that "under subsection 35(1) a person may carry on such works, undertakings or activities without contravening this prohibition, provided that they are carried on under the authority of one of the exceptions listed in subsection 35(2), and in accordance with the requirements of the

appropriate exception. In most cases, this exception would be Ministerial authorizations granted to proponents in accordance with the *Authorizations Concerning Fish and Fish Habitat Protection Regulations."*

The recommendations included in this report will keep operations away from all fish habitat identified within the proposed licenced area. As such, it is the opinion of RiverStone that activities proposed on the property will not contravene the *Fisheries Act*, and that an Authorization under the Section 35(2) is not likely required. Should however, during the course of this project, situations arise and lead to occurrences that result in a HADD, persons responsible for the project have a "duty to notify" DFO, take corrective actions, and provide written reports under Section 38 of the *Act*.

6.4 Provincial *Aggregate Resources Act*, R.S.O. 1990, c. A.8

The information and recommendations provided in this report satisfy the requirements restated below for Natural Environment Level 1 and Level 2 Assessments for a Category 1 and Category 2, Class A licence: a pit and quarry extracting greater than 20,000 tonnes per year below the water table, as set out in the Provincial Standards of Ontario.

2.2.1 Natural Environment Level 1: determine whether any of the following features exist on and within 120 metres of the site: significant wetland, significant portions of the habitat of endangered or threatened species, fish habitat, significant woodlands (south and east of the Canadian Shield), significant valley lands (south and east of the Canadian Shield), significant wildlife habitat and significant areas of natural and scientific interest; and

2.2.2 Natural Environment Level 2: impact assessment where the Level 1 identified any features on and within 120 metres of the site in order to determine any negative impacts on the natural features or ecological functions for which the area is identified, and any proposed preventative, mitigative or remedial measures.

The following natural features of conservation interest per ARA policies were identified within the study area: 1) fish habitat, 2) habitat of endangered and threatened species, and 3) significant wildlife habitat. Adequate recommendations and measures to ensure the above features are protected and/or potential impacts are appropriately mitigated are provided in **Section 5**.

6.5 Provincial *Endangered Species Act, 2007* (ESA)

The ESA replaces the previous provincial *Endangered Species Act* and came into effect June 30th, 2008. The following excerpt from the explanatory note provided with the Act summarizes the protection afforded to species:

> If a species is listed on the Species at Risk in Ontario List as an extirpated, endangered or threatened species, the Bill prohibits killing, harming, harassing, capturing, taking, possessing, transporting, collecting, buying, selling, leasing, trading or offering to buy, sell, lease or trade a member of the species, or selling, leasing, trading or offering to sell, lease or trade anything that is represented to be a member of the species.

Protection afforded to habitats of species is described as follows:

> If a species is listed on the Species at Risk in Ontario List as an endangered or threatened species, the Bill prohibits damaging or destroying the habitat of the species. This prohibition also applies to an extirpated species if the species is prescribed by the regulations. The regulations may specifically prescribe an area as the habitat of a species but, if no habitat regulation is in force with respect to a species, "habitat" is defined to mean an area on which the species depends, directly or indirectly, to carry on its life processes. With respect to certain species that were classified before first reading of the Bill, the prohibition on damaging or destroying habitat does not apply until the earlier of the date a regulation prescribing the habitat of the species comes into force and the fifth anniversary of the date the requirement to establish the Species at Risk in Ontario List comes into existence.

Appendix 3 lists the species protected under provisions of the ESA that have the potential to occur in the area of interest or on the adjoining lands. As detailed therein, and in **Section 5.4.1** of the report, the likelihood of contravening the ESA, should the proposed activities be implemented, can be reduced to an acceptable level by following RiverStone's recommended mitigation measures.

6.6 Provincial Policy Statement, pursuant to the Planning Act, R.S.O. 1990, c. P. 13

The 2020 Provincial Policy Study (PPS) is promulgated under the *Planning Act, 1990* and provides direction to municipalities on matters of provincial interest related to land-use planning. Municipal OP's must be consistent with the PPS. The PPS instructs (s. 2.1.1) that *natural features and areas shall be protected for the long term* and that (s. 2.1.2):

> *The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features.*

The PPS prohibits development and site alteration within the following natural heritage features in Ecoregion 5E (s. 2.1.4):

- Significant Wetlands
- Significant Coastal Wetlands

The PPS also prohibits development and site alteration within the following natural heritage features in Ecoregion 5E (s. 2.1.5) *unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions*:

- Significant Wildlife Habitat
- Significant Areas of Natural and Scientific Interest
- Non-Significant Coastal Wetlands

The PPS does not permit development and site alteration in fish habitat (s. 2.1.6) or the habitat of endangered and threatened species (s. 2.1.7) except in accordance with federal and provincial requirements, respectively. Finally, with respect to lands adjacent to significant natural heritage features, the PPS requires that (s. 2.1.8):

> *Development and site alteration shall not be permitted on adjacent lands to the natural heritage features and areas identified in policies 2.1.4, 2.1.5, and 2.1.6 unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions.*

In considering the aforementioned PPS policies, RiverStone has determined that the proposed extraction activities are consistent with the natural heritage provisions outlined in section 2.1 of the 2020 PPS for the following reasons:

- Per **Section 3.5** of this report, the study area is situated within Ecodistrict 5E-8 which contains an abundance of highly interconnected natural cover classes (e.g., forests, wetlands, open water, etc.). Although natural features (predominantly forest) require removal within the proposed extraction area, these natural features are quite common throughout Ecodistrict 5E-8.
- Per **Table 4** of this report, no significant wetlands or significant Areas of Natural or Scientific Interest are present within the study area.
- Per **Appendix 4** and **Section 5.4.2** of this report, RiverStone does not anticipate any negative impacts to significant wildlife habitat within the property or study area provided that the recommended mitigation measures are implemented in full.
- Per **Sections 5.2** and **5.3** of this report, RiverStone does not anticipate any negative impacts to fish habitat within the property or study area provided that the recommended mitigation measures are implemented in full.
- Per **Section 5.4.1** of this report, the requirements of the ESA will be adhered to.

6.7 District of Muskoka Official Plan (2019 consolidation)

The Muskoka Official Plan provides recommendations regarding the protection of the natural environment across the District of Muskoka (DMM). Many of the recommendations parallel the requirements set out in the ESA, *Fisheries Act*, and PPS; consequently, the preceding discussion of how development on the property would comply with those requirements similarly applies to policies in the Muskoka Official Plan.

In addition to the above polices and legislation, Section 1.3.1 of the Official Plan states:

> b) Development and site alteration shall not be permitted in the following features unless it has been demonstrated through an EIS that there will be no negative impacts on the natural features or their ecological functions:
>
> i) Coastal wetlands and all other wetlands that are not subject to Section C1.3.1 a);

The proposed licence will result in the removal of wetland communities present on the property. As per the impact assessment outlined in **Section 5.6.1**, these wetlands will be replaced as part of the rehabilitation of the site with larger and more diverse wetlands such that there is no negative impacts on wetland extent or ecological function within the study area.

Additionally, Section C1.4.1 of the Official Plan states

> Wetlands are important natural resources. The ecological, hydrological, social and economic benefits that can be attributed to wetlands are substantial. Wetlands maintain and improve

water quality, help control flooding, provide habitat for fish and wildlife, provide conditions for a wide variety of vegetation (including rare species), and contribute to substantial social and economic benefits such as hunting, fishing, wildlife viewing and appreciation of nature in general. Climate change is predicted to result in an overall drier environment in many parts of Muskoka. This will render the protection of wetlands both more challenging and more imperative. Development proposed in or adjacent to wetlands are subject to the policies in Section C1.3.

Section C2.3 of the District Official Plan provides restrictions relate to development and site alteration, specifically near surface and groundwater features. The recommendations related to development provided in **Section 5.2** will help to ensure the proposed quarry activities are consistent with Section C2.3 of the Official Plan. Additionally, the wetland creation outlined in **Section 5.6.1** will minimize immediate impacts to wetlands and result in an increased area of higher value wetland features in the long term. Section C1.4.6 of the District Official Plan addresses Muskoka Heritage Areas and Sites. Generally, this section of the Official Plan prohibits negative impacts on the heritage values for which these Areas and Sites were selected. As outlined above, the Sage Creek Subaquatic Fan is located in the southwestern portion of the study area; this feature has been recommended as a Muskoka Heritage Area by Reid and Bergsma (1994) and is mapped as such on Schedule C2 of the District OP.

Section H1.2.1 of the District OP outlines the objectives of the plan as they relate to Mineral Aggregate Resources. The objectives are as follows:

a) Ensure that as much of the mineral aggregate resources as is realistically possible is made available as physically close to market as possible;
b) Recognize existing mineral aggregate operations and protect them from activities that would preclude or hinder their continued use or expansion;
c) Protect known deposits of mineral aggregate resources for potential future extraction;
d) Ensure that extraction is carried out in a manner that minimizes negative social, economic and environmental impacts;
e) Encourage mineral aggregate resource conservation, including through the use of accessory aggregate recycling facilities within operations, wherever feasible; and,
f) Support the final and progressive rehabilitation to accommodate subsequent land uses, to promote land use compatibility, to recognize the interim nature of extraction, and to mitigate negative impacts to the extent possible.

Section H1.2.3.3.3 of the OP outlines the requirements for assessments in support of a mineral aggregate operation.

b) In cases where a proposed development is not exempt from Section H1.2.3.3.1 of this Plan in accordance with Section H1.2.3.3.2, an assessment addressing the following factors shall generally be required in support of an application for development on lands that have been identified as deposits of mineral aggregate resources and adjacent lands on Schedule E1:

vi) The nature and potential impact of natural heritage features and areas in the immediate area on the potential for mineral aggregate operations in the area in the future;

vii) The nature and location of any sensitive surface water and ground water features in the area and its impact on mineral aggregate operations;

Section H1.2.3.4 of the OP provides a list of requirements to be included in the application for the establishment or expansion of mineral aggregate operations.

a) The impact of the operation of the mineral aggregate operation on:

i) The natural heritage features and areas and related ecological functions on the site and in the area;

iv) The quality and quantity of groundwater and surface water;

vii) Surface water features in the area; and,

Results of the impact assessment outlined in **Section 5** of this report are consistent with the requirements of section H1.2.3.3.3 as they relate to natural heritage features. Additionally, this report is submitted in partial fulfillment of Section H1.2.3.4 Application Requirements, of the District Official Plan.

6.8 Town of Bracebridge Official Plan (2013)

Lands within the proposed licence expansion area have been designated Aggregate Extraction in the Town of Bracebridge Official Plan. The activities proposed within the licence expansion area will comply with the Official Plan policies within the Aggregate Extraction land use designation.

B10.2.4 Retention of natural vegetation and the retention or provision of buffer areas on lands adjacent to streams, creeks and shoreline areas shall be required in order to protect the riparian zone and revegetation may be required where vegetation has been impacted.

Adherence to the recommendations outlined in **Section 5.3** of this report will ensure that the proposed quarry is consistent with policy B10.2.4 of the Town of Bracebridge Official Plan.

B10.2.7 Significant wildlife habitat shall be protected from incompatible development.

As outlined in **Section 5.4.2** of this report, SWH features were identified within the study area. Adherence to the recommendations outlined in **Section 5.4.2** of this report will ensure that the proposed quarry is consistent with Policy B10.2.7 of the Town's Official Plan.

B10.3.2 The Endangered Species Act requires the protection of Habitat of Endangered or Threatened Species. Large portions of the Town are potential habitat for Species at Risk. All development is prohibited within the significant habitat of endangered and threatened species, and must address the requirements of the Endangered Species Act.

Adherence to the recommendations outlined in **Section 5.4.1** of this report will ensure that the proposed quarry is consistent with policy B10.2.4 of the Town of Bracebridge Official Plan.

B10.4.1 Where development is proposed in or within 30 metres of a portion of shoreline of land that contains Fish Habitat, confirmation from the authority having jurisdiction that the proposal will not negatively impact Fish Habitat shall be required. Alternatively, an Environmental Impact Statement, prepared in accordance with Section B.25.1 of this Plan, shall generally be required as determined by Town. The

> Environmental Impact Statement shall review the nature of the habitat, consider the most appropriate location for the proposed development from an environmental perspective and demonstrate that the proposed development will not have a negative impact on the Fish Habitat. The Environmental Impact Statement shall also make recommendations with respect to appropriate performance standards and mitigation techniques.

Adherence to the recommendations outlined in **Section 5.3** of this report will ensure that the proposed quarry will not negatively impact fish habitat which is consistent with policy B10.4.1 of the Town of Bracebridge Official Plan.

> B10.6.1 There are nine Muskoka Heritage Areas found in the Town that have been identified by the District Municipality of Muskoka. These Heritage Areas are identified on Appendix A to this Plan. The majority of these Heritage Areas/Sites have been identified in conjunction with other natural environmental features such as wetlands or Conservation Reserves. Development proposed within 50 metres of a Muskoka Heritage Area, identified in conjunction with other natural environmental features, shall generally be subject to the preparation of an Environmental Impact Statement, prepared in accordance with Section B.25.1, and completed to the satisfaction of the Town and District Municipality of Muskoka.

As outlined in **Section 3.8.1** of this report, the study area was found to contain a portion of the Sage Creek Subaquatic Fan which has been recommended as a Muskoka Heritage Area. The impact assessment provided in **Section 5.5** of this report

> B10.7.5 Where development is proposed within 30 metres of a wetland or within a wetland other than a Provincially Significant Wetland, an Environmental Impact Statement, prepared in accordance with Section B.25.1, shall generally be required as determined by the Town, to confirm that the proposed development will have no significant negative impact on the wetland feature or its function.

This report addresses policy B10.7.5 of the Town of Bracebridge Official Plan. The proposed quarry will result in the removal of wetland communities present within the licence area. The recommendations outlined in **Section 5.6** will ensure that there are no negative impacts to wetland area and ecological functions as a result of the proposed quarry.

> H1.5.3 A proposal for a new quarry or Class A Pit or expansions of an existing quarry or Class A Pit on lands that are not designated Aggregate Extraction shall require an Amendment to this Plan and the Zoning Bylaw. In order to be declared complete, such applications shall be supported by a site plan and such professionally prepared technical studies as required under the Aggregate Resources Act. The required reports may include:
>
> ii) a natural environmental report; This report has been prepared to address the requirements of policy H1.5.3 of the Town of Bracebridge Official Plan.

> H1.5.5 No new aggregate operation, wayside pit and quarries or earth extraction uses shall be permitted within a Provincially Significant Wetland or significant habitat of endangered or threatened species.

As per the results of RiverStone's onsite assessment provided in **Section 3** of this report, coupled with the impact assessment provided in **Section 5**, the proposed quarry is consistent with policy H1.5.5 of the Town of Bracebridge Official Plan.

> H1.5.6 An application for the approval of an Official Plan Amendment or a Zoning By-law Amendment made in order to permit the licensing of a mineral aggregate operation shall not be approved unless the applicant demonstrates that:
>
> iv) the proposed aggregate operation will not adversely affect the water table or ground water regime, including wetlands, ANSIs or nearby wells;

The current designation within the Town of Bracebridge Official Plan for the property permit the licensing of a mineral aggregate operation. No amendment to the Official Plan is required.

7 CONCLUSIONS

In accordance with *Aggregate Resources Act* policies, the preceding Level 1 and 2 Natural Environment Report provides a detailed characterization of the natural environment occurring within and adjacent to an existing and proposed pit licence in the Town of Bracebridge. This report details a comprehensive approach to confirming the presence and absence of natural features of conservation interest that are afforded protection under the ARA and applicable legislation and policies at the municipal, provincial, and federal levels. Potential negative impacts were assessed with recommendations for preventive, mitigative and rehabilitation measures where appropriate.

Based on the findings herein, RiverStone has determined that the proposed ARA licence application addresses the applicable policies and legislation, provided that the recommendations contained in **Section 5** are implemented in full. The requested local and regional planning approvals will allow for the proposed extractive land use without compromising the ecological values of the property and study area.

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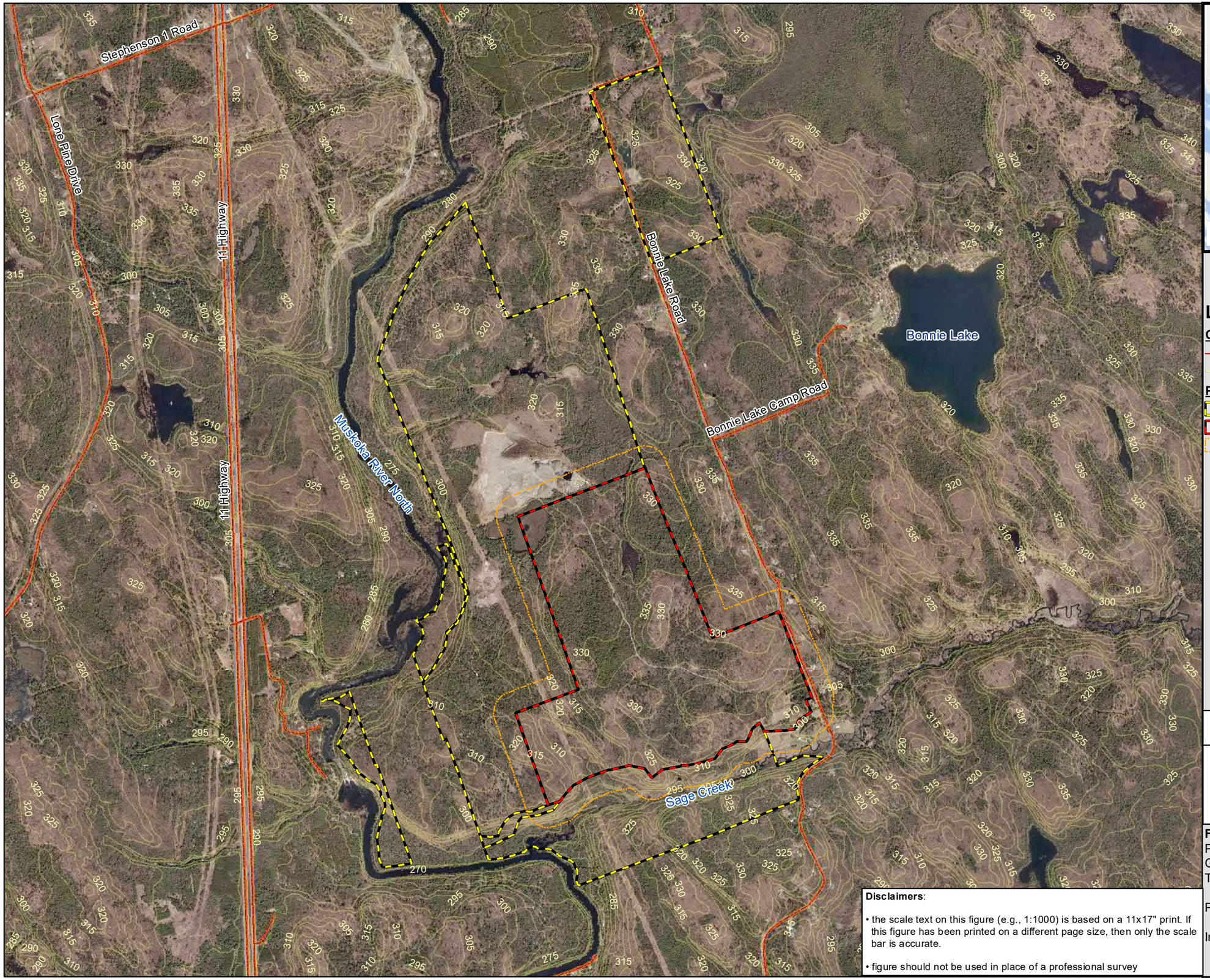


N

Legend

Ontario Base Mapping (OBM)

- Roads
- 5 m Contours

Planning Boundaries

- Lands Owned By Fowler Construction
- Property
- Study Area

Orthorectified aerial photo - spring 2008

Scale	RS Project No.	Date Last Updated	By
1:20,000	2011-078	Apr 24, 2020	GC

0 300 600 Metres

RIVERSTONE

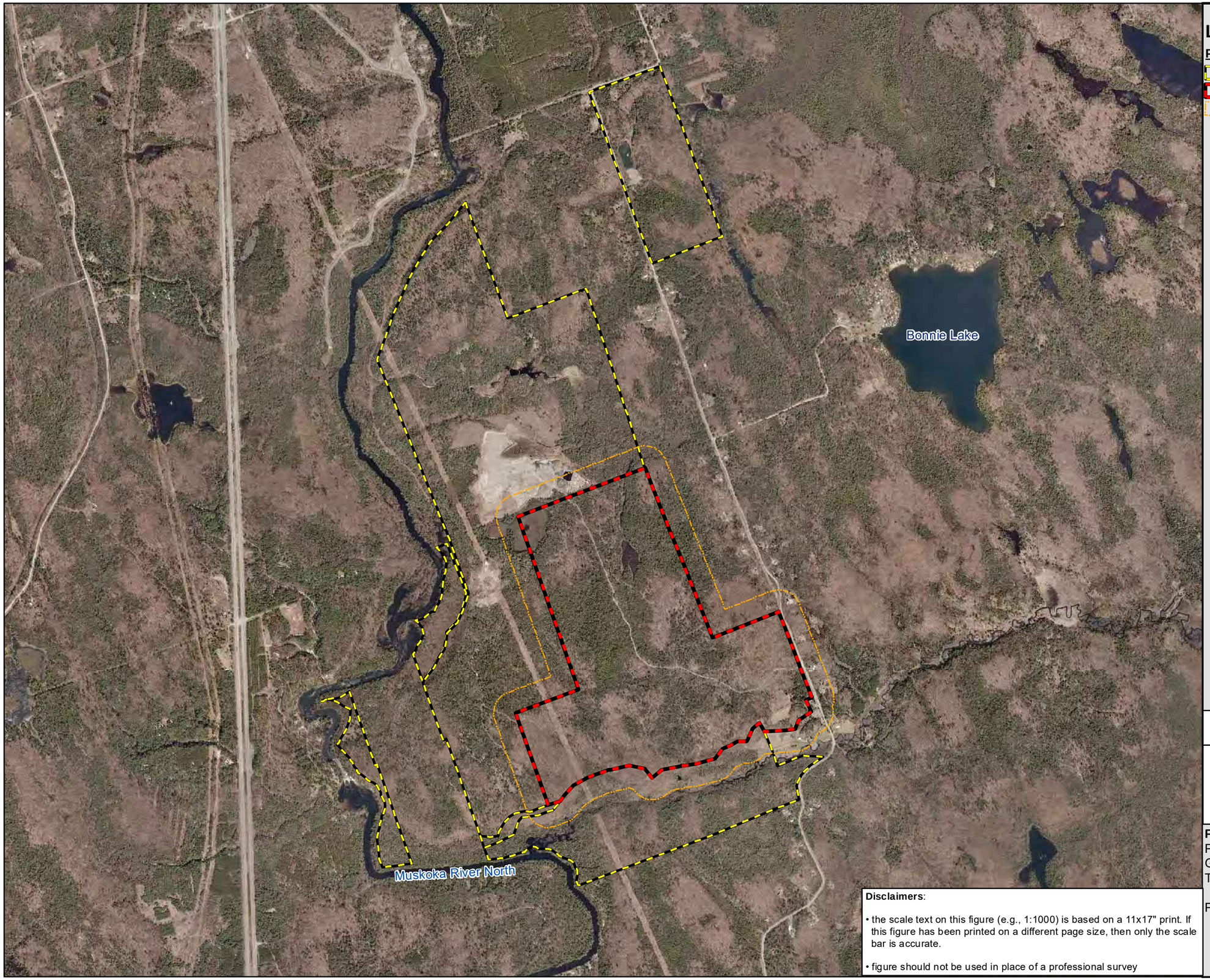
Disclaimers:

- the scale text on this figure (e.g., 1:1000) is based on a 11x17" print. If this figure has been printed on a different page size, then only the scale bar is accurate.
- figure should not be used in place of a professional survey

Figure 1. Location of Property And Study Area
Part Lots 14, 15, 16 and 17, Lots 15 and 16, Geographic
Township of McCaulay, Town of Bracebridge.

Prepared for: Fowler Construction

Inset: General Location Of Study Area



Legend

Planning Boundaries

- Lands Owned By Fowler Construction
- Property
- Study Area

N

Orthorectified aerial photo - spring 2008

Scale	RS Project No.	Date Last Updated	By
1:20,000	2011-078	Apr 24, 2020	GC

0 300 600 Metres

RiverStone

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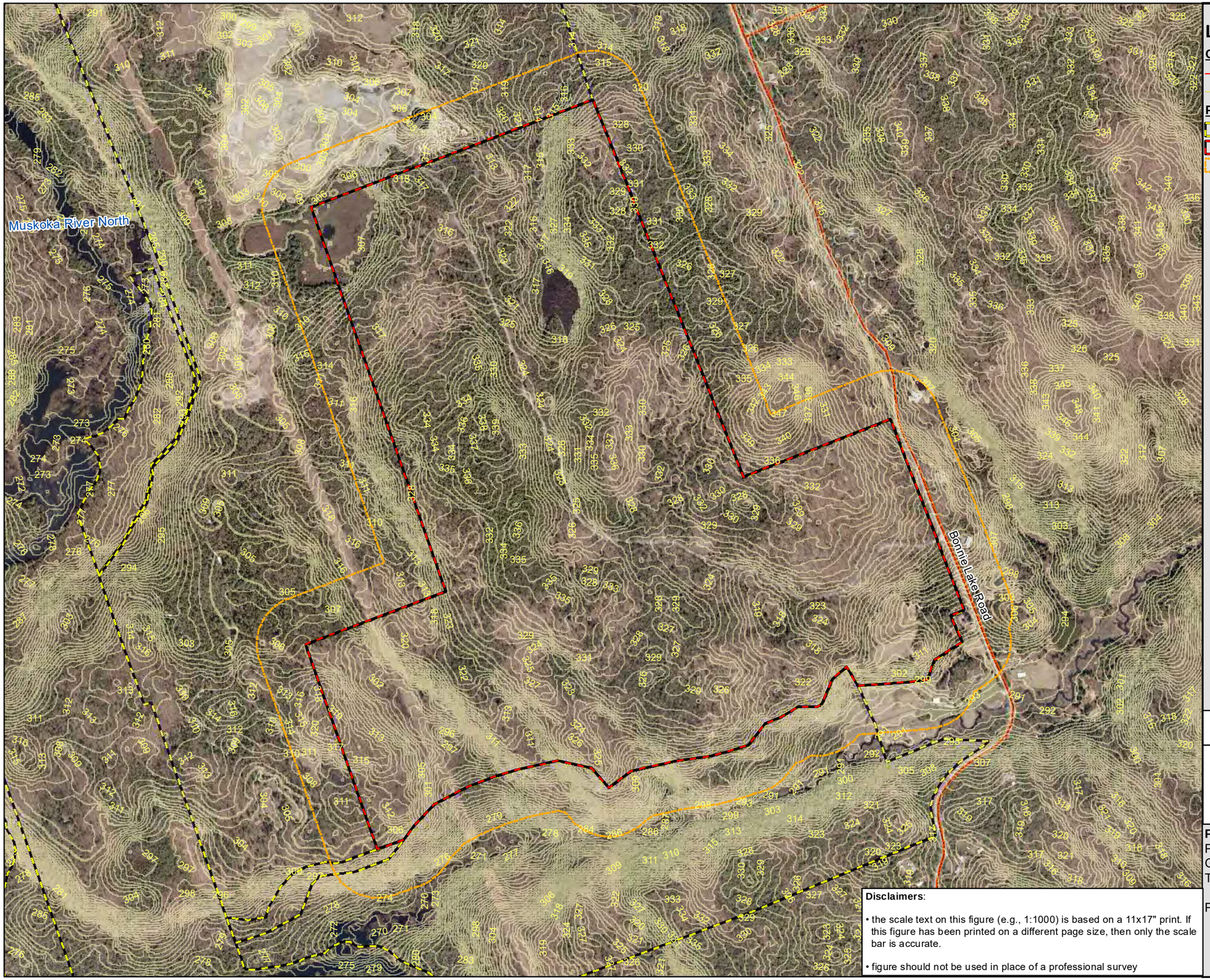
Figure 2. 2008 Orthophotograph
Part Lots 14, 15, 16 and 17, Lots 15 and 16, Geographic
Township of McCaulay, Town of Bracebridge.

Prepared for: Fowler Construction



Legend

Ontario Base Mapping (OBM)

- Roads
- 1 m Contours

Planning Boundaries

- Lands Owned By Fowler Construction
- Property
- Study Area

N

Orthorectified aerial photo - spring 2008

Scale	RS Project No.	Date Last Updated	By
1:9,000	2011-078	Apr 24, 2020	GC

0 130 260 Metres

RiverStone

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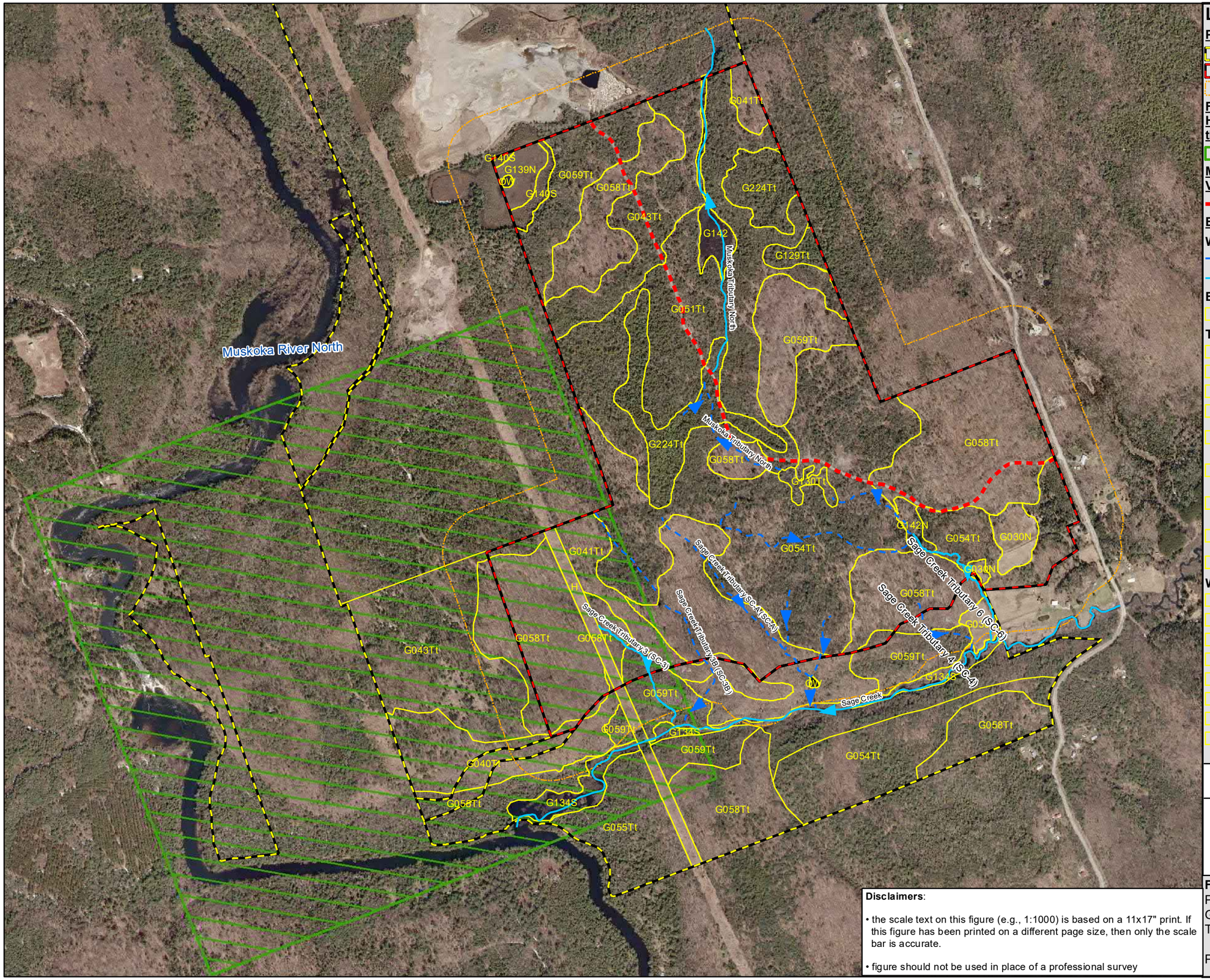
Figure 3. Topographic Contours Of Study Area
Part Lots 14, 15, 16 and 17, Lots 15 and 16, Geographic
Township of McCaulay, Town of Bracebridge.

Prepared for: Fowler Construction



Legend

Planning Boundaries

- Lands Owned By Fowler Construction
- Property
- Study Area

Features with Recognized High Natural Heritage Value - Identified by the Province or the Relevant Approval Authorities

- Sage Creek Subaquatic Fan (Muskoka Heritage Area)

Man-made Features Existing at Time of Site Visit(s)

- Existing Haul Route

Biophysical Features+Functions-RiverStone

Watercourses

- Intermittent Watercourse
- Permanent Watercourse

Ecological Communities

- H: Hydro Corridor

Terrestrial/Upland Communities

- G030N: Dry, Sandy - Meadow
- G040Tt: Dry, Sandy - Aspen-Birch Hardwood Forest
- G041Tt: Dry, Sandy - Oak Hardwood Forest
- G043Tt: Dry, Sandy - Mixedwood Forest
- G051Tt: Dry to Fresh, Coarse - Hemlock-Cedar Conifer Forest
- G054Tt: Dry to Fresh, Coarse - Red Pine-White Pine Mixedwood Forest
- G055Tt: Dry to Fresh, Coarse - Aspen-Birch Hardwood Forest
- G058Tt: Dry to Fresh, Coarse - Maple Hardwood Forest
- G059Tt: Dry to Fresh, Coarse - Mixedwood Forest

Wetland Community

- G129Tt: Organic Rich Conifer Swamp
- G130Tt: Intolerant Hardwood Swamp
- G134S: Mineral Thicket Swamp
- G139N: Poor Fen
- G140S: Open Moderately Rich Fen
- G142N: Mineral Meadow Marsh
- G224Tt: Mineral Rich Conifer Swamp
- OW: Open Water

Orthorectified aerial photo - spring 2008

Scale	RS Project No.	Date Last Updated	By
1:10,000	2011-078	May 15, 2020	JG

0 150 300 Metres

RiverStone

Disclaimers:

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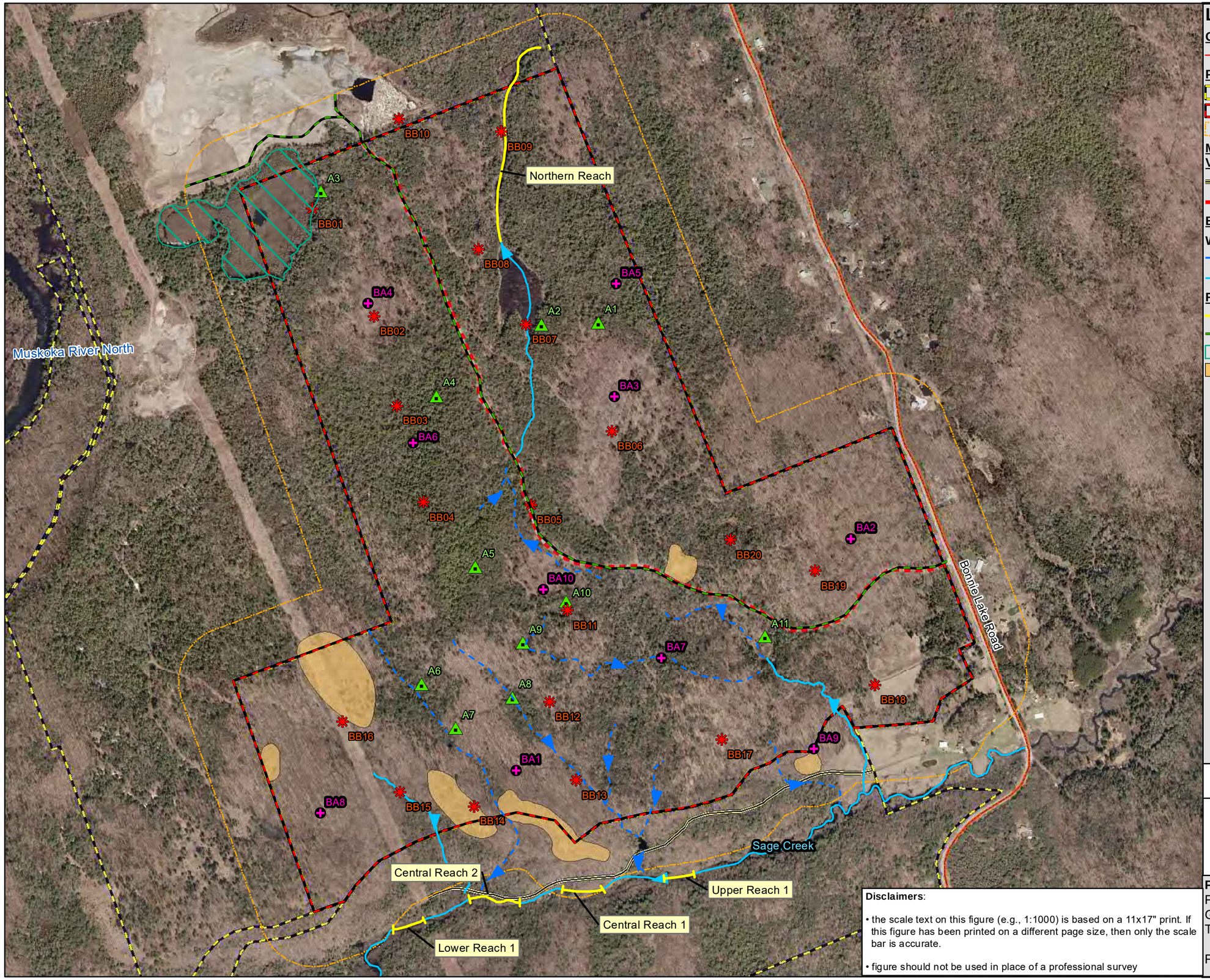
Figure 4. Biophysical Features and Functions
Part Lots 14, 15, 16 and 17, Lots 15 and 16, Geographic
Township of McCaulay, Town of Bracebridge.

Prepared for: Fowler Construction



Legend

N

Ontario Base Mapping (OBM)

- Roads

Planning Boundaries

- Lands Owned By Fowler Construction
- Property
- Study Area

Man-made Features Existing at Time of Site Visit(s)

- Off-road Vehicle Trail
- Existing Haul Route

Biophysical Features+Functions-RiverStone

Watercourses

- Intermittent Watercourse
- Permanent Watercourse

RiverStone Field Surveys

- Electrofishing Reach
- Whip-poor-will Survey Route
- Turtle Survey Location(s)
- Snake Emergence Survey Locations
- Breeding Bird Station
- Anuran Calling Station
- Bat Monitoring Location

Orthorectified aerial photo - spring 2008

Scale	RS Project No.	Date Last Updated	By
1:8,000	2011-078	Apr 30, 2020	JG

0 120 240 Metres

RiverStone

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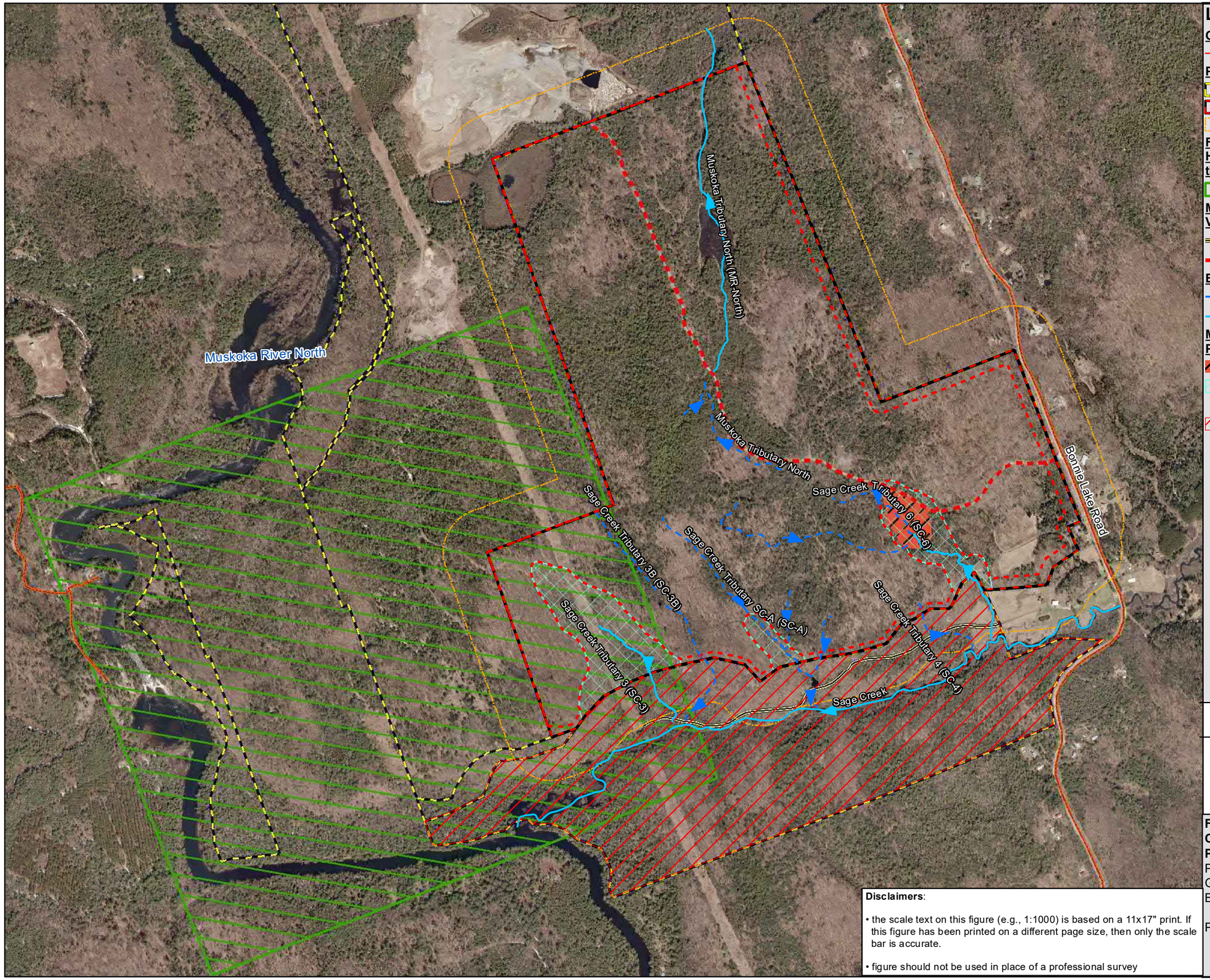
Figure 5. Targeted Survey Locations
Part Lots 14, 15, 16 and 17, Lots 15 and 16, Geographic
Township of McCaulay, Town of Bracebridge.

Prepared for: Fowler Construction



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Legend

N

Ontario Base Mapping (OBM)

- Roads

Planning Boundaries

- Lands Owned By Fowler Construction
- Property
- Study Area

Features with Recognized High Natural Heritage Value - Identified by the Province or the Relevant Approval Authorities

- Sage Creek Subaquatic Fan (Muskoka Heritage Area)

Man-made Features Existing at Time of Site Visit(s)

- Off-road Vehicle Trail
- Existing Haul Route

Biophysical Features+Functions-RiverStone

- Intermittent Watercourse
- Permanent Watercourse

Measures Recommended by RiverStone to Prevent and/or Reduce Impacts

- 30 m Variable Setback from Wetlands to be Retained
- Vegetated buffer (RS) and Catchment Protection Area (Golder)
- Lands to be Conveyed to Conservancy (65.8 ha / 162.6 ac)

Orthorectified aerial photo - spring 2008

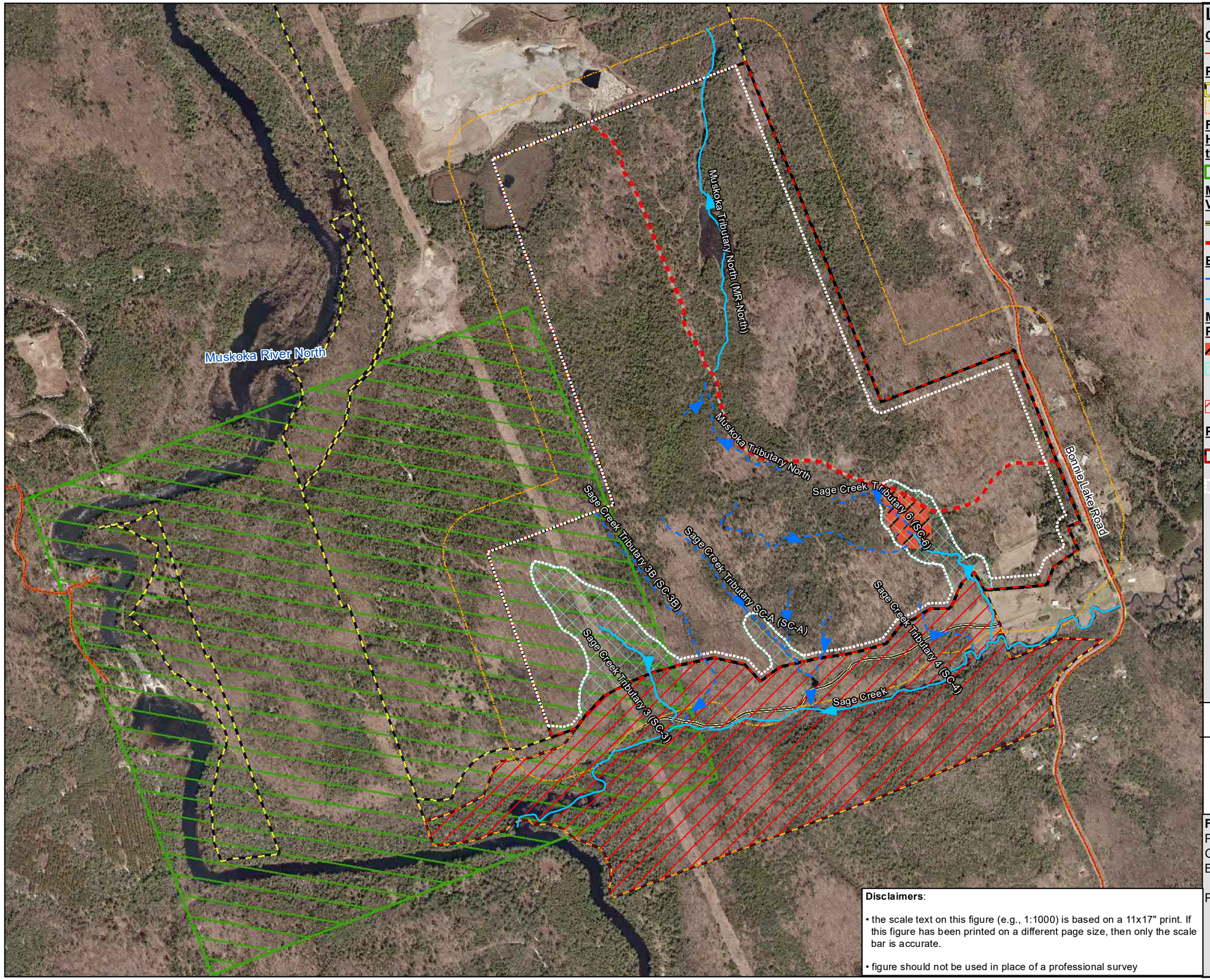
Scale	RS Project No.	Date Last Updated	By
1:10,000	2011-078	May 15, 2020	JG

0 150 300 Metres

RiverStone

Figure 6. Features And Functions Of Conservation Interest And Recommended Protective Measures
Part Lots 14, 15, 16 and 17, Lots 15 and 16, Geographic Township of McCaulay, Town of Bracebridge.

Prepared for: Fowler Construction



Legend

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Ontario Base Mapping (OBM)

- Roads

Planning Boundaries

- Lands Owned By Fowler Construction
- Study Area

Features with Recognized High Natural Heritage Value - Identified by the Province or the Relevant Approval Authorities

- Sage Creek Subaquatic Fan (Muskoka Heritage Area)

Man-made Features Existing at Time of Site Visit(s)

- Off-road Vehicle Trail
- Existing Haul Route

Biophysical Features+Functions-RiverStone

- Intermittent Watercourse
- Permanent Watercourse

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- 30 m Variable Setback from Wetlands to be Retained
- Vegetated buffer (RS) and Catchment Protection Area (Golder)
- Lands to be Conveyed to Conservancy (65.8 ha / 162.6 ac)

Proposed Development and Site Alteration

- Proposed Extension - Licence Boundary (163.1 ha / 403 ac)
- Proposed Extension - Limit of Extraction (143.2 ha / 353.8 ac)

Orthorectified aerial photo - spring 2008

Scale	RS Project No.	Date Last Updated	By
1:10,000	2011-078	May 15, 2020	JG

0 150 300 Metres

RiverStone

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Figure 7. Concept Plan Overlay
Part Lots 14, 15, 16 and 17, Lots 15 and 16, Geographic Township of McCaulay, Town of Bracebridge.

Prepared for: Fowler Construction

Appendix 1. Curricula Vitae for Principal Investigators.

Beverley J. Wicks, Ph.D.
Senior Aquatic Ecologist, Principal

CAREER AND ACADEMIC HISTORY

2008 – Present	**Senior Aquatic Ecologist, Principal; RiverStone Environmental Solutions Inc.**
2002 – 2008	Aquatic Biologist; Michalski Nielsen Associates Limited
2001	Research Assistant; Simon Fraser University, Burnaby, BC
1998 – 2001	Ph.D., University of British Columbia, Aquatic/Fisheries Toxicology
1998 – 2001	Research Assistant; University of British Columbia, Vancouver, BC
1997	Fisheries Biologist; Department of Environment, Lands and Parks, Vancouver, BC
1994 – 1996	M.Sc., University of Guelph, Guelph, ON
1993	Fisheries Technician; Trout Unlimited/Ontario Ministry of Natural Resources
1990 – 1992	Fisheries Technician; Ontario Ministry of Natural Resources, Muskoka Lakes Fisheries Assessment Unit
1989 – 1994	Honours B.Sc. (Agr.) University of Guelph, Guelph, ON

Professional Experience

Bev is a senior aquatic ecologist and project manager specializing in the characterization and management of fish and aquatic habitat. With 15 year of experience she has managed a large number of projects involving aquatic systems including: fish habitat surveys and mapping, aquatic habitat rehabilitation and impact assessment for development and infrastructure, and water quality impact assessment. Bev has managed several natural heritage planning exercises with results intended for incorporation into municipal and provincial policy.

The following is a partial list of consulting-based project experience for 2008–2016.

Ecological Site Assessments & Environmental Impact Studies/Statements

- Existing Ecological Conditions Assessment in the **Region of Peel**; *for the Regional Municipality of Peel*; **Key Tasks**: As part of a Municipal Class EA, project management, fish habitat assessment, impact analysis, assessment of policy compliance, and development of mitigation plan, and reporting in support of the rehabilitation of multiple bridge and culverts along Highway 50.
- Existing Ecological Conditions Assessment for three structures in the **Town of Caledon**; *for the Town of Caledon*; **Key Tasks**: As part of three separate Municipal Class EAs, project management, fish habitat assessment, impact analysis, assessment of policy compliance, and development of mitigation plan, and reporting in support of the rehabilitation of multiple structures along municipal roadways.
- Natural Environment Addendum in the **Town of Caledon/City of Brampton**; *for the Regional Municipality of Peel*; **Key Tasks**: project management, fish habitat assessment, impact analysis, assessment of policy compliance, and development of mitigation plan, and reporting in support of the expansion of Mayfield Road.

- Natural Environment Level 1 and Level 2 Technical Report in the **City of the Kawartha Lakes**; *for private client.*; **Key Tasks**: project management, fish habitat assessment, impact analysis, assessment of policy compliance, and development of mitigation plan to facilitate licensing of quarry under *Aggregate Resources Act* and obtaining a permit under *Endangered Species Act, 2007*
- Natural Environment Level 1 and Level 2 Technical Report in the **Township of Lake of Bays**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis, assessment of policy compliance, development of mitigation plan to facilitate licensing of quarry under *Aggregate Resources Act* and avoidance of habitat protected under *Endangered Species Act, 2007*
- Fish Habitat Impact Assessment and Water Quality Monitoring in the **Township of Muskoka Lakes**; *for private client;* **Key Tasks**: fish and aquatic habitat and impact assessment, development of water quality monitoring program to establish baseline conditions, and reporting as part of a Level ½ Natural Environment Report in support of a proposed quarry.
- Species at Risk and Fisheries Assessment in the **Township of Guelph/Eramosa**; *for River Valley Developments Inc.;* **Key Tasks**: project management, fisheries assessment, obtaining of permitting and approvals for the renewal of active extraction at an existing licensed quarry.
- Natural Environment Addendum in the **Town of Caledon/City of Brampton**; *for the Regional Municipality of Peel*; **Key Tasks**: project management, agency liaison, fish and aquatic habitat surveys, identification and assessment of significant natural heritage features, mitigation opportunities, reporting, permitting and approvals for the widening and reconstruction of ~7 Km of Mayfield Road (Phases 1 and 2).
- Environmental Impact Statement Addendum in the **Township of Southgate**; *Flato Developments Inc.*; **Key Tasks**: ELC, species at risk habitat assessment, wetland delineation, fisheries and aquatic habitat assessment, botanical inventory in support of a two phase plan of subdivision.
- Environmental Impact Assessment in the **Town of Uxbridge-Durham Region**; *for private client*; **Key Tasks**: project management, impact assessment, environmental conditions report, and analysis of impacts and mitigation measures, tree preservation and edge management plan, and TRCA permits for a 35-lot estate subdivision development.
- Environmental Impact Assessment in the **Town of Mt Albert-York Region**; *for private client*; **Key Tasks**: project management, existing site conditions, opportunities and constraint analysis, report completion, analysis of impacts and mitigation measures and permitting for a 602-lot estate subdivision development.
- Natural Heritage Evaluation in **King Township-York Region**; *for private client*; **Key Tasks**: project management, policy review, mapping of ecological constraints and report preparation for development of an equestrian centre.
- Environmental Impact Study for island property in the **Township of The Georgian Bay**; *for private client*; **Key Tasks**: project management, identification of fish habitat and significant natural heritage features, assessment of policy compliance, analysis of impacts potentially resulting from proposed multiple lot severance.
- Ecological Site and Impact Assessment on Kyle Island in the **Township of The Archipelago**; *for private client*; **Key Tasks**: project management, identification of fish habitat and significant natural heritage features, assessment of policy compliance, analysis of impacts potentially resulting from proposed single-lot severance.
- Site Evaluation Report for property on Drag Lake in the **Township of Dysart et al**; *for private client*; **Key Tasks**: project management, identification of SAR and fish habitat and significant natural heritage features, assessment of policy compliance, analysis of impacts potentially resulting from proposed multi-lot severance.

- Site Evaluation Report for property on Taylor Island in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: project management, identification of fish habitat and significant natural heritage features, assessment of policy compliance, analysis of impacts potentially resulting from proposed rezoning.
- Environmental Screening and Site Plan in the **Township of Seguin**; *for private client*; **Key Tasks**: project management, identification of significant natural heritage features, assessment of policy compliance, analysis of impacts potentially resulting from proposed land use as a result of re-zoning.
- Site Evaluation Report for property on Kawagama Lake in the **Township of Havelock**; *for private client*; **Key Tasks**: project management, identification of fish habitat and significant natural heritage features, aquatic impact assessment, assessment of policy compliance, analysis of impacts potentially resulting from proposed single-lot severance.
- Significant Natural Heritage Feature Assessment for the **Town of Bracebridge** Official Plan Review; *for Town of Bracebridge*; **Key Tasks**: project management, review existing significant natural heritage feature information in urban and near urban area for Town of Bracebridge.

Environmental Policy and Assessment

- Significant Natural Heritage Feature Assessment for the **Town of Bracebridge** Official Plan Review; *for Town of Bracebridge*; **Key Tasks**: project management, review existing significant natural heritage feature information in urban and near urban area for Town of Bracebridge.
- Large Natural Area Review and Policy Recommendations for the **District Municipality of Muskoka**; **Key Tasks**: scientific literature review, identification of data gaps and present recommendations to establish defendable planning benchmarks for the District of Muskoka.
- Background Research and Literature Review for the **Ontario Ministry of Natural Resources;** Impacts of cottage and shoreline development and associated activities on ecosystem features and functions for the purpose of policy development in Provincial Parks; scientific literature review, identification of data gaps and summary of potential and documented impact.
- Class Environmental Assessment Screening Report on the Severn River in the **Township of Severn** ; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis of application to dredge, and assessment of compliance with federal policy to facilitate dredging of marina.

Aquatic Habitat and Fisheries Assessments

- Fish Habitat Impact Assessment and Creek Channel Design Lakeshore Drive and Centennial Park Improvements in the **City of Barrie**; *for IBI Group*; **Key Tasks:** project management, permitting and agency liaison, contract tendering, construction monitoring, stream assessment, identification of fish habitat, data management, and analysis of impacts and mitigation measures for road reconstruction and park improvements project.
- Fish Habitat and Species at Risk Level 1 Assessment on Cole Lake in the **Township of Carling**; *for private client*; **Key Tasks**: project management, identification of fish habitat and significant natural heritage features, assessment of policy compliance, analysis of impacts potentially resulting from proposed single-lot severance.
- Fish Habitat Assessment on Georgian Bay, in the **Township of Georgian Bay**; *for private client*; **Key Tasks**: project management, fish habitat assessment, assessment of policy compliance.
- Environmental Evaluation Report in the **Town of East Gwillimbury**; *for private client*; **Key Tasks**: identification of fish habitat and significant natural heritage features, assessment of policy compliance, and analysis of impacts potentially resulting from subdivision development.

Fisheries Mitigation and Compensation/ DFO/MNR/CA Permit Applications

- Barrie Essa Road Reconstruction; for **City of Barrie**: **Key Tasks**: project management, fish habitat assessment, natural channel design and permitting, and construction mitigation measures development and monitoring protocol
- Fisheries Assessment for Highway 101 **Foleyete** for **Ministry of Transportation**; **Key Tasks:** project management, stream and fish habitat assessment, analysis of impacts and mitigation measures, agency approvals, construction monitoring.
- Muskoka Wharf Shoreline Assessment/Compensation Project at the Muskoka Wharf on Lake Muskoka in the **Town of Gravenhurst**; *for The Town of Gravenhurst*; **Key Tasks**: project management, fish habitat assessment, design of rehabilitated shoreline, and construction mitigation measures development and monitoring protocol.
- Fish Habitat Compensation, on the Mill Pond in the **Town of Parry Sound**; *for Crofter's Food Ltd*; **Key Tasks**: project management, fish habitat assessment, obtain permits and develop compensation plan.
- Kearney – Un-named Creek Rehabilitation, in the **Township of Perry**; *for private client*; **Key tasks**: project management, fish habitat assessment, obtain permits and develop restoration and compensation plan.
- Culvert Replacement, Mitigation and Compensation, in the **Town Parry Sound**; *for private client*; **Key Tasks**; project management, fish habitat assessment, obtain permits and develop restoration and compensation plan.
- Fisheries permitting and compensation for new Coaster in the **City of Vaughn**; *for Canada's Wonderland*; **Key Tasks**: project management, fish habitat assessment, permitting, compensation plan, construction mitigation measures and monitoring protocol.
- County Road 28 Reconstruction near Minesing Swamp in the **County of Simcoe**; *for R.J. Burnside and Associates*; **Key Tasks**: project management, fish habitat assessment, permitting, compensation plan, construction mitigation and monitoring.

Limnology, Water Quality/Sediment Quality Investigations

- Muskoka Lakes Association Water Quality Initiative Program in various townships of the **District of Muskoka**; *for the Muskoka Lakes Association* **Key Tasks**: project management, science and technical advisor, directed analysis of yearly water quality program and making scientific recommendations, and educational support.
- Aquatic Study in Lake Couchiching in the **County of Simcoe**; *for Totten Sims Hubicki Associates*; **Key Tasks**: project management, aquatic monitoring and benthic invertebrates assessment, impact analysis for Westshore Water and Sewage project.
- Bond Head – Environmental Monitoring, Holland River in the **Township of East Gwillimbury**; *for Geranium Homes;* **Key Tasks**: project management, collection and analysis of water quality data, background conditions report.
- Muskoka River Benthic and Water Quality Analysis in the **District of Muskoka**; *for the Town of Hunstville;* **Key Tasks**: project management, water monitoring and benthic invertebrates assessment, impact analysis.
- Phase 1 and Phase 2 Water Quality Impact Assessment on Lake Joseph in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: project management, identification of significant natural heritage features, locate suitable development envelopes, and analysis of impacts and mitigation measures for single lot severance and development on identified over-threshold waterbody.

- Phase 2 Water Quality Impact Assessment on Medora Lake in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: project management, identification of significant natural heritage features, locate suitable development envelopes, and analysis of impacts and mitigation measures for single lot severance and development on identified over-threshold waterbody.
- Phase 2 Water Quality Impact Assessment on Three Mile Lake in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: project management, identification of significant natural heritage features, locate suitable development envelopes, and analysis of impacts and mitigation measures for single lot severance and development on identified over-threshold waterbody.

Relevant Certification or Training Courses

2015 Fisheries Protection Program Fisheries Act Training, Fisheries and Oceans Canada Central and Arctic Region.

2013 Fisheries Assessment and Fisheries Contract Specialist, as per Ministry of Transportation / Department of Fisheries and Oceans / Ontario Ministry of Natural Resources, fisheries protocol training

2009 Ontario Benthos Biomonitoring Network participant, Ontario Ministry of the Environment

2003 Ichthyology course, Royal Ontario Museum Centre of Biodiversity and Conservation Biology

Publications

Wicks, B.J. and D.J. Randall. 2002. The effect of sub lethal ammonia exposure on fed and unfed rainbow trout: the role of glutamine in the regulation of ammonia. Comparative Biochemistry and Physiology. Part A: Molecular and Integrative Physiology. 132: 275-285.

Wicks, B.J. and D.J. Randall. 2002. The effect of feeding and fasting on ammonia toxicity in juvenile rainbow trout, *Oncorhynchus mykiss*. Aquatic Toxicology. 59:71-82.

Wicks, B.J., Q. Tang, R. Joensen, D.J. Randall. 2002. Swimming and ammonia toxicity in salmonids: the effect of sub lethal ammonia exposure on the swimming performance of coho salmon and the acute toxicity of ammonia in swimming and resting rainbow trout. Aquatic Toxicology. 59:55-69.

Rosenfeld, J.S., M. Porter, M. Pearson, **B. Wicks**, P. Van Dishoeck, T. Patton, E. Parkinson, G. Hass, and J. D. McPhail. 2001. The influence of temperature and habitat on the distribution of chiselmouth, *Acrocheilus alutaceus* in British Columbia. Env. Biol. Fish. 62: 401-413.

Val, A.L., **B.J. Wicks** and D.J. Randall. 2001. Anaemia and polycythaemia affect levels of ATP and GTP in fish red blood cells. Proceeding of the Sixth International Symposium on Fish Physiology, Toxicology, and Water Quality. Baja, Mexico.

Randall, D.J. and **B.J. Wicks**. 1999. Fish ammonia production, excretion and toxicity. Paper presented in the Fifth International Symposium on Fish Physiology, Toxicology and Water Quality, 9-12 November 1998, City University of Hong Kong.

Wicks, B.J., L.A. Barker, B.J. Morrison and F.W.H. Beamish. 1998. Gonadal variation in Great Lakes sea lamprey larvae. J. Great Lakes Res. 24: 962-968.

Barker, L.A. B.J. Morrison, **B.J. Wicks** and F.W.H. Beamish. 1998. Potential fecundity of landlocked sea lamprey larvae, *Petromyzon marinus*, with typical and atypical gonads. Copeia. 1998: 1070-1075.

Barker, L.A., B.J. Morrison, **B.J. Wicks** and F.W.H. Beamish. 1997. Age discrimination and statolith diversity in sea lamprey from streams with varying alkalinity. Trans. Am. Fish. Soc. 126:1021-1026.

E. Al Shaw, M.Sc., B.Sc.
Senior Aquatic Ecologist / Principal

CAREER AND ACADEMIC HISTORY

2008 – Present	**Senior Aquatic Ecologist / Principal, RiverStone Environmental Solutions Inc.**
2003 – 2007	Aquatic Biologist / Michalski Nielsen Associates Ltd.
2001 – 2003	Aquatic Ecologist / Project Manager, ESG International Inc., Guelph, ON
2000 – 2001	Aquatic Ecologist, Triton Environmental Consultants Ltd., Vancouver, BC
1999 – 2000	Systems Ecologist, Limnotek Research and Development Inc., Vancouver, BC
1998 – 1999	Research Assistant / Data Analyst, Dept. of Forest Sciences / UBC Fisheries Centre, University of British Columbia, Vancouver, BC
1997 – 1999	M.Sc., University of British Columbia, Department of Forest Sciences, Vancouver, BC
1997 – 1999	Teaching Assistant, Conservation Biology Field Course, Fish Conservation and Management, University of British Columbia, Vancouver, BC
1991 – 1994	B.Sc., University of Guelph, Environmental Biology, Guelph, ON

PROFESSIONAL EXPERIENCE

The following is a partial list of consulting-based project experience for 2008–2010.

Ecological Site Assessments & Environmental Impact Studies/Statements

- Environmental Impact Statement for property in the **Township of Perry**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate 2-lot severance
- Environmental Impact Statement for property in the **Township of Perry**; *for private client*; **Key Tasks**: project management, SAR and fish habitat assessment, impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate 4-lot severance and rezoning
- Environmental Impact Statement for property on Doe Lake in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate multi-lot severance and zoning amendment
- Environmental Impact Statement for property in the **Township of King**; *for private client*; **Key Tasks**: project management, SAR and fish habitat assessment, assessment of policy compliance, and impact analysis and development of mitigation plan to facilitate zoning by-law amendment,
- Environmental Impact Statement and Deer Wintering Habitat Assessment for property in the **Township of McKellar**; *for private client*; **Key Tasks**: project management, Species of Conservation interest and fish habitat assessment, impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate 4-lot severance

- Environmental Impact Statement for development of Driftwood Island (Lake Muskoka) in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate 6-lot severance
- Environmental Impact Statement for development in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: project management, Species of Conservation interest, fish habitat assessment; impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate multi-lot severance
- Environmental Impact Statement for property in the **Town of Huntsville**; *for private client*; **Key Tasks**: project management, fish habitat assessment, deer winter habitat, impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate 26-lot plan of subdivision
- Environmental Impact Statement for property in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: project management, SAR and fish habitat assessment, impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate 25-lot plan of subdivision
- Environmental Impact Statement for property on the Magnetawan River in the **Township of Ryerson**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate 3-lot severance
- Environmental Impact Statement and Deer Wintering Habitat Assessment for property in the **Township of the Archipelago**; *for private client*; **Key Tasks**: project management, assessment of Species of Conservation interest, impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate single lot severance and zoning amendment
- Biophysical Report for property in the **Township of Georgian Bay**; *for private client*; **Key Tasks**: project management, fish habitat assessment; impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate road extension project
- Environmental Impact Statement for property in the **Town of Huntsville**; *for Wayne Simpson and Associates;* **Key Tasks**: fish habitat assessment, impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate 200-lot severance with commercial facilities requiring Official Plan and zoning amendments
- Biophysical Report for property in the **Town of Bradford West Gwillimbury**; *for private client*; **Key Tasks**: project management, fish habitat assessment; impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate driveway extension through Ansnorveldt PSW
- Natural Environment Level 1 and Level 2 Technical Report in the **Town of Bracebridge**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis; assessment of policy compliance, development of mitigation plan to facilitate licensing of pit under *Aggregate Resources Act* and avoidance of habitat protected under *Endangered Species Act, 2007,* and assessment of policy compliance
- Environmental Impact Statement for property in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis, development of mitigation plan, and assessment of policy compliance to facilitate multi-unit condominium unit
- Environmental Impact Statement for property in the **Town of Huntsville**; *for Wayne Simpson and Associates;* **Key Tasks**: fish habitat assessment, impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate 5-lot severance with on Fairy Lake
- Site Evaluation Report for property on Jack's Lake in the **Township of Armour**; *for Hynde Paul Associates;* **Key Tasks**: project management, fish habitat assessment; impact analysis and development of mitigation plan, and assessment of policy compliance to facilitate 3-lot severance
- Environmental Impact Statement, Lake Capacity Assessment on Bells Lake in the **Township of Armour**; *for private client*; **Key Tasks**: project management, fisheries assessment, water quality monitoring, lake capacity modeling to facilitate waterfront lot severance

Environmental Assessments/ DFO/MNR/MOE/CA Permit Applications

- Federal Environmental Assessment in the **Town of Bradford West Gwillimbury**; *for Town of Bradford West Gwillimbury / Township of King;* **Key Tasks**: project management, fish habitat assessment, boat electrofishing, multi-agency negotiations, yearly *Fisheries Act* authorizations, to facilitate reconstruction of Holland Marsh drainage canal system
- Municipal Class Environmental Assessment in the **County of Simcoe**; *for CC Tatham*; **Key Tasks**: project management, aquatic habitat assessment, impact analysis and development of mitigation plan, assessment of federal policy compliance to facilitate road upgrades and re-alignment of County Road 43 and Wilson Drive
- Municipal Class Environmental Assessment in the **Township of Muskoka Lakes**; *for CC Tatham*; **Key Tasks**: project management, aquatic habitat assessment, impact analysis and development of mitigation plan, and assessment of federal policy compliance to facilitate road upgrades and re-alignment of Brackenrig Road
- Class Environmental Assessment in the **Township of Minden Hills**; *for CC Tatham*; **Key Tasks**: project management, site assessment, impact analysis and development of mitigation plan, and assessment of federal and provincial policy compliance to facilitate the installation of a water treatment plant
- Hydroelectric Class Environmental Assessment on the **Trent-Severn Waterway**; *for Canadian Hydro Developers;* **Key Tasks**: agency negotiation and submission of fish habitat compensation plan to facilitate development of two new hydroelectric facilities
- Class Environmental Assessment on several lakes in the **Township of Addington Highlands**; *for the Ministry of Natural Resources;* **Key Tasks**: aquatic habitat assessment for 6 MNR owned dams
- Contribution to Certificate of Approval for water discharge to the Welland River in the **Niagara Region**; *for private client;* **Key Tasks**: agency negotiations, water quality monitoring, assimilative capacity assessment to facilitate large expansion to chemical plant
- Contribution to Certificate of Approval for water discharge to Four Mile Creek in the **Niagara Region**; *for private client;* **Key Tasks**: agency negotiations, water quality monitoring, benthic invertebrate assessment, fisheries collections, assimilative capacity assessment to facilitate installation of treatment system for landfill discharge
- ESA Permit on Redside Dace tributary to Berczy Creek in the **City of Markham**; *for private client;* **Key Tasks**: agency negotiations, fisheries assessment, overall benefit ESA permit
- DFO and MNR letters of advice on Stewart Lake in the **Township of Georgian Bay**; *for private client;* **Key Tasks**: agency negotiations, fisheries assessment, applications to agencies to facilitate the reconstruction of public beach and boat docking facility
- DFO and Transport Canada letters of advice on Lake Muskoka in the **Town of Bracebridge**; *for private client*; **Key Tasks**: agency negotiations, fisheries assessment, applications to agencies to facilitate commercial dock expansion
- MOE Lake Capacity Assessment on Kernick Lake in the **Township of Armour**; *for private client;* **Key Tasks**: project management, aquatic habitat and limnological assessment to facilitate camp expansion

Aquatic and Fish Habitat Assessments

- Literature review of the impacts related to wood preservation chemicals in the aquatic environment; *for The Department of Fisheries and Oceans*; **Key Tasks**: collect and review primary literature, complete review paper and recommendations for DFO Staff reviewing potentially contaminated sites
- Fish/Aquatic Habitat Assessment on Tributary to Black Creek in the **City of Vaughn**; *for private client*; **Key Tasks**: Review of potential impacts of stockpiled concrete product on Redside Dace habitat, obtain permits and MNR Letter of Advice related to reconstruction of access road
- Fish/Aquatic Habitat Assessment on creek in the **City of Oshawa**; *for private client*; **Key Tasks**: project management, fish habitat assessment of headwater stream, to permit zoning bylaw amendment
- Fish Habitat Assessment on Fairy Lake in the **Town of Huntsville**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis, development of mitigation plan, and assessment of policy compliance to facilitate development of existing lot of record
- Fish Habitat Assessment on the Joseph River in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis, development of mitigation plan, and assessment of policy compliance to facilitate shoreline development
- Fish Habitat Assessment on Mary Lake in the **Town of Huntsville**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis, development of mitigation plan, and assessment of policy compliance to facilitate development of boathouse
- Fish Habitat Assessment on Lake Joseph in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis, development of mitigation plan, and assessment of policy compliance to facilitate shoreline development
- Fish Habitat Assessment on Lake Rosseau in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis, development of mitigation plan, and assessment of policy compliance to facilitate shoreline development
- Fish Habitat Assessment on Peninsula Lake, the **Township of Lake of Bays**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis, development of mitigation plan, and assessment of policy compliance to facilitate shoreline development
- Fish Habitat Assessment on the Muskoka River in the **Township of Lake of Bays**; *for private client*; **Key Tasks**: project management, fish habitat assessment, impact analysis, development of mitigation plan, and assessment of policy compliance to 3-lot severance
- Fish Salvage in the **Town of Bradford West Gwillimbury**; *for the Town of Bradford West Gwillimbury;* **Key Tasks**: project management, fish habitat assessment, fish salvage, to facilitate reconstruction of Holland Marsh drainage canal system
- Aquatic Habitat Monitoring in the **Township of Lake of Bays**; *for private client*; **Key Tasks**: development of environment monitoring requirements and studies to be completed prior to, during, and following construction of the golf course
- Aquatic Habitat Assessment on Deer Lake in the **City of North Bay**; *for K. Smart Associates Ltd.t*; **Key Tasks**: assessment and monitoring of water levels, and development of protocols regarding the creation of dam structure at outlet
- Aquatic Analysis of Water Quality near the **Town of Bradford West Gwillimbury**; *for private client* **Key Tasks**: analysis of water quality, fisheries and benthic invertebrates in relation to residential development and STP expansion

- Walleye spawning survey on Muskoka River in the **Town of Bracebridge**; *for the Ministry of Natural Resources;* **Key Tasks**: Walleye spawning survey and egg/fry outmigration study.
- Lake Capacity Assessment Model for multiple lakes in the **County of Haliburton**; *for private client;* **Key Tasks**: project management, aquatic habitat and limnological assessment, and lake trout dissolved oxygen modeling
- Aquatic Survey on the Mattagami River in the **Sudbury District**; *for OPG;* **Key Tasks**: Six week survey of lake sturgeon populations related to Little Long Reservoir and water quality in the river
- Aquatic Survey in the Trent-Severn Waterway in **Hastings County**; *for private client;* **Key Tasks**: fish habitat assessment design and monitoring of created fish habitat
- Aquatic Survey in Silver Creek in the **Town of Collingwood**; *for private client* **Key Tasks**: fish habitat and aquatic assessment, impact analysis
- Aquatic Survey in Lake Ontario *for private client;* **Key Tasks**: Environmental monitoring program for lake trout spawning on artificial reef in Lake Ontario
- Aquatic Training for Peawanuck First Nations in the **Kenora District**; *for Peawanuck First Nations;* **Key Tasks**: Fisheries biology and limnology training
- Aquatic Study in the **District of Muskoka**; *for District of Muskoka;* **Key Tasks**: design and collection of benthic invertebrates to evaluation impact of sewage treatment facility
- Aquatic Study on the Grand River in the **City of Kitchener**; *for Union Gas;* **Key Tasks**: design and analysis of Grand River benthic invertebrate study in relation to pipeline crossing
- Aquatic Study in the Trent-Severn Waterway in **Peterborough County**; *for SGS Lakefield;* **Key Tasks**: benthic invertebrate and water quality analysis of long-term metal contamination in the Trent Severn Waterway
- Aquatic Study in the Cataraque Creek in **Frontenac County**; *for Ontario Ministry of the Environment;* **Key Tasks**: Design of collection program for dioxins and PCBs in benthic invertebrate

Peer Reviews

- Review of Environment Impact Study for Planning Application in **Parry Sound**; *for Seguin Township*; **Key Tasks**: evaluation of site assessment and impact analysis submitted as part of a rezoning application
- Review of Environment Impact Study for Planning Application in the **City of Orillia**; *for City of Orillia*; **Key Tasks**: evaluation of issues pertaining to adjacent lands and Provincially Significant Wetlands
- Review of Requirements for Port Severn Plan of Subdivision (Oak Bay) in the **Township of Georgian Bay**; *for District Municipality of Muskoka*; **Key Tasks**: assessment of rationale for installation of an eco-passage under Muskoka Rd Five
- Review of Environment Impact Study in the **Township of Lake of Bays**; *for District of Muskoka*; **Key Tasks**: evaluation of issues pertaining to adjacent lands and shoreline of Menominee Lake

Glenn Cunnington, Ph.D.
Senior Ecologist / Species at Risk Specialist / CAN-CISEC (#0675)

CAREER AND ACADEMIC HISTORY

2011 – Present	**Senior Ecologist and Species at Risk Specialist**
2010 – 2011	Species at Risk Permitting and Agreements Coordinator, Peterborough and Bancroft District OMNR
2010	Species at Risk Biologist, Bancroft District, Ontario Ministry of Natural Resources
2006 – 2014	Ph.D. Carleton University, Road and Landscape Ecology
2003 – 2009	Private Ecological Consultant
2004 – 2006	M.Sc., Trent University, Watershed Ecosystem Ecology
2002 – 2004	B.Sc.(Hons), Trent University, Conservation Biology
2002 – 2006	Program Coordinator, Eastern Hog-nosed Snake Research Program
2001 – 2002	Program Coordinator, Eastern Foxsnake Research Program
1999 – 2001	Diploma, Sir Sandford Fleming College, Fish and Wildlife Technician

PROFESSIONAL EXPERIENCE

The following is a partial list of consulting-based project experience for 2008–2019.

Species at Risk Experience

- Development of 17(2)(c) Permit under the *Endangered Species Act, 2007* for proposed road improvements project in **Region of Peel**; *for Region of Peel;* **Key Tasks**: identification of Species at Risk (SAR) habitat; development of avoidance, overall benefit, and associated monitoring program for Redside Dace.
- Development of 17(2)(c) Permit under the *Endangered Species Act, 2007* for proposed bridge rehabilitation project in **Town of Oakville**; *for Town of Oakville;* **Key Tasks**: identification of Species at Risk (SAR) habitat; development of avoidance, overall benefit, and associated monitoring program for Redside Dace.
- Natural Environment Addendum in the **City of Kawartha Lakes**; *for Giofam Investments Inc.*; **Key Tasks**: species at risk surveys, significant wildlife habitat assessment, reporting in support of a quarry application.
- Development of 17(2)(c) Permit under the *Endangered Species Act, 2007* for proposed subdivision in **Town of Uxbridge**; *for private client;* **Key Tasks**: identification of Species at Risk (SAR) habitat on lands proposed for subdivision; development of avoidance, overall benefit, and associated monitoring plans for Bobolink
- Species at Risk Assessment for access road across crown land in Township of Georgian Bay; for **Township of Georgian Bay**; **Key Tasks**: identification of SAR habitat and significant natural heritage features; analysis of impacts potentially resulting from road proposed to access municipally owned aggregate pit; development of mitigation plan to demonstrate avoidance of habitat; development of Agreement under the *Endangered Species Act, 2007* to facilitate aggregate extraction without impacting Endangered and Threatened species
- Assisted in the development of 17(2)(c) Permit under the *Endangered Species Act, 2007* for proposed quarry in **City of Kawartha Lakes (Sebright)**; *for Giofam Investments Inc.*; **Key Tasks:** identification of Species at Risk (SAR) habitat on lands proposed for quarrying; development of avoidance, overall benefit, and associated monitoring plans for Blanding's Turtle, Whip-poor-will, and Eastern Hog-nosed Snake

- Natural Environment Level 1 and Level 2 Technical Report for proposed expansion aggregate pit in **Town of Bracebridge**; f*or private client;* **Key Tasks**: identification of SAR habitat and significant natural heritage features; terrestrial fauna assessment, impact analysis; development of mitigation plan to facilitate licensing of quarry under Aggregate Resources Act and avoidance of habitat protected under *Endangered Species Act, 2007*
- Species at Risk habitat mapping on private lands in the **Town of Wasaga Beach**; *for Jones Consulting Group Ltd*; **Key Tasks**: assessment of features and their potential to function as habitat for Eastern Hog-nosed Snake, mapping of the extent of habitat features, leading onsite meeting with client and approval agency representatives to discuss habitat features.
- Application for exemption under the *Endangered Species Act, 2007* for proposed private driveway crossing of a creek in **Town of Whitchurch-Stouffville**; *for private client;* **Key Tasks**: identification of Species at Risk (SAR) on lands proposed for private driveway; identification of previous planning provisions for Red Side Dace
- Species at Risk Aquatic Survey of the Holland Marsh for American Eel in the **Town of Bradford West Gwillimbury**; *for Town of Bradford West Gwillimbury / Township of King;* **Key Tasks**: boat electrofishing for American Eel
- Endangered Species Act 17(2)(d) Permit for American Eel in the Holland Marsh in the **Town of Bradford West Gwillimbury**; *for Town of Bradford West Gwillimbury / Township of King;* **Key Tasks**: multi-agency negotiations to facilitate reconstruction of Holland Marsh drainage canal system.
- Species At Risk Assessment for property on Georgina Island in, **Regional Municipality of York;** *for private client*; **Key Tasks**: identification of SAR habitat and significant natural heritage features, analysis of impacts potentially resulting from the development of a small cottage.
- Species At Risk Assessment for Provincial Park in the **Town of Wasaga Beach**; *for Ainley and Associates*; **Key Tasks**: develop mitigation methodology for the installation of a water main extension under Ontario Parks Property, determined timing windows and best management practices to reduce effects of construction on local eastern hog-nosed snake population in Wasaga Beach area of Simcoe County
- SAR Assessment for property in Honey Harbour, **Georgian Bay Township;** *for private client*; **Key Tasks**: identification of SAR habitat and impact assessment of dredging activities proposed to maintain water access to a developed lot
- Species At Risk Assessment for multiple locations in **Simcoe County**; *for Ontario Ministry of Natural Resources*; **Key Tasks**: complete habitat assessment and field surveys for eastern hog-nosed snake, and massasauga rattlesnake to determine persistence of species and habitat at locations of historical observation
- Species At Risk Assessment of **Trent Severn Waterway**; *for Parks Canada*; **Key Tasks**: Conducted habitat assessment and field surveys for eastern hog-nosed snake, Blanding's turtle and musk turtle to determine persistence of species and habitat at locations of historical observation
- **Habitat Suitability Indices for Canada Warbler, Olive-sided Flycatcher, and Rusty Blackbird, in** Pukaskwa National Park, *for Parks Canada, Pukaskwa National Park*
- **Habitat suitability mapping for Blanding's turtle, spotted turtle, musk turtle, eastern hog-nosed snake, American ginseng, flooded jellyskin, pale bellied frost lichen and butternut in** Bancroft District, *for Ontario Ministry of Natural Resources, Bancroft District Office*
- **Critical habitat for eastern hog-nosed snakes (*Heterodon platirhinos*)** at a provincial and selected regional scales; *for Parks Canada, Ecological Integrity Branch*
- **Identification of eastern hog-nosed snake habitat and assessment of quality**, in Wasaga Beach, ON, *Ontario Parks and Ontario Ministry of Natural Resources, Midhurst District Office*

Ecological Site Assessments/Environmental Impact Studies/Natural Heritage Evaluations

- Natural Environment Level 1 & 2 Technical Report in the **Township of Ramara**; *for private client*; **Key Tasks**: species at risk, significant wildlife habitat assessments, vegetation surveys, report writing in support a quarry application for a license expansion and new license.
- Natural Environment Addendum in the **City of Kawartha Lakes**; *for Giofam Investments Inc.*; **Key Tasks**: breeding bird surveys, significant wildlife habitat assessment, reporting in support of a quarry application.
- Natural Heritage Evaluation for the redevelopment of the Etobicoke General Hospital in the **City of Toronto**; *for William Osler Health Systems*; **Key Tasks**: scoping of required work, onsite field evaluations and biophysical inventories (i.e., habitat and ecosystem characterizations, species at risk assessment, etc.), liaison with Conservation Authority and City staff.
- Natural Heritage Impact Statement in the **Town of Oakville**; *for the Town of Oakville*; **Key Tasks**: aquatic habitat assessment, identification of mitigation opportunities, graphics, permitting under the *Conservation Authorities Act*, and reporting in support of bridge works on Bridge Road.
- Environmental Impact Statement Addendum in the **Township of Southgate**; *Flato Developments Inc.*; **Key Tasks**: species at risk habitat assessment, fisheries and aquatic habitat assessment, botanical inventory, reporting in support of a plan of subdivision application.
- Environmental Impact Study for a 36 unit estate subdivision in the **Town of Uxbridge**; *for private client*; **Key Tasks**: Wildlife species sightings and description of potential habitat for wildlife, including habitat of Species at Risk and species of Conservation Concern, provide design recommendations for wildlife crossing structures, data management, mapping and report preparation
- Existing Ecological Conditions Reports in the **Town of Caledon**; *for the Town of Caledon*; **Key Tasks**: ELC, tree inventory and health assessment, fish and aquatic habitat surveys, identification and assessment of significant natural heritage features, mitigation opportunities, permitting under the *Conservation Authorities Act* and reporting in support of the repair of three (3) bridges/culverts.
- Environmental Impact Assessment in the **Town of East Gwillimbury**: *for private client*; **Key Tasks**: field data collection, impact assessment, update of environmental conditions report, and analysis of impacts and mitigation measures for a 604 unit subdivision development.
- Natural Heritage Evaluation in **King Township-York Region**; *for private client*; **Key Tasks**: onsite evaluation, mapping of ecological constraints and report preparation.
- Scoped Environmental Impact Study on Lake of Bays in the **Township of Lake of Bays**; *for private client*; **Key Tasks**: identification of SAR habitat and significant natural heritage features, mapping, report preparation, analysis of impacts potentially resulting from the development of a small cottage
- Natural Heritage Study to support Community Plan; *for **Atikameksheng Anishnawbek First Nations***; **Key Tasks**: acquire all relevant background natural features data from various sources, summarize existing data and identify data gaps, recommend field assessments, contribute to policy formation.
- Environmental Impact Statement for property in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: Identification of significant natural heritage features, wildlife species sightings and description of potential habitat for wildlife, Species at Risk assessment and data management to support the development of a single residence on an existing lot
- Ecological Site and Impact Assessment for property on Georgian Bay in the **Township of The Archipelago**; *for Township of The Archipelago*; **Key Tasks**: identification of SAR habitat and significant natural heritage features; analysis of impacts potentially resulting from proposed single-lot severance

- Environmental Impact Study in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: Wildlife species sightings and description of potential habitat for wildlife, including habitat of Species at Risk and species of Conservation Concern to assess the properties potential for development as a residential education centre.
- Wildlife Scan for stormwater management pond in the **Town of Richmond Hill**; *for private client*; **Key Tasks**: assessment of habitat for Species at Risk, species of conservation interest, and other wildlife, identification of activities that may result in a negative impact on existing wildlife and recommendation of mitigation measures.
- Environmental Impact Statement for property in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: Identification of significant natural heritage features, wildlife species sightings and description of potential habitat for wildlife, Species at Risk assessment and data management to support the rezoning of an existing lot
- Impact Assessment for private road crossing crown land in the **Township of the Archipelago**; *for private client*; **Key Tasks**: Identification of significant natural heritage features, wildlife species sightings and description of potential habitat for wildlife, Species at Risk assessment, data management, mapping and report writing in support of a proposed road crossing crown land to access a private lot
- Ecological Site and Impact Assessment for property on Georgian Bay in the **Township of The Archipelago**; *for Township of The Archipelago*; **Key Tasks**: identification of SAR habitat and significant natural heritage features; analysis of impacts potentially resulting from proposed single-lot severance
- Environmental Impact Statement for property in the **Town of Huntsville**; *for private client*; **Key Tasks**: Species at Risk assessment, identification of potential habitat for wildlife, identification of significant natural heritage features, data management and mapping to support a proposed severance
- Boating Impact Assessment for a bay on Lake Joseph in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: document and quantify boating activity, analysis of boating carrying capacity, report writing.

Peer Review and Literature Reviews

- Blue Racer Recovery Strategy for the *Ontario Ministry of Natural Resources*; **Key Tasks**: compiled and reviewed information and resources pertaining threats to the Blue Racer in Ontario for the purposes of development a recovery strategy that meets the format and content requirements of the *Endangered Species Act, 2007*
- Lake Erie Watersnake Recovery Strategy for the *Ontario Ministry of Natural Resources*; **Key Tasks**: compiled and reviewed information and resources pertaining threats to the Lake Erie Watersnake in Ontario for the purposes of development a recovery strategy that meets the format and content requirements of the *Endangered Species Act, 2007*
- Lake Erie Watersnake Status Report Update for the *Committee on the Status of Endangered Wildlife in Canada (COSEWIC)*; Key Tasks: compiled and reviewed information and resources pertaining to the population and threats to the Lake Erie Watersanke in Ontario for the purposes of reviewing this species Endangered status in Canada.
- Background Research and Literature Review for the *Ontario Ministry of Natural Resources*; **Key Tasks**: compiled and reviewed information and resources pertaining to turtles listed as endangered or threatened in Ontario for the purposes of guiding the development of protocols, best practices, and guidance documents to support the implementation of the *Endangered Species Act, 2007*
- Background Research and Literature Review for the *Ontario Ministry of Natural Resources*; **Key Tasks**: reviewed literature on impacts of cottage and shoreline development and associated activities on ecosystem features and functions for the purpose of policy development in Provincial Parks, identified data gaps and summarized potential and documented impacts in parks

- Large Natural Area Review and Policy Recommendations for the *District Municipality of Muskoka*; **Key Tasks**: as part of a municipality-wide report card on watershed health, RiverStone completed a literature review to summarize the current state of the science with respect to the benefits and value of large natural areas; land use scenarios were explored in a GIS environment to determine how the municipality could most efficiently assess the health of large natural areas on a long-term basis; project deliverables included a report with maps, digital PDF library, and presentations to the Muskoka Watershed Councils
- Peer Review of a mitigation strategy for road development in **City of Ottawa**; *for Dillon Consulting Limited*; **Key Tasks**: evaluation and development of population monitoring methodology for Blanding's Turtle, provide wildlife crossing structure design considerations
- Peer Review of primary scientific literature; *for*
    - *Herpetological Review,*
    - *Journal of Applied Ecology*
    - *Acta Oecologica,*
    - *European Journal of Wildlife Research*
    - *Global Biology and Biogeography*

RESEARCH-FOCUSED EXPERIENCE

The following is a partial list of research-focused project experience.

Ph.D. Carleton University, Dept. of Biology

- Investigated effects of traffic noise on amphibian reproductive behaviour and efficacy of culverts as a means to reduce road mortality
- Conducted vocalization and live trapping surveys of anuran amphibians
- Gathered recordings of amphibian vocalizations at sites with various levels of traffic noise
- Analyzed recordings for variations in vocalizations acoustic properties
- Completed statistical analysis and modelling of data.
- Conducted road-kill surveys

M.Sc. Trent University, Dept. of Biology

- Developed spatially explicit models of biotic and abiotic variables that affect ground surface temperature and habitat quality for Eastern Hog-nosed Snakes.
- Collected large scale, high resolution thermal data
- Completed advanced multivariate statistical analysis of environmental data
- Developed models to determine variables associated with thermal habitat quality for hog-nosed snakes.

Eastern Hog-nosed Snake Research Program in Wasaga Beach Provincial Park - Program Co-ordinator

- Conducted a five year radio telemetry and mark recapture study to determine habitat use, spatial ecology, and population dynamics of a species at risk snake
- Developed research and field protocols
- Utilized GPS to accurately map snake locations and habitat features to later incorporate them into a spatial database
- Trained and supervised field technicians

Eastern Foxsnake Research Program in Awenda Provincial Park - Program Co-ordinator

- Designed and implemented a radio telemetry study of the spatial ecology of foxsnakes
- Developed animal care and research protocols

Relevant Certification, Training Courses, and Registrations

2019 Canadian Certified Inspector Sediment and Erosion Control (CAN-CISEC #0675)
2018 OSSGA Core Surface Miner Training
2015 Fisheries Assessment and Fisheries Contract Specialist, as per Ministry of Transportation / Department of Fisheries and Oceans / Ontario Ministry of Natural Resources, fisheries protocol training
2015 TRCA Expectations for Detailed ESC Plans, Toronto and Region Conservation Authority
2015 Introduction to Project Management, ECO Canada
2013 Species at Risk Mussel Identification, Fisheries and Oceans Canada (DFO)

RAQs registered in the Natural Science (Terrestrial and Aquatic) Specializations

PEER REVIEWED PUBLICATIONS

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Xuereb, A., J. Rouse, **G.M. Cunnington**, S. Lougheed. 2015. Population genetic structure at the northern range limit of the threatened eastern hog-nosed snake (*Heterodon platirhinos*). Conservation Genetics 16:1265–1276.

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Craig Mann, H.BSc.F, Dipl. IFRM.

Ecologist / AISA Certified Arborist (ON-2369A)

CAREER AND ACADEMIC HISTORY

2016 – Present	**Ecologist/Arborist, RiverStone Environmental Solutions**
2016 – Present	Project Ecologist – Terrestrial (Part Time), WSP, Kitchener, ON
2009 – 2016	Project Ecologist – Terrestrial, MMM Group Ltd, (Ecoplans Ltd.) Kitchener, ON
2006 – 2009	Terrestrial Ecologist, Michalski Nielsen Associates Ltd.
2000 – 2001	B.Ed, Lakehead University, Thunder Bay, Education
1996 – 1999	H.B.Sc.F, Lakehead University, Thunder Bay, Forestry
1994 – 1996	Diploma, Lakehead University, Thunder Bay, Integrated Forest Resource Management

PROFESSIONAL EXPERIENCE

- Craig has over a decade of experience on numerous projects and has gained sound understanding of the requirements for field assessment and preparation of documentation for Class Environmental Assessments for transportation and land development projects.
- Extensive knowledge of the ecology of central and northern Ontario, is proficient in conducting an array of field duties that include vegetation inventories, vegetation community mapping, woodland assessment, ELC, Species-at-Risk habitat assessments, amphibian surveys, wildlife inventories, benthic invertebrate collection, water sampling and fish rescues / transfer.
- Additional responsibilities include project coordination, proposal preparation, analysis of potential impacts, development of mitigation measures and report preparation.
- Prior work experience developed the bulk of his vegetation identification, ecological interpretation and outdoor skill while working with various forestry companies in northwest, northeast and central Ontario and implementing an enhanced water quality monitoring program in the Muskoka region. These experiences included the installation of permanent forestry plots, forest resource information surveys, road and cut-block location, tree marking, timber scaling, tree planting, forest tending, benthic monitoring and the use various agency protocols.
- Extensive experience working in multi-disciplinary teams, with volunteer groups including government agencies.
- Played a key role in the natural environment component of numerous planning, preliminary design and detail design for highway projects for the Ministry of Transportation (MTO). Responsibilities have included project coordination, review of background natural environment information, terrestrial field surveys, analysis of habitat types, potential impacts, development of mitigation measures for Species at Risk Act (SARA) and Endangered Species Act (ESA) authorizations, preparation of technical specialist reports and providing input to Transportation Environmental Study Reports (TESR) and Design and Construction Reports (DCR).

The following is a partial list of consulting-based project experience since 2006.

Species at Risk Habitat Assessments

- Species at Risk Screening in the **Town of Bracebridge**; *for private client*; **Key Tasks**: assessment of habitats to determine potential presence of Species at Risk, mapping of potential habitat, development of appropriate mitigation measures to support multiple lot subdivision.
- Species at Risk Study the **Town of Bracebridge**; *for private client*; **Key Tasks**: assessment of habitats to determine potential presence of Species at Risk, mapping of potential habitat, development of appropriate mitigation measures to a single lot severance.
- Species at Risk Screening in the **Town of Warren, Sudbury East Planning Board**; *for private client*; **Key Tasks**: Eastern Meadowlark and Bobolink assessment/surveys and Eastern Whip-poor-will assessment/surveys, mapping of potential habitat to determine potential of multi lot severance.
- Endangered and Threatened Species habitat Assessment in the **District of Parry Sound**; *for private client*; **Key Tasks**: assessment of habitats to determine potential presence of Species at Risk, surveys for turtles, Eastern Whip-poor-will, Eastern Meadowlark and Bobolink, mapping of potential habitat, development of appropriate mitigation measures to support construction of road across crown land.

Ecological Site Assessments/Environmental Impact Studies/Natural Heritage Evaluations

- Environmental Impact Statement in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: Vegetation classification (ELC), wetland boundary mapping, identification of significant natural heritage features, wildlife species sightings and description of potential habitat for wildlife, Species at Risk assessment and data management to support a multiple lot severance.
- Environmental Impact Statement in the **Town of Huntsville**; *for private client*; **Key Tasks**: Vegetation classification (ELC), wetland boundary mapping, identification of significant natural heritage features, wildlife species sightings and description of potential habitat for wildlife, Species at Risk assessment and data management to support a multiple lot severance.
- Environmental Impact Statement in the **Town of Gravenhurst**; for private client; **Key Tasks**: Vegetation classification (ELC), assessment of watercourse, assessment of fish habitat, wildlife species sightings, Species at Risk assessment and data management to support redevelopment of the property.
- Environmental Impact Statement in the **Town of Gravenhurst**; for private client; **Key Tasks**: Vegetation classification (ELC), identification of significant natural heritage features, wildlife species sightings and description of potential habitat for wildlife, Species at Risk assessment and data management as due diligence for lot purchase.

Tree Inventories and Arborist Reports

- Tree Inventory and Tree Compensation Plan in the **Town of Georgina**; **Key Tasks**: tree inventory and health assessment, significant species presence/absence, tree retainment and disturbance minimization recommendations, compensation plan.
- Tree Inventory and Health Assessment in the **Town of Caledon**; *Airport Road (Kings St. to Huntsmill Rd.)* **Key Tasks**: tree inventory and health assessment, significant species presence/absence.
- Tree Inventory and Health Assessment in the **Region of Peel,** *Cawthra Road (Eastgate Parkway to South Service Road*; **Key Tasks**: tree inventory and health assessment, significant species presence/absence.

Fisheries and Aquatic Assessments

- Fish Salvage in **Gamebridge Ontario, Trent Severn Waterway**; **Key Tasks**: fish rescue in support of lock reconstruction.
- Fish Salvage in **Bradford Ontario, 5th Line over unnamed tributary; Key Tasks**: fish rescue in support of bridge reconstruction.
- Fish Salvage in **Parry Sound District, Hwy 612 over tributary between Lake Joseph and Silver Lake; Key Tasks:** fish rescue in support of culvert reconstruction.
- Fish Habitat Assessment in **Township of Georgian Bay, Go Home Lake,** *for private client***; Key Tasks:** assessment of fish habitat in support of deck construction.
- Fish Habitat Assessment in **Town of Huntsville, Lake Vernon,** *for private client***; Key Tasks:** assessment of fish habitat in support of lot redevelopment.
- Fish Habitat Assessment in **Township of Lake of Bays, Lake of Bays,** *for private client***; Key Tasks:** assessment of fish habitat in support of boat port construction.

Transportation Experience

- Highway 11/17 Twinning from the **Manitoba border east to Kenora ON** Sections 1 and 2, Kenora ON: **Key Tasks:** Terrestrial Ecologist. Field assessments of vegetation and wildlife resources within the project limits. Documented the character, sensitivity and significance of terrestrial features, assessed impacts and developed appropriate mitigation strategies. Prepared a Terrestrial Preliminary Design and Detailed Design Reports (in progress). **Client: MTO Northwest Region**
- Hwy Structures - New Liskeard (GWP 5014-E-0019), **New Liskeard Area, ON** (2015–2018): **Key Tasks:** Project Ecologist. Assessment of vegetation and wildlife resources for the rehabilitation / replacement of 11 highway crossing structures throughout the New Liskeard area. Responsibilities included vegetation and wildlife inventories, documentation of the character, sensitivity and significance of all terrestrial features, assessment of impacts, development of appropriate mitigation strategies and documentation. **Client: MTO Northeast Region**
- Highway 11 Rehabilitation (GWP 5200-10-00), **Temagami, ON** (2013–2014): **Key Tasks:** Project Ecologist. Assessment of vegetation and wildlife resources for watercourse structure replacement and highway resurfacing along Highway 11 from 27.4 km north of Highway 64 to 0.7 km South of Lakeshore Drive in the town of Temagami, Ontario. Responsibilities included vegetation and wildlife inventories, documentation of the character, sensitivity and significance of all terrestrial features, assessment of impacts and development of appropriate mitigation strategies. **Client: MTO Northeast Region**
- Highway 11/17 Twinning Detailed Design (Hodder Avenue to Highway 527, Highway 527 to MacKenzie Station, **Red Rock to Nipigon and Ouimet to Dorion, ON** (2009–ongoing): **Key Tasks:** Terrestrial Ecologist. Conducted field assessments of vegetation and wildlife resources. Documented the character, sensitivity and significance of all terrestrial features, assessed impacts and developed appropriate mitigation strategies and prepared impact assessment reports. **Client: MTO Northwest**
- Highway 60 Twinning Hwy 11 to Hwy 35 District of Muskoka Preliminary Design Study, **Huntsville, ON**: **Key Tasks:** Terrestrial Ecologist. Conducted field assessments of all vegetation and wildlife resources within the project limits. Documented the character, sensitivity and significance of all terrestrial features, assessed impacts, provided input to the selection of alternatives and developed appropriate mitigation strategies. **Client: MTO Northeast**

Relevant Certification or Training Courses

2018 ISA Certified Arborist (ON-2369A)
2018 MNRF Ontario Wetlands Evaluation Systems (OWES) Certificate
2018 Surface Miner Core Module MTCU Program Certificate
2018 Standard First Aid and CPR Certificate
2018 WHMIS Certificate completion
2018 Class 2 Backpack Electrofishing Recertification
2016 MNRF Data Sensitivity Training
2015 Ecological Land Classification (ELC) Provincial
2007 Ecological Land Classification (ELC) Southern Ontario
2014 CN Rail Safety for Canadian Contractors
2014 Butternut Health Assessor Certificate, Ministry of Natural Resources (#493)
2013 Certificate in Garden Design, George Brown College
2010 Certified Seed Collector
2005 Ontario Tree Marker Course
2000 Ontario Timber Scalers License

Appendix 2. Selection of Photographs from Site Investigations.

Photo 1. Meadow community G030N (June 24, 2012).

Photo 2. Upland forest type G054Tt (November 3, 2011).

Photo 3. Upland forest type G058Tt (October 5, 2011).

Photo 4. Moist forest G051Tt (October 5, 2011).

Photo 5. Mixed forest type G040Tt (November 3, 2011).

Photo 6. Mixed forest type G055Tt (October 5, 2011).

Photo 7. Upland forest type G041Tt (November 3, 2011).

Photo 8. Moist forest G224Tt (October 5, 2011).

Photo 9. Moist forest G224Tt (October 5, 2011).

Photo 10. Wetland meadow community G142Tt (June 24, 2012).

Photo 11. Wetland G142N in northeast portion of property with a portion of the Muskoka Tributary North in the centre of the image (June 24, 2012).

Photo 12. Fen G139N (October 5, 2011).

Photo 13. Mineral Meadow Marsh (G142N) in north east portion of property (June 24, 2012).

Photo 14. Shrub Fen G140S (October 5, 2011).

Photo 15. Shrub thicket G134S (November 3, 2011).

Photo 16. Conifer swamp G129Tt (July 18, 2012).

Photo 17. Deciduous forest G058 (June 10, 2012).

Photo 18. Sage Creek Tributary 3 (November 3, 2011).

Photo 19. Forest type G054Tt (June 10, 2012).

Photo 20. Sage Creek Tributary SC-4 (November 3, 2011).

Photo 21. Sage Creek Tributary 3B (November 3, 2011).

Photo 22. Sage Creek Tributary 6 (November 3, 2011).

Photo 23. Central reach, Sage Creek (November 3, 2011).

Photo 24. Central reach, Sage Creek (November 3, 2011).

Photo 25. Central reach Sage Creek (November 3, 2011).

Photo 26. Upper reach, Sage Creek (November 3, 2011).

Photo 27. Upper reach, Sage Creek (November 3, 2011).

Photo 28. Lower reach of Sage Creek at outlet to Muskoka River (November 3, 2011).

Photo 29. Lower reach, Sage Creek (November 3, 2011).

Photo 30. Electrofishing Sage Creek (November 3, 2011)).

Photo 31. North branch Muskoka River (November 3, 2011).

Photo 32. Fen in northwestern corner of site (Sept 22, 2011).

Photo 33. Brook Trout caught by electrofishing in Sage Creek (November 3, 2011).

Photo 34. Muskoka Tributary North exiting from marsh (April 20, 2020).

Photo 35. Muskoka Tributary North downstream of marsh (April 20, 2020).

Photo 36. Fen in northwestern corner of site (October 5, 2011).

Photo 37. Fen in northwestern corner of site (Sept 22, 2011).

Photo 38. Open water portion of fen (Jun 10, 2012).

Photo 39. Open water portion of fen (October 5, 2011).

Photo 40. Active operations on licensed portion of fen (September 16, 2012).

Photo 41. Open channels maintained by beaver in portion of fen in licenced area (June 10, 2012).

Photo 42. Active operations adjacent to fen (May 10, 2012).

Photo 43. Active operations on licensed portion of fen (May 10, 2012).

Photo 44. Active operations on existing licenced quarry (October 10, 2011).

Photo 45. Active operations on existing licenced quarry (October 10, 2011).

Photo 46. Typical maintained recreation trail (September 22, 2011).

Photo 47. Fence around entire Fowler property (October 10, 2011).

Photo 48. Road constructed and upgraded to access Sage Creek (September 16, 2012).

Photo 49. Typical trail throughout property (June 24, 2012).

Photo 50. Road constructed and upgraded to access Sage Creek (September 16, 2012).

Photo 51. Road constructed and upgraded to access Sage Creek (September 16, 2012).

Appendix 3. Assessment of Endangered and Threatened Species

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Habitat-based Approach

Properly assessing whether an area is likely to contain Endangered or Threatened species for the purposes of determining whether a proposed development is likely to have a negative impact is becoming more difficult as the number of listed species increases. Approaches that depend solely on documenting the presence of individuals of a species in an area almost always underrepresent the biodiversity actually present because of the difficulty of observing species that are usually rare and well camouflaged. Given these difficulties, and the importance of protecting habitats of Endangered and Threatened species, RiverStone's primary approach to site assessment is habitat-based. This means that our field investigations focus on *evaluating the potential for features within an area of interest to function as habitat for species considered potentially present*, *rather than searching for live specimens*. An area is considered potential habitat if it satisfies a number of criteria, usually specific to a species, but occasionally characteristic of a broader group (e.g., several turtles use sandy shorelines for nesting, multiple bat species use dead or dying trees for roosting habitat). Physical attributes of a site that can be used as indicators of its potential to function as habitat for a species include structural characteristics (e.g., physical dimensions of rock fragments or trees, water depth), ecological community (e.g., meadow marsh, rock barren), and structural connectivity to other habitat features required by the species. Species-specific habitat preferences and/or affinities are determined from status reports produced by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Cadman et al. (2007), published and unpublished documents, and direct experience.

Table 1 provides RiverStone's desktop screening and on-site assessment for Endangered and Threatened species. RiverStone measures species- and feature-specific distances from the boundaries of proposed lots or development area(s)—rather than from the boundary of the significant natural heritage feature—and refers to this area as *adjoining lands* (AL). Evaluating the likelihood of species' presence and the potential for negative impacts using this approach ensures that the Adjacent Lands test of the PPS will be met.

For the purposes of RiverStone's assessment, the *property* as shown in **Figure 1** is referred to as the Area of Interest (AOI) and the adjoining lands (AL) extents were measured from the boundaries of the AOI.

Common Name[1]	Scientific Name	Step 1 (Desktop): Rationale for considering	Step 2 (Desktop): Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from aerial photography and other information sources indicate that potential habitat or communities might be present? Area of Interest (AOI)	Step 2 (Desktop): Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from aerial photography and other information sources indicate that potential habitat or communities might be present? Adjoining Lands (AL)	Step 3 (On Site): Potential and/or confirmed habitat documented during on-site assessment: Area of Interest (AOI)	Step 3 (On Site): Potential and/or confirmed habitat documented during on-site assessment: Adjoining Lands (AL)	Step 4: Is there potential for the species, its habitat, or ecological community to be negatively impacted by the activities that would be permissible within the AOI?
Endangered & Threatened (Provincially): status from Species at Risk in Ontario List (O Reg 230/08); updated January 2018							
Spotted Turtle	*Clemmys guttata*	range map	YES, suitable wetland communities are present.	YES, suitable wetland communities are present.	NO, although suitable wetland communities are present, this species was not detected during targeted surveys or during the course of other fieldwork.	NO, potential habitat not observed; however, areas with the physical characteristics necessary to function as habitat may be present.	NO, given the level of effort expended to document this species on site, it is unlikely that this species is present. Therefore, the potential for this species or its habitat to be negatively impacted by the proposed activities is acceptably low.
Blanding's Turtle	*Emydoidea blandingii*	SAR by Geo-Township Tool (MNR)	YES, suitable wetland and/or aquatic communities are present.	YES, suitable wetland and/or aquatic communities are present.	NO, although suitable wetland communities are present, this species was not detected during targeted surveys or during the course of other fieldwork.	NO, potential habitat not observed; however, areas with the physical characteristics necessary to function as habitat may be present.	NO, given the level of effort expended to document this species on site, it is unlikely that this species is present. Therefore, the potential for this species or its habitat to be negatively impacted by the proposed activities is acceptably low.
Eastern Hog-nosed Snake	*Heterodon platirhinos*	SAR by Geo-Township Tool (MNR)	YES, a mosaic of open communities, mixed forest, and wetland communities is present.	YES, a mosaic of open communities, mixed forest, and wetland communities is present.	YES, although the species was not documented during the course of field investigations, the physical characteristics of the area and the wide-ranging movement behaviour of the Eastern Hog-nosed Snake make use of the property and adjoining lands likely.	YES, a mosaic of open communities, mixed forest, and wetland communities is present.	YES.
Eastern Whip-poor-will	*Caprimulgus vociferus*	SAR by Geo-Township Tool (MNR)	YES, anthropogenic openings in the canopy along the existing access route could provide suitable breeding and foraging habitat.	YES, both natural and anthropogenic openings in the canopy associated with the existing licence could provide suitable breeding and foraging habitat.	NO, suitable habitat not identified within the AOI. Additionally, the species was not detected during nocturnal breeding bird surveys conducted on July 4 and 5, 2012 or during the course of other fieldwork. See **Figure 5** for survey area.	NO, species not detected during nocturnal breeding bird surveys conducted on July 4 and 5, 2012 or during the course of other fieldwork. See **Figure 5** for survey area.	NO, given that habitat was not identified within the AOI and potential habitat present on AL was not being used by this species, there is a low likelihood of the proposed development negatively impacting this species or its habitat.
Bobolink	*Dolichonyx oryzivorus*	OBBA	NO, suitable grassland or agricultural communities are absent.	NO, suitable grassland or agricultural communities are absent.	NO, suitable grassland or agricultural communities are absent.	NO, suitable grassland or agricultural communities are absent.	NO, see steps 2 and 3.
Chimney Swift	*Chaetura pelagica*	OBBA	NO, man-made structures or areas of old-growth forest suitable for nesting or roosting are absent.	NO, man-made structures or areas of old-growth forest suitable for nesting or roosting are absent.	NO, man-made structures or areas of old-growth forest suitable for nesting or roosting are absent.	NO, man-made structures or areas of old-growth forest suitable for nesting or roosting are absent.	NO, see steps 2 and 3.
Barn Swallow	*Hirundo rustica*	SAR by Geo-Township Tool (MNR)	NO, man-made or natural structures suitable for nesting are absent.	NO, man-made or natural structures suitable for nesting are absent.	NO, man-made or natural structures suitable for nesting are absent.	NO, man-made or natural structures suitable for nesting are absent.	NO, see steps 2 and 3.
Eastern Meadowlark	*Sturnella magna*	range map	NO, suitable grassland or agricultural communities are absent.	NO, suitable grassland or agricultural communities are absent.	NO, suitable grassland or agricultural communities are absent.	NO, suitable grassland or agricultural communities are absent.	NO, see steps 2 and 3.
Eastern Small-footed Myotis	*Myotis leibii*	range map	NO, natural structures (e.g., talus slopes, rocky ridges, rock outcrops, cliff crevices, rock fields) suitable for roosting do not appear to be present.	NO, natural structures (e.g., talus slopes, rocky ridges, rock outcrops, cliff crevices, rock fields) suitable for roosting do not appear to be present.	NO, species not detected during targeted acoustic surveys.	NO, natural structures (e.g., talus slopes, rocky ridges, rock outcrops, cliff crevices, rock fields) suitable for roosting are absent.	NO, see step 3.
Little Brown Myotis	*Myotis lucifugus*	range map	YES, dark sheltered hollow vertical structures (e.g., large trees with cavities or rock crevices) suitable for nesting or roosting may be present.	YES, dark sheltered hollow vertical structures (e.g., large trees with cavities or rock crevices) suitable for nesting or roosting may be present.	YES, although documented in limited numbers, species was detected during acoustic surveys.	YES, although specific trees with the characteristics necessary to function as gestating or roosting habitat were not documented, the forest communities present have the potential to support these types of features.	YES.

[1]Shaded rows denote species or communities for which negative impacts have been deemed possible.

Appendix 3: Table 1. Results of desktop screening and on-site assessment for endangered and threatened species.

Common Name[1]	Scientific Name	Step 1 (Desktop): Rationale for considering	Step 2 (Desktop): Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from aerial photography and other information sources indicate that potential habitat or communities might be present? Area of Interest (AOI)	Step 2 (Desktop): Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from aerial photography and other information sources indicate that potential habitat or communities might be present? Adjoining Lands (AL)	Step 3 (On Site): Potential and/or confirmed habitat documented during on-site assessment Area of Interest (AOI)	Step 3 (On Site): Potential and/or confirmed habitat documented during on-site assessment Adjoining Lands (AL)	Step 4: Is there potential for the species, its habitat, or ecological community to be negatively impacted by the activities that would be permissible within the AOI?
Northern Myotis	*Myotis septentrionalis*	range map	YES, dark sheltered hollow vertical structures (e.g., large trees with cavities or rock crevices) suitable for nesting or roosting may be present.	YES, dark sheltered hollow vertical structures (e.g., large trees with cavities or rock crevices) suitable for nesting or roosting may be present.	YES, although documented in limited numbers, species was detected during acoustic surveys.	YES, although specific trees with the characteristics necessary to function as gestating or roosting habitat were not documented, the forest communities present have the potential to support these types of features.	YES.
Bank Swallow	*Riparia riparia*	OBBA	YES, man-made or natural structures suitable for nesting may be present.	YES, man-made or natural structures suitable for nesting may be present.	NO, although areas of the subject property have the physical characteristics necessary to function as nesting habitat for species, potential areas are not currently being used—as determined by surveys conducted during the breeding season.	NO, potential habitat not observed; however, areas with the physical characteristics necessary to function as habitat may be present.	NO, nests were not documented within the AOI during nest surveys and activities associated with the development are unlikely to affect any breeding habitat being used on the AL.

[1]Shaded rows denote species or communities for which negative impacts have been deemed possible.

Appendix 4. Assessment of Significant Wildlife Habitat

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Ecoregion 5E	Candidate Significant Wildlife Habitat*	ELC Ecosites	Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from available information sources and on-site assessment indicate that candidate SHW might be present?
Seasonal Concentration Areas of Animals			
Waterfowl Stopover and Staging Areas (Terrestrial)	Fields with sheet water during Spring (mid March to May) Fields flooding during spring melt and run-off provide important invertebrate foraging habitat for migrating waterfowl. Agricultural fields with waste grains are commonly used by waterflow, these are not considered SWH unless they have spring sheet water available.	These field/meadow ELC ecosites with appropriate soils and vegetation: G060-062, G077-079, G093-095, G109-111 Plus evidence of annual spring flooding from melt water or run-off.	NO, the assessment area does not contain the ELC ecosites associated with this SWH category.
Waterfowl Stopover and Staging Areas (Aquatic)	Ponds, marshes, lakes, bays, coastal inlest, and watercourses used during migration. Sewage treatment Ponds and storm water Ponds do not qualify as a SWH, however a reservoir managed as a large wetland or pond/lake does qualify. These habitats have an abundance food supply (mostly aquatic invertebrates and vegetation in shallow water)	ELC Ecosites: G142-G152	NO, while the assessment area does contain ELC ecosites associated with this SWH category, no areas of concentrations of waterfowl were observed during onsite investigations.
Shorebird Migratory Stopover Areas	Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats. Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid-June and early July to October. Sewage treatment ponds and storm water ponds do not qualify as a SWH.	ELC Ecosites: G005-G006, G160-G162, G170-G172, G176-G178, G186-G188, G204-G214	NO, the assessment area does not contain the ELC ecosites associated with this SWH category.
Raptor Winter Feeding and Roosting Areas	The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. Raptor wintering sites need to be > 20 ha with a combination of forest and upland. Least disturbed sites, idle/fallow or lightly grazed field/meadow (>15ha) with adjacent woodlands Field area of the habitat is to be wind swept with limited snow depth or accumulation.	A combination of meadow/field and forest/woodland ecosites. Need to have a forest ELC Ecosite: G011-G19, G023-G028, G033-G043, G048-G059, G064-G076, G081-G092, G097-G108, G133-G125 or Central Ontario FEC Ecosites ES11–ES35 **AND** a meadow/field ELC Ecosite: G020-022, G029-G032, G044-G047, G060-G063, G077-080, G093-096, G109-G112	NO, while the assessment area contains forest/woodland ecosites, meadow/field ecosites are not present suggesting this area does not provide winter feeding and roosing areas for raptors.

*as per Significant Wildlife Habitat Criteria Schedules for Ecoregion 5E (January 2015)

Ecoregion 5E	Candidate Significant Wildlife Habitat*	ELC Ecosites	Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from available information sources and on-site assessment indicate that candidate SHW might be present?
Bat Hibernacula	Hibernacula may be found in caves, mine shafts, underground foundations and Karsts. Active mine sites are not SWH. The locations of bat hibernacula are relatively poorly known.	Bat Hibernacula may be found in association with components of cliffs and rock talus in these ELC Ecosites: G158-G159, G164, G180-G181 Or Central Ont. FEC: ES4, ES5 Note: buildings are not considered to be SWH	NO, while the assessment area contains steep slopes, rock crevices, caves, and mine shafts suitble for use as hibernation sites are absent.
Bat Maternal Colonies	Maternity colonies can be found in tree cavities, vegetation and often in buildlings (buildings are not considered to be SWH). Maternity roosts are not found in caves and mines in Ontario Maternity colonies located in Mature (dominant trees > 80yrs old) deciduous or mixed forest stands with >10/ha large diameter (>25cm dbh) wildlife trees Female Bats prefer wildlife trees (snags) in early stages of decay, class 1-3 . Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags/ha are preferred.	Maternity colonies considered SWH are found in forested Ecosites. ELC Ecosites: G016-G019, G028, G040-G043, G055-G059, G070-G076, G088-G092, G103-G108, G118-G125 or: Central Ontario Forest Ecosites: ES14, ES17, ES18, ES23, ES24, ES25, ES26, ES27, ES28, ES29, ES30	NO, results of the acoustic monitoring surveys completed within the assessment did not detect sufficient numbers of Big Brown Bats or Silver-haired Bats to indicate that Bat Maternity Colonies are present.
Turtle Wintering Areas	-For most turtles, wintering areas are in the same general area as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates. -Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen -Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH.	For Snapping and Midland Painted turtles; ELC Ecosites: G128-G135 G140-G152 For Northern Map Turtle - Open Water areas such as deeper rivers or streams and lakes with current can also be used as over-wintering habitat.	YES, results of targeted surveys within the assessment area indicate that turtle wintering areas are present within the Fen Community.

*as per Significant Wildlife Habitat Criteria Schedules for Ecoregion 5E (January 2015)

Ecoregion 5E	Candidate Significant Wildlife Habitat*	ELC Ecosites	Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from available information sources and on-site assessment indicate that candidate SHW might be present?
Snake Hibernaculum	-For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural or naturalized locations. The existence of features that go below frost line; such as rock piles or slopes, old stone fences, and abandoned crumbling foundations assist in identifying candidate SWH. -Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line -Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover. -Five-lined skink prefer mixed forests with rock outcrop openings providing cover rock overlaying granite bedrock with fissures.	For all snakes, habitat may be found in any forested ecosite in central Ontario other than very wet ones. Talus, Rock Barren, Crevice and Cave, and Alvar sites may be directly related to these habitats. The existence of rock piles or slopes, stone fences, and crumbling foundations assist in identifing candidate SWH. For Five-lined Skink; Central Ontario Forest Ecosites: ES14.2, ES17 – ES20, ES23 – ES30 Or; ELC Ecosites: G056-G059 G070-G076 G087-G092 G103-G108 G118-G125	NO, while the assessment area contains steep slopes, results of targeted surveys did not identify congregations of snakes that are indicative of snake hibernaculum.
Colonially - Nesting Bird Breeding Habitat (Bank and Cliff)	-Any site or areas with exposed soil banks, sandy hills, borrow pits, steep slopes, and sand piles that are undisturbed or naturally eroding that is not a licensed/permitted aggregate area. -Does not include man-made structures (bridges or buildings) or recently (2 years) disturbed soil areas, such as berms, embankments, soil or aggregate stockpiles. -Does not include a licensed/permitted Mineral Aggregate Operation.	Eroding banks, sandy hills, borrow pits, steep slopes, sand piles, cliff faces, bridge abutments, silos, barns. Habitat found in the following ELC Ecosites: G001-G004 G007-G008 G020-G021 G029-G031 G044-G046 G060-G062 G077-G079 G093-G095 G109-G111 G173-G175 G201-G203 G210-G212	NO, while the assessment area and adjacent lands contain steep slopes, these areas are forested and do not provide opportunityies for bank and cliff nesting avian species.
Colonially - Nesting Bird Breeding Habitat Breeding Habitat (Tree/Shrubs)	-Nests in live or dead standing trees in wetlands, lakes, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used. -Most nests in trees are 11 to 15 m from ground, near the top of the tree.	ELC Ecosites: G064-G076 G081-G092 G097-G108 G113-G125 G128-G136 Central Ontario Forest Ecosites: ES11.2 ES12.2 ES13.2 ES14.2 ES15.2 ES16.2 ES17.2 ES18.2 ES19.2 ES20.2 ES21.2 ES23.2 ES24.2 ES25.2 ES26.2 ES27.2 ES28.2 ES29.2 ES30.2 ES31 ES32 ES33 ES34 ES35	NO, no large stick nests were identified during on site assessments.

*as per Significant Wildlife Habitat Criteria Schedules for Ecoregion 5E (January 2015)

Ecoregion 5E	Candidate Significant Wildlife Habitat*	ELC Ecosites	Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from available information sources and on-site assessment indicate that candidate SHW might be present?
Colonially - Nesting Bird Breeding Habitat (Ground)	-Nesting colonies of gulls and terns are on islands or peninsulas (natural or artificial) associated with open water, marshy areas, lake or large river (two-lined on a 1;50,000 NTS map). -Brewers Blackbird colonies are found loosely on the ground in or in low bushes in close proximity to streams and irrigation ditches within farmlands.	Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1;50,000 NTS map). Close proximity to watercourses in open fields or pastures with scattered trees or shrubs (Brewer's Blackbird) G001-G004 G007-G008 G020-G021 G029-G031 G044-G046 G060-G062 G077-G079 G093-G095 G109-G111 G142-G145	NO, the assessment area lacks rocky islands or peninsulas.
Deer Yarding Areas	-Deer wintering areas or winter concentration areas (yards) are areas deer move to in response to the onset of winter snow and cold. This is a behavioural response and deer will establish traditional use areas. The yard is composed of two areas referred to as Stratum I and Stratum II. Stratum II covers the entire winter yard area and is usually a mixed or deciduous forest with plenty of browse available for food. Agricultural lands can also be included in this area. Deer move to these areas in early winter and generally, when snow depths reach 20 cm, most of the deer will have moved here. If the snow is light and fluffy, deer may continue to use this area until 30 cm snow depth. In mild winters, deer may remain in the Stratum II area the entire winter. -The Core of a deer yard (Stratum I) is located within Stratum II and is critical for deer survival in areas where winters become severe. It is primarily composed of coniferous trees (pine, hemlock, cedar, spruce) with a canopy cover of more than 60%. -OMNRF determines deer yards following methods outlined in "Selected Wildlife and Habitat Features: Inventory Manual". -Woodlots with high densities of deer due to artificial feeding are not significant.	May be found in all Tall Treed forest and swamp ELC Ecosites; G12-G15 G23-G27 G33-G38 G48-G54 G64-G69 G81-G87 G97-G103 G113-G118 G128-G129 Central Ontario Forest Ecosites: ES11 ES14 ES16 ES18 ES20 ES21 ES22 ES27 ES28 ES30 ES31 ES32 ES33 ES34 Note: OMNRF to determine this habitat.	NO, deer yarding areas have not been identified by MNRF within the assessment area.
Rare Vegetation Communities			
Beach / Beach Ridge / Bar / Sand Dunes	Vegetation can vary from patchy and barren to tree cover but less than 60%. Characterised by unstable sand. **Indicator Spp.** Marram Grass (*Ammophila breviligulata*), Beach Pea (*Lathyrus japonicus*)	Central Ontario FEC: ES1, ES2 ELC Ecosites: G005-G006, G166-G168, G182-G184, G213-G214	NO, the assessment area does not contain the ELC ecosites associated with this SWH category.
Shallow Atlandtic Coastal Marsh	Shallow marsh occurs on shallow mineral (sand) or mineral organic (sandy peat) shoreline subject to low wave energy, on inland lakes and beaver ponds particularly those that experience fluctuating water levels from year to year (i.e. some years with exposed shorelines in summer /fall). **Indicator Spp.:** Virginia Meadowbeauty (*Rhexia virgininica*) **Other Associated Spp:** *Rhynchospora capitellata, Xyris difformis, Panicum spretum, Triadenum virginicum, Polygonum careyi* and *Juncus militaris* .	ELC Ecosites: G143-G145, G148-G152	NO, the assessment area does not contain the ELC ecosites associated with this SWH category.

*as per Significant Wildlife Habitat Criteria Schedules for Ecoregion 5E (January 2015)

Ecoregion 5E	Candidate Significant Wildlife Habitat*	ELC Ecosites	Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from available information sources and on-site assessment indicate that candidate SHW might be present?
Cliffs and Talus Slopes	Vegetation can vary from patchy and barren to tree cover but less than 60%. Cliffs and talus slopes in 5E are primarily Precambrian rock and are typically sparsely vegetated. Characteristic flora for cliffs and talus slopes include: lichen, such as Rock Tripe *Umbilicaria* spp., and ferns *Polypodium virginianum* , *Cystopteris fragilis* and *Woodsia ilvensis, Cryptogramma stelleri, Woodsia alpina* , and *Saxifraga paniculata* .	ELC Ecosites: G158-G159, G166-G168, G173, G175, G182-G184, G201-G203	NO, the assessment area does not contain the ELC ecosites associated with this SWH category.
Rock Barren	Vegetation can vary from patchy and barren to tree cover but less than 60%. Rock barrens are characterized by extensive areas of exposed granitic rock bedrock sparsely vegetated. Characteristic flora for Rock Barrens include: lichens *Cladina* spp. and mosses *Polytrichum* spp.), sparse grasslands of *Danthonia spicata* and *Deschampsia flexuosa* , low shrubs (*Juniperus communis, Vaccinium angustifolium, Comptonia peregrina* , and stunted open grown trees *Quercus alba, Quercus rubra* and *Pinus strobus* . Also, *Pteridium aquilinum, Aralia hispida, Spiranthes casei, Saxifraga virginiensis, Gaylussacia baccata, Corydalis sempervirens, Prunus pensylvanica* , and *Comandra umbellata* .	ELC Ecosites: G163-G165, G179-G181 Central Ontario Forest Ecosites: ES8	NO, the assessment area does not contain the ELC ecosites associated with this SWH category.
Sand Barren	Sand Barrens typically are exposed sand, generally sparsely vegetated and caused by lack of moisture, periodic fires and erosion. They have little or no soil and the underlying rock protrudes through the surface. Usually located within other types of natural habitat such as forest or savannah. Vegetation can vary from patchy and barren to tree covered but less than 60%. Characteristic plant species of sand barrens in 5E include: *Cladina* spp., *Carex houghtoniana, Carex merrittfernaldii, Comptonia peregrina, Rubus flagellaris, Selaginella rupestris,* and *Viola labradorica, Polygonella articulata,* and *Stipa spartea* .	ELC Ecosites: G007, G215 Central Ontario Forest Ecosite: ES10	NO, the assessment area does not contain the ELC ecosites associated with this SWH category.

*as per Significant Wildlife Habitat Criteria Schedules for Ecoregion 5E (January 2015)

Ecoregion 5E	Candidate Significant Wildlife Habitat*	ELC Ecosites	Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from available information sources and on-site assessment indicate that candidate SHW might be present?
Alvar	An alvar is typically a level, mostly unfractured calcareous bedrock feature with a mosaic of rock pavements and bedrock overlain by a thin veneer of soil. The hydrology of alvars may be complex, with alternating periods of inundation and drought. Vegetation cover varies from sparse lichen-moss associations to grasslands and shrublands and comprising a number of characteristic or indicator plant. Undisturbed alvars can be phyto- and zoogeographically diverse, supporting many uncommon or are relict plant and animals species. Vegetation cover varies from patchy to barren with a less than 60% tree cover. 5E Alvar Plant Indicator species: *Penstemon hirsutus, Panicum philadelphicum, Scutellaria parvula, Rhus aromatica, Monarda fistulosa, Senecio pauperculus* .	Southern Ontario ELC Ecosites: ALO1, ALS1, ALT1, FOC1, FOC2, CUM2, CUS2, CUT2-1, CUW2 Central Ontario Forest Ecosites on very shallow soils: ES13.1, ES14.1, ES16.1, ES21.1, ES9	NO, the assessment area does not contain the ELC ecosites associated with this SWH category.
Old Growth Forest	Old Growth forests are characterized by exhibiting the greatest number of old-growth characteristics, such as mature forest with large trees that has been undisturbed. Heavy mortality or turnover of overstorey trees resulting in a mosaic of gaps that encourage development of a multi-layered canopy and an abundance of snags and downed woody debris.	Long-lived forest spp. within these Central Ontario Forest Ecosites: ES11, ES12, ES14, ES20, ES21, ES22, ES23, ES24, ES25, ES26, ES27 ES28 ES29 ES30 or ELC Ecosites: G011-G15, G017-G018, G023, G027, G033, G036, G039-G042, G048, G051, G054-G058, G064, G066, G069, G071-G075, G081, G084, G087, G089-G091, G103, G105-G107, G113, G115, G118, G120-G124.	NO, based on a review of available background documentation, old growth forest communities were not present on the assessment area. This was supported by conditions documented during on-site review (i.e., trees observered were of insufficient size).
Bog	Bogs are nutrientpoor, acid peatlands dominated by peat mosses (Sphagnum sp.), ericaceous shrubs and sedges (Cyperaceae). The water table is at or near the surface in spring and slightly lower the remainder of the year and is vitually isolated from mineral soil waters.	ELC Ecosites: G126, G137-G138	NO, the assessment area does not contain the ELC ecosites associated with this SWH category.
Tallgrass Prairie	Tallgrass Prairie is an open vegetation with less than < 25% tree cover, and dominated by prairie species, including grasses. **Indicator Spp.** *Andropogon gerardii* and *Spartina pectinata* **Characteristic Spp.** *Bromus kalmii, Ceanothus herbaceus, Lechea intermedia, Monarda fistulosa, Penstemon hirsutus, Polygala polygama, Rudbeckia hirta, Sorghastrum nutans, Viola fimbriatula* .	Southern ELC Ecosites: TPO1, TPO2 Central Ontario Ecosite: ES10	NO, the assessment area does not contain the ELC ecosites associated with this SWH category.
Savannah	A Savannah is related to tallgrass prairie, but includes trees, which vary from 25 – 60% canopy cover. The open areas between the trees are dominated by prairie species, while forest species are found beneath the tree canopy.	Southern ELC Ecosites: TPS1, TPS2, TPW1, TPW2, CUS2	NO, the assessment area does not contain the ELC ecosites associated with this SWH category.

*as per Significant Wildlife Habitat Criteria Schedules for Ecoregion 5E (January 2015)

Ecoregion 5E	Candidate Significant Wildlife Habitat*	ELC Ecosites	Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from available information sources and on-site assessment indicate that candidate SHW might be present?
Rare Forest Type - Red Spruce	Red Spruce is a valued wildlife cover tree. Historically red spruce was much more abundant then it is now within the Ecoregion 5e forests. Red spruce is a shade tolerant conifer that evolved within tolerant hardwood forests. Red spruce grows best in a cool, moist climate. It will grow in shallow, till soils (ave. of 46 cm) and may grow on sites unfavourable for other species such as organic soils over rock, steeper slopes, and wet bottomlands, although poorly drained sites will inhibit growth.	ELC Ecosites: G036, G051, G066, G084, G086, G100, G102, G116, G117 Central Ontario Forest Ecosites: ES 30.1, ES 30.2	NO, Red Spruce were not documented in the assessment area.
Rare Forest Type - White Oak	White oak is a valued wildlife mast producing tree. The mast produced by the white oak tree is often preferred over the more common red oak acorn. Forest stands containing white oak trees are uncommon in the Great Lakes St. Lawrence Forest.	ELC Ecosites: G017, G041, G057, G072, G090, G106, G121 Central Ont. FEC: ES 14.1, ES14.2	NO, White Oak were not documented in the assessment area.
Specialized Habitats for Wildlife			
Waterfowl Nesting Area	A waterfowl nesting area extends 120 m from a wetland (> 0.5 ha) or a cluster of 3 or more small (<0.5 ha) wetlands within 120 m of each individual wetland where waterfowl nesting is known to occur. Upland areas should be at least 120 m wide so that predators such as racoons, skunks, and foxes have difficulty finding nests. Wood Ducks, Bufflehead, Common Goldeneye and Hooded Mergansers utilize large diameter trees (>40cm dbh) in woodlands for cavity nest sites.	All upland habitats located adjacent to these wetland ELC Ecosites are Candidate SWH: G129-G135, G142-G152 Note: includes adjacency to provincially Significant Wetlands	NO, while the assessment area does contain the ELC ecosites associated with this SWH category, none of the indicator species were detected during onsite targeted surveys.
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat	Nests are associated with lakes, ponds, rivers or wetlands along forested shorelines, islands, or on structures over water. Osprey nests are usually at the top a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree's canopy. Nests located on man-made objects are not to be included as SWH (e.g. telephone poles and constructed nesting platforms).	Forest communities directly adjacent to riparian areas – rivers, lakes, ponds and wetlands	NO, stick nests were not documented in the assessment area.
Woodland Raptor Nesting Habitat	All natural or conifer plantation woodland/forest stands. Stick nests found in a variety of intermediate-aged to mature conifer, deciduous or mixed forests within tops or crotches of trees. Species such as Merlin or Coopers hawk nest along forest edges sometimes on peninsulas or small off-shore islands. Includes nest sites within tree cavities for Barred Owl and sometime Great Horned Owls and Merlin. In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest.	May be found in all forested ELC Ecosites in Community Class: TR May also be found in the forested swamp ELC Ecosites: G128-G133	NO, stick nests were not documented in the assessment area. Trees with cavities suitable to function as nesting habtiat for owls were not documented.

*as per Significant Wildlife Habitat Criteria Schedules for Ecoregion 5E (January 2015)

Ecoregion 5E	Candidate Significant Wildlife Habitat*	ELC Ecosites	Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from available information sources and on-site assessment indicate that candidate SHW might be present?
Turtle and Lizard Nesting Areas	Best nesting habitat for turtles are close to water and away from roads and sites less prone to loss of eggs by predation from skunks, raccoons or other animals. For an area to function as a turtle nesting area, it must provide sand and gravel that turtles are able to dig in and are located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH. Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes, and rivers are most frequently used. Skinks will nest under logs, in stumps or under loose rock in partially wooded areas.	Turtle Nesting areas may be adjacent to these ELC Ecosites: G138, G140-149 For Five-lined Skink - Central Ontario Forest Ecosites: ES14.2, ES17–ES20, ES23–ES30 or; ELC Ecosites: G056-G059, G070-G076, G087-G092, G103-G108, G118-G125	YES, evidence of turtle nesting was observed within the assessment area adjacent extraction area.
Seeps and Springs	Seeps/Springs are areas where ground water comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a stream could have seeps/springs.	Any forested area (with <25% meadow/field/pasture) within the headwaters of a stream or river system. Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species.	YES, areas of groundwater upwellings and headwater features were identified along the slopes assoicated with Sage Creek at the southern end of the assessment area.
Aquatic Feeding Habitat	MNRF maps these location on Crown land and rates the site on a scale of 0 – 4, with 4 being the best. Feeding sites classed 3 or 4 are potential/candidate significant. Where Moose Aquatic Feeding Areas (MAFA) habitat is in low supply, class 2 MAFA habitat could also be considered potential/candidate significant. Wetlands and isolated embayments in rivers or lakes which provide an abundance of submerged aquatic vegetation such as pondweeds, water milfoil and yellow water lily are preferred sites. Adjacent stands of lowland conifer or mixed woods will provide cover and shade.	Habitat may be found in all forested ecosites adjacent to water.	NO, while the assessment area does contain frontage on Sage Creek, no areas of wetlands or isolated embayments containing submerged aquatic vegetation were documented.
Mineral Lick	This habitat component is found in upwelling groundwater and the soil around these seepage areas. It typically occurs in areas of sedimentary and volcanic bedrock. In areas of granitic bedrock, the site is usually overlain with calcareous glacial till.	Habitat may be found in all forested ecosites.	NO, while groundwater upwellings were identified in the assessment area no evidence of mineral licks were documented.
Denning Sites and Mink, Otter, Martin, Fisher, and Eastern Wolf	Mink prefer shorelines dominated by coniferous or mixed forests with dens usually underground. Mink will sometimes use old muskrat lodges. Otters prefer undisturbed shorelines along water bodies that support productive fish populations with abundant shrubby vegetation and downed woody debris for denning. They often use old beaver lodges or log jams and crevices in rock piles. Marten and fisher share the same general habitat, requiring large tracts of coniferous or mixed forests of mature or older age classes. Denning sites are often in cavities in large trees or under large downed woody debris.	Habitat may be found in all forested ecosites.	NO, features potentially functioning as denning sites were not documented in the assessment area; no dens or excavated areas were documented. There is a low likelihood that the assessment area functions as denning habitat for these species.

*as per Significant Wildlife Habitat Criteria Schedules for Ecoregion 5E (January 2015)

Ecoregion 5E	Candidate Significant Wildlife Habitat*	ELC Ecosites	Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from available information sources and on-site assessment indicate that candidate SHW might be present?
Amphibian Breeding Habitat (Woodland)	Presence of a wetland or pond >500 m^2 (about 25 m diameter) within or adjacent (within 120m) to a woodland (no minimum size). The wetland, lake or pond and surrounding forest, would be the Candidate SWH. Some small wetlands may not be mapped and may be important breeding pools for amphibians. Breeding ponds within the woodland or the shortest distance from forest habitat are more significant because of reduced risk to migrating amphibians and more likely to be used. Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat.	All forested, ELC Ecosites; The wetland breeding ponds (including vernal pools) may be permanent, seasonal, ephemeral, large or small in size and could be located within or adjacent to the woodland.	NO, results of targeted surveys within the assessment area did not detect sufficient number of individuals of the focal species associated with this category to indicate that amphibian breeding habitat (woodland) is present.
Amphibian Breeding Habitat (Wetlands)	Wetlands and pools (including vernal pools) >500 m^2 (about 25 m diameter), supporting high species diversity are significant; some small or ephemeral habitats may not be identified on MNRF mapping and could be important amphibian breeding habitats. Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators. Bullfrogs require permanent water bodies with abundant emergent vegetation.	ELC Ecosites: G129-G135,G142-G152 Typically these wetland ecosites will be isolated (>120 m) from woodland ecosites, however larger wetlands containing predominantly aquatic species (e.g., Bull Frog) may be adjacent to woodlands.	NO, results of targeted surveys within the assessment area did not detect sufficient number of individuals of the focal species associated with this category to indicate that amphibian breeding habitat (wetlands) is present.
Mast Producing Areas	Most important areas are mature forests >0.5 ha containing numerous large beech and red oak trees that supply the energy-rich mast that wildlife prefer. Other significant tree species include hickory, basswood, black cherry, ironwood, mountain ash, pin cherry, and butternut. Significant shrub species include blueberries, wild black berry, serviceberry, raspberry, beaked hazel, choke cherry and hawthorn. Sites providing long-term, relatively stable food supplies, forest openings or barrens >1 ha provide excellent sites for mast producing shrubs. Sites such as clear-cuts or burns are temporary source of food and are less significant.	ELC Ecosites: G015, G017, G019, G027-G028, G041-G043, G057, G059, G072, G090, G106, G108, G121, Central Ontario Forest Ecosites: ES14, ES17.1, ES23, ES24, ES25, ES26	NO, while oak are present within the assessment area, these trees are not in sufficent number or size to provide SWH.

*as per Significant Wildlife Habitat Criteria Schedules for Ecoregion 5E (January 2015)

Ecoregion 5E	Candidate Significant Wildlife Habitat*	ELC Ecosites	Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from available information sources and on-site assessment indicate that candidate SHW might be present?
Habitat for Species of Conservation Concern (not including Endangered or Threatened Species)			
Marsh Bird Breeding Habitat	Nesting occurs in wetlands. All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present. For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it may be found in upland shrubs or forest a considerable distance from water.	ELC Ecosites: G138-G152 For Green Heron: above Ecosites plus G129-G136.	NO, while wetland communities are present, results of targeted breeding bird surveys did not detect the species associated with this SWH category.
Open Country Bird Breeding Habitat	Large grassland areas (includes natural and cultural fields and meadows) >30 ha Grasslands not Class 1 or 2 agricultural lands, and not being actively used for farming (i.e., no row cropping or intensive hay or livestock pasturing in the last 5 years). Grassland sites considered significant should have a history of longevity, either abandoned fields, mature hayfields and pasturelands that are at least 5 years or older. The Indicator bird species are area sensitive requiring larger grassland areas than the common grassland species.	ELC Ecosites: G008-G009, G020-G021, G029-G031, G044-G046, G060-G062, G077-G079, G093-G095, G109-G111	NO, the assessment area does not contain the ELC ecosites associated with this SWH category.
Shrub/Early Successional Bird Breeding Habitat	Large field areas succeeding to shrub and thicket habitats >30 ha in size. Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (i.e., no row-cropping, haying or livestock pasturing in the last 5 years). Larger shrub thicket habitats (>30 ha) are most likely to support and sustain a diversity of these species. Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or lightly grazed pasturelands.	ELC Ecosites: G009-G010, G021-G022, G031-G032, G046-G047, G062-G063, G079-G080, G095-G096, G111-G112, G134-G135 Patches of shrub ecosites can be complexed into a larger habitat for some bird species.	NO, while the assessment area does contain the ELC ecosites associated with this SWH category they are not more than 30 ha in size.
Special Concern and Rare Wildlife Species	All Special Concern and Provincially Rare (S1-S3, SH) plant and animal species. All plant and animal element occurrences (EO) within a 1 or 10 km grid. Older element occurrences were recorded prior to GPS being available, therefore location information may lack accuracy	When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or Provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites	See **Table 2**

*as per Significant Wildlife Habitat Criteria Schedules for Ecoregion 5E (January 2015)

Ecoregion 5E	Candidate Significant Wildlife Habitat*	ELC Ecosites	Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from available information sources and on-site assessment indicate that candidate SHW might be present?
Animal Movement Corridors			
Amphibian Movement Corridors	Corridors may be found in all ecosites associated with water. Corridors will be determined based on identifying the significant breeding habitat	Movement corridors between breeding habitat and summer habitat. Movement corridors must be determined when Amphibian breeding habitat is confirmed as SWH from Amphibian Breeding Habitat –Wetland (see above)	NO, given the absence of identified amphibian breeding habitat, movement corridors for amphibians are unlikely to be present.
Cervid Movement Corridors	Movement corridor must be determined when Deer Wintering Habitat is confirmed as SWH (see above), Moose Aquatic Feeding Area, or Mineral Lick Habitat are identified. A deer wintering habitat identified by the OMNRF as SWH will have corridors that the deer use during fall migration and spring dispersion. Corridors typically follow riparian areas, woodlots, areas of physical geography (ravines, or ridges). Corridors will be multifunctional (i.e., these will function for any smaller mammal species as well).	Corridors may be found in all forested ecosites.	NO, as the MNRF has not identified deer yarding areas within the assessment area, and the assessment area is not located between yarding areas, there is a low likelihood that movement corridors are present.
Furbearer Movement Corridor	Mink and Otter den sites are typically found within a riparian area of a lake, river, stream or wetland. The den site will potentially have a movement corridor associated with it. All Mink or Otter den sites identified under the habitat of Denning Sites for Mink, Otter, Marten Fisher and Eastern Wolf (see above) are to be considered for an animal movement corridor.	All Forested Ecosite Codes adjacent to or within shoreline habitats.	NO, as features potentially functioning as denning sites were not documented in the assessment area there is a low likelihood that the assessment area contains movement corridors for burbearers.

*as per Significant Wildlife Habitat Criteria Schedules for Ecoregion 5E (January 2015)

Common Name[1]	Scientific Name	Step 1 (Desktop): Rationale for considering	Step 2 (Desktop): Do site-specific attributes (e.g., ecological system and landscape configuration) assessed from aerial photography and other information sources indicate that potential habitat or communities might be present? Area of Interest (AOI)	Step 2 (Desktop): Adjoining Lands (AL)	Step 3 (On Site): Potential and/or confirmed habitat documented during on-site assessment Area of Interest (AOI)	Step 3 (On Site): Adjoining Lands (AL)	Step 4: Is there potential for the species, its habitat, or ecological community to be negatively impacted by the activities that would be permissible within the AOI?
Special Concern (Provincially): status from Species at Risk in Ontario List (O Reg 230/08); updated January 2018							
Snapping Turtle	*Chelydra serpentina*	SAR by Geo-Township Tool (MNR)	YES, suitable wetland and/or aquatic communities are present.	YES, suitable wetland and/or aquatic communities are present.	YES, this species was documented within the AOI.	YES, suitable wetland and/or aquatic communities are present.	YES, the proposed development and site alteration has the potential to damage habitat.
Eastern Ribbonsnake	*Thamnophis sauritus*	SAR by Geo-Township Tool (MNR)	YES, open shoreline fronting on aquatic and/or wetland community is present.	YES, open shoreline fronting on aquatic and/or wetland community is present.	YES, open shoreline fronting on aquatic and/or wetland community is present.	YES, open shoreline fronting on aquatic and/or wetland community is present.	YES, the proposed development and site alteration has the potential to damage habitat.
Five-lined Skink	*Plestiodon fasciatus*	range map	YES, suitably sized openings in forest canopy are present.	YES, suitably sized openings in forest canopy are present.	NO, natural, open-canopy communities are predominantly vegetated and hence unlikely to function as habitat.	NO, natural, open-canopy communities are predominantly vegetated and hence unlikely to function as habitat.	NO, see steps 2 and 3.
Olive-sided Flycatcher	*Contopus cooperi*	OBBA	YES, trees suitable for nesting may be present adjacent to open-canopy areas.	YES, trees suitable for nesting may be present adjacent to open-canopy areas.	NO, species not detected during morning breeding bird surveys or during the course of other fieldwork.	NO, species not detected during morning breeding bird surveys or during the course of other fieldwork.	NO, see step 3.
Canada Warbler	*Wilsonia canadensis*	OBBA	YES, areas of wet forest or thicket swamp suitable for nesting (i.e., with well-developed shrub layers) may be present.	YES, areas of wet forest or thicket swamp suitable for nesting (i.e., with well-developed shrub layers) may be present.	YES, individuals documented on site during surveys	YES, areas of wet forest or thicket swamp suitable for nesting (i.e., with well-developed shrub layers) are present.	YES, the proposed development and site alteration has the potential to damage habitat.
Common Nighthawk	*Chordeiles minor*	range map	YES, anthropogenic openings in the canopy along the existing access route could provide suitable breeding and foraging habitat.	YES, both natural and anthropogenic openings in the canopy associated with the existing licence could provide suitable breeding and foraging habitat.	NO, suitable habitat not identified within the AOI. Additionally, the species was not detected during nocturnal breeding bird surveys conducted on July 4 and 5, 2012 or during the course of other fieldwork. See **Figure 5** for survey area.	NO, species not detected during nocturnal breeding bird surveys conducted on July 4 and 5, 2012 or during the course of other fieldwork. See **Figure 5** for survey area.	NO, given that habitat was not identified within the AOI and potential habitat present on AL was not being used by this species, there is a low likelihood of the proposed development negatively impacting this species or its habitat.
Golden-winged Warbler	*Vermivora chrysoptera*	range map	YES, early successional vegetation communities with the physical structure necessary to provide breeding habitat may be present.	YES, early successional vegetation communities with the physical structure necessary to provide breeding habitat may be present.	NO, species not detected during morning breeding bird surveys or during the course of other fieldwork.	NO, potential habitat not observed; however, areas with the physical characteristics necessary to function as habitat may be present.	NO, likelihood of negative impacts from proposed development is low.
Black Tern	*Chlidonias niger*	range map	YES, suitable wetland communities (e.g., marsh) may be present.	YES, suitable wetland communities (e.g., marsh) may be present.	NO, suitable wetland communities (e.g., marsh) are absent.	NO, suitable wetland communities (e.g., marsh) are absent.	NO, see step 3.
Monarch	*Danaus plexippus*	range map	YES, both natural and anthropogenic openings in canopy could provide suitable breeding and foraging habitat.	YES, both natural and anthropogenic openings in canopy could provide suitable breeding and foraging habitat.	YES, both natural and anthropogenic openings in canopy could provide suitable breeding and foraging habitat.	YES, both natural and anthropogenic openings in canopy could provide suitable breeding and foraging habitat.	NO, the phased approach of extraction will make habitat available away from active areas.
West Virginia White	*Pieris virginiensis*	range map	YES, the species' host plant, Two-leaf Toothwort (*Cardamine diphylla*) may be present in the groundcover of the wooded areas.	YES, the species' host plant, Two-leaf Toothwort *(Cardamine diphylla*) may be present in the groundcover of the wooded areas.	YES, the species' host plant, Two-leaf Toothwort (*Cardamine diphylla*) may be present in the groundcover of the wooded areas.	YES, the species' host plant, Two-leaf Toothwort *(Cardamine diphylla*) may be present in the groundcover of the wooded areas.	NO, the phased approach of extraction will make habitat available away from active areas.
Eastern Wood Pewee	*Contopus virens*	OBBA	YES, suitably sized area of intact forest is present.	YES, suitably sized area of intact forest is present.	YES, species detected during morning breeding bird surveys.	YES, suitably sized area of intact forest is present.	YES, development or site alteration in or adjacent to breeding territories may have negative impacts on individuals or habitat.
Wood Thrush	*Hylocichla mustelina*	OBBA	YES, areas with well-developed understorey within deciduous and/or mixed forest may be present.	YES, areas with well-developed understorey within deciduous and/or mixed forest may be present.	NO, species was not detected during multiple years of morning breeding bird surveys.	NO, species was not detected within a distance that would be impacted by development within the AOI.	NO, see step 3.

[1]Shaded rows denote species or communities for which negative impacts have been deemed possible.

Appendix 5. List of Flora Documented During Onsite Investigations

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Appendix 5. Vascular plant species documented on Childs Pit property between 2011 and 2018 by RiverStone.

Scientific Name	Common Name	S Rank[1]	Muskoka Rarity[2]
Abies balsameae	Balsam Fir	S5	
Acer rubrum	Red Maple	S5	
Acer saccharum ssp. Saccharum	Sugar Maple	S5	
Achillea millefolium	Common Yarrow	SE5	
Actaea pachypoda	White Baneberry	S5	
Actaea rubra	Red Baneberry	S5	
Alnus incana ssp. rugosa	Speckled Alder	S5	
Amaranthus powellii	Green Pigweeed	SE5	
Ambrosia artemisiifolia	Common Ragweed	S5	
Amelanchier arborea	Downy Serviceberry	S5	
Apocynum androsaemifolium	Spreading Dogbane	S5	
Aquilegia canadensis	Wild Columbine	S5	
Arctium lappa	Great Burdock	SE5	
Arctostaphylos uva-ursi	Bearberry	S5	
Arisaema triphyllum	Jack-in-the-pulpit	S5	
Aronia melanocarpa	Black Chokeberry	S5	
Asclepias syriaca	Common Milkweed	S5	
Aster macrophyllus	Large Leaved Aster	S5	
Aster nemoralis	Bog Aster	S5	
Aster novae-angliae	New England Aster	S5	
Aster spp.	Aster Species		
Aster umbellatus	Flat Topped White Aster	S5	
Aster urophyllus	Arrow-leaved Aster	S4	
Athyrium felix-femina	Northern Lady Fern	S5	
Betula alleghaniensis	Yellow Birch	S5	
Betula papyrifera	White Birch	S5	
Biden cernua	Nodding Beggar-ticks	S5	
Brachyelytrum erectrum var. erectrum	Long-awned Wood Grass	S4?	
Brasenia schreberi	Water-shield	S5	
Calamagrotis canadensis	Canada Bluejoint	S5	
Carex arctata	Drooping Wood Sedge	S5	
Carex bebbii	Bebb's Sedge	S5	
Carex brunnescens ssp. Brunnescens	Brownish Sedge	SU	
Carex canescens	Hoary Sedge	S5	
Carex communis	Common Sedge	S5	
Carex crinita	Fringed Sedge	S5	
Carex cumulata	Clustered Sedge	S4	
Carex deflexa	Bent Northern Sedge	S5	R
Carex grandularis	Meadow Sedge	S5	
Carex intumescens	Bladder Sedge	S5	
Carex lacustris	Lakebank Sedge	S5	
Carex lupulina	Common Hop Sedge	S4	R
Carex magellanica ssp. Irrigua	Stunted Sedge	S5	

Appendix 6 Cont. Vascular plant species documented during 2011 and 2012 site visits at Childs Pit property.

Scientific Name	Common Name	S Rank[1]	Muskoka Rarity[2]
Carex oligosperma	Few-seeded Sedge	S4	
Carex pedunculata	Long-stalked Sedge	S5	
Carex pensylvanica	Pennsylvania Sedge	S5	
Carex spp.	Sedges		
Carex stipata	Awl-fruited Sedge	S5	
Carex stricta	Tussock Sedge	S5	
Carex trisperma	Three-seeded Sedge	S5	
Carex utriculata	Beaked Sedge	S5	
Carex vulpinoidea	Fox Sedge	S5	
Cerastium fontanum	Common Mouse-ear Chickweed	SE5	
Chamaedaphne calycultata	Leatherleaf	S5	
Chenopodium album	Lamb's-quarter	SE5	
Chimaphila umbellata ssp. Cisatantica	Pipsissewa	S5	
Chrysanthemum leucanthemum	Ox-eye Daisy	SE5	
Cinna latifolia	Broad-Leaved Reedgrass	S5	
Claytonia caroliniana	Carolina Spring Beauty	S5	
Clinopodium vulgare	Wild Basil	S5	
Clintonia borealis	Bluebead Lily	S5	
Coptis trifolia	Goldthread	S5	
Cornus alternifolia	Alternate-leaved Dogwood	S5	
Cornus canadensis	Bunchberry	S5	
Cornus stolonifera	Red-osier Dogwood	S5	
Corydalis sempervirens	Pink Corydalis	S5	
Corylus cornuta	Beaked Hazelnut	S5	
Crataegus spp.	Hawthorn		
Cypripedium acaule	Pink Moccasin Flower	S5	
Danthonia spicata	Poverty Oat Grass	S5	
Daucus carota	Wild Carrot	SE5	
Deschampsia flexuosa	Common Hairgrass	S5	
Dicentra cucullaria	Squirrel Corn	S5	
Diervilla Lonicera	Bush Honeysuckle	S5	
Digitaria sanguinalis	Large Crabgrass	SE5	
Diphasiastrum digitatum	Southern Ground Pine	S5	
Drosera rotundifolia	Round-leaved Sundew	S5	
Dryopteris carthusiana	Spinulose Wood Fern	S5	
Dryopteris intermedia	Evergreen Wood Fern	S5	
Dryopteris marginalis	Marginal wood fern	S5	
Dulichium arundinaceum	Three-way Sedge	S5	
Echinochloa crusgalli	Barnyard Grass	SE5	
Elocharis acicularis	Spike Rush	S5	
Elymus repens	Quackgrass	SE5	
Epigaea repens	Trailing Arbutus	S5	
Epilobium angustifolia	Fireweed	S5	
Epilobium palustre	Marsh Willow-herb	S5	R
Equisetum arvense	Field Horsetail	S5	

Appendix 6 Cont. Vascular plant species documented during 2011 and 2012 site visits at Childs Pit property.

Scientific Name	Common Name	S Rank[1]	Muskoka Rarity[2]
Erigeron philadelphicus	Philadelphia Fleabane	S5	
Eriophorum virginicum	Virginia Cottongrass	S5	
Erythronium americanum	Yellow Trout Lily	S5	
Eupatorium maculatum	Spotted Joe-pye Weed	S5	
Eupatorium perfoliatum	Common Boneset	S5	
Euthamia graminifolia	Common Goldentop	S5	
Fagus grandifolia	American Beech	S5	
Festuca pratense	Meadow Fescue	SE5	
Fragaria virginiana ssp. virginiana	Common Strawberry	S5	
Fraxinus americana	White Ash	S5	
Fraxinus nigra	Black Ash	S5	
Galium asprellum	Rough Bedstraw	S5	
Galium trifolium	Fragrant Bedstraw	S5	
Gaultheria hispidula	Creeping Snowberry	S5	
Gaultheria procumbens	Wintergreen	S5	
Gaylussacia baccata	Black Huckleberry	S5	
Geranium robertianum	Herb Robert	S5	
Glyceria canadensis	Rattlesnake Glyceria	S4S5	
Glyceria striata	Fowl Glyceria	S4S5	
Graminoid spp	Grasses		
Gymnocarpium dryopteris	Common Oak Fern	S5	
Hesperis matronalis	Dame's Rocket	SE5	
Hieracium aurantiacum	Orange Hawkweed	SE5	
Hieracium caespitosum	Field Hawkweed	SE5	
Huperzia lucidula	Shining Club-moss	S5	
Hypericum perforatum	St. John's-wort	SE5	
Impatiens capensis	Spotted Jewel-weed	S5	
Ipomoea purpurea	Tall Morning-glory	SE2	
Juncus bufonius	Toad Rush	S5	
Juncus compressus	Compressed Rush	SE5	
Juncus effusus spp. solutus	Soft Rush	S5	
Juncus secundus	Lopsided Rush	S3	
Juncus tenuis	Path Rush	S5	
Kalmia polifolia	Bog Laurel	S5	
Larix larcina	Tamarack	S5	
Leonurus cardiaca	Motherwort	SE5	
Lepidium campestre	Field Cress	SE5	
Linaria vulgaris	Butter-and-eggs	SE5	
Lonicera canadensis	Fly Honeysuckle	S5	
Lotus corniculatus	Bird's-foot Trefoil	SE5	
Lycopodium dendroideum	Ground Pine	S5	
Lycopus uniflorus	Northern Bugleweed	S5	
Maianthemum racemosum	False Solomon's Seal	S5	
Maianthemum trifolium	Three-leaved Solomon's-seal	S5	
Medeola virginiana	Indian Cucumber-root	S5	

Appendix 6 Cont. Vascular plant species documented during 2011 and 2012 site visits at Childs Pit property.

Scientific Name	Common Name	S Rank[1]	Muskoka Rarity[2]
Medicago lupulina	Black Medick	SE5	
Melilotus alba	White Sweet Clover	SE5	
Mentha arvensis spp. borealis	Wild mint	S5	
Menyanthes trifoliata	Common Bogbean	S5	
Mitell nuda	Bare-stem Miterwort	S5	
Mitchella repens	Partridgeberry	S5	
Myosotis scorpioides	Common Forget-me-not	SE5	
Myrica gale	Sweet Gale	S5	
Nemopanthus mucronatus	Mountain-holly	S5	
Nepeta cataria	Catnip	SE5	
Nuphar variegata	Bullhead Pond-lily	S5	
Nymphaea odorata ssp. Odorata	Small White Water Lily	S5?	
Oenothera biennis	Evening Primrose	S5	
Onoclea sensibilis	Sensitive Fern	S5	
Oryzopsis asperifolia	Rough-leaved Rice Grass	S5	
Osmunda cinnamomea	Cinnamon Fern	S5	
Osmunda claytoniana	Interrupted Fern	S5	
Osmunda regalis	Royal Fern	S5	
Ostrya virginiana	Ironwood	S5	
Oxalis acetosella spp. montana	Upright Wood Sorrel	S5	
Oxalis stricta	Upright Yellow Wood Sorrel	S5	
Panicum capillare	Witch Panic Grass	S5	
Penstemon digitalis	Foxglove Beard-tongue	S4S5	
Phalaris arundinaceae	Reed Canary Grass	S5	
Phelum pratense	Timothy	SE5	
Picea glauca	White Spruce	S5	
Picea mariana	Black Spruce	S5	
Pinus resinosa	Red Pine	S5	
Pinus strobus	White Pine	S5	
Plantago lanceolata	Ribgrass	SE5	
Plantago major	Common Plantain	SE5	
Poa annua	Annual Blue Grass	SE5	
Poa pratense	Kentucky Blue Grass	S5	
Polygala paucifolia	Fringed Polygala	S5	
Polygonatum pubescens	Hairy Solomon's Seal	S5	
Polygonnum sagittatum	Arrowleaved Tear Thumb	S4	
Polygonum convolvulus	Black Bindweed	SE5	
Polygonum hydropiper	Common Smartweed	SE5	
Polypodium virginianum	Common Polypod Fern	S5	
Polystichum acrostichoides	Christmas Fern	S5	
Pontederia cordata	Pickeral Weed Family	S5	
Populus balsamifera	Balsam Poplar	S5	
Populus grandidentata	Largetooth Aspen	S5	
Populus tremuloides	Trembling Aspen	S5	
Potentilla recta	Rough-fruited Cinquefoil	SE5	

Appendix 6 Cont. Vascular plant species documented during 2011 and 2012 site visits at Childs Pit property.

Scientific Name	Common Name	S Rank[1]	Muskoka Rarity[2]
Prenanthes altissima	Tall White Lettuce	S5	
Prunella vulgaris	Heal-all	SE5	
Prunus pensylvanica	Pin Cherry	S5	
Prunus serotina	Black Cherry	S5	
Prunus virginiana	Choke Cherry	S5	
Pteridium aquilinum var. Latiusculum	Northern Bracken Fern	S5	
Pyrola elliptica	Shinleaf	S5	
Quercus alba	White Oak	S5	
Quercus rubra	Red Oak	S5	
Ranunculus acris	Tall Buttercup	SE5	
Ribes lacustre	Black Swamp Currant	S5	
Rosa palustris	Swamp Rose	S5	
Rubus idaeus	European Red Raspberry	S5	
Rubus pubescens	Dwarf Red Blackberry	S5	
Rumex acetosella	Sheep Sorrel	SE5	
Rumex crispus	Curled Dock	SE5	
Rumex obtusifolius	Bitter Dock	SE5	
Salix bebbiana	Bebb's Willow	S5	
Salix discolor	Lowland Pussy Willow	S5	
Salix pedicellaris	Bog Willow	S5	
Sambucus canadensis	Black Elderberry	S5	
Sambucus racemosa	Red-berried Elderberry	S5	
Sarracenia purpurea	Pitcher-plant	S5	
Scirpus atrovirens	Black Bulrush	S5	
Scirpus cyperinus	Woolgrass	S5	
Scirpus microcarpus	Small-fruited Woolgrass	S5	
Solanum dulcamara	Bittersweet Nightshade	SE5	
Solidage hispida	Hairy Goldenrod	S5	
Solidago canadensis	Canada Goldenrod	S5	
Solidago juncea	Early Goldenrod	S5	
Solidago rugosa	Rough Stemmed Goldenrod	S5	
Sonchus oleraceus	Sow-thistle	SE5	
Sparganium emersum	Green-fruited Burreed	S5	
Spirea alba	Narrow-leaved Meadowsweet	S5	
Spirea tomentosa	Hardhack	S4S5	
Streptpous roseus	Rose Twisted Stalk	S5	
Taraxacum officinale	Common Dandelion	SE5	
Thalictrum dioicum	Early Meadow-rue	S5	
Thalictrum pubescens	Tall Meadowrue	S5	
Thelypteris noveboracensis	New York Fern	S4S5	
Thelypteris palustrisvar. Pubesens	Marsh Fern	S5	
Thuja occidentalis	Eastern White Cedar	S5	
Tiarella cordifolia	Foam Flower	S5	
Tilia americana	American Basswood	S5	
Tragopogon dubius Scop.	Goat's-beard	SE5	

Appendix 6 Cont. Vascular plant species documented during 2011 and 2012 site visits at Childs Pit property.

Scientific Name	Common Name	S Rank[1]	Muskoka Rarity[2]
Triadenum fraseri	Frasers St. John's Wort	S5	
Trientalis borealis	Northern Starflower	S5	
Trifolium pratense	Red Clover	SE5	
Trifolium repens	White Clover	SE5	
Trillium erectum	Red Trillium	S5	
Trillium grandiflorum	White Trillium	S5	
Tsuga canadensis	Eastern Hemlock	S5	
Tussilago farafara	Coltsfoot	SE5	
Typha angustifolia	Narrow-leaved Cattail	S5	
Typha latifolia	Broad-leaved Cattail	S5	
Ulmus americana	American Elm	S5	
Ulmus pumila	Siberian Elm	SNA	
Vaccinium angustifolium	Low Sweet Blueberry	S5	
Verbascum thapsus	Common Mullein	SE5	
Verbena hastata	Blue Vervain	S5	
Veronica officinalis	Common Speedwell	SE5	
Viburnum alnifolia	Hobblebush	S5	
Viburnum cassinoides	Northern Wild Raisin	S5	
Viburnum opulus	European High Bush Cranberry	SE4	
Vicia cracca	Cow Vetch	SE5	
Viola cucullata	Marsh Blue Violet	S5	
Viola macloskeyi spp. pallens	Smooth White Violet	S5	
Viola sororia	Wooly Blue Violet	S5	

[1]Bradley, D.J. 2013 Southern Ontario Vascular Plant Species List
Southern Science & Information Section. Ontario of Natural Resources.
[2]Locally Rare Vascular Plants - Site District 5E-7 (W.J. Crins, 1997).

Appendix 6. List of Fauna Documented During Onsite Investigations

RIVERSTONE
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Appendix 6. Fauna documented on Childs Pit property between 2011 and 2017 by RiverStone.

Upper Level Taxon	Common Name	Scientific Name	Status[1]	Likelihood that species breeds on property given the site's physical characteristics and behaviour of individuals observed
Amphibia	American Toad	*Anaxyrus americanus*		High
Amphibia	Green Frog	*Lithobates clamitans*		High
Amphibia	Northern Leopard Frog	*Lithobates pipiens*		High
Amphibia	Wood Frog	*Lithobates sylvaticus*		High
Amphibia	Gray Treefrog	*Hyla versicolor*		High
Amphibia	Spring Peeper	*Pseudacris crucifer*		High
Amphibia	Spotted Salamander	*Ambystoma maculatum*		High
Amphibia	Blue Spotted Salamander	*Ambystoma laterale*		High
Amphibia	Northern Two-lined Salamander	*Eurycea bilineata*		High
Aves	Spotted Sandpiper	*Actitis macularia*		High
Aves	Ruby-throated Hummingbird	*Archilochus colubris*		High
Aves	Cedar Waxwing	*Bombycilla cedrorum*		High
Aves	Ruffed Grouse	*Bonasa umbellus*		High
Aves	Broad-winged Hawk	*Buteo platypterus*	AS	High
Aves	American Goldfinch	*Carduelis tristis*		High
Aves	Purple Finch	*Carpodacus purpureus*		High
Aves	Veery	*Catharus fuscescens*	AS	High
Aves	Hermit Thrush	*Catharus guttatus*	AS	High
Aves	Swainson's Thrush	*Catharus ustulatus*		High
Aves	Brown Creeper	*Certhia americana*	AS	High
Aves	Northern Flicker	*Colaptes auratus*		High
Aves	Eastern Wood-pewee	*Contopus virens*	Special Concern (Provinical); AS	High
Aves	American Crow	*Corvus brachyrhynchos*		
Aves	Common Raven	*Corvus corax*		High
Aves	Blue Jay	*Cyanocitta cristata*		High
Aves	Pileated Woodpecker	*Dryocopus pileatus*	AS	High
Aves	Gray Catbird	*Dumetella carolinensis*		High
Aves	Least Flycatcher	*Empidonax minimus*	AS	High
Aves	Wood Thrush	*Hylocichla mustelina*		High
Aves	Dark-eyed Junco	*Junco hyemalis*		Intermediate
Aves	Red-bellied Woodpecker	*Melanerpes carolinus*		Intermediate
Aves	Wild Turkey	*Meleagris gallopavo*		Intermediate
Aves	Swamp Sparrow	*Melospiza georgiana*		High
Aves	Song Sparrow	*Melospiza melodia*		High
Aves	Great Crested Flycatcher	*Myiarchus crinitus*		High
Aves	Indigo Bunting	*Passerina cyanea*		High
Aves	Rose-breasted Grosbeak	*Pheucticus ludovicianus*		High
Aves	Hairy Woodpecker	*Picoides villosus*	AS	High
Aves	Scarlet Tanager	*Piranga olivacea*	AS	High
Aves	Downey Woodpecker	*Picoides pubescens*		High
Aves	Black-capped Chickadee	*Poecile atricapillus*		High

Upper Level Taxon	Common Name	Scientific Name	Status[1]	Likelihood that species breeds on property given the site's physical characteristics and behaviour of individuals observed
Aves	Ruby-crowned Kinglet	*Regulus calendula*		High
Aves	Golden-crowned Kinglet	*Regulus satrapa*		High
Aves	Eastern Phoebe	*Sayornis phoebe*		High
Aves	American Woodcock	*Scolopas minor*		High
Aves	Red-breasted Nuthatch	*Sitta canadensis*	AS	High
Aves	White-breasted Nuthatch	*Sitta carolinensis*	AS	High
Aves	Yellow-bellied Sapsucker	*Sphyrapicus varius*	AS	High
Aves	Chipping Sparrow	*Spizella passerina*		High
Aves	Brown Thrasher	*Toxostoma rufum*		High
Aves	Winter Wren	*Troglodytes troglodytes*	AS	High
Aves	American Robin	*Turdus migratorius*		High
Aves	Red-eyed Vireo	*Vireo olivaceus*		High
Aves	Blue-headed Vireo	*Vireo solitarius*	AS	High
Aves	Mourning Dove	*Zenaida macroura*		High
Aves	White-throated Sparrow	*Zonotrichia albicollis*		High
Aves; Parulidae	Blackburnian Warbler	*Dendroica fusca*	AS	High
Aves; Parulidae	Magnolia Warbler	*Dendroica magnolia*	AS	High
Aves; Parulidae	Chestnut-sided Warbler	*Dendroica pensylvanica*		High
Aves; Parulidae	Common Yellowthroat	*Geothlypis trichas*		High
Aves; Parulidae	Black-and-white Warbler	*Mniotilta varia*	AS	High
Aves; Parulidae	Mourning Warbler	*Oporornis philadelphia*		High
Aves; Parulidae	Nashville Warbler	*Oreothlypis ruficapilla*		High
Aves; Parulidae	Ovenbird	*Seiurus aurocapillus*	AS	High
Aves; Parulidae	Northern Waterthrush	*Seiurus noveboracensis*	AS	High
Aves; Parulidae	Black-throated Blue Warbler	*Setophaga caerulescens*	AS	High
Aves; Parulidae	Yellow-rumped (Myrtle) Warbler	*Setophaga coronata*		High
Aves; Parulidae	Magnolia Warbler	*Setophaga magnolea*		Intermediate
Aves; Parulidae	Yellow Warbler	*Setophaga petechia*		High
Aves; Parulidae	Black-throated Green Warbler	*Setophaga virens*	AS	High
Aves; Parulidae	Canada Warbler	*Cardellina canadensis*	Threatened (National); Special Concern (Provinical); AS	High
Mammalia	Moose	*Alces alces*	AS	Unknown
Mammalia	Eastern Wolf	*Canis lycaon*		Unknown
Mammalia	Beaver	*Castor canadensis*		High
Mammalia	Star-nosed Mole	*Condylura cristata*		Intermediate
Mammalia	Snoeshoe Hare	*Lepus americanus*		High
Mammalia	River Otter	*Lutra canadensis*		Unknown
Mammalia	White-tailed Deer	*Odocoileus virginianus*		High
Mammalia	White-footed Mouse	*Peromyscus leucopus*		High
Mammalia	Eastern Chipmunk	*Tamias striatus*		High

Upper Level Taxon	Common Name	Scientific Name	Status[1]	Likelihood that species breeds on property given the site's physical characteristics and behaviour of individuals observed
Mammalia	Red Squirrel	*Tamiasciurus hudsonicus*		High
Mammalia	Black Bear	*Ursus americanus*		High
Mammalia	Red Fox	*Vulpes vulpes*		Unknown
Mammalia	Hoary Bat	*Lasiurus cinereus*		Unknown
Mammalia	Silver-haired Bat	*Lasionycteris noctivagans*		Unknown
Mammalia	Big Brown Bat	*eptesicus fuscus*		Unknown
Mammalia	Eastern Red Bat	*Lasiurus borealis*		Unknown
Mammalia	Little Brown Myotis	*Myotis lucifugus*		Unknown
Mammalia	Northern Long-eared Myotis	*Myotis septentrionalis*		Unknown
Reptilia	Snapping Turtle	*Chelydra serpentina*	Special Concern (National); Special Concern (Provinical)	High
Reptilia	Midland Painted Turtle	*Chrysemys picta marginata*		High
Reptilia	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*		High
Reptilia	Northern Ring-necked Snake	*Diadophis punctatus*		High

[1]AS=area sensitive species as indicated in Significant Wildlife Habitat Technical Guide (OMNR 2000)

Breeding Bird Surveys - 2012
June 10, 2012: 0622–1040 h; 16–20 degrees C; cloud cover 70–90%; Wind Speed = 0 (Beaufort Scale);
June 24, 2012: 0645–1010 h; 14–16 degrees C; cloud cover 70–100%; Wind Speed = 1 (Beaufort Scale)
Notes:
Level of bird vocalization was high during morning surveys; thus, conditions were appropriate for assessing bird diversity.
Targeted surveys for species presence or absence were only conducted for birds (see Section 2 of report); thus, the amphibian, reptile, and mammal observations were incidental.

Appendix 7. Results of Targeted Anuran Surveys

Appendix 7: Results of RiverStone 2017 Anuran Calling Surveys, Child's Pit.

Station ID	Bearing	Survey #1 – April 26, 2017	Survey #2 – May 30, 2017	Survey #3 – June 26, 2017	Comments
1	341°	No calling anurans. Green frog observed.	No calling anurans.	N/A	**Survey #1:** Spring Peeper calls audible in abundance off station to the southwest, likely in marsh at Station 2. Green frogs observed. **Survey #2:** Gray Tree Frogs and Spring Peepers heard a far distance off station, likely at Station 2. **Survey #3:** Station not surveyed due to inadequate anuran breeding habitat.
2	307°	Spring Peeper (3) Wood Frog (2-5)	Spring Peeper (3)	No calling anurans.	**Survey #1:** Spring Peeper calls very abundant. **Survey #2:** Gray Tree Frogs heard off station likely at wetland edges. **Survey #3:** No notes.
3	298°	Spring Peeper (3) Wood Frog (1-2)	Spring Peeper (3) Gray Tree Frog (3)	Gray Tree Frog (2) Green Frog (1)	**Survey #1:** Spring Peeper calls so abundant, likely overpower calls of Wood Frogs present. **Survey #2:** No notes. **Survey #3:** Station not surveyed due to inadequate anuran breeding habitat.
4	273°	No calling anurans.	No calling anurans.	N/A	**Survey #1:** Spring Peeper calling at a far distance off station to the south **Survey #2:** Spring Peeper calling at far distance off station to the east. **Survey #3:** Station not surveyed due to inadequate anuran breeding habitat.
5	213°	No calling anurans.	N/A	N/A	**Survey #1:** Spring Peeper calling at far distance off station to the south and southeast. **Survey #2:** Station not surveyed due to inadequate anuran breeding habitat.

Station ID	Bearing	Survey #1 – April 26, 2017	Survey #2 – May 30, 2017	Survey #3 – June 26, 2017	Comments
					Survey #3: No notes.
6	242°	No calling anurans.	N/A	N/A	**Survey #1:** Spring Peeper calling at far distance off station to the southeast. **Survey #2:** Station not surveyed due to inadequate anuran breeding habitat. **Survey #3:** Station not surveyed due to inadequate anuran breeding habitat.
7	197°	Spring Peeper (3) Wood Frog (1-1)	Spring Peeper (1-1)	No calling anurans.	**Survey #1:** No notes. **Survey #2:** No notes. **Survey #3:** No notes.
8	149°	No calling anurans.	N/A	N/A	**Survey #1:** Spring Peepers calling off station to the northeast. **Survey #2:** Station not surveyed due to inadequate anuran breeding habitat. **Survey #3:** Station not surveyed due to inadequate anuran breeding habitat.
9	55°	Spring Peeper (3) Wood Frog (1-1)	Spring Peeper (1-2)	N/A	**Survey #1:** Spring Peepers calling in pond approximately 80m east of station. Wood Frogs and Spring Peepers calling approximately 125 m to the north of station. **Survey #2:** Gray Tree frogs heard in abundance just off station to the south. **Survey #3:** Station not surveyed due to inadequate anuran breeding habitat.
10	263°	Spring Peeper (3) Wood Frog (1-1) American Toad (1-1)	Spring Peeper (2-10)	No calling anurans.	**Survey #1:** American Toad call very faint. **Survey #2:** No notes.

Station ID	Bearing	Survey #1 – April 26, 2017	Survey #2 – May 30, 2017	Survey #3 – June 26, 2017	Comments
					Survey #3: No notes.
11	211°	Spring Peeper (3) Wood Frog (1-1)	American Toad (1-1)	N/A	**Survey #1:** No notes. **Survey #2:** Gray tree frog heard far off station to the east. **Survey #3:** Station not surveyed due to inadequate anuran breeding habitat.

Appendix 8. Results of Breeding Bird Surveys

Appendix 8. Results of Breeding Bird Surveys in 2017.

Common Name	Scientific Name	Breeding Bird Stations																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	T*
Ovenbird	*Seiurus aurocapilla*	X			X	X	X	X				X	X			X	X	X	X		X	X
Yellow Warbler	*Setophaga petechia*	X									X											
Winter Wren	*Troglodytes hiemalis*	X					X	X	X			X	X		X			X		X	X	X
Swamp Sparrow	*Melospiza georgiana*	X																				
Red-eyed Vireo	*Vireo olivaceus*	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
Song Sparrow	*Melospiza melodia*	X																				X
Hermit Thrush	*Catharus guttatus*	X			X		X	X					X	X		X	X			X	X	X
Chestnut-sided Warbler	*Setophagapensylvanica*	X	X			X	X										X	X	X			X
Dark-eyed Junco	*Junco hyemalis*	X																				
White-throated Sparrow	*Zonotrichia albicollis*	X									X											
Eastern Wood-Pewee	*Contopus virens*		X										X	X		X		X				
Black-throated Green Warbler	*Setophaga virens*		X	X	X	X	X	X		X		X	X	X							X	
Veery	*Catharus fuscescens*		X	X			X			X	X	X	X		X		X	X		X	X	
Pileated Woodpecker	*Dryocopus pileatus*							X											X			X
Red-Breasted Nuthatch	*Sitta canadensis*		X	X				X									X					X
Ruby-crowned Kinglet	*Regulus calendula*				X																	X
Wild Turkey	*Meleagris gallopavo*																					X
Broad-winged Hawk	*Buteo platypterus*																					X

Common Name	Scientific Name	Breeding Bird Stations																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	T*
White-breasted Nuthatch	*Sitta carolinensis*											X		X								
Golden-crowned Kinglet	*Regulus satrapa*				X																	
Black-throated Blue Warbler	*Setophaga caerulescens*		X				X		X	X		X	X		X			X				
Blue Jay	*Cyanocitta cristat*			X	X			X		X			X	X				X	X	X		
Yellow-rumped Warbler	*Setophaga coronata*				X					X												
Indigo Bunting	*Passerina cyanea*					X					X						X		X	X		
Rose-breasted Grosbeak	*Pheucticus ludovicianus*						X															X
Scarlet Tanager	*Piranga olivacea*						X	X	X									X	X			X
Great-crested Flycatcher	*Myiarchus crinitus*							X														X
Nashville Warbler	*Oreothlypis ruficapilla*							X	X	X							X					
Black-and-white Warbler	*Mniotilta varia*							X	X													
Canada Warbler	*Cardellina canadensis*															X						
Cedar Waxwing	*Bombycilla cedrorum*							X			X					X						X
Common raven	*Corvus corax*							X	X			X							X			
Hairy Woodpecker	*Picoides villosus*								X								X					
Magnolia Warbler	*Setophaga magnolia*								X													
Black-capped Chickadee	*Poecile atricapillus*								X			X							X			X
American Crow	*Corvus brachyrhynchos*									X												
Gray Catbird	*Dumetella carolinensis*									X												X

Common Name	Scientific Name	Breeding Bird Stations																				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	T*
Common Yellowthroat	*Geothlypis trichas*										X						X					X
Chipping Sparrow	*Spizella passerina*										X								X			X
American Redstart	*Setophaga ruticilla*										X											
American Goldfinch	*Spinus tristis*																					X
Ruby-throated Hummingbird	*Archilochus colubris*																					X
Yellow-bellied Sapsucker	*Sphyrapicus varius*													X	X					X		X
Downy Woodpecker	*Picoides pubescens*																			X		
Ruffed Grouse	*Bonasa umbellus*																					X

Locations of stations are provided on **Figure 5**.

T* – Observation when traversing between breeding bird stations and transect completed south of the proposed license expansion area.

June 21, 2017: 0555-0949 h; 15-17 degrees C; cloud cover 100%; Wind Speed=0-1 (Beaufort Scale)

June 27, 2017: 0632-0933 h; 9-17 degrees C; cloud cover 10-100 %; Wind Speed=0 (Beaufort Scale)

July 4, 2017: 0654-0949 h; 11-18 degrees C; cloud cover 0-5%; Wind Speed=0 (Beaufort Scale)

June 5, 2017: 0656-1019 h; 12-24 degrees C; cloud cover 0%; Wind Speed=1 (Beaufort Scale)

Appendix 9. Guidelines for the use of explosives in or near Canadian fisheries waters (DFO)

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters

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1998

Canadian Technical Report of Fisheries and Aquatic Sciences 2107

Canadian Technical Report of

Fisheries and Aquatic Sciences 2107

1998

GUIDELINES FOR THE USE OF EXPLOSIVES IN OR NEAR CANADIAN FISHERIES WATERS

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ABSTRACT

Wright, D.G., and G.E. Hopky. 1998. Guidelines for the use of explosives in or near Canadian fisheries waters. Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p.

The federal *Fisheries Act* includes provisions for the protection of fish, shellfish, crustaceans, marine mammals and their habitats. The detonation of explosives in or adjacent to fish habitat has been demonstrated to cause disturbance, injury and/or death to fish and marine mammals, and/or the harmful alteration, disruption or destruction of their habitats, sometimes at a considerable distance from the point of detonation.

Within the context of the guidelines and procedures outlined in this report, an explosive is defined as a chemical compound which, when detonated, creates a compressional wave having an almost instantaneous rise time to a very high peak pressure followed by a decay to below ambient pressure by either rapid oxidation or the breaking of high-energy chemical bonds.

The purpose of this report is to provide information to proponents who are proposing works or undertakings that involve the use of confined or unconfined explosives in or near Canadian fisheries waters, and to which the *Fisheries Act*, Sections 32 and 35 in particular, may apply. Guidelines are provided on methods and practices for the conservation and protection of fish, marine mammals, and fish habitat from impacts arising from the destructive forces of explosives. The report describes the suggested application and review procedures and processes for proponents whose use of explosives may result in the destruction of fish, or the harmful alteration, disruption or destruction of fish habitat.

RÉSUMÉ ANALYTIQUE

Wright, D.G. et G.E. Hopky. *Lignes directrices concernant l'utilisation d'explosifs à l'intérieur ou à proximité des eaux de pêche canadiennes,* rapport technique canadien des sciences halieutiques et aquatiques 2107, 1998, iv + 34 p.

La *Loi sur les pêches* fédérale renferme des dispositions relatives à la protection du poisson, des mollusques, des crustacés, des mammifères marins et de leur habitat. Il a été prouvé que la détonation d'explosifs dans l'habitat du poisson ou à proximité perturbe, blesse ou tue des poissons et des mammifères marins ou encore entraîne la détérioration, la destruction ou la perturbation de leur habitat. Il arrive parfois que les dommages se fassent sentir à une distance considérable du point de détonation.

Aux fins des lignes directrices et des procédures énoncées dans le présent rapport, on entend par explosif un composé chimique qui, lorsqu'il explose, crée une vague de compression entraînant presque instantanément un pic de pression extrêmement élevé suivi d'une décroissance sous la pression ambiante soit par oxydation rapide ou par la rupture des liaisons chimiques à haute énergie.

Le présent rapport a pour but de fournir de l'information aux promoteurs qui proposent des ouvrages ou des entreprises nécessitant l'utilisation d'explosifs confinés ou non confinés à l'intérieur ou à proximité des eaux de pêche canadiennes et auxquels la *Loi sur les pêches,* plus précisément les articles 32 et 35, pourraient s'appliquer. Il renferme des lignes directrices concernant les méthodes et pratiques de conservation et de protection du poisson, des mammifères marins et de leur habitat contre les effets découlant de la force destructrice des explosifs. On y décrit les procédures de présentation des demandes et d'examen pour les promoteurs qui prévoient l'utilisation d'explosifs de nature à entraîner la destruction du poisson ou la détérioration, la perturbation ou la destruction de son habitat.

SCOPE AND RATIONALE

The federal *Fisheries Act* includes provisions for the protection of fish, shellfish, crustaceans, marine mammals and their habitats. The detonation of explosives in or adjacent to fish habitat has been demonstrated to cause disturbance, injury and/or death to fish and marine mammals, and/or the harmful alteration, disruption or destruction of their habitats, sometimes at a considerable distance from the point of detonation. Therefore, the Department of Fisheries and Oceans (DFO) has prepared this document to provide information to proponents on the conservation and protection of fish, marine mammals, and their habitat from impacts arising from the use of confined or unconfined explosives in or near Canadian fisheries waters. The guidelines, and application and review procedures and processes outlined in this document apply in the context of the legislative and policy framework summarized below.

APPLICABLE LEGISLATION AND POLICY

Fisheries Act

A number of sections of the *Fisheries Act* and its attendant regulations are applicable to the conservation and protection of fish and fish habitat from the destructive forces of explosives.

- Section 2 defines “Canadian fisheries waters" as meaning all waters in the fishing zones of Canada, all waters in the territorial sea of Canada and all internal waters of Canada.

- Section 2 defines “fish" as including shellfish, crustaceans, marine animals and the eggs, sperm, spawn, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.

- Section 32 prohibits the destruction of fish by any means other than fishing, except as authorized by the Minister of Fisheries and Oceans or under regulations made by the Governor in Council under the *Fisheries Act*.

- Subsection 34(1) defines “fish habitat” as meaning spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes.

- Subsection 35(1) prohibits any person from carrying on any work or undertaking that results in the Harmful Alteration, Disruption or Destruction (HADD) of fish habitat.

- Subsection 35(2) provides for the alteration, disruption or destruction of fish habitat by any means or under any conditions authorized by the Minister of Fisheries and Oceans or under regulations made by the Governor in Council under the *Fisheries Act*.

- Subsection 36(3) prohibits the deposit of a deleterious substance into waters frequented by fish, unless otherwise permitted by regulation.

- Subsection 58(1) of the *Fishery (General) Regulations* provides for anyone proposing to carry on any work or undertaking likely to result in the HADD of fish habitat, to apply to have the means or conditions of that work or undertaking authorized by the Minister under Subsection 35(2) of the *Fisheries Act*, using the form set out in Schedule VI. Schedule VI includes a section for the applicant to provide details on the proposed use of explosives.

- Subsection 58(2) of the *Fishery (General) Regulations* provides the means for the Department of Fisheries and Oceans to issue Authorizations under Subsection 35(2) of the *Fisheries Act*, using the form set out in Schedule VII.

- Section 7 of the *Marine Mammal Regulations* prohibits disturbance of marine mammals except when fishing for them.

In addition, the Department of Fisheries and Oceans has developed a policy framework to assist in the interpretation and application of the applicable legislation. The most relevant documents are as follows:

- The **Policy for the Management of Fish Habitat** (1986) provides policy direction for interpreting the broad powers mandated in the *Fisheries Act* in a way that is consistent with the concept of sustainable development. To achieve the Policy's goal of fish habitat conservation when reviewing project proposals with the potential to affect fish habitat, DFO's habitat managers apply the No Net Loss (NNL) guiding principle. Under this principle, the Department strives to maintain the existing productive capacity of fish habitats, such that the fish habitat is able to sustain the production of fish suitable for fisheries purposes.

  In summary, in order to meet the NNL guiding principle, the habitat manager's first preference is to avoid or reduce the project's potential for a HADD of fish habitat through the application of appropriate mitigation measures. Avoidance measures, such as project relocation or redesign, can be effectively applied at the project design stage. Failing that, impacts may be further reduced by application of specific mitigation measures, such as use of timing windows during the construction phase. If a HADD is still expected to occur, unavoidable - i.e. residual - losses in habitat productive capacity may be compensated on a case-by-case basis if the manager concludes that compensation is acceptable and feasible.

- The **Directive on the Issuance of Subsection 35(2) Authorizations** (1995) clarifies the circumstances when an Authorization under Subsection 35(2) may be issued, and on providing proponents with letters of advice suggesting means of avoiding HADD of fish habitat.

- The **Habitat Conservation and Protection Guidelines** (1998) is a document for use by DFO's staff in administering the habitat provisions of the *Fisheries Act*. It outlines a standard approach to habitat conservation and protection through the application of the NNL guiding principle.

Canadian Environmental Assessment Act

A decision to issue an Authorization under Section 32 or Subsection 35(2) of the *Fisheries Act* triggers an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA).

IMPACTS

The use of explosives may result in a number of adverse impacts on fish and marine mammals, and their habitats.

Effects on Fish

The detonation of explosives in or near water produces post-detonation compressive shock waves characterized by a rapid rise to a high peak pressure followed by a rapid decay to below ambient hydrostatic pressure. The latter pressure deficit causes most impacts on fish.

The primary site of damage in finfish is the swimbladder, the gas-filled organ that permits most pelagic fish to maintain neutral buoyancy. The kidney, liver, spleen, and sinus venous also may rupture and haemorrhage. Fish eggs and larvae also may be killed or damaged (Wright 1982).

Studies (Wright 1982) show that an overpressure in excess of 100 kPa will result in these effects. The degree of damage is related to type of explosive, size and pattern of the charge(s), method of detonation, distance from the point of detonation, water depth, and species, size and life stage of fish.

Vibrations from the detonation of explosives may cause damage to incubating eggs (Wright 1982, Wright in prep.). Sublethal effects, such as changes in behaviour of fish, have been observed on several occasions as a result of noise produced by explosives. The effects may be intensified in the presence of ice and in areas of hard substrate (Wright 1982, Wright in prep.).

The detonation of explosives may be lethal to marine mammals and may cause auditory damage under certain conditions. The detonation of explosives in the proximity of marine mammals also has been demonstrated to induce changes in behaviour (Wright in prep.).

The number of shellfish and crustaceans killed by the detonation of explosives is believed to be negligible, however, few data are available. Sublethal effects of explosives on

shellfish and crustaceans including behavioural modifications are little known or understood (Wright 1982, Wright in prep.).

Effects on Fish Habitat

The use of explosives in and near fish habitat may also result in the physical and/or chemical alteration of that habitat. For example, sedimentation resulting from the use of explosives may cover spawning areas or may reduce or eliminate bottom-dwelling life forms that fish use for food. By-products from the detonation of explosives may include ammonia or similar compounds and may be toxic to fish and other aquatic biota (Wright in prep.).

GUIDELINES, AND APPLICATION AND REVIEW PROCESSES

The following sections have been prepared to guide proponents proposing works or undertakings that involve the use of confined or unconfined explosives in or near Canadian fisheries waters, and to which the *Fisheries Act*, Sections 32 and 35 in particular, may apply. Confined explosives are those that would be used within a substrate, including ice, while unconfined explosives are those that would be used in open water, or not within a substrate.

Note that the information and guidance provided in these sections pertains to the conservation and protection of fish and fish habitat in the context of the *Fisheries Act*, and to the CEAA requirements that may result. There is no intent to relieve the proponent of responsibilities under any other federal, provincial or municipal legislation. Proponents are encouraged to contact other appropriate regulatory agencies to ensure that the proposed work or undertaking is carried out according to their requirements.

GUIDELINES

This section provides guidelines on methods and practices which, if incorporated into a project proposal, are intended to prevent or avoid the destruction of fish, or any potentially harmful effects to fish habitat that could result from the use of explosives. Implementation of these measures, for this purpose, is at the discretion of the proponent. Use of these guidelines should not be taken to imply approval of the proposed project in accordance with the *Fisheries Act*. Note that should the proponent proceed with the project and the use of explosives results in the destruction of fish and/or the HADD of fish habitat as a result of a change in plans, or failure to implement the measures, contravention of Section 32 and/or Subsection 35(1) of the *Fisheries Act* could occur.

1. Proponents considering the use of explosives are encouraged to consult the appropriate DFO Regional/Area authorities (Appendix I) as early as possible in their planning process to identify possible alternatives to the use of explosives, the biological resources and their habitats at risk, and/or effective mitigation measures.

2. Where provincial or territorial resource management agencies, or aboriginal resource management boards undertake the administration of fisheries, the proponent is encouraged to consult with the relevant authorities.

3. The use of confined or, in particular, unconfined explosives in or near Canadian fisheries waters is discouraged, and proponents are encouraged to utilize other potentially less destructive methods wherever possible.

4. No use of ammonium nitrate-fuel oil mixtures occurs in or near water due to the production of toxic by-products (ammonia).

   Note:

   - The deposit of deleterious substances into waters frequented by fish is prohibited under Section 36(3) of the *Fisheries Act*, unless otherwise permitted by regulation. There is no regulation pursuant to the *Fisheries Act* that permits the deposit of by-products resulting from the use of ammonium nitrate-fuel oil mixtures.

5. After loading a charge in a hole, the hole is to be back-filled (stemmed) with angular gravel to the level of the substrate/water interface or the hole collapsed to confine the force of the explosion to the formation being fractured. The angular gravel is to have a particle size of approximately 1/12th the diameter of the borehole.

6. All “shock-tubes" and detonation wires are to be recovered and removed after each blast.

7. No explosive is to be knowingly detonated within 500 m of any marine mammal (or no visual contact from an observer using 7x35-power binocular).

   Note:

   - Upon review of a proposal, the DFO Regional/Area authority may impose a greater avoidance distance, depending on the size of the charge or other project specific or fishery resource conditions.

8. No explosive is to be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change (i.e., overpressure) greater than 100 kPa (14.5 psi) in the swimbladder of a fish.

   Notes:

   - For confined explosives, setback distances from the land-water interface (e.g., the shoreline), or burial depths from fish habitat (e.g., from under the riverbed) that will ensure that explosive charges meet the 100 kPa overpressure

guideline are shown in Table 1. Equations to derive these relationships have been adapted from Nicholls et al. (1971) and Anon (1980). The equations are described in Appendix II, and should be used for weights of explosives not covered in Table 1. Sample calculations and examples are illustrated in Appendix Ill.

- If a confined explosive is to be detonated close to the substrate-water interface (such as in trenching or demolition), the set-back distance closely approximates the theoretical lethal range within which 50% of the fish may be killed or injured. Consequently, the 100 kPa guideline is not likely to be met in those situations where, because of the design constraint's of the project, it is also likely not possible or practical to 'adjust' the setback distance as a means to meet the 100 kPa guideline. For example, preparation of a trench for a pipeline crossing typically requires no more than a below grade burial depth of about 2m. Therefore, the weight of explosive charge per delay will have to be adjusted in an effort to meet the 100 kPa guideline. A sample calculation to illustrate a trenching example is given in Appendix III.

- For unconfined explosives, proponents are encouraged to contact the appropriate DFO Regional/Area authorities (Appendix I) for further guidance.

9. No explosive is to be detonated that produces, or is likely to produce, a peak particle velocity greater than 13 $mm \cdot s^{-1}$ in a spawning bed during the period of egg incubation.

Note:

- For confined explosives, setback distances or burial depths from spawning beds that will ensure that explosive charges meet the 13 $mm \cdot s^{-1}$ guideline criteria are shown in Table 2. Equations to derive these relationships have been adapted from Nicholls et al. (1971) and Anon (1980) and are described in Appendix II. Sample calculations and examples are illustrated in Appendix III.

- For unconfined explosives, proponents are encouraged to contact the appropriate DFO Regional/Area authorities (Appendix I) for further guidance.

APPLICATION AND REVIEW PROCESSES

Proponents planning to use an explosive that is likely to destroy fish and/or cause a HADD of fish habitat are subject to certain legal obligations under the *Fisheries Act*, as identified in the preceding 'Applicable Legislation and Policy' section. This section discusses these obligations with respect to the proposed use of explosives, and suggests to proponents how to fulfil them.

Proponents should contact the DFO Regional/Area authorities (Appendix I) as early as possible in their planning process. The purpose is to find out whether the proposed use of

explosives is likely to affect a Canadian fisheries water and whether its use is likely to destroy fish and/or cause a HADD of fish habitat. Depending on the outcome, DFO may also discuss potential issues, specific information requirements, or the next steps and possible outcomes in a further review of the proposal. For example, as summarized in the subsequent 'Review and Decision-making Process' section, possible next steps could include a request for further information, or a recommendation that the proponent seek an authorization pursuant to Section 32 and/or Subsection 35(2). Possible outcomes may include the provision of written advice, the issuance of (an) authorization(s) subject to completion of a CEAA review, or, refusal to issue (an) authorization(s).

Proponents should contact DFO before irrevocable commitments (such as contracts for equipment/services) are made, in order to avoid any unnecessary delays in the application and review process. Note that DFO may become aware of your proposed project through its participation in co-operative arrangements with other governments, agencies, boards, etc.

The following 'Application Procedures' section provides information to assist the proponent in deciding if it should seek Authorization to destroy fish by means other than fishing, and/or Authorization to harmfully alter, disrupt or destroy fish habitat, through the use of explosives and, if so, provides information on procedures for filing, etc.

Note that application for Authorization under Section 32 and/or Subsection 35(2) is voluntary. Proponents are not prohibited from going ahead with their use of explosives without Authorization. But, if as a result of the use of explosives, fish are destroyed and/or there is a HADD of fish habitat, contravention of Section 32 and/or Subsection 35(1) of the *Fisheries Act* could occur and the proponent is liable to prosecution.

Application Procedures

1. Proponents unable to meet the overpressure or peak particle velocity guideline values identified, respectively, in measures 8 or 9 of the preceding 'Guidelines' section, should complete and submit an application for Authorization under Section 32 of the *Fisheries Act*, to destroy fish by means other than fishing. The recommended application form is shown in Appendix IV. However, the proponent should contact the appropriate DFO Regional/Area authority (Appendix I) to verify that this is the appropriate application form to use and/or to identify information requirements.

2. Proponents who wish to file for Authorization under Subsection 35(2) of the *Fisheries Act* should complete and submit a separate application in accordance with the form prescribed pursuant to Subsection 58(1) of the *Fishery (General) Regulations* (Appendix V). Assistance on filing the application form, and related procedures, may be obtained by contacting the appropriate DFO Regional/Area authorities (Appendix I).

3. Proponents seeking Authorization under both Section 32 and Subsection 35(2) should complete and submit both Section 32 (Appendix IV) and Subsection 35(2) (Appendix V) applications. However, to minimize duplication, the proponent may choose to cross-reference those sections that are the same in each application form, and is expected to only submit one set of the documents requested in the forms, unless otherwise requested by the DFO Regional/Area authority. Contact the appropriate DFO Regional/Area authorities (Appendix I) for further information and assistance.

4. In seeking Authorization, the proponent will be expected to provide the information requested in the application forms. Doing so will expedite the review process.

   In general, the proponent is expected to provide all plans, specifications, studies, procedures, samples or other information required to permit an assessment of the potential impact of the proposed use of explosives on fish and fish habitat, and the mitigation and/or compensation measures proposed to alleviate impacts and/or to compensate for any loss of productive capacity of habitat to produce fish. Typically, the fish and/or fish habitat information requirements include, but may not necessarily be limited to the items summarized below:

   a) A description of the project and the expected effects resulting from the use of explosives on the fisheries resources (including marine mammals) and/or fish habitat, including:

      i) A description of fish and marine mammal species and their habitats likely to be affected by the detonation;
      ii) A description of whether the fish, marine mammals and their habitats contribute, or have the potential to contribute, directly or indirectly, to a fishery - subsistence, commercial or recreational;
      iii) The timing of any seasonal migration of fish and marine mammals;
      iv) The theoretical lethal range (i.e., the range, or distance, over which the overpressure exceeds 100 kPa) of the explosives to be used (from equations provided in Appendix II);
      v) An assessment of potential impacts arising from the proposed use of explosives and a description of proposed mitigation and/or compensation measures; and
      vi) Other matters, such as the proposed contingency plan and monitoring and follow-up program.

   b) The proponent's mitigation plan should include discussion of the following measures that are particularly relevant to alleviating the potential impacts of explosives:

      i) The work or undertaking should be undertaken at the time of least biological activity or biological sensitivity. Proponents should consult with DFO Regional/Area authorities to determine the appropriate timing;

ii) If multiple charges are required, time-delay detonation initiators (blasting caps) should be used to reduce the overall detonation to a series of discrete explosions. Time delays for discrete explosions should be greater than 25 ms; and,
iii) If possible, large charges should be subdivided into a series of smaller discrete detonations or explosions using time-delay detonation initiators (a procedure known as decking) to reduce the overall detonation to a series of smaller discrete detonations or explosions.

In addition to these measures, the proponent should also consider additional mitigation measures including, but not limited to the following:

iv) Deployment of bubble curtains/air curtains to disrupt the shock wave;
v) Deployment of noise generating devices, such as an air compressor discharge line, to scare fish away from the site; or,
vi) Removal or exclusion of fish from the work area before the blast occurs.

5. Proponents should be aware that subsequent to filing the application, DFO may request additional information concerning fish and fish habitat, the mitigation and/or compensation plans, the contingency and monitoring and follow-up programs, and other matters as required to complete the *Fisheries Act* review. If the appropriate information is not already available, it is the proponent's responsibility to provide it and, also, to assure DFO that the proposed mitigation and/or compensation measures will be effective. Should it be necessary to conduct an environmental assessment of the project pursuant to the CEAA, then additional information will be required in order to meet the requirements of the CEAA.

6. The Department of Fisheries and Oceans will undertake to: respond to requests for review, or to referrals, of project proposals or activities; issue Authorizations or provide advice; and/or complete environmental assessments in a manner consistent with Departmental service standards. Generally, DFO will respond to requests for review or to referrals within 30 working days of notification. Timeframes required for the issuance of Authorizations or advice will be discussed with proponents. Proponents should be aware that the length of time required to complete a review can vary greatly, often depending on the type and complexity of project proposed, the fish and fish habitat issues involved, and whether or not an environmental assessment under the CEAA is required. Once again, proponents are encouraged to contact the appropriate DFO Regional/Area authorities (Appendix I) to discuss these issues.

7. If an unforeseen need to use explosives arises, Departmental service standards may be waived and a review completed as expeditiously as possible so as not to unduly delay a project. Further, Departmental service standards are waived in the event of an emergency where lives and/or property are threatened. In such cases, the amount of information required may be reduced due to the urgency of the

situation. Any verbal request for an emergency Authorization will be accepted only on the condition that it is followed by a written confirmation of the project details.

8. If applicable, proponents may be required by the Department of Fisheries and Oceans, Canadian Coast Guard, to issue a "Notice to Mariners" and/or a "Notice to Fishers". The appropriate DFO Area/Regional authorities (Appendix I) are prepared to assist the proponent with contacting the Canadian Coast Guard.

9. Resource management agencies of other governments, departments, or boards that have been established under some aboriginal land claim settlements, may have aquatic resource review requirements and service standards that are different than those described in this document. Proponents should contact those agencies to ensure compliance with any requirements they may have.

Review and Decision-making Process

This section summarizes the approach taken by the Department of Fisheries and Oceans in the review of referrals and of applications for Authorization. Included is a description of the key decisions possible from a review, and the criteria used in making decisions. There is also a brief summary of the linkage between Section 32 and/or Subsection 35(2) Authorizations and the responsibilities of the Department of Fisheries and Oceans to undertake environmental assessments pursuant to the *Canadian Environmental Assessment Act* (CEAA).

Fisheries Act

DFO will review the proponent's application in accordance with the *Fisheries Act* and its supporting policy framework, including this document. Upon receipt of information, notice, a referral, or application for Authorization concerning works or undertakings where the use of explosives is proposed, DFO will normally take the following steps in its review of the proposal:

1. Determine the adequacy of the information provided by the proponent.

2. Using the information provided, assess the extent of risk or potential damage to fish and marine mammals and/or fish habitat and the acceptability of this level of damage in context with the level of protection required.

3. Determine the probable success of proposed mitigation and/or compensation measures and, as appropriate the acceptability of any residual impacts.

4. Where relevant, consult with the appropriate provincial or territorial resource management agencies, and/or aboriginal resource management boards.

5. Note that prior to finalizing its review of the proposal DFO may, among other matters, advise the proponent of the need for more information, re-assess a revised project proposal, suggest that the proponent seek authorization, etc. The

review of a proposal is often an iterative process depending on a number of factors, such as the type of referral received by DFO, is completeness, its potential impacts on fish and/or fish habitat and the potential to mitigate and/or compensate for such impacts. Proponents should discuss this and related aspects of the review process with the relevant DFO/Regional area authority (Appendix I).

6. After examination of the proposal, DFO will make a decision regarding the proponent's application.

- **With respect to Section 32, DFO will either,**

  ⇒ upon determining that implementation of mitigation measures by the proponent is expected to prevent or avoid the destruction of fish, advise the proponent by letter that if such measures are incorporated into the project, Section 32 is not expected to be contravened. A letter of advice should not be taken to imply approval of the project pursuant to the habitat provisions of the *Fisheries Act*, or any other legislation. Note, if the destruction of fish occurs as a result of a change in the plans for the proposed project, or failure to implement the measures identified in the letter of advice, contravention of Section 32 of the *Fisheries Act* could occur.

  OR

  ⇒ upon determining that even with the implementation of mitigation measures the destruction of fish is still expected to occur **and**, because this mortality is acceptable within the context of the fisheries resource, issue a Section 32 Authorization using a letter format.

  OR

  ⇒ upon determining that even with the implementation of mitigation measures the destruction of fish is still expected to occur **but**, because this mortality is not acceptable within the context of the fisheries resource, reject the proposal, and notify the proponent that DFO will not issue a Section 32 Authorization and that a contravention of the *Fisheries Act* could occur should the proponent still choose to proceed as proposed.

- **With respect to Section 35, DFO will either,**

  ⇒ upon determining that implementation of mitigation measures by the proponent is expected to prevent or avoid a HADD of fish habitat, advise the proponent by letter that if such measures are incorporated into the project, Subsection 35(1) is not expected to be contravened. A letter of advice should not be taken to imply approval of the project pursuant to the habitat provisions of the *Fisheries Act*, or any other legislation. Note, if a

HADD of fish habitat occurs as a result of a change in the plans for the proposed project, or failure to implement the measures identified in the letter of advice, contravention of Subsection 35(1) of the *Fisheries Act* could occur.

OR

⇒ upon determining that even with the implementation of mitigation measures a HADD of fish habitat is still expected to occur **and**, because the proposed compensation for the unavoidable net loss of productive capacity of fish habitat is acceptable to DFO, issue a Subsection 35(2) authorization using the form provided in Schedule VII of Subsection 58(2) of the *Fishery (General) Regulations*.

OR

⇒ upon determining that even with the implementation of mitigation measures a HADD of fish habitat is still expected to occur **but**, because the proposed compensation for the unavoidable net loss of fish habitat productive capacity is not acceptable, reject the proposal, and notify the proponent that DFO will not issue a Subsection 35(2) Authorization and that a violation of the *Fisheries Act* could occur should the proponent still choose to proceed as proposed.

Notes:

- The Department of Fisheries and Oceans, in arriving at one of the above noted determinations, will also consider the following criteria:
    - Whether the use of explosives is the only technically feasible means by which to attain the desired objective; and
    - Whether the use of explosives is required to alleviate an emergency situation threatening human safety and/or property.
- Section 32 and/or Subsection 35(2) authorizations come with conditions attached, which among others may include:
    - The proponent may be required to develop, undertake and report on a monitoring program at its expense, typically, to monitor compliance and evaluate effectiveness of the mitigation and/or compensation measures.
    - If, during the course of the works or undertakings, the adverse effects of the explosives were significantly greater than anticipated, the proponent may be required to immediately cease all further use of explosives,

pending review of the situation with Department of Fisheries and Oceans personnel.

- Additional, site-specific terms and conditions as may be required in order to satisfy fishery resource and/or fish habitat protection requirements. For example, the conditions may be more stringent than the measures identified in the preceding 'Guidelines' section.

Canadian Environmental Assessment Act

Section 32 and Subsection 35(2) are included in the *Law List Regulation* of the *Canadian Environmental Assessment Act* (CEAA). Consequently, the Department of Fisheries and Oceans as the Responsible Authority must conduct an environmental assessment of the relevant proposed works or undertakings before an Authorization can be issued. If the result of the environmental assessment is that the work or undertaking will, after taking into account the appropriate measures, not likely result in significant impact that cannot be justified, then authorization(s) will normally be issued pursuant to Section 32 and/or Subsection 35(2) of the *Fisheries Act*. Procedures for coordinating the CEAA review with provincial and aboriginal government review processes vary. Proponents are strongly advised to contact the DFO Regional/Area authorities (Appendix I) to obtain additional information on environmental assessment procedures and requirements.

UPDATING

These guidelines will be reviewed and updated as necessary.

ACKNOWLEDGEMENTS

Many individuals and governmental and non-governmental organizations were consulted in the development of these guidelines. We gratefully acknowledge their interest and contributions. In particular, input from D. Haché, K. Fisher, K. Broughton and R. Drolet, from DFO, and L. Macanuf (Golder-VME) and R. Morin (Explotec Engineering Ltd) is appreciated.

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Table 1. Setback distance (m) from centre of detonation of a confined explosive to fish habitat to achieve 100 kPa guideline criteria for various substrates.

The data in this table is incorrect and should not be used.

Substrate Type	Weight of Explosive Charge (kg)							
	0.5	1	2	5	10	25	50	100
Rock	3.6	5.0	7.1	11.0	15.9	25.0	35.6	50.3
Frozen Soil	2.3	3.2	4.5	7.2	14.3	16	22.6	32
Ice	1.5	2.1	3.0	4.7	6.6	10.5	14.8	21
Saturated Soil	1.5	2.1	3.0	4.8	6.7	10.0	15.1	21.3
Unsaturated Soil	0.7	1.0	1.4	2.2	3.1	4.9	6.9	9.8

Erratum:

Wright, D.G., and G.E. Hopky. 1998. Guidelines for the use of explosives in or near Canadian fisheries waters. Can Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p.

Page 15: Table 1 should be replaced by the following Table:

Table 1. Setback distance (m) from centre of detonation of a confined explosive to fish habitat to achieve 100 kPa guideline criteria for various substrates.

Substrate Type	Weight of Explosive Charge (kg)							
	0.5	1	2	5	10	25	50	100
Rock	3.6	5.0	7.1	11.0	15.9	25.0	35.6	50.3
Frozen Soil	3.3	4.7	6.5	10.4	14.7	23.2	32.9	46.5
Ice	3.0	4.2	5.9	9.3	3.2	20.9	29.5	41.8
Saturated Soil	3.0	4.2	5.9	9.3	13.2	20.9	29.5	41.8
Unsaturated Soil	2.0	2.9	4.1	6.5	9.2	14.5	20.5	29.0

Table 2. Setback distance (m) from centre of detonation of a confined explosive to spawning habitat to achieve 13 mm•sec^{-1} guideline criteria for all types of substrate.

	Weight of Explosive Charge (kg)						
	0.5	1	5	10	25	50	100
Setback distance (m)	10.7	15.1	33.7	47.8	75.5	106.7	150.9

Appendix I
DFO Regional/Area Authorities

Newfoundland Region

Habitat Evaluation Engineer,
Habitat Management Division
Fisheries and Habitat Management Branch
PO Box 5667
St. John's, NF A1C 5X1
Voice: (709) 772-6157
Fax: (709) 772-4525

Maritime Region

New Brunswick and Prince Edward Island

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Nova Scotia

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Laurentian Region

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Fish Habitat and Environmental Science
Maurice-Lamontagne Institute
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Central and Arctic Region

Ontario

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Fisheries Management Branch
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Fax: (905) 336-6437

Manitoba, Saskatchewan and Alberta

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Fax: (204) 984-2402

Appendix I (concluded)
DFO Regional/Area Authorities

Central and Arctic Region (continued)

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Western Arctic

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Fisheries Management Branch
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Yukon

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Appendix II
General Equations to Determine Setback Distance for Confined Explosives to Meet Guideline Criteria of 100 kPa

Equation (A)

Equation (A) describes the transfer of shock pressure from the substrate to the water.

$$P_W = \frac{2(Z_W / Z_R)P_R}{1+(Z_W / Z_R)}$$

where:

P_W = pressure (kPa) in water
P_R = pressure (kPa) in substrate
Z_W = acoustic impedance of water
Z_R = acoustic impedance of substrate

Equation (B)

Equation (B) describes the relationship between acoustic impedance and the density and velocity of the medium through which the compressional wave travels.

$$Z_W/Z_R = \frac{D_W C_W}{D_R C_R}$$

where:

D_W = density of water = 1 g•cm^{-3}
D_R = density of the substrate in g•cm^{-3}
C_W = compressional wave velocity in water
= 146,300 cm•s^{-1}
C_R = compressional wave velocity in substrate in cm•s^{-1}

Appendix II (concluded)
General Equations to Determine Setback Distance for Confined Explosives to Meet Guideline Criteria of 100 kPa

Equation (B) (continued):

The following values are used for D_R and C_R for various substrates:

Substrate	D_R ($g \cdot cm^{-3}$)	C_R ($cm \cdot s^{-1}$)
Rock	2.64	457,200
Frozen Soil	1.92	304,800
Ice	0.98	304,800
Saturated soil	2.08	146,300
Unsaturated soil	1.92	45,700

Equation (C)

Equation (C) describes the relationship between the peak particle velocity (V_R) and the pressure, density and compressional wave velocity in the substrate.

$$V_R = \frac{2P_R}{D_R C_R}$$

Equation (D)

Equation (D) represents the scaled distance relationship and is used to equate the peak particle velocity to charge weight and distance.

$$V_R = 100\,(R/W^{.5})^{-1.6}$$

where:

V_R = peak particle velocity in $cm \cdot s^{-1}$
R = distance to the detonation point in m
W = charge weight per delay in kg

Appendix III
Sample Calculations and Examples for Confined Explosives

SAMPLE CALCULATIONS

Sample Calculation 1: Calculation of Setback Distance Required for a 100 kg Charge Set in Rock to Meet the 100 kPa Guideline.

1. From Equation (B):

$$Z_W/Z_R = \frac{D_W C_W}{D_R C_R}$$

$$= \frac{(1g \bullet cm^{-3})(146{,}300cm \bullet s^{-1})}{(2.64g \bullet cm^{-3})(457{,}200cm \bullet s^{-1})}$$

$$= 0.1212$$

2. From Equation (A):

$$P_W = \frac{2(Z_W / Z_R)P_R}{1+(Z_W / Z_R)}$$

$$P_W = \frac{2(0.1212)P_R}{1+(0.1212)}$$

$$P_W = 0.22\ P_R$$

3. To limit P_W to 100 kPa ($kg \bullet m \bullet s^{-2} \bullet m^{-2}$):

$$P_R = \frac{P_W}{0.22}$$

$$P_R = \frac{100\ kPa}{0.22}$$

$$P_R = 455\ kPa$$

$$P_R = 4.55 \times 10^2\ kPa$$

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

4. Convert kPa to dynes ($g \cdot cm \cdot s^{-2}$):

$$\text{dynes} = \text{kPa} \times 10^4$$

$$P_R = 4.55 \times 10^2 \times 10^4$$

$$P_R = 4.55 \times 10^6 \text{ dynes } (g \cdot cm \cdot s^{-2})$$

5. From Equation (C):

$$V_R = \frac{2P_R}{D_R C_R}$$

$$V_R = \frac{(2)\left(4.55 \bullet 10^6 \ g \bullet cm \bullet s^{-2}\right)}{\left(2.64 \ g \bullet cm^{-3}\right)\left(457{,}200 \ cm \bullet s^{-1}\right)}$$

$$V_R = 7.54 \ cm \bullet s^{-1}$$

6. From Equation (D):

$$V_R = 100(R/W^{.5})^{-1.6}$$
$$R = (W^{.5})(V_R/100)^{-0.625}$$
$$R = (100kg)^{.5}(7.54cm \bullet s^{-1}/100kg \bullet cm \bullet s^{-1} \bullet m)^{-0.625}$$
$$R = 50.3 \text{ m}$$

Therefore, a 100 kg charge of explosives detonated in rock requires a setback of 50.3 m from fish habitat in order to reduce the overpressure produced by the detonation to less than 100 kPa.

Now, the calculation of the set-back distance required for a 100 kg charge set in rock to meet the peak particle velocity guideline of 13 $mm \bullet sec^{-1}$ is as follows:

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

From Equation (D):

$$R = (W^{.5})(V_R/100)^{-0.625}$$

When

V_R = 13 mm•sec^{-1} = 1.3 cm•sec^{-1}

and W = 100 kg

$$R = (100^{.5})(1.3/100)^{-0.625}$$
$$R = 150.9 \text{ m}$$

Therefore, a 100 kg charge of explosives detonated in rock requires a setback of 150.9 m from a spawning area in order to reduce the peak particle velocity produced by the detonation to less than 13 mm•sec^{-1}.

Sample Calculation 2: Simplified Calculation of Setback Distance from Fish Habitat.

The calculations to determine the required setback distance to meet the 100 kPa guideline may be simplified. Since the weight of the charge and the distance from the charge to fish habitat are the only variables in the equations, a factor can be developed for substitution in Equation (D).

From Equation (D):

$$V_R = 100(R/W^{.5})^{-1.6}$$
$$R = (W.5)\ (V_R/100)^{-0.625}$$

Therefore:

$$R = W^{.5}(K)$$

By working through the equations of Appendix II and solving for V_R for each substrate

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

type, the following results are obtained:

SUBSTRATE TYPE	K
Rock	5.03
Frozen Soil	3.2
Ice	2.1
Saturated Soil	2.13
Unsaturated Soil	0.98

Therefore, to determine the setback distance required to meet the peak pressure guideline of 100 kPa, multiply the square root of the charge weight by the appropriate "K" factor.

Sample Calculation 3: Simplified Calculation of Setback Distance from Fish Spawning Habitat.

Similarly, to determine the set-back distance required to meet the peak particle velocity (V_R) guideline of 13 mm•sec^{-1}, a constant can be developed for substitution in Equation (D):

From Equation (D):

$$V_R = 100(R/W^{.5})^{-1.6}$$

$$R = (W^{.5})(V_R/100)^{-0.625}$$

where:

$$V_R = 13 \text{ mm•sec}^{-1} = 1.3 \text{ cm•sec}^{-1}$$

$$R = (W^{.5})(1.3/100)^{-0.625}$$

$$R = (W^{.5})(15.09)$$

Therefore, to determine the setback distance required to meet the peak particle velocity (V_R) guideline of 13 mm•sec^{-1}, multiply the square root of the charge weight by a factor of 15.09.

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

EXAMPLES

Example 1: On-shore Setback Distance from Fish Habitat.

A proponent wishes to use explosives to break rock in a quarry near a stream. What is the minimum setback distance from the stream required in order to limit the overpressure in the stream to less than 100 kPa?

Calculate the required set back distance for a 35 kg charges set in rock.

W		=	35 kg
$K_{(rock)}$	=	6.75	
R		=	$(W^{.5})(K)$
R		=	$(35^{.5})$ (5.03)
R		=	29.8 m

Note: It is assumed that the rock formation being quarried extends under the stream. Therefore the K factor for rock is used.

Therefore, the proponent would be required to maintain a set back distance of at least 29.8 m in order to meet the DFO guideline criteria of 100 kPa.

Example 2: Buried Charges for Geophysical Exploration.

A proponent wishes to conduct a geophysical survey beneath a shallow lake. Because of the shallow depth of the lake, it is not possible to use an air gun or other similar non-explosive energy source. To what depth must explosive charges (5 kg) be buried in order to limit the overpressure to less than 100 kPa?

W	=	5 kg
$K_{(sat.\ soil)}$	=	2.13
R	=	$(W^{.5})(K)$
R	=	$(5^{.5})$ (2.13)
R	=	4.8 m

Note: It is assumed that the charges are buried in un-consolidated sediments. Therefore the K factor for saturated soil is used.

Therefore the proponent would be required to bury the charges to a depth of at least 4.8 m below the substrate-water interface in order to limit the overpressure at the interface to less than 100 kPa.

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

Example 3: In-stream Trench Excavation.

A proponent wishes to use explosives to assist in the excavation of a trench for a pipeline across a trout stream. The right-of-way is located in a cobble bottom riffle area that is used as a feeding area. There is a potential spawning bed located 75 m upstream of the right-of-way. The explosives' parameters are as follows:

Weight of individual charges: 15 kg
# of holes detonated/delay: 5
Weight of charge/delay: 75 kg

Does the proposal meet the DFO guideline criteria for overpressure and peak particle velocity?

a) For the Overpressure Criteria:

$W = 75$ kg
$K_{(rock)} = 5.03$
$R = (W^{.5})(K)$
$R = (75^{.5})\ (5.03)$
$R = 43.6$ m

Note: Since explosives must be used to excavate the trench, it is assumed that the substrate consists of rock or strongly consolidated sediments. Therefore the K factor for rock is used.

Therefore the detonation of 75 kg of explosives could kill or injure fish within a radius of 43.6 m of the right-of-way.

b) For the Peak Particle Velocity Criteria:

To determine the setback distance required to meet the peak particle velocity (V_R) guideline of 13 mm•sec^{-1} in a spawning area, multiply the square root of the charge weight by a factor of 15.09.

$R = (W^{.5})(15.09)$
$R = (75^{.5})\ (15.09)$
$R = 130.7$ m

Therefore, the detonation of 75 kg of explosives would exceed the DFO Guideline for peak particle velocity of 13 mm•sec^{-1} in a spawning bed.

Appendix III (concluded)
Sample Calculations and Examples for Confined Explosives

Therefore, the application for an authorization to use explosives would be denied and major changes in the explosives program would be required in order for the project to be acceptable to DFO.

For example:

If the weight of explosive/delay were reduced to 5 kg by increasing the number of holes in the pattern and detonating each hole separately with 25 msec delays between each hole, the zone of overpressure exceeding 100 kPa would be:

$W = 5$ kg
$K_{(rock)} = 5.03$
$R = (W^{.5})(K)$
$R = (5^{.5})\ (5.03)$
$R = 11.2$ m

Similarly, the distance at which the peak particle velocity in the substrate would not exceed 13 mm•sec^{-1} would be:

$R = (W^{.5})(15.09)$
$R = (5^{.5})\ (15.09)$
$R = 33.7$ m

Therefore, if the weight of explosives per delay were reduced to 5 kg, the spawning area would be protected, as it is further than 33.7m from the detonation area. However, the detonation would still produce over-pressures exceeding 100 kPa to a distance of 11.2 m. Additional mitigation such as undertaking the project at a time of least fish activity or by removing/excluding fish from the area by either physical exclusion or scare tactics may be required.

Appendix IV
Application Form for Authorization to Destroy Fish by Means Other Than Fishing

¾ ¾

APPLICATION FOR AUTHORIZATION TO DESTROY FISH BY MEANS OTHER THAN FISHING

I, the undersigned, hereby request authorization to carry out the works or undertakings described on this application form. I understand that the approval of this application, if granted, is from the Department of Fisheries and Oceans standpoint only and does not release me from my obligation to obtain permission from other concerned regulatory agencies.

If an authorization is granted as a result of this application, I hereby agree to carry out all activities relating to the project within the designated time frames and conditions specified in the authorization.

Applicant's Name (Please Print) _____

Applicant's Business Address _____

_____

_____

_____

Applicant's Telephone Number _____

Applicant's Facsimile Number _____

Applicant's E-Mail Number _____

Date of Application _____

I solemnly declare that the information provided and facts set out in this application are true, complete and correct, and I make this solemn declaration conscientiously believing it to be true and knowing that it is of the same force and effect as if made under oath. This declaration applies to all material submitted as part of this application.

Applicant's Signature _____

Appendix IV (continued)
Application Form for Authorization to Destroy Fish by Means Other Than Fishing

¾ ¾

APPLICATION FOR AUTHORIZATION TO DESTROY FISH BY MEANS OTHER THAN FISHING (continued)

Location Details

Name of watercourse or waterbody (including co-ordinates)

_____

_____

Nearest Community _____

County _____

Province/Territory _____

Provide details of proposed activity including reasons as to why explosives must be used (attach additional information as required)

_____

_____

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Appendix IV (continued)
Application Form for Authorization to Destroy Fish by Means Other Than Fishing

¾ ¾

APPLICATION FOR AUTHORIZATION TO DESTROY FISH BY MEANS OTHER THAN FISHING (continued)

Schedule of Operations

Proposed starting date (D/M/Y) _____

Proposed completion date (D/M/Y) _____

The following documents will assist in assessing your application and help expedite its approval. Please check which documents you have attached.

Map indicating location of project	[ ]
Engineering specifications	[ ]
Dimensional drawings	[ ]
Assessment of fish and marine mammal resources	[ ]
Assessment of potential effects of project on fish and marine mammals	[ ]
Measures proposed to mitigate potential damage to fish and marine mammals	[ ]
Other	[ ]

Appendix IV (concluded)
Application Form for Authorization to Destroy Fish by Means Other Than Fishing

¾ ¾

APPLICATION FOR AUTHORIZATION TO DESTROY FISH BY MEANS OTHER THAN FISHING (concluded)

Explosives Contractor (If different from applicant)

Name _____

Address _____

_____

_____

Telephone number _____

Facsimile number _____

Details of Explosives

Type (including trade name) _____

Total weight of explosive to be used (kg) _____

Weight of individual shots/
Weight per delay _____

Shot pattern _____

Detonation depth _____

Delay period (msec) _____

Method of detonation _____

APPENDIX V
Application Form to Harmfully Alter, Disrupt or Destroy Fish Habitat

SCHEDULE VI/ANNEXE VI

(*Subsection 58(1)/paragraphe 58(1)*)

Fisheries and Oceans

Pêches et Océans

_____

Application No./N° de la demande

APPLICATION FOR AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
DEMANDE D'AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON

I, the undersigned, hereby request authorization to carry out the works or undertakings described on this application form. I understand that the approval of this application, if granted, is from the Minister of Fisheries and Oceans standpoint only and does not release me from my obligation to obtain permission from other concerned regulatory agencies.

Je soussigné, demande par les présentes l'autorisation d'exploiter les ouvrages ou entreprises décrits dans la formule. Je comprends que l'approbation de cette demande, le cas échéant, porte sur ce qui relève du ministre des Pêches et des Océans et ne me dispense pas d'obtenir la permission d'autres organismes réglementaires concernés.

If an authorization is granted as a result of this application, I hereby agree to carry out all activities relating to the project within the designated time frames and conditions specified in the authorization.

Si la demande est approuvée, je consens par les présentes à exécuter tous les travaux relatifs à ce projet selon les modalités et dans le laps de temps prescrits dans l'autorisation.

Applicant's Name (Please Print) _____ Nom du requérant (lettres moulées)

Applicant's Business Address _____ Adresse d'affaires du requérant

_____

_____

Applicant's Telephone No./ N° de téléphone du requérant _____ Date_____

I solemnly declare that the information provided and facts set out in this application are true, complete and correct, and I make this solemn declaration conscientiously believing it to be true and knowing that it is of the same force and effect as if made under oath. This declaration applies to all material submitted as part of this application.

Je déclare solennellement que les renseignements fournis et les faits énoncés dans cette demande sont véridiques, complets et exacts, et je fais cette déclaration solennelle, la croyant consciencieusement vraie et sachant qu'elle a la même force et le même effet que si elle était faite sous serment. Cette déclaration s'applique à tout document qui est présenté dans le cadre de cette demande.

_____ _____

Applicant's Signature (and corporate seal) Signature du requérant (et sceau de la société)

Name of watercourse or waterbody (give coordinates)
Cours d'eau ou plan d'eau (donner les coordonnées) _____

This watercourse is a tributary of (where applicable)
Cours d'eau tributaire de (le cas échéant)

_____

Nearest community Localité la plus proche	County Comté	Province Province
_____	_____	_____

APPENDIX V
Application Form to Harmfully Alter, Disrupt or Destroy Fish Habitat (continued)

SCHEDULE VI-Continued/ANNEXE VI (suite)

Fisheries and Oceans
Pêches et Océans

Application No./N° de la demande

APPLICATION FOR AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
DEMANDE D'AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON

Type of Activity/Genre d'activité

[ ] Bridge Pont	[ ] Stream Realignment Alignement de cours d'eau	[ ] Gravel Removal Enlèvement du gravier	[ ] Stream Traverse Traversée de cours d'eau
[ ] Culvert Ponceau	[ ] Channelization Canalisation	[ ] Obstruction Removal - Bypass Enlèvement ou contournement d'obstacle	[ ] Seismic Survey Levé sismique
[ ] Dam Barrage	[ ] Wharf - Break water Quai - Brise-lames	[ ] Stream Utilization - Recreation Utilisation récréative du cours d'eau	[ ] Agriculture
[ ] Stream Diversion Dérivation de cours d'eau	[ ] Dewatering Assèchement	[ ] Erosion Control Lutte contre l'érosion	[ ] Other (specify) Autres (préciser)
[ ] Mining Activité minière	[ ] Aquaculture	[ ] Flood Protection Protection contre les inondations	

List of Agencies (Federal, Provincial or Municipal) contacted or notified, or who have initiated contact with the applicant.
Liste des organismes (fédéraux, provinciaux ou municipaux) contactés ou qui ont pris contact avec le requérant.

PROVIDE DETAILS OF PROPOSED ACTIVITY INCLUDING REASONS FOR THE PROJECT AND TYPES OF EQUIPMENT TO BE USED
DONNER DES PRÉCISIONS SUR LES TRAVAUX PROJETÉS Y COMPRIS LA JUSTIFICATION DU PROJET ET LE TYPE D'ÉQUIPEMENT À UTILISER

APPENDIX V
Application Form to Harmfully Alter, Disrupt or Destroy Fish Habitat (continued)

SCHEDULE VI-Continued/ANNEXE VI (suite)

Fisheries and Oceans
Pêches et Océans

Application No./N° de la demande _____

APPLICATION FOR AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
DEMANDE D'AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON

SCHEDULE/CALENDRIER

	D/J	M/M	Y/A
Proposed Starting Date Date prévue du début des travaux	_____	_____	_____
Proposed Completion Date Date prévue de l'achèvement des travaux	_____	_____	_____

Approximate Timing of Work in shoreline, foreshore, tidal zone, or underwater areas.
Période approximative des travaux sur le rivage et les estrans ainsi que dans les zones àmarées et les zones sous-marines.

	D/J	M/M	Y/A		D/J	M/M	Y/A
From/De	_____	_____	_____	To/A	_____	_____	_____

The following documents will assist in assessing your application and help expedite its approval. Please check which documents you have attached.	**Les documents suivants faciliteront l'évaluation de votre demande et permettront d'accélérer son approbation. Veuillez cochez les documents vous avez joints àvotre demande.**
Map indicating location of project	[ ] Carte indiquant l'emplacement du projet
Engineering Specifications	[ ] Spécifications techniques
Scale Drawings	[ ] Dessins àl'échelle
Dimensional Drawings	[ ] Plans cotés
Assessment of Existing Fish Habitat Characteristics	[ ] Évaluation des caractéristiques existantes de l'habitat du poisson
Assessment of Potential Effects of Project on Fish Habitat	[ ] Évaluation des répercussions possibles sur l'habitat du poisson
Measures Proposed to Offset Potential Damage to Fish Habitat	[ ] Mesures proposées pour compenser les ventuels dommages àl'habitat du poisson
Other	[ ] Autres

ENVIRONMENTAL ASSESSMENT AND REVIEW PROCESS CONSIDERATIONS	**CONSIDIRATIONS CONCERNANT LE PROCESSUS D'IVALUATION ET D'EXAMEN EN MATIORE D'ENVIRONNEMENT**
NOTE: All applications pursuant to section 35 of the Fisheries Act will be assessed in accordance with applicable federal environmental assessment requirements.	REMARQUE : Toute demande en vertu l'article 35 de la Loi sur les pêches sera soumise aux exigences fédérales applicables àl'évaluation environnementale.

APPENDIX V
Application Form to Harmfully Alter, Disrupt or Destroy Fish Habitat (concluded)

SCHEDULE VI-Concluded/ANNEXE VI (fin)

Fisheries and Oceans
Pêches et Océans

Application No./N° de la demande _____

APPLICATION FOR AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
DEMANDE D'AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON

COMPLETE ONLY IF USE OF EXPLOSIVES IS INTENDED
A REMPLIR SEULEMENT EN CAS D'UTILISATION D'EXPLOSIFS

EXPLOSIVES CONTRACTOR (IF DIFFERENT FROM APPLICANT)/RESPONSABLE DES EXPLOSIFS (SI AUTRE QUE LE REQUIRANT)

Name/Nom : _____

Address/Adresse : _____

_____

Telephone No./N° de téléphone : _____

	D/J	M/M	Y/A		D/J	M/M	Y/Y
Anticipated Starting Date Date prévue du début des travaux	_____	_____	_____	Completion Date Date d'achèvement	_____	_____	_____

DETAILS OF EXPLOSIVES/PRÉCISIONS SUR LES EXPLOSIFS

Type (including trade name)
Genre (y compris la marque _____

_____

Weight and configuration (where applicable) _____
Poids et forme (le cas échéant)

_____

_____

Weight of individual shots and shot pattern where multiple charges are used
Poids des coups individuels et déploiement des coups, en cas de charges multiples

_____

_____

Detonation depth (in the rock; note also the depth of water, if applicable)
Profondeur de détonation (dans le roc; indiquer aussi, la profondeur de l'eau, s'il y a lieu)

_____

_____

Method of detonation
Méthode de détonation _____

_____

_____