NATURAL ENVIRONMENT REPORT (LEVEL 1 AND LEVEL 2 ASSESSMENTS)

SEBRIGHT QUARRY

April 2011

RiverStone
ENVIRONMENTAL SOLUTIONS INC.

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

April 19, 2011
RS# 2009-12

Giofam Investments Inc.
Attention: V. Giordano
P.O. Box 1359
Uxbridge Ontario
L0C 1K0

SUBJECT: Natural Environment Report: Level 1 and Level 2 Assessments, Sebright Quarry

Dear Mr. Giordano:

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.

Please contact us if there are any questions regarding the report, or if further information is required.

Best regards,

RiverStone Environmental Solutions Inc.

Report prepared by:

Bev Wicks, PhD
Senior Aquatic Ecologist

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Species at Risk Specialist
Senior Terrestrial Ecologist

Laura Alward Dipl. ET
Terrestrial Ecologist

REPORT SUMMARY

<table>
<tr><td colspan="2">Type of Study
Natural Environment Report: Level 1 and Level 2 Assessments</td><td>Date
April 19, 2011</td></tr>
<tr><td></td><td>Legal Description
Part of Lots 18 through 21, Concession 4, and Lots 20 and 21, Concession 5; Part of Lots 19 and 20, Concession 2 is also owned by the applicant; geographic Township of Dalton, formerly the County of Victoria, now in the City of Kawartha Lakes.</td><td>Proposal/Application
Category 2, Class A licence under the ARA and Official Plan and Zoning By-law amendment</td></tr>
<tr><td></td><td>Planning Authorities
Ministry of Natural Resources
City of Kawartha Lakes
County of Victoria</td><td>Owner/Agent
Bruno Giordano (Giofam Investments Inc.)</td></tr>
</table>

Report Summary

Biologists with RiverStone have been working with Giofam Investments Inc. since October 2003 on the proposed development of a Category 2, Class A quarry near Sebright 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 conducted between 2003 and 2010, it was determined that several significant natural heritage features and functions occurred on the subject property. The features identified include species of conservation interest (fish, Endangered and Threatened species, and Special Concern species) and their associated habitat. As per the requirements of the Level 2 assessment, the potential impacts of the proposed 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 three main watercourses (Watercourses 1 and 2 and the Cranberry River) and the southern Monck Road drainage features can be protected by implementing the recommended mitigation measures. Maintaining the quality and quantity of water within the watercourses throughout the life of the quarry can be ensured by following the monitoring protocols provided in the Performance Monitoring Plan.
- The fish habitat identified on the subject property corresponds to a forage fish community in the smaller watercourses (1 and 2) and open-water portions of the online wetlands, and a warmwater fishery in the Cranberry River. Fish and fish habitat will not be affected by the proposed development provided the recommendations contained in this report are implemented (i.e., 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).
- A considerable portion of the subject property either functions, or has the potential to function, as habitat for Endangered and Threatened species. Consequently, extensive studies were conducted to determine how the proposed quarry could be developed in a manner that would ensure the continued use of the subject property by the identified species. These studies have resulted in substantial

changes to the proposed quarry. In addition to ensuring the resident populations of Endangered and Threatened species remain viable, measures to achieve an "overall benefit" for affected species have been proposed as part of a permit application under the provincial Endangered Species Act.

- With regard to those species designated Special Concern (i.e., the third level within the Species at Risk group), detailed evaluations were also completed. Regarding the question of whether the habitat of some of these species would qualify as Significant Wildlife Habitat, and thus invoke consideration under policy 2.1.4 of the PPS, it is RiverStone's opinion that it would not, as per the methodology outlined in the most recent Natural Heritage Reference Manual (OMNR 2010). Based on these evaluations, it is RiverStone's conclusion that as long as the recommendations made in this report are implemented, any impacts on these species and their habitat will be acceptable given the relevant legislation and policy requirements.
- Although the subject property is directly adjacent to Queen Elizabeth II Wildlands Provincial Park, the area proposed for licensing (the Site) is approximately 400 m away from the nearest extent of the park; furthermore, the nearest proposed extraction area is a minimum of 470 m away from the park. Finally, the area between the Site and the park has been identified as Endangered and Threatened species habitat in this report; these lands are therefore subject to numerous protective measures detailed herein and within the permit application being negotiated under the provincial Endangered Species Act. Consequently, it is not anticipated that there will be any negative impacts on the ecological integrity of the park; rather this quarry proposal would ensure the maintenance of a substantial buffer (with high ecological function) adjacent to the park in this location.
- As detailed and mapped in this report, a wetland system with high natural heritage value and ecological function occurs on the subject property. None of the wetlands has been evaluated using the Ontario Wetland Evaluation System; therefore, none of them has been designated Provincially Significant (i.e., a PSW). Despite this lack of formal evaluation, the natural heritage features within this wetland system, as documented by RiverStone, indicate that the wetlands within the subject property and adjoining lands would be designated provincially significant if evaluated. Accordingly, RiverStone has evaluated potential impacts on the wetland system, and made recommendations to ensure its protection following the policy requirements that would be in effect if the wetlands were formally designated provincially significant.
- No other ecological communities recognized as being provincially or locally rare were identified on the subject property or adjoining lands.
- The final rehabilitation plan for the quarry will provide open water habitat for waterfowl. The rehabilitation plan has also been developed to include some areas of shallow habitat for aquatic, semi-aquatic, and terrestrial species via slopes and ledges. The final plan will also preserve the surface water drainage patterns to Watercourses 1 and 2 through the careful placement of lake outlets.
- Based on the findings presented in this Natural Environment Report, including the review of relevant environmental policy and legislation at federal, provincial, and municipal levels, RiverStone is of the opinion that the proposed quarry development plan will conform to these policies and provisions provided the recommendations contained herein are implemented. The required Official Plan and Zoning Amendments will allow for the proposed land use, while still preserving the Significant Natural Heritage Features identified on the subject property.

RECOMMENDATIONS

A full summary of the recommendations made in this report are provided below.

WATER QUALITY AND QUANTITY (5.1)

Baseline Conditions (5.1.1)

Given that the Performance Monitoring Plan contains critical details regarding trigger mechanisms (i.e., pre-established thresholds based on the baseline data collected to date that when exceeded will trigger contingency measures), RiverStone recommends the following:

- **GENIVAR Inc.'s (2011b) Performance Monitoring Plan should be made available to the MNR and the City of Kawartha Lakes.**

Operational Conditions (5.1.2)

- **A minimum 30 m buffer should be established from the high-water mark of Watercourses 1 and 2 and the open-water portions of the online wetlands, the Central Drainage, and the Cranberry River as shown in Figure 6. The buffer edge should be ground truthed by a qualified professional, well-marked prior to the commencement of quarry operations, and the buffer should remain in its natural state.**
- **Buffers should be protected from rock shatter and/or physical disruption through proper blast design, blast orientation, and monitoring.**
- **Appropriate sediment and erosion control measures should be used to prevent the movement of sediment and the erosion of unstable soils into watercourses; these measures should be in place prior to soil exposure and should be maintained whenever exposed soils are present.**
- **All stock-piled aggregates should be stored in a location that will prevent the movement of sediment laden runoff into the watercourses and wetlands.**
- **All stockpiled topsoil/overburden should be stabilized as quickly as possible (e.g., erosion-prone areas covered with textile) 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 quarrying, and to inspect and ensure necessary repairs following winter thaws, spring freshets, and heavy rainfall events.**

Quality of Quarry Discharge Water (5.1.3)

- **Prior to the initial discharge of quarry water (each phase), water quality analysis should be completed and reviewed by a qualified professional to determine potential impacts, if any, to the receiving waterbody. The analysis should include pH, temperature, dissolved oxygen,**

major ions, metals, total suspended solids, nutrients, oil and grease, and volatile organic compounds.

- **Once quarry dewatering commences, a minimum of monthly water quality sampling should be undertaken on quarry discharge water and analyzed for pH, dissolved oxygen, visible sheen, temperature, and total suspended solids. On a bimonthly basis (every two months) sample analysis should include the parameters above, plus major ions, nutrients, oil and grease, as well as volatile organic compounds (VOCs). Monthly monitoring can be reduced to bimonthly, if for two consecutive months, all parameter estimates are below their corresponding PWQO.**

- **Annual dewatering volumes from the quarry should be directed to Watercourse 1 and Watercourse 2 as detailed in Section 5 of the Updated Hydrogeological Evaluation (GENIVAR Inc. 2011a).**

- **Given that there is potential for a spill (most likely during refuelling) that could result in deterioration of water quality, a spill response plan should be developed, where discharge pumping would immediately stop in the event of a spill, followed by an effective clean-up and monitoring program.**

Monitoring of Surface Water Features (5.1.4)

- **Water quality conditions should be sampled every two months (between May and November when discharge is to occur) at the six surface water stations (SW1 through SW5, SWA and SWB) for temperature, dissolved oxygen, pH and total dissolved solids. On two occasions (June and October), analysis of all six stations should also include nutrients, major ions, total suspended solids, oil and grease, and volatile organic compounds. Collection of all samples should be geared towards heavy rain events.**

- **The Performance Monitoring Plan includes the baseline data for Cranberry River, and Watercourses 1 and 2. The trigger mechanisms outlined in the Updated Hydrogeological Evaluation (Table 20; GENIVAR Inc. 2011a) and in the Performance Monitoring Plan (GENIVAR Inc. 2011b) should be reflective of baseline conditions in the Cranberry River and Watercourses 1 and 2; additionally the responses to the trigger mechanisms should be designed to maintain the baseline water quality and quantity conditions in these watercourses.**

- **The on-going sampling results should be reviewed by the appropriate professionals, as the results are received, and Giofam Investments Inc. should be notified immediately if a problem is identified.**

Post-Operational Conditions (5.1.5)

- **The final design of the quarry lakes provide for overflow channels directed towards Watercourses 1 and 2. The final design of the channel should be developed with the assistance of a qualified professional, and should provide end uses for fish and wildlife.**

FISH AND FISH HABITAT (5.2)

- **Vegetation within the buffers should be maintained in a natural state.**

Due to the close proximity of the proposed extraction areas to fish bearing waters, namely Watercourses 1 and 2, RiverStone recommends the following:

- **The client should be aware of the Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Appendix 11).**
- **Blast designs must be such that during the warm water spawning season (April 1–June 30), overpressure does not exceed 100 kPa (14.5 psi) or vibrations do not exceed 13 mm/sec at the edge of the closest open water.**
- **A qualified professional should be retained to prepare a blasting plan that is compliant with Department of Fisheries and Oceans (DFO) regulations.**

SPECIES OF CONSERVATION INTEREST (5.3)

- **Except within the proposed extraction area shown in Figure 8, construction activities associated with quarrying should not occur within the Endangered and Threatened species habitat depicted in Figure 6. Note: the activities proposed within areas that are identified as Endangered and Threatened species habitat are subject to a 17(2)(c) Permit under the *Endangered Species Act, 2007*.**
- **A protective buffer between 35 and 60 m in width should be established between wetlands W5, W4, and M1 and the northern and eastern limits of extraction as shown in Figure 6.**
- **Specialized barrier fencing for reptiles should be erected as shown in Figure 6.**
- **Quarrying activities should be limited to the area within the barrier fencing shown in Figure 6 and Figure 8.**
- **Water inputs to the Central Marsh (W6) should be carefully monitored to ensure that there is no change in water quantity, temperature, or chemistry beyond normally occurring fluctuations (e.g., yearly ranges); these ranges are found in the Updated Hydrogeological Evaluation (GENIVAR Inc. 2011a)**
- **Water monitoring protocols, particularly those that pertain to the Central Marsh (W6), should remain adaptable to additional monitoring needs that may arise from requirements in a 17(2)(c) Permit under the *Endangered Species Act, 2007*.**
- **Blasting monitoring protocols should remain adaptable to additional monitoring needs that may arise from requirements in a 17(2)(c) Permit under the *Endangered Species Act, 2007*.**
- **Following the closure of the quarry, site rehabilitation plans should include the closing of the section of the haulage road between the Central Marsh and the former extraction areas.**
- **Quarrying activities should be limited to the areas shown in Figure 8.**
- **Clearing of trees in development areas established via the Site Plan should not occur from May 15 to July 31 as this time corresponds to the peak nesting period for birds in general, and**

encompasses the breeding seasons of the species of conservation interest determined to occur on the subject property.

- **If construction activities associated with quarrying are going to occur in areas where birds are potentially nesting between May 15 and July 31, a nest survey is suggested prior to commencement of construction activities to identify and locate active nests of migratory bird species. 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.**

NATURAL FEATURES AND FUNCTIONS (5.6)

The following measures are recommended to prevent or minimize the effects of development on the property's natural features and functions:

- **Vegetation removal and disturbance outside of the development envelopes should be minimized.**

- **Following the closure of the quarry, site rehabilitation will be required. The list of plant species provided in Table 6 should be used in the final rehabilitation plan to allow for naturalization that blends with the adjoining ecological communities.**

Table of Contents

List of Tables

List of Figures

List of Appendices

1 BACKGROUND

RiverStone Environmental Solutions Inc. (hereafter RiverStone) was retained by Giofam Investments Inc. in 2008 as its environmental consultant. Prior to RiverStone's involvement, Michalski Nielsen Associates Limited (MNAL) completed a Natural Environment Level 1 and Level 2 Assessments report on a potential quarry site in Sebright. Additionally, MNAL completed a smaller Environmental Impact Study in support of a re-zoning application (Part Lot 20, Concession 3, Geographic Township of Dalton) to the City of Kawartha Lakes to permit the construction of a service area and septic facilities. The information collected as part of these studies was transferred to RiverStone to continue the application process. It should be noted that two of the ecologists that completed the MNAL studies started working for RiverStone in 2008; therefore, the transfer process was relatively seamless and familiarity with the study area was high.

Information for the MNAL report was collected between October 2003 and June 2005 and the draft Natural Environment Level 1 and Level 2 Assessments Report was submitted to the Ministry of Natural Resources (MNR) in June 2006 for review and comment. Comments were received from the MNR (Mike Turner, Planner, Bancroft District; **Appendix 1**) on this report in December of 2006. Because the comments were of a general nature and the MNR stated it was "satisfied that natural heritage values are to be protected.", the final report was submitted April 2008 with only minor updates to the City of Kawartha Lakes in support of Applications for Official Plan and Zoning By-law Amendments.

Since 2008, RiverStone has conducted extensive studies on the lands owned by Giofam Investments Inc. in Sebright, particularly involving Endangered and Threatened species. The decision to conduct these studies reflects changes in legislation, e.g., the new provincial *Endangered Species Act, 2007* came into effect in June 2008, and a desire to address some of the concerns raised in correspondence from the MNR (**Appendix 2**), as well as some of the public comments received with respect to the original Natural Environment Report.

1.1 Natural Environment Level 1 and Level 2 Report

This Natural Environment Level 1 and Level 2 Report has been prepared to address the requirements under the *Aggregate Resources Act* (ARA) for the existing application and support the applications for Official Plan and Zoning By-law Amendments as revised relative to changes to the proposed quarry.

For the purpose of this report, the subject property refers to the lands owned by Giofam Investments Inc. and the site refers to the area proposed for licensing as depicted on **Figure 1**.

As described in the MNR policy document (No. A.R. 2.01.07; OMNR 2006), the purpose of a Natural Environment Level 1 Report is to describe the existing natural environmental conditions on and within 120 m of the site. The site proposed for licencing is just a small portion of the subject property consisting of 83.7 ha, with 23.3 ha proposed for extraction. It is located in Part of Lots 18 through 21, Concession 4, and Lots 20 and 21, Concession 5, in the geographic Township of Dalton, formerly the County of Victoria, now in the City of Kawartha Lakes. In addition to the lands described above, Giofam Investments Inc. also owns Part Lots 18, 19 and 20, Concession 3, geographic Township of Dalton, City of Kawartha Lakes; these lands front on the north side of Monck Road and extend north to the unopened road allowance between Concessions 3 and 4, just south of the proposed quarry. In light of concerns raised by the City of Kawartha Lakes and residents of Sebright regarding the location of the quarry access road, these lands have been also assessed for any significant natural features and functions. The Level 1 assessment must 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)
- Significant valleylands (south and east of the Canadian Shield)
- Significant wildlife habitat
- Fish habitat

When any of the above listed features are identified during the Level 1 assessment, a Natural Environment Level 2 impact assessment is required to assess the potential for negative impacts on the identified features of significance. If potential impacts are identified, then the Level 2 assessment should provide recommendations for appropriate preventative, mitigative, and remedial measures.

In addition to satisfying the requirements for Level 1 and 2 assessments, this report is intended to provide the Natural Heritage information necessary for the City of Kawartha Lakes to evaluate the changes to the original applications for an Official Plan and Zoning Bylaw Amendments to permit aggregate extraction on the subject property. This report also includes an assessment of whether the activities proposed on the property conform to the Natural Heritage policies of the current County of

Victoria Official Plan (Consolidation dated March 2004), has regard for the new City of Kawartha Lakes Official Plan (Adopted September 21, 2010), and is consistent with the Natural Environment policies contained in the 2005 Provincial Policy Statement. Finally, the assessment and recommendations presented herein take into account the relevant provisions of a number of other provincial and federal policies including the *Endangered Species Act, 2007* (hereafter ESA).

Because of the continuity of the key biologists that completed the field studies and prepared the Natural Environment Level 1 and Level 2 Assessments Report (MNAL 2008a) and the Scoped Environmental Impact Study (MNAL 2008b), the current report incorporates relevant information, data, and report content from the two previously completed MNAL reports.

2 APPROACH AND METHODS

2.1 Personnel and Qualifications

The primary field investigations between 2003 and 2008 and the previous MNAL reports were completed by Bev Wicks, PhD, Dave Cunningham, BSc, and Al Shaw, MSc. Michael Michalski provided comments on the report. Commencing in 2008, Rob Willson, MSc, Bev Wicks, Dave Cunningham, and Laura Alward Dipl. ET undertook additional fieldwork on the subject property. This updated report has been prepared by Bev Wicks, Rob Willson, and Laura Alward with input from Dave Cunningham provided in relation to the botanical evaluations completed. The curriculum vitae for the primary investigators are provided in **Appendix 3**.

2.2 Guiding Environmental Legislation and Policy

The primary legislation directing this assessment is the Provincial ARA. In accordance with this Act, the application being considered falls under the requirements of a Category 2, Class A licence: a quarry extracting greater than 20,000 tonnes per year below the water table. As described in the MNR policy document (No. A.R. 2.01.07; OMNR 2006), the purpose of a Natural Environment Level 1 Report is to describe the existing natural environmental conditions on and within 120 m of the area that is proposed for licensing. The assessment must 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)

- Significant valleylands (south and east of the Canadian Shield)
- Significant wildlife habitat
- Fish habitat

When any of the above listed features are identified during the Level 1 assessment, a Natural Environment Level 2 impact assessment is required to assess the potential for negative impacts on the identified features of significance. If potential impacts are identified, then the Level 2 assessment should provide recommendations for appropriate preventative, mitigative, and remedial measures.

This report is intended to provide the necessary information for both the Natural Environment Level 1 and Level 2 assessments.

To assess whether the application being evaluated satisfies relevant federal, provincial, and municipal requirements with respect to the natural environment, the following documents were considered during both the field investigations and the impact analysis:

- Federal *Fisheries Act*, (1985)
- Federal *Canadian Environmental Assessment Act, 1992*
- Federal *Species at Risk Act*
- Federal *Migratory Birds Convention Act, 1994*
- Provincial *Endangered Species Act, 2007*
- Provincial Policy Statement (2005) and supporting documents (i.e., Significant Wildlife Habitat Technical Guide (OMNR 2000) and Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005 (OMNR 2010))
- Provincial Water Quality Objectives, Ministry of the Environment (1994)
- Provincial *Aggregate Resources Act*
- County of Victoria Official Plan (2004)
- City of Kawartha Lakes Adopted Official Plan (September 2010)
- Township of Dalton, Schedule "A", Zoning By-law No. A-14-922, Figure 4A

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:

- SAR range maps
  http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/246809.html

- Online databases of the Natural Heritage Information Centre (NHIC) regarding information on occurrences of species of conservation interest on or adjacent to the subject property, as well as significant natural areas (accessed April 2011) https://www.biodiversityexplorer.mnr.gov.on.ca/nhicWEB/mainSubmit.do
- Online databases of the Ontario Breeding Bird Atlas (OBBA) project and the Atlas of the Breeding Birds of Ontario, 2001–2005 (Cadman et al. 2007) regarding birds that were documented to be breeding in the vicinity of the subject lands during the 2001–2005 period (atlas square numbers: 17PK35, 17PK44, 17PK45, 17PK46, 17PK54, 17PK55, 17PK56, 17PK65)
- Henson, B. L., K. E. Brodribb, and J. L. Riley. (2005). Great Lakes Conservation Blueprint for Terrestrial Biodiversity.
- Henson, B. L. and K. E. Brodribb. (2005). Great Lakes Conservation Blueprint for Terrestrial Biodiversity, Volume 2: Ecodistrict Summaries.
- A Reconnaissance Life Science Inventory of the Proposed Dalton-Digby Wildlands Provincial Park (Ontario Parks 2001)
- Digital Ontario Base Maps (OBMs; 1:10,000)
- Colour aerial photography (orthophotographs; summer 2009; Forest Resource Inventory; FRI); Land Information Ontario
- RiverStone's in-house databases and reference collections
- On-site investigations by RiverStone, MNAL, and sub-contractor staff (see Section 2.10)

2.4 Agency Contacts

The follow individuals from involved agencies were contacted throughout this project for information relating to resource management and for agency data and input as pertaining to significant natural heritage features on the subject property and adjoining lands.

- Hank van Luit, Planner, – MNR Central Parks Zone, Queen Elizabeth II Wildlands Provincial Park
- Gerry Moraal, Management Biologist – MNR, Minden Area Office, regarding fisheries information for the Cranberry River and resource mapping for the subject property
- Wasyl Bakowsky, Community Ecologist – MNR, Peterborough, regarding rare plant communities and flora
- Paul Cutmore, Aggregate Resources Officer – MNR, Peterborough District
- Graham Cameron, Biodiversity/Species at Risk Biologist – MNR, Bancroft District
- Kathy Irwin, District Planning and Habitat Biologist – MNR, Bancroft District, regarding wildlife and planning matters
- Stephanie Gauley, Environmental Planner – Kawartha Region Conservation Authority (KRCA) for aerial photographs and natural resources data
- Doug Carroll, Senior Planner – City of Kawartha Lakes Planning Department for official plan land use designations and schedules, zoning by-laws and natural environmental policies

2.5 Technical Documents Reviewed

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

- Technical Background Report Giofam Sebright Quarry, City of Kawartha Lakes (Skelton, Brumwell &Associates Inc., Revised April 2011)
- Site Plan (April 2011, Drwg No. 052019, 5 sheets), including the Existing Features and Cross Sections, Operational Plan, Progressive and Final Rehabilitation Plan, and Details (2 sheets)
- Natural Environment Level 1 and Level 2 Assessments Report, (Michalski Nielsen Associates Limited, April 2008)
- Sebright Quarry Service Facility Scoped Environmental Impact Study (Michalski Nielsen Associates Limited, October 2008)
- Sebright Quarry Updated Hydrogeological Evaluation Geographic Township of Dalton, City of Kawartha Lakes (GENIVAR Inc., 2011a)
- Sebright Quarry Performance Monitoring Plan, Geographic Township of Dalton, City of Kawartha Lakes, (GENIVAR Inc., Update 2011b)
- Dust Management Plan Sebright Quarry, City of Kawartha Lakes (Church & Trought Inc., April 2011)
- Blast Impact Analysis, Proposed Giofam Sebright Quarry (Explotech Engineering Ltd., March 2011)

2.6 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 study area is important in understanding how a property and its associated natural environment will respond to development pressures. The geophysical setting of this property was reviewed using OBMs, soils mapping, and aerial photography (**Figure 2** and **Figure 3**).

2.7 Surface Water

Information pertaining to surface water on the subject property has been collected by GENIVAR Inc., RiverStone, and MNAL. Data collected specifically for the Natural Environment Report included the degree of channelization, size, morphology, substrates, bank characteristics, and general flow conditions. Over the past six years, surface water conditions have been monitored throughout the entire year to include data from all four seasons. Surface water samples were collected regularly from six stations (**Figure 4**) by GENIVAR Inc., and analyzed for a variety of ions, metals, pH, conductivity,

ammonia, dissolved organic carbon, total organic carbon, alkalinity, chlorine, nitrate, nitrite, phosphate and sulphate through an accredited laboratory. These samples provide a record of baseline conditions and an indication of water quality prior to quarry development.

The open water portions of the wetlands associated with the area's watercourses were also evaluated. These features are controlled by topography and beaver activity; thus, they inherently dynamic systems.

2.8 Ecological Land Classification

The ecological communities on the subject property were characterized in accordance with Ontario's Ecological Land Classification (ELC) system. The ELC system defines ecological units or communities based on bedrock, climate (temperature, precipitation), physiography (soils, slope, aspect), and corresponding vegetation. Use of the system permits biologists and other land managers to use a common language to describe ecological communities, which in turn facilitates the identification of communities likely to support features or functions of conservation interest. The ELC system is an organizational framework that can be applied at different scales. The ecological units most useful for site-specific evaluations are ecosite and vegetation type, the latter unit nested within the former. Vegetation types are the finest level of resolution in the ELC system and are recurring patterns found in the plant species assemblages associated with a particular ecosite (Lee et al. 1998).

The ELC system is continually evolving as provincial working groups strive to improve the classification to cover the full breadth of community diversity in Ontario. Since the publication of Lee et al. (1998), further designations have been developed for many communities not covered originally and existing codes have been modified to convey additional information. To reflect these changes, we provide the new community description and code where applicable, followed by the old code from Lee et al. (1998) in square brackets.

2.9 Natural Features and Functions of Conservation Interest

2.9.1 Habitat-based Approach

Properly assessing whether an area is likely to contain species of conservation interest for the purposes of determining whether a proposed development is likely to have a negative impact is becoming more complex 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 SAR, fish, and other species of conservation interest, 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 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. (2007), published and unpublished documents, and direct experience.

2.9.2 Fish Habitat

Detailed aquatic habitat surveys were completed in the fall of 2003 and summer of 2004, with some additional observations recorded during more recent site visits. For each watercourse, surveys included the characterization of physical habitat. The characteristics of each watercourse were described according to channel structure, instream cover, substrate type, and stability. The type and density of riparian vegetation was also noted in the areas directly adjacent to the main channels and ponds. Finally, the presence and location of groundwater upwelling's or source water were documented when observed.

More recently, watercourses that were encountered on the subject property were also assessed for permanency in flow. 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).

During the assessment of physical characteristics and permanency of watercourses, several aquatic features were identified as potential fish habitat on both the subject property and the adjoining lands. When completing a fisheries assessment, it is recommended by the MNR that the following be completed:

1) confirm the presence or absence of fish habitat;
2) identify any potential fisheries features including intermittent watercourses and seasonally flooded areas, and assess their importance in terms of supporting fisheries functions;
3) determine the fish communities located at a specific site and understand the life-cycle requirements; and
4) determine the sensitivity of the fish habitat on a site-specific basis.

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

A Licence to Collect Fish for Scientific Purposes was obtained from the MNR (**Appendix 4**). Electrofishing surveys were not completed on the subject property. Surveys were only conducted where water levels permitted, i.e., sites were not electrofished due to very low water or a lack of water. Baited minnow traps were used in the open water portions of the wetlands to determine presence/absence of fish and complete a basic inventory.

2.9.3 Species of Conservation Interest

2.9.3.1 NHIC Databases

When assessing the likelihood that a particular species or feature occurs on a property, one of the most commonly used sources of information is the online databases of the MNR's NHIC (accessed through a geographic webquery or shapefile download). Although the information contained in the NHIC databases is a valuable resource, the limitations of this data source must be recognized when screening a property for the presence of SAR or other species of conservation interest (i.e., species determined to have provincial, regional, or local conservation value but not designated a SAR). The following factors were considered in the evaluation completed for this assessment: (1) the observation records in the NHIC databases do not provide complete geographic representation for any species; that is, there are many sites where a species is known to occur that are not represented by records in the database; (2) many species have only recently been recognized as SAR or of conservation interest and, therefore, have distributions that are poorly represented in the database; and (3) the method used by the NHIC to geographically represent species' occurrences does not reflect the way the species being represented moves or uses space.

2.9.3.2 Adjacent and Adjoining Lands

Provincial policy regarding the protection of significant natural heritage features, as reflected in Section 2.1 of the PPS, recognizes that lands adjacent to a proposed development may have features

and functions that would be negatively affected if land use changes were to proceed without appropriate consideration. To ensure that potential impacts are duly considered and/or prevented, the Province developed the concept of "Adjacent Lands." The following definition of Adjacent Lands is provided in the 2005 PPS:

> a) for the purposes of policy 2.1, those lands contiguous to a specific *natural heritage feature or area* where it is likely that *development* or *site alteration* would have a *negative impact* on the feature or area. The extent of the *adjacent lands* may be recommended by the Province or based on municipal approaches which achieve the same objectives…

Properly assessing the extent of Adjacent Lands is important because of the following policy in Section 2.1 of the PPS:

> **2.1.6** *Development* and *site alteration* shall not be permitted on *adjacent lands* to the *natural heritage features and areas* identified in policies 2.1.3, 2.1.4 and 2.1.5 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*.

Furthermore, if a significant natural heritage feature being considered is habitat for a species designated Endangered or Threatened in Ontario, then the *Endangered Species Act, 2007* (ESA) prohibits the damaging or destroying of this habitat, in addition to prohibitions against killing, harming, or harassing the species.

Given the policies of the PPS and the prohibitions set out in the ESA, it is clearly important to be able to make defensible arguments regarding the extent of lands within which the potential for negative impacts on significant features has been evaluated. Determining what constitutes Adjacent Lands for a specific feature requires consideration of several factors, including (1) type of feature (e.g., Provincially Significant Wetland, habitat for Endangered and Threatened species); (2) sensitivity of the feature to disturbance (e.g., based on habitat function or ecological community); (3) species-specific ecological attributes (e.g., differences in movement capacity); and (4) the scale and type of development being considered. Unfortunately, the term "Adjacent Lands", as defined in the PPS, is not particularly useful for evaluating potential impacts in the initial stages of impact assessment because in the majority of cases, the location of significant natural heritage features, particularly SAR habitat, is unknown prior to the completion of on-site investigations. Additionally, site investigations often have to be conducted prior to fully understanding the proposed development, further making it difficult to determine what constitutes Adjacent Lands while on site. Therefore, given the importance of the

Adjacent Lands concept for addressing both PPS and ESA considerations, particularly the value of using ecologically-based extents to evaluate potential impacts, RiverStone measures species- and feature-specific distances from the boundaries of proposed development area(s)—rather than from the boundary of the significant natural heritage feature—and refer to this area as "adjoining lands." 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 applications being considered here, the adjoining lands extents were measured out from the boundary of the subject property as defined in Section 1, and shown in **Figure 1**. As indicated previously, the adjoining lands extents are ecologically based and thus feature/species specific, for example, the appropriate distance within which to consider impacts for a plant species is much less than that for a Blanding's Turtle. Because of the variability between species, each species of conservation interest determined to be relevant to this assessment is evaluated separately in the desktop evaluation provided in **Table 1**.

Table 1. Results of desktop screening for species of conservation interest on subject property or adjoining lands [1].

Common name	Scientific name	Rationale for considering species as potentially occurring on subject property or adjoining lands	Do site-specific attributes (e.g., ecological communities and landscape configuration) assessed from 2009 orthophotos and digital OBM data indicate that potential habitat might be present on the subject property or adjoining lands?
Endangered & Threatened (MNR)[2]			
American Ginseng	*Panax quinquefolius*	Species range map	• **Subject Property or Adjoining Lands**: **yes**
Eastern Loggerhead Shrike	*Lanius ludovicianus migrans*	NHIC databases; Breeding evidence in OBBA squares encompassing site; nearby research studies	• **Subject Property or Adjoining Lands**: **yes**
Henslow's Sparrow	*Ammodramus henslowii*	Species range map; breeding evidence in OBBA square just south of Carden Alvar and nearby record from OBBA survey period	• **Subject Property or Adjoining Lands**: **yes**
Least Bittern	*Ixobrychus exilis*	Breeding evidence in OBBA squares encompassing site	• **Subject Property or Adjoining Lands**: **yes**
Whip-poor-will	*Caprimulgus vociferus*	Breeding evidence in OBBA squares encompassing site	• **Subject Property or Adjoining Lands**: **yes**
Bobolink	*Dolichonyx oryzivorus*	Breeding evidence in OBBA squares encompassing site	• **Subject Property or Adjoining Lands**: **yes**
Chimney Swift	*Chaetura pelagica*	Breeding evidence in OBBA squares encompassing or adjoining site; species range map	• **Subject Property or Adjoining Lands**: **yes**
Spotted Turtle	*Clemmys guttata*	NHIC databases; nearby research studies; landscape features as determined from aerial photography and OBM data	• **Subject Property or Adjoining Lands**: **yes**
Blanding's Turtle	*Emydoidea blandingii*	NHIC databases; species range map; landscape features as determined from aerial photography & OBM data	• **Subject Property or Adjoining Lands**: **yes**
Eastern Hog-nosed Snake	*Heterodon platirhinos*	SAR by Township tool provided by Parry Sound District MNR; species range map	• **Subject Property or Adjoining Lands**: **yes**

Common name	Scientific name	Rationale for considering species as potentially occurring on subject property or adjoining lands	Do site-specific attributes (e.g., ecological communities and landscape configuration) assessed from 2009 orthophotos and digital OBM data indicate that potential habitat might be present on the subject property or adjoining lands?
Special Concern (MNR)[2]			
Eastern Ribbonsnake	*Thamnophis sauritus*	NHIC databases; species range map; landscape features as determined from aerial photography & OBM data	• **Subject Property or Adjoining Lands**: **yes**
Milksnake	*Lampropeltis triangulum*	NHIC databases; species range map; landscape features as determined from aerial photography & OBM data	• **Subject Property or Adjoining Lands**: **yes**
Five-lined Skink	*Eumeces fasciatus*	NHIC databases; species range map; landscape features as determined from aerial photography & OBM data	• **Subject Property or Adjoining Lands**: **yes**
Snapping Turtle	*Chelydra serpentina*	Species range map	• **Subject Property or Adjoining Lands**: **yes**
Common Nighthawk	*Chordeiles minor*	Breeding evidence in OBBA squares encompassing site	• **Subject Property or Adjoining Lands**: **yes**
Olive-sided Flycatcher [3]	*Contopus cooperi*	Breeding evidence in OBBA squares encompassing site	• **Subject Property or Adjoining Lands**: **yes**
Red-headed Woodpecker[3]	*Melanerpes erythrocephalus*	Breeding evidence in OBBA squares adjacent to but not within squares encompassing site	• **Subject Property or Adjoining Lands**: **yes**
Yellow Rail	*Coturnicops noveboracensis*	Breeding evidence in OBBA squares adjacent to but not within squares encompassing site	• **Subject Property or Adjoining Lands**: **yes**
Black Tern	*Chlidonias niger*	Breeding evidence in OBBA squares encompassing site	• **Subject Property or Adjoining Lands**: **yes**
Canada Warbler[3]	*Wilsonia canadensis*	Breeding evidence in OBBA squares encompassing site	• **Subject Property or Adjoining Lands**: **yes**

Common name	Scientific name	Rationale for considering species as potentially occurring on subject property or adjoining lands	Do site-specific attributes (e.g., ecological communities and landscape configuration) assessed from 2009 orthophotos and digital OBM data indicate that potential habitat might be present on the subject property or adjoining lands?
Golden-winged Warbler	*Vermivora chrysoptera*	Breeding evidence in OBBA squares encompassing site	• **Subject Property or Adjoining Lands**: **yes**
Monarch	*Danaus plexippus*	Species range map	• **Subject Property or Adjoining Lands**: **yes**
Conservation Interest – Provincially Rare			
Secund Rush (S3)[4]	*Juncus secundus*	Previously documented on property	• **Subject Property or Adjoining Lands**: **yes**

[1]see Section 2.9.3.2 for distinction between adjoining lands and Adjacent Lands
[2]Provincial conservation status of Species at Risk (Endangered, Threatened, and Special Concern designations) from MNR list updated September 29, 2010 at http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/276503.html
[3]Species designated Threatened nationally by the Committee on the Status of Endangered Wildlife in Canada
[4](Oldham and Brinker 2009)

Finally, the subject property and adjoining lands were also evaluated for their potential to contain specialized features and functions that would qualify as Significant Wildlife Habitat (e.g., seasonal concentrations of animals, rare vegetation communities, specialized habitats) as per the Significant Wildlife Habitat Technical Guide (OMNR 2000) and Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005 (OMNR 2010). Henson et al. (2005) and Henson and Brodribb (2005) were consulted to determine whether any of the ecological or vegetation communities documented on the subject property were provincially rare.

2.10 Site Investigations

Table 2 details the field investigations completed between October 2003 and November 2010. As part of the initial desktop evaluation, areas of potential conservation interest (e.g., potential habitat for species of conservation interest and fish) were identified on the aerial photos and targeted during the site investigations. Fish inventories were completed for watercourses identified within the subject property. The presence or absence of the following characteristics were considered when assessing the likelihood that an area functioned as fish habitat: barriers to fish passage, stream permanency, thermal regime, areas of aquatic vegetation, wetlands, connecting tributaries, dominant and secondary substrates, fallen trees, evidence of ground water input and riparian vegetation.

Table 2. Site visits and primary tasks.

Date	(Primary Tasks	Staff	Hours Spent on Site
Oct 27, 2003	Reconnaissance of the proposed extraction areas, Cranberry River, and to gather general descriptions of the property's terrestrial, aquatic and wetland features	Bev Wicks Dave Cunningham	6 6
May 26, 2004	Breeding bird survey, ELC, botanical & fauna inventory	Bev Wicks Dave Cunningham	6 6
June 8, 2004	Breeding bird survey, ELC, botanical & fauna inventory	Dave Cunningham	6
June 25, 2004	Breeding bird survey, ELC, botanical & fauna inventory	Dave Cunningham	6
July 28, 2004	Stream assessment, wetland assessment, ELC, botanical & fauna inventory	Bev Wicks Dave Cunningham	6 6
July 29, 2004	Stream assessment, wetland assessment, ELC, botanical & fauna inventory	Bev Wicks Dave Cunningham	6 6
June 6, 2005	Breeding bird survey, ELC, botanical & fauna inventory	Dave Cunningham Al Shaw	6 6
June15, 2005	Breeding bird survey, ELC, botanical & fauna inventory	Dave Cunningham Al Shaw	6 6

Date	(Primary Tasks	Staff	Hours Spent on Site
May 18, 2007	Loggerhead Shrike survey	Dave Cunningham	4
June 7, 2007	Loggerhead Shrike survey	Dave Cunningham	4
October 26, 2007	Site visit with MNR staff (Wasyl Bakowsky, Kathy Irwin).	Bev Wicks	2.5
June 25, 2008	ELC, botanical & fauna inventory, survey of topography and surface drainage	Dave Cunningham	6
July 7, 2008	ELC, botanical & fauna inventory, survey of topography and surface drainage	Dave Cunningham	6
September 5, 2008	ELC, botanical & fauna inventory, survey of topography and surface drainage	Dave Cunningham	6
May 13, 2009	Assess proposed extraction area for SAR habitat	Rob Willson Laura Alward	8 8
May 20, 2009	Assess proposed extraction area for SAR habitat	Rob Willson	8
May 31,2009	Breeding bird survey on lands south of area proposed to be licensed	Rob Willson	6
June 4, 2010	Assess proposed extraction area for SAR habitat, particularly Spotted Turtle and Blanding's Turtle (Site visit with MNR SAR Biologists Graham Cameron and Jeremy Rouse, also Paul Cutmore MNR Aggregates officer)	Rob Willson Bev Wicks	4 4
June 12, 2009	Breeding bird survey on lands south of area proposed to be licensed; wetlands in northern portion of extraction area assessed for SAR turtle activity	Rob Willson	8
June 22, 2009	Additional ELC and botanical inventory surveys	Dave Cunningham Laura Alward	6 6
June 25, 2009	Evening and dusk survey to assess turtle nesting areas and other vertebrate species active at dusk	Rob Willson Laura Alward	5 5
2010	Because of the number of site visits conducted in 2010 in the course of focused field studies on Endangered and Threatened species, dates and notable observations are presented in presented in **Appendix 5**	Rob Willson et al.	
August 11, 2010	Meeting to discuss potential impacts on Endangered and Threatened species (Site visit with MNR SAR Biologist Graham Cameron and Paul Cutmore - MNR Aggregates officer)	Rob Willson Bev Wicks	4 4

Overall, the level of effort expended during the field investigations was deemed adequate to document the features and functions with recognized conservation status occurring on the subject property and

adjoining lands, keeping in mind the habitat-based approach described in Section 2.9.1. Whereas specific surveys were conducted to evaluate habitat potential for species of conservation interest and birds, targeted surveys were not completed for other taxonomic groups as explained below.

Salamander and frog call surveys were not completed because any wetland communities would be protected from development and site alteration due to species of conservation interest and fish habitat issues regardless of use by amphibians.

Mammal surveys were not conducted because signs of large and intermediate-sized mammals are often documented during the course of other field investigations (e.g., scat and browse); and the remainder of the mammalian species assemblage that typically occurs in this type of system can be presumed to occur without sampling.

Surveys for odonates (damselflies and dragonflies) were not conducted because features likely to function as habitat for this taxonomic group (e.g., wetlands and watercourses) will already receive protection for their wetland and fish habitat values. Finally, surveys for lepidopterans (moths and butterflies) were not conducted because the only species in this region with SAR status is the Monarch, and suitable habitat would be identified during typical field investigations.

Evidence for the presence of a species or use of an area was determined from visual and/or auditory observation (e.g., song, call) and observation of nests, tracks, burrows, browse, skins, and scats. Plant nomenclature is generally consistent with the Southern Ontario Vascular Plant Species List compiled by D. Bradley of the NHIC (revised edition, 2009; based on the Ontario Plant List by Newmaster et al. [1998]), Voss (1972, 1985, 1996), and Cody and Britton (1989). Provincial rarity of plant species was determined from Oldham and Brinker (2009).

Natural features of interest (e.g., SAR habitat) were delineated in the field with a survey-grade GPS (SXBlue II) capable of 1-m accuracy. Features of interest were photographed and all information collected was catalogued for future reference.

3 BIOPHYSICAL FEATURES AND FUNCTIONS

Sections 3.1–3.3 are from GENIVAR Inc. (2011a) and are included here with permission; for additional detail see source report.

3.1 Physiography

The property and regional study area are located on the boundary between the Carden Plain physiographic region to the south and the Georgian Bay Fringe physiographic region to the north (Chapman and Putnam, 1984). The boundary of the two physiographic regions roughly follows Kawartha Lakes Road 45 within the regional study area. The Carden Plain is comprised of a Paleozoic-age limestone plain with thin overburden. Similarly, the Precambrian age rock of the Georgian Bay Fringe has little soil cover, but also has bare rock knobs and ridges.

3.2 Topography

The topography of the regional study area is shown in the regional plan of Figure 2. Higher topography occurs within the eastern portion of the study area, with highlands that exceed an elevation of 280 metres above sea level (m asl). The elevation generally decreases from east to west towards Head River where elevations less than 230 m asl occur. Occasional rock knobs are evident from the topographic contours, with one rock knob on the property that exceeds an elevation of 260 m asl.

Within the southeastern corner of the regional study area, an area of highland also occurs with elevations higher than 260 m asl. The land in this area slopes towards Head River to the northeast and northwest.

3.3 Surface Drainage

Surface water drainage is influenced by the soil cover and rock type, with the drainage direction influenced by topography. Beaver dams also affect the drainage locally. There are a number of swampy areas and small lakes within the study area.

Estimated watershed boundaries are presented in Figure 2. The main watershed in the study area is the Head River watershed, which also includes the Cranberry River subwatershed and Deverells Creek subwatershed. In addition, Dalrymple Lake and Young Lake discharge to Head River. The Black River watershed is located within the northwestern portion of the study area. Head River eventually joins Black River approximately 7.5 km northwest of Sebright, with discharge into Lake Couchiching.

The property is located on a surface water drainage divide between Head River to the south and Cranberry River to the north. This drainage divide extends over areas of high land and rock knobs within the southern portion of the property. Cranberry River flows through the northwestern portion of the property, while Head River is located south of the property and Kawartha Lakes Road 45.

3.4 Geology

3.4.1 Regional Geologic Setting

The regional bedrock geology based on published maps is shown in Figure 4. Bedrock within the majority of the study area consists of Precambrian rock, including gneisses, migmatites, and felsic intrusives. These rocks are part of the Canadian Shield, which has its southern boundary just south of Kawartha Lakes Road 45 within Dalton Township.

In the southern portion of the subject property, and also south of Head River, overlying Paleozoic rocks include the following, from the oldest (Shadow Lake Formation) that directly overlies the Precambrian rock, to the youngest (Bobcaygeon Formation).

NAME	DESCRIPTION
Shadow Lake Formation	Shale and sandstone
Gull River Formation – Lower Member	Various types of limestone and dolostone
Gull River Formation – Upper Member	Limestone
Bobcaygeon Formation – Lower Member	Limestone
Bobcaygeon Formation – Middle Member	Limestone and shale

The shale and sandstone of the Shadow Lake Formation directly overly the Precambrian rock and occur along the perimeter of the Paleozoic rock. An outlier of the Shadow Lake Formation also occurs within the southern portion of the property. Limestone and dolostone of the Gull River Formation (lower member) are also present overlying the Shadow Lake Formation within the outlier on the property. Paleozoic rock becomes progressively younger to the south of the property.

The Quaternary geology of the study area is presented in Figure 5. It is noted that Figure 5 is based upon two maps referenced in the figure. As a result, some of the geologic boundaries do not match at the contact of the two maps. A majority of the regional study area consists of exposed bedrock and bedrock with thin soil cover. In addition, north of Kawartha Lakes Road 45 a large proportion of the soil cover is bog and swamp deposits of muck and peat with some marl. A variety of soil types that range from clay to sand and gravel also occur as localized deposits in the area. For example, within the western portion of the property, a glaciolacustrine shallow water deposit of sand, with some clay and/or silt is present and is less than 1.5 m thick (OGS, 1992).

Regional cross-sections presented in Figures A-1 and A-2, Appendix A, show the variable topography, soil thickness, and rock type across the study area. The cross-sections are based on water well records presented in Table A-2, Appendix A. Water well locations are shown in Figure 6.

3.5 Water Quality

Surface water monitoring has been undertaken through GENIVAR Inc. over the past seven years. Stations were established on the Cranberry River and Watercourses 1 and 2 (**Figure 4**). While the Cranberry River is not in the immediate vicinity of the proposed quarry, the majority of the overland drainage from the subject property ultimately flows into the river. Three stations are regularly sampled on the Cranberry River, upstream (SW1) and downstream (SW5) of the discharge points of the two smaller watercourses and a third station just downstream of the outlets of Watercourse 2 and the Central Drainage feature (SW3). The sampling locations for the two smaller watercourses (Watercourse 1 (SWA and SW4) and Watercourse 2 (SWB and SW2)) were selected, as both are fish bearing and have the potential to be affected by the proposed quarry development. Due to the beaver activity and low base flow on both of these watercourses, fish habitat is limited to the open water wetland portions of these watercourses. In the event that flowing water was not available for collection, samples were secured at the outlet end of both beaver ponds. Surface water flows have also been collected for these stations when applicable. Water quality results are provided in **Appendix 6**. A description of some parameters, and a discussion of the measured values, is provided in the paragraphs following.

Conductivity is a measure of the resistance of a solution to electrical flow, and shows a strong positive relationship with the concentration of the major ions. In this landscape, conductivity would be primarily influenced by the geology of the area with major sources of dissolved ions coming from the soil and rock. The typically the conductivity of streams flowing through granite bedrock in the Canadian Shield is lower than in southern Ontario. As evident in **Appendix 6**, this is the case for the majority of the samples collected from both the Cranberry River and Watercourses 1 and 2. The highest conductivity was observed in Watercourse 1 samples.

Alkalinity is a measure of the buffering capacity of water or the ability of a waterbody to resist changes in pH. The buffering capacity is dependent on the concentrations of mainly $CaCo_3$, and if concentrations are low, then the buffering capacity of the waterbody is low. Alkalinity is also a contributing factor to the toxicity of many metals. Carbonates enter a waterbody when water passes through soil and rock that contains these minerals. Where granite rock predominates, water typically

has low alkalinity. A value of <10 mg/L is indicative of a poorly buffered system. As the acidity of a waterbody increases, sensitive species such as bass and trout show reduced reproduction. The relatively low alkalinity in the Cranberry River (mean of 9, 9 and 18 mg/L over the six year of sampling data) indicates limited buffering capacity; the alkalinity was higher in both Watercourses 1 and 2, thus providing these features with more capacity to resist pH change. Note the higher mean concentrations in the Cranberry River were observed downstream of the outlets of Watercourses 1 and 2, likely resulting in the higher alkalinity at this station.

pH is the chemical short form relating to the concentration of hydrogen ions in a solution. The more hydrogen ions, the lower the pH and vice versa. Because the pH scale is a logarithmic scale, there is a tenfold difference in acidity between one number and the next. Guidelines for pH, to protect aquatic life and recreational water uses, have been set by the MOE (1994); in this regard, the pH should be within the range of 6.5 and 8.5. The pH in Watercourses 1 and 2, and in the Cranberry River fall for the most part within this range.

Nitrate nitrogen is the principal form of inorganic nitrogen in natural waters, and results from the complete oxidation of other nitrogen compounds, particularly ammonia. A numerical limit has not been established by the Province of Ontario for nitrates in surface waters, although it is recognized that elevated levels may contribute to nuisance vascular and algal plant growth. Nitrate nitrogen is not toxic to fish at concentrations normally found in lakes and streams; in this regard, toxicity information provided in the Canadian Water Quality Guidelines (Canadian Council of Ministers of the Environment, 1987), indicates an acute lethal concentration of 5,800 mg/L for Chinook Salmon and 6,000 mg/L for rainbow trout, and some mortality of rainbow trout eggs at concentrations as low as 5 mg/L. The observed nitrate nitrogen concentrations in the watercourses on the subject property are substantially lower than above-noted concentrations. **Nitrite nitrogen**, a less stable form of inorganic nitrogen, was present in only trace amounts.

Ammonia nitrogen enters surface waters directly from municipal and industrial effluents, agricultural runoff and atmospheric precipitation. Indirectly, it can also input via chemical and biological transformation of nitrogenous material in soil and water, nitrogen fixation of dissolved oxygen in water, and excretion of ammonia by biota. Aquatic ammonia is in constant equilibrium with its ionized form, a relationship that is highly temperature and pH dependent. **Un-ionized ammonia** is the form most toxic to aquatic biota; the MOE has indicated that concentrations should not exceed 0.02 mg/L for the protection of aquatic life (Ministry of the Environment 1994). Transformation of the ammonia

nitrogen data to concentrations of the un-ionized form generated values that are well below the Ministry's objective. This parameter is important because it is present in explosives used in blasting.

Phosphorus is a non-metallic element that occurs in dissolved and particulate, and organic and inorganic forms in water. It is the principle nutrient causing eutrophication and occurs naturally as well through the activities of man. Clearing of forests causing increased runoff and airborne particulates, as well as sanitary sewage are examples of human influence in the phosphorus cycle. Increased concentrations of phosphorus affect water bodies in a number of ways including decreased water clarity, and increased algal growth.

The Ministry of the Environment (MOE; 1994) does not have an objective for total phosphorus for surface waters; instead, it has set an Interim Provincial Water Quality Objective (PWQO) as follows:

> "Current scientific evidence is insufficient to develop a firm objective at this time. Accordingly, the following phosphorus concentrations should be considered as general guidelines which should be supplemented by site specific studies;
>
> To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 μg/L;
>
> A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10 μg/L or less. This should apply to all lakes naturally below this value;
>
> Excessive plant growth in rivers and streams should be eliminated at a total phosphorus concentration below 30 μg/L."

The mean phosphorus concentration in Cranberry River over the past seven years was less than 30 μg/L at the stations sampled, which is below the interim guideline for rivers and streams; however, there were a number of sampling events where the guideline was exceeded. Phosphorus concentrations in the open water portions of Watercourses 1 and 2 were typically well above the guideline, which is not unusual for standing water or in watercourses with a high component of wetland associated habitat.

Aluminum is one of the most abundant metals on earth. It is commonly found in streams with typical sources being industrial waste and backwash from drinking water treatment plants. If aluminum concentration in water is high, there is an increased risk of toxicity when pH levels decrease. The PWQO for aluminum at pH levels found in Watercourses 1 and 2 and the Cranberry River is 75 μg/L; this concentration was exceeded in Watercourses 1 and 2 and Cranberry River on a number of individual sampling occasions. Mean measured concentrations in Cranberry River were below the

PWQO over the past six years; however, Watercourses 1 and 2 both had mean concentrations that exceeded the objective. In the case of these three watercourses, the following policy from the PWQO applies.

> "If natural background aluminum concentrations in water bodies unaffected by man-made inputs are greater than the numerical Interim PWQO (above), no condition is permitted that would increase the aluminum concentration in clay-free samples by more than 10% of the natural background level."

Iron is an abundant metal and is commonly found in groundwater. A precipitate of iron is often the cause of orange coloured stream substrates. The PWQO for iron for the protection of aquatic life is 300 µg/L. Iron levels measured in Cranberry River as well as the other two watercourses range between <100 µg/L and 5,100 µg/L, often well in excess of the PWQO.

Copper enters the aquatic environment through the weathering of copper minerals, native copper and some human activities. Background levels for copper in aquatic systems range from 1.0 µg/L to 20 µg/L (Nriagu 1979). The concentrations detected in the watercourses on the subject property are below the typical background level and the PWQO of 5 µg/L, with the exception of a few isolated occurrences on the Cranberry River and Watercourse 1 and 2. Acute toxicity occurs in rainbow trout at copper concentrations between 5 µg/L – 10 µg/L (Marr *et al*. 1999).

Cadmium is a natural mineral found in rocks and soil. It can occur in surface waters in very low concentrations, less than 0.1 µg/L, but can increase to several µg/L (EPA 2001) with anthropogenic inputs. Sources of cadmium include fertilizers, pesticides, mine waste, batteries, and commercial pigments. The toxicity of cadmium increases as the alkalinity or $CaCo_3$ decreases. The PWQO for this mineral is 0.1 µg/L at the hardness found in these watercourses and was exceeded during one sampling event for Watercourse 2.

Lead, is a common heavy metal that most often enters water through the corrosion of lead pipes, but is also found in batteries, ammunition, fishing tackle, insecticides and fertilizers. The toxicity of lead as with many of the other metals varies with $CaCo_3$, thus the PWQO is calculated based on the associated CaCo3 concentration. Based on the concentrations of both parameters the PWQO for lead was exceeded periodically for the Stations sampled. The concentration for **silver**, another common metal was also above the corresponding PWQO periodically for the watercourses sampled.

Cobalt, is found in trace amounts in the surface waters on Ontario, with the sediment being the primary sink (Fletcher et al. 1996). Sources include farm feed, fertilizers, and colouring agents for glass and ceramics (Fletcher et al. 1996). The PWQO of 0.9 µg/L was exceeded in the surface water samples collected on Watercourse 1 on three occasions.

Water temperature is one indicator of the thermal regime (coldwater or coolwater) of a watercourse, particularly when measurements are made during the afternoon on warm days, and when the corresponding air temperature is recorded. The warmest temperatures are typically recorded in the late afternoon during the summer months, with the coolest temperature recorded in the early morning. Temperatures in Watercourse 2 and the open water marsh (W6 – Watercourse 1) were collected during the fisheries surveys on July 28, 2004. Recorded temperatures were 23.6°C and 28.4°C respectively. Air temperature was 28°C. Water temperatures in a warmwater stream will rise along with the air temperature and, depending on the degree of shading; afternoon stream temperatures may reach those measured in the air. In contrast, a coldwater stream that receives much of its flow from groundwater discharge will maintain a much colder and more constant temperature that can be as low as 10°C under hot summer conditions. As is evident above, water temperatures quite closely follow air temperatures, most likely reflecting a warmwater condition.

Dissolved oxygen is required by fish and other aquatic organisms to breath. In shallow, rapidly flowing streams, dissolved oxygen levels are typically close to saturation (approximately 8 mg/L at 25°C, and higher with decreasing water temperature). Fish can tolerate lower oxygen concentrations; although anything less than 100%, saturation can act as a stressor. Fish differ in their ability to withstand decreasing levels of dissolved oxygen, with warmwater fish generally more tolerant than coldwater species. The MOE (1994) has specified PWQO for dissolved oxygen to protect both coldwater and warmwater biota. These objectives vary with water temperatures. For example, at 25°C, the lower limit is 5 mg/L for coldwater biota, and 4 mg/L for warmwater biota. At 15°C, the limits are 6 mg/L and 5 mg/L respectively. The dissolved oxygen levels in the Cranberry River were on average within the PWQO for warmwater biota. The dissolved oxygen levels in Watercourses 1 and 2 (open water portion) varied seasonally, with the lowest dissolved oxygen concentrations observed in the fall. These concentrations are likely related to high decomposition rates in the associated wetlands.

Water quality in the Cranberry River and the two smaller fish bearing watercourses on the subject property is adequate for the protection of aquatic life. The chemical constituents are generally low, and the temperature and oxygen regimes are suited to warmwater species of fish. Of note are the naturally

elevated concentrations of aluminum, iron and copper in all three watercourses, and naturally elevated phosphorus in the open portions of the wetlands online with Watercourses 1 and 2.

3.6 Ecological Land Classification and Flora

The subject property is situated within Ecodistrict 5E-8 (Henson and Brodribb 2005). The subject property is situated near the southern boundary of the ecodistrict which coincides with the contact zone between Precambrian formations to the north and Ordovician sedimentaries to the south. Because the subject property is situated within the transition zone between ecodistricts, Precambrian shield occurs on the northern portions of the property whereas portions of the southern part of the property are underlain by limestone. Bedrock ridges and knolls are present on most of the subject property. These features have varying degrees of natural forest cover and wetlands (open water marsh, treed swamp, and peatlands occur between the bedrock ridges and knolls. Beaver activity (cuttings and dams) and cattle grazing have had and continue to have major influences on the property's vegetation cover and aquatic features.

Sugar Maple (*Acer saccharum*), American Beech (*Fagus grandifolia*), Basswood (*Tilia americana*), Yellow Birch (*Betula alleghaniensis*), Eastern Hemlock (*Tsuga canadensis*), Eastern White Pine (*Pinus strobus*), Red Maple (*Acer rubrum*), and White Ash (*Fraxinus americana*) form mixed woodland stands on the uplands. White Spruce (*Picea glauca*) is common on sand flats and other coarse-textured soils. Eastern Hemlock is found along mesic slopes along tributaries, creeks, ravines and thin-soiled rock ridges. The thin-soiled rock ridges and outcrops also support scrubby stands of Jack Pine (*Pinus banksiana*), Trembling Aspen (*Populus tremuloides*), Red Oak (*Quercus rubra*), White Birch (*Betula papyrifera*), White Pine, White Spruce, and Black Spruce (*Picea mariana*). Both species of spruce are common components of treed swamps. Red Maple, Black Ash (*Fraxinus nigra*), Eastern White Cedar (*Thuja occidentalis*), and Speckled Alder (*Alnus incana ssp. rugosa*) are also found in the treed swamps.

Peatland features vary from wet sedge meadows to deciduous thicket and treed swamps, with drainage being intermittent or affected by beaver dams. Sedge meadows grade into deciduous thicket swamps that support shrubs such as Speckled Alder, Red-osier Dogwood (*Cornus stolonifera*), Common Meadowsweet (*Spiraea alba*), Winterberry (*Ilex verticillata*), and Wild Raisin *(Viburnum cassinoides*).

Most of the subject property in the north-central section consists of granite/till rock barrens and knolls with sparse to dense deciduous and mixed tree and shrub cover. Other flat sections to the south are

dominated by cultural savannah (i.e., hawthorn scrub and old field communities) that are affected by cattle grazing. Adjacent to the northern and eastern edges of the rock barrens and knolls are a series of open-water marshes (W1-W6) or ponds. The extent of these wetlands in any one year is strongly influenced by beaver activity. The west side of the subject property contains wet meadow habitat and a portion of Cranberry River and its floodplain. Surface drainage is generally in an east to west direction through swales and tributaries towards Cranberry River.

The ELC methodology was applied using a combination of air-photo analysis and field investigations. The ecological communities are mapped on **Figure 5** and are described in the ensuing sections. A tabular summary of the ecological communities is provided in **Appendix 7.** and a master list of the vascular plant species found on the property is provided in **Appendix 8**.

3.7 Terrestrial System

3.7.1.1 Rock Barren Communities

Non-Calcareous Open Rock Barren Type (RBOB2-1[RBO3-1])

The most prevalent type of features on the property are three types of open and treed rock barrens/bedrock knolls (RBOB2-1, RBSB2-2and RBTB2-3) along the north-central portion. All three types are contiguous with and grade into each other at various locations from west to east. The characteristic tree, shrub and ground cover species for each are listed in detail. For unit RBOB2-1 (**Photograph 1** and **Photograph 2**), the main types of plant species are essentially grasses, forbs and mosses such as Poverty Oat Grass (*Danthonia spicata*), Common Hairgrass (*Deschampsia flexuosa*), Pink Corydalis (*Corydalis sempervirens*), Cow Wheat (*Melampyrum pratense*), Wild Basil (*Clinopodium vulgare*), Wild Columbine (*Aquilegia canadensis*), Annual Blue Grass (*Poa annua*), Eastern Bracken Fern (*Pteridium aquilinum*), Sweetfern (*Comptonia peregrina*), Blue Grass, Harebell (*Campanula rotundifolia*), Early Saxifrage (*Saxifragia virginiensis*), Daisy Fleabane (*Erigeron annuus*), Ox-eye Daisy (*Chrysanthemum leucanthemum*), Rough Goldenrod (*Solidago rugosa)*, Grass-leaved Goldenrod (*Euthamia graminifolia*), Viper's Bugloss (*Echium vulgare*), Rough-fruited Cinquefoil (*Potentilla recta*), St. John's-wort (*Hypericum perforatum*), Pearly Everlasting *(Anaphalis margaritacea*), Spreading Dogbane (*Apocynum androsaemifolium*), Fringed Bindweed (*Polygonum cilinode*), and one rare species, Secund Rush (*Juncus secundus*) (S3).

Photograph 1. General view of Dry Non-Calcareous Open Rock Barren Type (RBOB2-1) (October 2003).

Photograph 2. General view of Dry Non-Calcareous Open Rock Barren Type (RBOB2-1) (July 2003).

Common Juniper Non-Calcareous Shrub Rock Barren Type (RBSB2-2[RBS3-2])

Associated with this community were sections of rock barren with scattered to dense growths of Common Juniper (*Juniperus communis*). Also present was Red-osier Dogwood, Narrow-leaved Meadowsweet (*Spirea alba*), Wild Red Raspberry (*Rubus idaeus ssp. melanolasius*), and Staghorn Sumac (*Rhus typhina*). The ground cover was sparse and similar to that found on the open rock barren (**Photograph 3** and **Photograph 4**). Typical plant species found in the ground cover included Poverty Oat Grass, Blue Grass, Annual Blue Grass, Timothy, Eastern Bracken Fern, Sweet Fern, Grass-leaved Goldenrod, Canada Goldenrod (*Solidago canadensis*), Sheep Sorrel (*Rumex acetosella*), and Common Milkweed (*Asclepias syriaca*).

Photograph 3. View of Common Juniper Non-Calcareous Shrub Rock Barren Type (RBSB2-2) (October 2003).

Photograph 4. View of a portion Common Juniper Non-Calcareous Shrub Rock Barren Type (RBSB2-2) (October 2003).

Oak-Red Maple-Pine Basic Treed Rock Barren Type (RBTB2-3[RBT2-1])

Based on Lee *et al.* (1998), this is the closest ELC ecosite equivalent for the forest cover on the rock knoll barrens that dominate the north central portion of the property. However, the bedrock is more acidic and has characteristics of ELC ecosite ES8 (rock barren – acidic/circumneutral) found to the north in Site Region 5E-7. The dominant tree species in this unit include Red Oak, Red Maple and White Pine, with other associates such as White Birch, Trembling Aspen, Sugar Maple, Black Cherry (*Prunus serotina*), Choke Cherry (*Prunus virginiana*), Staghorn Sumac, and Common Juniper (**Photograph 5** and **Photograph 6**). Some sections of treed rock barren have a dense forest cover with a closed canopy, while others have canopies that are more open. Tree growth is stunted in many locales due to exposure to wind and harsh conditions. The ground cover contains a lusher growth of grasses, forbs and ferns similar to those found in the open and shrub rock barrens.

Photograph 5. View of a portion of Oak-Red Maple-Pine Basic Treed Rock Barren Type (RBTB2-3).

Photograph 6. View of a portion of Oak-Red Maple-Pine Basic Treed Rock Barren (RBTB2-3).

3.7.1.2 Forest Communities

Dry-Fresh Poplar Deciduous Forest Type (FODM3-1[FOD3-1])

This type of feature lies on other property owned the applicant to the southwest and west of the proposed extraction area and consists of relatively large stands of immature poplar bush, intermixed with old field meadow. Other woody associates include White Birch, Largetooth Aspen (*Populus grandidentata*), Choke Cherry, American Elm (*Ulmus americana*), Nannyberry (*Viburnum lentago*), and a weedy ground cover consisting of old wet meadow species.

Dry-Fresh Sugar Maple-Basswood Deciduous Forest Type (FODM5-6 [FOD5-6])

To the east of the proposed extraction area is a stand of semi-mature to mature Sugar Maple-Basswood bush, with some remnant specimens of Sugar Maple encroaching into the old field meadow feature that is extensively grazed by cattle. Other woody associates in this forested feature include White Ash, Trembling Aspen, Largetooth Aspen, Ironwood (*Ostrya virginiana*), Red Oak, American Elm, White Birch, and scattered Black Cherry and American Beech. The groundflora consist of species similar to those found in the Dry-Fresh Sugar Maple-White Birch-Poplar Deciduous Forest Type (FODM5-10).

Dry-Fresh Sugar Maple-White Birch – Poplar Deciduous Forest Type (FODM5-10[FOD5-10])

On the top portions and sloped edges of part of the rock knolls are thin to wide swaths of upland deciduous woodland with closed canopies. These forested features are dominated by Sugar Maple in conjunction with White Birch, Largetooth Aspen, and Trembling Aspen (**Photograph 7** and **Photograph 8**). Other tree species include Red Maple, Red Oak, Black Cherry, Ironwood, American Beech, Basswood, and Downy Serviceberry (*Amelanchier arborea*). Scattered conifers include White Pine and Balsam Fir (*Abies balsamea*). The shrub stratum contains Choke Cherry, Honeysuckles (*Lonicera* spp.), Beaked Hazelnut (*Corylus cornuta*), and Raspberries (*Rubus spp*.). The ground cover contains typical species such as Wild Sarsaparilla (*Aralia nudicaulis*), Large-leaved Aster (*Aster macrophyllus*), Canada Mayflower (*Maianthemum canadense*), Bluebead Lily (*Clintonia borealis*), Marginal Wood Fern (*Dryopteris marginalis*), Shinleaf (*Pyrola elliptica*), Wintergreen (*Gaultheria procumbens*), and Pennsylvania Sedge (*Carex pensylvanica*).

Photograph 7. View of a portion of Dry-Fresh Sugar Maple-White Birch-Poplar Deciduous Forest Type (FODM5-10) situated along slope and toe of slope of treed rock barren (October 2003).

Photograph 8. View of a narrow stand of upland deciduous woodland (FODM5-10), along edge of rock barren (October 2003).

Dry-Fresh Sugar Maple-Ironwood Deciduous Forest Type (FODM5-4[FOD5-4])

Bordering both sides of the north-south unopened road allowance (between Lots 20 & 21), including the southwestern property edge, is a narrow band of upland dry-fresh sugar maple-ironwood woodland (**Photograph 9**). Another stand of this type exists at the north end of the road allowance, and is contiguous off site to the west. Other woody associates in various combinations, densities and distributions in the closed canopy and understorey include Basswood, Black Cherry, White Ash, White Birch, White Elm, Trembling Aspen, Beaked Hazel, Choke Cherry, Staghorn Sumac, Common Juniper, Round-leaved Dogwood (*Cornus rugosa*), Nannyberry, Wild Red Raspberry, and Prickly Gooseberry (*Ribes cynosbati*). The groundcover contains a combination of weeds and woodland forbs and ferns such as Downy Yellow Violet (*Viola pubescens*), Common Dandelion (*Taraxacum officinale*), Wild Grape (*Vitis riparia*), Virginia Waterleaf (*Hydrophyllum virginianum*), Woodland Strawberry (*Fragaria vesca*), and Red Trillium (*Trillium erectum*).

Photograph 9. View inside part of hardwood stand FODM5-4.

Dry-Fresh Poplar Mixed Forest Type (FOMM5-2[FOM5-2])

Constituent deciduous tree and shrub species in this forest type include Trembling Aspen, White Birch, Largetooth Aspen, Red Maple, Sugar Maple, White Ash, American Elm, Red Oak, Choke Cherry, Beaked Hazelnut, Honeysuckles and Staghorn Sumac. The other part of this feature includes scattered conifers such as White Pine, White Spruce, Eastern White Cedar, and Balsam Fir. Typical locations for

this stand type include the upland edges and fringes of the open and treed rock barrens. The species composition in the ground cover is similar to that found in the fresh-moist poplar mixed forest type (FOMM8-1), but less lowland forbs, sedges and ferns.

Fresh-Moist Poplar Mixed Forest (FOMM8-1[FOM8-1])

Along the southeastern base of the main rock knoll and bordering much of the edge of the Cranberry River is a large stand classified as fresh-moist poplar mixed forest (FOMM8-1); it contains a variety of upland and lowland tree and shrub species such as Poplar, White Birch, Red Maple, Sugar Maple, Basswood, and scattered White Spruce (**Photograph 10** and **Photograph 11**). The largest of these stands is contiguous with the Red Maple Organic Deciduous Swamp Type (SWDO2-1) to the south and portions of the Dry-Fresh Poplar Mixed Forest Type (FOMM5-2) to the north and east near Central Marsh, W6. This low-lying area at the base of the rock knoll contains ponded water during the spring and fall months, as is evident by the fern, sedge, and grass ground flora. The drier sections of the stand contain wildflowers, forbs, and ferns similar to those found in the FODM5-10 unit. Typical ferns and sedges in this feature included Sensitive Fern (*Onoclea sensibilis*), Northern Lady Fern (*Athyrium felix-femina*), Eastern Bracken Fern, Mackay's Brittle Fern (*Cystopteris tenuis*), Beaked Sedge (*Carex utriculata*), Fringed Sedge (*Carex crinita*), Awl-fruited Sedge (*Carex stipata*), Black Bulrush (*Scirpus atrovirens*), Cyperus-like Sedge (*Carex pseudo-cyperus*), Fowl Glyceria (*Glyceria striata*), Wild Red Raspberry, Spotted Joe-pye Weed (*Eupatorium maculatum*), Spotted Jewelweed (*Impatiens capensis*), Canada Enchanter's Nightshade (*Circaea lutetiana spp. canadensis*), Herb Robert (*Geranium robertianum*), Wild Sarsaparilla, and Large-leaved Aster.

Photograph 10. View of a portion of lowland forested characterized as Fresh-Moist Poplar Mixed Forest Type (FOMM8-1) (October 2003).

Photograph 11. View of edge of Fresh-Moist Poplar Mixed Forest Type (FOMM8-1).

Fresh-Moist White Cedar - Hardwood Mixed Forest (FOMM7-2[FOM7-2])

The southeastern portion of the subject property contains a lowland forest area best described as Fresh to Moist White Cedar - Hardwood Mixed forest (FOMM7-2[FOM7-2]) (**Photograph 12**). This area contains dense canopy cover of Eastern White Cedar with associates of Balsam Fir, Black Ash (*Fraxinus nigra*), American Elm, Yellow Birch (*Betula alleghaniensis*), and Mountain Maple (*Acer spicatum*) in the shrub layer and a variety of herbaceous species growing on the moist organic soils. Species included Spikenard (*Aralia racemosa*), Goldthread (*Coptis trifolia*), Dwarf Raspberry (*Rubus pubescens*), Foamflower (*Tiarella cordifolia*), and Sensitive Fern.

Photograph 12. Typical view of Fresh-Moist White Cedar - Hardwood Mixed Forest (FOMM7-2) (August 5, 2009).

3.7.1.3 Woodland Communities

Hawthorn Cultural Alvar Woodland Type (RBTA1-8[CUW2-2])

In the southeastern portion of the property are large patches of Hawthorn Cultural Alvar Woodland (RBTA1-8) intermixed with small patches of Common Juniper Alvar and large sections of Fresh-Foist

Open Graminoid Meadow Type (MEGM4-1) (**Photograph 13** and **Photograph 14**). The ground flora contains species similar to those found in the Open Graminoid Meadow Type (MEGM4-1).

Photograph 13. View of a portion of Hawthorn Cultural Alvar Woodland Type (RBTA1-8) (June 22, 2009).

Photograph 14. View of open Open Graminoid Meadow Type (MEGM4-1) within and along interface with units of Hawthorn Cultural Alvar Woodland Type (RBTA1-8), overlying limestone outcrops in south-central portion of property.

3.7.1.4 Meadow Communities

Fresh-Moist Open Graminoid Meadow Type (MEGM4-1[CUM1-1)

Photograph 15 and **Photograph 16** show views of features characterized as Fresh-Moist Open Graminoid Meadow Type (MEGM4-1]) that in some areas are intermixed with Common Juniper Alvar Type (RBSA1-1[ALS1-1]) and expanses of Hawthorn Cultural Alvar Woodland Type (RBTA1-8), all of which are maintained through heavy cattle grazing. The sparse tree and shrub cover consists predominantly of Hawthorns (*Crataegus spp*.), Red-osier Dogwood, Common Juniper, American Elm, Alternate-leaved Dogwood (*Cornus alternifolia*), Honeysuckles, Nannyberry, and Wild Red Raspberry. The grazed ground cover contains species such as Cow Vetch (*Vicia cracca*), Canada Goldenrod, Sheep Sorrel, Viper's Bugloss (*Echium vulgare*), Wild Carrot (*Daucus carota*), Field Horsetail (*Equisetum arvense*), St. John's-wort, Red Clover (*Trifolium pratense*), and White Clover (*Trifolium repens*). Within and adjacent to the Cranberry River floodplain is a large expanse of natural old field meadow (MEGM4-1*), that has not been altered by cattle grazing. Parts of this feature exhibit characteristics of a Mixed Forb Meadow Marsh (MAMO2-3[MAS3-9]).

Photograph 15. View of a portion of Fresh-Moist Open Graminoid Meadow Type (MEGM4-1]) with Common Juniper alvar affinities (intrusion of limestone bedrock), grazed extensively by cattle (June 22, 2009).

Photograph 16. View of open Fresh-Moist Open Graminoid Meadow Type (MEGM4-1]) within and along interface with units of Hawthorn Cultural Alvar Woodland Type (MEGM4-1) (June 22, 2009).

Agricultural Cropland (Ag – hay field)

Photograph 17 and **Photograph 18** show various perspectives of the large block of agricultural cropland (hay field) that is present in the most southwestern portion of the subject property. This anthropogenic feature is dominated by common grasses, intermixed with weeds and herbaceous forbs. Typical species found in this habitat include Red Fescue (*Festuca rubra*), Quackgrass (*Elymus repens*), Timothy (*Phelum pratense*), Orchard Grass (*Dactylis glomerata*), Wild Carrot, Common Milkweed, and Red Clover.

Photograph 17. Northward view of large block of agricultural cropland – Ag (hay) in southwestern portion of subject property (July, 2008).

Photograph 18. View of agricultural cropland –Ag (hay) in southwestern portion of subject property, along eastern edge of tree-lined unopened road allowance (July, 2008).

3.7.2 Wetland System

3.7.2.1 Swamp Communities

Red Maple Organic Deciduous Swamp Type (SWDO2-1[SWD6-1])

Along the northern border of Central Marsh, W6, there are areas of Red Maple Organic Deciduous Swamp (SWDO2-1). Although this wetland feature was not thoroughly assessed, it includes elements of Black Ash Organic Deciduous Swamp (SWDO1-1[SWD5-1]) and Speckled Alder Organic Thicket Swamp (SWTO1-1[SWT3-1]) types (**Photograph 19** and **Photograph 20**). Red Maple is the dominant species in these areas with other woody vegetation including American Elm, Silver Maple (*Acer saccharinum*), Speckled Alder, Wild Raisin, Narrow-leaved Meadowsweet, Green Ash (*Fraxinus pennsylvanica*), Willow (*Salix spp*.), and scattered Balsam Fir and White Spruce.The lush ground cover intermixed with pockets of open stagnant water includes species such as Sensitive Fern, Regal Fern (*Osmunda regalis*), Cinnamon Fern (*Osmunda cinnamomea*), Fringed Sedge, Fowl Glyceria, Canada Blue-joint, and Woolgrass (*Scirpus cyperinus*).

Photograph 19. General view of Red Maple Organic Deciduous Swamp Type (SWDO2-1), with elements of Black Ash Organic Deciduous Swamp Type (SWDO1-1) and Speckled Alder Organic Thicket Swamp Type (SWTO1-1).

Photograph 20. General view of Red Maple Organic Deciduous Swamp Type (SWDO2-1).

Willow Mineral Thicket Swamp Type (SWTM3-2 [SWT2-2])

In the southwestern portion of the study area are several small pockets of unevaluated wetland habitat, characterized as Willow Mineral Thicket Swamp (SWTM3-2) (**Photograph 21** and **Photograph 22**). This natural feature also contains elements of a Reed Canary Grass Mineral Meadow marsh (MAMM1-3[MAM2-2]) and a White Elm Mineral Deciduous Swamp (SWDM4-2 [SWD4-2]). The woody vegetation cover consists of Lowland Pussy Willow (*Salix discolor*), Slender Willow (*Salix petiolaris*), Black Willow (*Salix nigra*), American Elm, Red Maple, Common Meadowsweet, Red-osier Dogwood, and scattered Black Ash. The ground flora included Reed Canary Grass, Common Boneset (*Eupatorium perfoliatum*), Spotted Joe-Pye Weed (*Eupatorium maculatum*), Black Bulrush (*Scirpus atrovirens*), and Bebb's Sedge (*Carex bebbii*).

Photograph 21. View within a portion of a small pocket of Willow Mineral Thicket Swamp (SWTM3-2) with an inner component of Reed Canary Grass Mineral Meadow (MAMM1-3).

Photograph 22. View of Willow Mineral Thicket Swamp (SWTM3-2)

3.7.2.2 Marsh Communities

Cattail Organic Shallow Marsh (MASO1-1[MAS3-1])

East of the steep granite knoll which is part of the proposed extraction area is an area identified as Cattail Organic Shallow Marsh (MASO1-1). This area is dominated by Broad-leaved Cattail (*Typha latifolia*) and Canada Blue-Joint Grass on organic soils with many large dead standing trees.

Mixed Forb Organic Shallow Meadow Marsh (MASO2-1[MAS3-10])

Historically, beaver activity had created large wetlands downstream of W1-W5. Presently, with the beaver dams gone, these areas are densely vegetated with a combination of Forb Organic Meadow Marsh (MASO2-1) and Sedge Graminoid Organic Meadow Marsh (MAMO1-6[MAM3-6]), along with immature tree and shrub growth of White Birch, Trembling Aspen, Balsam Fir, Speckled Alder, Wild Raisin, Narrow-leaved Meadowsweet, and Willows (**Photograph 23**).

Typical aquatic vegetation found throughout all of the wetlands included a combination of sedges, ferns, grasses, pondweeds, water-lilies, cattails and aquatic forbs such as Bullhead Pond Lily (*Nuphar variegatum*), Small White Water Lily (*Nymphaea odorata*), Watershield (*Brasenia schreberi*), Pickerel-weed (*Pontederia cordata*), Narrow-leaved Cattail, Fringed Sedge, Cyperus-like Sedge

(*Carex pseudo-cyperus*), Swamp Milkweed (*Asclepias incarnata*), Sweet Gale (*Myrica gale*), Blue Vervain (*Verbena hastata*), Three-way Sedge (*Dulichium arundinaceum*), and Lesser Duckweed (*Lemna minor*).

Photograph 23. Westward view of Forb Organic Meadow Marsh (MASO2-1) and Broad-leaved Sedge Organic Meadow Marsh (MAM3-6). This area no longer contains standing, impounded water, but has intermittent flow through an ill-defined channel**.**

3.7.2.3 Open Water Communities

Mixed Wetland (W1–W6)

Along the northern edge of the study area are a series of interconnected wetlands (referred to as Watercourse 2) that flow in an east to west direction, eventually draining into the Cranberry River. All of these wetlands are hydrologically connected with each other (**Figure 5**). The Central Marsh, W6, is not connected hydrologically to wetlands W1–W5, and lies to the southwest of this string. It drains in a south to west direction through an intermittent swale and eventually into the Cranberry River; it is referred to as Watercourse 1.

The open-water portions of these wetlands contain fish and fish habitat, with water levels established by active beaver dams. The wetlands are composed of several different ecological communities, namely a combination of Open Water Marsh (OAW), Water Lily-Bullhead Lily Floating-leaved

Shallow Aquatic Type (SAF1-1), Cattail Organic Shallow Marsh (MASO1-1[MAS3-1]), Bur-reed Organic Shallow Marsh (MASO3-7[MAS3-7]), Broad-leaved Sedge Organic Shallow Marsh (MASO1-6[MAS3-4]), Pondweed Mixed Shallow Aquatic (SAM1-4), Forb Organic Shallow Marsh (MASO2-1), and White Cedar-Harwood Organic Mixed Swamp (SWMO1-1[SWM4-1]).

Photograph 24 gives a general view of wetland W2, dominated by open water marsh, in conjunction with Cattail Organic Shallow Marsh (MASO1-1), Bur-reed Organic Shallow Marsh (MASO3-7), and Water Lily-Bullhead Lily Floating-leaved Shallow Aquatic Type (SAF1-1) types. **Photograph 25** and **Photograph 26** show views of wetland W4, dominated by open water marsh, with edges of cattail organic shallow marsh, broad-leaved sedge organic shallow marsh and water lily-bullhead lily floating-leaved shallow aquatic. Wetland W5 is comprised of a variety of wetland types ranging from Water Lily-Bullhead Lily Floating-leaved Shallow Aquatic (SAF1-1), to Cattail Organic Shallow Marsh(MASO1-1), to Bur-reed Organic Shallow Marsh (MASO3-7) to Open Water Marsh (OAW) with pondweeds and duckweed (**Photograph 27, Photograph 28,** and **Photograph 29**).

The Central Marsh, W6, covers a relatively large area and contains a combination of White Cedar-Hardwood Organic Mixed Swamp (SWMO1-1), Pondweed Mixed Shallow Aquatic (SAM1-4), Cattail Organic Shallow Marsh (MASO1-1) and Meadowsweet Mineral Thicket Swamp(SWTM5-7[SWT2-6]) (**Photograph 30, Photograph 31,** and **Photograph 32**).

Photograph 24. General view eastward of wetland (W2).

Photograph 25. Eastward view of wetland (W4).

Photograph 26. Down gradient end (west side) of wetland (W4), showing active beaver dam, with drainage into wetland W5 to the west.

Photograph 27. General view northeastward of wetland (W5) showing a variety of aquatic habitats.

Photograph 28. View of outlet in wetland (W5) at west end, with active beaver dam and habitat of open water marsh.

Photograph 29. Western edge of wetland (W5) showing two-tiered active beaver dam, with aquatic forb habitats.

Photograph 30. General view of southern edge of Central Marsh (W6), showing active beaver dam.

Photograph 31. General view of Central Marsh (W6).

Photograph 32. General view of western zone of the Central Marsh (W6).

3.8 Natural Features and Functions of Conservation Interest

3.8.1 Vertebrates (non-fish)

Appendix 9 contains a list of the fauna observed on and/or flying overhead of the property during the various site inventories. A total of 70 bird species, 12 mammal species and 9 herpetofauna species (amphibians and reptiles) were documented. Most of the bird species observed can be considered year-round residents and/or summer breeders. Other bird species have been reported in the OBBA breeding bird squares that encompass the property; these are included in **Appendix 9**, as potential breeding habitat for these species exists on-site.

3.8.2 Fish/Aquatic Habitat

Three main watercourses were identified on the subject property as indicated previously (**Figure 5**). The most significant in terms of size is the Cranberry River, which flows in a generally southerly direction along the western side of the subject property. The wet width of the river varies between 5 m and 10 m within the study area, with much of the adjacent riparian area consisting of wet meadow (**Photograph 35** and **Photograph 36**). Water depth varies from, approximately 20 cm to 30 cm in shallow runs, to 75 cm in deeper pools. Substrates are variable, with reaches containing silt, sand,

gravel and cobble; however, the dominant substrates are sand and silt. Generally, fish cover within the river was sparse; some woody debris and aquatic vegetation was observed in shallow reaches. Overhanging riparian vegetation provided the most significant structural diversity. No fisheries inventory was completed for the Cranberry River; however, file information from the MNR suggests that since both the upstream and downstream lakes are warmwater, the river itself likely supports similar warmwater fish as those found in the lakes. The documented species for the lakes include Walleye (*Stizostedion vitreum vitreum*), Large and Smallmouth Bass (*Micropterus salmoides, M. dolomieui*) and Pumpkinseed (*Lepomis gibbosus*) (Gerry Moraal, personal communication).

The second watercourse on the subject property (Watercourse 2) is composed of a series of wetlands that run along the northern and eastern edge of the proposed site (**Photograph 24** to **Photograph 29**). The open-water portions of W2, W4, and W5 depicted in **Figure 5** were sampled for fish using minnow traps on July 28 and 29, 2004. All ponds were found to be fish bearing, and **Table 3** provides of a summary of the fish documented. The wetlands on this watercourse outlet through a culvert located beneath a causeway/beaver dam. The downstream channel is best described as poor to moderately defined in the reach between the dam and the Cranberry River. Where the channel is well defined a bankful width of 1.5 m was estimated (**Photograph 37**); however, the majority of the channel is ill-defined, dispersing through a meadow community (**Photograph 38**). During the October 27, 2003 site visit, flows of less than 5 L/sec were observed at the culvert located beneath the causeway at the downstream end of wetland W2. On July 29, 2004, the flow at this location was very low (**Photograph 39**). Based on the characteristics of this watercourse, including documented flow for more than nine months per year, reaches having defined banks and substrates, and the presence of invertebrates this watercourse would be considered a permanent stream (Bergmann et al, 2005). In terms of fish habitat, the nature of the channel outside the wetlands and the observed flow regime, provides very limited opportunities for permanent fish habitat and limited potential for migration up or down stream (**Photograph 40**). Further, the lack of a well-defined channel upstream of the ponds precludes any fish habitat in the uppermost reaches of the watershed, except in beaver ponds.

The third watercourse (Watercourse 1) is located in the southwestern corner of the subject property. It drains a very small landbase, and is comprised primarily of a large well-established Central Marsh (W6) (**Photograph 30** to **Photograph 32**). The open-water area of the marsh is shallow, with less than one metre of water depth on average and is heavily vegetated. Substrates in the pond are typically organic, consisting of both fine and course debris. Structural cover is available for fish in the form of

vegetation and woody debris. The Central Marsh, W6, was sampled using minnow traps on July 28 and 29, 2004. The wetland was fish bearing and a summary of the collection is located in **Table 3**. The outlet of the wetland is located at the south end and flows into a poorly defined swale, which eventually ends up in Cranberry River. The swale downstream of the Central Marsh provides limited opportunity in the way of direct fish habitat due to the intermittent nature of the baseflow.

One other location of surface water drainage was identified centrally on the western portion of the subject property. This feature was poorly defined from its origins in the Fresh Moist Poplar Mixed Forest north of the Central Marsh (W6) (**Photograph 33** and **Photograph 34**) to the point that it meets the Cranberry River. The overland drainage contributing to the baseflow to this ill-defined feature appears to be divided between this feature and Watercourse 1 (**Figure 5**). This watercourse is best described as intermittent and indirect fish habitat as it flows less than 9 months of the year, has no defined banks, and is for the most part not distinguishable from the wetland feature from which it originated.

Watercourses 1 and 2 provide limited marginal direct fish habitat, with the exception of the numerous beaver ponds. The beaver ponds do provide direct fish habitat for a warmwater forage fish community. In addition, these watercourses provide some volume of water to the downgradient portion of the Cranberry River, which contains fish and fish habitat. In this regard, the quality and quantity of these water sources need to be protected and maintained. The Cranberry River, as mentioned previously, is a warmwater fish bearing stream, and thus needs consideration during the proposed development.

Photograph 33. View of central drainage feature east of the Central Marsh within the Fresh to Moist-Poplar Mixed Forest (May 20, 2009).

Photograph 34. View of central drainage feature east of the Central within the Dry Fresh Poplar Mixed Forest (May 20, 2009).

Table 3. Fish collected in Watercourses 1 and 2 on the Giofam Investments Inc. property in Sebright on July 28 and 29, 2004. All collections were completed by Michalski Nielsen Associates Limited.

Fish species		Station number			
Common name	**Scientific name**	**W2**	**W4**	**W5**	**W6**
Northern Redbelly Dace	*Phoxinus eos*	1	5	12	300+
Creek Chub	*Semotilus atromaculatus*	–	3	7	4
Brown Bullhead	*Ictalurus nebulosus*	–	–	1	–
Common Shiner	*Notropis cornutus*	–	–	–	3

Photograph 35. Westward view of upstream reach, Cranberry River.

Photograph 36. Westward view of downstream reach, Cranberry River.

Photograph 37. Defined reach of Watercourse 2, downstream of W5.

Photograph 38. Ill-defined reach of Watercourse 2 as it flows west toward the Cranberry River.

Photograph 39. Outlet culvert on Watercourse 2, downstream of W2. Note the low flow conditions and ill-defined downstream channel reach (July 29, 2004).

Photograph 40. Poorly defined reach of Watercourse 2 downstream of wetland W2 (July 29, 2004).

In the southern portion of the subject property closest to Monck Road, three intermittent drainage features were recently assessed; these watercourses are referred to as Monck Road Drainage 1 -3 and are depicted in **Figure 4**. These features drain from north to south towards the Head River.

Monck Road drainage feature 1 begins as a flooded Willow Mineral Thicket Swamp (SWTM3-2), created by a bowl in the rolling topography of the area (**Photograph 41**). It flows southeast as an ill-defined swale through dense perennial upland vegetation (**Photograph 42**). Most of this drainage feature is best described as intermittent and indirect fish habitat as it flows less than 9 months of the year, and has no defined banks. Exceptions to this are two open water features present along the watercourse. This first is a large Cattail Graminoid Mineral Meadow Marsh Type (MAMM1-2) approximately 5 ha in size that is contained along the southern end with a constructed dam (**Photograph 43**). No surveys were conducted on this feature, but it is assumed to be fish bearing. The second is a small, open pond approximately 20 m long by 8 m wide and less than a meter deep. This pond appears to have been constructed to allow cattle access to open water (**Photograph 44**).

Monck Road drainage feature 2 originates as a low area Fresh-Moist Open Graminoid Meadow Type (MEGM4-1) that contains some small pockets of wetland vegetation such as Cattail, Bulrush, and

Willows (**Photograph 45**). It becomes an ill-defined intermittent swale that is highly degraded by cattle as it moves southerly towards Monck Road.. The width of this feature varied from 1 m up to 10 m of wet width, mainly as a result of the erosion caused by the cattle (**Photograph 46**). Near Monck Road there is an old, exposed culvert in the channel that is not functional. In this swale there is a variety of herbaceous wetland vegetation similar to other areas of the property. This feature best described as intermittent and indirect fish habitat, providing for some baseflow to downstream systems.

Monck Road drainage feature 3 is located in the far southeastern corner of the subject property. This feature originates in Fresh-Moist White Cedar - Hardwood Mixed Forest (FOMM7-2) and is another ill-defined, intermittent swale (**Photograph 47**). This swale ranges in width from 1 m, and widening up to 5 m adjacent to Monck Road. The feature is densely vegetated with perennial upland and wetland species; it contains very little water even after high rainfall events. This feature is alsobest described as intermittent and indirect fish habitat, providing for some baseflow to downstream systems.

Photograph 41. Origins of Monck Road drainage feature 1, Willow Mineral Thicket Swamp (SWTM3-2).

Photograph 42. Typical view of Monck Road drainage feature 1.

Photograph 43. Cattail Graminoid Mineral Meadow Marsh Type (MAMM1-2) along Monck Road drainage feature 1.

Photograph 44. Small constructed pond along Monck Road drainage feature 1.

Photograph 45. Low, wet area that marks beginning of Monck Road drainage feature 2.

Photograph 46. Ill-defined and highly degraded reach of Monck Road drainage feature 2 with exposed culvert.

Photograph 47. View of the ill-defined reach of Monck Road drainage feature 3 with the Fresh-Moist White Cedar - Hardwood Mixed Forest (FOMM7-2) in distance.

3.8.3 Species of Conservation Interest

Table 4. Results of field investigations to evaluate habitat potential for species of conservation interest on the subject property and adjoining lands. Shaded rows indicate those species for which potential or confirmed habitat was documented.

Common name	Potential and/or confirmed habitat documented
Endangered & Threatened (MNR)[1]	
American Ginseng	• **Subject Property**: **no**, species not documented during botanical inventories. • **Adjoining Lands**: **no**, even if species present on lands adjacent to subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.
Eastern Loggerhead Shrike	• **Subject Property: no**, although areas of the subject property have the physical characteristics necessary to function as nesting habitat for species, potential sites have shown no use during breeding season surveys in 2004, 2005, 2007, 2009, and during regular visits to the property in 2010 during the course of other fieldwork. • **Adjoining Lands**: **no**, even if species present on lands adjacent to subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.
Henslow's Sparrow	• **Subject Property**: **possible**, although species not detected during field investigations, survey methods necessary to rule out the potential presence of Henslow's Sparrow were not employed. • **Adjoining Lands**: **no**, even if species present on lands adjacent to subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.
Least Bittern	• **Subject Property**: **possible**, although species not detected during field investigations, survey methods necessary to rule out the potential presence of Henslow's Sparrow were not employed. • **Adjoining Lands**: **no**, even if species present on lands adjacent to subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.
Whip-poor-will	• **Subject Property**: **yes**, several breeding territories documented on and adjacent to the extensive rock barrens on property. • **Adjoining Lands**: **no**, although species is almost certainly present on the lands adjacent to the subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.
Bobolink	• **Subject Property**: **yes**, species documented breeding in southwest corner of property in an area where grazing by cattle had been restricted. • **Adjoining Lands**: **no**, even if species present on lands adjacent to subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.
Chimney Swift	• **Subject Property**: **no**, species nor suitable habitat documented during field investigations. • **Adjoining Lands**: **no**, even if species present on lands adjacent to subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.
Spotted Turtle	• **Subject Property**: **possible**, although species not detected during field investigations, survey methods necessary to rule out the potential presence of Spotted Turtle were not employed.

Common name	Potential and/or confirmed habitat documented
	• **Adjoining Lands**: **yes**, wetland complexes to the north, northwest, and northeast, as well as the Cranberry River have the potential to function as habitat for species.
Blanding's Turtle	• **Subject Property**: **yes**, Blanding's Turtles documented using Central Marsh, Wetlands W1–W5, as well as nesting areas on the rock barrens to the north and west of central marsh during field investigations in 2009 and 2010. • **Adjoining Lands**: **yes**, wetland complexes to the north, northwest, and northeast, as well as the Cranberry River have the potential to function as habitat for species.
Eastern Hog-nosed Snake	• **Subject Property and Adjoining Lands**: **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.
Special Concern (MNR)[1]	
Eastern Ribbonsnake	• **Subject Property: yes**, species documented within and adjacent to wetland communities. • **Adjoining Lands**: **no**, although species is almost certainly present on the lands adjacent to the subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.
Milksnake	• **Subject Property**: **yes**, although the species was not documented during the course of field investigations, the physical characteristics of numerous areas on the property indicate that potential habitat is present. • **Adjoining Lands**: **no**, although species is almost certainly present on the lands adjacent to the subject property, it is unlikely that the activities proposed have the potential to cause negative impacts on the species or its habitat in these areas.
Five-lined Skink	• **Subject Property**: **yes**, species documented in several locations within the rock barren ecological communities. • **Adjoining Lands**: **no**, although species is almost certainly present on the lands adjacent to the subject property, it is unlikely that the activities proposed have the potential to cause negative impacts on the species or its habitat in these areas.
Snapping Turtle	• **Subject Property**: **yes**, species was documented in several wetlands on the property; individuals also observed making overland movements during the species' nesting season. • **Adjoining Lands**: **yes**, wetland complexes to the north, northwest, and northeast, as well as the Cranberry River have the potential to function as habitat for species.
Common Nighthawk	• **Subject Property**: **yes**, species documented foraging over considerable areas of the subject property during the course of evening field investigations; potential nesting habitat present on the extensive rock barrens on property. • **Adjoining Lands**: **no**, although species is almost certainly present on the lands adjacent to the subject property, it is unlikely that the activities proposed have the potential to cause negative impacts on the species or its habitat in these areas.
Olive-sided Flycatcher[2]	• **Subject Property: no**, species not detected during morning breeding bird surveys or during the course of other fieldwork. • **Adjoining Lands**: **no,** species not detected during morning breeding bird surveys or during the course of other fieldwork within a distance that could be impacted by proposed activities.
Red-headed Woodpecker[2]	• **Subject Property: no**, species not detected during morning breeding bird surveys or during the course of other fieldwork. • **Adjoining Lands**: **no,** species not detected during morning breeding bird surveys or during the course of other fieldwork within a distance that could be impacted by proposed activities.

Common name	Potential and/or confirmed habitat documented
Yellow Rail	• **Subject Property: no**, although there are areas with the physical characteristics necessary to function as breeding habitat for this species, documented breeding by this species in the region is uncommon. • **Adjoining Lands**: **no**, even if species present on lands adjacent to subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.
Black Tern	• **Subject Property**: **yes,** between 2 and 10 individuals observed foraging over Central Marsh and wetland W2 during 2009 and 2010. Given the regular observations during the nesting season and the observation of foraging fledglings in August, it is likely that some individuals had nests within these wetlands. • **Adjoining Lands**: **no**, even if species present on lands adjacent to subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.
Canada Warbler[2]	• **Subject Property**: **possible**, although species not detected during field investigations, species is difficult to rule out given size of property. • **Adjoining Lands**: **no**, even if species present on lands adjacent to subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.
Golden-winged Warbler[2]	• **Subject Property: Yes**, 4 males of the species visually confirmed after singing heard; confirmed and potential habitat in areas where vegetation is in early stages of succession. • **Adjoining Lands**: **no**, even if species present on lands adjacent to subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.
Monarch	• **Subject Property: yes**, Milkweed (*Asclepias syriaca*) present at edges of disturbed areas and Swamp Milkweed (*Asclepias incarnata*) present in wetlands; therefore, these areas could provide suitable breeding and foraging areas for this species. • **Adjoining Lands**: **no**, although species is almost certainly present on the lands adjacent to the subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.
Conservation Interest – Provincially Rare	
Secund Rush (S3)[3]	• **Subject Property**: **yes**, species documented by Wasyl Bakowsky (Community Ecologist, Peterborough District MNR**).** • **Adjoining Lands**: **no**, even if species present on lands adjacent to subject property, the activities proposed do not have the potential to cause negative impacts on the species or its habitat in these areas.

[1]Provincial conservation status of Species at Risk (Endangered, Threatened, and Special Concern designations) from MNR list updated September 29, 2010 at http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/276503.html
[2]Species designated Threatened nationally by the Committee on the Status of Endangered Wildlife in Canada
[3](Oldham and Brinker 2009)

4 PHASING AND OPERATIONAL PLAN

The Operational Plan, prepared by Skelton, Brumwell & Associates Inc. is provided in **Appendix 10**. The proposed quarry is expected to be implemented in two phases, over a period of more than 20 years depending on market demands. During the first phase, the infrastructure, including roads, scale house, vehicle maintenance building, site office, fuel storage area, fencing, and services for the quarry operation will be constructed. The following phasing strategy and operational notes (Sections 4.1–4.7) are from GENIVAR Inc. (2011a) and are included here with permission. This concept was reviewed in the context of the significant natural features on the subject property during the impact analysis.

4.1 Quarry Development Concept

A quarry development concept is provided to permit an impact assessment of the quarry. Location details are shown in Figure 25 and a Conceptual Quarry Development Plan is provided at the back of the report as Sheet 1. Figures 26 and 27 provide development concept schematics through the property (**Appendix 10**).

4.2 Phase 1

Overburden will be stripped, where present, and stockpiled adjacent to the area to be extracted for use in future progressive rehabilitation. Extraction will commence within the southern portion of Phase 1 and progress in a northerly direction. The initial excavation of Phase 1 (identified as Phase 1A) will be completed to an elevation above 242 masl, such that the base elevation of the quarry will be above the surrounding ground surface and about 2 m above the water table of the surrounding low-lying area. To maintain this base elevation of 242 masl, the area of Phase 1A will be slightly less than the Phase 1 area presented in the Conceptual Quarry Development Plan owing to grounds surface elevations of between about 240 and 242 masl within the western portion of Phase 1. Overall, based on the existing topography, the minimum extraction base elevation will be between about 242 masl within the western portion of Phase 1 and about 244 masl within the eastern portion. As a result, runoff within the extraction area will initially flow toward the west to the interior of the proposed licensed area.

Within the southern portion of Phase 1, an initial sump(s) will be excavated down to an elevation of about 232 masl to provide initial water storage for use as part of on-site operations, then for dewatering purposes as the base of the excavation of Phase 1 is deepened. Phase 1B will consist of the progressive deepening of the Phase 1A extraction area to an elevation of about 220 masl, with a base slope that directs runoff to the sump(s). The sump base elevation for Phase 1B would be about 215 masl.

The on-site operations will initially include crushing and screening, with material transported off-site for washing. A Settling Pond and an Equalization Pond will be constructed and operated to reduce suspended solids within runoff and for eventual storage/recycling of washwater. Upon accumulation of

sufficient water within the on-site sump(s), washing operations may be established. The plant and associated ponds will be located immediately west and south of Phase 2. This area is identified as the Access, Processing and Stockpile Area of the Site Plan (Skelton Brumwell & Associates Inc. 2011). Material stockpiles will be placed in the wash plant area or on the quarry floors during operation.

4.3 Phase 2

Phase 2 is located south of Phase 1 and will be started as Phase 1 nears completion. It may be necessary to commence portions of Phase 2 during extraction of Phase 1 to manage rock quality. Similar to Phase 1, Phase 2 may be operated in two phases. The base of Phase 2 will be about 220 masl as shown in Figure 27. Extraction within Phase 2 will proceed in a north to south direction.

4.4 Water Use

Water use will occur for dust control, material washing, and to service the scale house and maintenance building.

Dust control will be required on a seasonal basis to supplement incident precipitation. Most of the dust control will occur within the permanent and temporary haul roads, and within the traffic areas of the Processing and Stockpiling Area. Based on a maximum application rate of 2.5 cm (1 inch) per week during dry summer periods over an area of about 5 ha, it is estimated that between 0 and 200 m^3/day (6 days/week) of water will be consumed for dust control. Water required for dust control may initially be obtained from an on-site water well capable and permitted to provide up to 200 m^3/day of water or from the Settling Pond.

Wash operations will reuse water from the Settling Pond to wash material prior to stockpiling for off-site transport. The following summary provides an estimate of water to be used for material washing.

VARIABLE	UNITS	VALUE
Production	Tonnes/year	200,000
Production Period	Days/year (6 months)(26 weeks)	130
Duration of Washing Per Day	Average Hours	12
Water for Washing	Litres/minute/tonne/hour	18
Average Water Use	Cubic metres/12 hour day	1,662

NOTES:
1) Washing will be periodic. Assumes washing 5 days per week on average.

Water consumed by washing will be lost by evaporation from stockpiles and settling ponds, as well as water that adheres to product that is removed from the quarry. Studies suggest that stockpile evaporation and adherence losses can range from about 2% to 4% of aggregate by weight (Golder Associates, 2006), which is equivalent to between 31 m^3/day to 62 m^3/day (130 day period). Water loss by evaporation from the Settling Pond could represent an additional loss of about 3 m^3/day for a 5 m deep pond with three days of storage capacity (4,986 m^3) in each of three compartments, and a

difference between existing evapotranspiration and open water evaporation of about 3 mm/a (565 mm/a – 562 mm/a) (MOE, 2009).

In total, the calculated water consumption by quarry operations is between 34 m^3/day and 265 m^3/day. Therefore, for an average water use for quarry operations of 1,662 m^3/day, about 84% to 98% of the water used will be recycled and reused.

Water loss from the Equalization Pond is not considered as this pond will dominantly contain water removed as part of the dewatering process, which will remove water from the quarry extraction area that would have moved to surface water under pre-quarry conditions.

4.5 Servicing

i) Access Road

Construction of the access road will reduce infiltration along the road and will influence the direction of surface water runoff. Owing to the length and width of the access road relative to the surrounding land, the reduction in infiltration will be minor. Mitigation will include the collection of road runoff into adjacent vegetated ditches or swales that will: 1) encourage infiltration within the ditches or swales, 2) prevent water ponding adjacent to the access road during the spring or after prolonged precipitation events, and 3) permit the removal of fines or grit from the road runoff with the vegetation in the ditches or swales.

Use of grassed ditches or swales that discharge into the existing Monck Road drainage ditch will continue to encourage runoff drainage within the existing watershed and will reduce fines or grit within the surface water.

ii) Scale, Scale House, and Maintenance Building

For construction and operation of the scale, scale house, and maintenance building runoff will be directed to adjacent vegetated ditches or swales to: 1) encourage infiltration into the soil and 2) prevent ponding on the adjacent land. It is recommended that a geotechnical assessment be completed to ensure suitable soil bearing capacity or to design suitable engineering measures for the scale, scale house, and maintenance building.

It is understood that waste products from the maintenance building will be disposed in an environmentally acceptable manner. Waste oil, lubricants, and similar material will be contained in an approved storage container with secondary containment. This material will be stored temporarily in the

service area for collection and off-site disposal by a licensed contractor. Spill containment material will be available in the maintenance building.

iii) Sewage System

Considering the potentially high percolation time for the soil and the potential for elevated water table levels during the spring, a raised tile bed for the sewage system may be required. A detailed sewage system design based on field testing will be required for a sewage system in accordance with the Ontario Building Code. No water quality or quantity impacts should occur as a result of the operation of the sewage system.

iv) Aboveground Fuel Storage

It is understood that fuel will be stored in aboveground storage tanks with secondary containment and crash barriers. Staff will be trained and familiar with the spill contingency plan. Spill containment material will be available in the maintenance building. Through adhering to current industry practice for fuel storage and dispensing, no impacts to groundwater or surface water quality are predicted.

4.6 Settling Pond and Equalization Pond

The Settling Pond and Equalization Pond will be located immediately southwest of Phase 2 as shown in the Conceptual Quarry Development Plan. The purpose of the Settling Pond and the Equalization Pond is to provide sufficient retention time for the water to remove suspended solids, such that water may be reused for on-site processing of aggregate, and for discharge of water into the low-lying area southwest of the Processing and Stockpile Area.

The Settling Pond will be used as the primary settling pond for water that originates from the following sources.

- Runoff from the Stockpile and Processing Area
- Washwater from the washing plant

Water from the Settling Pond will be used for the following.

- Recycled for use as washwater
- Dust control

The Settling Pond has been sized with a depth of 5 m and to provide a minimum of three days storage for average washwater requirements (1,662 m^3/day) within each of three settling compartments. This storage time will provide sufficient time for the settlement of silt-sized suspended solids. At about 70 m in width, a minimum pond length of about 47 m (43 m plus two, 2 m separation barriers) is proposed.

The Equalization Pond will operate as a contingency settling pond as it will collect excess discharge from the Settling Pond after excessive precipitation events and it will permit equalization of water

temperature from the dewatering systems for the extraction areas prior to discharge into the low-lying area of Watercourse 1. As shown in the Conceptual Quarry Development Plan, the Equalization Pond is about 300 m long and 70 m wide. One downstream outlet from the Equalization Pond will discharge into the eastern portion of the low-lying area. With a 2 m depth, the Equalization Pond will provide a storage volume of 42,000 m^3, which is sufficient to provide two weeks retention of the predicted water to be removed from Phase 1/2 during dewatering at the time of the spring freshet. A smaller Equalization Pond size may be considered if a decreased retention time is required for discharge into the low-lying area.

4.7 Rehabilitation

Quarry rehabilitation will include the establishment of a lake within the excavation. The final lake level will correspond with the lowest existing outlet elevation, although alternative outlets can be constructed at a similar or lower elevation. Based on the available topographic mapping, two outlets for the rehabilitation lake were established to allow surface water flow from the western edge of the lake into low-lying area of Watercourse 1 (natural low elevation) and the northeastern edge of the lake into Watercourse 2 (will require channel construction). The two outlets of the Phase 1/2 lake would be at an elevation of about 240 masl. Figure 27 provides conceptual schematics of the lake levels within the excavation. Table 8 provides a comparison of the pre-extraction catchment areas for Phases 1 and 2 compared to the predicted post-extraction catchment areas with two lake outlets, each providing 50% of the lake discharge to the respective watercourse.

5 IMPACT ASSESSMENT AND RECOMMENDATIONS

Based on the results of the studies conducted and detailed in Section 3, a number of features and functions of conservation interest have been identified on the subject property. These features along with recommended protection measures are presented in (**Figure 6**).

The subject property is presently designated Rural according the County of Victoria Official Plan (Consolidation 2004) and zoned Rural General (RG) and Environmental Protection (EP) (Former Township of Dalton By-Law 1077, Schedule A Zoning By-law 14-922) (**Figure 7**). The property will require an Official Plan Amendment to a designation of Aggregate and a zoning by-law amendment from Rural to M3 to permit and regulate the proposed site. An exception to the M3 zoning will also be required to allow for a quarry and associated processing facilities. The designation of the lands as Aggregate will allow for not only the quarry but also for accessory uses and “natural heritage and wildlife habitat conservation, management and/or stewardship”. RiverStone has reviewed the proposed designations and zoning and this impact assessment takes into consideration the activities that are permissible within these in place. Finally, our determination of whether the risk of potential impacts on

a specific feature is acceptable relies upon the relevant policies and legislation referenced in Section 2.2, as well as our assessment of the significance or quality of the particular feature.

The major constraints are the habitat of species of conservation interest, the Cranberry River, Watercourses 1 and 2 and the associated riparian buffers with respect to both fish and fish habitat, and maintenance of water quality and quantity. These constraints can be addressed in part by locating roads, building envelopes, quarry infrastructure, etc. in areas that are constraint free. The extraction area itself will need to be set back an appropriate distance from the significant natural heritage features identified. This can be accomplished for the most part with the Operational Plan proposed (**Figure 8**). The extraction operation can be generalized into five steps: site preparation, extraction, processing, shipping and rehabilitation (Skelton, Brumwell & Associates Inc. 2011). The remainder of the property will remain in its natural state. Ground truthing of the footprint of the proposed quarry areas with respect to the identified environmental constraints will be required prior to commencement of operations.

The proposed Operational Plan (**Appendix 10**) reflects a concerted effort to balance the conservation of environmental features, while permitting the extraction of a high quality aggregate. The present plan has been significantly revised from the original presented with the applications in 2008 to increase the extent of protection for significant natural heritage features.

In addition to the extraction area, an entrance to the licenced site will be located on the southeast corner of the subject property. An internal haul route is proposed as depicted in **Figure 8**.

Notwithstanding the best of intentions to protect all natural features, a number of impacts are anticipated, some of which can be mitigated, others that cannot. The following impact assessment evaluates the potential for negative impacts resulting from the activities proposed on the subject property as outlined in Section 4 and shown in **Figure 8**.

5.1 Water Quality and Quantity

5.1.1 Baseline Conditions

With regard to the existing water quality in the watercourses within the proposed site and the downstream receiver, the Cranberry River, the data collected as part of the baseline monitoring program suggests that conditions pre-development are mostly unremarkable and within ranges that would normally be anticipated for similar watercourses in the area. There were, however, a few

instances of high concentrations of common metals and nutrients at some monitoring stations during some of the sampling events. These high levels are believed to be natural occurrences. Baseline concentrations of phosphorus in these watercourses are of sufficient concentration to contribute to excessive plant growth and nuisance algae, underscoring the need to maintain or improve upon this condition. Also of concern would be runoff containing elevated concentrations of suspended sediment, metals, ions, and chemicals and compounds associated with the quarry operation.

To ensure that water quality and aquatic biota are not adversely affected by land use changes requires careful monitoring. Monitoring plans are most effective when baseline conditions have been measured prior to the proposed changes. To this end, baseline data has been collected for the previous 8 years. The surface water data has been provided in detail in the Updated Hydrogeological Evaluation (GENIVAR Inc. 2011a) with some general comments provided in this Natural Environment report. GENIVAR has used these data to set trigger mechanisms or thresholds which are presented in the Performance Monitoring Plan (GENIVAR Inc. 2011b). RiverStone provided input to the Performance Monitoring Plan to ensure it was designed to protect the features identified in this Natural Environment Report. Given that the Performance Monitoring Plan contains critical details regarding trigger mechanisms (i.e., pre-established thresholds based on the baseline data collected to date that when exceeded will trigger contingency measures), RiverStone recommends the following:

- **GENIVAR Inc.'s (2011b) Performance Monitoring Plan should be made available to the MNR and the City of Kawartha Lakes.**

Note that the flow and water quality data contained within the Updated Hydrogeological Evaluation (GENIVAR Inc. 2011a) provides the baseline water quantity and quality conditions against which any changes can be measured.

5.1.2 Operational Conditions

In terms of surface water quality/quantity impacts, there are three components of the proposed application that could potentially have negative effects. The first is quarry design and the extent to which the quarry will encroach on the watercourses and their associated riparian buffers. In order to protect the quality of the watercourses from dust, chemicals, and physical damage, the riparian habitat requires protection. This can be accomplished through adjustments to the design of the quarry and the implementation of appropriate setbacks. In this regard RiverStone recommends that:

- **A minimum 30 m buffer should be established from the high-water mark of Watercourses 1 and 2 and the open-water portions of the online wetlands, the Central Drainage, and the Cranberry River as shown in Figure 6. The buffer edge should be ground truthed by a qualified professional, well-marked prior to the commencement of quarry operations, and the buffer should remain in its natural state.**
- **Buffers should be protected from rock shatter and/or physical disruption through proper blast design, blast orientation, and monitoring.**
- **Appropriate sediment and erosion control measures should be used to prevent the movement of sediment and the erosion of unstable soils into watercourses; these measures should be in place prior to soil exposure and should be maintained whenever exposed soils are present.**
- **All stock-piled aggregates should be stored in a location that will prevent the movement of sediment laden runoff into the watercourses and wetlands.**
- **All stockpiled topsoil/overburden should be stabilized as quickly as possible (e.g., erosion-prone areas covered with textile) 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 quarrying, and to inspect and ensure necessary repairs following winter thaws, spring freshets, and heavy rainfall events.**

Second, initial implementation of the quarry Operational Plan, starting with the stripping of vegetation and any overburden has the potential to have negative impacts on fish habitat. During this phase of the operation, there is increased potential for erosion and movement of sediment-laden runoff because of vegetation removal and stock piling of overburden material. RiverStone, therefore, recommends the following to protect water quality:

5.1.3 Quality of Quarry Discharge Water

The third component of the quarry operations that has the potential for impact on surface water is the extraction of aggregates and the resultant changes in the landscape drainage patterns. The quarry will be developed and extracted in two phases over a period of almost 100 year, thus any anticipated impacts to groundwater and surface water will occur gradually. Based on the findings of the Updated Hydrogeological Evaluation (GENIVAR, 2011), there will be negligible impacts on the quantity and quality of surface waters on the subject property, including the Cranberry River and the two smaller watercourses. There will be some redirection of surface and ground water away from the two smaller watercourses during the operational lifespan of the quarry. These can be mitigated through the appropriate distribution of the water from the sump discharge to Watercourses 1 and 2, as per the Updated Hydrogeological Evaluation (GENIVAR, 2011). There is a predicted increase in surface flow

of 0.001 cubic metres per second (m^3/s) annually for Watercourse 1 and no expected measurable change for Watercourse 2; this is minimal in comparison to natural seasonal fluctuations. The existing conditions and post excavations flow conditions are provided (**Appendix 6**, Table 18).

In terms of the change in catchment areas for Watercourses 1 and 2 upon final rehabilitation of the quarry, there will be a 25% reduction in area of Watercourse 1 and a 50% increase for Watercourse 2 (**Appendix 6**, calculated from Table 8, GENIVAR 2011). These reductions are calculated prior to the dewatering of the quarry during active operations, and any permanent placement of outlets from the new quarry lakes. In order to maintain the existing features, some mitigation measures will be required to maintain pre-development baseflow conditions. This will be accomplished through strategic placement of final lake outlets. Upon final rehabilitation, the flow in Watercourse 1 post-extraction may be result in fewer periods of dry conditions (i.e. possible increase from no change up to 0.004 to 0.006 m^3/s during spring freshet). For Watercourse 2 a similar change is expected post-extraction, with the potential for fewer dry periods (i.e. possible increase from no change up to an increase of 0.002 to 0.003 m^3/s during spring freshet).

Of importance during the extraction phase, is the need to manage the surface water that will accumulate within the quarry operation. During operations, there will be a requirement to dewater the work area, with the most likely receivers being either Watercourse 1 or Watercourse 1. In this regard, RiverStone recommends the following to maintain the quantity and quality of water in Watercourses 1 and 2 and ultimately the Cranberry River:

- **Prior to the initial discharge of quarry water (each phase), water quality analysis should be completed and reviewed by a qualified professional to determine potential impacts, if any, to the receiving waterbody. The analysis should include pH, temperature, dissolved oxygen, major ions, metals, total suspended solids, nutrients, oil and grease, and volatile organic compounds.**
- **Once quarry dewatering commences, a minimum of monthly water quality sampling should be undertaken on quarry discharge water and analyzed for pH, dissolved oxygen, visible sheen, temperature, and total suspended solids. On a bimonthly basis (every two months) sample analysis should include the parameters above, plus major ions, nutrients, oil and grease, as well as volatile organic compounds (VOCs). Monthly monitoring can be reduced to bimonthly, if for two consecutive months, all parameter estimates are below their corresponding PWQO.**
- **Annual dewatering volumes from the quarry should be directed to Watercourse 1 and Watercourse 2 as detailed in Section 5 of the Updated Hydrogeological Evaluation (GENIVAR Inc. 2011a).**

- **Given that there is potential for a spill (most likely during refuelling) that could result in deterioration of water quality, a spill response plan should be developed, where discharge pumping would immediately stop in the event of a spill, followed by an effective clean-up and monitoring program.**

5.1.4 Monitoring of Surface Water Features

On-going water quality and quantity monitoring in Watercourses 1 and 2 and the Cranberry River, after the commencement of quarry operations, will ensure that the quality of the surface water is maintained. In this regard, RiverStone recommends that the following surface water quality sampling and analysis be included in the Performance Monitoring Plan outlined in the Updated Hydrogeological Evaluation (Table 19; GENIVAR Inc. 2011a).

- **Water quality conditions should be sampled every two months (between May and November when discharge is to occur) at the six surface water stations (SW1 through SW5, SWA and SWB) for temperature, dissolved oxygen, pH and total dissolved solids. On two occasions (June and October), analysis of all six stations should also include nutrients, major ions, total suspended solids, oil and grease, and volatile organic compounds. Collection of all samples should be geared towards heavy rain events.**
- **The Performance Monitoring Plan includes the baseline data for Cranberry River, and Watercourses 1 and 2. The trigger mechanisms outlined in the Updated Hydrogeological Evaluation (Table 20; GENIVAR Inc. 2011a) and in the Performance Monitoring Plan (GENIVAR Inc. 2011b) should be reflective of baseline conditions in the Cranberry River and Watercourses 1 and 2; additionally the responses to the trigger mechanisms should be designed to maintain the baseline water quality and quantity conditions in these watercourses.**
- **The on-going sampling results should be reviewed by the appropriate professionals, as the results are received, and Giofam Investments Inc. should be notified immediately if a problem is identified.**

5.1.5 Post-Operational Conditions

The final concern is the maintenance of baseflow to Watercourses 1 and 2 after the extraction process is finished and the quarry has been rehabilitated. Due to the sensitivity of the natural features and functions associated with Watercourses 1 and 2 the maintenance of the existing flow regime once quarry operations conclude is required. In this regard, RiverStone recommends that:

- **The final design of the quarry lakes provide for overflow channels directed towards Watercourses 1 and 2. The final design of the channel should be developed with the assistance of a qualified professional, and should provide end uses for fish and wildlife.**

5.2 Fish and Fish Habitat

The potential for negative impacts to 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. Based on the Updated Hydrogeological Evaluation (GENIVAR Inc. 2011a) any changes resulting from quarry operations would likely be within the natural variation that occurs seasonally and/or annually and would not affect fish and fish habitat.

Our assessment indicated that both Watercourse 1 and 2 support communities of warmwater forage fish, and the Cranberry River supports populations of both warmwater forage fish and sport fish. Watercourse 2 has limited base flow during the summer months, with the majority of the fish habitat is located in a number of the open water portions of the wetlands. Watercourse 1 has very low to no flow during the summer months; thus, fish habitat is isolated in a large open water marsh. The Cranberry River has a permanent flow regime and provides a diversity of fish habitat features and aquatic habitat. All possible measures need to be taken to ensure that the quality and quantity of water to all watercourses is maintained at the baseline conditions or better.

To protect the fish habitat within the identified watercourses, development setbacks are required. In addition to the watercourses, the adjacent riparian habitat features require consideration. These areas are of concern largely because they contribute to in-water fish habitat through contributions of woody and smaller organic debris. The most appropriate way to protect the watercourses in this case is to restrict all quarry activities to areas outside of the recommended buffers and to avoid any steep-slope areas to the extent possible. These measures will ensure that impacts to fish habitat are prevented.

Many of the mitigation measures required to protect fish and fish habitat are also necessary to protect water quality. To reduce the potential for negative impacts on fish habitat resulting from quarry activities, RiverStone recommends the following measures in addition to recommendations included in Section 5.1.2:

- **Vegetation within the buffers should be maintained in a natural state.**

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 has caused 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 close proximity of extraction areas in all phases of the quarry development to fish bearing waters, namely Watercourses 1 and 2, RiverStone recommends that:

- **The client should be aware of the Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Appendix 11).**
- **Blast designs must be such that during the warm water spawning season (April 1–June 30), overpressure does not exceed 100 kPa (14.5 psi) or vibrations do not exceed 13 mm/sec at the edge of the closest open water.**
- **A qualified professional should be retained to prepare a blasting plan that is compliant with Department of Fisheries and Oceans (DFO) regulations.**

In the current Operational Plan there are no proposed crossings of the identified watercourses. The internal haul road may cross the at least one of the Monk Road drainage features. Should the need arise to culvert, dam, divert, channelize or complete any works with the watercourses or drainage features on the subject property, a Work Permit from the MNR under the Lakes and Rivers Improvement Act (LRIA) may be required, in addition to any approvals required under the *Fisheries Act*. The specifics of LRIA are provided in **Appendix 12**. If the Department of Fisheries and Oceans (DFO) determines that a harmful, alteration, disruption or destruction of fish habitat (HADD) will occur because of required works, then an Authorization will be required under the *Fisheries Ac*t that will subsequently trigger a review under *Canadian Environmental Assessment Act* (CEAA).

In terms of potential impacts on fish and fish habitat, there are three fish bearing watercourses on the subject property and based on our impact analysis, there was nothing to suggest that there would be impacts on these features and functions if the recommendations outlined in Sections 5.1 and 5.2 are implemented. In this regard, it is RiverStone's opinion that the proposed quarrying activities, if conducted following the mitigation recommendations presented herein, will reduce the likelihood of negative impacts to an acceptable level.

5.3 Species of Conservation Interest

Table 5 presents RiverStone's assessment of the potential impacts on species of conservation interest and their habitat that could result from the proposed activities. Note that **Table 5** only presents the evaluation of impacts on species that were determined to have confirmed or potential habitat on the subject property or adjoining lands as described in **Table 4**.

Table 5. Assessment of potential impacts on species of conservation interest as a result of proposed activities on the subject property and adjoining lands. Shaded rows denote species for which mitigation measures are recommended to prevent or minimize the likelihood of negative impacts. Abbreviations: ESA – *Endangered Species Act, 2007*; PPS – Provincial Policy Statement (2005); SH – Significant Habitat as per PPS 2.1.3(a); SWH – Significant Wildlife Habitat as per PPS 2.1.4(d); SARA – *Species at Risk Act* (federal); MBCA – *Migratory Bird Convention Act, 1994*.

Species	Is there potential for the species or its habitat to be negatively impacted by the proposed activities?	Recommended mitigation	Protection afforded by:	Will recommended mitigation reduce likelihood of negative impacts to acceptable level?
Endangered & Threatened (MNR)[1]				
Blanding's Turtle	• **Subject Property: yes**. • **Adjoining Lands**: **yes**.	• Except within the proposed extraction area shown in Figure 8, construction activities associated with quarrying should not occur within the Endangered and Threatened species habitat depicted in Figure 6. Note: the activities proposed within areas that are identified as Endangered and Threatened species habitat are subject to a 17(2)(c) Permit under the Endangered Species Act, 2007. • A protective buffer between 35 and 60 m in width should be established between wetlands W5, W4, and M1 and the northern and eastern limits of extraction as shown in Figure 6. • Specialized barrier fencing for reptiles should be erected as shown in Figure 6. • Quarrying activities should be limited to the area within the barrier fencing shown in Figure 6 and Figure 8. • Water inputs to the Central Marsh (W6) should be carefully monitored to ensure that there is no change in water quantity, temperature, or chemistry beyond normally occurring fluctuations (e.g., yearly ranges); these ranges are found in the Updated Hydrogeological Evaluation (GENIVAR Inc. 2011a) • Water monitoring protocols, particularly those that pertain to the Central Marsh (W6), should remain adaptable to additional monitoring needs that may arise from requirements in a 17(2)(c) Permit under the Endangered Species Act, 2007. • Blasting monitoring protocols should remain adaptable to additional monitoring needs that may	• ESA • SH	• **No**, although the recommended mitigation measures will substantially reduce the likelihood of negative impacts on Blanding's Turtle and its habitat, provisions under the Endangered Species Act require that additional avoidance and overall benefit measures be implemented as part of a 17(2)(c) Permit under the Act. This type of permit is currently being sought from the MNR.

Species	Is there potential for the species or its habitat to be negatively impacted by the proposed activities?	Recommended mitigation	Protection afforded by:	Will recommended mitigation reduce likelihood of negative impacts to acceptable level?
		arise from requirements in a 17(2)(c) Permit under the Endangered Species Act, 2007. • Following the closure of the quarry, site rehabilitation plans should include the closing of the section of the haulage road between the Central Marsh and the former extraction areas.		
Spotted Turtle	• **Subject Property: yes**. • **Adjoining Lands: yes**.	• See mitigation for Blanding's Turtle.	• ESA • SH	• **Yes,** because of the extent of the area being protected for Blanding's Turtle, the likelihood of negative impacts on Spotted Turtle is low (i.e., the areas that could be considered habitat for Spotted Turtle are largely encompassed by the areas protected as Blanding's Turtle habitat). Additionally, the barrier fencing for reptiles will prevent any Spotted Turtles from accessing the proposed areas of extraction.
Whip-poor-will	• **Subject Property: yes**.	• Quarrying activities should be limited to the areas shown in **Figure 8**.	• ESA • SH	• **No**, given the extent of suitable breeding habitat around the proposed extraction area (primarily west, north, and east), as evidenced by RiverStone's observations of calling activity in 2010, the loss of 2 breeding territories is unlikely to have an impact on the resident breeding population. However, provisions under the Endangered Species Act require that additional avoidance and overall benefit measures be implemented as part of a 17(2)(c) Permit under the Act. This type of permit is currently being sought from the MNR.
Henslow's Sparrow	• **Subject Property: no**, the haulage road is the only development feature that traverses ecological communities where the species may breed in the future **Figure 8**. The remainder of the southern portion of the property would be available for Henslow's Sparrow.	• None	• ESA • SH	---

Species	Is there potential for the species or its habitat to be negatively impacted by the proposed activities?	Recommended mitigation	Protection afforded by:	Will recommended mitigation reduce likelihood of negative impacts to acceptable level?
Least Bittern	• **Subject Property: no**, potential habitat for this species within wetland M1 is > 60 m from proposed extraction areas.	• None	• ESA • SH	---
Bobolink	• **Subject Property: no**, proposed haulage road and extraction areas (**Figure 8**) are > 300 m from Bobolink habitat.	• None	• ESA • SH	---
Eastern Hog-nosed Snake	• **Subject Property: yes**. • **Adjoining Lands: yes**.	• Specialized barrier fencing for reptiles should be erected as shown in **Figure 6**. • Quarrying activities should be limited to the area within the barrier fencing.	• ESA • SH	• **Yes**, given that the population density of this species in the area is likely to be low, as well as the presence of extensive areas outside of the proposed extraction phases that are physically suitable to function as nesting habitat for the species (see extent of rock barrens in **Figure 1** and **Figure 2**), loss of potential nesting opportunities within Phase 1 should have a negligible impact on the resident population.
Special Concern (MNR)[1]				
Eastern Ribbonsnake	• **Subject Property: no**, proposed extraction areas are > 50 m from areas of habitat for this species.	• None	• SWH	---
Milksnake	• **Subject Property: yes.**	• Specialized barrier fencing for reptiles should be erected as shown in **Figure 6**.	• SWH	• **Yes**, the barrier fencing for reptiles will prevent species from accessing the proposed areas of extraction. The amount of potential habitat for this species on the property is considerably larger than the area proposed for extraction. Regarding the question of whether the habitat of this species on the subject property would qualify as SWH, and thus invoke consideration under policy 2.1.4 of the PPS, it is RiverStone's opinion that it would not, as per the methodology outlined in the most recent Natural Heritage Reference Manual (OMNR 2010).

Species	Is there potential for the species or its habitat to be negatively impacted by the proposed activities?	Recommended mitigation	Protection afforded by:	Will recommended mitigation reduce likelihood of negative impacts to acceptable level?
Five-lined Skink	• **Subject Property: yes.**	• None	• SWH	• **Yes**, although the rock barren community where Phase 1 is proposed (**Figure 8**) is high quality habitat for Five-lined Skink, the extent of habitat for this species on the subject property (primarily corresponding with the rock barren communities shown in **Figure 5**) is extensive. Regarding the question of whether the habitat of this species on the subject property would qualify as SWH, and thus invoke consideration under policy 2.1.4 of the PPS, it is RiverStone's opinion that it would not, as per the methodology outlined in the most recent Natural Heritage Reference Manual (OMNR 2010).
Snapping Turtle	• **Subject Property: yes**. • **Adjoining Lands: yes**.	• See Blanding's Turtle	• SWH	• **Yes,** because of the extent of the area being protected for Blanding's Turtle, the likelihood of negative impacts on Snapping Turtle is low. Additionally, the barrier fencing for reptiles will prevent any turtles from accessing the proposed areas of extraction.

Species	Is there potential for the species or its habitat to be negatively impacted by the proposed activities?	Recommended mitigation	Protection afforded by:	Will recommended mitigation reduce likelihood of negative impacts to acceptable level?
Common Nighthawk[2]	• **Subject Property: yes**.	• Quarrying activities should be limited to the areas shown in **Figure 8**. • Clearing of trees in development areas established via the Site Plan should not occur from May 15 to July 31 as this time corresponds to the peak nesting period for birds in general, and encompasses the breeding seasons of the species of conservation interest determined to occur on the subject property. • If construction activities associated with quarrying are going to occur in areas where birds are potentially nesting between May 15 and July 31, a nest survey is suggested prior to commencement of construction activities to identify and locate active nests of migratory bird species. 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.**	• SWH • SARA via MBCA	• **Yes,** given the extent of suitable breeding habitat around the proposed extraction area (primarily west, north, and east), as evidenced by RiverStone's observations of calling activity in 2010, the loss of a few nest areas is unlikely to have an impact on the resident breeding population.
Black Tern	• **Subject Property: no**, proposed extraction areas are > 100 m from areas of habitat for this species.	• None	• SWH	---
Canada Warbler[2]	• **Subject Property: yes**.	• See Common Nighthawk	• SWH • SARA via MBCA	**Yes**
Golden-winged Warbler[2]	• **Subject Property: yes**.	• See Common Nighthawk	• SWH • SARA via MBCA	**yes**

Species	Is there potential for the species or its habitat to be negatively impacted by the proposed activities?	Recommended mitigation	Protection afforded by:	Will recommended mitigation reduce likelihood of negative impacts to acceptable level?
Monarch	• **Subject Property: no**, extensive habitat for this species is available away from the proposed development areas.	• None	• SWH	---
Conservation Interest – Provincially Rare				
Secund Rush	• **Subject Property: yes**.	• None	• SWH	• Yes**,** given that the provincial rarity rank of this species was recently downgraded (S2 → S3; Oldham and Brinker 2009) and the extent of the property that will not be affected by the actvities proposed, any impacts, although minor, will be acceptable.

[1]Provincial conservation status of Species at Risk (Endangered, Threatened, and Special Concern designations) from MNR list updated September 29, 2010 at http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/276503.html

[2]Species designated Threatened nationally by the Committee on the Status of Endangered Wildlife in Canada

5.4 Areas with Recognized Conservation Significance

5.4.1 Queen Elizabeth II Wildlands Provincial Park

Although the subject property is directly adjacent to Queen Elizabeth II Wildlands Provincial Park, the area proposed for licensing (the Site) is approximately 400 m away from the nearest extent of the park; furthermore, the nearest proposed extraction area is a minimum of 470 m away from the park. Finally, the area between the Site and the park has been identified as Endangered and Threatened species habitat in this report; these lands are therefore subject to numerous protective measures detailed herein, as well as those being proposed as part of the permit application under the provincial Endangered Species Act. Consequently, it is not anticipated that there will be any negative impacts on the ecological integrity of the park; rather this quarry proposal would ensure the maintenance of a substantial buffer (with high ecological function) adjacent to the park in this location. It should also be noted that many of the species of conservation interest likely to move between the subject property and the park have been evaluated for potential negative impacts in **Table 5**.

5.5 Wetlands

As detailed and mapped in this report, a wetland system with high natural heritage value and ecological function occurs on the subject property. None of the wetlands has been evaluated using the Ontario Wetland Evaluation System; therefore, none of them has been designated Provincially Significant (i.e., a PSW). Despite this lack of formal evaluation, the natural heritage features within this wetland system, as documented by RiverStone, indicate that the wetlands within the subject property and adjoining lands would be designated provincially significant if evaluated. Accordingly, RiverStone has evaluated potential impacts on the wetland system, and made recommendations to ensure its protection following the policy requirements that would be in effect if the wetlands were formally designated provincially significant.

5.6 Natural Features and Functions

The proposed 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. These activities will result in the partial loss of the ecological communities identified in **Figure 5**. Although none of the ecological communities that will be altered by the proposed quarry activities is considered provincially rare (Henson and Brodribb 2005), the ecological function of these areas will be negatively impacted during site preparations and during the life of the quarry. To mitigate some of the ecological

impacts associated with the loss of forest and vegetation cover in, RiverStone recommends the following:

- **Vegetation removal and disturbance outside of the development envelopes should be minimized.**
- **Following the closure of the quarry, site rehabilitation will be required. The list of plant species provided in Table 6 should be used in the final rehabilitation plan to allow for naturalization that blends with the adjoining ecological communities.**

Table 6. Species suitable for quarry rehabilitation.

Trees and Shrubs	Herbaceous Species
• White Spruce (*Picea glauca*) • Red Pine (*Pinus resinosa*) • 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*) • Black Locust (*Robinia pseudo-acacia*) • 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 applicable to the proposal being evaluated here, and describes how the recommendations provided in this report will permit the proposed land use changes to comply with these provisions.

6.1 Canadian Environmental Assessment Act

The CEAA reviews projects in a "precautionary manner before federal authorities take action" to ensure no significant adverse environmental effects. This Act allows agencies to carry out reviews of projects in a coordinated manner with respect to federal and provincial agencies and allows for public participation throughout the process. The CEAA is triggered when a federal authority is any of the following: the proponent; provides funding; sells, leases, or disperses the lands; or issues a permit or licence.

As long as the recommendations herein are followed, it is the opinion of RiverStone that activities permissible within the site and on the subject property will not contravene the *Fisheries Act*. However, if it becomes necessary to directly or indirectly cause a HADD, then an Authorization will be required under the *Fisheries Act* and this would subsequently trigger a review under the CEAA.

6.2 Federal Fisheries Act (1985)

The most applicable portions of the federal *Fisheries Act* related to the current proposal are Sections 32, which prohibits the destruction of fish by any means other than fishing except as authorized by the Minster; 35 (1 and 2), which restricts any work or undertakings that would cause a HADD unless authorized by the Minister; and 36, which prohibits the deposition of any deleterious substance in any type of water frequented by fish.

As long as the recommendations herein are followed, it is the opinion of RiverStone that activities permissible within the site and on the subject property will not contravene the *Fisheries Act*. However, if it becomes necessary to directly or indirectly cause a HADD, then an Authorization will be required under the *Fisheries Act* and this would subsequently trigger a review under the CEAA.

6.3 Federal Species at Risk Act

The intent of the federal *Species at Risk Act* (SARA) is to prevent, ". . . Canadian indigenous species, subspecies and distinct populations of wildlife from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species, to encourage the management of other species to prevent them from becoming at risk."

Because the subject property is on non-federal lands, and no Endangered or Threatened fish species are present, the only features that are protected under this act are the nests of several bird species as

indicated in **Table 5**. As long as the recommendations in **Table 5** are followed, the proposed activities will comply with the SARA.

6.4 Federal Migratory Birds Convention Act, 1994

Section 6 of the Migratory Birds Regulations under the *Migratory Birds Convention Act, 1994* makes it an offence to "disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird."

As long as the recommendations in **Table 5** are followed, the proposed activities will be in compliance with this act.

6.5 Aggregate Resources Act

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 2, Class A licence: a quarry extracting greater than 20,000 tonnes per year below the water table.

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.

6.6 Provincial Endangered Species Act, 2007

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.

As indicated in **Table 4**, seven species protected under provisions of the ESA were determined to have potential habitat on or adjacent to the proposed site. However, as detailed in **Table 5**, the proposed activities are not expected to contravene provisions of the ESA for the majority of species evaluated. However, for the three species where the risk of contravening the ESA cannot be reduced to an acceptably low level, a 17(2)(c) Permit under the ESA is currently being sought.

6.7 Lakes and Rivers Improvement Act R.S.O. 1990

The purpose of the *LRIA* is as follows:

a. the management, protection, preservation and use of the waters of the lakes and rivers of Ontario and the land under them;

b. the protection and equitable exercise of public rights in or over the waters of the lakes and rivers of Ontario;

c. the protection of the interests of riparian owners;

d. the management, perpetuation and use of the fish, wildlife and other natural resources dependent on the lakes and rivers;

e. the protection of the natural amenities of the lakes and rivers and their shores and banks; and

f. the protection of persons and of property by ensuring that dams are suitably located, constructed, operated and maintained and are of an appropriate nature with regard to the purposes of clauses (a) to (e). 1998, c. 18, Sched. I, s. 23.

For the purposes of approvals under sections 14 and 16 of the LRIA, Ontario Regulation 454/96 identifies a narrower category of types of structures or works requiring approval. In this regulation, structures or works include channelization, water-crossings, and dams. Ontario Regulation 454/96 defines channelization and water crossing.

With respect to the proposed site and the subject property, the LRIA applies if the applicant proposes a water crossing of a feature that has a drainage area > 5.0 km^2 and/or the culvert is > 20 m in length. If either of these applies to proposed crossings, the property owner would require a Work Permit prior to installation of any culverts. Permits for culverts may be required during the construction of the internal haul road, depending on final design.

As long as the recommendations herein are followed, it is the opinion of RiverStone that activities permissible within the site and the subject property will not contravene provisions of the LRIA.

6.8 Provincial Policy Statement (2005)

The following provisions from Section 2.1 Natural Heritage and 2.2 Water of the 2005 PPS are relevant to this Natural Environment Report:

> **2.1.3** *Development* and *site alteration* shall not be permitted in:
>
> a) *significant* habitat of *endangered species* and *threatened species*;

As indicated in **Table 5**, the activities (development and site alteration) proposed on the subject property will not occur within Significant Habitat of Endangered and Threatened species for the majority of species evaluated; for three species, a 17(2)(c) Permit under the ESA is being sought as indicated in Section 6.6.

> **2.1.4** *Development* and *site alteration* shall not be permitted in:
>
> d) *significant wildlife habitat*; and
>
> unless it has been demonstrated that there will be no *negative impacts* on the natural features or their *ecological functions*.

Table 5 provides our assessment of the likelihood that development and site alteration permissible on the subject property (which for the Site would be restricted to quarrying and accessory uses in accordance with the licence under the ARA and the zoning of the property) would negatively impact habitat of species of conservation interest. Based on the assessment provided therein, it is our conclusion that development and site alteration permissible on the subject property would be consistent with policy 2.1.4., as long as the recommended mitigation measures are followed. Note that no other specialized features that could potentially qualify as Significant Wildlife Habitat were documented.

> **2.1.5** *Development* and *site alteration* shall not be permitted in *fish habitat* except in accordance with *provincial* and *federal requirements*.

Implementing the recommendations outlined in Section 5.2 will ensure any potential impacts to Fish Habitat are managed at an acceptable level and in accordance with the federal and provincial legislation.

2.1.6 *Development* and *site alteration* shall not be permitted on *adjacent lands* to the *natural heritage features and areas* identified in policies 2.1.3, 2.1.4 and 2.1.5 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*.

The extent of the area evaluated for negative impacts on potentially significant natural heritage features as described in Section 2.9.3.2 and detailed in **Table 5** and Section 5.1 is more than sufficient to ensure that impacts on Adjacent Lands were appropriately assessed. Careful evaluation of the ecological function of the lands potentially affected by the activities proposed on the subject property indicates that the application will be consistent with policy 2.1.6., as long as the recommended mitigation measures are followed.

2.2 Water

2.2.1 Planning authorities shall protect, improve or restore the *quality and quantity of water* by:

a) using the *watershed* as the ecologically meaningful scale for planning;
b) minimizing potential *negative impacts*, including cross-jurisdictional and cross-*watershed* impacts;
c) identifying *surface water features, ground water features, hydrologic functions* and *natural heritage features and areas* which are necessary for the ecological and hydrological integrity of the *watershed*;
d) implementing necessary restrictions on *development* and *site alteration* to:
    1) protect all municipal drinking water supplies and *designated vulnerable areas*; and
    2) protect, improve or restore *vulnerable* surface and ground water, *sensitive surface water features* and *sensitive ground water features,* and their *hydrologic functions*;
e) maintaining linkages and related functions among *surface water features, ground water features, hydrologic functions* and *natural heritage features and areas*;
f) promoting efficient and sustainable use of water resources, including practices for water conservation and sustaining water quality; and
g) ensuring stormwater management practices minimize stormwater volumes and contaminant loads, and maintain or increase the extent of vegetative and pervious surfaces.

The above policies pertaining to water were considered in the context of both the proposal considered herein and the PWQO as discussed in the subsequent section.

6.8.1 Ministry of the Environment Provincial Water Quality Objectives

The Ministry of the Environment and Energy (MOE) Guidelines Provincial Water Quality Objectives (PWQO) (1994 reprinted 1999) need to be consulted with regard to existing surface water conditions, and any requirements of the quarry development to bypass, pump, or de-water future quarry areas. The quality of water in all of the watercourses on the subject property is presently better than the PWQO for most parameters measured. The exceptions, noted from the baseline data collected include aluminum, iron and phosphorus which appear to be naturally elevated in the Cranberry River and Watercourses 1 and 2 and periodic exceedance of the PWQO for pH, cobalt, copper, lead, silver and total suspended solids. In this regard, the Ministry of Environment has the following policies:

3.0 SURFACE WATER QUALITY MANAGEMENT

3.1 Goal

The surface waters of Ontario are put to many uses, and each use has specific water quality requirements. As a general management principle, water quality must be protected, preserved or restored to permit the greatest number of uses, based on the best interest of the people of Ontario. Water which meets the water quality requirements for the protection of aquatic life and recreation (i.e. the Provincial Water Quality Objectives) will, in most cases, be suitable for other surface water uses.

The surface water quality management goal is, therefore:

TO ENSURE THAT THE SURFACE WATERS OF THE PROVINCE ARE OF A QUALITY WHICH IS SATISFACTORY FOR AQUATIC LIFE AND RECREATION.

Provincial Water Quality Objectives are useful indicators of, but not direct measurements of aquatic ecosystem health. Non-chemical factors such as the loss of habitat, sedimentation, water quantity regulation and the introduction of non-indigenous species often have profound and overriding influences on aquatic ecosystems.

Meeting the Provincial Water quality Objectives is the minimum requirement. Considerations such as ecosystem health, the additive effects of more than one chemical, or the protection of other uses may lead to more stringent requirements. For example, in site specific situations, where better water quality is required than that provided by the PWQO's to protect beneficial uses in a given location, the appropriate, more stringent criteria shall be applied in that location. Ontario borders on inter-provincial and international waters, and the implications of the Province's activities must be considered in that context. For example, the Province has agreed that the Specific Water Quality Objectives contained in the Great Lakes Water Quality Agreement or more stringent Provincial objectives shall be used in environmental programs to achieve and maintain

Great Lakes water quality. Also, Ontario enforces effluent requirements developed by the Federal Government for specific industrial sectors and for specific pollutants.

3.2 Policies

The following policies deal with two situations: a) where water qualify is better than the Provincial Water Quality Objectives; b) where water quality presently does not meet the Objectives. These water quality designations are made on a parameter by parameter basis and compliance or non-compliance with the Provincial Water Quality Objectives should be determined from data that adequately reflect the spatial and temporal variations of the quality of the waterbody under consideration.

3.2.1 Areas with Water Quality Better than the Objectives

Policy 1 ***"In areas which have water quality better than the Provincial Water Quality Objectives, water quality shall be maintained at or above the Objectives."***

Although some lowering of water quality is permissible in these areas, degradation below the Provincial Water Quality Objectives will not be allowed, ensuring continuing protection of aquatic communities and recreational uses.

3.2.2 Areas with Water Quality Not Meeting the Objectives

Policy 2 ***"Water quality which presently does not meet the Provincial Water Quality Objectives shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the Objectives."***

Evaluations of existing conditions in problem areas shall be conducted and all reasonable and practical measures shall be taken to upgrade water quality to the Provincial Water Quality Objectives. Where new or expanded discharges are proposed, no further degradation will be permitted and all practical measures shall be undertaken to upgrade water quality. However, it is recognized that, in some circumstances, it may not be technically feasible, physically possible or socially desirable to improve water quality toward the Provincial Water Quality Objectives.

Accordingly, where it is clearly demonstrated that all reasonable and practical measures to attain the Provincial Water Quality Objectives have been undertaken but where:

1) the Provincial Water Quality Objectives are not attainable because of natural background water quality; or

2) the Provincial Water Quality Objectives are not attainable because of irreversible human induced conditions; or

3) to attain or maintain the Provincial Water Quality Objectives would result in substantial and widespread adverse economic and social impact; or

4) suitable pollution prevention techniques are not available;

> then deviations from this policy may be allowed, subject to the approval of the Ministry of Environment and Energy. Detailed procedures for preparing a deviation are described in "Guideline for Handling Requests for Deviations." in the MOEE document entitled Deriving Receiving Water Based, Point-source Effluent Requirements for Ontario Waters (1994)

These policies can be achieved by implementing the recommendations outlined in Section 5.1. of this report. The most significant of the recommendations is the implementation of the Performance Monitoring Program.

6.9 County of Victoria

6.9.1 County of Victoria Official Plan (Consolidation March 2004)

Under the **County of Victoria Official Plan** (Consolidation March 2004) which is presently in force and effect, the subject property will require an Official Plan Amendment for the proposed quarry site, from a Rural designation to Pits and Quarries, and will require a zoning by-law amendment from Rural General to Industrial Extractive – Exception (M3) to accommodate a quarry. In addition, sections of the subject property are presently zoned Environmental Protection. The sections of the Official Plan that were reviewed during the preparation of this report are provided in (**Appendix 13**).

After reviewing the current Official Plan policies pertaining to the natural environment, it is the opinion of RiverStone that this Natural Environment Level 1 and 2 Assessment Report meets the requirements for an Environmental Evaluation as requisite for development proposals on or adjacent to sensitive areas as identified in the plan.

The proposed quarry meets the goals and objectives of the current Official Plan in that the operation will be “located on those areas that are not environmentally sensitive”. The main concern identified is the impact on Endangered and Threatened species and their habitats. This issue will be appropriately addressed and enforced through an ESA permit that is presently underway. Additionally, it is RiverStone’s opinion that the proposed application if approved will conform to the relevant environmental policies, provided the recommendations contained herein are implemented.

6.9.2 City of Kawartha Lakes adopted Official Plan (adopted September 2010)

In the addition to the current Official Plan policies RiverStone has had regard for the policies contained in the City of Kawartha Lakes adopted Official Plan (adopted September 2010). Under the adopted Official Plan the subject property is also designated Rural and Environmental Protection and thus the

site would require and OPA to permit the proposed quarry. The appropriate designation for the proposed land use from the adopted plan would be Aggregate. This designation includes pits and quarries licensed under the ARA, accessory uses, and "natural heritage and wildlife habitat conservation, management and rehabilitation". In the preparation of this report, the permitted uses within the Aggregate designation and relevant environmental policies were considered. The policies reviewed included Section 3. Environment and 3.5 Natural Heritage System (**Appendix 13**). In addition, the Terms of Reference: Environmental Impact Study in **Appendix** J., Schedule A-8 Land Use Designations and Schedule B8 Natural Heritage Features were reviewed.

In the preparation of this report RiverStone has had regard for the Natural Environment policies of the adopted Official Plan and is again of the opinion that the that this Natural Environment Level 1 and 2 Assessment Report has appropriately respects these policies.

7 CONCLUSIONS

Based on the findings presented in this Natural Environment Report, including the review of relevant environmental policy and legislation at federal, provincial, and municipal levels, RiverStone is of the opinion that the proposed quarry development plan will conform to these policies and provisions provided the recommendations contained herein are implemented. The required Official Plan and Zoning Amendments will allow for the proposed land use, while still preserving the Significant Natural Heritage Features identified on the subject property.

8 REFERENCES

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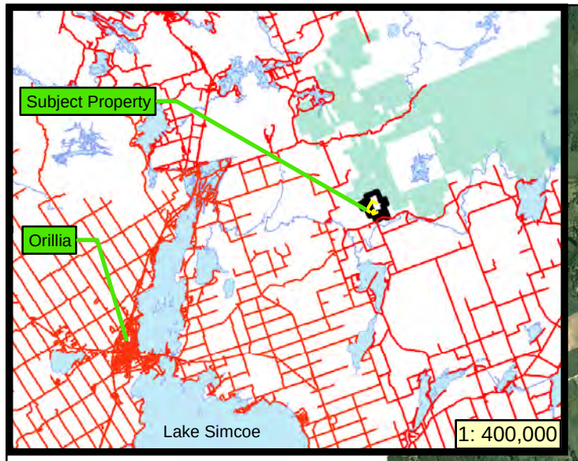
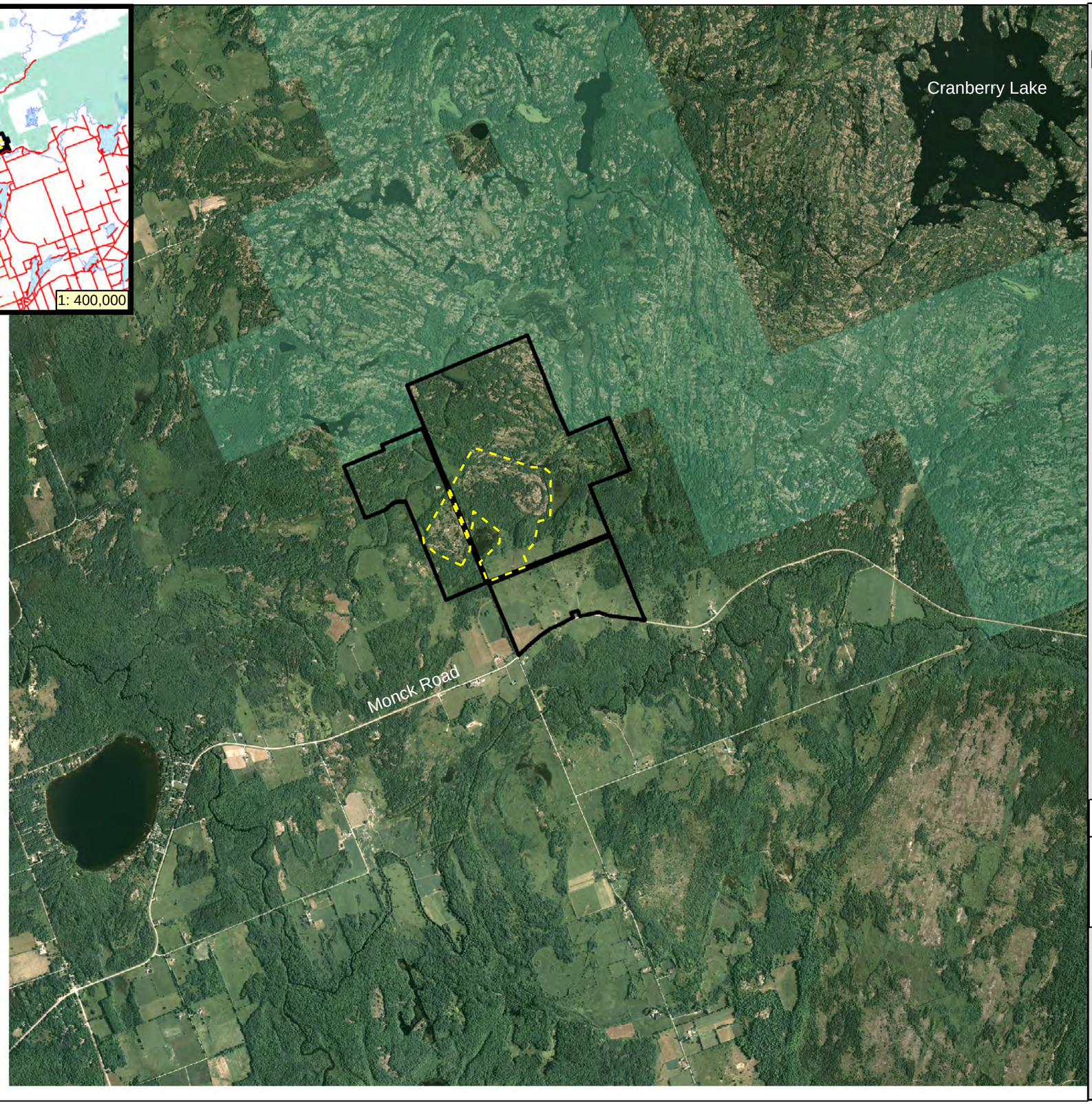




Legend

N

Planning Boundaries

- Subject Property (Owned by Giofam Investments Inc.)
- The Site - Proposed License Boundary

Areas Recognized as Having High Natural Heritage Value

- Queen Elizabeth II Provincial Park

Ontario Base Mapping (OBM)

- Roads
- Surface Water Features

Colour Orthophotograph - Summer 2009 (Forest Resource Inventory; FRI). Source: Land Information Ontario.

Scale	RS Project No.	Date Last Updated	By
1:38,000	2009-12	Apr 10, 2011	RW

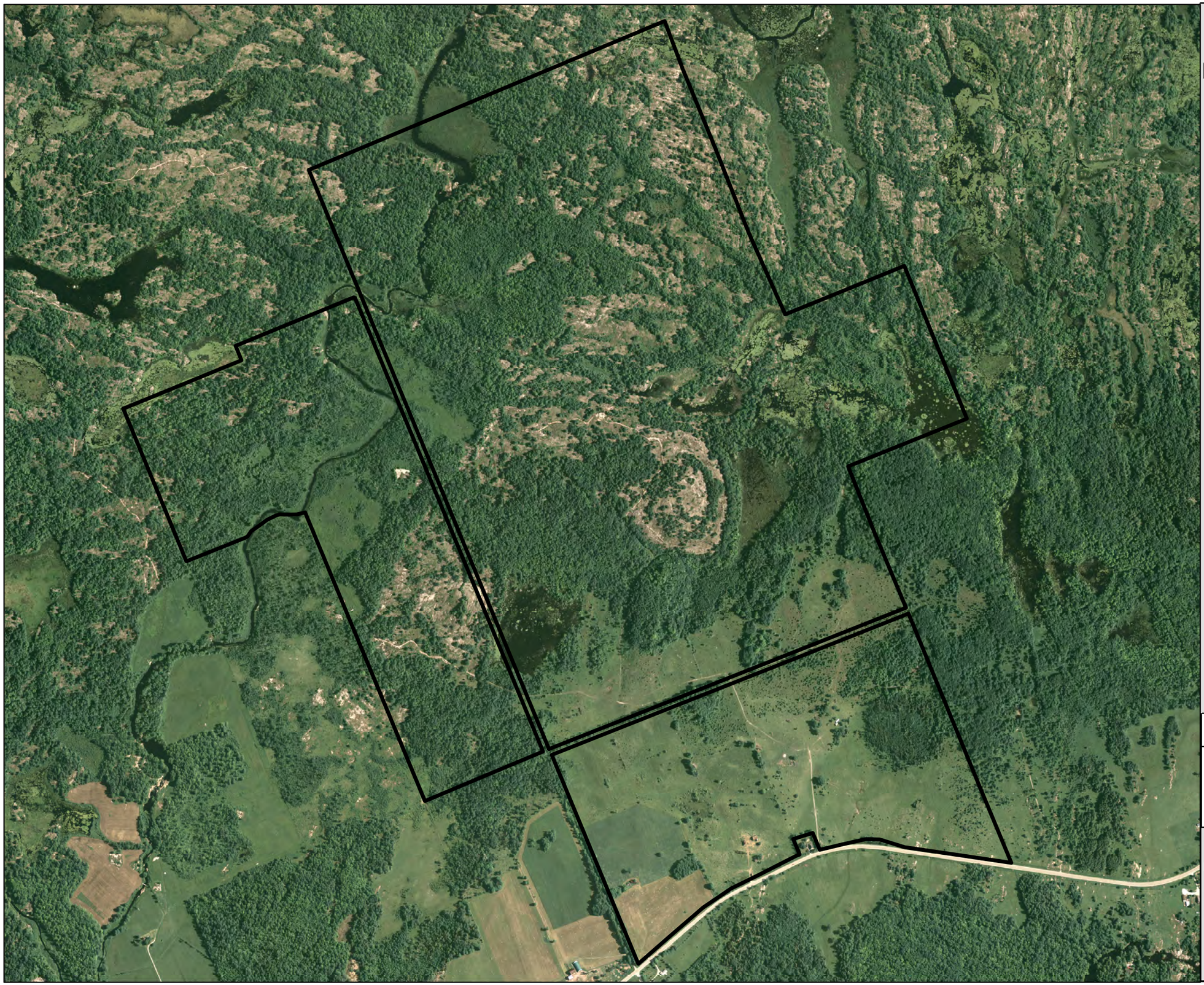
0 500 1,000 Metres

RIVERSTONE ENVIRONMENTAL SOLUTIONS INC.

Figure 1. Location of subject property

Prepared for: Giofam Investments Inc.
Inset: general location of subject lands; 1:400,000

Note: this figure should not be used in place of a professional survey.



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Planning Boundaries

Subject Property (Owned by Giofam Investments Inc.)

N

Colour Orthophotograph - Summer 2009 (Forest Resource Inventory; FRI). Source: Land Information Ontario.

Scale	RS Project No.	Date Last Updated	By
1:11,500	2009-12	Jan 17, 2011	RW

0 200 400 Metres

RiverStone Environmental Solutions Inc.

Figure 2. 2009 orthophotograph.

Prepared for: Giofam Investments Inc.

Note: this figure should not be used in place of a professional survey.

Legend

N

Planning Boundaries

Subject Property (Owned by Giofam Investments Inc.)

Contours

5-m Contours (Ontario Base Mapping)

Interpolated 1-m Contours (Skelton Brumwell)

Colour Orthophotograph - Summer 2009 (Forest Resource Inventory; FRI). Source: Land Information Ontario.

Scale	RS Project No.	Date Last Updated	By
1:11,500	2009-12	Feb 10, 2011	RW

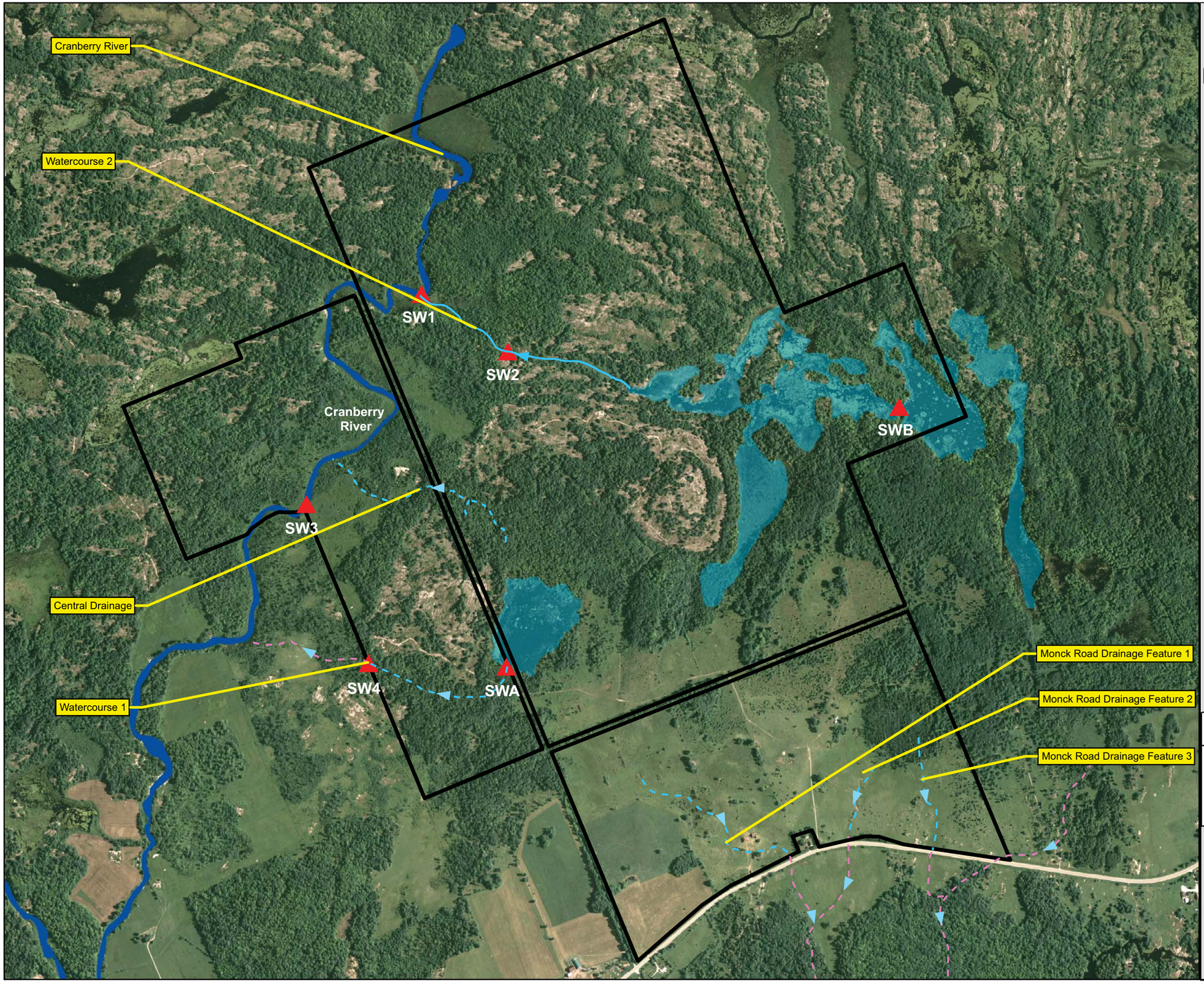
0 200 400 Metres

RiverStone Environmental Solutions Inc.

Figure 3. Contour map.

Prepared for: Giofam Investments Inc.

Note: this figure should not be used in place of a professional survey.



Legend

N

Planning Boundaries

- Subject Property (Owned by Giofam Investments Inc.)
- Surface Water Sampling Station

Primary Surface Water Features

- Wetlands Digitized from Aerial Photos
- Cranberry River (Ontario Base Mapping)
- Watercourses (permanent flow) Delineated by aerial photography and ground-truthed
- Watercourses (intermittent flow) Delineated by aerial photography and ground-truthed
- Watercourses (intermittent flow) Delineated by aerial photography

Colour Orthophotograph - Summer 2009 (Forest Resource Inventory; FRI). Source: Land Information Ontario.

Scale	RS Project No.	Date Last Updated	By
1:11,500	2009-12	Apr 8, 2011	LA

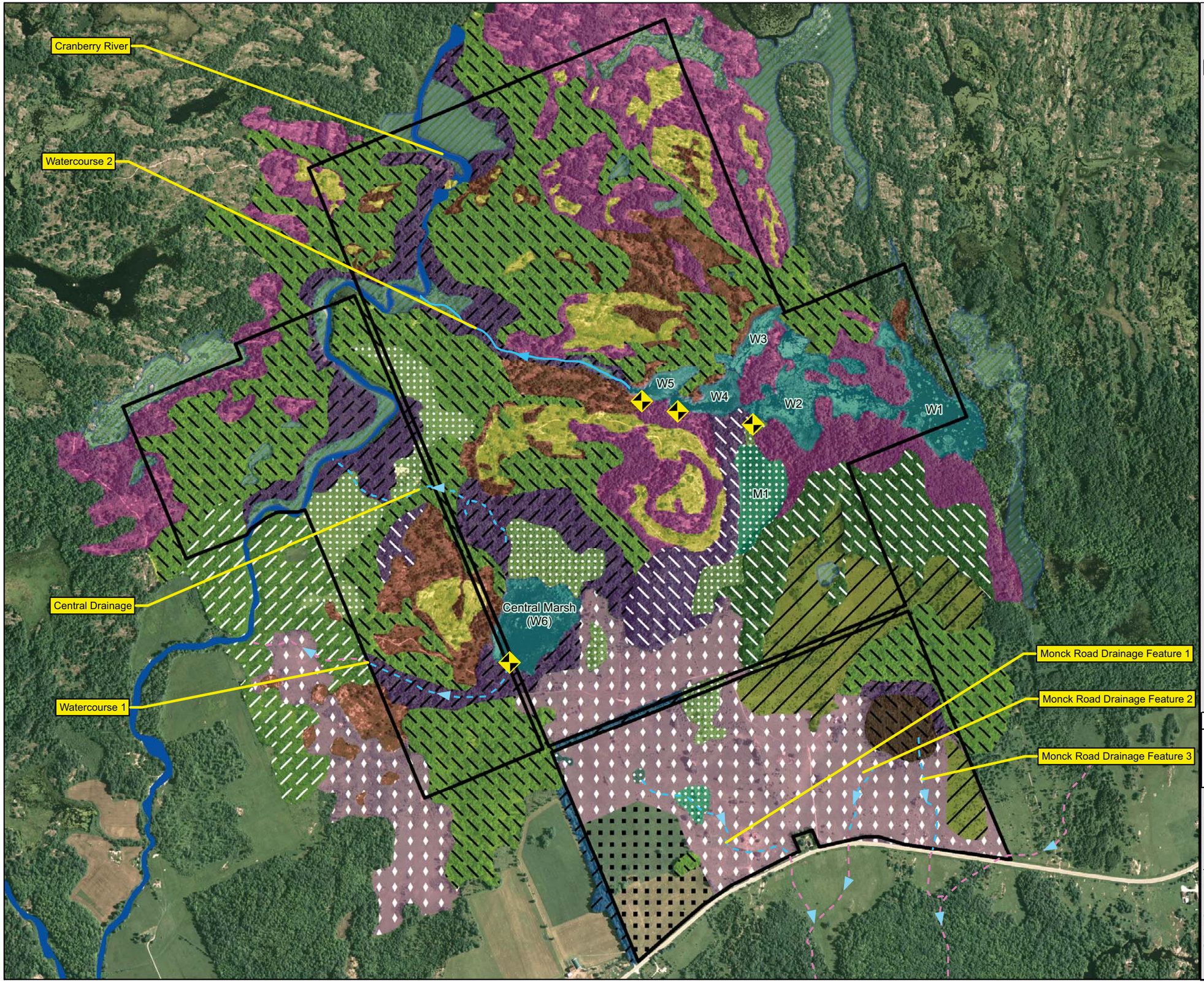
0 200 400 Metres

RiverStone Environmental Solutions Inc.

Figure 4. Surface water sampling stations.

Prepared for: Giofam Investments Inc.

Note: this figure should not be used in place of a professional survey.



Legend

N

Planning Boundaries

- Subject Property (Owned by Giofam Investments Inc.)

Ecological Communities

- Non-Calcareous Open Rock Barren Outcrop Type (RBOB2-1)
- Common Juniper Non-Calcareous Shrub Rock Barren Type (RBSB2-2)
- Oak-Red Maple-Pine Basic Treed Rock Barren Type (RBTB2-3)
- Dry-Fresh Poplar Deciduous Forest Type (FODM3-1)
- Dry-Fresh Sugar Maple-Basswood Deciduous Forest Type (FODM5-6)
- Dry-Fresh Sugar Maple-White Birch – Poplar Deciduous Forest Type (FODM5-10)
- Dry-Fresh Sugar Maple - Ironwood Deciduous Forest Type (FODM5-4)
- Dry-Fresh Poplar Mixed Forest Type (FOMM5-2)
- Fresh-Moist Poplar Mixed Forest (FOMM8-1)
- Fresh-Moist White Cedar - Hardwood Mixed Forest (FOMM7-2)
- Hawthorn Cultural Alvar Woodland Type (RBTA1-8)
- Fresh-Moist Open Graminoid Meadow Type (MEGM4-1)
- Agricultural Cropland (Ag - Hay)
- Red Maple Organic Deciduous Swamp Type (SWDO2-1)
- Willow Mineral Thicket Swamp Type (SWTM3-2)
- Cattail Graminoid Mineral Meadow Marsh Type (MAMM1-2)
- Open Water Marsh
- Unclassified Wetland
- Fish Sampling Station
- Watercourses (permanent flow) Delineated by aerial photography and ground-truthed
- Watercourses (intermittent flow) Delineated by aerial photography and ground-truthed
- Watercourses (intermittent flow) Delineated by aerial photography

Scale	RS No.	Date Updated	By
1:11,500	2009-12	Apr 8, 2011	LA

0 200 400 Metres

RiverStone Environmental Solutions Inc

Figure 5. Biophysical features and functions.
Prepared for: Giofam Investments Inc.

Notes: Ecological Communities beyond the boundaries of the subject property were determined from aerial photography; this figure should not be used in place of a professional survey.

Colour Orthophotograph - Summer 2009 (Forest Resource Inventory; FRI). Source: Land Information Ontario.

Cranberry River

Watercourse 2

Variable Buffer Widths Proposed to Protect Function of Blanding's Turtle Habitat:

The buffer between the proposed areas of extraction and aquatic habitat for Blanding's Turtle (corresponding here with the wetlands shown in blue) varies between 35 and 60 m. The extent of this buffer corresponds to the transition from open rock barren to treed slope. Because this area is steeply sloped, it is unlikely to have ever facilitated movement of turtles; therefore, the primary function of the buffer in this location, in terms of protecting the function of the Blanding's Turtle habitat, is noise suppression. In this regard, retaining the trees in this buffer zone will provide considerable noise suppression. Increasing the width of the buffer by extending it farther onto the rock barren would not result in a substantive reduction in noise.

Specialized Barrier Fencing for Reptiles

Barrier fencing will prevent Blanding's Turtle, Eastern Hog-nosed Snake, and other reptiles from accessing the extraction areas

Monitoring Protocols

Both water and blasting protocols should remain adaptable to additional monitoring needs that may arise from requirements in a 17(2)(c) Permit under the Endangered Species Act, 2007.

W1

W2

W3

W4

W5

M1

Activities proposed in this area (i.e., within the specialized barrier fencing for reptiles) is subject to a 17(2)(c) Permit under the Endangered Species Act, 2007.

Central Drainage

Central Marsh (W6)

Barrier fencing will extend to suitable landscape feature

Monck Road Drainage Feature 1

Monck Road Drainage Feature 2

Monck Road Drainage Feature 3

Watercourse 1

Setbacks from Central Marsh

In this location, the barrier fencing will be set back a minimum of 50 m from the edge of the central marsh. The land use proposed east of the fence is for open water ponds that will permit settling of sediments and equalization. Activities within this area will be limited to the initial excavation of the ponds (minor, controlled blasting) and annual cleaning. The ponds will, therefore, function as an additional buffer in terms of noise dissipation.

The minimum distance the access road is set back from the edge of the central marsh is 115 m.

Barrier fencing will extend to suitable landscape feature

N

Legend

Planning Boundaries

- Subject Property (Owned by Giofam Investments Inc.)
- The Site - Proposed License Boundary

Areas Recognized as Having High Natural Heritage Value

- Queen Elizabeth II Provincial Park

Biophysical Features and Functions - RiverStone

- Endangered and Threatened Species Habitat
- Primary Wetlands
- Watercourses (permanent flow) Delineated by aerial photography and ground-truthed
- Watercourses (intermittent flow) Delineated by aerial photography and ground-truthed
- Watercourses (intermittent flow) Delineated by aerial photography

Measures Recommended by RiverStone to Prevent and/or Reduce Impacts

- Specialized Barrier Fencing for Reptiles

Protective Buffers

- 15-m Buffer of Monck Rd Drainage Features
- 30-m Buffer of Watercourses
- 35-60 m Buffer

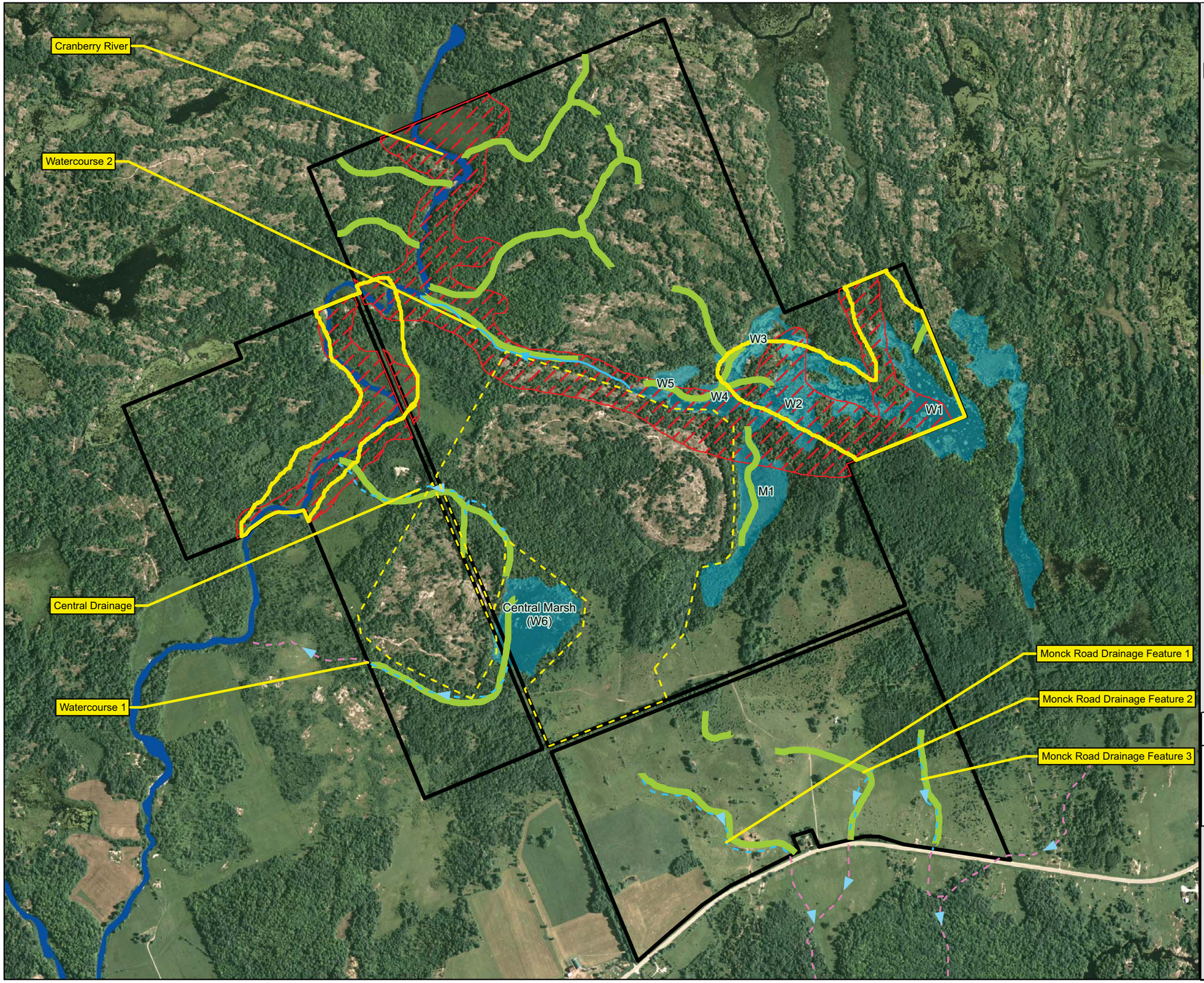
Scale	RS Project No.	Date Last Updated	By
1:11,500	2009-12	Apr 18, 2011	RW

0 200 400 Metres

RiverStone Environmental Solutions Inc.

Figure 6. Features and functions of conservation interest and recommended protection measures.
Prepared for: Giofam Investments Inc.

Note: this figure should not be used in place of a professional survey. Colour Orthophotograph - Summer 2009 (Forest Resource Inventory; FRI). Source: Land Information Ontario.



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N

Planning Boundaries

- Subject Property (Owned by Giofam Investments Inc.)
- The Site - Proposed License Boundary

Biophysical Features and Functions - RiverStone

- Primary Wetlands
- Watercourses (permanent flow) Delineated by aerial photography and ground-truthed
- Watercourses (intermittent flow) Delineated by aerial photography and ground-truthed
- Watercourses (intermittent flow) Delineated by aerial photography

City of Kawartha Lakes Official Plan Schedule A-8 Land Use Designations

- Environmental Protection

County of Victoria Official Plan, Schedule 'A', March 2004 Consolidation

- Environmental Protection

Township of Dalton, Schedule 'A' Zoning By-law No. 14-922, Figure 4A, Current Zoning By-law

- Environmental Protection Zone

Colour Orthophotograph - Summer 2009 (Forest Resource Inventory; FRI). Source: Land Information Ontario.

Scale	RS Project No.	Date Last Updated	By
1:11,500	2009-12	Apr 8, 2011	LA

0 200 400 Metres

RiverStone Environmental Solutions Inc

Figure 7. Land use designations and zoning.

Prepared for: Giofam Investments Inc.

Note: this figure should not be used in place of a professional survey.

Cranberry River

Watercourse 2

W3

W5

W4

W2

W1

M1

Central Marsh
(W6)

Central Drainage

Watercourse 1

Monck Road Drainage Feature 1

Monck Road Drainage Feature 2

Monck Road Drainage Feature 3

Legend

N

Planning Boundaries

- Subject Property (Owned by Giofam Investments Inc.)
- The Site - Proposed License Boundary

Biophysical Features and Functions - RiverStone

- Primary Wetlands
- Watercourses (permanent flow) Delineated by aerial photography and ground-truthed
- Watercourses (intermittent flow) Delineated by aerial photography and ground-truthed
- Watercourses (intermittent flow) Delineated by aerial photography

Measures Recommended by RiverStone to Prevent and/or Reduce Impacts

- Specialized Barrier Fencing for Reptiles

Protective Buffers

- 15-m Buffer of Monck Rd Drainage Features
- 30-m Buffer of Watercourses
- 35-60 m Buffer

Proposed Development

- Phase 1 of Extraction; 17 ha
- Phase 2 of Extraction; 6.2 ha
- Access, Processing, and Stockpile Area; 7.1 ha
- Settling Ponds; 2.6 ha
- Approximate Footprint of Access Road - 18 m Wide (3.3 ha)

Colour Orthophotograph - Summer 2009 (Forest Resource Inventory; FRI). Source: Land Information Ontario.

Scale	RS Project No.	Date Last Updated	By
1:11,500	2011-01	Apr 15, 2011	RW

0 200 400 Metres

RIVERSTONE ENVIRONMENTAL SOLUTIONS INC

Figure 8. Concept Plan overlay.

Prepared for: Giofam Investments Inc.

Note: this figure should not be used in place of a professional survey.

Appendix 1. Email Turner to Wicks, December 7th 2006, Comments on Draft Natural Environment Report

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

From: Turner, Mike (MNR) [mailto:mike.turner@mnr.gov.on.ca]
Sent: Thursday, December 07, 2006 2:05 PM
To: Bev Wicks
Subject: RE: Giofam Sebright Quarry-Request for comments

Bev;

FINALLY!

MNR has reviewed the Natural Environment Report for proposed Giofam quarry. MNR is satisfied that natural heritage values are to be protected. No significant NH values have been formally identified on or adjacent to the development site. The City of Kawartha Lakes has not identified any significant wildlife habitat, significant woodlands or valleylands in the area. The limestone area on the southern portion of the site does have some alvar features and as such could be afforded protection as significant wildlife habitat if it were deemed Provincially Significant. A better example of this feature is protected south of proposed development site in Carden Township as the Carden ANSI, a provincially significant life science area of natural scientific interest.

As you know, if any threatened or endangered species are encountered during the development of the site, the applicant should contact MNR in order to evaluate how best to protect the species. As mentioned above no significant NH value has been identified on or adjacent to the site, but spotted turtles have been documented within the township. As well loggerhead shrike have been documented south of the proposed site. As indicated within the report no fish habitat will be affected by the development.

If you have any questions concerning this matter, please feel free to call me.

Mike

Mike Turner
MNR District Planner
Bancroft District
(705)286-5216

From: Bev Wicks [mailto:bev@mnal.ca]
Sent: Tuesday, November 14, 2006 11:20 AM
To: Turner, Mike (MNR)
Cc: tpaterson@skeltonbrumwell.ca
Subject: Giofam Sebright Quarry-Request for comments

12/7/2006

Mike,

As discussed, could MNR please provide comment on the Giofam Natural Environment Report, which was submitted in June 2006.

If you have questions or clarification of material is required, please call.

Kind Regards,

Bev Wicks Ph.D.
Aquatic Biologist
Michalski Nielsen Associates Limited
104 Kimberley Avenue, Unit #1
Bracebridge, Ontario
P1L 1Z8
P: 705.645.1413
F: 705.645.1904

Appendix 2. Email Cutmore to Paterson February 26th, 2008 Comments on the Natural Environment Level 1 and Level 2 Assessments Report (April 2008).

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

Laura Alward

From: Bev Wicks
Sent: Saturday, 02 April, 2011 11:27
To: Bev Wicks
Subject: FW: (Fwd) FW: Giofam
Attachments: Attachment information.; FILE18588.JPG; Attachment information.; Attachment information.; -; -; image001.jpg; image002.gif; -; -; -; memo to Kathy Irwin re Geofam Sebright Quarry.doc; -; -; -; memo to Kathy Irwin re Geofam Sebright Quarry.doc

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From: tpaterson@skeltonbrumwell.ca [mailto:tpaterson@skeltonbrumwell.ca]
Sent: Tuesday, February 26, 2008 2:31 PM
To: bgiordano@vicdom.com; jbalsdon@jaggerhims.com; Al Shaw
Subject: (Fwd) FW: Giofam

Hi there

Here's the response from MNR. There are comments from Kathy Irwin in the body of the message and comments from Wasyl and Dave Webster in the attachments.

Dave Webster's comments are favourable with just one matter to be addressed relative to monitoring.

Al, please review Kathy and Wasyl's comments and provide your advice as to the implications. Note that Wasyls comments are dated today, whereas Kathy's are dated yesterday. We may have to ask who's comments take precedence. Let me know what you think.

Thanks

Trudy
------- Forwarded message follows -------
Subject: **FW: Giofam**
Date sent: **Tue, 26 Feb 2008 10:40:13 -0500**
From: **"Cutmore, Paul (MNR)" <paul.cutmore@ontario.ca>**
To: **<tpaterson@skeltonbrumwell.ca>**
Copies to: **"Turner, Mike (MNR)" <mike.turner@ontario.ca>,**
"Irwin, Kathy (MNR)" <kathy.irwin@ontario.ca>,
"Webster, David (MNR)" <david.webster@ontario.ca>,
"Kor, Phil (MNR)" <phil.kor@ontario.ca>,
"Hutson, Bill (MNR)" <bill.hutson@ontario.ca>

Hi Trudy,

Attached to this e-mail and two e-mails as below, are the preliminary review comments for the Giofam Investments Inc. site in Dalton Twp. The comments involve the HG matters by Dave Webster of Ptbo. Region MNR, and the NE matters by

Kathy Irwin of Bancroft District. A copy of Wasyl Bakowsky's MNR Ecologists' comments are also provided to go in unison with Kathy's NE comments. Each discipline has a few issues that require additional work by the respective consultants. Please have the consultants contact Dave or Kathy directly if further clarification is required.

The matter of the "granite balds"to be reviewed by the MNR's Phil Kor, will be handled by me, hopefully in a field visit in the spring as soon as the snow disappears. I will report on the out come of that matter once covered.

If you have any questions on these matters please give me call at 755-3110. (705)

Paul Cutmore – Ptbo. MNR

From: Irwin, Kathy (MNR)
Sent: Monday, February 25, 2008 4:33 PM
To: Cutmore, Paul (MNR)
Subject: FW: Giofam

Paul

Further to my email below, the NER must discuss the "Rare Vegetation Communities or Specialized Wildlife Habitats" that are on the property and their significance to the surrounding landscape. As Wasyl noted there is an S2 plant species on the property that he found with just a walk-through. Consequently, I think we need a more comprehensive assessment of that alvar habitat and some discussion as to it's significance on the landscape.

As well, I would highly recommend that we involve Phil Kor as a qualified earth science specialist. He needs to conduct a site visit to determine whether this site is significant in terms of earth science characteristics (granitic balds).

David Webster's comments address my concerns over any impacts that may occur to the wetlands on the property.

Hope this clears-up any loose ends for now.

Kathy Irwin
District Planning and Habitat Biologist
Bancroft District
106 Monck St.
Bancroft, ON K0L 1C0

Phone: 613 332 3940 ext 234
Fax: 613 332 0608
email: kathy.irwin@ontario.ca

From: Cutmore, Paul (MNR)
Sent: Thursday, August 16, 2007 9:26 AM
To: Irwin, Kathy (MNR)
Cc: Ewing, Vince (MNR); Turner, Mike (MNR); Webster, David (MNR); Bakowsky, Wasyl (MNR)
Subject: RE: Giofam

Hi Kathy,

Thanks for reviewing the Giofam NER. I received a call yesterday from Trudy Patterson of Skelton Brumwell to set up a pre-consultation meeting for the main application process. We have had one meeting on this application, the pre-consultation for the NER about 11/2 years ago. The NER seems complete except for the Alvar issue. I would propose a

field meeting with Wasyl, yourself and etc. to go over the report and the alvar. Dave Webster gave a preliminary review with the HG report and Dave seems fine with the drilling layout, but hasn't gone over in detail. The HG is done by Jagger-Hims which is usually one of the more competent reports.

I would favour that Wasyl examine the site before our general meeting. I know that we are past the peak alvar season and it is very dry on the alvar plains. Vegetation will be next to non-existent.

Trudy has proposed the second week of Sept. for the meeting. I will try to setup two meetings, the field and the office meeting. I will need dates when everyone can attend and I'll try to include Dave on the field trip as this is a below water application.

Please provide available dates for the two meetings hopefully in the next month.

Thank you,

Paul Cutmore - 705-755-3110

From: Irwin, Kathy (MNR)
Sent: Wednesday, August 15, 2007 4:17 PM
To: Cutmore, Paul (MNR)
Cc: Ewing, Vince (MNR); Turner, Mike (MNR)
Subject: Giofam

Paul

I've reviewed the June 13, 2006 NER for Giofam. I notice that Mike Turner has already made MNR comment to Bev Wicks of MNA back in December 2006. My only comment on the NER is that in the Wildlife Habitat section they don't discuss the "Rare Vegetation Communities or Specialized Wildlife Habitats" likelihood on the property. They do indicate that there is alvar type communities in their ELC community Units but they don't indicate whether they are rare on the landscape or not. Since this property is in Dalton, I would be concerned that the alvar type community may be a rare alvar in the area? I am certainly not an alvar expert but the red flags go up in my mind when alvars are mentioned. Perhaps during the next go around, they might discuss the alvar community in relation to rare vegetation communities and compare it to the other alvars in the area.

Kathy Irwin
District Planning and Habitat Biologist
Bancroft District
106 Monck St.
Bancroft, ON K0L 1C0

Phone: 613 332 3940 ext 234
Fax: 613 332 0608
email: kathy.irwin@ontario.ca

------- End of forwarded message -------
Trudy P. Paterson, CET, MCIP, RPP
Senior Planner
Skelton, Brumwell & Associates Inc.

93 Bell Farm Rd., Suite 107, Barrie, ON L4M 5G1
Tel: 705-726-1141 Fax: 705-726-0331
tpaterson@skeltonbrumwell.ca

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Ontario Ministry of Natural Resources

Memo

To: Kathy Irwin

From: Wasyl Bakowsky

CC: Paul Cutmore

Date: February 26, 2008

Re: Geofam Sebright Quarry Natural Heritage Values

Dear Kathy

This memo serves as a summary of my assessment of the vegetation and other natural heritage values found on the two granitic balds on the proposed Geofam Sebright quarry, during our site visit on October 26, 2007.

The granitic balds are outliers of the Precambrian shield which occurs just to the north of the site, and are immediately surrounded by calcareous limestone plains. They are an inspiring sight to my eye, arising from the flat surrounding landscape.

The open Red Oak treed rock barren vegetation developed on it is typical of that found along the southern margin of the Precambrian shield on sites with shallow soils and areas of exposed bedrock.. The quality of the vegetation is somewhat degraded, due to grazing by cattle, which disturbs the shallow soils, and brings in weedy species.

I did find a provincially rare species at a number of locations on the eastern bald, Secund Rush (*Juncus secundus*). This species is currently ranked as S2, which means there are between 6 to 20 occurrences in the province. However, this species is similar in appearance to the common and widespread Dudley's Rush (*Juncus dudleyi*), and is likely overlooked by many botanists. Fieldworkers conducting surveys of alvars in Ontario over the past decade have found numerous new occurrences for this species. Consequently, it is likely that it will be re-ranked to S3, which means that it occurs at between 21 to 100 locations.

This species has not been reviewed by COSSARO or COSEWIC, nor will it, given our better understanding of it's numbers and occurrences in the province, so it is not a Species at Risk, nor a candidate.

I do not consider the vegetation on the site to be provincially significant, in terms of the quality and representation of the vegetation. It may have significance as an earth science feature, but this would need review and assessment by a qualified earth science specialist.

Wasyl Bakowsky

Appendix 3. The Curriculum Vitae for the Primary Investigators.

RIVERSTONE
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Beverly 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
	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
1990 – 1992	Ontario Ministry of Natural Resources, Muskoka Lakes Fisheries Assessment Unit
1989 – 1994	Honours B.Sc. (Agr.) University of Guelph, Guelph, ON
1993	Fisheries Technician, Trout Unlimited/Ontario Ministry of Natural Resources

Professional Experience

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

Ecological Site Assessments & Environmental Impact Studies/Statements

- 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 avoidance of habitat protected 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*
- Environmental Impact Study for island property (Georgian Bay) 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
- Site Evaluation Report for property on Big Island (Georgian Bay) 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 single-lot severance

- Ecological Site and Impact Assessment on Kyle Island (Georgian Bay) 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 (Lake Muskoka) 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 Impact Statement for property on Harris Lake in the **Township of The Archipelago**; *for Township of The Archipelago*; **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
- Environmental Impact Statement for property on Georgian Bay in the **Township of The Archipelago**; *for Township of The Archipelago*; **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
- Environmental Impact Study for property on Rathlyn Island (Georgian Bay) 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
- Environmental Impact Study for property on Middle Muldrew Lake 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 single-lot severance
- Site Evaluation Report for property in the **Town of Huntsville**; *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 development and application for zoning by-law amendment
- Environmental Impact Statement for property on the Oro Moraine in the **Township of Oro-Medonte**; *for private client*; **Key Tasks**: identification of significant natural heritage features, assessment of policy compliance, analysis of impacts potentially resulting from proposed severance

Environmental Assessments

- 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 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
- Fish Habitat Assessment on Rebecca Lake, in the **Township of Lake of Bays**; *for private client*; **Key Tasks**: project management, fish habitat assessment, assessment of policy compliance, and impact analysis, development of mitigation plan to facilitate shoreline development
- Fish Habitat Assessment on Joe River, in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: project management, fish habitat assessment, assessment of policy compliance, and impact analysis, development of mitigation plan to facilitate shoreline development
- 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

- 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 restoration on Buck Lake, in the **Township of Seguin**; *for private client*; **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 Behemoth 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

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

2006 Fisheries Assessment and Fisheries Contract Specialist, as per Ministry of Transportation / Department of Fisheries and Oceans / Ontario Ministry of Natural Resources, fisheries protocol training

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

2001 Electrofishing Certification – British Columbia

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.

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(4) 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.

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.

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

ROB WILLSON, M.Sc., B.Sc.
Senior Terrestrial Ecologist and Species at Risk Specialist / Principal

CAREER AND ACADEMIC HISTORY

2008 – Present	**Senior Terrestrial Ecologist and Species at Risk (SAR) Specialist / Principal, RiverStone Environmental Solutions Inc.**
2007 – 2008	Terrestrial Ecologist/Species at Risk Specialist, Michalski Nielsen Associates Limited, Bracebridge, ON
2002 – 2007	Private Ecological Consultant
2000 – 2002	Director of Research – The Wilds of Pelee Island, Outdoor Centre for Conservation, Pelee Island, ON
1997 – 1999	M.Sc., University of Guelph, Department of Zoology, Guelph, ON
1997 – 1999	Teaching Assistant, Ornithology, Animal Behaviour, University of Guelph, Guelph, ON
1992 – 1996	B.Sc., University of Guelph, Pure and Applied Ecology, 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

- Development of 17(2)(c) Permit under the *Endangered Species Act, 2007* for proposed quarry in the **City of Kawartha Lakes (Sebright)**; *for private client;* **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 and Whip-poor-will, and Eastern Hog-nosed Snake
- SAR Assessment for access road across crown land in the **Township of Georgian Bay**; *for the Town of MacTier*; **Key Tasks**: identification of SAR habitat and significant natural heritage features; analysis of impacts potentially resulting from road proposed to access municipally owned pit; development of mitigation plan to demonstrate avoidance of habitat; development of Agreement 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**: 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*
- Assessment of habitat potential for Whip-poor-will and Eastern Hog-nosed Snake to assess concerns under the *Endangered Species Act, 2007* in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: conduct nocturnal surveys for Whip-poor-will; conduct habitat assessment for Eastern Hog-nosed Snake; submit recommendations to client for approval by MNR; approved October 2010

- Site Evaluation Report for property on the Severn River in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: identification of SAR habitat and significant natural heritage features; analysis of impacts potentially resulting from proposed single-lot severance
- SAR and Significant Natural Heritage Feature Assessment for the **Town of Bracebridge** Official Plan Review; *for the Town of Bracebridge*; **Key Tasks**: review existing SAR and significant natural heritage feature information in urban and near urban area for Town of Bracebridge
- Environmental Impact Statement for property on Harris Lake in the **Township of The Archipelago**; *for the 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 on Georgian Bay in the **Township of The Archipelago**; *for the 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**: identification of SAR habitat and terrestrial fauna assessment; impact analysis and development of mitigation plan to facilitate 26-lot plan of subdivision
- Natural Environment Level 1 and Level 2 Technical Report in the **Town of Bracebridge**; *for private client*; **Key Tasks**: identification of SAR habitat and significant natural heritage features; terrestrial fauna assessment, ELC, impact analysis; development of mitigation plan to facilitate licensing of pit under *Aggregate Resources Act* and avoidance of habitat protected under *Endangered Species Act, 2007*
- SAR Assessment for property in Humphrey, the **Township of Seguin**; *for private client*; **Key Tasks**: identification of SAR habitat and significant natural heritage features, analysis of impacts potentially resulting from proposed development
- Habitat-use assessment for Massasauga on **Rathlyn Island (Georgian Bay)**; *for private client*; **Key Tasks**: two-year study of potential Massasauga gestation sites to evaluate use of these habitats, as per the requirements set out in Guidelines for the Massasauga by the species recovery team
- Environmental Impact Statement for property in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: identification of SAR habitat, terrestrial fauna, ELC, impact analysis, development of mitigation plan to facilitate multi-unit condominium unit
- Environmental Impact Study for property on Middle Muldrew Lake in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: identification of SAR habitat, analysis of impacts potentially resulting from proposed Zoning By-law amendment to reduce setbacks on a single lot
- Site Evaluation Report for property in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: identification of SAR habitat and significant natural heritage features, analysis of impacts resulting from development on an undersized lot
- Assessment of SAR Habitat (Eastern Foxsnake) on island in Georgian Bay in the **Township of The Archipelago**; *for Private Client*; **Key Tasks**: identification of Eastern Foxsnake habitat on small island, development of mitigation and site plan to facilitate removal of "no building" condition by MNR

Species at Risk Habitat Modeling

- Identification of Massasauga Habitat and Assessment Of Habitat Quality (2009), in **Carling, Archipelago, and Seguin Townships**; *for Ontario Ministry of Natural Resources, Parry Sound Office*; **Key Tasks**: evaluation of potential for rock barren and wetland communities to function as habitat for Massasauga based on size, orientation, and proximity to other key habitats, evaluation based on 2004 orthophoto interpretation

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 **Orillia**; *for the 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

Research-focused Experience

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

May 06–Nov 06 — **Evaluation and Validation** of Eastern Foxsnake and Eastern Hog-nosed Snake observation records in the Natural Heritage Information Centre's database—Contract with the Eastern Foxsnake and Eastern Hog-nosed Snake Recovery Team

- Evaluated spatial accuracy and reliability of observation records for spatial analysis and habitat modelling using ArcGIS 9 and knowledge of species' distribution and habitat requirements
- Evaluated the data's potential to identify Significant Habitat and Critical Habitat

Jun 02–Oct 05 — **Radiotelemetry, mark-recapture, and road mortality study of Eastern Massasauga rattlesnake and Eastern Hog-nosed Snake populations along Hwy 400**—Ministry of Natural Resources; Species at Risk Technician (4 field seasons; Parry Sound Office)

- Radiotracked ≈ 60 eastern massasaugas and eastern hog-nosed snakes over four years
- Assessed road mortality along newly constructed section of highway using road surveys, culvert monitoring via infrared cameras, and drift fence trapping
- Conducted site inspections at several locations within the Georgian Bay region for presence of Species at Risk: Massasauga, Hog-nosed Snake, Eastern Foxsnake, Five-lined Skink, Spotted Turtle, Blanding's Turtle, and Eastern Musk Turtle

Dec 03–Jan 04 — **GIS Spatial evaluation and presentation of the Endangered Blue Racer snake radiotelemetry and mark-recapture data**—preparation for Ontario Municipal Board hearing (OMNR contract; Aylmer District)

- Evaluated and prepared 3 years of radiotracking data and 4 years of mark-recapture data for OMB hearing preparations

Jan 01–Jun 01 — **Data Evaluation, Literature Compendium, and Species Reporting** set-up for Species at Risk in Georgian Bay; the Georgian Bay Reptile Awareness Program (OMNR Contract, Parry Sound Office)

Sep 00–Jun 02 — **Wilds of Pelee Island, Outdoor Centre for Conservation—Director of Research**

- Organized research and restoration projects for multiple species at risk
- Restored degraded habitats via artificial microhabitat creation for egg-laying snakes and seed collection of rare prairie flora for future plantings

Apr 00–Sept 02 **Endangered Blue Racer Snake - Spring Survey** (**OMNR Contract**, Chatham Office) – **Project Leader**

- Organized research team of 8 biologists to conduct a systematic survey to determine the distribution and abundance of the endangered blue racer snake on Pelee Island; all snake species were recorded
- Field work – captured blue racers and eastern foxsnakes and marked individuals with passive integrated transponders continuing long term mark-recapture study
- Data incorporated into mark-recapture and GIS databases
- Synthesis – yearly final reports incorporating collected and historical data

Feb 00 **Pelee Island Spatial Database** (WWF Canada c/o Pelee Island Conservation Plan) – Contracted Technician

- Georeferenced property boundary maps incorporating them into GIS database (ArcView 3.1)

Nov 99 **Pelee Island Spatial Database** (WWF Canada c/o B. D. Porchuk's Pelee Island Conservation Plan) – Contracted Technician

- Georeferenced 1994 aerial photos (1:10000) incorporating them into GIS database (ArcView 3.1)

March 98 – Sept 00 **M.Sc. Dept. of Zoology -** investigated the reproductive ecology of the Eastern Foxsnake on Pelee Island

- surgically implanted and removed radiotransmitters into/from female eastern foxsnakes to investigate reproductive ecology; primarily thermoregulation and nesting behaviour
- investigated the utility of artificially created nest sites by monitoring incubation temperatures and nesting success
- accurately mapped snake locations (radiotelemetry and GPS) and habitat features incorporating them into a spatial database (ArcView 3.1)

June 94 – Sept 97 **Eastern Massasauga Rattlesnake Research in Killbear Provincial Park**—Field Technician

- assisted M.Sc. student during 4 field seasons; radiotracked >30 eastern massasaugas over 3-year period
- Quantified habitat use and movement using GPS and ArcView
- Communicated research results to members of the public and fellow staff through educational displays, newsletter articles, on-the-spot interpretation, and Natural Heritage Education programs

Relevant Certification or Training Courses

2009 Ecological Land Classification, Ontario Ministry of Natural Resources

2008 Ontario Wetland Evaluation System (OWES) certification, Ontario Ministry of Natural Resources

Reports and Articles

Rouse, J.D., Willson, R.J., Black, R., and Brooks, R.J. 2010. Movement and spatial dispersion of *Sistrurus catenatus* and *Heterodon platirhinos*: Implications for interactions with roads. Copeia. *In Press*.

Willson, R.J., 2008. Update COSEWIC status report on the Eastern Foxsnake, *Elaphe gloydi*, in Canada, in COSEWIC assessment and update status report on the Eastern Foxsnake, *Elaphe gloydi*, in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa.

Willson, R.J., Brooks, R.J., 2006. Thermal biology of reproduction in female Eastern Foxsnakes (*Elaphe gloydi*). Journal of Herpetology 40, 285-289.

Willson, R.J., 2003. Invasive procedures protocol for snakes. Snake and Lizard Advisory Group (SLAG), Unpublished report for the Ontario Ministry of Natural Resources.

Willson, R. J. 2002. A systematic search for the blue racer (*Coluber constrictor foxii*) on Pelee Island (2000–2002): Final Report. Unpublished report for the Ontario Ministry of Natural Resources.

Willson, R. J., Rouse, J. D. 2002. Update COSEWIC status report on the blue racer *Coluber constrictor foxii* in Canada, in COSEWIC assessment and update status report on the blue racer (*Coluber constrictor foxii*) in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa.

Rouse, J.D., Willson, R.J., 2002. Update COSEWIC status report on the massasauga *Sistrurus catenatus* in Canada, in COSEWIC assessment and update status report on the massasauga *Sistrurus catenatus* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa.

Willson, R.J. 2000. A systematic search for the blue racer snake (*Coluber constrictor foxii*) on Pelee Island. Unpublished report for the Ontario Ministry of Natural Resources.

Willson, R.J. 2000. The thermal ecology of gravidity in eastern fox snakes (*Elaphe gloydi*). M.Sc. Thesis, University of Guelph, Guelph, Ontario.

Willson, R.J., Porchuk, B.D., and Brooks, R. J. 2000. The dangers of living on Pelee Island: a survey of snake road mortality. Unpublished Report.

Rouse, J.D., Willson, R.J. 1999. Status of the northern water snake (*Nerodia sipedon sipedon*) in Canada. Status Report. COSEWIC. 24 pp.

Willson, R.J., Prior, K.A. 1998. Status of the eastern fox snake (*Elaphe vulpina gloydi*) in Canada. Status Report. COSEWIC. 35 pp.

Willson, R.J., Brooks, R.J. 1996. Thermoregulation in free-ranging eastern massasauga rattlesnakes (*Sistrurus catenatus catenatus*). Honours Thesis, University of Guelph.

Willson, R. J. 1995. A two-year (1993,1994) survey of roadkills on Pelee Island. In B. D. Porchuk and R. J. Brooks (eds.), Conservation and Biology of The Endangered Blue Racer Snake (*Coluber constrictor foxii*) on Pelee Island, pp. 21-30. Progress report for the Ontario Ministry of Natural Resources.

DAVID G. CUNNINGHAM, Hon. B.Sc.
Senior Ecologist/Principal

EDUCATION

- Honours Bachelor of Science, Environmental Sciences (1978)
  York University, Toronto, Ontario

MEMBERSHIPS

- The Field Botanists of Ontario
- The Canadian Society of Environmental Biologists
- Federation of Ontario Naturalists
- Ontario Field Ornithologists

CERTIFICATIONS

- Certification for Ontario Ministry of Natural Resources Wetland Evaluation System (Southern and Northern Ontario). Third Edition. March 1993
- Ontario Ministry of Natural Resources Environmental Impact Study (EIS) Training Sessions
- Professional Association of Diving Instructors (PADI) - 1980 Certification
- MNR Ecological Land Classification Certification (2009)

AREAS OF PROFESSIONAL EXPERIENCE

General

Mr. Cunningham has 32 years experience in the natural environment profession, which includes 27 years as an environmental consultant. He specializes in environmental evaluations and impact assessments related primarily to natural resources, with expertise in vegetation, wildlife, and wetlands. David has managed and/or participated in over 800 projects dealing with natural environmental features and issues, including their significance and sensitivity. He has managed multi-disciplinary studies pertaining to the identification and evaluation of terrestrial, aquatic and wetland resources, from both a watershed and subwatershed perspective. These types of studies have included the formulation of natural environmental standards, targets and policies for natural heritage systems.

Mr. Cunningham regularly identifies and assesses the impacts of various development proposals on existing terrestrial and wetland resources. Development proposals have included infrastructures such as water and sewer pipelines, roads, sewage treatment plants, storm water management facilities, and landfills. Other projects have included airports, parkland, golf courses, subdivisions, pits and quarries, transportation corridors, coal-fired electric and small-head hydroelectric facilities including transmission line route selection. Many of these projects have been completed under Federal and Provincial Environmental Assessment statutes, the ***"Provincial Policy Statement"***, regional/municipal/ township/town Official Plans, Secondary Plans and other acts.

David has participated in watershed, subwatershed and master drainage studies throughout Ontario. In these studies he was responsible for the collection and review of natural environment background information, undertaking site inventories and evaluations, as well as liaising with resource management agencies to ascertain and address their policy and program issues.

Mr. Cunningham has been qualified as an expert witness for development applications before the Ontario Municipal Board (OMB). He has also prepared evidence and participated in mediation sessions before the: OMB; Ontario Mining & Lands Division Committee; Regional, Municipal and Township Councils; and Federal Court (Criminal Division).

Terrestrial Vegetation and Wildlife Studies

David has extensive experience in vegetation evaluations including species inventories, vegetation community and Ecological Land Classification (ELC) protocol, classification and mapping, evaluations and monitoring. Inventories and after-construction monitoring programs have been undertaken using a variety of mapping, qualitative, and quantitative sampling techniques. The determination of species habitat and utilization, and species rarity or significance was a critical component of most studies. He has managed and participated in the identification and evaluation of Environmentally Significant/Sensitive Areas (ESAs) as a part of watershed greenland strategies, Secondary Plans, Master Drainage Plans (MDPs) and Master Environmental Servicing Plans (MESPs).

David has also worked extensively on wildlife studies including habitat evaluations and management plans, population assessments and impact mitigation from adjacent land uses. He has managed projects dealing with the inventory and control of nuisance animals, particularly bird and mammal species in the vicinity of waterfront parks, airports and construction sites. Wildlife habitat evaluation and management projects have included mapping, as well as the identification and assessment of movement corridors and habitat linkages. These projects were conducted using standard small mammal trapping and tagging techniques, bird banding, and provincial breeding bird survey methodologies. David was a volunteer participant in the Ontario Breeding Bird Atlas (OBBA) having participated in the atlas project of 1981-1985, as well as 2001-2005.

Wetland Studies

Mr. Cunningham has participated in over 100 wetland evaluations and re-evaluations throughout Ontario using the standard Canadian Federal and the Ontario Provincial Evaluation System for Wetlands - Southern Ontario and Northern Ontario (OWES). He has managed and prepared Environmental Impact Studies (EIS) for various development proposals on adjacent wetland features, attributes and functions. Developments involving wetland issues have included housing, roads, utility corridors, storm water facilities, landfills, golf courses and aggregate extraction.

Mr. Cunningham has formulated and provided mitigation measures and recommendations, site selection and compensation criteria, and restoration/rehabilitation/enhancement management plans as solutions for development proposals in and adjacent to wetlands and shoreline features, within the context of both the Federal and Provincial wetland policies. He has been involved in the research and testing of wetland buffers, including enhancement/restoration planting plans within buffers adjacent to various wetland features. He has worked extensively with the OMNR, Parks Canada, Conservation Authorities and the Trent-Severn Waterway on wetland and shoreline issues and is a certified wetland evaluator under the OMNR 1st, 2nd and 3rd editions of the OWES for both Southern and Northern Ontario.

Woodlot Studies

David has experience in evaluating woodlot ecosystems in relation to other identified natural resources. These evaluations have included the integration of information on woodlot ecology, soils, surface drainage, vascular flora and wildlife. Woodlot assessment projects have included the use of quantitative sampling techniques (tree tagging) to determine species dominance, age, height, health and community structure. Some of these projects involved the ranking of wooded areas and individual trees for preservation or integration into proposed developments and natural greenland systems, with appropriate buffer restoration/enhancement naturalization planting. He has participated in the preparation of Managed Forest Plans using the Managed Forest Tax Incentive Program (MFTIP) guidelines in conjunction with forest plan approvers, and the Conservation Land Tax Incentive Program (CLTIP).

Aquatic Studies

Mr. Cunningham has participated in studies which have focused on aquatic and fish habitat evaluations and has assessed the impacts of dredged sediment disposal, hydroelectric facilities, sewage disposal and water supply facilities on fish habitat and water quality. He has prepared plans and drawings, and supervised the construction of fisheries enhancement projects - FEP (riparian shoreline restoration, fencing, cattle watering stations, spawning shoals). Most of these projects have included the use of various fish and water quality sampling equipment such as a dissolved oxygen/temperature meter, secchi disk, Van Doren bottle, backpack electro-shocker, beach seine net, gill net, trap net, portable HACH kit, ponar, dome sampler, and depth sounder.

Federal, Provincial and Conservation Authority Statutes, Regulations & Policies

Mr. Cunningham has extensive knowledge of the statutes and regulations pertaining to species at risk for both the Federal ***"Species At Risk Act"*** (SARA) and Schedule 1-3 listed species, as well as the Province of Ontario ***"Endangered Species Act"*** and the Species At Risk in Ontario (SARO) list. He regularly reviews the updates for both lists and their applicability to data obtained for each consulting project. He is very familiar with the Ontario ***"Oak Ridges Moraine Act"*** - Oak Ridges Moraine Conservation Plan (ORMCP) having completed numerous ORM Compliance Statements and Natural Heritage Evaluations (NHE). He has also dealt with environmental issues related to the Ontario ***"Greenbelt Plan"*** and Ontario regulations and development policies as mandated by Conservation Authorities.

Project and Management/Budgetary Skills

An integral part of Mr. Cunningham's experience in both the public and private sectors involves project management, particularly scheduling, budgets, and quality control. His participation in many multi-disciplinary studies has required input from stakeholders, planners, engineers, hydrologists, foresters, fisheries biologists, hydrogeologists, and legal professionals. In this regard, he has managed various groups and individuals to ensure completion of projects in a timely and cost-effective manner. The clients needs and production of quality products were always paramount to all projects.

Computer Skills

Mr. Cunningham is knowledgeable and equipped with all types of digital and computer hardware including a Canon G11 digital camera and accessories, CPU, HP colour scanner, HP colour deskjet, HP colour laser printer and fax. He is proficient in software such as Windows XP and Vista, Microsoft Word, Excel, Access, Powerpoint, CorelDraw, WordPerfect and Quattro Pro, with a working knowledge of ArcView, AutoCAD 2009 and various internet communications.

PROFESSIONAL HISTORY

Principal	
Cunningham Environmental Associates, Lindsay, Ontario	1985 to Present
Associate Ecologist	
Bird and Hale Limited, Toronto, Ontario	2000 to Present
Associate Ecologist	
Michalski Nielsen Associates Limited, Bracebridge, Ontario	1998 to 2007
Associate Ecologist	
Ecologistics Limited, Waterloo, Ontario.	1995 to 1998
Senior Ecologist	
Niblett Environmental Associates Inc., Bethany, Ontario	1990 - 1995
Terrestrial Ecologist	
Proctor & Redfern Limited, Toronto, Ontario	1984 - 1985
Resource Technician	
Ontario Ministry of Natural Resources, Maple District Office, Maple, Ontario	1984
Senior Biologist	
Seatech Investigation Services Limited, Halifax, Nova Scotia	1983
Authority Biologist	
Lake Simcoe Region Conservation Authority, Newmarket, Ontario	1982 - 1983
Biologist	
Metropolitan Toronto and Region Conservation Authority, Downsview, Ontario	1979 - 1982

* References available upon request

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

Laura Alward-Gilmour, Dipl. E.T.
Terrestrial Ecologist

CAREER AND ACADEMIC HISTORY

2009 – Present	**Terrestrial Ecologist, RiverStone Environmental Solutions Inc.**
2007 – 2008	Ecological Landscaper, Northway Gardeners Ltd., Muskoka, ON
2005 – 2006	Independent Ecological Gardening and Habitat Restoration Consultant, British Columbia and Washington State, USA
2004	Native Plant Nursery Manager, Seven Ravens Forestry, Salt Spring Island, BC
2002 – 2003	Silviculturalist, Brinkman and Associates Reforestation Ltd., ON
2001 – 2003	Diploma, Sir Sandford Fleming College, Environmental Technician, ON

PROFESSIONAL EXPERIENCE

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

Ecological Site Assessments & Environmental Impact Studies/Statements

- Natural Environment Level 1 and Level 2 Technical Report in the **Township of Lake of Bays**; *for private client*; **Key Tasks**: Ecological Land Classification, flora and fauna inventory, assist in identifying SAR habitat and significant natural heritage features, data management and graphics generation to facilitate licensing of quarry under *Aggregate Resources Act* and avoidance of habitat protected under *Endangered Species Act, 2007*
- Environmental Impact Statement for property in the **Township of Perry**; *for private client*; **Key Tasks**: Ecological Land Classification, flora and fauna inventory, identification of significant natural heritage feature, and data management to facilitate 4-lot severance and rezoning
- Site Evaluation Report for property on Drag Lake in the **Township of Dysart et al**; *for private client*; **Key Tasks**: Ecological Land Classification, flora and fauna inventory, identification of SAR habitat, significant natural heritage features, data management and graphics generation for proposed multi-lot severance
- Site Evaluation Report for property in the **Town of Huntsville**; *for private client*; **Key Tasks**: flora and fauna inventory, development of naturalization plan, significant natural heritage features, data management and graphics generation for zoning by-law amendment
- Environmental Impact Statement for property on the Magnetawan River in the **Township of Perry**; *for private client*; **Key Tasks**: Ecological Land Classification, flora and fauna inventory, identification of significant natural heritage feature, data management and graphics generation to facilitate 2-lot severance
- Site Evaluation Report for property on Taylor Island (Lake Muskoka) in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: Ecological Land Classification, flora and fauna inventory, identify SAR habitat, significant natural heritage features, data management, graphics generation for proposed single-lot severance

- Site Evaluation Report for property on the Severn River in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: Ecological Land Classification, flora and fauna inventory, identify SAR habitat, significant natural heritage features, data management and graphics generation for proposed single-lot severance
- Environmental Screening and Site Plan in the **Township of Seguin**; *for private client*; **Key Tasks**: flora and fauna inventory, identification of SAR habitat, significant natural heritage features, data management and graphics generation for re-zoning application
- Environmental Impact Statement for property on Harris Lake in the **Township of The Archipelago**; *for Township of The Archipelago*; **Key Tasks**: Ecological Land Classification, flora and fauna inventory, identify significant natural heritage feature, and data management to facilitate single-lot severance
- Environmental Impact Statement for property on Georgian Bay in the **Township of The Archipelago**; *for Township of The Archipelago*; **Key Tasks**: Ecological Land Classification, flora and fauna inventory, identification of significant natural heritage feature, data management and graphics generation to facilitate single-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 to facilitate single lot severance and zoning amendment
- Environmental Impact Statement for property in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: Ecological Land Classification, flora and fauna inventory, identification of significant natural heritage feature, and data management to facilitate 25-lot plan of subdivision
- Environmental Impact Statement for property on Driftwood Island (Lake Muskoka) in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: Ecological Land Classification, flora and fauna inventory, identify significant natural heritage feature, and data management to facilitate multi-lot plan of subdivision
- Environmental Impact Statement for property in the **Town of Huntsville**; *for private client*; **Key Tasks**: Ecological Land Classification, flora and fauna inventory, identification of significant natural heritage feature, data management and graphics generation to facilitate 26-lot plan of subdivision
- Environmental Impact Statement for property on Clearwater Lake in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: Ecological Land Classification, flora and fauna inventory, identification of significant natural heritage feature, data management and graphics generation to facilitate single lot severance

Environmental Assessments

- Class Environmental Assessment on the Severn River in the **Township of Severn** ; *for private client*; **Key Tasks:** flora and fauna inventory, identification of SAR habitat, significant natural heritage features, data management and graphics generation to facilitate the dredging of marina
- Class Environmental Assessment in the **County of Simcoe** *for Page: 2*
  CC Tatham; **Key Tasks:** flora and fauna inventory, significant natural heritage features, data management and graphics generation to facilitate road upgrades and re-alignment of County Road 43 and Wilson Drive
- Class Environmental Assessment in the **Township of Muskoka Lakes** *for Page: 2*
  CC Tatham; **Key Tasks:** flora and fauna inventory, significant natural heritage features, data management and graphics generation to facilitate road upgrades and re-alignment of Brackenrig Road
- Class Environmental Assessment in the **Township of Minden Hills** *for Page: 2*
  CC Tatham; **Key Tasks:** flora and fauna inventory, significant natural heritage features, data management and graphics generation to facilitate instalment of a water treatment facility

Water Quality Impact Assessments and Water Quality Programs

- Phase 2 Water Quality Impact Assessment on Loon Lake in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: identification of significant natural heritage features, data management 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 Loon Lake in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: identification of significant natural heritage features, data management 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**: identification of significant natural heritage features, data management and analysis of impacts and mitigation measures generation for single lot severance and development on identified over-threshold waterbody
- Phase 1 and Phase 2 Water Quality Impact Assessment on Lake Joseph in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: flora and fauna inventory, identification of significant natural heritage features, data management and analysis of impacts and mitigation measures for single lot severance and development on identified over-threshold waterbody
- Phase 1 and Phase 2 Water Quality Impact Assessment on Three Mile Lake in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: flora and fauna inventory, identification of significant natural heritage features, data management and analysis of impacts and mitigation measures for single lot severance and development on identified over-threshold waterbody
- Phase 1 and Phase 2 Water Quality Impact Assessment on Three Mile Lake in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: flora and fauna inventory, identification of significant natural heritage features, data management 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 Lake Joseph in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: identify significant natural heritage features, data management and analysis of impacts and mitigation measures for single lot severance and development on identified over-threshold waterbody
- Muskoka Lakes Association Water Quality Initiative Program in various townships of the **District of Muskoka**; *for the Muskoka Lakes Association;* **Key Tasks**: data management, technical and educational support, report development

Ecological Monitoring, Restoration and Mitigation Plans

- Environmental Monitoring for property in the **City of Kawartha Lakes**; *for private client*; **Key Tasks**: data management, conducting targeted Species at Risk radio telemetry study and habitat assessment to facilitate licensing of quarry under *Aggregate Resources Act* and avoidance of habitat protected under *Endangered Species Act, 2007*
- SAR Training Session in the **Township of Georgian Bay**; *for Town of MacTier*; **Key Tasks**: development of identification resources, conducted training session on identification of SAR and encounters protocol as per required by Agreement under *Endangered Species Act, 2007*
- Revegetation Plan on Lake of Bays in the **Town of Huntsville**; *for private client*; **Key Tasks**: assessment of site conditions, development of naturalisation plan and mitigation measures to facilitate proposed zoning amendment

- Revegetation Plan on Lake Vernon in the **Town of Huntsville**; *for private client*; **Key Tasks**: assessment of site conditions, development of naturalisation plan and mitigation measures for landowners legal dispute
- Revegetation Plan on Oudaze Lake in the **Town of Huntsville**; *for private client*; **Key Tasks**: assessment of site conditions, development of naturalisation plan and mitigation measures to facilitate proposed zoning amendment
- Habitat Restoration on Lake Joseph in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: evaluation of disturbed site, development and implementation of naturalization plan using native species
- Habitat Restoration on Lake Rosseau in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: evaluation of disturbed site, development and implementation of naturalization plan using native species
- Habitat Restoration on Lake Joseph in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: evaluation of disturbed shoreline buffer, development and implementation of naturalization plan using native species

Relevant Certification or Training Courses

2009 Ecological Land Classification, Ontario Ministry of Natural Resources

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

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

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

CAREER AND ACADEMIC HISTORY

2008 – Present	**Senior 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

Appendix 4. Licence to Collect Fish for Scientific Purposes

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

Ontario

Ministry of Natural Resources

Ministère des Richesses naturelles

Licence to Collect Fish for Scientific Purposes

Permis pour faire la collecte de poissons à des fins scientifiques

Licence No. / Nº de permis: 1016632

Local Reference No. / Nº de référence local:

Issuer Account No. / Nº de compte du délivreur de permis: 5291046

This licence is issued under Part I of the Fish Licensing Regulation made under the Fish and Wildlife Conservation Act, 1997 to:

Ce permis est délivré en vertu de la Partie I du règlement sur la délivrance de permis de pêche formulé conformément à la Loi sur la protection du poisson et de la faune de 1997 à:

	Last Name / Nom de famille	First Name / Prénom	Middle Name / Second Prénom
Name of Licencee / Nom du titulaire du permis	Mrs. Wicks	Beverley	Jean

Name of Business/Organization/Affiliation (if applicable) / Nom de l'entreprise/de l'organisme/de l'affiliation (le cas échéant)

Michalski Nielsen Associates Limited

	Street Name & No./PO Box/RR#/Gen. Del./ Nº rue/C.P./R.R./poste restante		
Mailing address of Licencee / *Adresse postale du titulaire du permis*	104 Kimberley Avenue		
	City/Town/Municipality / Ville/village/municipalité	Province/State Province/Etat	Postal Code/Zip Code Code Postal/Zip
	Gravenhurst	ON	P1L 1Z8

to collect the species, size and quantites of fish from the waters as set out below.

Pour faire la collecte des espèces suivantes (stade et nombre indiqués ci-dessous):

Species Espèces	Eggs Oeuf X	Juvenile Fretin X	Adults Adulte X	Numbers Nombre	Name of Waterbody Nom de l'étendue d'eau
all species	X	X	X		Cranberry River and tributaries

Yes/Oui ☐ Additional species/Waterbody list attached / Liste d'espèces/d'étendue d'eau additionnelles ci-jointe

Purpose of collection / *But de la collecte*: To determine the potential impacts from proposed quarry operation, and offer recommendations as to setbacks and buffer areas around the creek.

Licence Dates / *Dates du permis*	Effective Date / Date d'entrée en vigueur (YYYY-MM-DD)	Expiry Date / Date d'expiration (YYYY-MM-DD)
	2004-07-21	2004-08-15

Licence conditions: This licence is subject to the conditions contained in Schedule A if included. / Ce permis doit respecter les conditions de l'annexe A si celle-ci est jointe.

Conditions du permis: Yes/Oui ☒ No/Non ☐ Schedule A included. / Annexe A ci-jointe

Issued by (please print) Delivré par (veuillez écrire en caractères d'imprimerie)	Signature of issuer / Signature du délivreur	Date of Issue/Date de délivrance (YYYY-MM-DD)
Brian Vermeersch	Brian Vermeersch	2004-07-21
Signature of Licencee / Signature du titulaire du permis		Date (YYYY-MM-DD)
		2004-07-21

Personal information contained on this form is collected under the authority of the Fish and Wildlife Conservation Act, 1997 and will be used for the purpose of licencing, identification, enforcement, resource management and customer service surveys. Please direct further inquiries to the District Manager of the MNR issuing district.

Les renseignements personnels dans ce formulaire sont recueillis conformément à la Loi sur la protection du poisson de la faune, 1997 , et ils seront utilisés aux fins de délivrance de permis, d'identification, d'application des règlements, de gestion des ressources et de sondage sur les services à la clientèle. Veuillez communiquer avec le chef du district du MRN qui délivre le permis si vous avez des questions.

FW0032 (04/00)

Licence to Collect Fish for Scientific Purposes
Permis pour faire la collecte de poissons à des fins scientifiques
Schedule A - Licence Conditions
Annexe A - Conditions du permis

Licence No.
No de permis 1016632

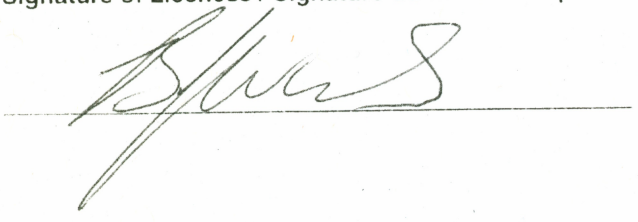
This licence is subject to the conditions listed below.

1. This Licence is valid only for the persons, species, numbers, areas and calendar year indicated. A written report covering the operation of the preceding year must be submitted to the licence issuer within 30 days of the termination date, but in no case later than January 31 next following the year of issue. The report shall contain a statement outlining the objectives of the operations, the methods used, the number and species of fish caught and their fate as well as a map indicating where the collections took place. An analysis is not required. The submission of a satisfactory report is a prerequisite to any subsequent renewals.
2. Before carrying out any operation under the licence in any area the licenced person shall inform the Area Supervisor or Lake Manager of his or her intentions at least a week before commencing work and include information as to the type of operation, location, duration, and the name or names of personnel involved.
3. A copy of the original licence must be carried by the licenced person when working at the designated sites. An assistant of the licenced person who is carrying out activities under this licence during the absence of the licenced person shall carry a copy of the licence on his or her person.
4. All collection gear shall be clearly marked with the licenced person's and the organization's name.
5. This licence is not valid in Provincial Parks, park reserves, or National Parks without the written permission from the authorized person in charge of the area concerned.
6. Capture gear shall be inspected regularly and live holding traps must be inspected at least once daily.
7. This licence does not allow access to any property without permission of the landowner.
8. Names of Assistants: Ernest A. Shaw, David Cunningham, Mark Cosas, James Nairn, Gord Nielsen.
9. Gear to be Used: Electrofisher (back pack), minnow traps, seine net.

Ce permis doit se conformer aux conditions ci-dessous.

1. Ce permis n'est valide que pour les personnes, espèces, nombres, zones et année civile indiqués. Un rapport écrit portant sur les activités de l'année précédente doit être soumis au délivreur du permis dans les 30 jours suivant la date d'expiration et jamais plus tard que le 31 janvier qui suit la date de délivrance. Le rapport devra comprendre une déclaration décrivant les objectifs des activités, les méthodes utilisées, le nombre et les espèces de poissons capturés et leur destination finale ainsi qu'une carte montrant l'emplacement des collectes. Une analyse n'est pas requise. La présentation d'un rapport satisfaisant est une condition préalable pour obtenir un renouvellement de permis.
2. Avant de réaliser toute activité visée par le permis dans toute zone, le titulaire du permis doit aviser le superviseur de la zone ou le gestionnaire du lac de ses intentions au moins une semaine avant de commencer ses activités et il doit fournir des renseignements sur le type d'activité, l'emplacement, la durée et le nom de toutes les personnes impliquées.
3. Le titulaire du permis doit avoir en sa possession un exemplaire du permis original lorsqu'il travaille dans les endroits désignés. Si un adjoint du titulaire du permis réalise des activités visées par le permis en l'absence du titulaire du permis, il devra avoir un exemplaire du permis en sa possession.
4. Tout le matériel de collecte doit indiquer bien clairement le nom du titulaire du permis et de son organisme.
5. Ce permis n'est pas valide dans les parcs provinciaux, les réserves de parcs et les parcs nationaux sans la permission écrite de la personne autorisée qui est responsable de la zone en question.
6. Tout le matériel de collecte doit être inspecté régulièrement
et les viviers doivent être inspectés au moins une fois par jour.
7. Ce permis ne permet pas au titulaire d'avoir accès à une propriété privée sans la permission du propriétaire foncier.

Signature of Licencee / Signature du titulaire du permis



Date

July 28/04

Appendix 5. Summary of Field Investigations Completed in 2010 and 2011

Appendix 5. Summary of field investigations completed in 2010 and 2011.

Date	Personnel	Primary tasks	Hours on Property
2010-04-02	R. Willson; D. Wolfe	Assess potential of wetlands to function as hibernating habitat for Spotted Turtle; Reptile Search	6.25
2010-05-01	R. Willson; D. Wolfe	Turtle Search	2.5
2010-05-10	R. Willson; D. Wolfe; J Prahl	Reptile Search	3.75
2010-05-12	R. Willson; D. Wolfe; L. Alward	Turtle Search	7
2010-05-16	R. Willson	Turtle Search	6.5
2010-05-17	R. Willson; D. Wolfe; L. Alward	Turtle Search	8
2010-05-19	R. Willson; L. Alward; J Prahl	Turtle Search	6.5
2010-05-23	R. Willson; D. Wolfe	Turtle Search; Radiotracking turtles	7.5
2010-05-24	R. Willson; D. Wolfe	Turtle Search; Radiotracking turtles	3
2010-05-27	R. Willson; D. Wolfe	Turtle Search; Radiotracking turtles	5
2010-05-28	R. Willson; L. Alward; J Prahl	Turtle Search; Radiotracking turtles	4.75
2010-05-28	R. Willson	Turtle Search; Radiotracking turtles	4
2010-05-29	R. Willson	Whip-poor-will survey	3
2010-05-29	R. Willson; D. Wolfe	Turtle Search; Radiotracking turtles	3.75
2010-05-30	L. Alward; J Prahl	Turtle Search; Radiotracking turtles	3
2010-06-01	L. Alward; J Prahl	Turtle Search; Radiotracking turtles	3.25
2010-06-01	R. Willson; D. Wolfe	Turtle Search; Radiotracking turtles	5.5
2010-06-02	L. Alward, C.Gilmour	Turtle Search; Radiotracking turtles	
2010-06-03	L. Alward; J Prahl	Turtle Search; Radiotracking turtles	3
2010-06-05	R. Willson; D. Wolfe	Turtle Search; Radiotracking turtles	2.5
2010-06-08	R. Willson; D. Wolfe	Turtle Search; Radiotracking turtles	3.75
2010-06-10	R. Willson; Al Shaw	Turtle Search; Radiotracking turtles	2.75
2010-06-17	R. Willson; J Prahl	Radiotracking turtles and Whip-poor-will Survey	3.5
2010-06-26	R. Willson	Whip-poor-will Survey	2.75
2010-06-27	R. Willson	Whip-poor-will Survey	1.25
2010-06-28	L. Alward; J Prahl	Radiotracking turtles	4.25
2010-06-30	R. Willson	Whip-poor-will Survey	3.25
2010-06-30	R. Willson	Whip-poor-will Survey	3.25
2010-07-01	R. Willson	Radiotracking turtles	4
2010-07-07	L. Alward D. McFadyen	Radiotracking turtles	7.25
2010-07-14	L. Alward D. Mcfayden	Radiotracking turtles	6.5
2010-07-22	L. Alward; D. McFayden	Radiotracking turtles	7.75
2010-07-25	R. Willson	Radiotracking turtles	2
2010-07-27	L. Alward; D. McFayden	Radiotracking turtles	3.25
2010-07-28	R. Willson; B. Wicks	Radiotracking turtles	2.5
2010-08-04	L. Alward; D. McFayden	Radiotracking turtles	4.5
2010-08-10	L. Alward; D. McFayden	Radiotracking turtles	5.75
2010-08-11	R. Willson; B. Wicks	Radiotracking turtles	3
2010-08-18	L. Alward; D. McFayden	Radiotracking turtles	6
2010-08-23	L. Alward; D. McFayden	Radiotracking turtles	5.5
2010-08-29	L. Alward; D. McFayden	Radiotracking turtles	4.5
2010-09-09	L. Alward; J Prahl	Radiotracking turtles	4
2010-09-15	L. Alward; J Prahl	Radiotracking turtles	5.25
2010-09-22	J Prahl; L Crown	Radiotracking turtles	5
2010-10-06	L. Alward; J Prahl	Radiotracking turtles	4.75
2010-10-14	L. Alward; J Prahl	Radiotracking turtles	2.75
2010-10-21	L. Alward, Joel	Radiotracking turtles	3.75
2010-10-28	L. Alward; J Prahl	Radiotracking turtles	3
2010-11-04	L. Alward, ; J. Gauthier	Radiotracking turtles	4.5

Date	Personnel	Primary tasks	Hours on Property
2010-11-11	L. Alward; J. Gauthier	Radiotracking turtles	5.5
2010-11-24	L. Alward; J. Gauthier	Radiotracking turtles	5
2011-01-30	R. Willson; D. Wolfe	Radiotracking turtles	4
2011-02-03	L. Alward; J Prahl	Radiotracking turtles	4.25
		Total Hours	**227.75**

Notes:

- If determining person hours on property then Hours on Property should be multiplied by the number of persons on site.

Appendix 6. Surface Sampling Stations, Water Chemistry Results, and Data from Updated Hydrogeological Evaluation (GENIVAR 2011)

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

Appendix C

Surface Water Data

- Surface Water Flow Rates – Table C-1
- Surface Water Flow Graph – Figure C-1
- General Chemical Results – Surface Water – Table C-3
- Time-Concentration Graphs – Figures C-2 to C-4
- Organic Chemical Results – Surface Water – Table C-3

FIGURE C-1
SURFACE WATER FLOW GRAPH

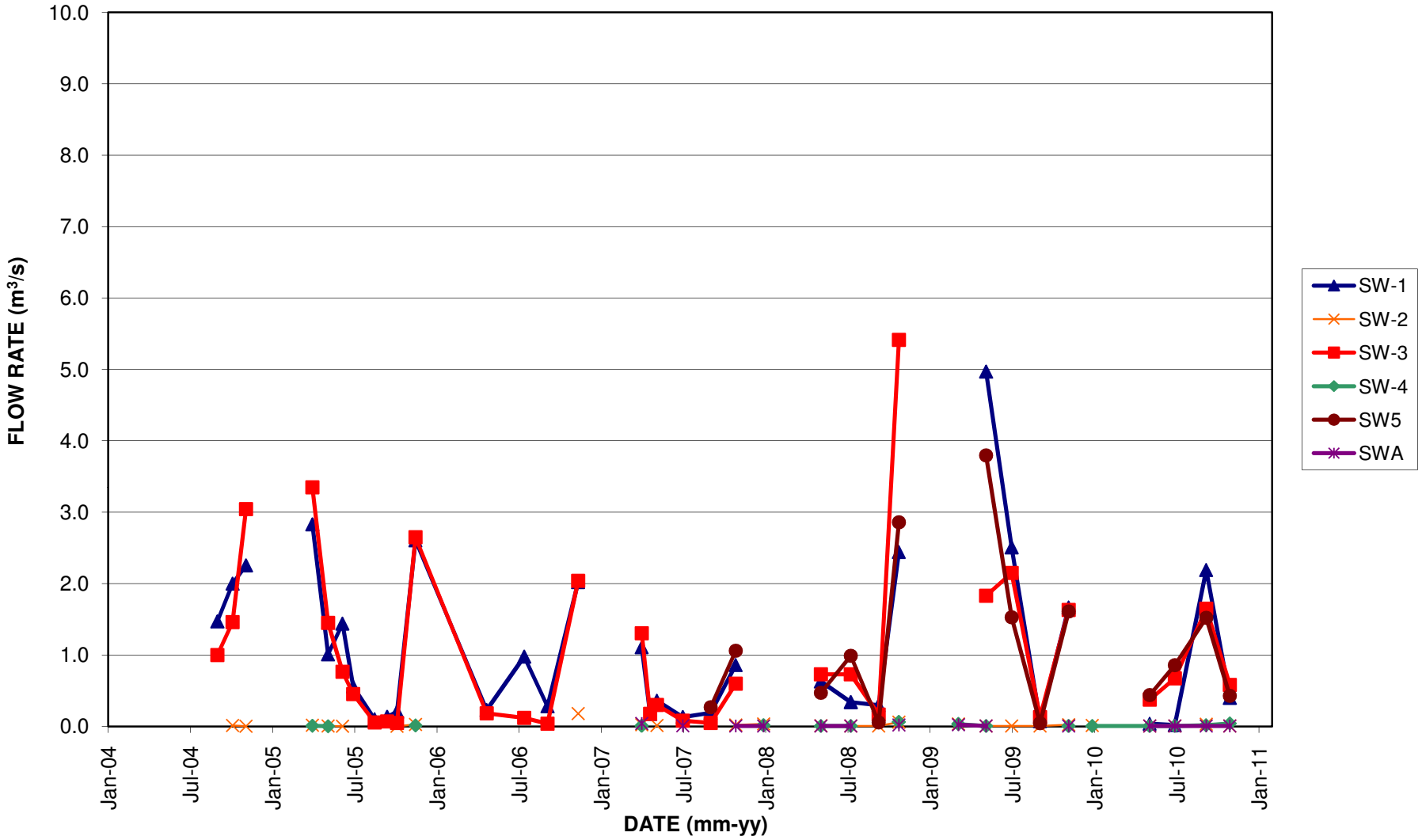


FIGURE C-2
TIME-CONCENTRATION GRAPH
CRANBERRY RIVER STATIONS SW1, SW3 and SW5

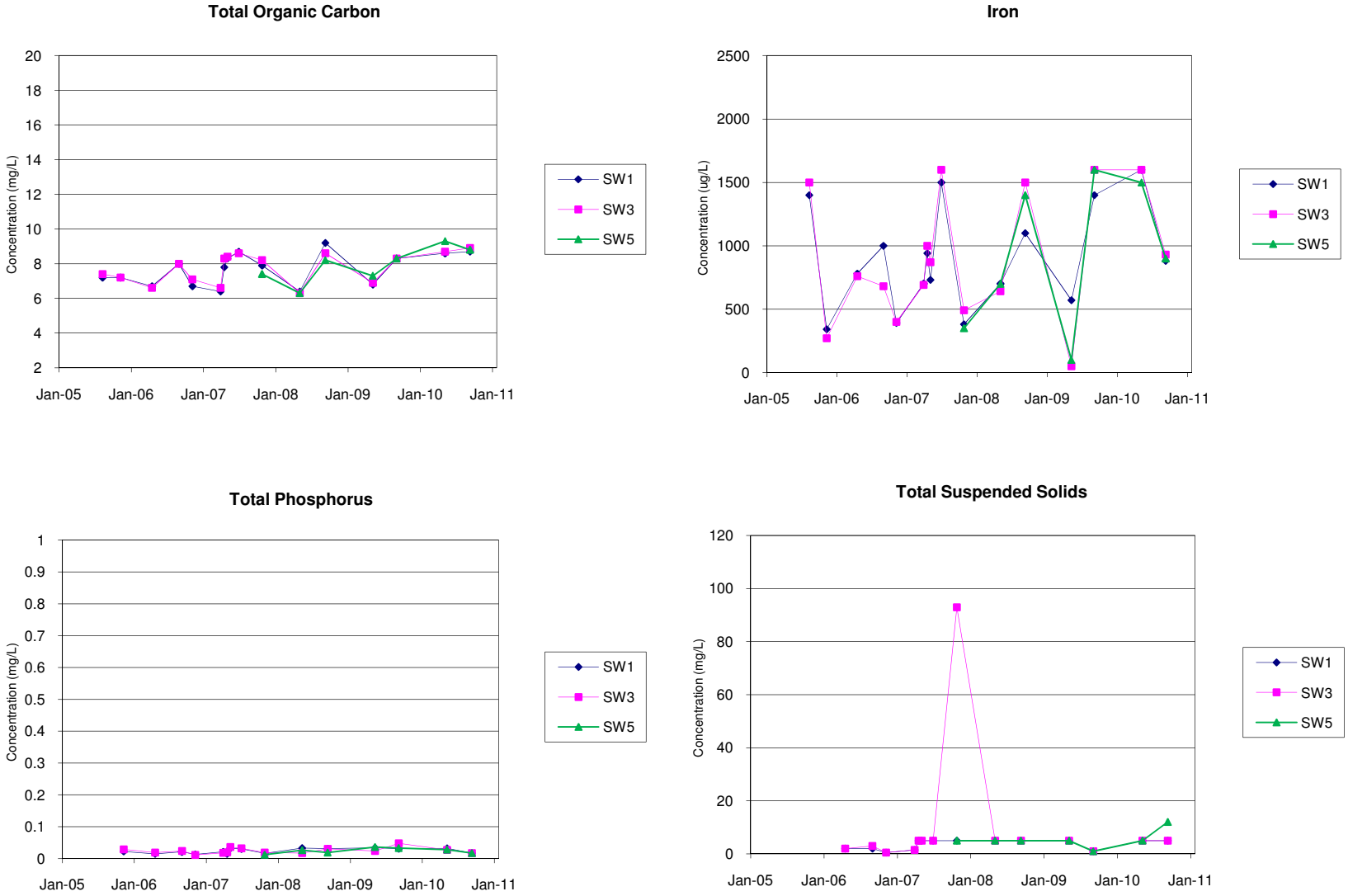


FIGURE C-3
TIME-CONCENTRATION GRAPH
WATER COURSE 1 - STATIONS SWA AND SW4

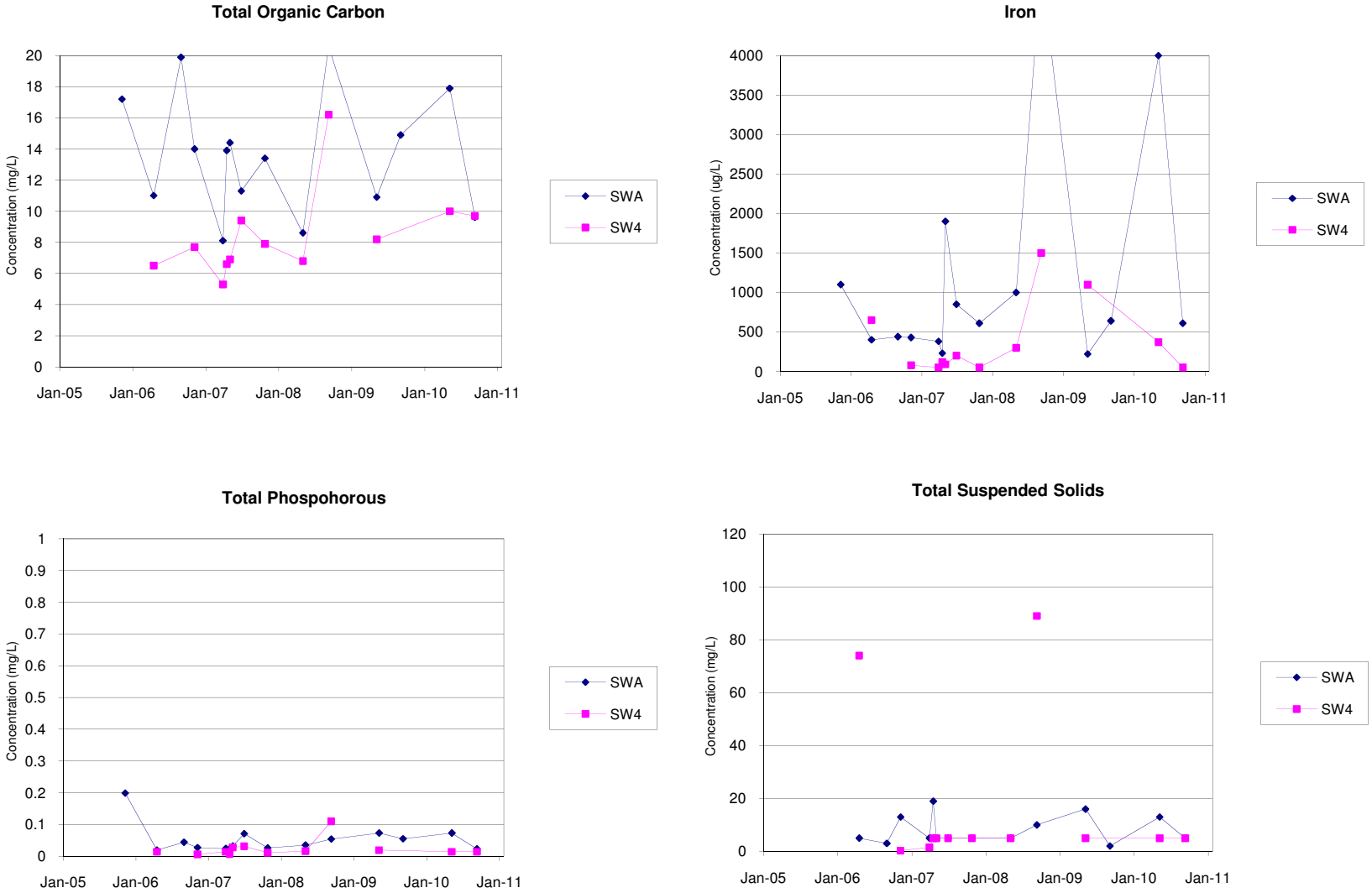


FIGURE C-4
TIME-CONCENTRATION GRAPH
WATER COURSE 2 - STATIONS SWB AND SW2

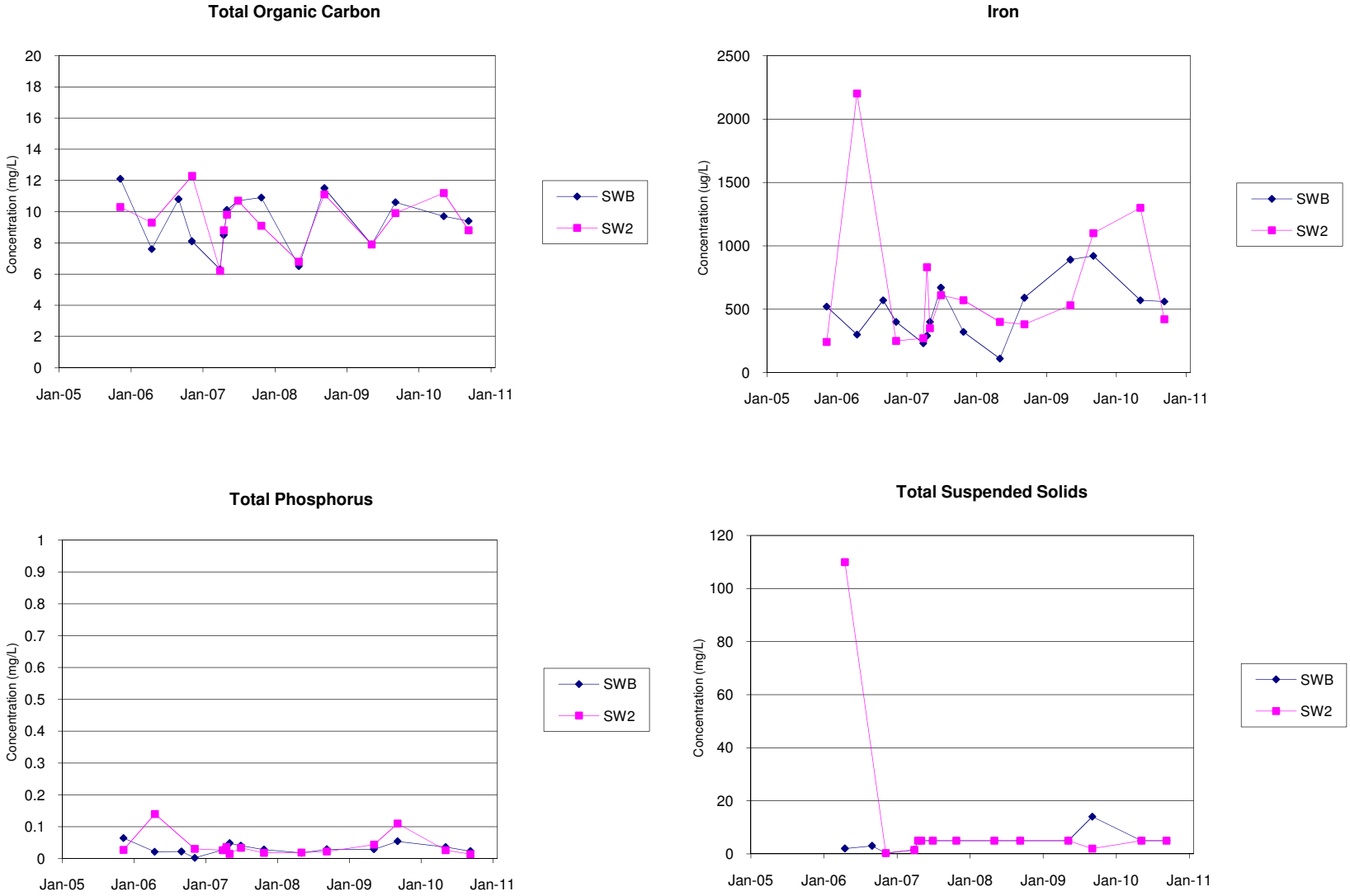


TABLE C-1
SURFACE WATER FLOW RATES
SEBRIGHT QUARRY

	FLOW RATE (m^3/s)						
DATE	**SW1**	**SW2**	**SW3**	**SW4**	**SW5**	**SWA**	**SWB**
14-Sep-04	1.47	Standing Water	1.00	Dry			
18-Oct-04	2.00	0.02	1.46	Dry			
17-Nov-04	2.26	<0.01	3.04	Standing Water			
13-Dec-04	Frozen	Frozen	Frozen	Frozen			
24-Jan-05	Frozen	Frozen	Frozen	Frozen			
17-Feb-05	Frozen	Frozen	Frozen	Frozen			
18-Mar-05	Frozen	Frozen	Frozen	Frozen			
14-Apr-05	2.83	0.02	3.35	0.01			
19-May-05	1.01	0.01	1.45	<0.01			
20-Jun-05	1.44	<0.01	0.77	Standing Water			
14-Jul-05	0.56	Standing Water	0.45	Standing Water			
31-Aug-05	0.10	Dry	0.06	Dry			
28-Sep-05	0.14	Dry	0.07	Dry			
20-Oct-05	0.21	<0.01	0.05	Dry			
30-Nov-05	2.61	0.03	2.65	0.01			
8-May-06	0.23	<0.01	0.18	<0.1		Dry	Standing Water
31-Jul-06	0.98	Dry	0.12	Dry		Dry	Standing Water
21-Sep-06	0.28	Dry	0.04	Dry		Dry	Standing Water
28-Nov-06	2.02	0.18	2.04	<0.01		<0.01	Standing Water
24-Jan-07	Frozen	Frozen	Frozen	Frozen		Frozen	Frozen
22-Mar-07	Frozen	0.16	Frozen	Frozen		Frozen	Frozen
19-Apr-07	1.11	0.03	1.30	0.01		0.04	Minimal flow
8-May-07	0.17	<0.01	0.18	<0.01		<0.01	Minimal flow
23-May-07	0.36	0.01	0.30	<0.01		<0.01	Minimal flow
20-Jul-07	0.13	<0.01	0.08	<0.01		0.01	Minimal flow
20-Sep-07	0.19	Dry	0.05	Dry	0.27	Dry	Minimal flow
15-Nov-07	0.86	0.02	0.60	<0.01	1.06	<0.01	Minimal flow
16-Jan-08	Frozen	0.03	Frozen	0.01	-	<0.01	Frozen
25-Mar-08	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen
23-May-08	0.63	0.01	0.73	<0.01	0.47	<0.01	Minimal flow
29-Jul-08	0.34	<0.01	0.73	<0.01	0.99	<0.01	Minimal flow
29-Sep-08	0.30	<0.01	0.17	Standing Water	0.05	Standing Water	Minimal flow
13-Nov-08	2.44	0.06	5.41	0.06	2.86	0.02	Minimal flow

TABLE C-1
SURFACE WATER FLOW RATES
SEBRIGHT QUARRY

	FLOW RATE (m^3/s)						
DATE	**SW1**	**SW2**	**SW3**	**SW4**	**SW5**	**SWA**	**SWB**
29-Jan-09	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen
26-Mar-09	-	0.03	Frozen	0.03	-	0.02	Frozen
27-May-09	4.97	<0.01	1.83	<0.01	3.80	<0.01	Minimal flow
23-Jul-09	2.51	<0.01	2.15	Dry	1.53	Standing Water	Minimal flow
24-Sep-09	0.07	<0.01	0.13	Dry	0.05	Standing Water	Minimal flow
27-Nov-09	1.67	0.02	1.63	<0.01	1.61	<0.01	Minimal flow
19-Jan-10	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen
22-Mar-10	-	0.02	-	<0.01	-	Standing Water	Standing Water
27-May-10	0.04	<0.01	0.38	<0.01	0.44	<0.01	Minimal flow
22-Jul-10	0.02	<0.01	0.67	<0.01	0.86	<0.01	Standing Water
30-Sep-10	2.19	0.03	1.65	0.02	1.52	<0.01	Minimal flow
22-Nov-10	0.40	<0.01	0.58	0.04	0.43	<0.01	Minimal flow

NOTES:

1) 'm^3/s' indicates cubic metres per second.

2) Surface water stations SWA and SWB were added to the monitoring program in May 2006.

3) November 2006 monitoring event completed over one week.

4) '-' indicates measurement not obtained due to cold water temperatures.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW1**									
Sampling Date			31-Aug-05	30-Nov-05	8-May-06	21-Sep-06	28-Nov-06	19-Apr-07	8-May-07	24-May-07	20-Jul-07	15-Nov-07
Temperature (field)	C		23.2	5.4	19.7	17.1	3.8	14.2	17.2	23.9	24.3	6.2
pH (field)	pH	6.5 - 8.5	7.6	**9.3**	7.2	**5.6**	**6.4**	8.2	7.4	7.3	8.2	8.3
Conductivity (field)	uS/cm		35	19	19	43	11	15	16	7	23	13
Turbidity (field)	NTU		17.0		8.2	6.0	0.8	4.3	1.4	5.4	6.9	0.7
Dissolved Oxygen (field)	mg/L									11.0		11.8
Turbidity	NTU					2.4	1.5	4.34	1.4	5.4	2.3	0.9
Total Ammonia-N	mg/L		<0.05	0.05	<0.05	0.09	0.09	0.07	<0.05	<0.05	0.07	0.1
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		28	31	27	53	23	20	26	28	32	25
Total Organic Carbon	mg/L		7.2	7.2	6.7	8	6.7	6.4	7.8	8.3	8.7	7.9
pH	pH	6.5 - 8.5	7.2	7.0	**10.0**	7.4	6.9	6.7	**6.3**	6.6	7.0	6.9
Alkalinity (Total as CaCO3)	mg/L		11.5	6	24	16	5	3	6	10	10	6
Chloride (Cl)	mg/L		<1	<1	1	2	<1	<1	<1	<1	<1	2
Nitrite (N)	mg/L		<0.3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (N)	mg/L		<0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate-P	mg/L		<1	0.011	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sulphate (SO4)	mg/L		13.5	5	3	6	3	3	3	3	3	3
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		11.5	6	10	16	5	3	6	10	10	6
Calculated TDS	mg/L		26.2								17	15
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	9	<1	<1	<1	<1	<1	<1	<1
Cation Sum	me/L		0.307									
Dissolved Hardness (CaCO3)	mg/L		14	11	10	19	7	7	9	10	13	9
Total Aluminum (Al)	ug/L	75	22	71	**84**	66	**79**	**85**	**83**	56	45	52
Total Antimony (Sb)	ug/L	20	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L		13	12	14	23	12	13	16	14	16	11
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Boron (B)	ug/L	200	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L		3900	3100	3000	5900	2300	2200	2500	3000	4100	2600
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	1 (5)	<1	**2**	<1	<1	<1	<1	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	**1400**	**340**	**780**	**1000**	**390**	**700**	**940**	**730**	**1500**	**380**
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Magnesium (Mg)	ug/L		1000	1000	820	1500	680	680	760	820	1100	760
Total Manganese (Mn)	ug/L		180	56	150	310	22	36	190	130	320	20
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Potassium (K)	ug/L		<200	440	290	510	270	330	300	<200	260	230
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Silicon (Si)	ug/L		1700	960	280	700	610	780	370	230	780	810
Total Silver (Ag)	ug/L	0.1	**<0.5**	**<0.5**	**0.3**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L		490	960	1400	1900	660	710	800	760	660	670
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	ug/L	6	<1	<1	<1	3	<1	<1	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	20	<5	5	<5	<5	<5	6	7	<5	6	<5
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Phosphorus (P)	mg/L	0.03		0.022	0.015	0.021	0.013	0.021	0.015	**0.032**	0.03	0.016
Total Suspended Solids	mg/L				2	2	<1	<3	<10	<10	<10	<10

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		PWQO	SW1						Range	Arithmetic Mean	Standard Deviation	Geometric Mean
Sampling Date			23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10				
Temperature (field)	C		16.6	17.8	16.2	18.9	24.1	15	3.8 - 24.3	16.5	6.5	14.7
pH (field)	pH	6.5 - 8.5	7.0	7.3	8.0	7.3	7.2	6.7	5.6 - 9.3	7.5	0.9	7.4
Conductivity (field)	uS/cm		8	18	18	20	42	12	7 - 43	20	11	18
Turbidity (field)	NTU		3.2	9.0	2.0	6.0	8.9	1.2	0.7 - 17.0	5.4	4.4	3.7
Dissolved Oxygen (field)	mg/L		10.2	4.0	6.8	7.0	6.1	9.6	4.0 - 11.8	8.3	2.7	7.9
Turbidity	NTU		3.19	1.3	1.4	1.4	2.6	1.2	0.9 - 5.4	2.3	1.4	2.0
Total Ammonia-N	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - 0.1	0.05	0.03	0.04
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		22	33	21	27	28	21	20 - 53	28	8	27
Total Organic Carbon	mg/L		6.4	9.2	6.8	8.3	8.6	8.7	6.4 - 9.2	7.7	0.9	7.6
pH	pH	6.5 - 8.5	6.9	7.4	6.5	6.9	7.1	6.6	6.3 - 10.0	7.1	0.8	7.0
Alkalinity (Total as CaCO3)	mg/L		6	12	5	9	8	6	3 - 24	9	5	8
Chloride (Cl)	mg/L		<1	1	<1	<1	1	<1	0.5 - 2	0.8	0.5	0.7
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <0.3			
Nitrate (N)	mg/L		<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01 - 0.2	0.06	0.04	0.05
Phosphate-P	mg/L		<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <1			
Sulphate (SO4)	mg/L		3	2	2	2	1	<1	0.5 - 13.5	4	3	3
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		6	12	5	9	8	6	3 - 16	8	3	7
Calculated TDS	mg/L		11			15			11 - 26.2	17	6	16
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1 - 9	1.0	2.1	0.6
Cation Sum	me/L											
Dissolved Hardness (CaCO3)	mg/L		7	12	7	11	10	8	7 - 19	10	3	10
Total Aluminum (Al)	ug/L	75	71	**76**	38	58	**79**	69	22 - 85	65	18	61
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <1			
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Barium (Ba)	ug/L		13	17	110	16	21	14	11 - 110	21	24	17
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <0.5			
Total Boron (B)	ug/L	200	<10	<10	15	<10	<10	<10	<10 - 15	6	3	5
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Total Calcium (Ca)	ug/L		2400	3900	16000	3500	3000	2300	2200 - 16000	3981	3342	3396
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5 - <5			
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	0.8	<0.5	0.7	<0.5	<0.5 - 0.8	0.3	0.2	0.3
Total Copper (Cu)	ug/L	1 (5)	<1	<1	<1	<1	<1	<1	<1 - 2	0.6	0.4	0.5
Total Iron (Fe)	ug/L	300	**700**	**1100**	**570**	**1400**	**1600**	**880**	340 - 1600	901	406	810
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <0.5			
Total Magnesium (Mg)	ug/L		630	1100	6500	900	800	640	630 - 6500	1231	1423	970
Total Manganese (Mn)	ug/L		94	310	98	310	400	46	20 - 400	167	126	115
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Potassium (K)	ug/L		<200	330	270	260	260	230	230 - 510	306	82	298
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2 - <2			
Total Silicon (Si)	ug/L		480	1400	370	890	460	1000	230 - 1700	739	401	642
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.5			
Total Sodium (Na)	ug/L		670	780	690	740	720	640	490 - 1900	828	347	782
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - <0.05			
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1 - 3	0.7	0.6	0.6
Total Zinc (Zn)	ug/L	20	6	5	<5	<5	<5	<5	<5 - 7	4	2	3
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Phosphorus (P)	mg/L	0.03	**0.033**	**0.031**	**0.034**	**0.031**	**0.032**	0.017	0.013 - 0.034	0.024	0.008	0.023
Total Suspended Solids	mg/L		<10	<10	<10	1	<10	<10	<1 - <10			

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW2**							
Sampling Date			30-Nov-05	8-May-06	28-Nov-06	19-Apr-07	8-May-07	24-May-07	20-Jul-07	15-Nov-07
Temperature (field)	C		5.3	19.5	5.1	13	20.5	25.6	23.2	6.4
pH (field)	pH	6.5 - 8.5	8.3	7.0	**6.4**	7.6	7.4	7.6	7.9	7.8
Conductivity (field)	uS/cm		63	81	68	35	75	86	86	81
Turbidity (field)	NTU			15.7	0.6	2.1	0.2	2.5		1.2
Dissolved Oxygen (field)	mg/L							7.9		7.3
Turbidity	NTU				0.7	2.07	0.2	2.48	2.1	1.8
Total Ammonia-N	mg/L		<0.05	<0.05	0.11	0.08	<0.05	<0.05	0.09	0.05
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		80	83	80	90	100	107	94	537
Total Organic Carbon	mg/L		10.3	9.3	12.3	6.2	8.8	9.8	10.7	9.1
pH	pH	6.5 - 8.5	7.7	8.3	7.6	7.7	7.2	7.1	7.4	**3.0**
Alkalinity (Total as CaCO3)	mg/L		32	45	36	40	45	52	43	<1
Chloride (Cl)	mg/L		1	<1	1	<1	<1	<1	<1	1
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (N)	mg/L		<0.1	<0.1	0.2	<0.1	1.3	<0.1	<0.1	<0.1
Phosphate-P	mg/L		0.015	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.02
Sulphate (SO4)	mg/L		8	3	3	5	3	3	4	135
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		32	45	36	40	45	52	43	<1
Calculated TDS	mg/L								49	156
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1	<1
Cation Sum	me/L									
Dissolved Hardness (CaCO3)	mg/L		36	43	38	41	45	52	47	47
Total Aluminum (Al)	ug/L	75	**100**	**1400**	52	46	**350**	27	35	67
Total Antimony (Sb)	ug/L	20	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L		59	96	63	89	100	91	96	78
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Boron (B)	ug/L	200	<10	<10	<10	12	<10	<10	13	10
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L		9800	11000	9500	11000	12000	13000	13000	12000
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5	<5
Total Cobalt (Co)	ug/L	0.9	<0.5	**1.3**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	1 (5)	<1	2	<1	2	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	240	**2200**	250	270	**830**	**350**	**610**	**570**
Total Lead (Pb)	ug/L	1 (3)	<0.5	1.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Magnesium (Mg)	ug/L		4100	4500	4000	4500	4900	5100	4900	5000
Total Manganese (Mn)	ug/L		10	290	8	13	110	44	89	93
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1	<1
Total Potassium (K)	ug/L		850	390	860	840	300	<200	<200	680
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	5	<2
Total Silicon (Si)	ug/L		1900	1600	1500	660	370	310	1400	1100
Total Silver (Ag)	ug/L	0.1	**<0.5**	**0.3**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L		1200	980	990	1100	970	740	650	1400
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1	<1
Total Uranium (U)	ug/L	5	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	ug/L	6	<1	4	<1	<1	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	20	8	12	9	6	7	<5	8	<5
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1	<1
Total Phosphorus (P)	mg/L	0.03	0.027	**0.14**	0.03	0.026	**0.036**	0.015	**0.034**	0.018
Total Suspended Solids	mg/L			110	<0.5	<3	<10	<10	<10	<10

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		PWQO	SW2						Range	Arithmetic Mean	Standard Deviation	Geometric Mean
Sampling Date			23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10				
Temperature (field)	C		17.4	13.8	15.1	15.7	27.2	16.6	5.1 - 27.2	16.0	7.0	14.2
pH (field)	pH	6.5 - 8.5	7.1	7.2	7.9	7.6	7.4	6.5	6.4 - 8.3	7.4	0.5	7.4
Conductivity (field)	uS/cm		70	109	137	120	138	99	35 - 138	89	29	84
Turbidity (field)	NTU		2.1	5.7	3.2	5.5	1.6	1.1	0.2 - 15.7	3.5	4.2	2.0
Dissolved Oxygen (field)	mg/L		8.2	6.8	6.6	7.0	5.9	9.0	5.9 - 9.0	7.3	1.0	7.3
Turbidity	NTU		1.1	1	2.3	1.4	2.5	1	0.2 - 2.5	1.6	0.8	1.3
Total Ammonia-N	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - 0.11	0.04	0.03	0.03
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		99	136	138	131	132	112	80 - 537	137	117	117
Total Organic Carbon	mg/L		6.8	11.1	7.9	9.9	11.2	8.8	6.2 - 12.3	9.4	1.7	9.3
pH	pH	6.5 - 8.5	7.9	7.6	7.5	7.5	7.9	7.1	3.0 - 8.3	7.2	1.3	7.1
Alkalinity (Total as CaCO3)	mg/L		49	71	69	68	67	56	32 - 71	52	13	50
Chloride (Cl)	mg/L		<1	1	<1	<5	<1	<1	<1 - <5			
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <0.01			
Nitrate (N)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - 1.3	0.2	0.3	0.1
Phosphate-P	mg/L			<0.01	<0.01	<0.05	<0.01	<0.01	<0.01 - <0.05			
Sulphate (SO4)	mg/L		2	<1	<1	<5	<1	<1	<1 - 135	12	35	3
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		49	70	69	68	66	56	<1 - 70	48	19	36
Calculated TDS	mg/L		50			67			49 - 156	81	51	71
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1 - <1			
Cation Sum	me/L											
Dissolved Hardness (CaCO3)	mg/L		50	68	64	69	63	58	36 - 69	52	11	50
Total Aluminum (Al)	ug/L	75	27	15	37	**230**	55	42	15 - 1400	177	364	69
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <1			
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Barium (Ba)	ug/L		81	99	110	110	140	110	59 - 140	94	21	92
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <0.5			
Total Boron (B)	ug/L	200	11	<10	13	12	<10	<10	<10 - 13	8	4	7
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Total Calcium (Ca)	ug/L		12000	17000	15000	17000	17000	14000	9500 - 17000	13093	2578	12863
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5 - <5			
Total Cobalt (Co)	ug/L	0.9	<0.5	0.8	0.5	0.5	<0.5	<0.5	<0.5 - 1.3	0.4	0.3	0.3
Total Copper (Cu)	ug/L	1 (5)	<1	<1	<1	<1	<1	**20**	<1 - 20	2	5	1
Total Iron (Fe)	ug/L	300	**400**	**380**	**530**	**1100**	**1300**	**420**	240 - 2200	675	542	539
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - 1.4	0.3	0.3	0.3
Total Magnesium (Mg)	ug/L		5400	7900	6400	7900	6900	6000	4000 - 7900	5536	1297	5405
Total Manganese (Mn)	ug/L		50	44	95	140	130	32	8 - 290	82	74	53
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Potassium (K)	ug/L		<200	530	250	660	320	360	<200 - 860	453	283	354
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2 - 5	1.3	1.1	1.1
Total Silicon (Si)	ug/L		310	1300	370	1400	750	1800	310 - 1900	1055	579	873
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.5			
Total Sodium (Na)	ug/L		680	1300	670	1200	940	770	650 - 1400	971	246	942
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - <0.05			
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - 0.2	0.06	0.04	0.06
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1 - 4	0.8	0.9	0.6
Total Zinc (Zn)	ug/L	20	<5	<5	<5	<5	<5	<5	<5 - 12	5	3	4
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Phosphorus (P)	mg/L	0.03	0.02	0.02	**0.04**	**0.11**	0.026	0.014	0.014 - 0.14	0.04	0.04	0.03
Total Suspended Solids	mg/L		<10	<10	10	2	<10	<10	<0.5 - 110	13	29	5

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW3**									
Sampling Date			31-Aug-05	30-Nov-05	8-May-06	21-Sep-06	28-Nov-06	19-Apr-07	8-May-07	24-May-07	20-Jul-07	15-Nov-07
Temperature (field)	C		24.5	4.8	18.2	16.8	4.3	15.1	17.1	22.4	25.4	6.6
pH (field)	pH	6.5 - 8.5	7.4	**9.0**	7.4	**6.1**	**6.2**	8.1	7.6	7.2	7.7	8.5
Conductivity (field)	uS/cm		38	28	19	28	13	24	16	24	34	12
Turbidity (field)	NTU				1.8	3.7	0.6	6.3	1.1	3.0	5.0	3.0
Dissolved Oxygen (field)	mg/L									5.4		11.6
Turbidity	NTU				1.4	2	1.3	6.33	1.1	3	2.1	13.4
Total Ammonia-N	mg/L		<0.05	<0.05	<0.05	0.09	0.09	<0.05	<0.05	<0.05	<0.05	0.06
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		29		28	40	23	22	29	32	40	24
Total Organic Carbon	mg/L		7.4	7.2	6.6	8	7.1	6.6	8.3	8.4	8.6	8.2
pH	pH	6.5 - 8.5	7.0		7.3	7.4	6.8	6.7	**6.4**	6.6	6.9	6.5
Alkalinity (Total as CaCO3)	mg/L		11.6		9	17	5	5	8	13	14	4
Chloride (Cl)	mg/L		<1	1	1	1	<1	<1	<1	1	<1	1
Nitrite (N)	mg/L		<0.3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (N)	mg/L		<0.2		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate-P	mg/L		<1	0.028	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sulphate (SO4)	mg/L		13.4	13	3	2	4	3	3	3	3	3
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		11.6		9	17	5	5	8	13	14	4
Calculated TDS	mg/L		26.6								21	13
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1		<1	<1	<1	<1	<1	<1	<1	<1
Cation Sum	me/L		0.337									
Dissolved Hardness (CaCO3)	mg/L		14	22	10	16	8	7	9	12	18	9
Total Aluminum (Al)	ug/L	75	47	**110**	**89**	44	**79**	**76**	**83**	**82**	45	69
Total Antimony (Sb)	ug/L	20	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L		18	15	15	18	12	13	18	18	23	13
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Boron (B)	ug/L	200	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L		4200	3600	3100	4400	3900	2300	2800	3400	5400	2700
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	1 (5)	**13**	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	**1500**	270	**760**	**680**	**400**	**690**	**1000**	**870**	**1600**	**490**
Total Lead (Pb)	ug/L	1 (3)	<0.5	0.6	**1.3**	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5
Total Magnesium (Mg)	ug/L		1200	1100	860	1600	750	680	840	990	1700	820
Total Manganese (Mn)	ug/L		150	53	170	270	25	39	260	180	220	64
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Potassium (K)	ug/L		310	530	340	560	280	310	320	<200	<200	280
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Silicon (Si)	ug/L		1600	1100	310	460	640	790	370	300	760	800
Total Silver (Ag)	ug/L	0.1	**<0.5**	**<0.5**	**0.3**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L		610	970	810	1100	680	720	820	760	640	740
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	20	<5	6	<5	<5	6	7	8	6	5	19
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Phosphorus (P)	mg/L	0.03		0.029	0.019	0.024	0.011	0.018	0.02	**0.036**	**0.032**	0.019
Total Suspended Solids	mg/L				2	3	<1	<3	<10	<10	<10	93

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		PWQO	SW3						Range	Arithmetic Mean	Standard Deviation	Geometric Mean
Sampling Date			23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10				
Temperature (field)	C		15.4	18.6	15.9	18.8	25.8	15.5	4.3 - 25.8	16.6	6.7	14.8
pH (field)	pH	6.5 - 8.5	7.2	6.9	8.4	7.2	6.7	**6.0**	6.0 - 9.0	7.4	0.9	7.3
Conductivity (field)	uS/cm		11	32	17	25	25	13	11 - 38	22	8	21
Turbidity (field)	NTU		2.5	7.6	3.8	18.2	1.7	2.1	0.6 - 18.2	4.3	4.5	3.0
Dissolved Oxygen (field)	mg/L		9.3	3.4	6.0	3.8	4.5	9.5	3.4 - 11.6	6.7	3.1	6.1
Turbidity	NTU		1.5	1.6	1.7	2.0	2.6	1.4	1.1 - 13.4	3.0	3.3	2.2
Total Ammonia-N	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - 0.09	0.04	0.02	0.03
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		24	41	28	32	28	22	22 - 41	29	6	29
Total Organic Carbon	mg/L		6.3	8.6	6.9	8.3	8.7	8.9	6.3 - 8.9	7.8	0.9	7.7
pH	pH	6.5 - 8.5	7.0	6.8	6.5	6.6	7.0	6.4	6.4 - 7.4	6.8	0.3	6.8
Alkalinity (Total as CaCO3)	mg/L		6	13	6	10	9	6	4 - 17	9	4	8
Chloride (Cl)	mg/L		1	2	1	<5	1	<1	<1 - <5			
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <0.3			
Nitrate (N)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.2			
Phosphate-P	mg/L			<0.01	<0.01	<0.05	<0.01	<0.01	<0.01 - <1			
Sulphate (SO4)	mg/L		3	3	2	<5	1	<1	<1 - 13.4	3.9	3.7	2.9
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		6	13	6	10	9	6	4 - 17	9	4	8
Calculated TDS	mg/L		12			15			12 - 26.6	17.5	6.2	16.7
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1 - <1			
Cation Sum	me/L								0.337 - 0.337			
Dissolved Hardness (CaCO3)	mg/L		9	18	8	13	10	9	7 - 22	12	4	11
Total Aluminum (Al)	ug/L	75	69	47	22	**95**	**86**	75	22 - 110	70	23	65
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <1			
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Barium (Ba)	ug/L		14	20	160	19	22	15	12 - 160	26	36	19
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <0.5			
Total Boron (B)	ug/L	200	<10	<10	10	<10	<10	<10	<10 - 10	5	1	5
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Total Calcium (Ca)	ug/L		2600	5200	22000	3900	3100	2600	2300 - 22000	4700	4704	3857
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5 - <5			
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5	0.5	0.7	<0.5	<0.5 - 0.7	0.3	0.1	0.3
Total Copper (Cu)	ug/L	1 (5)	<1	**4**	<1	<1	<1	<1	<1 - 13	2	3	1
Total Iron (Fe)	ug/L	300	**640**	**1500**	<100	**1600**	**1600**	**930**	<100 - 1600	911	511	713
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - 1.3	0.4	0.3	0.3
Total Magnesium (Mg)	ug/L		760	1600	7900	1000	810	740	680 - 7900	1459	1749	1121
Total Manganese (Mn)	ug/L		98	430	52	460	440	44	25 - 460	185	151	127
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Potassium (K)	ug/L		200	490	650	300	260	260	<200 - 650	331	155	294
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2 - <2			
Total Silicon (Si)	ug/L		510	1400	1800	880	490	1100	300 - 1800	832	460	720
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.5			
Total Sodium (Na)	ug/L		710	1100	1200	900	710	670	610 - 1200	821	181	804
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - <0.05			
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Zinc (Zn)	ug/L	20	6	6	<5	<5	<5	<5	<5 - 19	5	4	4
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Phosphorus (P)	mg/L	0.03	0.017	0.03	0.024	**0.048**	0.027	0.017	0.011 - 0.048	0.025	0.009	0.023
Total Suspended Solids	mg/L		<10	<10	<10	1	<10	<10	<1 - 93	10	24	4

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		PWQO	SW4									
Sampling Date			8-May-06	28-Nov-06	19-Apr-07	8-May-07	24-May-07	20-Jul-07	15-Nov-07	23-May-08	29-Sep-08	27-May-09
Temperature (field)	C		17.9	4.7	15	14.9	16.5	19.2	6.9	14.1	13.2	12.5
pH (field)	pH	6.5 - 8.5	7.0	**6.4**	7.6	7.2	7.2	7.6	7.4	7.1	7.0	7.9
Conductivity (field)	uS/cm		133	103	102	124	138	119	96	102	161	184
Turbidity (field)	NTU		16.1	1.2	1.2	0.1		1.5	2.3	2.9	10.6	8.9
Dissolved Oxygen (field)	mg/L						6.2		9.0	10.9	1.8	6.0
Turbidity	NTU			1.5	1.17	6.8		1.9	0.8	3.1	19	0.9
Total Ammonia-N	mg/L		<0.05	0.07	<0.05	<0.05	<0.05	0.09	0.1	<0.05	<0.05	<0.05
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		136	116	119	157	164	138	121	143	195	183
Total Organic Carbon	mg/L		6.5	7.7	5.3	6.6	6.9	9.4	7.9	6.8	16.2	8.2
pH	pH	6.5 - 8.5	7.8	7.7	7.6	7.5	7.5	7.5	7.6	8.0	7.6	7.6
Alkalinity (Total as CaCO3)	mg/L		71	54	57	80	86	58	54	75	92	96
Chloride (Cl)	mg/L		1	1	1	<1	1	<1	1	<1	3	<1
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (N)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate-P	mg/L		0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01		<0.01	<0.01
Sulphate (SO4)	mg/L		2	7	5	1	<1	13	8	<0.1	6	<1
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		71	54	56	80	85	57	53	74	91	95
Calculated TDS	mg/L							80	70	77		
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cation Sum	me/L											
Dissolved Hardness (CaCO3)	mg/L		75	55	56	71	79	67	56	72	98	89
Total Aluminum (Al)	ug/L	75	**310**	**100**	59	72	**81**	**94**	57	**270**	**690**	**120**
Total Antimony (Sb)	ug/L	20	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L		160	98	120	160	160	130	100	140	230	20
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Boron (B)	ug/L	200	10	<10	12	13	<10	14	<10	12	14	<10
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L		19000	17000	15000	20000	21000	19000	15000	19000	26000	2300
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Cobalt (Co)	ug/L	0.9	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**1.3**	<0.5
Total Copper (Cu)	ug/L	1 (5)	2	1	<1	<1	<1	<1	<1	<1	1	<1
Total Iron (Fe)	ug/L	300	**650**	79	51	120	90	200	<100	300	**1500**	**1100**
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	<0.5	0.6	<0.5
Total Magnesium (Mg)	ug/L		6600	5700	6600	7700	7600	7100	5800	7500	10000	690
Total Manganese (Mn)	ug/L		220	2	3	38	71	18	17	62	1100	310
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1	<1	1	<1
Total Potassium (K)	ug/L		860	800	910	880	620	860	570	570	3000	200
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Silicon (Si)	ug/L		2800	3000	1800	2400	2800	4400	3600	2900	6200	280
Total Silver (Ag)	ug/L	0.1	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L		1700	1400	1500	1700	1600	2100	1500	1400	2000	510
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	ug/L	6	1	<1	<1	1	<1	<1	<1	<1	2	<1
Total Zinc (Zn)	ug/L	20	8	7	<5	<5	8	<5	<5	6	10	5
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Phosphorus (P)	mg/L	0.03	0.014	0.006	0.014	0.007	0.028	**0.031**	0.011	0.016	**0.11**	0.019
Total Suspended Solids	mg/L		74	<0.5	<3	<10	<10	<10	<10	<10	89	<10

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		PWQO	SW4		Range	Arithmetic Mean	Standard Deviation	Geometric Mean
Sampling Date			27-May-10	30-Sep-10				
Temperature (field)	C		25.3	14.8	4.7 - 25.3	14.6	5.3	13.5
pH (field)	pH	6.5 - 8.5	7.1	6.5	6.4 - 7.9	7.2	0.4	7.2
Conductivity (field)	uS/cm		234	147	96 - 234	137	41	132
Turbidity (field)	NTU		3.2	0.5	0.1 - 16.1	4.4	5.2	2.1
Dissolved Oxygen (field)	mg/L		4.3	5.8	1.8 - 10.9	6.3	3.0	5.5
Turbidity	NTU		2.3	0.5	0.5 - 19	3.8	5.6	2.0
Total Ammonia-N	mg/L		<0.05	<0.05	<0.05 - 0.1	0.04	0.03	0.03
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		228	169	116 - 228	156	34	153
Total Organic Carbon	mg/L		10.0	9.7	5.3 - 16.2	8.4	2.8	8.1
pH	pH	6.5 - 8.5	8.0	7.3	7.3 - 8.0	7.6	0.2	7.6
Alkalinity (Total as CaCO3)	mg/L		119	89	54 - 119	78	20	75
Chloride (Cl)	mg/L		<1	<1	<1 - 3	0.9	0.7	0.8
Nitrite (N)	mg/L		<0.01	<0.01	<0.01 - <0.01			
Nitrate (N)	mg/L		<0.1	<0.1	<0.1 - <0.1			
Phosphate-P	mg/L		<0.01	0.01	<0.01 - 0.01	0.01	0.00	0.01
Sulphate (SO4)	mg/L		<1	<1	<0.1 - 13	3.7	4.1	1.5
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		118	89	53 - 118	77	20	75
Calculated TDS	mg/L				70 - 80	76	5	76
Carb. Alkalinity (calc. as CaCO3)	mg/L		1	<1	<1 - 1	0.5	0.1	0.5
Cation Sum	me/L							
Dissolved Hardness (CaCO3)	mg/L		110	86	55 - 110	76	17	74
Total Aluminum (Al)	ug/L	75	12	31	12 - 690	158	190	94
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5 - <1			
Total Arsenic (As)	ug/L	5	<1	<1	<1 - <1			
Total Barium (Ba)	ug/L		270	120	20 - 270	142	64	124
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5 - <0.5			
Total Boron (B)	ug/L	200	10	11	<10 - 14	10	4	9
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1 - <0.1			
Total Calcium (Ca)	ug/L		30000	21000	2300 - 30000	18692	6693	16527
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5 - <5			
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5 - 1.3	0.37	0.31	0.31
Total Copper (Cu)	ug/L	1 (5)	<1	<1	<1 - 2	0.7	0.5	0.6
Total Iron (Fe)	ug/L	300	**370**	<100	50 - 1500	380	472	193
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5 - 0.9	0.3	0.2	0.3
Total Magnesium (Mg)	ug/L		11000	8900	690 - 11000	7099	2574	6168
Total Manganese (Mn)	ug/L		730	20	2 - 1100	216	349	51
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1 - <1			
Total Nickel (Ni)	ug/L	25	<1	<1	<1 - 1	0.5	0.1	0.5
Total Potassium (K)	ug/L		810	1100	200 - 3000	932	691	780
Total Selenium (Se)	ug/L	100	<2	<2	<2 - <2			
Total Silicon (Si)	ug/L		3200	3600	280 - 6200	3082	1420	2595
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1 - 0.2	0.06	0.04	0.06
Total Sodium (Na)	ug/L		2000	1400	510 - 2100	1568	416	1493
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05 - <0.05			
Total Tungsten (W)	ug/L	30	<1	<1	<1 - <1			
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1 - <0.1			
Total Vanadium (V)	ug/L	6	<1	<1	<1 - 2	0.7	0.5	0.6
Total Zinc (Zn)	ug/L	20	<5	<5	<5 - 10	4.9	2.8	4.2
Total Zirconium (Zr)	ug/L	4	<1	<1	<1 - <1			
Total Phosphorus (P)	mg/L	0.03	0.014	0.014	0.006 - 0.11	0.024	0.028	0.017
Total Suspended Solids	mg/L		<10	<10	<0.5 - 89	17	30	6

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		PWQO	SW5							Range	Arithmetic Mean	Standard Deviation	Geometric Mean
Sampling Date			15-Nov-07	23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10				
Temperature (field)	C		6.1	18.5	18.7	15.7	18.8	25.1	15.7	6.1 - 25.1	16.9	5.7	15.8
pH (field)	pH	6.5 - 8.5	**8.6**	7.1	7.1	**8.6**	7.1	7.1	**6.1**	6.1 - 8.6	7.4	0.9	7.3
Conductivity (field)	uS/cm		15	28	26	12	24	30	13	12 - 30	21	8	20
Turbidity (field)	NTU		0.7	2.0	9.0	10.3	5.1	2.4	1.3	0.7 - 10.3	4.4	3.9	3.0
Dissolved Oxygen (field)	mg/L		11.6	12.3	5.4	5.9	4.2	4.2	8.8	4.2 - 12.3	7.5	3.4	6.8
Turbidity	NTU		1.6	1.8	1.9	2.3	1.7	2.7	1.1	1.1 - 2.7	1.9	0.5	1.8
Total Ammonia-N	mg/L		0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - 0.08	0.03	0.02	0.03
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		24	23	37	24	31	29	24	23 - 37	27	5	27
Total Organic Carbon	mg/L		7.4	6.3	8.2	7.3	8.3	9.3	8.8	6.3 - 9.3	7.9	1.0	7.9
pH	pH	6.5 - 8.5	6.7	6.5	6.8	6.5	6.6	7.0	6.5	6.5 - 7.0	6.7	0.2	6.7
Alkalinity (Total as CaCO3)	mg/L		5	73	12	7	10	9	7	5 - 73	18	25	11
Chloride (Cl)	mg/L		<1	<1	2	<1	<5	1	<1	<1 - <5			
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <0.01			
Nitrate (N)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Phosphate-P	mg/L		<0.01		<0.01	<0.01	<0.05	<0.01	<0.01	<0.01 - <0.05			
Sulphate (SO4)	mg/L		3	<1	3	2	<5	1	<1	<1 - <5			
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		5	9	12	7	10	9	7	5 - 12	8	2	8
Calculated TDS	mg/L		13	13			14			13 - 14	13.3	0.6	13.3
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1	<1 - <1			
Cation Sum	me/L												
Dissolved Hardness (CaCO3)	mg/L		9	9	15	9	13	10	10	9 - 15	11	2	11
Total Aluminum (Al)	ug/L	75	41	**78**	59	5	58	**83**	72	5 - 83	57	27	44
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5 - 0.5	0.29	0.09	0.28
Total Arsenic (As)	ug/L	5	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Barium (Ba)	ug/L		12	15	18	5	19	21	14	5 - 21	15	5	14
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5 - 0.5	0.3	0.1	0.3
Total Boron (B)	ug/L	200	<10	<10	<10	10	<10	<10	<10	<10 - 10	6	2	6
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1 - 0.1	0.06	0.02	0.06
Total Calcium (Ca)	ug/L		2600	2700	4500	200	4100	3100	2700	200 - 4500	2843	1383	2156
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	5	<5	<5	<5	<5 - 5	3	1	3
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5	0.5	<0.5	0.6	<0.5	0.25 - 0.6	0.3	0.1	0.3
Total Copper (Cu)	ug/L	1 (5)	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Iron (Fe)	ug/L	300	**350**	**700**	**1400**	100	**1600**	**1500**	**900**	100 - 1600	936	588	690
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5 - 0.5	0.3	0.1	0.3
Total Magnesium (Mg)	ug/L		750	790	1400	50	1100	810	810	50 - 1400	816	411	606
Total Manganese (Mn)	ug/L		18	100	350	2	400	430	41	2 - 430	192	193	71
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Nickel (Ni)	ug/L	25	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Potassium (K)	ug/L		230	210	470	200	280	280	270	200 - 470	277	91	267
Total Selenium (Se)	ug/L	100	<2	<2	<2	2	<2	<2	<2	<2 - 2	1.1	0.4	1.1
Total Silicon (Si)	ug/L		710	520	1200	50	820	460	1200	50 - 1200	709	414	518
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1 - 0.1	0.06	0.02	0.06
Total Sodium (Na)	ug/L		700	750	1100	100	860	690	630	100 - 1100	690	303	578
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05 - 0.05	0.03	0.01	0.03
Total Tungsten (W)	ug/L	30	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1 - 0.1	0.06	0.02	0.06
Total Vanadium (V)	ug/L	6	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Zinc (Zn)	ug/L	20	<5	6	<5	5	<5	<5	6	<5 - 6	3.9	1.7	3.5
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Phosphorus (P)	mg/L	0.03	0.012	0.026	0.019	**0.036**	**0.033**	0.028	0.017	0.012 - 0.036	0.024	0.009	0.023
Total Suspended Solids	mg/L		<10	<10	<10	<10	1	<10	12	1 - 12	5	3	5

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SWA**								
Sampling Date			30-Nov-05	8-May-06	21-Sep-06	28-Nov-06	19-Apr-07	8-May-07	24-May-07	20-Jul-07	15-Nov-07
Temperature (field)	C		4.9	21.2	16	4.2	16	12.6	16.6	20.3	8.2
pH (field)	pH	6.5 - 8.5	8.2	6.9	**6.1**	**6.4**	7.6	7.1	7.1	7.5	7.5
Conductivity (field)	uS/cm		39	136	166	108	110	176	204	91	111
Turbidity (field)	NTU			5.6	6.8	1.5	2.5	2.9	8.3		1.3
Dissolved Oxygen (field)	mg/L								6.4		7.9
Turbidity	NTU				3.7	2.2	2.47	2.9	8.3	5.6	2.1
Total Ammonia-N	mg/L		<0.05	<0.05	0.09	<0.05	0.06	<0.05	<0.05	0.06	0.06
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		65	134	194	123	125	22	188	98	151
Total Organic Carbon	mg/L		17.2	11	19.9	14	8.1	13.9	14.4	11.3	13.4
pH	pH	6.5 - 8.5	7.2	7.8	8.1	7.8	7.9	7.6	7.5	7.4	7.8
Alkalinity (Total as CaCO3)	mg/L		24	71	110	56	62	116	100	44	73
Chloride (Cl)	mg/L		1	<1	2	2	<1	<1	<1	1	2
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (N)	mg/L		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate-P	mg/L		0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Sulphate (SO4)	mg/L		3	1	<1	7	2	<1	<1	5	3
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		24	71	108	55	62	115	100	44	73
Calculated TDS	mg/L									55	82
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	1	<1	<1	<1	<1	<1	<1
Cation Sum	me/L										
Dissolved Hardness (CaCO3)	mg/L		27	70	98	55	62	10	94	48	77
Total Aluminum (Al)	ug/L	75	**410**	**150**	**97**	**110**	61	**170**	69	**200**	31
Total Antimony (Sb)	ug/L	20	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L		45	120	250	100	110	230	160	97	120
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Boron (B)	ug/L	200	16	<10	14	11	12	11	<10	22	11
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L		6900	17000	26000	16000	16000	29000	24000	13000	19000
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	**1.2**	**1.2**	<0.5	<0.5
Total Copper (Cu)	ug/L	1 (5)	2	2	<1	<1	<1	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	**1100**	**400**	**440**	**430**	**380**	230	**1900**	**850**	**610**
Total Lead (Pb)	ug/L	1 (3)	1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Magnesium (Mg)	ug/L		3400	7100	9700	6400	6800	11000	8600	5200	7600
Total Manganese (Mn)	ug/L		74	14	18	13	49	810	1000	45	66
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Potassium (K)	ug/L		4800	420	2000	1100	820	1500	760	1100	660
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Silicon (Si)	ug/L		2000	320	890	1800	770	2200	1300	3000	2500
Total Silver (Ag)	ug/L	0.1	**<0.5**	**0.2**	<0.1	**0.7**	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L		1100	1000	1400	1300	1100	1400	1100	840	1400
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Uranium (U)	ug/L	5	<0.1	<0.1	0.1	<0.1		<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	ug/L	6	1	<1	<1	<1	<1	2	1	<1	<1
Total Zinc (Zn)	ug/L	20	10	<5	<5	<5	9	8	6	8	<5
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Phosphorus (P)	mg/L	0.03	**0.199**	0.019	**0.044**	0.027	0.024	0.022	**0.032**	**0.071**	0.026
Total Suspended Solids	mg/L			5	3	13	5	19	<10	<10	<10

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		PWQO	SWA						Range	Arithmetic Mean	Standard Deviation	Geometric Mean
Sampling Date			23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10				
Temperature (field)	C		16.8	13.2	15.9	20.0	24.6	16.2	4.2 - 24.6	15.1	5.8	13.7
pH (field)	pH	6.5 - 8.5	6.7	7.1	7.5	7.8	7.3	**6.2**	6.1 - 8.2	7.1	0.6	7.1
Conductivity (field)	uS/cm		119	178	129	148	244	152	39 - 244	141	50	131
Turbidity (field)	NTU		6.5	18.4	1.9	5.9	5.3	2.1	1.3 - 18.4	5.3	4.6	4.0
Dissolved Oxygen (field)	mg/L		7.1	0.4	2.8	6.6	5.6	3.9	0.4 - 7.9	5.1	2.5	3.9
Turbidity	NTU		3.7	11	13	2.4	7.6	2.7	2.1 - 13	5.2	3.7	4.3
Total Ammonia-N	mg/L		<0.05	0.09	0.12	<0.05	0.10	<0.05	<0.05 - 0.12	0.05	0.03	0.04
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		136	203	156	157	224	169	22 - 224	143	53	128
Total Organic Carbon	mg/L		8.6	20.6	10.9	14.9	17.9	9.6	8.1 - 20.6	13.7	3.9	13.2
pH	pH	6.5 - 8.5	8.0	7.7	7.5	7.5	8.0	7.2	7.2 - 8.1	7.7	0.3	7.7
Alkalinity (Total as CaCO3)	mg/L		73	107	78	80	118	90	24 - 118	80	27	75
Chloride (Cl)	mg/L		<1	3	<1	<5	1	<1	<1 - <5			
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <0.01			
Nitrate (N)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - 0.1	0.05	0.01	0.05
Phosphate-P	mg/L			<0.01	0.02	<0.05	0.02	<0.01	<0.01 - <0.05			
Sulphate (SO4)	mg/L		<1	<1	<1	<5	<1	<1	<1 - 7	2	2	1
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		72	106	78	80	117	90	24 - 117	80	27	74
Calculated TDS	mg/L		71			78			55 - 82	72	12	71
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	1	<1	<1 - 1	0.6	0.2	0.5
Cation Sum	me/L											
Dissolved Hardness (CaCO3)	mg/L		70	110	76	83	110	88	10 - 110	72	28	63
Total Aluminum (Al)	ug/L	75	39	**95**	23	**160**	49	42	23 - 410	114	99	85
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <1			
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Barium (Ba)	ug/L		130	180	95	180	220	150	45 - 250	146	57	134
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <0.5			
Total Boron (B)	ug/L	200	13	<10	<10	15	10	11	<10 - 22	11	5	10
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Total Calcium (Ca)	ug/L		19000	29000	9700	21000	31000	22000	6900 - 31000	19907	7119	18512
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5 - <5			
Total Cobalt (Co)	ug/L	0.9	<0.5	**2.3**	<0.5	<0.5	**2.0**	<0.5	<0.5 - 2.3	0.6	0.7	0.4
Total Copper (Cu)	ug/L	1 (5)	<1	<1	<1	<1	<1	<1	<1 - 2	0.7	0.5	0.6
Total Iron (Fe)	ug/L	300	**1000**	**5100**	220	**640**	**4000**	**610**	220 - 5100	1194	1442	747
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - 1	0.3	0.2	0.3
Total Magnesium (Mg)	ug/L		7500	13000	4200	9400	12000	9200	3400 - 13000	8073	2742	7597
Total Manganese (Mn)	ug/L		89	860	8	86	900	100	8 - 1000	275	388	88
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Potassium (K)	ug/L		440	1600	<200	1100	1100	850	<200 - 4800	1223	1103	903
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2 - <2			
Total Silicon (Si)	ug/L		1200	3200	<50	590	2000	1900	<50 - 3200	1580	953	1090
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - 0.7	0.1	0.2	0.1
Total Sodium (Na)	ug/L		1100	1200	450	1000	1300	940	450 - 1400	1109	253	1073
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - <0.05			
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Uranium (U)	ug/L	5	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - 0.2	0.06	0.04	0.06
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1 - 2	0.7	0.4	0.6
Total Zinc (Zn)	ug/L	20	<5	<5	14	<5	<5	<5	<5 - 14	5	4	4
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Phosphorus (P)	mg/L	0.03	**0.035**	**0.054**	**0.073**	**0.055**	**0.073**	0.023	0.019 - 0.199	0.052	0.045	0.041
Total Suspended Solids	mg/L		<10	10	16	2	13	<10	2 - 19	8	5	7

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SWB**								
Sampling Date			30-Nov-05	8-May-06	21-Sep-06	28-Nov-06	19-Apr-07	8-May-07	24-May-07	20-Jul-07	15-Nov-07
Temperature (field)	C		5.5	18.8	18.5	5.5	15	19.8	24.2	26.8	6.6
pH (field)	pH	6.5 - 8.5	8.3	7.4	**6.3**	6.5	7.5	7.3	8.0	7.7	7.7
Conductivity (field)	uS/cm		105	70	68	93	65	70	108	71	65
Turbidity (field)	NTU			2.6	6.6	1.9	2.7	1.4	4.4		1.7
Dissolved Oxygen (field)	mg/L								8.2		8.3
Turbidity	NTU				1.6	1.6	2.7	1.4	4.4	2.6	2.3
Total Ammonia-N	mg/L		<0.05	<0.05	0.07	0.07	<0.05	<0.05	<0.05	<0.05	<0.05
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		97	69	74	79	77	91	94	76	90
Total Organic Carbon	mg/L		12.1	7.6	10.8	8.1	6.3	8.5	10.1	10.7	10.9
pH	pH	6.5 - 8.5	7.1	7.5	7.8	7.4	7.6	7.2	7.0	7.2	7.5
Alkalinity (Total as CaCO3)	mg/L		14	36	43	37	34	42	45	37	44
Chloride (Cl)	mg/L		1	<1	1	1	<1	<1	1	<1	1
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (N)	mg/L		4.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate-P	mg/L		0.016	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sulphate (SO4)	mg/L		9	3	<1	3	5	4	2	1	1
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		14	35	43	37	34	42	45	37	44
Calculated TDS	mg/L									38	45
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Cation Sum	me/L										
Dissolved Hardness (CaCO3)	mg/L		42	35	37	37	36	39	43	39	42
Total Aluminum (Al)	ug/L	75	**120**	26	20	62	47	26	25	36	**160**
Total Antimony (Sb)	ug/L	20	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L		70	84	88	75	86	100	100	99	89
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Boron (B)	ug/L	200	13	<10	11	<10	<10	<10	<10	10	11
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L		9600	9000	9600	9400	9700	10000	11000	13000	10000
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	1 (5)	3	<1	<1	<1	<1	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	**520**	300	**570**	**400**	230	290	**400**	**670**	**320**
Total Lead (Pb)	ug/L	1 (3)	**1.7**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Magnesium (Mg)	ug/L		4700	3500	4000	3700	4100	4200	4200	5200	4600
Total Manganese (Mn)	ug/L		16	12	19	17	6	13	15	90	14
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1	1	<1
Total Potassium (K)	ug/L		1300	550	<200	950	790	650	370	<200	760
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Silicon (Si)	ug/L		1200	120	1900	940	430	110	130	1500	970
Total Silver (Ag)	ug/L	0.1	**<0.5**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L		1100	870	240	900	920	900	990	740	900
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	20	16	<5	<5	9	<5	9	7	6	<5
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Phosphorus (P)	mg/L	0.03	**0.064**	0.021	0.022	<0.004	0.027	**0.032**	**0.048**	**0.04**	0.028
Total Suspended Solids	mg/L			2	3	<0.5	<3	<10	<10	<10	<10

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
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6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		PWQO	SWB						Range	Arithmetic Mean	Standard Deviation	Geometric Mean
Sampling Date			23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10				
Temperature (field)	C		17.3	16.9	15.9	19.7	27.9	17.8	5.5 - 27.9	17.1	6.9	15.3
pH (field)	pH	6.5 - 8.5	7.1	**6.3**	8.1	7.1	7.4	6.5	6.3 - 8.3	7.3	0.7	7.2
Conductivity (field)	uS/cm		43	76	115	80	99	85	43 - 115	81	20	79
Turbidity (field)	NTU		2.3	7.0	2.2	6.6	4.3	1.2	1.2 - 7.0	3.5	2.1	2.9
Dissolved Oxygen (field)	mg/L		7.2	0.5	5.1	2.8	3.6	3.1	0.5 - 8.3	4.8	2.8	3.7
Turbidity	NTU		2.5	1.8	1.2	1.1	2.3	1.5	1.1 - 4.4	2.1	0.9	1.9
Total Ammonia-N	mg/L		<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - 0.07	0.03	0.02	0.03
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		66	89	86	87	87	97	66 - 97	84	10	83
Total Organic Carbon	mg/L		6.5	11.5	7.9	10.6	9.7	9.4	6.3 - 12.1	9.4	1.8	9.2
pH	pH	6.5 - 8.5	7.7	7.5	7.2	7.0	7.5	7.0	7.0 - 7.8	7.3	0.3	7.3
Alkalinity (Total as CaCO3)	mg/L		31	47	43	44	41	47	14 - 47	39	8	38
Chloride (Cl)	mg/L		<1	2	<1	<5	1	<1	<1 - <5			
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <0.01			
Nitrate (N)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - 4.5	0.35	1.15	0.07
Phosphate-P	mg/L			<0.01	<0.01	<0.05	<0.01	<0.01	<0.01 - 0.025	0.01	0.01	0.01
Sulphate (SO4)	mg/L		3	<1	2	<5	2	<1	<1 - 9	2.6	2.2	1.9
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		31	47	43	44	41	47	14 - 47	39	8	38
Calculated TDS	mg/L		33			46			33 - 46	40.5	6.1	40.1
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1 - <1			
Cation Sum	me/L											
Dissolved Hardness (CaCO3)	mg/L		32	47	42	47	41	46	32 - 47	40	4	40
Total Aluminum (Al)	ug/L	75	23	11	60	49	39	43	11 - 160	50	40	39
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <1			
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Barium (Ba)	ug/L		77	120	14	110	110	120	14 - 120	89	26	82
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <0.5			
Total Boron (B)	ug/L	200	<10	11	<10	12	<10	12	<10 - 13	8	3	7
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	**0.2**	<0.1	<0.1	<0.1	<0.1 - 0.2	0.06	0.04	0.06
Total Calcium (Ca)	ug/L		7900	12000	2200	11000	9900	12000	2200 - 13000	9753	2466	9218
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5 - <5			
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5 - 0.8	0.3	0.1	0.3
Total Copper (Cu)	ug/L	1 (5)	<1	<1	<1	<1	1	<1	<1 - 3	0.7	0.6	0.6
Total Iron (Fe)	ug/L	300	110	**590**	**890**	**920**	**570**	**560**	110 - 920	489	230	432
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5 - 1.7	0.4	0.4	0.3
Total Magnesium (Mg)	ug/L		3600	5200	650	5400	4300	5100	650 - 5400	4163	1146	3851
Total Manganese (Mn)	ug/L		3	28	160	38	19	48	3 - 160	33	41	20
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1 - 1	0.5	0.1	0.5
Total Potassium (K)	ug/L		<200	<200	240	<200	250	340	240 - 1300	620	341	537
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2 - <2			
Total Silicon (Si)	ug/L		<50	2400	240	1800	170	890	<50 - 2400	855	768	461
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.5			
Total Sodium (Na)	ug/L		590	420	740	380	790	750	240 - 1100	749	243	699
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	<0.05 - 0.1	0.03	0.02	0.03
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Uranium (U)	ug/L	5	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1 - 0.2	0.06	0.04	0.05
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Zinc (Zn)	ug/L	20	7	<5	<5	<5	<5	<5	<5 - 16	5.1	3.9	4.1
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Phosphorus (P)	mg/L	0.03	0.018	0.029	0.029	**0.054**	**0.036**	0.023	0.018 - 0.064	0.034	0.013	0.031
Total Suspended Solids	mg/L		<10	<10	<10	14	<10	<10	0.25 - 14	5	3	4

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).

2) Shading indicates concentration exceeds does not satisfy the PWQO.

3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.

4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.

5) Bold indicates the method detection limit is above the PWQO.

6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW 1**						
Sampling Date			24-May-07	23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L		<0.5			<0.5	<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L		<0.5			0.9	<0.5	<0.5	
Total oil and grease	mg/L		<0.5	<0.5	<0.5	0.9	<0.5	<0.5	1.2
1,1,1,2-Tetrachloroethane	µg/L	20*	<0.1	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/L	10*	<0.1	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	70*	<0.2	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	800*	<0.2	-	-	-	-	-	-
1,1-Dichloroethane	µg/L	200*	<0.1	-	-	-	-	-	-
1,1-Dichloroethene	µg/L	40*	<0.1	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,2-Dichloroethane	µg/L	100*	<0.1	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	0.7*	<0.1	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	4	<0.2	-	-	-	-	-	-
Acetone	µg/L		<10	-	-	-	-	-	-
Benzene	µg/L	100*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Bromodichloromethane	µg/L	200*	<0.1	-	-	-	-	-	-
Bromoform	µg/L	60*	<0.2	-	-	-	-	-	-
Bromomethane	µg/L	0.9*	<0.5	-	-	-	-	-	-
Carbon Tetrachloride	µg/L		<0.1	-	-	-	-	-	-
Chlorobenzene	µg/L	15	<0.1	-	-	-	-	-	-
Chloroform	µg/L		<0.1	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Dibromochloromethane	µg/L	40*	<0.2	-	-	-	-	-	-
Dibromoethane	µg/L	5*	<0.2	-	-	-	-	-	-
Dichloromethane	µg/L	100*	<0.5	-	-	-	-	-	-
Ethylbenzene	µg/L	8*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Methyl Ethyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl Isobutyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl-t-Butyl Ether	µg/L		<0.2	-	-	-	-	-	-
m/p-Xylene	µg/L	2*/30*	<0.1	<0.4	<0.4	<0.1	<0.4	<0.1	<0.4
o-Xylene	µg/L	40*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Styrene	µg/L	4*	<0.1	-	-	-	-	-	-
Tetrachloroethene	µg/L	50*	<0.1	-	-	-	-	-	-
Toluene	µg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
trans-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Trichloroethene	µg/L	20*	<0.1	-	-	-	-	-	-
Vinyl Chloride	µg/L	600*	<0.2	-	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW2**						
Sampling Date			24-May-07	23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L		<0.5			<0.5	<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L		<0.5			0.8	<0.5	<0.5	
Total oil and grease	mg/L		<0.5	<0.6	<0.5	0.8	<0.5	<0.5	1.1
1,1,1,2-Tetrachloroethane	µg/L	20*	<0.1	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/L	10*	<0.1	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	70*	<0.2	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	800*	<0.2	-	-	-	-	-	-
1,1-Dichloroethane	µg/L	200*	<0.1	-	-	-	-	-	-
1,1-Dichloroethene	µg/L	40*	<0.1	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,2-Dichloroethane	µg/L	100*	<0.1	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	0.7*	<0.1	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	4	<0.2	-	-	-	-	-	-
Acetone	µg/L		<10	-	-	-	-	-	-
Benzene	µg/L	100*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Bromodichloromethane	µg/L	200*	<0.1	-	-	-	-	-	-
Bromoform	µg/L	60*	<0.2	-	-	-	-	-	-
Bromomethane	µg/L	0.9*	<0.5	-	-	-	-	-	-
Carbon Tetrachloride	µg/L		<0.1	-	-	-	-	-	-
Chlorobenzene	µg/L	15	<0.1	-	-	-	-	-	-
Chloroform	µg/L		<0.1	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Dibromochloromethane	µg/L	40*	<0.2	-	-	-	-	-	-
Dibromoethane	µg/L	5*	<0.2	-	-	-	-	-	-
Dichloromethane	µg/L	100*	<0.5	-	-	-	-	-	-
Ethylbenzene	µg/L	8*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Methyl Ethyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl Isobutyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl-t-Butyl Ether	µg/L		<0.2	-	-	-	-	-	-
m/p-Xylene	µg/L	2*/30*	<0.1	<0.4	<0.4	<0.1	<0.4	<0.1	<0.4
o-Xylene	µg/L	40*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Styrene	µg/L	4*	<0.1	-	-	-	-	-	-
Tetrachloroethene	µg/L	50*	<0.1	-	-	-	-	-	-
Toluene	µg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
trans-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Trichloroethene	µg/L	20*	<0.1	-	-	-	-	-	-
Vinyl Chloride	µg/L	600*	<0.2	-	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW 3**						
Sampling Date			24-May-07	23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L		<0.5			<0.5	<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L		<0.5			1.0	<0.5	<0.5	
Total oil and grease	mg/L		<0.5	<0.5	<0.5	1.0	<0.5	<0.5	<0.5
1,1,1,2-Tetrachloroethane	µg/L	20*	<0.1	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/L	10*	<0.1	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	70*	<0.2	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	800*	<0.2	-	-	-	-	-	-
1,1-Dichloroethane	µg/L	200*	<0.1	-	-	-	-	-	-
1,1-Dichloroethene	µg/L	40*	<0.1	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,2-Dichloroethane	µg/L	100*	<0.1	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	0.7*	<0.1	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	4	<0.2	-	-	-	-	-	-
Acetone	µg/L		<10	-	-	-	-	-	-
Benzene	µg/L	100*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Bromodichloromethane	µg/L	200*	<0.1	-	-	-	-	-	-
Bromoform	µg/L	60*	<0.2	-	-	-	-	-	-
Bromomethane	µg/L	0.9*	<0.5	-	-	-	-	-	-
Carbon Tetrachloride	µg/L		<0.1	-	-	-	-	-	-
Chlorobenzene	µg/L	15	<0.1	-	-	-	-	-	-
Chloroform	µg/L		<0.1	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Dibromochloromethane	µg/L	40*	<0.2	-	-	-	-	-	-
Dibromoethane	µg/L	5*	<0.2	-	-	-	-	-	-
Dichloromethane	µg/L	100*	<0.5	-	-	-	-	-	-
Ethylbenzene	µg/L	8*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Methyl Ethyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl Isobutyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl-t-Butyl Ether	µg/L		<0.2	-	-	-	-	-	-
m/p-Xylene	µg/L	2*/30*	<0.1	<0.4	<0.4	<0.1	<0.4	<0.1	<0.4
o-Xylene	µg/L	40*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Styrene	µg/L	4*	<0.1	-	-	-	-	-	-
Tetrachloroethene	µg/L	50*	<0.1	-	-	-	-	-	-
Toluene	µg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
trans-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Trichloroethene	µg/L	20*	<0.1	-	-	-	-	-	-
Vinyl Chloride	µg/L	600*	<0.2	-	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW4**					
Sampling Date			24-May-07	23-May-08	29-Sep-08	27-May-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L		<0.5			<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L		<0.5			0.7	<0.5	
Total oil and grease	mg/L		<0.5	<0.5	<0.5	0.7	<0.5	0.9
1,1,1,2-Tetrachloroethane	µg/L	20*	<0.1	-	-	-	-	-
1,1,1-Trichloroethane	µg/L	10*	<0.1	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	70*	<0.2	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	800*	<0.2	-	-	-	-	-
1,1-Dichloroethane	µg/L	200*	<0.1	-	-	-	-	-
1,1-Dichloroethene	µg/L	40*	<0.1	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-
1,2-Dichloroethane	µg/L	100*	<0.1	-	-	-	-	-
1,2-Dichloropropane	µg/L	0.7*	<0.1	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	4	<0.2	-	-	-	-	-
Acetone	µg/L		<10	-	-	-	-	-
Benzene	µg/L	100*	<0.1	<0.2	<0.2	<0.1	<0.1	<0.2
Bromodichloromethane	µg/L	200*	<0.1	-	-	-	-	-
Bromoform	µg/L	60*	<0.2	-	-	-	-	-
Bromomethane	µg/L	0.9*	<0.5	-	-	-	-	-
Carbon Tetrachloride	µg/L		<0.1	-	-	-	-	-
Chlorobenzene	µg/L	15	<0.1	-	-	-	-	-
Chloroform	µg/L		<0.1	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-
Dibromochloromethane	µg/L	40*	<0.2	-	-	-	-	-
Dibromoethane	µg/L	5*	<0.2	-	-	-	-	-
Dichloromethane	µg/L	100*	<0.5	-	-	-	-	-
Ethylbenzene	µg/L	8*	<0.1	<0.2	<0.2	<0.1	<0.1	<0.2
Methyl Ethyl Ketone	µg/L		<5	-	-	-	-	-
Methyl Isobutyl Ketone	µg/L		<5	-	-	-	-	-
Methyl-t-Butyl Ether	µg/L		<0.2	-	-	-	-	-
m/p-Xylene	µg/L	2*/30*	<0.1	<0.4	<0.4	<0.1	<0.1	<0.4
o-Xylene	µg/L	40*	<0.1	<0.2	<0.2	<0.1	<0.1	<0.2
Styrene	µg/L	4*	<0.1	-	-	-	-	-
Tetrachloroethene	µg/L	50*	<0.1	-	-	-	-	-
Toluene	µg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-
trans-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-
Trichloroethene	µg/L	20*	<0.1	-	-	-	-	-
Vinyl Chloride	µg/L	600*	<0.2	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW5**					
Sampling Date			23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L				<0.5	<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L				<0.5	<0.5	<0.5	
Total oil and grease	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5	1.2
1,1,1,2-Tetrachloroethane	µg/L	20*	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/L	10*	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	70*	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	800*	-	-	-	-	-	-
1,1-Dichloroethane	µg/L	200*	-	-	-	-	-	-
1,1-Dichloroethene	µg/L	40*	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2.5	-	-	-	-	-	-
1,2-Dichloroethane	µg/L	100*	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	0.7*	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2.5	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	4	-	-	-	-	-	-
Acetone	µg/L		-	-	-	-	-	-
Benzene	µg/L	100*	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Bromodichloromethane	µg/L	200*	-	-	-	-	-	-
Bromoform	µg/L	60*	-	-	-	-	-	-
Bromomethane	µg/L	0.9*	-	-	-	-	-	-
Carbon Tetrachloride	µg/L		-	-	-	-	-	-
Chlorobenzene	µg/L	15	-	-	-	-	-	-
Chloroform	µg/L		-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L		-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L		-	-	-	-	-	-
Dibromochloromethane	µg/L	40*	-	-	-	-	-	-
Dibromoethane	µg/L	5*	-	-	-	-	-	-
Dichloromethane	µg/L	100*	-	-	-	-	-	-
Ethylbenzene	µg/L	8*	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Methyl Ethyl Ketone	µg/L		-	-	-	-	-	-
Methyl Isobutyl Ketone	µg/L		-	-	-	-	-	-
Methyl-t-Butyl Ether	µg/L		-	-	-	-	-	-
m/p-Xylene	µg/L	2*/30*	<0.4	<0.4	<0.1	<0.4	<0.1	<0.4
o-Xylene	µg/L	40*	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Styrene	µg/L	4*	-	-	-	-	-	-
Tetrachloroethene	µg/L	50*	-	-	-	-	-	-
Toluene	µg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	µg/L		-	-	-	-	-	-
trans-1,3-Dichloropropene	µg/L		-	-	-	-	-	-
Trichloroethene	µg/L	20*	-	-	-	-	-	-
Vinyl Chloride	µg/L	600*	-	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW A**						
Sampling Date			24-May-07	23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L		<0.5			<0.5	<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L		<0.5			0.6	<0.5	<0.5	
Total oil and grease	mg/L		<0.5	<0.5	<0.5	0.6	<0.5	<0.5	1.3
1,1,1,2-Tetrachloroethane	µg/L	20*	<0.1	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/L	10*	<0.1	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	70*	<0.2	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	800*	<0.2	-	-	-	-	-	-
1,1-Dichloroethane	µg/L	200*	<0.1	-	-	-	-	-	-
1,1-Dichloroethene	µg/L	40*	<0.1	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,2-Dichloroethane	µg/L	100*	<0.1	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	0.7*	<0.1	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	4	<0.2	-	-	-	-	-	-
Acetone	µg/L		<10	-	-	-	-	-	-
Benzene	µg/L	100*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Bromodichloromethane	µg/L	200*	<0.1	-	-	-	-	-	-
Bromoform	µg/L	60*	<0.2	-	-	-	-	-	-
Bromomethane	µg/L	0.9*	<0.5	-	-	-	-	-	-
Carbon Tetrachloride	µg/L		<0.1	-	-	-	-	-	-
Chlorobenzene	µg/L	15	<0.1	-	-	-	-	-	-
Chloroform	µg/L		<0.1	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Dibromochloromethane	µg/L	40*	<0.2	-	-	-	-	-	-
Dibromoethane	µg/L	5*	<0.2	-	-	-	-	-	-
Dichloromethane	µg/L	100*	<0.5	-	-	-	-	-	-
Ethylbenzene	µg/L	8*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Methyl Ethyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl Isobutyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl-t-Butyl Ether	µg/L		<0.2	-	-	-	-	-	-
m/p-Xylene	µg/L	2*/30*	<0.1	<0.4	<0.4	<0.1	<0.4	<0.1	<0.4
o-Xylene	µg/L	40*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Styrene	µg/L	4*	<0.1	-	-	-	-	-	-
Tetrachloroethene	µg/L	50*	<0.1	-	-	-	-	-	-
Toluene	µg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
trans-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Trichloroethene	µg/L	20*	<0.1	-	-	-	-	-	-
Vinyl Chloride	µg/L	600*	<0.2	-	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SWB**						
Sampling Date			24-May-07	23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L		<0.5			<0.5	<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L		<0.5			1.5	<0.5	<0.5	
Total oil and grease	mg/L		<0.5	<0.5	<0.5	1.5	<0.5	<0.5	1.1
1,1,1,2-Tetrachloroethane	µg/L	20*	<0.1	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/L	10*	<0.1	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	70*	<0.2	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	800*	<0.2	-	-	-	-	-	-
1,1-Dichloroethane	µg/L	200*	<0.1	-	-	-	-	-	-
1,1-Dichloroethene	µg/L	40*	<0.1	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,2-Dichloroethane	µg/L	100*	<0.1	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	0.7*	<0.1	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	4	<0.2	-	-	-	-	-	-
Acetone	µg/L		<10	-	-	-	-	-	-
Benzene	µg/L	100*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Bromodichloromethane	µg/L	200*	<0.1	-	-	-	-	-	-
Bromoform	µg/L	60*	<0.2	-	-	-	-	-	-
Bromomethane	µg/L	0.9*	<0.5	-	-	-	-	-	-
Carbon Tetrachloride	µg/L		<0.1	-	-	-	-	-	-
Chlorobenzene	µg/L	15	<0.1	-	-	-	-	-	-
Chloroform	µg/L		<0.1	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Dibromochloromethane	µg/L	40*	<0.2	-	-	-	-	-	-
Dibromoethane	µg/L	5*	<0.2	-	-	-	-	-	-
Dichloromethane	µg/L	100*	<0.5	-	-	-	-	-	-
Ethylbenzene	µg/L	8*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Methyl Ethyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl Isobutyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl-t-Butyl Ether	µg/L		<0.2	-	-	-	-	-	-
m/p-Xylene	µg/L	2*/30*	<0.1	<0.4	<0.4	<0.1	<0.4	<0.1	<0.4
o-Xylene	µg/L	40*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Styrene	µg/L	4*	<0.1	-	-	-	-	-	-
Tetrachloroethene	µg/L	50*	<0.1	-	-	-	-	-	-
Toluene	µg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
trans-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Trichloroethene	µg/L	20*	<0.1	-	-	-	-	-	-
Vinyl Chloride	µg/L	600*	<0.2	-	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

TABLE 3
MONITORING WELL INSTALLATION SUMMARY
SEBRIGHT QUARRY

BOREHOLE DESIGNATION	MONITOR DESIGNATION	DATE INSTALLED	SCREEN INTERVAL (m ASL)
BH03-1	II	April 2, 2004	236.7 to 238.9
BH03-1	I	April 2, 2004	224.9 to 226.3
BH03-4	II	April 2, 2004	230.5 to 233.5
BH03-4	I	April 2, 2004	216.9 to 218.4
BH03-5	II	April 1, 2004	238.6 to 241.6
BH03-5	I	April 1, 2004	224.4 to 225.9
BH03-6	II	April 1, 2004	237.2 to 240.2
BH03-6	I	April 1, 2004	220.8 to 222.3
BH04-7	II	September 15, 2004	225.1 to 226.5
BH04-7	I	November 29, 2004	211.2 to 212.6
BH04-8	II	September 13, 004	228.3 to 230.0
BH04-8	I	November 29, 2004	215.2 to 216.7

NOTE:
1) 'm ASL' indicates metres above sea level.

TABLE 4
SURFACE WATER MONITORING STATION SUMMARY
SEBRIGHT QUARRY

STATION DESIGNATION	STATION LOCATION
SW1	Within Cranberry River, upstream of the confluence of Cranberry River and a tributary that extends north of Sebright Quarry.
SW2	Within a tributary that extends north of Sebright Quarry (Watercourse 2).
SW3	Within Cranberry River, at the downstream property boundary.
SW4	At the western property boundary within a tributary of Cranberry River. The tributary extends from a low-lying area within the southwestern portion of the property (Watercourse 1).
SW5	Within Cranberry River downstream of the property and downstream of the discharge point for Watercourse 1.
SWA	Near the outlet of the low-lying area within the southwestern portion of the property (Watercourse 1).
SWB	Between two ponds located north of Sebright Quarry (Watercourse 2). The ponds provide surface water to the tributary that discharges into the Cranberry River.

TABLE 8
REHABILITATION LAKE CATCHMENT AREAS
SEBRIGHT QUARRY

PRE-EXTRACTION			
PHASE	**PHASE AREA (ha)**	**CATCHMENT AREAS (ha)**	
		WATERCOURSE 1	**WATERCOURSE 2**
1	17.0	11.6	5.4
2	6.2	4.0	2.2
	SUBTOTAL	15.6	7.6

POST-EXTRACTION			
REHABILITATION LAKE PHASE	**LAKE AREA (ha)**	**CATCHMENT AREAS (ha)**	
		WATERCOURSE 1	**WATERCOURSE 2**
1 / 2	23.2	11.6	11.6
	SUBTOTAL	11.6	11.6

NOTES:

1) 'ha' indicates hectares.
2) Two lake discharge points will result in approximately 50% discharge to each watercourse.

TABLE 18
WATER MANAGEMENT PLAN
SEABRIGHT QUARRY

PHASE	COMMENTS	DEWATERING DISCHARGE RATE TO WATERCOURSE 1				DEWATERING DISCHARGE RATE TO WATERCOURSE 2			
		Percent of Discharge	m^3/day (Average)	m^3/day (30-day freshet)	m^3/a	Percent of Discharge	m^3/day (Average)	m^3/day (30-day freshet)	m^3/a
Phase 1A	Active Quarry	68	89	876	32,433	32	42	412	15,262
Phase 1B	Active Quarry	68	189	1,864	69,039	32	89	877	32,489
Phase 1 / 2	Active Quarry	67	261	2,577	95,446	33	129	1,269	47,010

PHASE	COMMENTS	TOTAL SURFACE WATER FLOW RATE IN WATERCOURSE 1			TOTAL SURFACE WATER FLOW RATE IN WATERCOURSE 2		
		Average (m^3/s)	Peak (m^3/s)	Annual (m^3/a)	Average (m^3/s)	Peak (m^3/s)	Annual (m^3/a)
Phase 1A	Pre-Quarry	0.002	0.018	57,222	0.001	0.008	26,696
	Post Quarry	0.002	0.018	57,222	0.001	0.008	26,696
Phase 1B	Pre-Quarry	0.002	0.018	57,222	0.001	0.008	26,696
	Post Quarry	0.002	0.022	69,039	0.001	0.010	32,489
Phase 1 and 2	Pre-Quarry	0.002	0.024	76,943	0.001	0.012	37,897
	Post Quarry	0.003	0.030	95,446	0.001	0.015	47,010

NOTES:

1) 'm^3/a' indicates cubic metres per year.
2) 'm^3/day' indicates cubic metres per day.
3) 'm^3/s' indicates cubic metres per second.
4) 30-day freshet based on 81% of annual flow over a 30 day period for the first month with average temperature greater than -1ºC (April).
5) Total Surface Water Flow Rate considers that groundwater infiltration contributes baseflow to Watercourse 1 and 2.

TABLE 19
PERFORMANCE MONITORING PROGRAM
SEBRIGHT QUARRY

PARAMETER	FREQUENCY	LOCATIONS	PARAMETERS
Groundwater Levels	Bimonthly Prior to Extraction, Then Monthly	BH03-1, BH03-4, BH03-5, BH03-6, BH04-7, BH04-8	Water Levels
	Annually (May)	Residential Wells Within 1 km of Property	Water Levels
Groundwater Quality	Annually (May)	BH03-1, BH03-4, BH03-5, BH03-6, BH04-7, BH04-8	Field: pH, conductivity, temperature Lab: Major ions, metals, TSS, nutrients
Surface Water Flow Rates	Bimonthly, Monthly During Dewatering	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Flow Rate
Surface Water Quality	Semi-Annually (May and September)	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Field: pH, conductivity, temperature, turbidity, dissolved oxygen Lab: Major ions, metals, TSS, nutrients, oil and grease, and BTEX
	Bimonthly During Dewatering (After Precipitation Events when Possible)	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Field: pH, conductivity, temperature, turbidity, dissolved oxygen, visible sheen
Quarry Discharge	Daily	Discharge Point(s) For Dewatering Pump(s)	Flow Rates
	Monthly	Discharge Point(s) For Dewatering Pump(s) and Equalization Pond	Field: pH, conductivity, temperature, turbidity, dissolved oxygen, visible sheen
	Annually Prior to Dewatering of Each Phase and Bimonthly During Dewatering	Discharge Point(s) For Dewatering Pump(s)	Field: pH, conductivity, temperature, turbidity, dissolved oxygen, visible sheen. Lab: Major ions, metals, TSS, nutrients

NOTES:

1) Major ions include: chloride, sulphate, alkalinity, sodium, potassium, calcium, magnesium.
2) Metals include: Al, Sb, As, Be, Bo, Cd, Cr, Co, Cu, Fe, Pb, Mo, Ni, Se, Ag, Ti, V, Zn.
3) Nutrients include: total ammonia, nitrate, nitrite, and total phosphorus.
4) TSS indicates total suspended solids.
5) BTEX indicates benzene, toluene, ethylbenzene, and xylenes.
6) Bimonthly indicates once every two months. Semi-annually indicates twice per year.

TABLE 20
TRIGGER MECHANISMS
SEBRIGHT QUARRY

PARAMETER	TRIGGER MECHANISM	LOCATIONS	ACTION
Groundwater Levels	At BH03-1, BH03-4, BH03-6, BH04-7, and BH04-8: Groundwater level decrease by more than 1 m below baseline condition. At BH03-5: Groundwater level decrease of 5 m below baseline conditions.	BH03-1, BH03-4, BH03-5, BH03-6, BH04-7, BH04-8	Determine if the water level decrease is a result of quarry activities. If the impact is quarry related at BH03-1, BH03-4, BH03-6, BH04-7, and BH04-8 implement the applicable contingency measure. If the impact is at BH03-5, evaluate off-site residential well effects then: 1) implement contingency measures if required, or 2) revise Trigger Mechanism.
	Water level below pump intake or insufficient storage capacity in well to meet residential requirements.	Residential Water Wells	Determine if the water level decrease is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure.
Groundwater Quality	Degradation of water quality in excess of baseline conditions and ODWQS. Ammonia (Total): 50 mg/L Nitrate: 10.0 mg/L Phosphorus: 0.2 mg/L	BH03-1, BH03-4, BH03-5, BH03-6, BH04-7, BH04-8	Determine if the water level decrease is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure.
Surface Water Flow Rates	Decrease or increase in flow rate more than 50% of baseline flow rate.	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Determine if the flow rate change is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure.
Surface Water Quality	Degradation of water quality in excess of baseline conditions (*) and PWQO. TSS: 25 mg/L Ammonia (unionized): 0.02 mg/L Total Phosphorus: 0.2 mg/L* Oil & Grease: 1.0 mg/L Antimony: 0.020 mg/L Arsenic: 0.005 mg/L Boron: 0.200 mg/L Cadmium: 0.0001 mg/L Chromium: 0.0089 mg/L Cobalt: 0.001 mg/L* Copper: 0.002 mg/L* Iron: 2.2 mg/L* Lead: 0.001 mg/L Molybdenum: 0.040 mg/L Nickel: 0.025 mg/L Silver: 0.0002 mg/L* Vanadium: 0.006 mg/L Benzene: 0.100 mg/L Toluene: 0.0008 mg/L Ethylbenzene: 0.008 mg/L Xylenes: 0.002 mg/L	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Determine if the water quality change is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure for quarry discharge.

TABLE 20
TRIGGER MECHANISMS
SEBRIGHT QUARRY

PARAMETER	TRIGGER MECHANISM	LOCATIONS	ACTION
	Turbidity: 100 NTU	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Test for TSS. If TSS is >25 mg/L and the change is quarry related, implement the applicable contingency measure.
	Visible Sheen	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Determine if the water quality change is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure for quarry discharge.
Quarry Discharge	Exceeds permitted flow rate	Discharge Point(s) for Dewatering Pumps	Reduce discharge rate in accordance with Permit.
	Turbidity: 100 NTU	Discharge Point(s) for Dewatering Pumps, Equalization Pond	Test for TSS. If TSS is >25 mg/L and the change is quarry related, implement the applicable contingency measure.
	TSS: 25 mg/L Ammonia (unionized): 0.02 mg/L Total Phosphorus: 0.03 mg/L Oil & Grease (Mineral/Synthetic) : 1.0 mg/L	Discharge Point(s) for Dewatering Pumps	Implement the applicable contingency measure.

NOTE:
1) '*' denotes concentration naturally exceeds PWQO.

Appendix 7. Ecological Communities Identified on the Subject Property.

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

Ecological communities identified on the subject property.

ELC Code	Nested ELC Community Units	Vegetation Characteristics	Designation(s) in 2010 Official Plan	Comments
RBOB2-1 [RBO3-1]	Non-Calcareous Open Rock Barren Type	• Poverty Oat Grass, Common Hairgrass, Cow Wheat, Pink Corydalis, and Fringed Bindweed	Rural (R)	• sparsely vegetated, clumps of grasses, forbs and mosses • exposed bedrock on high knobs with little overburden
RBSB2-2 [RBS3-2]	Common Juniper Non-Calcareous Shrub Rock Barren Type	• cover patchy and barren to continuous thicket • Common Juniper, Staghorn Sumac, with patches of grasses, forbs and mosses	Rural (R)	• sparsely vegetated with clumps of grasses, forbs and mosses • patches of common juniper, Staghorn Sumac and poplars
RBTB2-3 [RBT2-1]	Oak-Red Maple-Pine Basic Treed Rock Barren Type	• Red Oak, Red Maple, White Pine dominant • other associates include White Birch, Trembling Aspen, Sugar Maple, Black Cherry, Choke Cherry, Staghorn Sumac and Common Juniper	Rural (R)	• more heavily treed than RBOB3-1 and RBSB3-2 • patchy to larger stands, usually around perimeter of open portions of rock barrens
FODM3-1 [FOD3-1]	Dry-Fresh Poplar Deciduous Forest Type	• dominant trees include Trembling Aspen, Largetooth Aspen and White Birch, with minor components of Sugar Maple, Red Maple, American Elm, White Ash and Basswood	Rural (R)	• early successional stands on other lands owned by the applicant outside of the proposed extraction area • also intermixed along edges of FOM5-2
FODM5-6 [FOD5-6]	Dry-Fresh Sugar Maple-Basswood Deciduous Forest Type	• dominated by Sugar Maple and Basswood • specimens of mature scattered Sugar Maple encroaching into MEMG4-1	Rural (R)	• outside of proposed extraction area on other lands owned by the applicant • separated from proposed extraction area by treed swamp (SWDO2-1 and MAMM1-2)
FODM5-10 [FOD5-10]	Dry-Fresh Sugar Maple-White Birch Poplar Deciduous Forest Type	• relatively large block of upland deciduous forested stand on to of rock knoll • dominated by Sugar Maple, White Birch and Trembling Aspen with other woody associates including Red Maple, Red Oak, Black Cherry, Ironwood, American Beech, Basswood and Downy Serviceberry	Rural (R)	• heavily treed rock knob • steep-sided edges
FODM5-4 [FOD5-4]	Dry-Fresh Maple-Ironwood Deciduous Forest Type	• Hedgerow along unopened road allowance • dominant species include Sugar Maple, Ironwood, Basswood, Black Cherry, White Ash, White Birch, and American Elm	Rural (R)	• found along north-south unopened road allowance along southwestern property boundary.
FOMM5-2 [FOM5-2]	Dry-Fresh Poplar Mixed Forest Type	• similar in structure to FODM5-10 but Sugar Maple a minor component • dominant trees include Trembling Aspen, Largetooth Aspen and White Birch along with scattered conifers such as White Pine, Balsam Fir, White Spruce and Eastern White Cedar	Rural (R)	• portions of this stand type lie adjacent to and within proposed extraction area
FOMM8-1 [FOM8-1]	Fresh-Moist Poplar Mixed Forest Type	• dominated by poplars, White Birch, along with scattered White Spruce and Balsam Fir • lush groundcover of ferns, sedges and forbs • soil moistures variable from mesic to wet	Rural (R)	• found along edges and adjacent to Cranberry River and in low lying areas near Beaver Pond BP6 • low-lying portions dominated by ferns, sedges and mosses
FOMM7-2 [FOM7-2]	Fresh-Moist White Cedar-Hardwood Mixed Forest	• dominated by White Cedar with Balsam Fir, American Elm, Yellow Birch, Black Ash • lush groundcover of ferns, sedges and forbs • soil moistures variable from mesic to wet	Rural (R)	• found in the southeastern portion of the property
RBTA1-8 [CUW2-2]	Hawthorn Cultural Alvar Woodland Type	• dominated by Hawthorns on carbonate (limestone) bedrock intrusion near southern edge of site	Rural (R)	• alvar-like qualities with some groundflora typical of true alvar habitats further south on the Carden Plain • short-grass stratum maintained through extensive cattle

ELC Code	Nested ELC Community Units	Vegetation Characteristics	Designation(s) in 2010 Official Plan	Comments
		• other shrubs include Red-oiser Dogwood and Common Juniper • groundcover dominated by old field forbs and grasses typical of MEGM4-1 and RBSB1-1 • remnants of limestone alvar located further south on Carden Plain		grazing • portions classified as potential Loggerhead Shrike nesting and foraging habitat
MEGM4-1 [CUM1-1] RBSA1-1 [ALS1-1] **MEGM4-1* [CUM1-1]** MAMO2-3 [MAS 3-9]	Fresh-Moist Open Graminoid Meadow Type (grazed) Common Juniper Shrub Alvar Type * Fresh-Moist Open Graminoid Meadow Type (natural) Mixed Forb Meadow Marsh	• typical groundcover found in conjunction with MEGM4-1 and RBSA1-1, heavily grazed by cattle • species include Awnless Brome Grass, Meadow Fescue, Goldenrods, Asters, Poverty Oat Grass, Wild Columbine, Field Sorrel, Red Clover, Early Saxifrage • located in northwest section along floodplain and edge of Cranberry Creek • dominated by naturally regenerating grasses, forbs and sedges, some sections consistent with wet meadow, unaffected by cattle grazing	Rural (R)	• located mainly on limestone intrusion at southern end of property • portions classified as potential Loggerhead Shrike nesting and foraging habitat
Ag	Agricultural – hay field	• species included Red Fescue, Quack Grass, Timothy, and common weed species	Rural (R)	• located in southwestern corner of property
SWDO2-1 [SWD6-1] (SWDO1-1 [SWD5-1]) (SWTO1-1 [SWT3-1])	Red Maple Organic Deciduous Swamp Type Black Ash Organic Deciduous Swamp Type Speckled Alder Organic Thicket Swamp Type	• dominated by Red Maple, along with Black Ash and Speckled Alder • other woody vegetation includes American Elm, Silver Maple, Wild Raisin, Narrow-leaved Meadowsweet, Green Ash, Willow and scattered Balsam Fir and White Spruce • pockets of open water with organic soils containing lush groundcover of ferns, sedges and grasses	Rural (R)	• trough of treed swamp that extends north of BP6 and in sections that drain into BP2
SWTM3-2 [SWT2-2] MAMM1-3 [MAM2-2] SWDM4-2 [SWD4-2]	Willow Mineral Thicket Swamp Type Reed Canary Grass Mineral Meadow Marsh Type White Elm Mineral Deciduous Swamp	• mixed willow species on mineral soils • pockets of dense Reed Canary Grass and areas of shallow open water • small areas dominated by American Elm	Rural (R)	• Several small pockets throughout MEGM4-1 that drain south off of subject property
MASO1-1 [MAS3-1]	Cattail Organic Shallow Marsh Type	• Area dominated by dense Broad-leaved Cattails	Rural (R)	• East of proposed extraction area
(MASO2-1 [MAS3-10]) (MAMO1-6 [MAM3-6])	Forb Organic Shallow Meadow Marsh Type Broad-leaved Sedge Organic Meadow Marsh Type	• dominated by spotted Joe-pye Weed, Purple-stem Aster, Boneset, Spotted Jewelweed, Sensitive Fern, Royal Fern, Lady Fern, Cattail and Swamp Milkweed • dominated by Canada Blue-joint Grass, Fowl Glyceria, American Glyceria, Retrorse Sedge, Lakebank Sedge, Cyperus-like Sedge, Fringed Sedge	Environmental Protection (EP)	• previously contained open water due to beaver activity as indicated on 1988 aerial photographs • beaver activity ceased and ponds filling in with dense growth of aquatic forbs, sedges, grasses and ferns • defined outlet channel more or less permanent, although dry during most of growing season
Wetlands W1-W5 MASO1-1 [MAS3-1] MASO3-7	Cattail Organic Shallow Marsh Type Bur-reed Organic Shallow Marsh Type	• swaths and bands of cattail marsh within beaver pond, usually around perimeter	Environmental Protection (EP)	• string of connected beaver ponds along northern edge of study area • drainage from east to west and eventually into Cranberry River

ELC Code	Nested ELC Community Units	Vegetation Characteristics	Designation(s) in 2010 Official Plan	Comments
[MAS3-7] SAF1-1	Water Lily-Bullhead Lily Floating-leaved Shallow Aquatic Type	• patches and extensive beds of Bur-reed dominated marsh within beaver pond		
MASO1-6 [MAS3-4]	Broad-leaved Sedge Organic Shallow MarshType	• Small White Water-lily, Water-shield, Common Duckweed and Pondweed dominant		
SAM1-4	Pondweed Mixed Shallow Aquatic Type	• dominated by sedges and grasses such as Lakebank Sedge, Retrorse Sedge, Fringed Sedge, Cyperus-like Sedge, Canada Blue-joint Grass, Reed Canary Grass and Creeping Bent Grass • open water marsh portions of beaver ponds dominated by pondweeds, Common Duckweed and Canada Waterweed		
Central Marsh W6 (MASO2-1 [MAS3-10])	Forb Organic Shallow Meadow Marsh Type	• Swamp Milkweed, Spotted Joe-pye Weed, Boneset, Spotted Jewelweed, Sensitive Fern, Royal Fern • swaths and bands of Cattail marsh within beaver pond, usually around perimeter	Rural (R)	• isolated, relatively extensive beaver pond that drains southward and then westward eventually into Cranberry River • outlet of intermittent swale from pond traverse through lowland poplar bush and across old field habitats
MASO1-1 [MAS3-1]	Cattail Organic Shallow Marsh Type			
(SAM1-4)	Pondweed Mixed Shallow Aquatic Type	• open water marsh portions of beaver ponds dominated by pondweeds, Common Duckweed and Canada Waterweed		
(SWMO1-1 [SWM4-1)	White Cedar-Hardwood Organic Mixed Swamp Type	• flooded areas of dead Eastern White Cedar and Black Ash		
SWTM5-7 [SWT2-6]	Meadowsweet Mineral Thicket Swamp Type	• outer edge of pond dominated by shrub thicket swamp		

Appendix 8. Master List of Vascular Plant Species

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

Appendix 8. Flora documented on Giofam Investments Inc. Property on 10/27/2003, 05/26/2004, 06/09/2004, 06/25/2004, 06/28/2004, 07/29/2004. 06/06/2005, 06/15/2005 and 06/22/2009 by MNAL and RS.

Taxon - Scientific	Taxon - Common	S-Rank
PINOPSIDA		
Cupressacea	Cypress Family	
Juniperus communis L.	Common Juniper	S5
Thuja occidentalis	Eastern White Cedar	S5
Pinacea	*Pine Family*	
Abies balsameae	Balsam Fir	S5
Larix larcina	Tamarack	S5
Picea glauca	White Spruce	S5
Pinus strobus	White Pine	S5
Tsuga canadensis	Eastern Hemlock	S5
MONOCOTS		
Aristolochaiaceae	Dutchman's Pipe Family	
Asarum canadense	Wild Ginger	S5
Alismataceae	Water Plantain Family	
Alisma plantago-aquatica	Common Water-plantain	S4?
Sagittaria latifolia	Common Arrowhead	S5
Araceae	Arum Family	
Arisaema triphyllum	Jack-in-the-pulpit	S5
Cyperacea	Sedge Family	
Carex aurea	Golden-fruited Sedge	S5
Carex bebbii	Bebb's Sedge	S5
Carex blanda Dew.	Common Wood Sedge	S5
Carex crinita	Fringed Sedge	S5
Carex cristatella	Crested Sedge	S5
Carex deweyana	Dewey's Sedge	S5
Carex flava	Yellow Sedge	S5
Carex gracillima	Graceful Sedge	S5
Carex granularis	Meadow Sedge	S5
Carex interior	Interior Sedge	S5
Carex intumescens	Bladder Sedge	S5
Carex lacustris	Lakebank Sedge	S5
Carex lupilina	Common Hop Sedge	S4
Carex pseudo-cyperus	Cyperus-like Sedge	S5
Carex radiata	Radiate Sedge	S4
Carex retrorsa	Retrorse Sedge	S5
Carex rosea	Stellate Sedge	S5
Carex rostrata Stokes (F. Boott) L. Bailey	Beaked Sedge	S5
Carex scoparia	Pointed Broom Sedge	S5
Carex stipata	Awl-fruited Sedge	S5
Carex stricta	Tussock Sedge	S5
Carex trisperma	Three-Fruited Sedge	S5

Appendix 8 Cont. Flora documented during 2003, 2004, 2005 2009 site visits at Giofam Investments Inc. Property.

Taxon - Scientific	Taxon - Common	S-Rank
Carex utriculata	Beaked Sedge	S5
Carex vulpinoidea	Fox Sedge	S5
Dulichium arundinaceum	Three-way Sedge	S5
Eleocharis erythropoda	Red-stemmed Spike-rush	S5
Eleocharis obtusa	Blunt Spike-rush	S5
Scirpus atrovirens	Black Bulrush	S5
Scirpus cyperinus	Woolgrass	S5
Scirpus fluviatilis	River Bulrush	S5
Scirpus rubrotinctus Fern.	Bulrush	S5
Scirpus validus	Softstem Bulrush	S5
Juncaceae	Juncus Family	
Juncus bufonius	Toad Rush	S5
Juncus compressus	Compressed Rush	SE5
Juncus effusus spp. solutus	Soft Rush	S5
Juncus secundus	Secund Rush	S3
Juncus tenuis	Path Rush	S5
Hydrocharitaceae	Tape Grass Family	
Elodea canadensis	Canada Waterweed	S5
Iridaceae	Iris Family	
Iris versicolor	Blue Flag Iris	S5
Sisyrinchium montanum	Common Blue-eyed Grass	S5
Lemnaceae	Duckweed Family	
Lemna minor	Lesser Duckweed	S5
Lemna trisulca	Star Duckweed	S5
Lilaceae	Lily Family	
Allium tricoccum	Wild Leek	S5
Clintonia borealis	Bluebead Lily	S5
Erythronium americanum ssp. americanum	Yellow Trout Lily	S5
Hemerocallis fulva	Tawny Day Lily	SE5
Maianthemum canadense	Canada Mayflower	S5
Maianthemum racemosum	False Solomon's Seal	S5
Maianthemum stellata	Starry False Solomon's-seal	S5
Maianthemum trifolium	Three-leaved Solomon’s-seal	S5
Medeola virginiana	Indian Cucumber-root	S5
Polygonatum pubescens	Hairy Solomon's Seal	S5
Streptpous roseus	Rose Twisted Stalk	S5
Trillium erectum	Red Trillium	S5
Trillium grandiflorum	White Trillium	S5
Orchidaceae	Orchid Family	
Cypripedium acaule	Pink Moccasin Flower	S5

Appendix 8 Cont. Flora documented during 2003, 2004, 2005 2009 site visits at Giofam Investments Inc. Property.

Taxon - Scientific	Taxon - Common	S-Rank
Epipactis helleborine	Helleborine	SE5
Spiranthes lacera var. lacera	Northern Ladies Tresses	S4S5
Poaceae	Grass Family	
Agrotis gigantea	Redtop	SE5
Agrostis stolonifera	Creeping Bent Grass	S5
Bromus inermis	Smooth Brome	SE5
Calamagrotis canadensis	Canada Bluejoint	S5
Cinna latifolia	Broad-Leaved Reedgrass	S5
Dactylis glomerata	Orchard Grass	SE5
Danthonia spicata	Poverty Oat Grass	S5
Deschampsia flexuosa	Common Hairgrass	S5
Digitaria sanguinalis	Large Crabgrass	SE5
Echinochloa crusgalli	Barnyard Grass	SE5
Elymus hystrix	Bottlebrush Grass	S5
Elymus repens	Quackgrass	SE5
Festuca pratense	Meadow Fescue	SE5
Festuca rubra	Red Fescue	S5
Glyceria canadensis	Rattlesnake Glyceria	S4S5
Glyceria grandis	American Glyceria	S4S5
Glyceria striata	Fowl Glyceria	S4S5
Leersia oryzoides	Rice Cut Grass	S5
Muhlenbergia mexicana	Leafy Satin Grass	S5
Oryzopsis asperifolia	Rough-leaved Rice Grass	S5
Panicum capillare	Witch Panic Grass	S5
Phalaris arundinacea	Reed Canary Grass	S5
Phleum pratense	Timothy	SE5
Poa annua	Annual Blue Grass	SE5
Poa compressa	Canada Blue Grass	SE5
Poa plaustris	Fowl Blue Grass	S5
Poa pratense	Kentucky Blue Grass	S5
Schizachne purpurascens	False Melic	S5
Setaria pumila	Yellow Foxtail	SE5
Setaria viridis	Green Foxtail	SE5
Potamogetonaceae	Pondweed Family	
Potamogeton crispus	Curly Pondweed	SE5
Potamogeton natans	Common Floating Pondweed	S5
Potamogeton pectinatus	Sago Pondweed	S5
Potamogeton zosteriformis	Flat-stemmed Pondweed	S5
Pontederiaceae	Pickeral Weed Family	
Pontederia cordata	Pickeral Weed Family	S5
Sparganiaceae	Bur-reed Family	
Sparganium emersum	Narrow-leaved Bur-reed	S5

Appendix 8 Cont. Flora documented during 2003, 2004, 2005 2009 site visits at Giofam Investments Inc. Property.

Taxon - Scientific	Taxon - Common	S-Rank
Sparganium eurycarpum	Giant Bur-reed	S5
Typhaceae	Cattail Family	
Typha angustifolia	Narrow-leaved Cattail	S5
Typha latifolia	Broad-leaved Cattail	S5
DICOTS		
Aceracea	Maple Family	S5
Acer negundo	Manitoba Maple	S5
Acer pensylvanicum	Striped Maple	S5
Acer rubrum	Red Maple	S5
Acer saccharinum	Silver Maple	S5
Acer saccharum ssp. saccharum	Sugar Maple	S5
Acer spicatum	Mountain Maple	S5
Amaranthaceae	Amaranth Family	
Amaranthus powellii	Green Pigweeed	SE5
Anacardiaceae	Cashew Family	
Rhus radicans spp. negundo	Climbing Poison-ivy	S5
Rhus typhina	Staghorn Sumach	S5
Apocynaceae	Dogbane Family	
Apocynum androsaemifolium	Spreading Dogbane	S5
Apiaceae	Carrot Family	
Cicuta bulbifera	Bulb-bearing Water Hemlock	S5
Daucus carota	Wild Carrot	SE5
Pastinaca sativa	Wild Parsnip	SE5
Sium suave	Water-parsnip	S5
Aquifoliaceae	Holly Family	
Ilex verticillata	Winterberry	S5
Araliaceae	Ginseng Family	
Aralia hispida	Bristly Sarsparilla	S5
Aralia nudicaulis	Wild Sasparilla	S5
Aralia racemosa	Spikenard	S5
Asclepiadaceae	Milkweed Family	
Asclepias incarnata	Swamp Milkweed	S5
Asclepias syriaca	Common Milkweed	S5
Vincetoxicum rossicum (Kleopov) Borh.	Dog-strangling Vine	SE5
Asteraceae	Aster Family	
Achillea millefolium	Common Yarrow	SE5

Appendix 8 Cont. Flora documented during 2003, 2004, 2005 2009 site visits at Giofam Investments Inc. Property.

Taxon - Scientific	Taxon - Common	S-Rank
Ambrosia artemisiifolia	Common Ragweed	S5
Anaphalis margaritaceae	Pearly Everlasting	S5
Antennaria neglecta	Field Pussytoes	S5
Arctium lappa	Great Burdock	SE5
Artemisia biennis	Biennial Wormwood	SE5
Aster cordifolius	Heart-leaved Aster	S5
Aster eriocoides	Heath Aster	S5
Aster laneolatus	Panicled Aster	S5
Aster macrophyllus	Large Leaved Aster	S5
Aster novae-angliae	New England Aster	S5
Aster puniceus	Purple-stem Aster	S5
Biden cernua	Nodding Beggar-ticks	S5
Bidens frondosa	Devil's Beggar-ticks	S5
Centaurea maculosa	Spotted Knapweed	SE5
Chrysanthemum leucanthemum	Ox-eye Daisy	SE5
Cichorium intybus	Chicory	SE5
Cirsium arvense	Canada Thistle	SE5
Cirsium vulgare	Bull Thistle	SE5
Conyza canadensis	Horseweed	S5
Erigeron annuus	Daisy Fleabane	S5
Erigeron philadelphicus	Philadelphia Fleabane	S5
Eupatorium maculatum	Spotted Joe-pye Weed	S5
Eupatorium perfoliatum	Common Boneset	S5
Euthamia graminifolia	Common Goldentop	S5
Hieracium aurantiacum	Orange Hawkweed	SE5
Hieracium caespitosum	Field Hawkweed	SE5
Inula helenium	Elecampane	SE5
Matricaria matricarioides	Pineapple Weed	SE5
Prenanthes altissima	Tall White Lettuce	S5
Rudibeckia hirta	Black-eyed Susan	S5
Senecio pauperculus	Balsam Ragwort	S5
Solidago altissima	Tall Goldenrod	S4?
Solidago caesia	Blue-stem Goldenrod	S5
Solidago canadensis	Canada Goldenrod	S5
Solidago flexicaulis	Zig-zag Goldenrod	S5
Solidago nemoralis	Gray Goldenrod	S5
Solidago rugosa	Rough Goldenrod	
Solidago uliginosa	Marsh Goldenrod	S5
Sonchus arvensis	Perennial Sow-thistle	SE5
Sonchus asper	Spiny-leaved Sow-thistle	SE5
Sonchus oleraceus	Sow-thistle	SE5
Taraxacum officinale	Common Dandelion	SE5
Tragopogon dubius Scop.	Goat's-beard	SE5
Tragopogon pratensis	Meadow Goat's-beard	SE5
Tussilago farafara	Coltsfoot	SE5

Appendix 8 Cont. Flora documented during 2003, 2004, 2005 2009 site visits at Giofam Investments Inc. Property.

Taxon - Scientific	Taxon - Common	S-Rank
Balsaminaceae	Touch-Me-Not Family	
Impatiens capensis	Spotted Jewel-weed	S5
Berberidaceae	Barberry Family	
Berberis vulgaris	Common Barberry	SE5
Caulophyllum thalictroides	Blue Cohosh	S5
Podophyllum peltatum	Mayapple	S5
Betulaceae	Birch Family	
Alnus incana ssp. rugosa	Speckled Alder	S5
Betula alleghaniensis	Yellow Birch	S5
Betula papyrifera	White Birch	S5
Corylus cornuta	Beaked Hazelnut	S5
Ostrya virginiana	Ironwood	S5
Boraginaceae	Borage Family	
Cynoglossum officinale	Common Hound's Tongue	SE5
Echium vulgare	Viper’s Bugloss	SE5
Myosotis scorpioides	Common Forget-me-not	SE5
Brassicaceae	Mustard Family	
Allaria peteolata	Garlic Mustard	SE5
Barbarea vulgaris	Common Barberry	SE5
Capsella bursa-pastoris	Shepherd's-purse	SE5
Cardamine diphylla	Broad-leaved Toothwort	S5
Erysimum cheiranthoides	Wormseed Mustard	SE5
Hesperis matronalis	Dame’s Rocket	SE5
Lepidium campestre	Field Cress	SE5
Lepidium densiflorum	Common Pepper-grass	SE5
Thlaspi arvense	Field Penny Cress	SE5
Cabombaceae	Water-Shield Family	
Brasenia schreberi	Water-Shield	S5
Capanulaceae	Bellflower Family	
Campanula rotundifolia	Harebell	S5
Caprifoliaceae	Honeysuckle Family	
Diervilla Lonicera	Bush Honeysuckle	S5
Lonicera tatarica	Tartarian Honeysuckle	SE5
Sambucus canadensis	Black Elderberry	S5
Sambucus racemosa	Red-berried Elderberry	S5
Viburnum acerifolium	Maple-leaved Viburnum	S5
Viburnum cassinoides	Northern Wild Raisin	S5
Viburnum lentago	Nannyberry	S5
Viburnum trilobum	Highbush Cranberry	S5

Appendix 8 Cont. Flora documented during 2003, 2004, 2005 2009 site visits at Giofam Investments Inc. Property.

Taxon - Scientific	Taxon - Common	S-Rank
Viburnum opulus	European Highbush Cranberry	SE4
Viburnum rafinesquianum	Downy Arrow-wood	S5
Caryophyllaceae	Pink Family	
Cerastium arvense	Meadow Chickweed	SE3
Cerastium fontanum	Common Mouse-ear Chickweed	SE5
Dianthus armeria	Deptford pink	SE5
Saponaria officinalis	Bouncing Bet	SE5
Silene latifolia	Bladder Campion	SE5
Silene noctiflora	Night-flowering Catchfly	SE5
Silene vulgaris	Catchfly	SE5
Stellaria media	Common Stitchwort	SE5
Ceratophyllacea	Hornwort Family	
Ceratophyllum demersum	Common Coontail	S5
Chenopodiaceae	Goosefoot Family	
Chenopodium album	Lamb's-quarter	SE5
Chenopodium glaucum	Oak-leaved Goosefoot	SE5
Cornaceae	Dogwood Family	
Cornus alternifolia	Alternate-leaved Dogwood	S5
Cornus canadensis	Bunchberry	S5
Cornus rugosa	Round-leaved Dogwood	S5
Cornus stolonifera	Red-osier Dogwood	S5
Crassulaceae	Stonecrop Family	
Sedum acre	Mossy Stonecrop	SE5
Cucurbitaceae	Gourd Family	
Echinocystis lobata	Wild Cucumber	S5
Ericaceae	Heath Family	
Chamaedaphne calycultata	Leatherleaf	S5
Gaultheria procumbens	Wintergreen	S5
Vaccinium angustifolium	Low Sweet Blueberry	S5
Fagaceae	Beech Family	
Fagus grandifolia	American Beech	S5
Quercus alba	White Oak	S5
Quercus macrocarpa	Bur oak	S5
Quercus rubra	Red Oak	S5
Fabeaceae	Pea Family	
Desmodium canadense	Showy tick-Trefoil	S4
Lotus corniculatus	Bird's-foot Trefoil	SE5

Appendix 8 Cont. Flora documented during 2003, 2004, 2005 2009 site visits at Giofam Investments Inc. Property.

Taxon - Scientific	Taxon - Common	S-Rank
Medicago lupulina	Black Medick	SE5
Melilotus alba	White Sweet Clover	SE5
Melilotus officinalis	Yellow Sweet-clover	SE5
Trifolium agarium	Hop Clover	SE5
Trifolium campestre	Large Hop Clover	SE5
Trifolium pratense	Red Clover	SE5
Trifolium repens	White Clover	SE5
Vicia cracca	Cow Vetch	SE5
Fumariaceare	Fumewort Family	
Corydalis sempervirens	Pink Corydalis	S5
Dicentra cucullaria	Squirrel Corn	S5
Gentianaceae	Gentian Family	
Gentian andrewsii	Closed Gentian	S4
Geraniaceae	Geranium Family	
Geranium robertianum	Herb Robert	S5
Grossulariaceae	Gooseberry Family	
Ribes americanum	Wild Black Currant	S5
Ribes cyanobati	Prickly Gooseberry	S5
Ribes rubrum	Red Currant	SE5
Haloragaceae	Water-Milfoil Family	
Myriophyllum spicatum	Spiked water-milfoil	SE5
Hydrophyllaceae	Water-leaf Family	
Hydrophyllum virginianum	Virginia Water-leaf	S5
Hypericaceae	St. John's Wort Family	
Hypericum perforatum	St. John's-wort	SE5
Triadenum fraseri	Frasers St. John's Wort	S5
Lamiaceae	Mint Family	
Clinopodium vulgare	Wild Basil	S5
Glechoma hederacea	Ground Ivy	SE5
Leonurus cardiaca	Motherwort	SE5
Lycopus europaeus	European water‑horehound	SE5
Mentha arvensis spp. borealis	Wild mint	S5
Monarda fistulosa	Wild Bergamot	S5
Prunella vulgaris ssp. Lanceolata	Heal-all	S5
Lentibulariaceae	Bladderwort Family	
Utricularia cornuta	Horned Bladderwort	S5
Utricularia vulgaris	Common Bladderwort	S5

Appendix 8 Cont. Flora documented during 2003, 2004, 2005 2009 site visits at Giofam Investments Inc. Property.

Taxon - Scientific	Taxon - Common	S-Rank
Lobeliaceae	Lobelia Family	
Lobelia inflata	Indian Tobacco	S5
Lythraceae	Loosestrife Family	
Decodon verticillatus	Swamp Loosestrife	S5
Lythrum salicaria	Purple Loosestrife	SE5
Malvaceae	Mallow Family	
Malva neglecta	Cheeses	SE5
Monotropaceae	Indian-Pipe Family	
Monotropa uniflora	Indian Pipe	S5
Myricaceae	Bayberry Family	
Comptonia peregrina	Sweet Fern	S5
Myrica gale	Sweet Gale	S5
Myrsinaceae	Myrsine Family	
Trientalis borealis	Starflower	S5
Nymphaeaceae	Water Lily Family	
Brasenia schreberi	Water-shield	S5
Nymphaea odorata ssp. Odorata	Small White Water Lily	S5
Nuphar variegata	Bullhead Pond-lily	S5
Oleaceae	Olive Family	
Fraxinus americana	White Ash	S5
Fraxinus pennsylvanica	Green ash	S5
Syringa spp.	Lilac	SE5
Onagraceae	Evening Primrose Family	
Circaea lutetiana spp. canadensis	Canada Enchanter's Nightshade	S5
Epilobium ciliatum	American Willow-herb	S5
Epilobium hirsutum	Hairy Willow-herb	SE5
Oenothera parviflora	Small-flowered Evening-primrose	S4?
Orobanchaceae	Broom-Rape Family	
Castilleja coccinea	Indian Paintbrush	S5
Melampyrum lineare	Cow-wheat	S4S5
Oxalidaceae	Wood-Sorrel Family	
Oxalis stricta	Upright Yellow Wood Sorrel	S5
Papaveraceae	Poppy Family	
Sanguinaria canadensis	Bloodroot	S5

Appendix 8 Cont. Flora documented during 2003, 2004, 2005 2009 site visits at Giofam Investments Inc. Property.

Taxon - Scientific	Taxon - Common	S-Rank
Plantaginaceae	Plantain Family	
Plantago lanceolata	Ribgrass	SE5
Plantago major	Common Plantain	SE5
Polygalaceae	Milkwort Family	
Polygala paucifolia	Fringed Polygala	S5
Polygonaceae	Buckwheat Family	
Fagopyrum esculentum	Buckwheat	SE3
Polygonum cilinode	Fringed Bindweed	S5
Polygonum persicaria	Lady's Thumb	SE5
Polygonnum sagittatum	Arrowleaved Tear Thumb	S4
Rheum rhabarbarum	Rhubarb	SE5
Rumex acetosella	Sheep Sorrel	SE5
Rumex crispus	Curled Dock	SE5
Rumex obtusifolius	Bitter Dock	SE5
Portulacaceae	Purslane Family	
Claytonia caroliniana	Carolina Spring Beauty	S5
Primulaceae	Primrose Family	
Lysimachia ciliata	Fringed Loosestrife	S5
Lysimachia terrestris	Swamp Loosestrife	S5
Trientalis borealis ssp. borealis	Starflower	S5
Pyrolaceae	Wintergreen Family	
Pyrola asarifolia	Pink Pyrola	S5
Pyrola elliptica	Shinleaf	S5
Ranunculaceae	Buttercup Family	
Actaea pachypoda	White Baneberry	S5
Actaea rubra	Red Baneberry	S5
Anemone americana	Round-leaved Hepatica	S5
Anemone canadensis	Canada Anemone	S5
Anemone virginiana	Thimbleweed	S5
Aquilegia canadensis	Wild Columbine	S5
Caltha palustris	Marsh Marigold	S5
Clematis virginiana	Virginia Creeper	S5
Coptis trifolia	Goldthread	S5
Ranunculus acris	Tall Buttercup	SE5
Ranunculus acris	Tall Buttercup	SE5
Ranunculus repens	Creeping Buttercup	SE5
Ranunculus scleratus	Cursed Crowfoot	S5
Thalictrum dioicum	Early Meadow-rue	S5
Thalictrum pubescens	Tall Meadowrue	S5

Appendix 8 Cont. Flora documented during 2003, 2004, 2005 2009 site visits at Giofam Investments Inc. Property.

Taxon - Scientific	Taxon - Common	S-Rank
Rhamnaceae	Buckthorn Family	
Rhamnus cathartica	Common Buckthorn	SE5
Rosaceae	Rose Family	
Agrimony gryposepala	Tall Agrimony	S5
Amelanchier arborea	Downy Serviceberry	S5
Crataegus spp.	Hawthorn	
Fragaria vesca	Woodland Strawberry	S5
Fragaria virginiana	Common Strawberry	S5
Geum aleppicum	Yellow Avens	S5
Geum canadense	White Avens	S5
Geum triflorum	Prairie Smoke	S4
Malus pumila	Common Apple	SE5
Potentilla recta	Rough-fruited Cinquefoil	SE5
Prunus serotina	Black Cherry	S5
Prunus virginiana	Choke Cherry	S5
Rosa multiflora	Multiflora Rose	SE4
Rubus allegheniensis	Common Blackberry	S5
Rubus idaeus ssp. melanolasius	Wild Red Raspberry	S5
Rubus pubensens	Dwarf Raspberry	S5
Spirea alba	Narrow-leaved Meadowsweet	S5
Spirea tomentosa	Hardhack	S4S5
Waldsteinia fragarioides	Barren Strawberry	S5
Rubiaceae	Madder Family	
Galium mullogo	White Bedstraw	SE5
Galium palustre	Marsh Bedstraw	S5
Galium trifolium	Fragrant Bedstraw	S5
Mitchella repens	Partridgeberry	S5
Salicaceae	Willow Family	
Populus grandidentata	Largetooth Aspen	S5
Populus tremuloides	Trembling Aspen	S5
Salix amygdaloides	Peach-leaved Willow	S5
Salix bebbiana	Bebb's Willow	S5
Salix discolor	Lowland Pussy Willow	S5
Salix exigua	Sandbar Willow	S5
Salix nigra	Black Willow	S4?
Salix petiolaris	Slender Willow	S5
Santalaceae	Sandelwood Family	
Comandra umbellata	Bastard Toadflax	S5
Saxifragaceae	Saxifrage Family	
Mitella nuda	Naked Mitrewort	S5

Appendix 8 Cont. Flora documented during 2003, 2004, 2005 2009 site visits at Giofam Investments Inc. Property.

Taxon - Scientific	Taxon - Common	S-Rank
Saxifraga virginiensis	Early Saxifrage	S5
Tiarella cordifolia	Foam Flower	S5
Scrophulariacea	Figwort Family	
Linaria vulgaris	Butter-and-eggs	SE5
Verbascum blattaria	Moth Mullein	SE5
Verbascum thapsus	Common Mullein	SE5
Veronica anagallis-aquatica	Water Speedwell	SE5
Veronica officinalis	Common Speedwell	SE5
Solanaceae	Nightshade Family	
Solanum dulcamara	Bittersweet Nightshade	SE5
Tiliaceae	Linden Family	
Tilia americana	American Basswood	S5
Ulmaceae	Elm Family	
Ulmus americana	American Elm	S5
Ulmus pumila	Siberian Elm	SE3
Urticacea	Nettle Family	
Laportea canadensis	Wood Nettle	S5
Pilea pumila	Common Clearweed	S5
Urtica dioica	European Stinging Nettle	SE2
Verbenaceae	Vervain Family	
Verbena hastata	Blue Vervain	S5
Vitaceae	Grape Family	
Parthenocissus quinquefolia	Virginia Creeper	S4?
Vitis ripariana	Riverbank Grape	S5
Violaceae	Violet Family	
Viola blanda	White Sweet Violet	S5
Viola conspersa	Dog violet	S5
Viola cucullata	Marsh Blue Violet	S5
Viola pubescens	Downy Yellow Violet	S5
PTERIDOPHYTA		
Dryopteridaceae	Wood Fern Family	
Athyrium felix-femina	Northern Lady Fern	S5
Cystopteris bulbifera	Bulblet Bladder Fern	S5
Cystopteris tenuis	Mackay's Brittle Fern	S5
Dyopteris carthusiana	Spinulose Wood Fern	S5
Dryopteris cristata	Crested Wood Fern	S5
Dryopteris intermedia	Evergreen Wood Fern	S5

Appendix 8 Cont. Flora documented during 2003, 2004, 2005 2009 site visits at Giofam Investments Inc. Property.

Taxon - Scientific	Taxon - Common	S-Rank
Dryopteris marginalis	Marginal Wood fern	S5
Gymnocarpium dryopteris	Common Oak Fern	S5
Matteuccia struthiopteris	American Ostrich Fern	S5
Onoclea sensibilis	Sensitive Fern	S5
Equisetaceae	Horsetail Family	
Equisetum arvense	Field Horsetail	S5
Equisetum fluviatile	Water Horsetail	S5
Equisetum palustris	Marsh Horsetail	S5
Equisetum hyemale ssp. affine	Scouring Rush	S5
Lycopodiophyta	Club Mosses	
Diphasiastrum digitatum	Southern Ground Pine	S5
Huperzia lucidula	Shining Club-moss	S5
Lycopodium dendroideum	Prickly Tree Clubmoss	S5
Osmundaceae	Royal Fern Family	
Osmunda cinnamomea	Cinnamon Fern	S5
Osmunda claytoniana	Interrupted Fern	S5
Osmunda regalis	Regal Fern	S5
Polypodiaceae	Polypod Family	
Polypodium virginianum	Common Polypod Fern	S5
Pteridaceae	Bracken Fern Family	
Phegopteris connectilis	Northern Beech Fern	S5
Pteridium aquilinum var. latiusculum	Eastern Bracken Fern	S5
Thelypteridaceae	Marsh Fern Family	
Thelypteris palustris var. pubesens	Marsh Fern	S5
BRYOPHYTA		
Bryaceae	Bryum Family	
Leucobryum glaucum	Pin Cushion Moss	
Polytrichaceae	Hair Cap Moss Family	
Polytrichum juniperinum	Juniper Moss	
Dicranaceae	Dicranum Family	
Certodon purpureus	Fire Moss	
ASCOMYCETES		
Cladoniaceae	Cladonia Family	
Cladonia chlorophaea	False Pixie Cup	
Cladonia cristatella	British Soldiers	
Cladonia mitis	Yellow-Green Lichen	

Appendix 8 Cont. Flora documented during 2003, 2004, 2005 2009 site visits at Giofam Investments Inc. Property.

Taxon - Scientific	Taxon - Common	S-Rank
Cladina rangiferina	Reindeer Lichen	

Bradley, D.J. 2010 (Based on Ontario Plant List, Newmaster et. al. 1998)
Southern Science & Information Section. Ontario of Natural Resources.

Appendix 9. Master List of Fauna Species

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

Appendix 9. Fauna documented on Giofam Investments Inc. property on 10/27/03, 05/26/04, 06/09/04, 06/25/04, 06/28/04, 07/29/04. 06/06/05, 06/15/05 by MNAL and 05/13/09, 05/20/09, 06/12/09, 06/22/09, 06/25/09 and throughout 2010 by RiverStone.

Class	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	*Bufo americanus*		High
Amphibia	Gray Treefrog	*Hyla versicolor*		High
Amphibia	Eastern Newt	*Notophthalmus viridescens*		High
Amphibia	Eastern Red-backed Salamander	*Plethodon cinereus*		High
Amphibia	American Bullfrog	*Rana catesbeiana*		High
Amphibia	Green Frog	*Rana clamitans*		High
Amphibia	Mink Frog	*Rana septentrionalis*		High
Amphibia	Wood Frog	*Rana sylvatica*		High
Amphibia	Spring Peeper	*Pseudacris crucifer*		High
Amphibia	Northern Leopard Frog	*Rana pipiens*		High
Reptilia	Snapping Turtle	*Chelydra serpentina*		High
Reptilia	Midland Painted Turtle	*Chrysemys picta marginata*		High
Reptilia	Blanding's Turtle	*Emydoidea blandingii*	Threatened (National, Provinical)	High
Reptilia	Five-lined Skink	*Eumeces fasciatus*	Special Concern (National, Provinical)	High
Reptilia	Northern Watersnake	*Nerodia sipedon*		High
Reptilia	Dekay's Brownsnake	*Storeria dekayi*		High
Reptilia	Eastern Ribbonsnake	*Thamnophis sauritus*	Special Concern (National, Provinical)	High
Reptilia	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*		High
Aves	Great Blue Heron	*Ardea herodias*		High
Aves	Green Heron	*Ardea striatus*		Intermediate
Aves	American Bittern	*Botaurus lentiginosus*	AS	Intermediate
Aves	Canada Goose	*Branta canadensis*		High
Aves	Trumpeter Swan	*Cygnus buccinator*		Low
Aves	Wood Duck	*Aix sponsa*		High
Aves	Mallard	*Anas platyrhynchos*		Intermediate
Aves	Hooded Merganser	*Lophodytes cucullatus*		Intermediate
Aves	Turkey Vulture	*Cathartes aura*		Low
Aves	Northern Harrier	*Circus cyaneus*		Intermediate
Aves	Cooper’s hawk	*Accipiter striatus*	AS	Intermediate
Aves	Broad-winged Hawk	*Buteo platypterus*	AS	Intermediate
Aves	Red-tailed Hawk	*Buteo jamaicensis*		Intermediate
Aves	American Kestrel	*Falco sparverius*		Intermediate
Aves	Ruffed Grouse	*Bonasa umbellus*		High
Aves	Wild Turkey	*Meleagris gallopavo*		Intermediate
Aves	Common Moorhen	*Gallinula chloropus*		Low
Aves	Virginia Rail	*Rallus limicola*		Intermediate
Aves	Sora	*Porzana carolina*		Intermediate
Aves	Sandhill Crane	*Grus canadensis*		Low

Class	Common name	Scientific name	Status[1]	Likelihood that species breeds on property given the site's physical characteristics and behaviour of individuals observed
Aves	Killdeer	*Charadrius vociferus*		High
Aves	Spotted Sandpiper	*Actitis macularia*		Low
Aves	Solitary Sandpiper	*Tringa solitaria*		Low
Aves	American Woodcock	*Scolopax minor*		High
Aves	Common Snipe	*Gallinago gallinago*		Intermediate
Aves	Black Tern	*Chlidonias niger*	Not at Risk (National); Special Concern (Provinical); AS	High
Aves	Mourning Dove	*Zenaida macroura*		High
Aves	Black-billed Cuckoo	*Coccyzus erythropthalmus*		Intermediate
Aves	Barred Owl	*Strix varia*	AS	High
Aves	Common Nighthawk	*Chordeiles minor*	Threatened (National); Special Concern (Provinical)	High
Aves	Whip-poor-will	*Caprimulgus vociferus*	Threatened (National, Provinical); AS	High
Aves	Ruby-throated Hummingbird	*Archilochus colubris*		High
Aves	Belted Kingfisher	*Ceryle alcyon*		High
Aves	Yellow-bellied Sapsucker	*Sphyrapicus varius*	AS	High
Aves	Downy Woodpecker	*Picoides pubescens*		High
Aves	Hairy Woodpecker	*Picoides villosus*	AS	High
Aves	Northern Flicker	*Colaptes auratus*		High
Aves	Pileated Woodpecker	*Dryocopus pileatus*		High
Aves	Eastern Wood-pewee	*Contopus virens*		High
Aves	Least Flycatcher	*Empidonax minimus*	AS	High
Aves	Eastern Phoebe	*Sayornis phoebe*		High
Aves	Great Crested Flycatcher	*Myiarchus crinitus*		High
Aves	Eastern Kingbird	*Tyrannus tyrannus*		High
Aves	Warbling Vireo	*Vireo gilvus*		High
Aves	Red-eyed Vireo	*Vireo olivaceus*		High
Aves	Blue-headed Vireo	*Vireo solitarius*	AS	High
Aves	Yellow-throated Vireo	*Vireo flavifrons*		Intermediate
Aves	Blue Jay	*Cyanocitta cristata*		High
Aves	American Crow	*Corvus brachyrhynchos*		High
Aves	Common Raven	*Corvus corax*		Low
Aves	Tree Swallow	*Tachycineta bicolor*		High
Aves	Barn Swallow	*Hirundo rustica*		Possibly
Aves	Black-capped Chickadee	*Poecile atricapillus*		High
Aves	Red-breasted Nuthatch	*Sitta canadensis*		High
Aves	White-breasted Nuthatch	*Sitta carolinensis*	AS	High
Aves	House Wren	*Troglodytes aedon*		Intermediate

Class	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*		Low
Aves	Eastern Bluebird	*Sialia sialis*		Intermediate
Aves	Veery	*Catharus fuscescens*	AS	High
Aves	Hermit Thrush	*Catharus guttatus*	AS	High
Aves	Wood Thrush	*Hylocichla mustelina*		Possibly
Aves	American Robin	*Turdus migratorius*		High
Aves	Gray Catbird	*Dumetella carolinensis*		Intermediate
Aves	Brown Thrasher	*Toxostoma rufum*		High
Aves	European Starling	*Sturnus vulgaris*		High
Aves	Cedar Waxwing	*Bombycilla cedrorum*		Possibly
Aves	Golden-winged Warbler	*Vermivora chrysoptera*	Threatened (National); Special Concern (Provinical)	High
Aves	Nashville Warbler	*Vermivora ruficapilla*		High
Aves	Yellow Warbler	*Dendroica petechia*		High
Aves	Chestnut-sided Warbler	*Dendroica pensylvanica*		High
Aves	Magnolia Warbler	*Dendroica magnolia*	AS	High
Aves	Yellow-rumped Warbler	*Dendroica coronata*		High
Aves	Black-and-white Warbler	*Mniotilta varia*	AS	High
Aves	Black-throated Green Warbler	*Dendroica virens*		High
Aves	American Redstart	*Setophaga ruticilla*	AS	High
Aves	Ovenbird	*Seiurus aurocapillus*	AS	High
Aves	Canada Warbler	*Wilsonia canadensis*	Threatened (National); Special Concern (Provinical); AS	High
Aves	Common Yellowthroat	*Geothlypis trichas*		High
Aves	Northern Waterthrush	*Seiurus noveboracensis*		Intermediate
Aves	Scarlet Tanager	*Piranga olivacea*	AS	Intermediate
Aves	Eastern Towhee	*Pipilo erythrophthalmus*		High
Aves	Chipping Sparrow	*Spizella passerina*		High
Aves	Field Sparrow	*Spizella pusilla*		High
Aves	Vesper Sparrow	*Pooecetes gramineus*		Possibly
Aves	Savannah Sparrow	*Passerculus sandwichensis*	AS	High
Aves	House Sparrow	*Passer domesticus*		Intermediate
Aves	Song Sparrow	*Melospiza melodia*		High
Aves	Swamp Sparrow	*Melospiza georgiana*		High
Aves	White-throated Sparrow	*Zonotrichia albicollis*		Intermediate
Aves	Dark-eyed Junco	*Junco hyemalis*		Low
Aves	Northern Cardinal	*Cardinalis cardinalis*		Possibly
Aves	Rose-breasted Grosbeak	*Pheucticus ludovicianus*		High
Aves	Indigo Bunting	*Passerina cyanea*		High

Class	Common name	Scientific name	Status[1]	Likelihood that species breeds on property given the site's physical characteristics and behaviour of individuals observed
Aves	Bobolink	*Dolichonyx oryzivorus*	No Status (National); Threatened (Provinical)	High
Aves	Red-winged Blackbird	*Agelaius phoeniceus*		High
Aves	Eastern Meadowlark	*Sturnella vulgaris*	AS	High
Aves	Common Grackle	*Quiscalus quiscula*		High
Aves	Brown-headed Cowbird	*Molothrus ater*		Possibly
Aves	Baltimore Oriole	*Icterus galbula*		High
Aves	American Goldfinch	*Carduelis tristis*		High
Mammalia	American porcupine	*Erethizon dorsatum*		Intermediate
Mammalia	Beaver	*Castor canadensis*		High
Mammalia	Muskrat	*Ondatra zibethicus*		High
Mammalia	Groundhog	*Marmota monax*		High
Mammalia	Red Squirrel	*Tamiasciurus carolinensis*		High
Mammalia	Eastern Gray Squirrel	*Sciurus carolinensis*		Intermediate
Mammalia	Northern Flying Squirrel	*Glaucomys sabrinus*		Intermediate
Mammalia	Eastern Chipmunk	*Tamias striatus*		Intermediate
Mammalia	Meadow Vole	*Microtus pennsylvanicus*		Intermediate
Mammalia	White-footed Mouse	*Peromyscus leucopus*		High
Mammalia	Eastern Cottontail	*Sylvilagus floridanus*		High
Mammalia	Snowshoe Hare	*Lepus americanus*		High
Mammalia	Northern Short-tailed Shrew	*Blarina brevicauda*		Intermediate
Mammalia	Star-nosed Mole	*Condylura cristata*		Intermediate
Mammalia	Little Brown Bat	*Myotis lucifugus*		Intermediate
Mammalia	Red Fox	*Vulpes vulpes*		Intermediate
Mammalia	Coyote	*Canis latrans*		Intermediate
Mammalia	Black Bear	*Ursus americanus*		High
Mammalia	River Otter	*Lontra canadensis*		High
Mammalia	Raccoon	*Procyon lotor*		High
Mammalia	Mink	*Mustela vison*		Intermediate
Mammalia	Long-tailed Weasel	*Mustela frenata*		Intermediate
Mammalia	White-tailed Deer	*Odocoileus virginianus*		High
Mammalia	Moose	*Alces alces*		Intermediate

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

Appendix 10. Site Plan

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

QUEEN ELIZABETH II PARK

PRIVATE RECREATIONAL

CRAWFORD RIVER

GEOGRAPHIC TOWNSHIP OF DALTON

QUEEN ELIZABETH II PARK

PRIVATE RECREATIONAL

PHASE 1
17.0ha

PHASE 2
6.2ha

UNOPENED ROAD ALLOWANCE BETWEEN CONCESSIONS 3 & 4

ROAD ALLOWANCE BETWEEN LOTS 20 & 21

AGRICULTURAL

657 MONCK ROAD

633 MONCK ROAD

AGRICULTURAL

MONCK ROAD

17 18 19 20 21 22 23

N

SCALE 1:12,500

N

PHASE 2

MAINTENANCE BUILDING

SCALE & SCALE HOUSE

FUEL STORAGE

SCALE 1:7,500

- BOUNDARY OF GIOFAM LANDS
- BOUNDARY OF QUEEN ELIZABETH II PARK
- PROPOSED QUARRY LICENCE BOUNDARY
- PROPOSED LIMIT OF EXTRACTION
- IDENTIFIED AGGREGATE RESOURCE
- ENDANGERED AND THREATENED SPECIES HABITAT (NOT TO BE ALTERED)
- ACCESS, PROCESSING AND STOCKPILE AREA
- AREA ADDED TO PROPOSED LIMIT OF EXTRACTION
- SETTLING AND EQUALIZATION PONDS
- QUARRY ENTRANCE
- BUILDINGS (NOT TO SCALE)
- LOT/CONCESSION
- REPTILE FENCE
- ACCESS DRIVEWAY (APPROXIMATE ROUTE)

SEBRIGHT QUARRY
CITY OF KAWARTHA LAKES

REVISED
CONCEPT PLAN

Scale: AS SHOWN

P/N 2019 | MARCH 2011

Skelton Brumwell & ASSOCIATES INC
CONSULTING ENGINEERS & PLANNERS
93 BELL FARM ROAD, SUITE 107 BARRIE, ONTARIO L4M 5G1
TELEPHONE (705) 726-1141 FAX. (705) 726-0331

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2019- 1

DECLARATION OF PURPOSE

THIS SITE PLAN IS PREPARED UNDER THE AGGREGATE RESOURCES ACT FOR A CLASS 'A' LICENCE, CATEGORY 2.

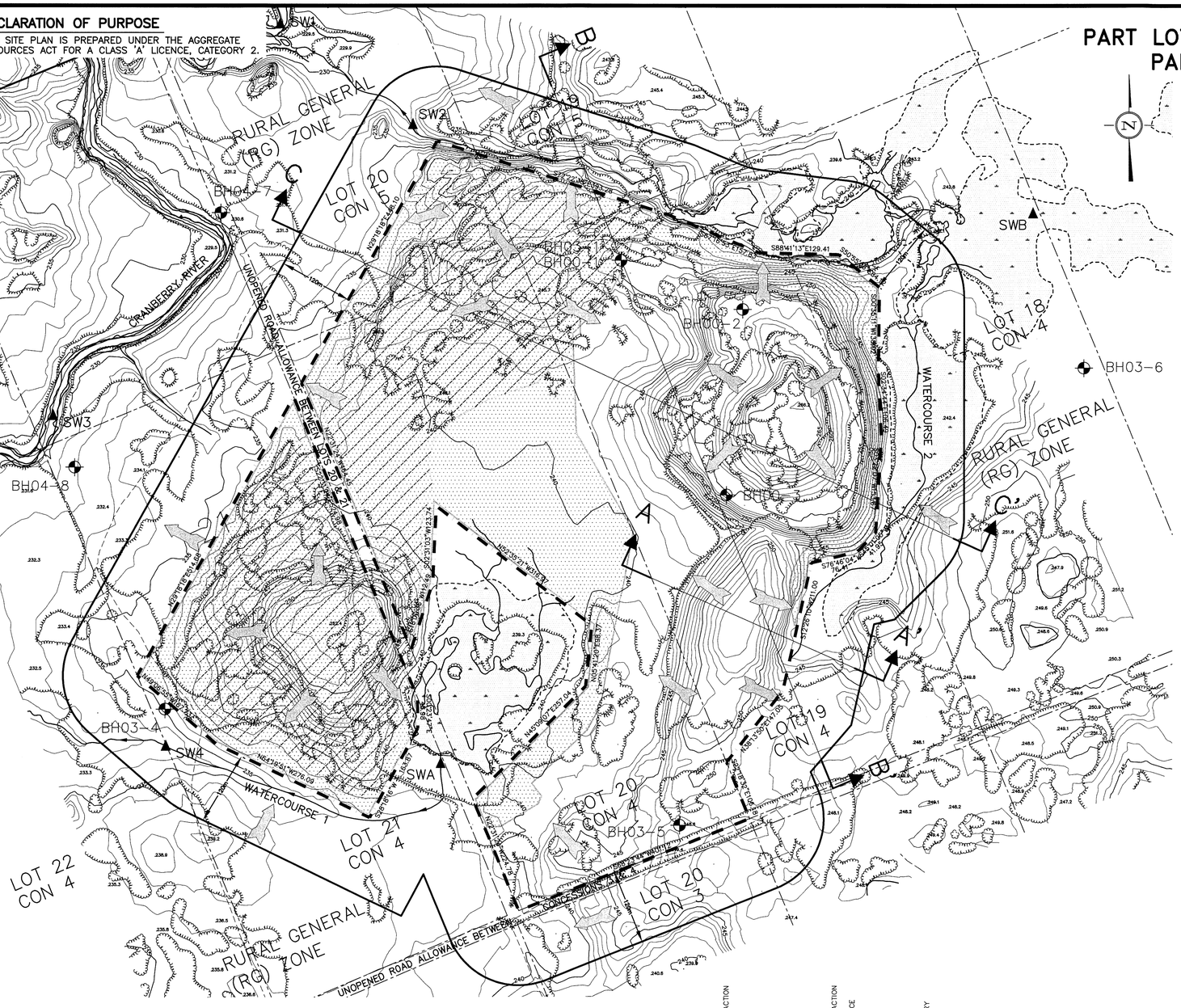
PART LOTS 18, 19, 20, & 21 CONCESSION 4
PART LOTS 19, 20 CONCESSION 5

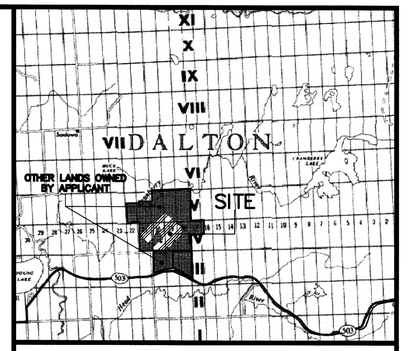
GEOGRAPHIC TOWNSHIP OF DALTON

CITY OF KAWARTHA LAKES

80 0 80 160 240 320 400 metres

SCALE 1:4000





KEY MAP

2000 0 2000 4000 6000 metres

SCALE 1:100,000

LEGEND

- PROPOSED LICENCE BOUNDARY
- LOT/CONCESSION LINE
- BOUNDARY OF LANDS WITHIN 120m OF PROPOSED LICENCE BOUNDARY
- TRAIL
- 250 / 250.42 CONTOURS & SPOT ELEVATIONS
- GENERAL DIRECTION OF DRAINAGE
- TREES/BUSH
- WETLANDS DIGITIZED FROM AERIAL PHOTOGRAPHY
- BH00-3 BOREHOLE
- ENDANGERED AND THREATENED SPECIES HABITAT (NOT TO BE ALTERED)
- IDENTIFIED AGGREGATE RESOURCE
- SW2 SURFACE WATER MONITORING STATION
- WATERCOURSE
- A A' SECTION ARROWS

A. SITE PLAN REFERENCES

1. CONTOUR MAPPING AND TOPOGRAPHIC FEATURES BY NORTHWAY–PHOTOMAP LIMITED OCTOBER 13, 2004 USING 1991 AERIAL PHOTOGRAPHY. ALL FEATURES ARE SHOWN TO SCALE.

   CONTOURS ARE AT 1.0 METRE INTERVALS.

   ELEVATIONS SHOWN ARE RELATED TO A GEODETIC BENCHMARK DESCRIBED AS: TOP OF PIPE OF GROUNDWATER MONITOR BH03–05. ELEVATION: 248.39 masl.
2. BOUNDARY INFORMATION BASED ON THE BEARING AND DISTANCE OF THE SOUTH LIMIT OF LOT 20, CONCESSION 4 FROM A SITE SURVEY BY C.T. STRONGMAN SURVEY LIMITED, JUNE 20, 2003.
3. ALL LANDS TO BE LICENCED AND WITHIN 120 METRES OF THE PROPOSED LICENCE BOUNDARY ARE ZONED RURAL GENERAL (RG) BY TOWNSHIP OF DALTON BY–LAW 10–77.
4. ALL LANDS TO BE LICENCED AND WITHIN 120 METRES OF THE PROPOSED LICENCE BOUNDARY ARE USED FOR PRIVATE RECREATION EXCEPT FOR LANDS IN LOTS 20 & 21, CONCESSION 3 WHICH ARE USED FOR PASTURE, AND ARE OUTSIDE THE PROPOSED LICENCE.
5. THERE ARE NO BUILDINGS OR STRUCTURES ON OR WITHIN 120 METRES OF THE LICENCE BOUNDARY.

B. TECHNICAL REPORTS

1. STAGE 1 AND STAGE 2 ARCHAEOLOGICAL ASSESSMENT OF THE PROPOSED GIOFAM QUARRY BY ARCHAEOLOGICAL ASSESSMENTS LTD., DATED APRIL 2006 AND MAY 2007.
2. NATURAL ENVIRONMENT LEVEL 1 AND LEVEL 2 ASSESSMENTS, SEBRIGHT QUARRY BY RIVERSTONE ENVIRONMENTAL SOLUTIONS INC., APRIL 2011.
3. UPDATED HYDROGEOLOGICAL EVALUATION, SEBRIGHT QUARRY BY GENIVAR, APRIL 2011.
4. BLAST IMPACT ANALYSIS BY EXPLOTECH ENGINEERING LTD., APRIL 2011.
5. TRAFFIC IMPACT STUDY BY SKELTON, BRUMWELL & ASSOCIATES INC., REVISED APRIL 2011.
6. UPDATED PERFORMANCE MONITORING PLAN BY GENIVAR, APRIL 2011.
7. TECHNICAL BACKGROUND REPORT BY SKELTON, BRUMWELL & ASSOCIATES INC., REVISED APRIL 2011.
8. DUST MANAGEMENT PLAN BY CHURCH & TROUGHT LTD., APRIL 2011.

C. SITE DESCRIPTION

1. AREA TO BE LICENCED 83.69 HA
2. THIS QUARRY WILL PRIMARILY PRODUCE SPECIALTY AGGREGATE FOR HIGH SPEED HIGHWAY ASPHALT. OTHER AGGREGATE PRODUCTS WILL ALSO BE PRODUCED TO OPTIMIZE RESOURCE UTILIZATION.
3. THERE IS NO FENCING ON SITE.

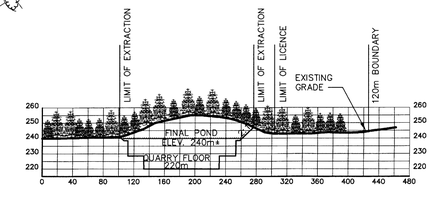
D. DRAINAGE

1. DRAINAGE OF THE SITE AND THE AREA WITHIN 120 M OF THE SITE IS BY OVERLAND FLOW IN THE DIRECTION SHOWN BY THE ARROWS ON THE PLAN, OR BY INFILTRATION.

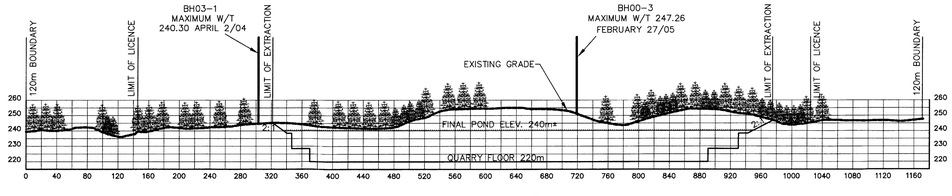
E. GROUNDWATER

1. THE ESTABLISHED GROUNDWATER TABLE IS AT AN ELEVATION OF BETWEEN 228.89 MASL AT BH04–7, JANUARY 24, 2005, AND 256.30 MASL AT BH00–2, SEPTEMBER 30, 2010, BASED ON ON–SITE BOREHOLES AND DESCRIBED IN THE UPDATE HYDROGEOLOGICAL EVALUATION.

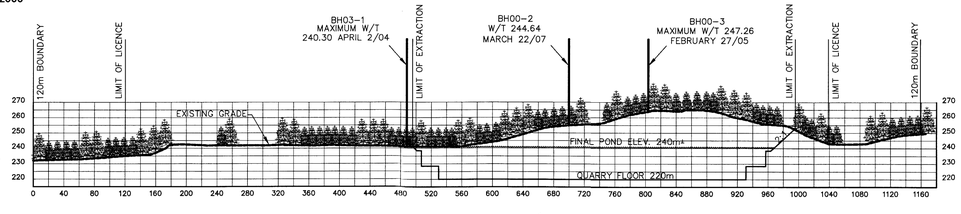
BH Number	Monitor Designation	Ground Surface Elevation (masl)	Highest Groundwater Elevation (masl)	Date
BH03–1	II	244.58	240.30	April 2, 2004
	I	244.58	240.24	April 2, 2004, January 24, 2005
	OH	244.58	239.52	April 2, 2004
BH00–1	OH	244.61	244.64	March 22, 2007
BH00–2	OH	256.33	256.30	September 30, 2010
BH00–3	OH	254.61	247.26	February 17, 2005
BH03–4	II	236.55	235.31	March 22, 2007
	I	236.55	235.36	March 22, 2007
	OH	236.55	234.34	April 2, 2004
BH03–5	II	247.61	245.64	January 16, 2008
	I	247.61	240.94	September 30, 2010
	OH	247.61	239.86	April 1, 2004
BH03–6	II	245.20	245.43	March 24, 2008
	I	245.20	245.12	April 2, 2004
	OH	245.20	244.45	April 1, 2004
BH04–7	II	228.82	228.89	January 24, 2005
	I	228.81	>229.67 Flowing	Numerous dates.
BH04–8	II	231.39	231.68	November 13, 2008
	I	231.27	231.79	September 30, 2010



SECTION A–A'
HORIZONTAL 1 : 4000
VERTICAL 1 : 2000



SECTION B–B'
HORIZONTAL 1 : 4000
VERTICAL 1 : 2000



SECTION C–C'
HORIZONTAL 1 : 4000
VERTICAL 1 : 2000

FOR EXTRACTION AND REHABILITATED SLOPE DETAILS
SEE DWG. 3 OF 5 AND 4 OF 5

SCHEDULE OF REVISIONS PRIOR TO LICENCE

NO.	DATE	DESCRIPTION	APPROVED
1	DEC 11/08	REV PER MNR COMMENTS NOV 24/08	
2	APRIL 19, 2011	GENERAL REVISIONS	

SCHEDULE OF AMENDMENTS

NO.	DATE	DESCRIPTION	APPROVED

TRUDY P. PATERSON
IS APPROVED BY THE MINISTRY OF NATURAL RESOURCES PURSUANT TO SECTION 8 (4) OF THE AGGREGATE RESOURCES ACT TO PREPARE AND CERTIFY SITE PLANS.

TRUDY P. PATERSON — Apr 19/11 DATE

SEBRIGHT QUARRY
CITY OF KAWARTHA LAKES

APPLICANT: GIOFAM INVESTMENTS INC.
BOX 1359
UXBRIDGE, ONTARIO
L9P 1N6

EXISTING FEATURES & CROSS SECTIONS

PROJECT NO. 05–2019		DRWG. NO. 052019	1 OF 5
DATE: APR 2011		SCALE: 1:4000	
DRAWN: TAR	CHECKED:	APPROVED:	

Skelton Brumwell & ASSOCIATES INC.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS
93 BELL FARM ROAD, SUITE 107 BARRIE, ONTARIO L4M 5G1
TELEPHONE (705) 726–1141 FAX. (705) 726–0331

2019- 2

PART LOTS 18, 19, 20, & 21 CONCESSION 4
PART LOTS 19, 20 CONCESSION 5

GEOGRAPHIC TOWNSHIP OF DALTON

CITY OF KAWARTHA LAKES

DECLARATION OF PURPOSE

THIS SITE PLAN IS PREPARED UNDER THE AGGREGATE RESOURCES ACT FOR A CLASS 'A' LICENCE, CATEGORY 2.

A. GENERAL

1. LICENCED AREA 83.74 HA
2. AREA TO BE EXTRACTED
   PHASE 1 17.1 HA
   PHASE 2 6.2 HA
   TOTAL 23.3 HA
3. THE ESTABLISHED GROUNDWATER TABLE IS AT AN ELEVATION OF BETWEEN 228.89 MASL, AT BH04–7, JANUARY 24, 2005, AND 256.30 MASL AT BH00–2, SEPTEMBER 30, 2010, BASED ON ON–SITE BOREHOLES AND DESCRIBED IN THE HYDROGEOLOGICAL EVALUATION SEBRIGHT QUARRY.
4. EXTRACTION WILL OCCUR BELOW THE ESTABLISHED WATER TABLE BUT NOT BELOW 220 MASL EXCEPT FOR SUMPS.
5. ANNUAL EXTRACTION WILL NOT EXCEED 200,000 TONNES.
6. PRIOR TO ANY TRANSPORTATION OF AGGREGATE FROM THE SITE, THE LICENCE WILL ENTER INTO A HAUL ROUTE AGREEMENT WITH THE CITY OF KAWARTHA LAKE.
7. ANNUAL EXTRACTION WILL BE LIMITED TO 50,000 TONNES UNTIL THE IMPROVEMENTS TO MONCK ROAD HAVE BEEN COMPLETED AND APPROVED BY THE CITY OF KAWARTHA LAKES.
8. NO DISTURBANCE, INCLUDING CLEARING, GRADING OR EXCAVATION, WILL OCCUR WITHIN THE SETBACKS OR ANY HABITAT OF THREATENED AND ENDANGERED SPECIES, EXCEPT IN ACCORDANCE WITH A PERMIT UNDER THE ENDANGERED SPECIES ACT.
9. THE SCALES, A SCALE HOUSE, MAINTENANCE/OFFICE FACILITIES AND FUEL STORAGE AS SHOWN MAY BE INSTALLED/CONSTRUCTED ON SITE.

B. HOURS OF OPERATION

1. LOADING, TRANSPORTATION — 7:00 AM TO 6:00 PM MONDAY TO THURSDAY AND 7:00 AM TO 3:00 PM FRIDAY
2. EXTRACTION, PROCESSING — 7:00 AM TO 6:00 PM MONDAY TO FRIDAY AND 7:00 AM TO 12:00 PM SATURDAY
3. MAINTENANCE — 7:00 AM TO 6:00 PM MONDAY TO FRIDAY AND 7:00 AM TO 12:00 PM SATURDAY
4. BLASTING — 8:00 AM TO 4:00 PM MONDAY TO FRIDAY

NO OPERATIONS WILL OCCUR ON SUNDAYS OR PUBLIC HOLIDAYS AS DEFINED BY THE EMPLOYMENT STANDARDS ACT.

C. FENCING

1. POST AND WIRE FENCING, MINIMUM HEIGHT 1.2 M, WILL BE INSTALLED ALONG PART OF THE SOUTHERLY LICENSED BOUNDARY AS SHOWN ON THIS PLAN WITHIN 12 MONTHS OF LICENSING. THE ACTIVE AREA OF THE SITE WILL BE DEMARCATED BY THE REPTILE FENCE (SEE SECTION O – VARIATIONS FROM PROVINCIAL STANDARDS).
2. A GATE WILL BE INSTALLED AT THE ENTRANCE/EXIT OF THE SITE AND WILL BE KEPT CLOSED DURING HOURS OF NON–OPERATION.
3. ALL FENCING WILL BE MAINTAINED AND/OR REPLACED AS NECESSARY UNTIL THE LICENCE IS SURRENDERED.

D. SITE PREPARATION

1. PRIOR TO ANY CLEARING, STRIPPING OR EXTRACTION ON THE SITE, THE LIMIT OF EXTRACTION AND THE LOCATION OF THE REPTILE FENCE AND BOUNDARIES OF THE WETLANDS WILL BE STAKED BY A QUALIFIED PERSON USING GPS.
2. NO CLEARING WILL OCCUR BETWEEN MAY 15 AND JULY 31.
3. THE AREA OF THE SETTLING AND EQUALIZATION PONDS, AND ADJACENT AREA, WILL BE CLEARED FIRST TO MAKE ROOM FOR ACCESS AND EQUIPMENT FOR CONSTRUCTION OF THE PONDS AND INSTALLATION OF THE REPTILE FENCE. TO PREVENT SEDIMENTATION OF ADJACENT AREAS TEMPORARY, OR PERMANENT, SILTATION CONTROL MEASURES WILL BE INSTALLED PRIOR TO THIS CONSTRUCTION. CONSTRUCTION OF THE PONDS WILL REQUIRE BLASTING.
4. NO FURTHER CLEARING OR ANY STRIPPING OR EXTRACTION WILL OCCUR IN PHASE 1 UNTIL THE INSTALLATION OF THE PONDS, ALL OF THE REPTILE FENCE, AND THE PERMANENT SILTATION CONTROLS AROUND WEST LIMIT OF EXTRACTION OF PHASE 1 IS COMPLETE.
5. BRUSH AND STUMPS WILL BE REMOVED FROM SITE, DISPOSED OF BY BURNING WITH APPLICABLE PERMITS, CHIPPED AND/OR STOCKPILED IN THE PROCESSING AREA FOR USE IN REHABILITATION.
6. WITHIN THE LIMIT OF EXTRACTION ALL TREES WILL BE REMOVED WITHIN 5 M OF THE EXCAVATION FACE.
7. THE DEPTH OF TOPSOIL/OVERBURDEN VARIES BUT IS GENERALLY LESS THAN 0.3 M. ALL TOPSOIL/OVERBURDEN WILL BE STRIPPED AND STOCKPILED WITHIN THE AREA TO BE EXTRACTED, THE STOCKPILE AND PROCESSING AREA, OR UTILIZED IN PROGRESSIVE REHABILITATION. (SEE SECTION O – VARIATIONS FROM PROVINCIAL STANDARDS.)
8. TOPSOIL/OVERBURDEN STOCKPILES AND ANY EROSION PRONE AREAS WILL BE SEEDED AND MAINTAINED TO CONTROL EROSION.
9. NO TOPSOIL/OVERBURDEN WILL BE REMOVED FROM THE SITE.

E. SILTATION CONTROL

1. SILTATION CONTROL MECHANISMS WILL INCLUDE SEDIMENT TRAPS AND SILT FENCE INSTALLED ON THE REPTILE FENCE.
2. SEDIMENT TRAPS AND/OR SILT FENCE WILL BE INSTALLED IN LOCATIONS SHOWN ON THIS PLAN AND IN ACCORDANCE WITH DETAIL 2A AND 2B ON DWG NO. 2019–4 OF 5 ALONG THE LIMIT OF EXTRACTION DOWN SLOPE OF AREAS TO BE PREPARED FOR EXTRACTION:
   A) AS SPECIFIED IN NOTE D.
   B) PRIOR TO STRIPPING WITHIN 30 METRES OF THE LIMIT OF EXTRACTION, AND
   C) PRIOR TO ANY STRIPPING IN AREAS WHERE THERE IS INSUFFICIENT NATURAL VEGETATION WITHIN 30 METRES OF THE LIMIT OF EXTRACTION TO PREVENT SILTATION ONTO SETBACKS OR ADJACENT LANDS.
3. A QUALIFIED PERSON BE RETAINED TO CERTIFY THE ADEQUACY OF SEDIMENTATION AND EROSION CONTROLS FOR ALL PHASES OF THE QUARRY, AND TO INSPECT AND ENSURE NECESSARY REPAIRS FOLLOWING WINTER THAWS, SPRING FRESHETS, AND HEAVY RAINFALL EVENTS.
4. SEDIMENT TRAPS AND/OR SILT FENCE, WILL BE MAINTAINED UNTIL THE STRIPPED AREA IS EXTRACTED TO AN ELEVATION THAT DIRECTS ALL RUNOFF TO A SUMP.

F. DRAINAGE AND WATER DIVERSION

1. DRAINAGE OF UNDISTURBED AREAS WILL CONTINUE AS SHOWN AND DESCRIBED ON THE EXISTING CONDITIONS PLAN.
2. DURING INITIAL EXTRACTION IN PHASE 1A DRAINAGE FROM THE EXTRACTION AREA WILL BE DIRECTED TO THE SETTLING POND. THE SUMP WILL BE CONSTRUCTED IN PHASE 1 ONCE EXTRACTION IS BELOW THE ELEVATION OF THE ADJACENT LANDS.
3. THE SUMP WILL BE LOCATED A MINIMUM OF 10 METRES FROM THE LIMIT OF EXTRACTION.
4. FOLLOWING INSTALLATION OF THE SUMP IN PHASE 1, AND DURING EXTRACTION IN PHASE 2, PRECIPITATION AND GROUNDWATER FROM THE DISTURBED AREAS WILL BE COLLECTED IN THE SUMP AND DISCHARGED TO MAINTAIN FLOW IN THE WATERCOURSES OR TO THE EQUALIZATION POND.
5. RUNOFF FROM THE ACCESS, STOCKPILE AND PROCESSING AREA, AND WASH PLANT DISCHARGE WILL BE DIRECTED TOWARD THE SETTLING POND. WATER COLLECTED IN THE SETTLING POND WILL BE RECYCLED TO THE WASH PLANT, USED FOR DUST CONTROL, OR DISCHARGED TO THE EQUALIZATION POND.
6. WATER WILL BE DISCHARGED FROM THE EQUALIZATION POND TO MAINTAIN FLOW IN WATERCOURSE 1, AND FROM THE PHASE 1/2 SUMP TO MAINTAIN FLOW CONDITIONS IN WATERCOURSE 2. (SEE DETAIL 1, DWG NO. 2019–4 OF 5)
7. A PERMIT TO TAKE WATER, FOR WATER TAKING IN EXCESS OF 50 CU M PER DAY, AND CERTIFICATE OF APPROVAL FOR DISCHARGE WILL BE OBTAINED PRIOR TO ANY PUMPING.
8. THERE WILL BE NO DIRECT DISCHARGE INTO THE CRANBERRY RIVER.

G. WASHING AND PONDS

1. A WASH PLANT WILL BE INSTALLED AFTER A SUMP HAS BEEN ESTABLISHED IN PHASE 1 AND THE SETTLING AND EQUALIZATION PONDS HAVE BEEN CONSTRUCTED. THE WASH PLANT MAY BE RELOCATED FROM TIME TO TIME BUT WILL REMAIN WITHIN THE LIMIT OF EXTRACTION.
2. THE SETTLING AND EQUALIZATION PONDS WILL BE CONSTRUCTED AS SHOWN ON THE DETAILS, DWG NO. 2019–5 OF 5.
3. THE SETTLING POND WILL BE THE PRIMARY SETTLING POND FOR RUNOFF FROM THE ACCESS, STOCKPILE AND PROCESSING AREA, AND WASH WATER FROM THE WASH PLANT. WATER FROM THIS POND WILL BE RECYCLED TO THE WASH PLANT, USED FOR DUST CONTROL OR DISCHARGED TO THE EQUALIZATION POND.
4. THE EQUALIZATION POND WILL PROVIDE SECONDARY SETTLING AND WILL COLLECT OVERFLOW FROM SETTLING POND AND WATER PUMPED FROM THE SUMPS. WATER FROM THE EQUALIZATION POND WILL BE DISCHARGED TO MAINTAIN FLOW IN WATERCOURSE 1. (SEE DETAIL 1, DWG NO. 2019–4 OF 5)
5. THE SETTLING AND EQUALIZATION PONDS WILL BE CONSTRUCTED WITH CONTROL STRUCTURES TO MAINTAIN ACCEPTABLE SURFACE WATER QUALITY FOR DISCHARGE TO WATERCOURSE 1. SIMILARLY, DIRECT DISCHARGE INTO THE HEADWATER OF WATERCOURSE 2 WILL SATISFY THE PROVINCIAL WATER QUALITY OBJECTIVES (1999 AND UPDATES) OR BACKGROUND CONDITIONS.
6. THE SETTLING AND EQUALIZATION PONDS AND SUMPS WILL BE CLEANED OUT ON A REGULAR BASIS TO MAINTAIN THE REQUIRED VOLUME AND SETTLING TIME. MATERIAL REMOVED FROM THE PONDS AND SUMPS (POND FINES) WILL BE STOCKPILED IN THE ACCESS, STOCKPILE AND PROCESSING AREA FOR SALE OR USED IN PROGRESSIVE REHABILITATION.

H. DUST CONTROL

1. DUST WILL BE MITIGATED ON SITE.
2. WATER FROM THE SETTLING POND, OR OTHER PROVINCIALLY APPROVED DUST SUPPRESSANT, WILL BE APPLIED TO HAUL ROADS AND PROCESSING AREAS AS OFTEN AS REQUIRED TO MITIGATE DUST IN ACCORDANCE WITH THE POND MANAGEMENT PLAN. (SEE DETAILS DWG NO. 2019–5 OF 5)
3. PRIMARY AND SECONDARY DUST COLLECTORS WILL BE EMPLOYED ON THE ROCK DRILL TO KEEP THE LEVEL OF ROCK DUST TO A MINIMUM.
4. MAXIMUM SPEED ON THE ACCESS ROAD AND INTERNAL HAUL ROADS WILL BE 30km/hr.

I. BLASTING

1. BLASTING WILL OCCUR A MAXIMUM OF 3 TIMES PER WEEK.
2. AN ATTENUATION STUDY SHALL BE UNDERTAKEN BY AN INDEPENDENT BLASTING CONSULTANT DURING THE FIRST 12 MONTHS OF OPERATION IN ORDER TO OBTAIN SUFFICIENT QUARRY DATA FOR THE DEVELOPMENT OF SITE SPECIFIC ATTENUATION RELATIONS. THIS STUDY WILL BE USED TO CONFIRM THE APPLICABILITY OF THE INITIAL GUIDELINE PARAMETERS AND ASSIST IN DEVELOPMENT OF FUTURE BLAST DESIGNS.
3. MINIMUM COLLAR WILL BE 1.5 METRES ON BODY HOLES AND 2.7 METRES ON FACE HOLES. IN THE EVENT OF THE APPLICATION OF BOREHOLES GREATER THAN 100 MILLIMETRES IN DIAMETER, COLLARS WILL BE INCREASED ACCORDINGLY.
4. CLEAR CRUSHED STONE WILL BE USED FOR STEMMING.
5. BLAST DESIGN WILL BE CONTINUALLY REVIEWED WITH RESPECT TO FRAGMENTATION, GROUND VIBRATION AND OVERPRESSURE. BLAST DESIGNS SHALL BE MODIFIED AS REQUIRED TO ENSURE COMPLIANCE WITH APPLICABLE GUIDELINES AND REGULATIONS. DECKING, REDUCED HOLE DIAMETERS AND SEQUENTIAL BLASTING TECHNIQUES WILL BE USED TO ENSURE MINIMAL EXPLOSIVES PER DELAY PERIOD INITIATED.
6. BLASTING WILL BE MONITORED IN ACCORDANCE WITH THE PERFORMANCE MONITORING PROGRAM. (SEE DRAWING 5 OF 5)
7. THE OPERATOR WILL BE AWARE OF THE GUIDELINES FOR USE OF EXPLOSIVES IN OR NEAR CANADIAN FISHERIES WATERS.
8. BUFFERS SHOULD BE PROTECTED FROM ROCK SHATTER AND/OR PHYSICAL DISRUPTION THROUGH PROPER BLAST DESIGN, BLAST ORIENTATION AND MONITORING.
9. BLAST DESIGN MUST BE SUCH THAT DURING THE WARM WATER SPAWNING SEASON (APRIL 1 TO JUNE 30) OVERPRESSURE DOES NOT EXCEED 100 KPA (14.5 PSI) OR VIBRATION EXCEED 13 MM/SEC AT THE EDGE OF THE CLOSEST OPEN WATER.
10. A QUALIFIED PROFESSIONAL BE RETAINED TO PREPARE A BLASTING PLAN THAT IS COMPLIANT WITH DFO REGULATIONS, AND 13mm/sec GUIDELINE VIBRATION LIMIT.

J. EXTRACTION SEQUENCE

1. INITIAL EXTRACTION WILL OCCUR IN PHASE 1A. MATERIAL WILL BE CRUSHED, SCREENED AND STOCKPILED WITHIN THE DISTURBED AREA. NO WASHING OF THIS MATERIAL WILL OCCUR ON SITE.
2. EXTRACTION WILL CONTINUE IN PHASE 1A AND PROCEED FROM SOUTH TO NORTH THROUGH THE PHASE TO DEPTH OF APPROXIMATELY 242 MASL.
3. EXTRACTION IN PHASE 1B MAY COMMENCE DURING EXTRACTION IN PHASE 1A AND PROCEED FROM SOUTH TO NORTH TO AN ELEVATION OF 220 MASL.
4. EXTRACTION IN PHASE 2 WILL PROCEED FROM NORTH TO SOUTH THROUGH THE PHASE, AND MAY OCCUR DURING EXTRACTION IN PHASES 1A OR 1B.
5. AS THE HORIZONTAL LIMIT OF EXTRACTION IN ANY PART OF EACH PHASE, PROGRESSIVE REHABILITATION WILL COMMENCE AS SHOWN ON THE PROGRESSIVE AND FINAL REHABILITATION PLAN.
6. IF DEVELOPMENT AND SITE ALTERATION IS GOING TO OCCUR BETWEEN MAY 15 AND JULY 31, A NEST SURVEY IS SUGGESTED PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES TO LOCATE AND IDENTIFY ACTIVE NESTS OF MIGRATORY BIRD SPECIES COVERED BY THE ACT. IF A NEST IS LOCATED OR EVIDENCE OF BREEDING NOTED, THEN A MITIGATION PLAN SHOULD BE DEVELOPED TO ADDRESS ANY POTENTIAL IMPACTS ON MIGRATORY BIRD NESTS OR THEIR ACTIVE NESTS; MITIGATION MAY REQUIRE ESTABLISHING APPROPRIATE BUFFERS AROUND ACTIVE NESTS OR DELAYING CONSTRUCTION ACTIVITIES UNTIL THE CONCLUSION OF THE NESTING SEASON.

K. EXTRACTION DETAILS

1. HEIGHT OF THE LIFTS WILL VARY DUE TO ROCK QUALITY AND SAFETY CONSIDERATIONS, BUT WILL NOT EXCEED 20 M. THE NUMBER OF LIFTS WILL VARY THROUGH THE PHASES DUE TO THE VARIABLE SURFACE TOPOGRAPHY.
2. THE HIGHEST ELEVATION WITHIN THE LIMIT OF EXTRACTION IS 266.2 MASL EXTRACTED TO A QUARRY FLOOR ELEVATION OF 220 MASL ESTABLISHES AN APPROXIMATE MAXIMUM DEPTH OF EXCAVATION OF 46.2 M. AT THE MAXIMUM LIFT HEIGHT OF 20 METRES THERE WILL BE A MAXIMUM OF 3 LIFTS.
3. AGGREGATE STOCKPILES WILL BE LOCATED ON THE QUARRY FLOOR IN CLOSE PROXIMITY TO THE EXTRACTION FACE, AND IN THE ACCESS, STOCK PILE AND PROCESSING AREA.
4. WHERE THE QUALITY OF MATERIAL DOES NOT MEET THE OPERATORS MARKET REQUIREMENTS, THE HORIZONTAL EXTENT OR DEPTH OF EXTRACTION MAY BE REDUCED.
5. THE LOCATION OF THE INTERNAL HAUL ROAD FROM THE ENTRANCE TO PHASE 1 WILL BE PERMANENT. THE LOCATION OF SECONDARY HAUL ROADS WILL VARY AS THE OPERATION PROGRESSES.
6. SCRAP WILL BE STORED IN THE ACCESS, STOCKPILE AND PROCESSING AREA AND WILL BE REMOVED FROM THE SITE ON AN ON–GOING BASIS.

L EQUIPMENT

1. EQUIPMENT TO BE UTILIZED ON THE SITE WILL INCLUDE, BUT NOT BE LIMITED TO:

   MOBILE (SELF PROPELLED) – SCRAPERS, EXCAVATORS, LOADERS, DOZERS, TRUCKS AND OFF–ROAD TRUCKS

   STATIONARY – SCREENING PLANT, STACKER, CONVEYORS, POWER PLANT, FEED BIN, CRUSHING PLANT, WASH PLANT, TOOL TRAILER AND ROCK DRILLS
2. PROCESSING EQUIPMENT WILL BE PORTABLE AND WILL BE LOCATED IN PROXIMITY TO THE ACTIVE FACE OR THE ACCESS, STOCKPILE AND PROCESSING AREA.
3. IF REQUIRED, A CERTIFICATE OF APPROVAL WILL BE OBTAINED FOR PROCESSING EQUIPMENT TO BE USED ON SITE.

M. FUEL STORAGE AND EQUIPMENT MAINTENANCE

1. FUEL STORAGE FACILITIES WILL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE REQUIREMENTS OF THE TECHNICAL STANDARDS AND SAFETY AUTHORITY.
2. STATIONARY EQUIPMENT WILL BE FUELLED BY A MOBILE REFUELLING TANK, ALL IN ACCORDANCE WITH THE LIQUID FUEL HANDLING CODE AND WITH CARE TO PREVENT SPILLS.
3. ALL EQUIPMENT WILL BE INSPECTED DAILY FOR LEAKS OF FUEL, OIL OR HYDRAULIC SYSTEMS.
4. MOBILE EQUIPMENT MAY BE SERVICED ON–SITE IN THE MAINTENANCE BUILDING, OR OFF–SITE.
5. STATIONARY EQUIPMENT WILL BE SERVICED ON–SITE.
6. ALL PETROLEUM WASTE PRODUCTS WILL BE COLLECTED AND DISPOSED OF BY AN MOE APPROVED AGENT.
7. SPILLS CONTAINMENT MATERIALS WILL BE STORED ON SITE.

N. PERFORMANCE MONITORING PLAN

SEE DWG. NO. 05–2019–5 OF 5

O. VARIATIONS FROM PROVINCIAL STANDARDS

No.	DESCRIPTION	REFERENCE TO STANDARDS	COMMENTS
1.	Only the south boundary of the licenced area in the vicinity of the road allowance will be fenced with 1.2m wire fencing.	5.1	Active areas of the quarry will be demarcated by the reptile fence and signage.
2.	Topsoil and Overburden will not be stripped and stockpiled separately.	5.4	The depth of topsoil/overburden is 0.3 metres or less.
3.	Scales and scale house may be located within 30 metres of the licence boundary.	5.13.1	No extraction will occur within 30 metres of the licence boundary.
4.	Slopes below the future lake surface elevations will be vertical (17–21m high) except in specified locations.	5.19	Extraction to a vertical face provides for maximum resource recovery. Shallow access points with full 2:1 slopes are provided.

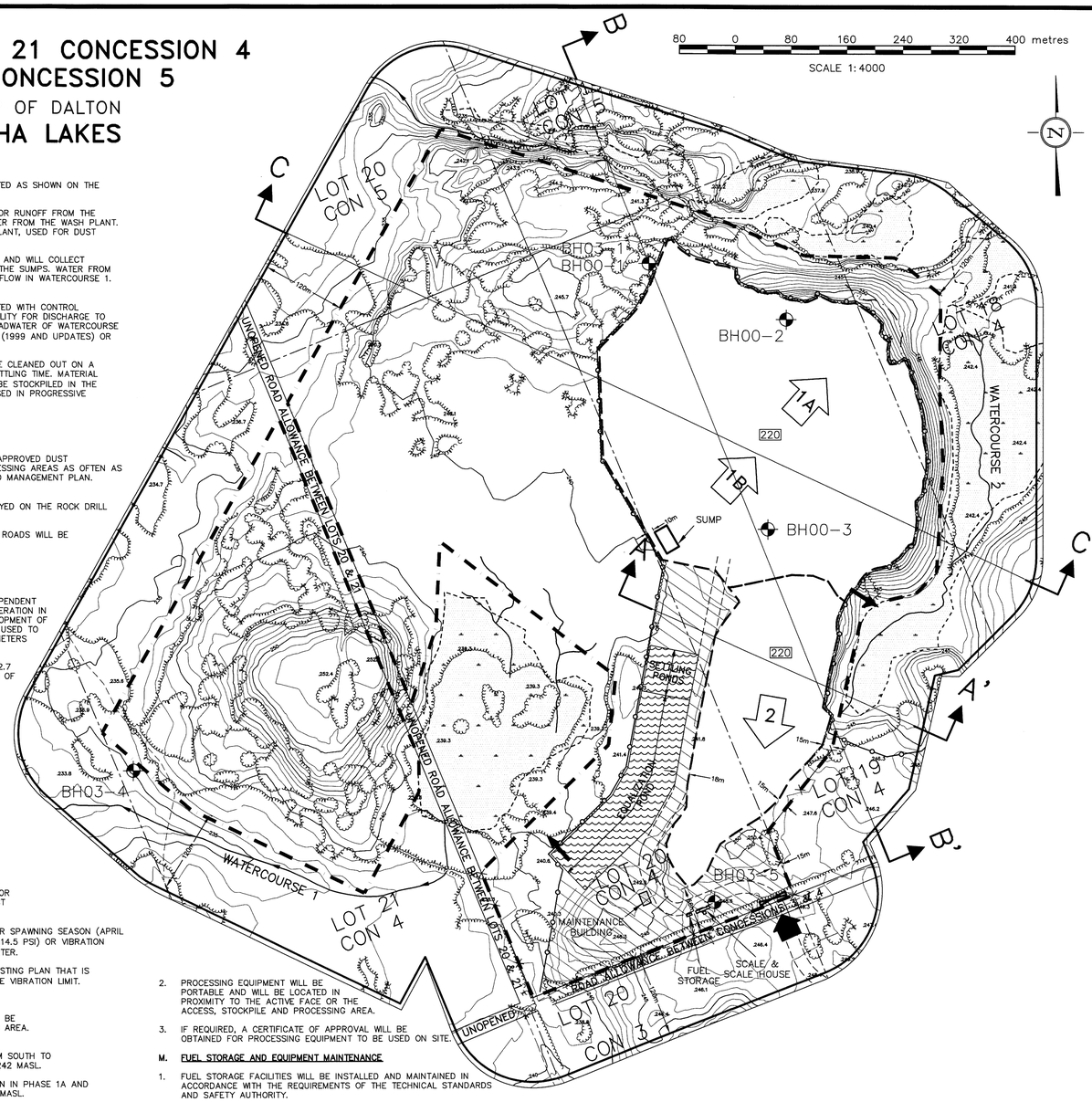
P. SPILLS CONTINGENCY PLAN

1. SPILL CONTAINMENT MATERIALS WILL BE STORED ON SITE.
2. IN THE EVENT OF A SPILL ON SITE, ALL EMPLOYEES AND CONTRACTORS ARE RESPONSIBLE TO IMMEDIATELY:
   - CEASE PUMPING OPERATIONS AND BLOCK OVERFLOW STRUCTURES;
   - IDENTIFY THE SOURCE OF THE SPILL AND PREVENT FURTHER SPILLAGE;
   - CONTAIN THE SPILL;
   - NOTIFY SITE MANAGER;
   - EXCAVATE ALL CONTAMINATED MATERIAL AND PLACE IN AN IMPERVIOUS CONTAINER FOR DISPOSAL AS DIRECTED; AND
   - COMPLETE A RECORD OF SPILL.
3. IF THE SPILL IS MORE THAN 100 LITRES OF FUEL OR OTHER FLUID FROM ANY EQUIPMENT, OR IF THE SPILL ENTERS, OR IS LIKELY TO ENTER ANY WATER, THE FOLLOWING MUST ALSO BE NOTIFIED:

   CITY OF KAWARTHA LAKES 1–888–822–2225 OR

   COBOCONK SERVICE CENTRE 1–705–454–3322

   MOE SPILLS ACTION CENTRE 1–800–268–6060
4. THE SPILLS CONTINGENCY PLAN WILL BE UPDATED AS NECESSARY IN ACCORDANCE WITH APPLICABLE LEGISLATION AND REGULATIONS.
5. THE INTERNAL ROAD WILL BE MAINTAINED FOR ACCESS.



LEGEND

- LICENCED BOUNDARY
- LIMIT OF EXTRACTION
- LIMIT OF EXTRACTION VERTICAL FACE
- LIMIT OF EXTRACTION CUT & FILL
- LOT/CONCESSION LINE
- BOUNDARY OF LANDS WITHIN 120m OF THE LICENSED BOUNDARY
- INTERNAL HAUL ROAD
- POST & WIRE FENCE
- TRAIL
- 250 – 250.42 CONTOURS & SPOT ELEVATIONS
- GENERAL DIRECTION OF DRAINAGE
- PIT ENTRANCE/EXIT
- GATE
- TREES/BUSH
- BH00–1 BOREHOLE
- WETLANDS DIGITIZED FROM AERIAL PHOTOGRAPHY
- WATERCOURSE
- A A' SECTION ARROWS
- 1 DIRECTION/SEQUENCE OF EXTRACTION
- BUILDING
- 220 MAXIMUM DEPTH OF EXCAVATION
- DISCHARGE POINTS
- REPTILE FENCE
- PERIMETER DITCH
- SUMP DISCHARGE
- ACCESS, STOCKPILE AND PROCESSING AREA

SCHEDULE OF REVISIONS PRIOR TO LICENCE

NO.	DATE	DESCRIPTION	APPROVED
1	DEC 11/08	REV PER MNR COMMENTS NOV 24/08	
2	APR. 30/09	ADDED NOTE O.5.	
3	APRIL 19, 2011	GENERAL REVISIONS	

SCHEDULE OF AMENDMENTS

NO.	DATE	DESCRIPTION	APPROVED

TRUDY P. PATERSON
IS APPROVED BY THE MINISTRY OF NATURAL RESOURCES PURSUANT TO SECTION 8 (4) OF THE AGGREGATE RESOURCES ACT TO PREPARE AND CERTIFY SITE PLANS.

TRUDY P. PATERSON — DATE Mar 19/11

SEBRIGHT QUARRY
CITY OF KAWARTHA LAKES

APPLICANT: GIOFAM INVESTMENTS INC.
BOX 1359
UXBRIDGE, ONTARIO
L9P 1N6

OPERATIONAL PLAN

PROJECT NO. 05 – 2019 | DRWG. NO. 052019 – 2 OF 5
DATE: APR 2011 | SCALE: 1:4000
DRAWN: TAR | CHECKED: | APPROVED:

Skelton Brumwell & Associates Inc.

ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS
93 BELL FARM ROAD, SUITE 107 BARRIE, ONTARIO L4M 5G1
TELEPHONE (705) 726–1141 FAX. (705) 726–0331

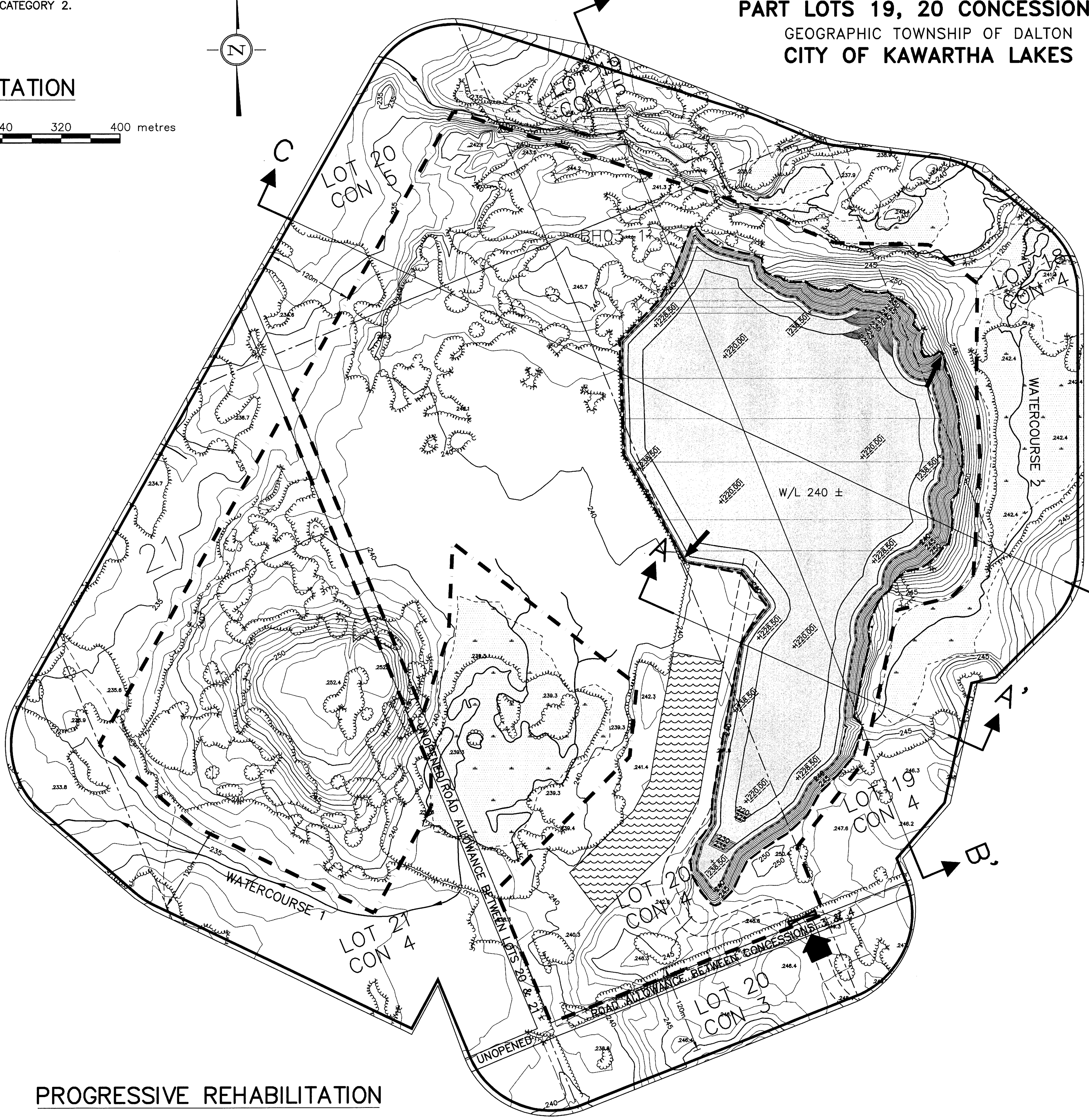
2019-3

DECLARATION OF PURPOSE
THIS SITE PLAN IS PREPARED UNDER THE AGGREGATE RESOURCES ACT FOR A CLASS 'A' LICENCE, CATEGORY 2.

PART LOTS 18, 19, 20, & 21 CONCESSION 4
PART LOTS 19, 20 CONCESSION 5
GEOGRAPHIC TOWNSHIP OF DALTON
CITY OF KAWARTHA LAKES

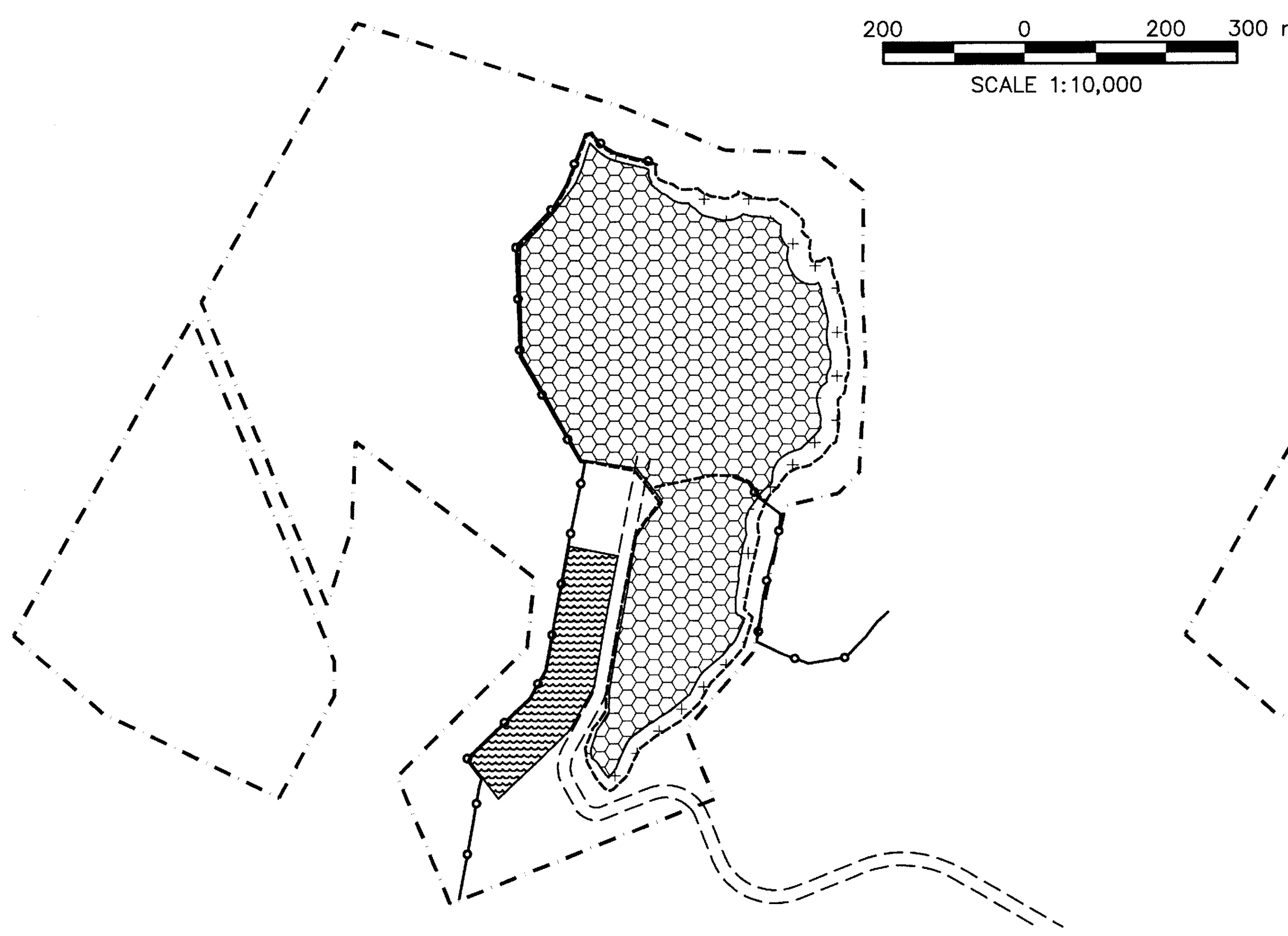
FINAL REHABILITATION

80 0 80 160 240 320 400 metres
SCALE 1:4000

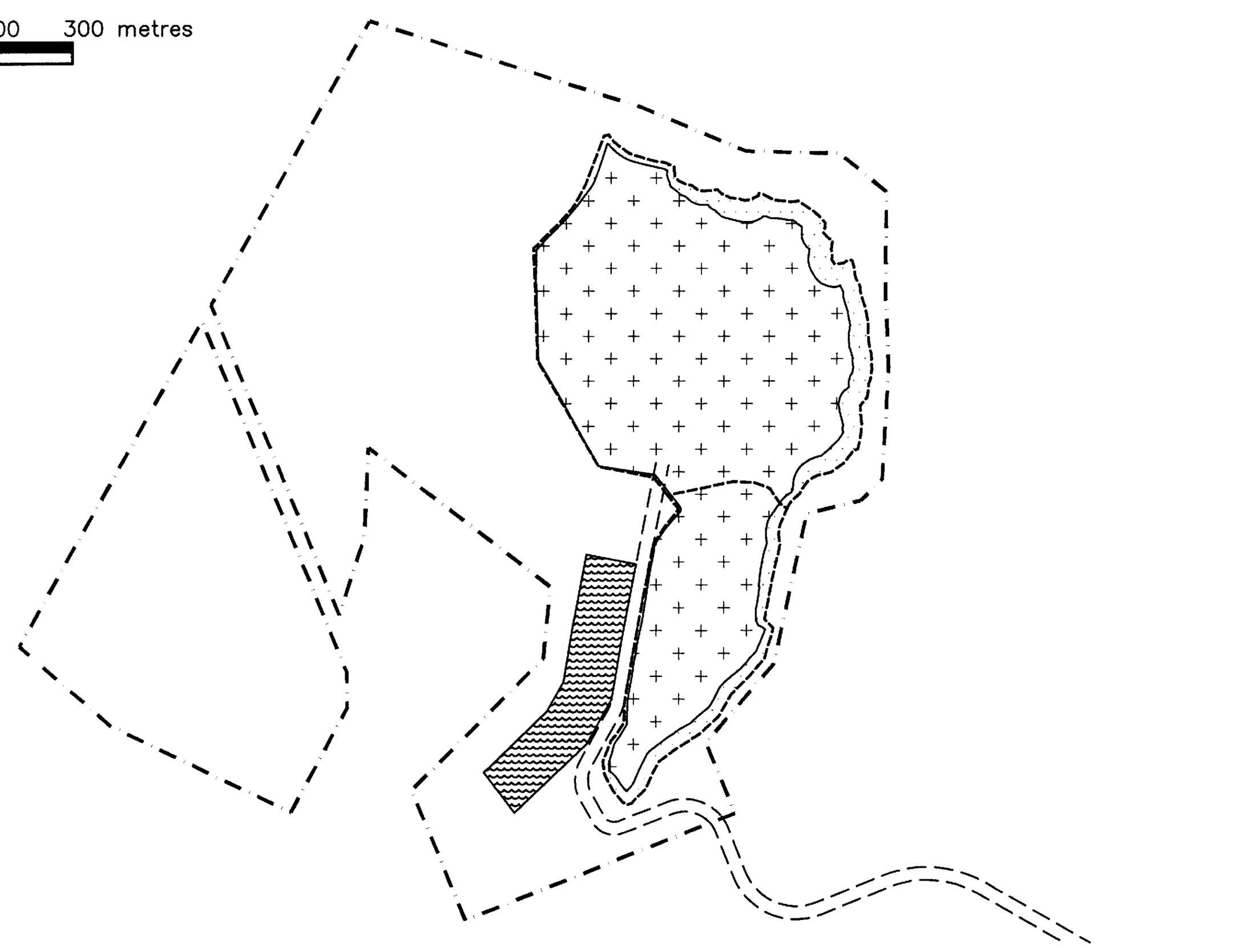


PROGRESSIVE REHABILITATION

200 0 200 300 metres
SCALE 1:10,000



STAGE 1
Extraction in Phases 1B & 2
Progressive Rehabilitation in Phase 1 & 2



STAGE 2
Final Rehabilitation in Phases 1 & 2

TYPICAL PLANTING NODE
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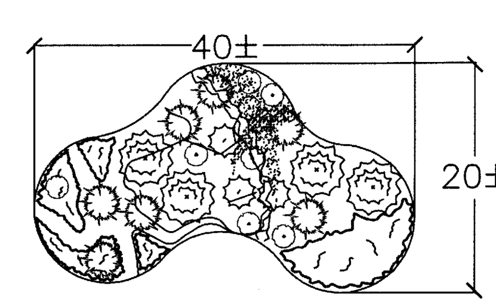


PROGRESSIVE REHABILITATION

A STAGING

1. STAGING OF PROGRESSIVE AND FINAL REHABILITATION WILL FOLLOW THE DIRECTION AND SEQUENCE OF EXTRACTION AS SHOWN ON THE OPERATIONAL PLAN AND THIS PLAN.

2. AS THE HORIZONTAL LIMIT OF EXTRACTION IS REACHED IN ANY PART OF EACH PHASE, SLOPES WILL BE ESTABLISHED BY BACKFILLING WITH ON–SITE MATERIALS, CUT AND FILL, OR EXTRACTION TO A 2:1 SLOPE IN STEPS AS SHOWN IN DETAIL 3 DWG. NO. 052019 – 4 of 5.

3. WHERE THE QUALITY OF MATERIAL DOES NOT MEET THE OPERATORS MARKET REQUIREMENTS, THE HORIZONTAL EXTENT OR DEPTH OF EXTRACTION MAY BE REDUCED AND PROGRESSIVE REHABILITATION COMMENCED AS REQUIRED THROUGHOUT THE PIT.

B LAKES

1. ONCE EXTRACTION IS COMPLETE, DEWATERING WILL CEASE AND LAKES WILL BE CREATED IN THE EXCAVATED AREAS.

2. OUTLET STRUCTURES FOR THE LAKE WILL BE CREATED AT THE LOCATIONS SHOWN AS PART OF THE PROGRESSIVE REHABILITATION OF THE SLOPES. THE STRUCTURES WILL BE DESIGNED IN CONSULTATION WITH QUALIFIED PROFESSIONALS TO PROVIDE FOR USE BY FISH AND WILDLIFE.

3. ALL AVAILABLE MATERIALS SUCH AS ROOT WADS, LOGS AND BRANCHES, BRUSH PILES AND ROCKS AND BOULDERS MAY BE PLACED RANDOMLY ON THE QUARRY FLOOR. THESE MATERIALS WILL PROVIDE AQUATIC HABITAT AS THE LAKES FILL.

4. IT IS ANTICIPATED THAT IT WILL TAKE 30 TO 40 YEARS FOR THE LAKE REACH A STABLE LEVEL.

C. SEEDING AND PLANTING

1. ALL AVAILABLE OVERBURDEN AND ORGANIC MATERIAL WILL BE PLACED ON BACKFILLED SLOPES AND THE AREAS WILL BE SEEDED WITH A NATIVE GRASS SEED MIX AS SOON AS POSSIBLE TO CONTROL EROSION.

2. NATIVE PLANT SPECIES WILL BE PLANTED OR TRANSPLANTED IN CLUSTERS ON STEPPED AND BACKFILLED SLOPES.

3. PLANTING NODES WILL BE CREATED THROUGHOUT THE STOCKPILING/PROCESSING AREA UTILIZING ALL AVAILABLE OVERBURDEN, TOPSOIL AND ORGANIC MATERIAL.

4. NODES WILL BE APPROXIMATELY 100 SQUARE METRES IN AREA WITH RANDOM SHAPES AND SPACING.

5. NATIVE/LOCAL PLANT MATERIAL WILL BE PLANTED OR TRANSPLANTED TO THE NODES.

FINAL REHABILITATION

1. ALL EQUIPMENT, AGGREGATE, SCALES, SCALE HOUSE, FUEL STORAGE, AND THE ROAD BETWEEN THE SETTLING/EQUALIZATION POND AND THE LAKE WILL BE REMOVED FROM THE SITE. MAINTENANCE BUILDING MAY REMAIN FOR PRIVATE USE.

2. ALL STOCKPILES OF OVERBURDEN AND ORGANIC MATERIAL WILL BE UTILIZED IN PROGRESSIVE AND FINAL REHABILITATION.

3. THE ANTICIPATED FINAL END USE IS PRIVATE RECREATION OPEN SPACE.

4. THE INTERNAL ROAD WILL REMAIN FOR ACCESS TO SITE.

5. FOR SPECIES SUITABLE FOR QUARRY REHABILITATION SEE TABLE BELOW.

• White Spruce (Picea glauca) • Red Pine (Pinus resinosa) • 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) • Black Locust (Robinia pseudo-acacia) • 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)

LEGEND

- LICENCED BOUNDARY
- LIMIT OF EXTRACTION
- LOT/CONCESSION LINE
- BOUNDARY OF LANDS WITHIN 120m OF LICENCE BOUNDARY
- TRAIL
- CONTOURS & SPOT ELEVATIONS (250, 250.42)
- PIT ENTRANCE/EXIT
- GATE
- TREES/BUSH
- BENCH MARK
- WETLAND DIGITIZED FROM AERIAL PHOTOGRAPHY
- INTERMITTENT WATERCOURSE
- WATERCOURSE
- SECTION ARROWS (A, A')
- REHABILITATED LAKE
- REHABILITATED COMPLETELY
- UNDERGOING PROGRESSIVE REHABILITATION
- UNDER EXTRACTION
- UNEXCAVATED AREA
- PLANTING NODES (SCHEMATIC ONLY)
- LAKE OUTLET
- FINAL DEPTH OF EXTRACTION BELOW WATER TABLE

SCHEDULE OF REVISIONS PRIOR TO LICENCE

NO.	DATE	DESCRIPTION	APPROVED
1	DEC. 11/08	REV PER MNR COMMENTS NOV 24/08	TPP
2	APRIL 19 2011	GENERAL REVISIONS	TPP

SCHEDULE OF AMENDMENTS

NO.	DATE	DESCRIPTION	APPROVED

TRUDY P. PATERSON
IS APPROVED BY THE MINISTRY OF NATURAL RESOURCES PURSUANT TO SECTION 8 (4) OF THE AGGREGATE RESOURCES ACT TO PREPARE AND CERTIFY SITE PLANS.

Trudy Paterson Apr 19/11
TRUDY P. PATERSON DATE

GIOFAM SEBRIGHT QUARRY
CITY OF KAWARTHA LAKES

APPLICANT: GIOFAM INVESTMENTS INC.
BOX 1359
UXBRIDGE, ONTARIO
L9P 1N6

PROGRESSIVE & FINAL REHABILITATION PLAN

PROJECT NO. 05 – 2019	DRWG. NO. 052019 – 3 OF 5
DATE: APRIL 2011	SCALE: 1:4000

DRAWN: TAR/CAP | CHECKED: TPP | APPROVED: TPP

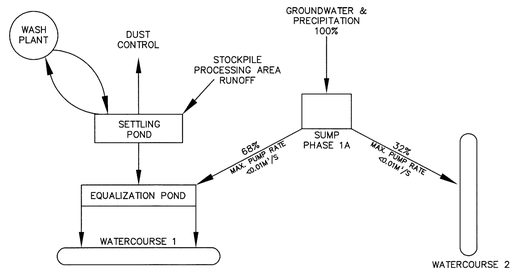
Skelton Brumwell & ASSOCIATES INC.

CONSULTING ENGINEERS & PLANNERS
951 BEEFERMAN ROAD, SUITE 10/300 BARRIE, ONTARIO L4M 6C1
TELEPHONE (705) 726-1141 FAX. (705) 726-0331

2019- 4

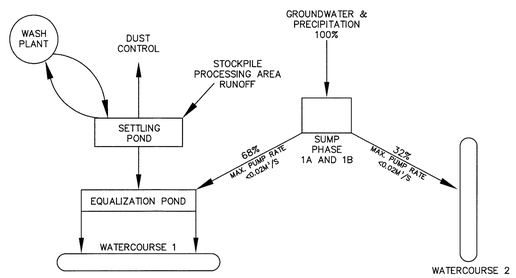
DETAIL 1 – WATER DIVERSION

1A. WATER DIVERSION PHASE 1A



% ARE APPROXIMATE

1B. WATER DIVERSION PHASE 1B



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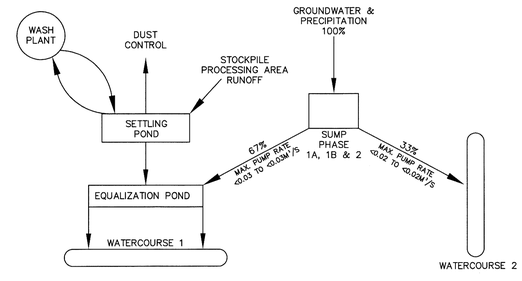
1C. WATER DIVERSION PHASES 1 AND 2



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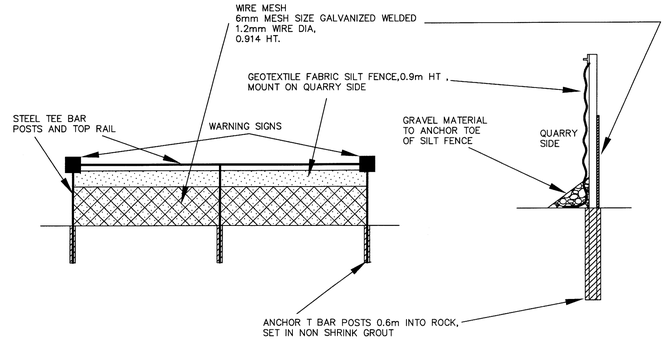
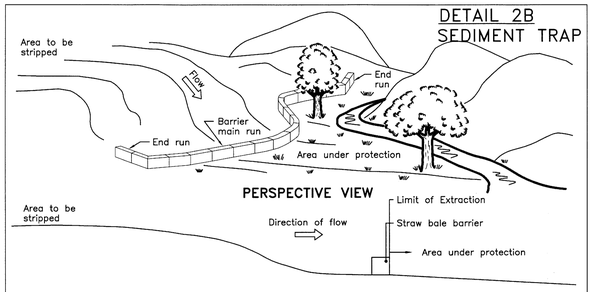
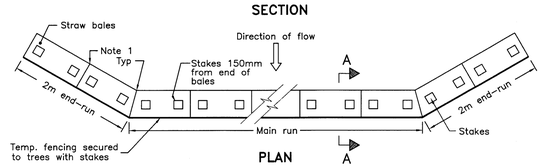
DETAIL 2A
REPTILE FENCE/SILT FENCE INSTALLATION IN ROCK



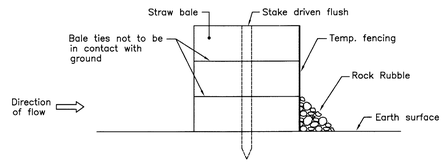
DETAIL 2B
SEDIMENT TRAP



SECTION



PLAN



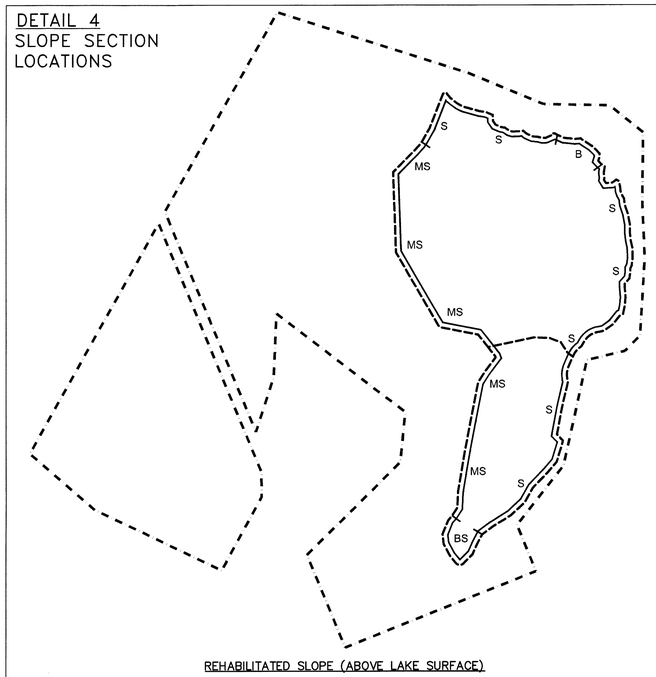
SECTION A–A

NOTES:
1 Straw bales to be butted tightly against adjoining bales to prevent sediment flow through barrier.
2 Straw bales to be staked wherever there is overburden.
A All dimensions are in millimetres unless otherwise shown.

Modified by SBA Jan/08.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev	1
LIGHT–DUTY STRAW BALE BARRIER			
			OPSD 219.100

DETAIL 4
SLOPE SECTION LOCATIONS



REHABILITATED SLOPE (ABOVE LAKE SURFACE)

B – BACKFILLED SLOPE (SEE DETAIL 3A)

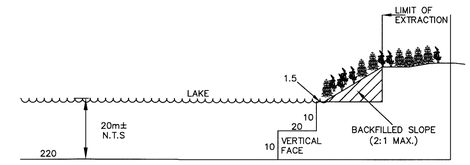
S – STEPPED OR TALUS SLOPE (SEE DETAIL 3B & BC)

BS – BACKFILLED SHALLOW SLOPE WITH FULL 2:1 SLOPE BELOW LAKE LEVEL (SEE DETAIL 3D)

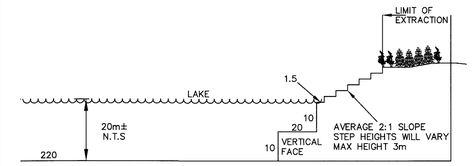
MS – SLOPE ABOVE WATER SURFACE LESS THAN 2m HIGH

DETAIL 3 – SLOPE SECTIONS

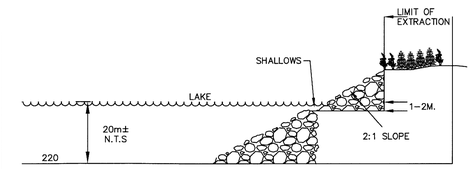
3A. TYPICAL BACKFILLED SLOPE SECTION



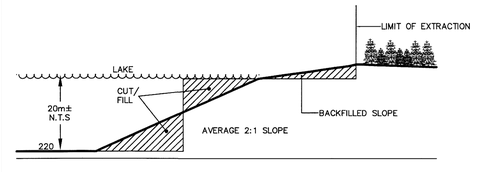
3B. TYPICAL STEPPED SLOPE SECTION



3C. TALUS SLOPE



3D. BACKFILLED SHALLOW SLOPE WITH FULL 2:1 SLOPE BELOW LAKE LEVEL



SLOPE BELOW WATER MAY BE CREATED BY CUT AND FILL OR EXTRACTION TO THE 2:1 SLOPE IN STEPS.

SCHEDULE OF REVISIONS PRIOR TO LICENCE			
NO.	DATE	DESCRIPTION	APPROVED
1.	APR. 30/09	CLARIFY "NO SLOPE" OPTION, ADD SECTION 3E	
2.	APRIL 19 2011	GENERAL REVISIONS	

SCHEDULE OF AMENDMENTS			
NO.	DATE	DESCRIPTION	APPROVED

TRUDY P. PATERSON
IS APPROVED BY THE MINISTRY OF NATURAL RESOURCES PURSUANT TO SECTION 8 (4) OF THE AGGREGATE RESOURCES ACT TO PREPARE AND CERTIFY SITE PLANS.

TRUDY P. PATERSON DATE

GIOFAM SEBRIGHT QUARRY
CITY OF KAWARTHA LAKES

APPLICANT: GIOFAM INVESTMENTS INC.
BOX 1359
UXBRIDGE, ONTARIO
L9P 1N6

DETAILS

PROJECT NO. 05 – 2019	DRWG. NO. 052019 – 4 OF 5
DATE: APRIL 2011	SCALE: 1:4000
DRAWN: CJU/CAP	CHECKED: APPROVED:

Skelton Brumwell & ASSOCIATES INC.
ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS
93 BELL FARM ROAD, SUITE 107 BARRIE, ONTARIO L4M 5G1
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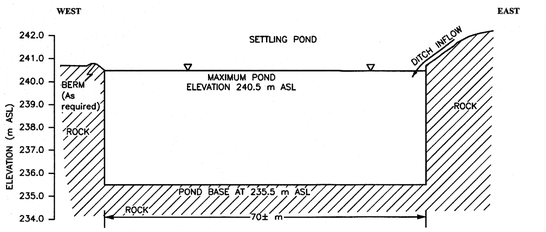
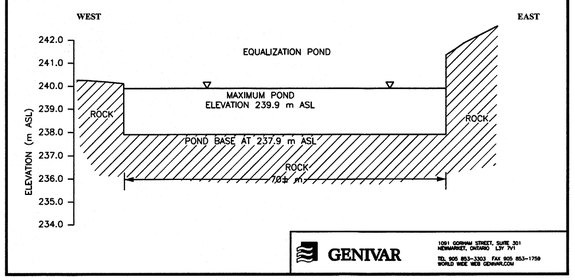
2019- 5

SETTLING AND EQUALIZATION PONDS GENERAL NOTES:

1. SITE PREPARATION FOR PONDS INCLUDES CLEAR, GRUB, AND STRIP SOIL.
2. PONDS TO BE EXTRACTED INTO ROCK. PERIMETER BERMS TO BE USED AS REQUIRED TO MAINTAIN PERIMETER OF SETTLING POND AT ELEVATION 240.0 mASL.
3. ROCK CUT AS REQUIRED FOR PERIMETER DITCHES AND OUTFLOW/INFLOW CHANNELS FOR PONDS.
4. WATER ELEVATIONS IN POND TO BE MAXIMUM ELEVATION CONTROLLED BY OUTFLOW CHANNEL ELEVATION.
5. SETTLING POND PROVIDES FOR 0.5 m OF SEDIMENT ACCUMULATION IN BASE.
6. SETTLING POND TO COLLECT RUNOFF AND WASH WATER FROM STOCKPILE AND PROCESSING AREA.
7. EQUALIZATION POND TO COLLECT POTENTIAL SEASONAL OUTFLOW FROM SETTLING POND AND DISCHARGE FROM QUARRY DEWATERING.





GENIVAR
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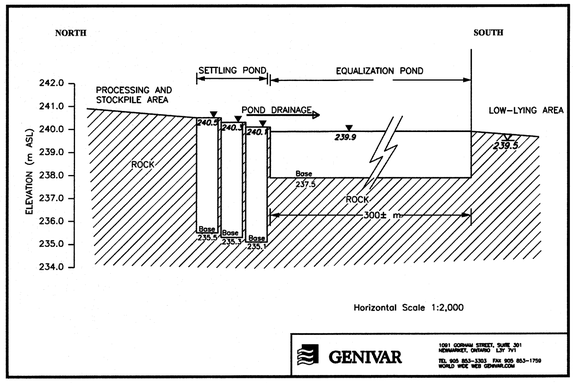
NEWMARKET, ONTARIO L3Y 7V1
TEL 905 853-3303 FAX 905 853-1759
WORLD WIDE WEB GENIVAR.COM



Horizontal Scale 1:2,000

GENIVAR
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NEWMARKET, ONTARIO L3Y 7V1
TEL 905 853-3303 FAX 905 853-1759
WORLD WIDE WEB GENIVAR.COM

GROUNDWATER AND SURFACE WATER

MONITORING				TRIGGER MECHANISMS		SUGGESTED CONTINGENCY MEASURES
PARAMETER	FREQUENCY	LOCATIONS	PARAMETERS	TRIGGER MECHANISM	ACTION	
Groundwater levels	Bimonthly Prior to Extraction, Then Monthly	BH03-1, BH03-4, BH03-5, BH03-6, BH04-7, BH04-8	Water levels	At BH03-1, BH03-4, BH03-6, BH04-7, BH04-8: Groundwater level decrease by more than 1 m below baseline condition. BH03-5: Groundwater level decrease of 5 m below baseline conditions.	Determine if the water level decrease is a result of quarry activities. If the impact is quarry related at BH03-1, BH03-4, BH03-6, BH04-7 and BH04-8 implement the applicable contingency measure. If impact is at BH03-5, evaluate off-site residential well effects then: 1) implement contingency measures if required, or 2) revise Trigger Mechanism.	Construction of a groundwater recharge zone will maintain acceptable groundwater levels to the south. This recharge zone could be developed with an infiltration trench(s) or ponds that are supplemented with water removed from the quarry during dewatering. Construction of a low permeable barrier with grout-filled trenches or boreholes will prevent groundwater movement through rock fractures. As a result, groundwater drawdown would not extend beyond the property boundary and baseline groundwater conditions would be maintained to the south.
	Annually (May)	Residential wells within 1km of site	Water levels	Water level below pump intake or insufficient storage capacity in well to meet residential requirements.	Determine if the water level decrease is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure.	A temporary potable water supply could be provided. The water supply wells impacted by the quarry would then be deepened or replaced with suitable groundwater supplies as a long-term contingency measure.
Groundwater quality	Annually (May)	BH03-1, BH03-4, BH03-5, BH03-6, BH04-7, BH04-8	Field: pH, conductivity, temperature Lab: Major ions, metals, TSS, nutrients	Degradation of water quality in excess of baseline conditions and ODWQS. Ammonia (Total):50 mg/L Nitrate: 10.0 mg/L Phosphorus: 0.2 mg/L	Determine if the water quality degradation is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure.	
Surface Water Flow Rates	Bimonthly, Monthly During dewatering	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Flow Rate	Decrease or increase in flow rate more than 50% of baseline flow rate.	Determine if the flow rate change is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure.	Discharge may be directed to one or more discharge points to compensate for loss of surface water flow or to supplement surface water flow. As the tributaries of the Cranberry River are ephemeral, they provide the opportunity for flow modifications in response to changing site operations or weather conditions. The overall flow in the Cranberry River would remain the same.
Surface Water Quality	Semi-Annually (May and September)	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Field: pH, conductivity, temperature, turbidity, dissolved oxygen, Lab: Major ions, metals, TSS, nutrients, oil and grease, and BTEX	Degradation of water quality in excess of baseline conditions (*) and PWQO. TSS: 25 mg/L, Ammonia (unionized): 0.02 mg/L, Total Phosphorus: 0.2 mg/L*, Oil & Grease: 1.0 mg/L, Antimony: 0.020 mg/L, Arsenic: 0.005 mg/L, Boron: 0.200 mg/L, Cadmium: 0.0001 mg/L, Chromium: 0.0089 mg/L, Cobalt: 0.001 mg/L*, Copper: 0.002 mg/L*, Iron: 2.2 mg/L*, Lead: 0.001 mg/L, Molybdenum: 0.040 mg/L, Nickel: 0.025 mg/L, Silver: 0.0002 mg/L*, Vanadium: 0.006 mg/L, Benzene: 0.100 mg/L, Toluene: 0.0008 mg/L, Ethylbenzene: 0.008 mg/L, Xylenes: 0.002 mg/L Turbidity: 100 NTU	Determine if the water quality change is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure for quarry discharge. Test for TSS. If TSS is >25 mg/L and the change is quarry related, implement the applicable contingency measure.	Quality could be improved with the discharge of water into a constructed wetland. Controlled flow through the wetland would reduce total suspended solids and provide additional water quality polishing and temperature equalization prior to discharge into a watercourse(s). The design of the Settling Pond could be improved to reduce the discharge rate, provide a longer residence time for enhanced settling, or provide additional storage capacity. In addition, supplemental inline settling ponds could be constructed owing to the large size of the Equalization Pond.
	Bimonthly During Dewatering (After precipitation events when possible)	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Field: pH, conductivity, temperature, turbidity, dissolved oxygen, visible sheen	Visible sheen	Determine if the water quality change is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure for quarry discharge.	
Quarry Discharge	Daily	Discharge Point(s) For Dewatering Pump(s)	Flow rates	Exceeds permitted flow rate	Reduce discharge rate in accordance with permit.	
	Monthly	Discharge Point(s) For Dewatering Pump(s) and Equalization Pond	Field: pH, conductivity, temperature, turbidity, dissolved oxygen, visible sheen	Turbidity: 100 NTU	Test for TSS. If TSS is >25 mg/L and the change is quarry related, implement the applicable contingency measure.	Quality could be improved with the discharge of water into a constructed wetland. Controlled flow through the wetland would reduce total suspended solids and provide additional water quality polishing and temperature equalization prior to discharge into a watercourse(s).
	Annually Prior to dewatering of Each Phase and Bimonthly During Dewatering	Discharge Point(s) For Dewatering Pump(s)	Field: pH, conductivity, temperature, turbidity, dissolved oxygen, visible sheen Lab: Major ions, metals, TSS, nutrients	TSS: 25 mg/L, Ammonia (unionized): 0.02 mg/L, Total Phosphorus: 0.03 mg/L, Oil & Grease (Mineral/Synthentic): 1.0 mg/L	Implement the applicable Contingency measure.	The design of the Settling Pond could be improved to reduce the discharge rate, provide a longer residence time for enhanced settling, or provide additional storage capacity. In addition, supplemental inline settling ponds could be constructed owing to the large size of the Equalization Pond.

NOTES:
1) Major ions include: chloride, sulphate, alkalinity, sodium, potassium, calcium, magnesium.
2) Metals include: Al, Sb, As, Be, Bo, Cd, Cr, Co, Cu, Fe, Pb, Mo, Ni, Se, Ag, Ti, V, Zn.
3) Nutrients include: total ammonia, nitrate, nitrite, and total phosphorus.
4) TSS indicates total suspended solids.
* denotes concentration naturally exceeds PWQO.
5) BTEX indicates benzene, toluene, ethylbenzene, xylenes.
6) Bimonthly indicates once every two months. Semi-annually indicates twice per year.

References: Monitoring - Table 1, Sebright Quarry Performance Monitoring Plan | Reference: Trigger Mechanisms - Table 2, Sebright Quarry Performance Monitoring Plan | Reference: Contingency Measures - Section 3.5, Sebright Quarry Performance Monitoring Plan

NATURAL ENVIRONMENT

MONITORING			TRIGGER MECHANISMS		SUGGESTED CONTINGENCY MEASURES
PARAMETER	FREQUENCY	LOCATIONS	TRIGGER MECHANISM	ACTION	
Surface water and Discharge	See surface water and discharge quality and quantity monitoring under GROUNDWATER AND SURFACE WATER		See trigger mechanisms for surface water and discharge quality and quantity under GROUNDWATER AND SURFACE WATER		
Condition of 30 m Buffer and Sedimentation and Erosion Controls	Semi-annually (June and September/ October)	Adjacent to Cranberry River and Watercourses 1 and 2	Sedimentation of buffer recorded via inspections and photographs.	Implement contingency measures.	Placement of sedimentation control, such as fabric/geotextile or straw bales, on the quarry side of the affected buffer. Re-establish and/or expand the vegetation buffer upon completion of adjacent quarry activities.
Reference: Section 4.1, 4.2- Sebright Quarry Performance Monitoring Plan			Reference:Section 4.3, Sebright Quarry Performance Monitoring Plan		Reference:Section 4.4, Sebright Quarry Performance Monitoring Plan

BLASTING

MONITORING Monitoring shall conform to industry standards.			TRIGGER MECHANISMS		SUGGESTED CONTINGENCY MEASURES
PARAMETER	FREQUENCY	LOCATIONS	TRIGGER MECHANISM	ACTION	
Ground Vibration and Overpressure	All blasts	One digital seismograph to be established at closest privately owned sensitive receptor adjacent to the property.	Vibration - 12.5 mm/second Peak Particle Velocity	Implement one or more of the contingency measures.	Reduction in the explosives used per period or blast. Modification of the blasting schedule. Modify the orientation of the blast face. Modify the blasting design, including decking, reduced hole diameter, and sequential blasting techniques.
			Overpressure - 128 dB Peak Sound Pressure level	Implement one or more of the contingency measures.	
Reference: Section 5.2, Sebright Quarry Performance Monitoring Plan Recommendations, Blast Impact Analysis - Glofam Sebright Quarry			Reference: Section 5.3, Sebright Quarry Performance Monitoring Plan Recommendations, Blast Impact Analysis - Glofam Sebright Quarry		Reference: Section 5.4, Sebright Quarry Performance Monitoring

DUST MANAGEMENT PLAN

SOURCE OF DUST	CONTROL MEASURE	TRIGGER MECHANISM	INSPECTION AND MAINTENANCE
Aggregate crushing and screening	The processing plant shall be equipped with a water spray system capable of supplying up to 1000 L/hr with variable application rate. Water shall be provided from the sump/settling pond. Where possible, height of lifts and discharge distances to the top of stockpile shall be kept to a minimum.	Spray bars will be triggered whenever the site manager or scale operator observes visible dust emissions. Operations may be curtailed if dust control equipment is not adequately performing.	The water spray system for the processing plant will be inspected when in use. The Site Operator shall be informed of any issues that arise from inspection performed. Haul routes to be re-graded approximately monthly during May to October, to ensure that loose fine material on the haul route surface is minimized.
Unpaved Roads	A truck/trailer mounted tank equipped with spray bar to deliver water or another approved dust suppressant evenly over the haul route surface. Water/approved dust suppressant shall be available to allow the tank/truck to fill and apply the full payload each hour, if necessary, during dry conditions. The actual application rate shall vary, depending on surface moisture conditions and traffic conditions. Trucks and other mobile equipment shall reduce speed as necessary to reduce trailing dust clouds. The maximum speed will be 30 km/hr.	When Site Manager or scale operator observes visible dust emissions producing a trailing cloud of dust greater than 1/3 of a trailer length	
Paved Roads	The facility shall have the capability to spray water or other approved dust suppressants on pave surfaces on-site, as well as roads near the quarry entrance as needed. Environmentally hazardous compounds such as waste oil shall not be used as a dust suppressant. The actual application rate shall vary, depending on surface moisture conditions and traffic conditions. Trucks and other mobile equipment shall reduce speed as necessary to reduce trailing dust clouds. The maximum speed will be 30 km/hr.	When Site Manager or scale operator observes visible dust emissions producing a trailing cloud of dust greater than 1/3 of a trailer length.	Haul routes shall be maintained during quarry operations to ensure that loose fine material on the haul route surface is minimized.
Truck Loading and Transportation	The highest point of the material loaded into a truck shall not exceed the vehicle tray walls unless it is covered. Truck loading will be suspended when warranted.	When Site Manager or scale operator observes the material to be dry and dusty and the wind is directed toward a residence at a speed greater than 30 km/h or otherwise sufficient to cause wide-spread visible emissions.	
Wind erosion of Exposed Faces	Aggregate stockpiles shall be located on the Quarry floor/close proximity to extraction face/stockpile area. Extraction shall be suspended when warranted.	When Site Manager or scale operator observes the material to be dry and dusty and the wind is directed toward a residence at a speed greater than 30 km/h or otherwise sufficient to cause wide-spread visible erosion of the open face.	
Rock Drilling	Primary and secondary dust collectors shall be employed on the rock drill during use.		The dust collectors will be maintained to the manufacturer's specifications.

IMPLEMENTATION

All control measures are to be in place prior to extraction. Control measures shall remain in place so long as the Quarry remains in operation.

- The DMP shall be kept on file at the scale house.
- Training on new and existing operating procedures shall be provided to relevant staff.
- Refresher training shall be provided at a minimum of once every 3 years.
- The Site Manager shall be responsible for ensuring the DMP is followed.
- Management shall ensure the DMP is reviewed annually.
- The staff shall follow the DMP procedures.
- The quarry management shall communicate the DMP to responsible supervisors, who shall ensure staff is following operating procedures defined in the DMP.

RECORD KEEPING

Records shall be made each time the following events occur:

- Visual inspection for dusty conditions in areas of emission sources shall occur at a minimum of twice daily during dry weather and once per day otherwise. Dust suppressant is applied to paved/unpaved haul routes;
- Unpaved haul routes are maintained.
- Water sprays are used at the processing plant;
- Wet/vacuum sweeper arrives and cleans paved surfaces;
- Heavy plumes are observed: and
- A complaint is received.

Records will be kept on site in a log book.

COMPLAINT PROCEDURE

Signs shall be placed outside the Quarry providing a phone number for citizens to call should they have any dust concerns.

The Quarry Site Manager will request that the MOE District Office and/or City of Kawartha Lakes notify them immediately if they receive a complaint to allow for prompt company response and follow-up. Complainants will be requested to identify the location and time of the incident.

If a complaint is received the Quarry shall notify the MOE District Manager in writing of each environmental complaint within two (2) business days. The notification shall include:

- a description of the nature of the complaint;
- the time, date and location of the incident;
- the wind direction and weather conditions at the time of the incident; and
- names of the Quarry personnel responsible for handling the incident.

The Site Manager shall ensure the following steps are implemented:

- conduct a site survey to identify sources of visible dust contributing to the complaint;
- create a record of this survey;
- determine weather conditions (both current and at the time that the complaint was made); and
- report on all on-site activities at the time the complaint was made.

If the information collected from the survey procedures indicates that the Quarry is not the source of the dust complaint, the complainant shall be notified of this finding. Documentation supporting this response mechanism (including the site survey record and wind station readings at the time of the complaint) shall be provided to the complainant upon request. The Site Manager or other Quarry staff shall respond to all complaints within 24 hours with a phone call to the complainant.

If it is determined that the complaint is related to Quarry activities, the following response procedures shall be followed, the in the order provided below:

If it is determined that the complaint is related to Quarry activities, in order, the following procedures shall be followed:

Level 1 - Inspection and correction of operations
The Site Manager shall ensure all elements of the DMP are being followed. Control measures, such as spraying shall be increased or operations may be curtailed, as required.

Level 2 – Review of the DMP
If the Level 1 response does not adequately resolve the source of the dust complaint, the DMP shall be reviewed for additional control measures.

Level 3 – Operational Modifications
If the Level 2 response does not adequately resolve the source of the dust complaint, the Quarry shall commit to making physical changes to the facility to address the source of the dust emissions. Such changes may include, but are not limited to additional enclosures, relocation of equipment, or additional paving.

Reference: Dust Management Plan Sebright Quarry City of Kawartha Lakes, April 2011

ANNUAL REPORTS

CONTENT

DATA	GROUNDWATER AND SURFACE WATER	NATURAL ENVIRONMENT	BLASTING
Historic data and data collected for the current year, including water quality and quantity, and terrestrial health.	Required	Required	
An assessment of changes in data trends or patterns and an evaluation of potential quarry effects.	Required	Required	
A comparison of the data with the trigger mechanisms.	Required	Required	
A comparison of quarry dewatering rates to permitted rates in accordance with the Permit to Take Water.	Required		
A summary of mitigative or contingency measures implemented and associated results.	Required	Required	Required
A summary of public complaints and response/action to resolve the complaints.	Required		
Changes to the site operations.	Required	Required	Required
Review of blasting procedures such as drilling and loading to ensure compliance with industry standards.			Required see Detailed Blast Records
Recommended changes to the Performance Monitoring Plan.	Required	Required	Required

DISTRIBUTION - Copies of report(s) to be provided to MNR and City of Kawartha Lakes, and to MOE as required by PTTW and C of A.

Reference: Section 3.6, 4.5, 5.4 Sebright Quarry Performance Monitoring Plan Also see detailed Blast Record Requirements.

DETAILED BLAST RECORDS

Detailed blast records shall be maintained. The MOE (1985) recommends that the body of blast reports should include the following information:

- Location, date and time of the blast.
- Dimensional sketch including photographs, if necessary, of the location of the blasting operation, and the nearest point of reception.
- Physical and topographical description of the ground between the source and the receptor location.
- Type of material being blasted.
- Sub-soil condition, if known.
- Prevailing meteorological conditions including wind speed in m/s, wind direction, air temperature in °C, relative humidity, degree of cloud cover and ground moisture content.
- Number of drill holes.
- Pattern and pitch of drill holes.
- Size of holes.
- Depth of drilling.
- Depth of collar (or stemming).
- Depth of toe-load.
- Weight of charge per delay.
- Number and time of delays.
- The result and calculated value of Peak pressure Level in dB and Peak Particle Velocity in mm/s.
- Applicable limits or Trigger Mechanisms.
- The excess, if any, over the prescribed limit or Trigger Mechanism.

Reference: Recommendations, Blast Impact Analysis - Glofam Sebright Quarry, March 2011.

SCHEDULE OF AMENDMENTS

NO.	DATE	DESCRIPTION	APPROVED
1	APRIL 19 2011	GENERAL REVISIONS	

TRUDY P. PATERSON
IS APPROVED BY THE MINISTRY OF NATURAL RESOURCES PURSUANT TO SECTION 8 (4) OF THE AGGREGATE RESOURCES ACT TO PREPARE AND CERTIFY SITE PLANS.

TRUDY P. PATERSON / DATE

GLOFAM SEBRIGHT QUARRY
CITY OF KAWARTHA LAKES

APPLICANT: GLOFAM INVESTMENTS INC.
BOX 1359
UXBRIDGE, ONTARIO
L9P 1N6

DETAILS

PROJECT NO. 05 – 2019 | DRWG. NO. 052019 – 5 OF 5
DATE: APRIL 2011 | SCALE:
DRAWN: CJU/CAP | CHECKED: | APPROVED:

Skelton Brumwell

ENGINEERING PLANNING ENVIRONMENTAL CONSULTANTS
93 BELL FARM ROAD, SUITE 107 BARRIE, ONTARIO L4M 5G1
TELEPHONE (705) 726-1141 FAX. (705) 726-6344 0331

Appendix 11. Guidelines for the use of explosives in or near Canadian fisheries waters.

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

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

D.G. Wright and G.E. Hopky

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Central and Arctic Region
Department of Fisheries and Oceans
Winnipeg, Manitoba R3T 2N6

and

Habitat Management & Environmental Science Directorate
Department of Fisheries and Oceans
Ottawa, Ontario K1A 0E6

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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Cat. No. Fs 98-6/2107E ISSN 0706-6457

Correct citation for this publication:

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.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

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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Nicholls H.R., C.F. Johnson, and W.I. Duvall. 1971. Blasting vibrations and their effects on structures. U.S. Dept. of Interior, Bureau of Mines, Washington, DC Bull. 656. 105 p.

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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

Denis Haché, P. Eng.
Habitat Evaluation Engineer
PO Box 5030
Moncton, NB E1C 9B6
Voice: (506) 851-6252
Fax: (506) 851-6579

Nova Scotia

Brian Jollymore, P. Eng.
Habitat Evaluation Engineer
PO Box 550
Halifax, NS B3J 2S7
Voice: (902) 426-2549
Fax: (902) 426-1489

Laurentian Region

Manager, Fish Habitat
Fish Habitat and Environmental Science
Maurice-Lamontagne Institute
PO Box 1000
Mont-Joli, QC G5H 3Z4
Voice: (418) 775-0577
Fax: (418) 775-0658

Central and Arctic Region

Ontario

Area Manager, Ontario Area
Fisheries Management Branch
PO Box 5050, 867 Lakeshore Road
Burlington, ON L7R 4A6
Voice: (905) 336-4567
Fax: (905) 336-6437

Manitoba, Saskatchewan and Alberta

Manager, Habitat Management Division
Fisheries Science Branch
501 University Crescent
Winnipeg, MB R3T 2N6
Voice: (204) 983-5164
Fax: (204) 984-2402

Appendix I (concluded)
DFO Regional/Area Authorities

Central and Arctic Region (continued)

Nunavut

Area Manager, Nunavut Area
Fisheries Management Branch
PO Box 358
Iqaluit, NWT X0A 0H0
Voice: (867) 979-8002
Fax: (867) 979-8039

Western Arctic

Area Manager, NWT West Area
Fisheries Management Branch
PO Box 2310
Yellowknife, NWT X1A 2P7
Voice: (867) 920-6636
Fax: (867) 873-8871

Pacific Region

North Coast

Chief,
Habitat and Enhancement Branch
North Coast Division
South 417 - 2nd Ave. W.
Prince Rupert, BC V8J 1G8
Voice: (250) 627-3453
Fax: (250) 627-3480

Fraser River

Chief,
Habitat and Enhancement Branch
Fraser River Division
610 Derwent Way
Annacis Island
New Westminster, BC V3M 5P8
Voice: (604) 666-0315
Fax: (604) 666-6627

Northeastern and Southeastern B.C.

Chief, Major Projects Unit
Habitat and Enhancement Branch
327 – 555 Hastings Street
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Voice: (604) 666-2057
Fax: (604) 666-7907

South Coast

Chief,
Habitat and Enhancement Branch
South Coast Division
3225 Stephenson Pt. Road
Nanaimo, BC V9T 1K3
Voice: (250) 756-7284
Fax: (250) 756-7162

Yukon

Chief,
Habitat and Enhancement Branch
Yukon Division
122 Industrial Road
Whitehorse, YT Y1A 2T9
Voice: (867) 393-6725
Fax: (867) 393-6738

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 mm•sec^{-1} = 1.3 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)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

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 _____

_____

_____

Appendix 12. Lakes and Rivers Improvement Act - Fact Sheet

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

Ontario

ServiceOntario
e-Laws

Lakes and Rivers Improvement Act
Loi sur l'aménagement des lacs et des rivières

ONTARIO REGULATION 454/96

CONSTRUCTION

Consolidation Period: From April 20, 2007 to the e-Laws currency date.

Last amendment: O. Reg. 160/07

This Regulation is made in English only.

1. In this Regulation,

"channelize" means to alter the alignment, width, depth, sinuosity, conveyance or bed or bank material of a river or stream channel;

"water crossing" means a bridge, culvert or causeway that is constructed to provide access between two places separated by water but that also holds back, forwards or diverts water. O. Reg. 454/96, s. 1; O. Reg. 160/07, s. 1.

2. (1) For the purpose of subsection 14 (1) and section 16 of the Act, approval is required,

(a) to construct or decommission a dam that holds back water in a river, lake, pond or stream to raise the water level, create a reservoir to control flooding or divert the flow of water;

(b) to make alterations, improvements or repairs to a dam that holds back water in a river, lake, pond or stream to raise the water level, create a reservoir to control flooding or divert the flow of water, if the alterations, improvements or repairs may affect the dam's safety or structural integrity, the waters or natural resources; or

(c) to do any of the following things outside the area of jurisdiction of a conservation authority, or within the area of jurisdiction of a conservation authority that has in effect a regulation governing development, interference with wetlands and alteration to shorelines and watercourses if the area in which the work will be done does not form part of the area covered by the regulation:

(i) Constructing a water crossing draining an area greater than five square kilometres, unless construction is undertaken by a Ministry or municipality on lands owned by the Crown or the municipality undertaking the construction.

(ii) Channelizing a river or stream that may harmfully alter fish habitat or impede

the movement of fish in a river, stream or lake, except for the installation or maintenance of a drain, subject to the *Drainage Act*;

(iii) Enclosing or covering a length of river or stream for greater than 20 metres in length.

(iv) Installing, if the installation may result in damming, forwarding or diverting water, a cable or pipeline into the bed of a river, stream or lake except for the installation of heat loops, water intakes and service cables for private residences.

(v) Installing a temporary dam for the purpose of removing water or water flow from an area during construction of any of the works described in subclauses (i) to (iv). O. Reg. 160/07, s. 2 (1).

(2) For the purpose of section 16 of the Act, approval is required before a person operates a dam in a manner different from that contemplated by plans and specifications approved by the Minister under section 14 or 16 of the Act. O. Reg. 160/07, s. 2 (2).

3. No approval is required under section 14 or 16 of the Act for a water crossing to which the *Public Lands Act* applies or that has been constructed as part of a forest operation to which the Forest Operation and Silvicultural Manual under *Crown Forest Sustainability Act* applies. O. Reg. 454/96, s. 3.

Back to top

Appendix 13. Official Plan Policies County of Victoria (March 2004) and City of Kawartha Lakes (September 2010)

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

Official Plan Policies Count of Victoria (March 2004)

3 INTERPRETATION

3.2 Definitions

3.2.8 Environmental Protection refers to lands having physical characteristics such as poor drainage, organic soils, flood and erosion susceptibility, steep slopes, instability or any other physical condition which could cause property damage, loss of life or damage to the environment if developed upon.

4 GROWTH STRATEGY, GOALS AND OBJECTIVES

4.4 Environment

Goal

4.4.1 To enhance and protect the quality of the environment in providing for changing needs.

Objectives

4.4.1.2 To encourage development to locate on those areas which are not environmentally sensitive.

Resource Management

4.4.2.2 To encourage the proper management of these resources so as to minimize negative environmental impact.

5 GENERAL POLICIES

5.1 Environment

5.1.1 Further development should be aimed at providing as pleasing an environment as possible to all residents of the County through proper management of man-made and natural environmental features.

5.1.2 Environmental Evaluation shall be required by Council for development proposals on or adjacent to Sensitive Areas when as a result of consultation with the Ministry of Natural Resources and any Conservation Authority having jurisdiction or interest, it is determined that an Environmental Evaluation report is necessary in order to assess potential impacts to an Environmentally Sensitive Area.

5.1.3 In the preparation of Environmental Evaluation reports, the nature of the sensitivity will determine the basis and extent of Environmental Evaluation required. The Evaluation should, however, be detailed enough to identify other possible sensitive aspects of the site. In the case of a subdivision application the Environmental Evaluation must be completed prior to draft approval by the Ministry of Housing. Sensitive Areas are depicted on Schedule B.

5.1.4 The scope of the Environmental Evaluation shall include:

- nature of the sensitive features of the site;
- anticipated impact on the natural environmental ecosystems;

- an indication of the manner in which such a development could be integrated into the fabric of adjacent land uses, and where appropriate, design alternatives depicting height, bulk, architectural treatment and landscaping; and
- other matters deemed necessary by Council.

5.1.5 Council will review the Environmental Evaluation in a manner consistent with the basic philosophy of the *Environmental Assessment Act*. Council will consult with appropriate government agencies in determining the exact nature and scope of any Evaluation carried out under this Section.

6 DESIGNATIONS

6.8 Environmental Protection Designation

6.8.1 Environmental Protection as defined in Section 3.2.6, shall be primarily for the preservation and conservation of land and/or environment, and should be managed in such a fashion as to complement adjacent land uses and protect such uses from any physical hazards. Uses such as agriculture, conservation, nursery and market gardening, forestry, wildlife management areas and recreation shall be permitted. However, the uses permitted will depend on the particular physical constraints of any given site.

6.8.2 No buildings or structures shall be permitted in any Environmental Protection Designation except those required for flood and erosion control as approved by the local Conservation Authority or the Ministry of Natural Resources.

6.8.3 Where major physical alterations are necessary, an amendment to this Plan will be required.

6.8.4 Where detailed investigation shows that an area is not subject to flooding or other physical constraint and provided that the Ministry of Natural Resources or the local Conservation Authority confirms this in writing, then an alternate use consistent with the surrounding uses may be considered and appropriately zoned.

6.8.5 Agriculture, recreation and forestry operations within the Environmental Protection Designation should maintain the unique natural characteristics of such lands and should not contribute to problems of erosion, flooding, pollution or the deterioration of the environment.

6.8.6 As floodline mapping becomes available, the Plan will be amended to reflect any changes in the extent of the flooded area.

6.8.7 Where regulations are in effect, no placing or removal of fill of any kind, where originating on the site or elsewhere shall be permitted within this Designation unless such is approved by the local Conservation Authority.

6.8.8 Where lands within this Designation are under private ownership, it shall not be construed that these lands shall be free and open to the general public nor that they shall be acquired by the County or any other public agency.

6.8.9 Where, no Conservation Authority exists, Council should obtain the technical advice of the Ministry of Natural Resources in Environmental Protection management matters.

6.10 Pits and Quarries Designation

6.10.5 A local Municipality may pass a By-law under the Municipal Act to regulate the operation of pits and quarries as defined in the Pits and Quarries Control Act. The By-law to be passed under the Municipal Act shall provide that no pit or quarry may be operated without:

a) a letter of approval from the Council of the affected municipality, in the case of a municipality designated under the Pits and Quarries Control Act; or

b) a permit or licence issued by the Council of the affected municipality in the case of a municipality not designated under the Pits and Quarries Control Act.

Prior to either a letter of approval, or a permit or licence being issued, the Council of the affected municipality shall be satisfied that the opening, establishment or operation of the proposed pit or quarry will:

4. comply with the requirements of the Ministry of the Environment with respect to water supply and the disposal of liquid waste; and

6. ensure that the proposed pit or quarry will be rehabilitated to a reasonable standard.

City of Kawartha Lakes adopted Official Plan (adopted September 2010)

PART B - STRATEGIC DIRECTIONS

3. ENVIRONMENT

3.1. GOALS:

a) To enhance and protect the quality of the natural environment within the City.

b) To support water conservation, energy conservation, air quality protection through programs and land use patterns that encourage energy efficiency and conservation.

c) To protect and where possible, enhance the ground and surface water resources throughout the City.

3.5. NATURAL HERITAGE SYSTEM

3.5.1. The Official Plan incorporates broad general principles protecting and enhancing natural heritage areas and features. These principles include themes of biodiversity and connectivity. Development will be restricted in sensitive areas and assessed for impacts on adjacent lands, in accordance with this Plan.

3.5.2. The Natural Heritage System is comprised of the following natural heritage features: wetlands, fish habitat, significant woodlands, significant valleylands, habitat of threatened and endangered species, significant wildlife and areas of natural and scientific interests. The general locations of most natural heritage features are identified on Schedule B. The location and extent of the features may be further confirmed through studies. Schedule B does not identify all natural heritage areas and features. Some natural heritage features and areas will be determined by the Conservation Authority, the Ministry of Natural Resources, local studies and through the review of development applications.

WETLANDS

3.5.3. The Ministry of Natural Resources has identified the Provincially Significant Wetlands (PSW). Locally Significant Wetlands (LSW) includes all other non PSW and are based on Ecological Land Classification (ELC) mapping prepared by Conservation Authorities and unevaluated wetlands.

3.5.4. All wetlands shall generally be protected. Development and site alteration shall not be permitted in PSW. Any development or site alteration proposed on or adjacent to a LSW shall not occur unless it has been demonstrated that there will be no negative impact on the features or functions of the wetland or alternatively it has been demonstrated that there will be a net environmental gain to the satisfaction of the City.

3.5.5. Environmental Impact Study (EIS) shall be prepared by a qualified person for development within 120 m. of a PSW and within 30 m. of a LSW. The EIS must

assess the impacts the development could have on the wetland. If the EIS can demonstrate that the wetland can be protected without loss of function and it proves that an alternate width would be appropriate, a buffer from PSW and LSW of less than 120 metres and 30 metres respectively may be permitted.

3.5.6. Within a PSW or LSW, peat extraction will not be permitted.

3.5.7. If a development is proposed on or within 120 metres of an unevaluated wetland that has characteristics or contains components that are typical of a PSW, as determined through a scoped environmental impact study, an evaluation prepared by a qualified person and submitted to MNR for approval to determine if it is a PSW. Once the significance is determined the appropriate policies of this Plan apply.

Fish Habitat

3.5.8. The City's fisheries and fish habitat will be protected, enhanced and restored from any harmful alteration, disruption and/or destruction. Increased setbacks from critical spawning areas and warm and cold-water streams will be secured.

3.5.9. For development and site alteration proposals adjacent to a lake, river or watercourse where the land is within 120 metres of the waters edge, a review of available information from the Conservation Authority, MNR, TSW and DFO shall be undertaken to determine if the water in the area is a known fish habitat.

3.5.10. If it is found to be fish habitat, then a study shall be undertaken to determine what impacts could occur to fish habitat and recommend mitigative measures to minimize impacts. If fish habitat is present and may be altered, disrupted or destroyed, the applicable agency (TSW, DFO or CA) shall be consulted to determine if there could be Harmful Alteration, Disruption or Destruction (HADD) of the fish habitat. If it is not a HADD then the project can proceed subject to the applicant obtaining all necessary permits and approvals.

3.5.11. If it is a HADD and DFO determines the HADD is not acceptable, then the development cannot proceed as presented and must be altered so as not to impact on the fish habitat.

3.5.12. If it is a HADD and DFO determines that development can be modified or altered to mitigate the impact, then it can proceed subject to any applicable conditions being obtained from DFO and all required permits and approvals be obtained.

Habitat of Threatened Species and Endangered Species

3.5.25. Applications for development and/or site alteration will be considered within significant habitat of Threatened and Endangered Species and will be subject to the discretion of the Ontario Ministry of Natural Resources.

3.5.26. The known Threatened and Endangered Species (TES) found within the City is catalogued by the MNR Natural Heritage Information Centre (NHIC). The City will accept information regarding Threatened and Endangered Species habitat from the Ministry of Natural Resources as it becomes available and will, accordingly, use this

information to screen all planning applications for potential development constraints.

3.5.27. The City shall be consulted to determine the location of TES habitat when development and site alteration proposals are presented since most of this information is not readily available to the public in order to protect threatened species and endangered species and their habitat. In order to determine the presence of Threatened and Endangered species and to assess the impacts the proposal may have on the Threatened and Endangered species, a site assessment is required. The assessment shall also propose appropriate mitigation. MNR may be contacted for further direction regarding site specific proposals.

3.5.28. Development and site alteration may be permitted in adjacent areas generally being within 120 metres, but dependent on species, provided an EIS shows that the proposed development or site alteration will have no negative impact on the species or habitat.

Significant Wildlife Habitat

3.5.29. Significant wildlife habitat including, areas of seasonal concentrations, specialized habitats and habitats of special concern species are generally identified on Schedule B as part of the Natural Heritage System.

3.5.30. Development and site alteration may only be permitted in areas identified as Significant Wildlife Habitat if it has been determined through an EIS that there will be no negative impacts on the natural features or on the ecological functions for which the area is identified. Development may only be permitted in the adjacent area, being within 120 metres if it has been determined through an EIS that there will be no negative impacts on the features or on the ecological functions for which the area is identified.

3.5.31. Additional significant wildlife habitat may be identified as additional information becomes available or upon site inspection. If additional habitat has been identified an EIS will be required prior to development within or adjacent to the significant wildlife habitat.

Alvars

3.5.32. Alvars are naturally open areas of thin or no soils over essentially flat limestone, dolostone or marble rock, supporting a sparse vegetation cover of mostly shrubs and herbs. Development or site alteration is not permitted within or adjacent to (within 50 metres) of an Alvar unless it has been demonstrated by the completion of an EIS, that the alvar is not significant or, that there will be no negative impact on the features or functions of the Alvar area.

Areas of Natural and Scientific Interest

3.5.33. Areas of Natural and Scientific Interest (ANSIs) are important because they

represent the best examples of the vegetation – landform features of the area based on five criteria being: representation, diversity, ecological functions, site condition and special features. For this reason, they should be identified and protected.

3.5.34. Life and Earth Science ANSIs shall be protected equally. Development and site alteration may be permitted in ANSIs and areas adjacent to them within 50 m., if it can be demonstrated that there will be no negative impacts on the features or functions for which the area is identified.

Environmental Impact Studies

3.5.36. An Environmental Impact Study (EIS) shall be required for development or site alteration proposals on or adjacent to natural heritage features as outlined in section This policy is applicable whenever an application is made under the Planning Act. The terms of reference for the EIS are outlined in Appendix – J – for reference purpose.

3.5.37. An EIS, when prepared for the City in accordance with this Official Plan will:
• confirm the boundaries of the natural feature and adjacent lands to be protected and define the limits of all hazards including erosion, flooding and slope instability hazards where not already determined;

• carry out a detailed inventory, at the appropriate time of year, of the natural feature including the verification of constituent vegetation communities and their respective floral and faunal compositions, physical site characteristics, and identification of its ecological functions and attributes, including habitats of any threatened or endangered species, and species and communities of concern to the Conservation Authority and MNR having regard to habitat, type, diversity, size and configuration, the degree of connection to other environmental resources;
• assess the degree of sensitivity of the environmental conditions, including an evaluation of such conditions in relation to the proposed development;
• assess the potential cumulative impacts of the proposed development on the natural area's ecological functions and attributes.
• define the need for, and nature of any mitigating measures required to protect the feature and ecosystem from the impacts of the proposed development; and
• include a tree inventory, assessment, management and preservation plan prepared by a qualified practitioner which outlines specific methods of tree preservation, mitigation and, if necessary, compensation.

3.5.38. The City in consultation with the Conservation Authority and MNR shall identify the appropriate scope and study area for each required EIS.

3.5.39. The City in consultation with the Conservation Authority and MNR may alter the requirements for an EIS where appropriate studies and fieldwork have been prepared and accepted by the City in connection with a previous development application or a previous development approval for the subject lands, or where site conditions warrant. In such cases, the City may impose a buffer area requirement.