FISH HABITAT IMPACT ASSESSMENT
Granite Ridge Subdivision–Phase 2
Municipality of Trent Lakes

April 2014

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

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Fisheries and Oceans Canada
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Mr. Jeff Chesher 1447147 Ontario Inc.
P.O. Box 100
Buckhorn, ON
K0L 1J0

SUBJECT: Fish Habitat Impact Assessment; Granite Ridge Subdivision–Phase 2, Municipality of Trent Lakes

Dear Mr. Chesher:

RiverStone Environmental Solutions Inc. (hereafter RiverStone) is pleased to provide this Fish Habitat Impact Assessment that includes a detailed project description and a Request for Project Review under the Fish Habitat Protection Provisions of the Fisheries Act. The assessment was completed for a proposed 32-lot subdivision near Buckhorn, ON that has the potential to impact two aquatic features. The purpose of the report is to provide sufficient information for Fisheries and Oceans Canada to review the proposed project and, if necessary, an authorization under the *Fisheries Act*.

Best regards,

RiverStone Environmental Solutions Inc.

Report prepared by:

Bev Wicks, Ph.D.
Senior Aquatic Ecologist

Report reviewed by:

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Ecologist, Species at Risk Specialist

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1 BACKGROUND

RiverStone Environmental Solutions Inc. (hereafter RiverStone) was retained by Mr. Jeff Chesher, 1447147 Ontario Inc. to complete a Fish Habitat Impact Assessment for a proposed 32-lot subdivision located on Lots 8 and 9, Concession 9, Municipality of Trent Lakes, within the County of Peterborough (**Figure 1**). The subject property has been used as a gravel pit for more than 20 years. As part of the redevelopment, three aquatic features have the potential to be impacted; the first feature is a groundwater fed watercourse located upstream of both an onsite pond that was excavated during pit operations, and Buckhorn Lake; the second is the pond itself and an outlet channel that has a direct connection to Buckhorn Lake; the third feature is Buckhorn Lake.

This report has been prepared to address the fisheries issues as related to the Fish Habitat Protection Provisions of the *Fisheries Act*. Included herein are descriptions of the fish habitat, the construction plan for the subdivision including the treatment of the two aquatic features, an assessment of the project using Fisheries and Oceans Canada (DFO)Guidance Documents and Measures to Avoid Harm, and project specific mitigation strategies to reduce impacts to the aquatic environment during construction and in the long term.

2 APPROACH AND METHODS

2.1 Guiding Environmental Legislation and Policy

The following documents guided the investigations:

- Federal *Fisheries Act*
- Fisheries Protection Policy Statement (November 25, 2013)
- DFO Measures to Avoid Harm (http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html)
- Provincial *Lakes and Rivers Improvement Act*
- Provincial Policy Statement (2014) 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)

2.2 Information Sources Used to Assess Site Conditions

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

- Fish community information for Buckhorn Lake (Ontario Ministry of Natural Resources, [MNR])
- Digital Ontario Base Maps (OBMs; 1:10,000)
- Colour aerial photography of the property (digital orthophotos: leaf-off; 2008)
- RiverStone's in-house databases and reference collections
- On-site investigations by RiverStone staff (see Section 2.3)
- Environmental Impact Study, Granite Ridge Subdivision Phase 2, Township of Galway-Cavendish & Harvey (Skelton Brumwell and Associates, October 2012)

The aquatic features within and adjacent to the subject property were evaluated for their potential to function as fish habitat. The evaluation was completed using classification criteria established by the

MNR as per the Natural Heritage Reference Manual (OMNR 2010). The three key habitat types are described in **Table 1** and differ based on their sensitivity to development and overall productive capacity for fish.

Table 1. Classification of Fish Habitat Types (OMNR 2010).

Classification Type	Description
Type 1	Habitats have high productive capacity, are rare, in space and/or time, are highly sensitive to development, or have a critical role in sustaining fisheries (e.g., spawning and nursery areas for some species, and ground water discharge areas for summer and/or winter thermal refuges).
Type 2	Habitats are moderately sensitive to development and, although important to the fish population, are not considered critical (e.g., feeding areas and open water habitats of lakes).
Type 3	Habitats have low productive capacity or are highly degraded, and do not currently contribute directly to fish productivity. They often have the potential to be improved significantly (e.g., a portion of a waterbody, a channelized stream that has been highly altered physically).

A number of methods can be used to evaluate a watercourse depending on its physical characteristics. Key characteristics to assess include the physical dimensions of the channel, thermal regime, groundwater sources, and adjacent vegetation. The most comprehensive and widely applied habitat assessment protocol for wadeable creeks, streams, and rivers was developed by MNR. The Ontario Stream Assessment Protocol (Stanfield 2005) provides standard assessment techniques to identify key components of fish habitat at discrete locations. The entire protocol can be used to establish baseline conditions to address comprehensive academic questions, whereas individual components of the protocol can be used to provide site-specific information. In the case of the present study, components of the assessment protocol relating to the characterization of physical habitat and thermal regime were employed. The physical characteristics of each watercourse on the subject property 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 channel and ponds. Finally, the presence and location of groundwater upwellings or source water were documented when observed.

All aquatic features that were encountered on the property were also assessed for permanency. 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 of the aquatic features identified and the permanency of watercourses, several aquatic features were identified as potential fish habitat on the subject property. When completing a fisheries assessment, a number of recommendations have been outlined by DFO and MNR including:

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) confirm that fish passage is possible and connections exists between waterbodies that could contain a fish

4) determine the fish communities located at a specific site and understand the life-cycle requirements
5) 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.

2.3 Site Investigations

As part of the initial desktop evaluation, areas of potential conservation interest (e.g., potential habitat for species of conservation interest including fish) were identified and targeted during the site investigations. **Table 2** summarizes the level of field effort and primary tasks for each staff member.

Table 2. Site visits and primary tasks.

Date	Primary tasks	Staff	Hours spent on site
Jun 11, 2013	Walked full length of all watercourses and ponds; delineated areas of ground water upwelling; completed a fish habitat assessment; reviewed outlet at Buckhorn Lake	Bev Wicks, Glenn Cunnington	4 (1030–1430 hrs)

Overall, the level of effort expended during the field investigations was deemed adequate to document the fish habitat occurring on the subject property.

3 BIOPHYSICAL FEATURES AND FUNCTIONS

3.1 General Site Conditions

At the time of our site visit on June 11, 2013, a large portion of the subject property was in a highly disturbed state resulting from historical and recent construction operations as well as the construction of access roads through the property. The western edge, the northwest corner, and the southeastern edge and corner were the only areas in a relatively natural state. The central part of the subject property has been actively used as a pit and contains two excavated ponds, a large central pond (1.6 ha) and a smaller pond (0.12 ha) located to the west, areas of exposed soils, piles of aggregate material, roads, and exposed bedrock. There was an area of groundwater upwelling and groundwater "recharge" identified in the northeast corner of the property (**Figure 2**) that formed a natural channel for approximately 260 m between Melody Bay Road and an existing internal gravel road. The east side of Melody Bay Road was examined from the road with no evidence of a watercourse or culvert found, suggesting the origin of this feature is on the subject property. Some ditching was viewed along Mitchell Crescent located to the north, in Phase 1 of the Granite Ridge Subdivision; however, no sign of a permanent or intermittent drainage feature was identified. In addition to the natural channel there is approximately 540 m of drainage channels and ditches throughout the western portion of the property that convey the groundwater generated flows to one of the two ponds on the property. Both of the manmade ponds outlet through a dug channel and culvert under Adam and Eve Road into Buckhorn Lake. A photographic record representative of existing conditions is included in **Appendix 1**.

3.2 Fish and Fish Habitat

Fish habitat mapping was requested for Buckhorn Lake from Peterborough District MNR; however, none was available (**Appendix 2**). Provincial Base Map layers were reviewed to determine if watercourses were depicted on the base maps (**Appendix 2**). In the absence of detailed MNR mapping

within the subject property, the potential for direct and indirect fish habitat within the subject property and the outlet channel within Buckhorn Lake was assessed completely during the site visit.

MNR's records indicate that Buckhorn Lake is classified as coolwater. The primary fishery in the lake is Walleye (*Sander vitreus*), Muskellunge (*Esox masquinongy*) Pumpkinseed (*Lepomis gibbosus*), Smallmouth Bass (*Micropterus dolomieu*), Largemouth Bass (*Micropterus salmoides*), Black Crappie (*Pomoxis nigromaculatus*) and Yellow Perch (*Perca flavescens*). A complete species list was provided by MNR and is included in **Appendix 2**.

The large central pond has been historically stocked with bass by the landowner and it is assumed that many of the species located in Buckhorn Lake could also have accessed the pond. Pumpkinseed and cyprinids were observed in the central pond during the site visit, in addition to what appeared to be Centrarchid nests. Brook stickleback were observed in both the west pond and the outlet channel between the Central Pond and Buckhorn Lake. No detailed fisheries surveys were undertaken for these features.

3.2.1 Watercourse Natural State—Melody Road to Internal Road

A natural channel originates from a series of groundwater upwelling's in the northwest corner of the subject property (**Figure 2**). The upwelling's appear and then disappear a number of times before a defined channel forms. The natural channel exists for 260 m prior to entering a ditch system along the internal roads. The characteristics of the defined channel are described as follows: water temperature was 10 °C with an air temperature of 23 °C (13:00hr); substrates were variable ranging from sand and organics to areas with gravel, cobble and boulders; average channel width was approximately 1 m with wet width 0.5 m; source was ground water; riparian vegetation was well established and canopy cover was 100%. This watercourse did not appear to support any fishery and there are likely periods during a dry year that there is no flow. Presently it has no direct connection to the pond features that contain fish and thus upstream fish passage from Buckhorn Lake or the ponds is not possible. Based on the characteristic of the watercourse as it currently exists it is best described as a permanent watercourse that does not support a fishery.

3.2.2 Watercourse Altered—Ditches

The natural watercourse ends once it enters the disturbed portions of the subject property (**Figure 2**). The flow from the natural watercourse is conveyed to the south along the west side of the internal road through a roadside ditch. The road does not currently contain any culverts; however, a series of flowing braided channels occur on the east side of the road eventually outletting to the Central Pond. It is assumed that the base flow entering the pond results from water movement through the road. The water that does not percolate through the road to the north percolates through the road at the southwestern corner of the subject property. These ditches do not directly connect to waterbodies that contain fish or contain features that would permit upstream passage by fish; therefore, these ditches do not support a fishery.

3.2.3 Ponds

There are two man-made ponds on the subject property, a large Central Pond and a smaller pond to the west. The large Central Pond is 1.6 ha in area and according to the landowner is between 6 and 9 m in depth. Many of the margins are very steep resulting from excavation activities that created the pond. The shoreline is highly disturbed and contains very little in the way of vegetation. A small bedrock outcrop is present in the central part of the pond . For the most part the pond has low habitat diversity

and little in the way of structure for fish habitat. The substrates consist of sand and gravel with pockets of boulder and other aggregate. There are some shallow margins around the pond that support both submerged and emergent aquatic vegetation, but in general, it would be considered sparse at best. To the best of our knowledge, the Central Pond is ground water fed. An outlet to Buckhorn Lake is located at the southwest corner of the pond. Schools of fish were evident along some of the margins with Brook Stickleback (*Culaea inconstans*), Pumpkinseed, young of the year Smallmouth Bass and other cyprinids observed in various locations. There was evidence of Centrarchid spawning along the shoreline, with what appeared to be Smallmouth Bass and Pumkinseed nests observed. The Central Pond is best described as a feature that contains fish that are part of a recreational fishery.

The West Pond appears to have been created recently because of onsite excavation activities. It is likely groundwater fed with some infiltration of water from the roadside ditch/channel that percolates through to the road. The pond has very steep margins and water depth is unknown. Brook Stickleback and other cyprinids were observed throughout the pond, interspersed amongst the aquatic vegetation. Pond banks are highly disturbed and unstable, with no vegetation. The overflow outlet from the pond consisted of a dug channel that emptied into the main outlet channel to Buckhorn Lake. Although this pond contains fish that could be used as forage for fish within Buckhorn Lake if downstream migration occurs, the size of the feature limits its ability to contribute significantly to the downstream fishery; therefore, it is RiverStone's opinion that the West Pond does not support a fishery.

The communal outlet channel for both the Central Pond and the West pond varies between 0.3 and 1 m in width and has an average depth of 0.15 m. This channel is poorly defined, contains primarily sand/silt substrates, and abundant vegetation. The connection between the ponds and the outlet channel are little more than an overflow point and as such, it is highly likely that during dry periods the connection between Buckhorn Lake and the two ponds is severed due to low outflows from the upstream ponds. During periods of elevated flow the outlet channel would allow for fish passage between Buckhorn Lake and the Central Pond therefore it is RiverStone's opinion that the channel and the Central pond supports a fishery.

4 DEVELOPMENT PLAN AND PROPOSED WORKS

The proposed development plan is a 32-lot subdivision, consisting of single detached homes surrounding the Central Pond (DRWG No. 2361-SWM2, **Appendix 3**). The development plan is depicted on **Figure 3**. The current proposal requires that the Central Pond be disconnected from Buckhorn Lake with a rock check dam, and orifice plates attached to twin 675 mm culverts to manage outflows. The plan also proposes using the Central Pond as a Storm Water Management (SWM) pond, for controlling quality and quantity of run-off from the development. The development as proposed requires the ditching of all groundwater fed streams such that groundwater and surface water is directed through the Central Pond. Initially, this will be achieved by permitting surface water flows on lots 24 and 25 (**Figure 3**) to remain in their existing state with downstream flows being conveyed under the internal road via culverts that outlet into a defined open channel watercourse that outlets into the western end of the central pond. Use of sub-drains and culverts are proposed to address groundwater and surface flows on lots 24 and 25 as they are developed; these structures will outlet into the downstream culverts and open channel watercourse described above. The West Pond would be filled to accommodate development. The outlet channel for the Central SWM pond is proposed on a common block to be held in common ownership.

4.1 Watercourse Natural and Altered

The development of Lots 24 and 25 within the proposed subdivision would result in the alteration of 260 m of watercourse that is best classified as indirect fish habitat, not supporting a fishery; 540 m of existing ditched and channelized watercourse will be altered via the installation of culverts under the existing road to convey flows. This 540 m of altered watercourse is also best described as indirect fish habitat that does not support a fishery. While these two sections of watercourse do not directly support a fishery, they do contribute base flow to the Central Pond and ultimately downstream Buckhorn Lake. The Central Pond and Buckhorn Lake both support a fishery.

4.2 Central and West Ponds

The West Pond will be filled as part of the development proposed on the subject property. The Central Pond will be used as a SWM pond through which both the watercourse and all surface water and stormwater from the subdivision will be directed. A rock check dam, culvert and orifice plates will be installed at the outlet of the pond; these structures will prevent upstream fish migration from Buckhorn Lake. A 5 m buffer surrounding the pond is to be naturalized as per recommendations contained in the Skeleton, Brumwell & Associates Environmental Impact Study (October 2012).

5 FISHERIES IMPACT ASSESSMENT AND RECOMMENDATIONS

Recent regulatory changes to the Fisheries Act require that project activities be reviewed to determine if they have the potential to result in *serious harm to fish* that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery. Based on guidance documents provided by DFO, *serious harm to fish* includes:

- direct fish mortality,
- the permanent alteration of fish habitat at a spatial scale, duration or intensity that negatively impacts habitat used to carry out one or more of their life processes (i.e., spawning, nursery, or rearing grounds, food supply areas, mitigation corridors, etc.), and
- destruction of fish habitat at a spatial scale, duration or intensity such that fish can no longer utilize habitats necessary to carry out one or more of their life processes (i.e., spawning, nursery, or rearing grounds, food supply areas, mitigation corridors, etc.).

Table 3 provides our assessment of the potential for the proposed development activities as outlined in **Section 4** and **Figure 3** of this report, to result in *serious harm* to a fishery or fish that support a fishery. In the context of the subject property, the central pond and its outlet are the only features that support a fishery.

In general, to avoid contravention of the *Fisheries Act*, RiverStone recommends that:

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

As part of the impact analysis, the potential to cause *serious harm to fish*, including fish habitat were assessed. Although the land use changes that are proposed have the potential to have negative impacts on water quality, fish, and fish habitat, it is RiverStone's opinion that the mitigation measures recommended in **Table 3** can mitigate potential negative impacts, so that *serious harm to fish* in the downstream fishery in Buckhorn Lake is prevented. In light of this, RiverStone recommends:

- **All recommendations within this report be incorporated onto the design and engineering drawings for the subject property.**

Table 3. Fisheries Impact Assessment

Project Activity	Project Specific Description of Activities and Potential Impacts to Fish and Fish Habitat	DFO Pathways of Effects Considered	Measures to Avoid Harm (DFO)*	Project Specific Recommended Mitigation Provided by RiverStone	After considering the proposed avoidance and mitigation measures, are there residual impacts that are likely to result in *serious harm* to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery?
Land-Based Activities					
Vegetation Clearing	The proposed development will involve the removal of vegetation as part of site preparation and grading activities. A large portion of the subject property including the Central Pond is part of a surrendered pit thus very little native vegetation is present is some areas. Given the limited existing vegetation, no change in the thermal characteristics of the pond are predicted however, the temporary removal of any remaining vegetation on the property will expose more soil and aggregates that could result in increased erosion and sediment loading to the Central Pond.	• Change in habitat structure and cover • Changes in water temperature • Change in sediment concentrations	• See Section 3 of Appendix 4	**• Site clearing should be minimized, with efforts to maintain vegetative cover and windbreaks. Clearing should only occur when revegetation of exposed soils can occur in the short term.**	By minimizing the removal of vegetative cover from the subject property, there is a low likelihood that the proposed activities related to vegetation clearing will result in *serious harm* to either the fishery in the Central Pond or the downstream fishery in Buckhorn Lake. **Conclusion** **NO RESIDUAL IMPACTS PREDICTED**
Use of industrial equipment	Industrial equipment will be used for land clearing, grading, for various stages of construction. The activities that the equipment will be involved in has the potential to increase soil erosion thus resulting in increase sediment loading. Additionally equipment maintenance including repair and refueling can results in spills or leaks of oil, grease and fuel products.	• Change in sediment concentrations • Change in contaminant concentrations	• See Section 5 of Appendix 4.	**• The contractor will not carry out equipment maintenance, refuelling, or washing within 30 m of the watercourse or pond. Machinery will be refuelled on impermeable pads/pans to allow full containment of spills.** **• All oils, lubricants, fuels, chemical or other contaminants will be stored in a secure area on impermeable pads, within the defined staging area, a minimum of 30 m from any water.** **• An emergency spill kit (absorption pads and surface boom) must be stored on-site in case of any fluid leaks or spills while in operation or storage.** **• Any and all spills will be reported to the Ontario Spills Action Centre (1-800-268-6060) as soon as possible.** **• Equipment parts that will enter the water must be kept free from oil and grease.** **• All maintenance and refuelling of equipment must be conducted at least 30 m from the water to prevent accidental spills of deleterious substances.** **• Appropriate spill response materials must be kept on site in the event of an accidental spill or hydraulic leak.**	By adhering to the recommended avoidance and mitigation measures, there is a low likelihood that the proposed activities that require use of industrial equipment will result in *serious harm* to either the fishery in the Central Pond or the downstream fishery in Buckhorn Lake. **Conclusion** **NO RESIDUAL IMPACTS PREDICTED**
Riparian planting	The proposed development is a residential subdivision with a portion of the lots backing onto the Central Pond. This pond was created as part of the extraction of aggregates with the shoreline currently devoid of vegetation. Landscaping of the shoreline of the pond is proposed including a natural shoreline edge moving into sod as proximity to the house increases. The proposed landscaping will decrease the current erosion issues and improve canopy cover at the pond margins. The residential uses surrounding the pond will result in increased nutrient loading to the pond. Planting of vegetation along the riparian areas may provide overhanging branches and sources of organic debris thereby increasing the diversity of aquatic structure and cover.	• Change in sediment concentrations• Change in water temperature• Change in habitat structure and cover	• See Section 3 of Appendix 4	**• Re-vegetation of any disturbed areas with native species will be required to stabilize soils. If planting is not possible due to the time of year, soils will be covered with an erosion control blanket to keep them in place until conditions are suitable for planting.• Typically a 15 m vegetated buffer would be recommended for the protection of a warmwater feature; however, given that the feature was the result of aggregate extraction activities and the extent of the existing disturbance at the site, a 5 - 10 m vegetated buffer comprised of hardy native species should be planted in the riparian area surrounding the Central Pond feature.**	By adhering to the recommended avoidance and mitigation measures, there is a low likelihood that the proposed revegetation and riparian planting activities will result in *serious harm* to either the fishery in the Central Pond or the downstream fishery in Buckhorn Lake. **Conclusion** **NO RESIDUAL IMPACTS PREDICTED**

Project Activity	Project Specific Description of Activities and Potential Impacts to Fish and Fish Habitat	DFO Pathways of Effects Considered	Measures to Avoid Harm (DFO)*	Project Specific Recommended Mitigation Provided by RiverStone	After considering the proposed avoidance and mitigation measures, are there residual impacts that are likely to result in *serious harm* to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery?
Excavation	The project will require alteration of the Central Pond to prepare it for use as a SWM pond and alteration of current ditches and natural drainage channels will also be required. Any work within the Central Pond will result in temporary increases in sediment concentrations. Changes in the groundwater flow and drainage patterns could change the thermal properties in the Central Pond.	• Change in water temperature • Change in sediment concentrations	• See Sections 2, 3, and 5 of Appendix 4	**• All excavations and subsequent work will be undertaken in dry weather conditions. Groundwater flow and surface flow entering any excavation will be removed from the excavation.** **• The offloading/loading of aggregate will be undertaken during fair weather conditions and must ensure material does not enter the water.** **• Run-off from excavations will not be permitted to drain directly into watercourses but will be diffused onto vegetated areas a minimum of 30 m from the watercourse. Where this measure is not sufficient or feasible to control sediment entering the watercourse, sediment traps or geotextile coverage will be employed.** **• No potentially deleterious materials, including fill or topsoil, will be stored or disposed of within 30 m of the watercourse or Central Pond.** **• The offloading/loading of aggregate will be undertaken during fair weather conditions and must ensure material does not enter the water.** **• A hydrogeologist must review the final design to ensure that the quantity and quality of groundwater inputs to the Central Pond remains consistent pre and post development.**	By adhering to the recommended avoidance and mitigation measures, there is a low likelihood that the proposed excavation activities will result in *serious harm* to either the fishery in the Central Pond or the downstream fishery in Buckhorn Lake. **Conclusion** **NO RESIDUAL IMPACTS PREDICTED**
Grading	The proposed development activities will result in changes to the existing grade around the Central Pond; however, given the limited existing riparian vegetation, changes in the availability and diversity of habitats is unlikely. Final slopes adjacent to the Central Pond are proposed at 7:1. During all grading activities there is the potential for increased sediment loading to the Central Pond as a result of exposed soils. Increased sedimentation of the Central Pond will occur over time when it is used for SWM pond. All sediment loading to the pond has the potential to impact the aquatic habitat structure. Grading of the outlet end of the Central Pond to create a rock check dam and associated flow control structure will effectively create a barrier to fish passage between the Central Pond and Buckhorn Lake.	• Change in habitat structure and cover • Blockage of fish passage• Change in sediment concentrations	• See Sections 2, 3, and 5 of Appendix 4	**• All sediment fencing will be properly installed (trenched in) to maintain integrity during inclement weather events.• Additional sediment fencing and appropriate sediment control measures will be stockpiled on site so that any breach can be repaired.• Sediment laden groundwater or surface discharge will be pumped to a settling basin or through filter bags prior to introduction to a waterbody.• All sediment fencing will be properly installed (trenched in) to maintain integrity during inclement weather events.• Additional sediment fencing and appropriate sediment control measures will be stockpiled on site so that any breach can be repaired.• Sediment laden groundwater or surface discharge will be pumped to a settling basin or through filter bags prior to introduction to a watercourse or wetland.• Construction activities that occur in close proximity to the water are best completed during dry weather conditions to the extent possible and should be completed quickly. • Temporary storage locations of aggregate material must be set back from the water's edge approximately 10 m. These temporary storage locations should be contained by heavy-duty sediment fencing that has been properly installed (trenched in). • Sediment fencing must be maintained until all construction work is complete and the site is stabilized. • An onsite supervisor should be responsible for daily inspections of the sediment and erosion control measures and record the time and date of inspections, the status of the mitigation measures, and any repairs undertaken.**	By adhering to the recommended avoidance and mitigation measures, there is a low likelihood that the proposed grading activities will result in *serious harm* to either the fishery in the Central Pond or the downstream fishery in Buckhorn Lake as a result of sedimentation or habitat changes. There will be a barrier to fish passage created that has the potential to cause harm to the fishery in the Central Pond. **Residual Impact Assessment** **• Duration: long-term barrier to fish migration between Central Pond and Buckhorn Lake.** **• Geographic Scale: local and restricted to created sport fishery in the Central Pond, impacts to Buckhorn Lake not predicted.** **• Availability/Condition of Fish Habitat: the impacted Central Pond is a created limited access fishery; Buckhorn Lake a significant sport fishery will not be impacted.** **• Impact on Fish: fish in the Central Pond will be isolated from the downstream gene pool available in Buckhorn Lake. Grading changes and increased nutrient and sediment loads may reduce both population fitness and habitat function.** **Conclusion** **LOW TO MODERATE POTENTIAL FOR *SERIOUS HARM* TO THE CENTRAL POND FISHERY**
In-Water Activities					
Addition or removal of aquatic vegetation	None of the proposed activities will result in the addition or removal of aquatic vegetation from the Central Pond.	• Change in habitat structure and cover	• See Appendix 4	**• No work should be completed during the warm water spawning season (April 1 to June 30).**	The proposed activities will not result in the removal of aquatic vegetation in either the Central Pond or Buckhorn Lake and as such, have a low likelihood of resulting in *serious harm* to either fishery as a result of aquatic vegetation removal. **Conclusion** **NO RESIDUAL IMPACTS PREDICTED**

Project Activity	Project Specific Description of Activities and Potential Impacts to Fish and Fish Habitat	DFO Pathways of Effects Considered	Measures to Avoid Harm (DFO)*	Project Specific Recommended Mitigation Provided by RiverStone	After considering the proposed avoidance and mitigation measures, are there residual impacts that are likely to result in *serious harm* to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery?
Fish passage issues	The proposed use of the Central Pond as a SWM pond will necessitate the installation of a watercontrol device too small to allow for fish passage thus resulting in the severance of the Central Pond from the downstream fishery in Buckhorn Lake. The installation of a rock check dam, an orifice plate, and additional culverts will create a complete barrier to upstream fish passage.	• Change in access to habitat/migration • Change in thermal cues or temperature barriers • Interbasin transfer of species • Incidental entrainment impingement or mortality of resident species	• See Appendix 4	**• No work should be completed during the warm water spawning season (April 1 to June 30).**	While currently there is a direct connection between the Central Pond and the downstream fishery in Buckhorn Lake, it is our understanding that the pond has been historically stocked with sport fish species. The community structure and population in the pond may be supported by upstream migration from the lake during periods of suitable flow. The proposed activities that will create a barrier to fish passage have are unlikely to result in *serious harm* to fish or the fishery in Buckhorn but harm in the long term may occur to the created fishery in the Central Pond. **<u>Residual Impact Assessment</u>** **• Duration: long-term barrier to fish migration between Central Pond and Buckhorn Lake.** **• Geographic Scale: local and restricted to created sport fishery in the Central Pond, impacts to Buckhorn Lake not predicted.** **• Availability/Condition of Fish Habitat: the impacted Central Pond is a created limited access fishery; Buckhorn Lake a significant sport fishery will not be impacted.** **• Impact on Fish: fish in the Central Pond will be isolated from the downstream gene pool available in Buckhorn Lake.** **<u>Conclusion</u>** **LOW TO MODERATE POTENTIAL FOR *SERIOUS HARM* TO THE CENTRAL POND FISHERY**
Change in timing, duration, and frequency of flow	The proposed use of the Central Pond as SWM pond to treat for quantity and quality of water coming off the subject property will result in changes in the timing and duration of flow to downstream Buckhorn Lake. The changes to flow patterns will, due to the necessary installation of water control devices, result in a barrier to fish passage. Increased surface water flow rates to the Central Pond will also occur as a result of the increased hardened surfaces on the subject property. The natural channel downstream, given its limited size and the volume and source of water in the Central Pond (i.e., groundwater) it is unlikely that the proposed activities will result in the displacement or stranding of fish in the connecting channel; however, fish within the Central Pond will become isolated from the downstream fishery in Buckhorn Lake.	• Change in water temperature • Displacement or stranding of fish • Change in sediment concentrations • Change in habitat structure and cover • Change in migration patterns	• See Appendix 4	**• No work should be completed during the warm water spawning season (April 1 to June 30).**	The operation of the Central Pond as a SWM pond will require that outflow maintain both the quality and quantity of water flowing from the pond to Buckhorn Lake, but also requires a water control structure that creates a barrier to fish passage. Migration of fish will not be possible. Additionally, timing of discharge from the SWM pond will be based on storm events and may not reflect current flow patterns. As such, there is the potential for the proposed activities related to timing, duration, and frequency of flow to result in harm to the fishery in the Central Pond but not the downstream fishery in Buckhorn Lake. **<u>Residual Impact Assessment</u>** **• Duration: long-term change in flow patterns in downstream channel and barrier to fish migration between Central Pond and Buckhorn Lake.** **• Geographic Scale: local and restricted to created sport fishery in the Central Pond, impacts to fish or the fishery in Buckhorn Lake not predicted.** **• Availability/Condition of Fish Habitat: the impacted Central Pond is a created limited access fishery; Buckhorn Lake a significant sport fishery will not be impacted.** **• Impact on Fish: fish in the Central Pond will be isolated from the downstream gene pool available in Buckhorn Lake.** **<u>Conclusion</u>** **LOW TO MODERATE POTENTIAL FOR *SERIOUS HARM* TO THE CENTRAL POND FISHERY**

Project Activity	Project Specific Description of Activities and Potential Impacts to Fish and Fish Habitat	DFO Pathways of Effects Considered	Measures to Avoid Harm (DFO)*	Project Specific Recommended Mitigation Provided by RiverStone	After considering the proposed avoidance and mitigation measures, are there residual impacts that are likely to result in *serious harm* to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery?
Placement of material or structures in water	The proposed activities include the installation of a 0.15m high rock check dam and twin 425 mm orifice plates with twin 675 mm culverts at the outlet of the Central Pond, upstream from the existing culvert. Placement of these two structures has the potential to impact downstream sediment concentrations. Infilling of the West Pond has the potential to impact sediment concentrations in downstream watercourses and lakes. Culverting of the natural and altered (ditches) watercourses upstream of the Central Pond has the potential to introduce additional sediment into the pond during construction.	• Change in habitat structure and cover• Change in sediment concentrations	• See Appendix 4	**• No work should be completed during the warm water spawning season (April 1 to June 30). • The most appropriate and desirable time to complete the work is between the end of June through to March to minimize the risk of sedimentation and potential to impact fish and fish habitat during the spawning season. • Construction activities that occur in close proximity to the water are best completed during dry weather conditions to the extent possible and should be completed quickly• All cofferdams will be constructed of clean, non-erodible materials such as, but not limited to: pea gravel bags, clean gravel and plastic sheeting, precast barriers and plastic sheeting, or sheet steel piling. • Dams can be constructed using aggregate filled bags or other suitable alternative.• The selected diversion method (pump or pipe) must be ready to divert flow immediately following placement of cofferdam.• All cofferdams and pumps must be regularly inspected to ensure structural integrity and function, with particular diligence around rain events. Necessary repairs to the dams and pumps must be completed immediately to ensure there is no release of sediment-laden water into the downstream receivers. • Culvert installations and construction activities around water should be undertaken during fair weather conditions and with care not to allow any material to enter the water.**	The Central Pond was created as the result of pit excavation activities. To the best of our knowledge, this pond has become a local recreational fishery through intentional introductions and not necessarily through migration events. The placement of the check dam and orifice plate will functionally sever the connection between the Central Pond and the downstream fishery in Buckhorn Lake. Severance of this connection has a very low likelihood of resulting in *serious harm* to fish or the fishery in Buckhorn Lake. Given the origin of the fish community in the Central Pond and the intermittent nature of the downstream connection with Buckhorn lake, the placement of structures in the channel has a low to moderate likelihood of resulting in serious harm to the fishery in the pond. **<u>Residual Impact Assessment</u>** **• Duration: long-term change in flow patterns in downstream channel and barrier to fish migration between Central Pond and Buckhorn Lake.** **• Geographic Scale: local and restricted to created sport fishery in the Central Pond, impacts to fish or the fishery in Buckhorn Lake not predicted.** **• Availability/Condition of Fish Habitat: the impacted Central Pond is a created limited access fishery; Buckhorn Lake a significant sport fishery will not be impacted.** **• Impact on Fish: fish in the Central Pond will be isolated from the downstream gene pool available in Buckhorn Lake.** **<u>Conclusion</u>** **LOW TO MODERATE POTENTIAL FOR *SERIOUS HARM* TO THE CENTRAL POND FISHERY**
Wastewater management	The Central Pond is to be repurposed for managing stormwater. The physical changes that are proposed for the pond are permanent and water quality in the Central Pond will deteriorate over time. It is anticipated that sediment and nutrient loading within the Central Pond will increase over time. As water depths decrease in response to sediment settling, there is the potential for increases in temperature within the pond. Given the depth of the pond (approx. 9 m) these impacts are anticipated to occur gradually, over a long period of time. Any inwater works (culvert installation, channel relocations, excavations) within the subject property must be completed in dry conditions to prevent downstream migration of suspended sediments, this may require dam and pump set ups to temporarily redirect flows.	• Change in water temperature	• See Appendix 4	**• A maintenance plan should be developed and implemented for the SWM pond to ensure the long term health of the facility and to maintain the quality of discharged water to downstream Buckhorn Lake.• Sediment laden groundwater or surface discharge will be pumped to a settling basin or through filter bags prior to introduction to a watercourse or waterbody.**	The design of the Central Pond as a SWM pond must include elements to maintain the quality water flowing from the pond to Buckhorn Lake. As such, there is a low likelihood that the proposed activities related to wastewater management will result in *serious harm* to the downstream fishery in Buckhorn Lake.Over time the functional use of the Central Pond as a SWM pond will result in decreasing water depths as sediments deposition increases, increased nutrient and contaminant concentrations, followed with changes in the fish community to favour the more pollution tolerant species; this change has a low likelihood of resulting in *serious harm* to the sport fish population in the pond. **<u>Residual Impact Assessment</u>** **• Duration: long-term slow change in sediment concentrations and water depths in Central Pond. No impacts predicted for Buckhorn Lake.** **• Geographic Scale: local and restricted to created sport fishery in the Central Pond, impacts to fish or the fishery in Buckhorn Lake not predicted.** **• Availability/Condition of Fish Habitat: the impacted Central Pond is a created limited access fishery; Buckhorn Lake a significant sport fishery will not be impacted.** **• Impact on Fish: fish community in the Central Pond will likely change over time.** **<u>Conclusion</u>** **LOW TO MODERATE POTENTIAL FOR *SERIOUS HARM* TO THE CENTRAL POND FISHERY**

*Standard Recommendations Provided by DFO

6 CONCLUSIONS

The subject property was found to contain both natural and altered watercourses, and two large ponds; watercourses were fed by natural groundwater upwellings, while the two pond features were the result of previous aggregate extraction activities. The Central Pond was the only aquatic feature on the subject property that contained a fishery. Buckhorn Lake, located downstream of the subject property, also contains a fishery. RiverStone is of the opinion that the proposed development activities will not result in *serious harm* to the significant fishery in Buckhorn Lake. The activities as proposed have a low to moderate likelihood of resulting in *serious harm to fish* that are part of the limited access, recreational fishery that has been created in the Central Pond. These conclusions are based upon the results of our onsite assessment and consideration of whether this project is likely to cause *serious harm to fish*, and are contingent upon the implementation of the recommendations made herein.

7 REFERENCES

Bergmann, B., K. Irwin, and J. Boos. 2005. The Stream Permanency Handbook. Ontario Ministry of Natural Resources.

Fisheries and Oceans Canada (DFO). 2006. Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff. Version 1.0. Habitat Management Program. Fisheries and Oceans Canada.

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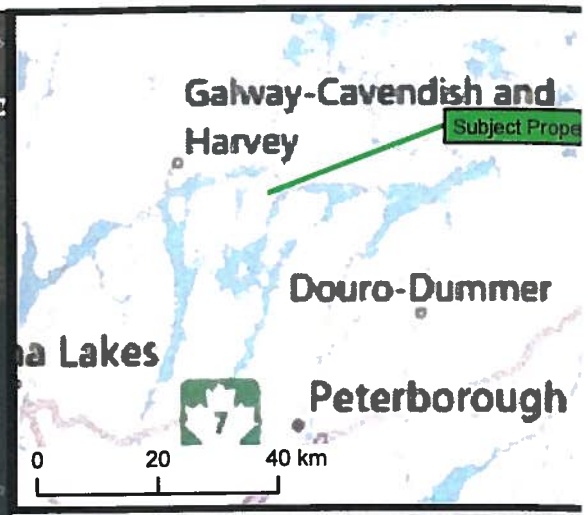
Stanfield, L. (editor), 2005. Ontario Stream Assessment Protocol Version 7 (updated May 2007). Fish and Wildlife Branch, Ontario Ministry of Natural Resources, Peterborough, Ontario.



Legend

Planning Boundaries

Subject Property (Approximate)

Bing Maps Hybrid Base Layer

Scale	RS Project No.	Date Last Updated	E
1:20,000	2013-045	Jul 2, 2013	G

0 300 600 Metres

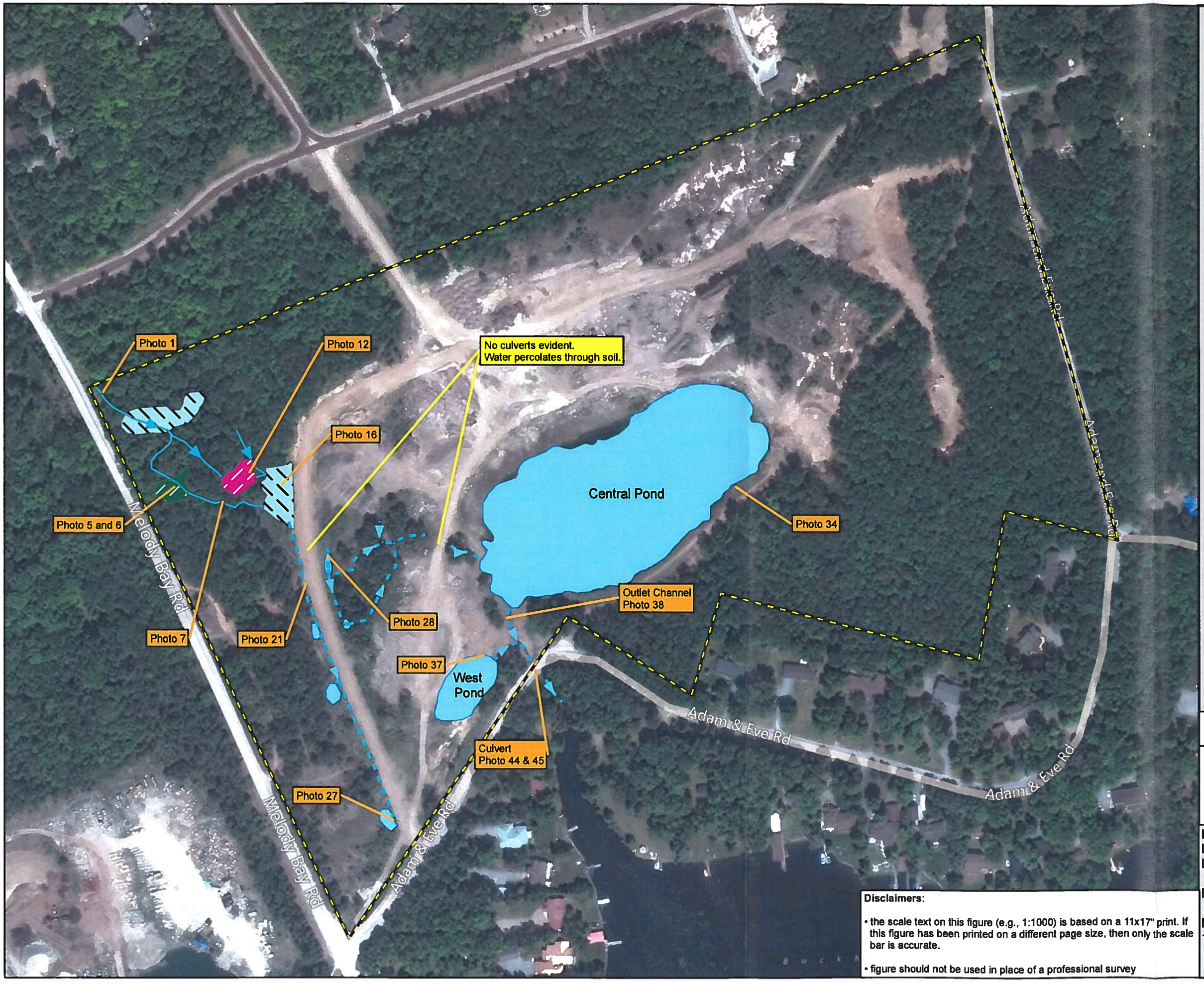
RiverSt

Figure 1. Location of Subject Property. Lots 8
9, Concession 9, Municipality of Trent Lakes, Cou
of Peterborough.

Prepared for 1447147 Ontario Inc.

Disclaimers:

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



Legend

Planning Boundaries

- Subject Property (Approximate)

Biophysical Features and Functions - RiverStone

- Watercourse (natural state)
- Watercourse (altered state)
- Braided Channels
- Groundwater "recharge" area
- Groundwater upwelling area
- Ponds

N

Bing Maps Hybrid Base Layer

Scale	RS Project No.	Date Last Updated	By
1:2,400	2013-045	Jul 10, 2013	GC

0 30 60 Metres

RiverStone

Disclaimers:

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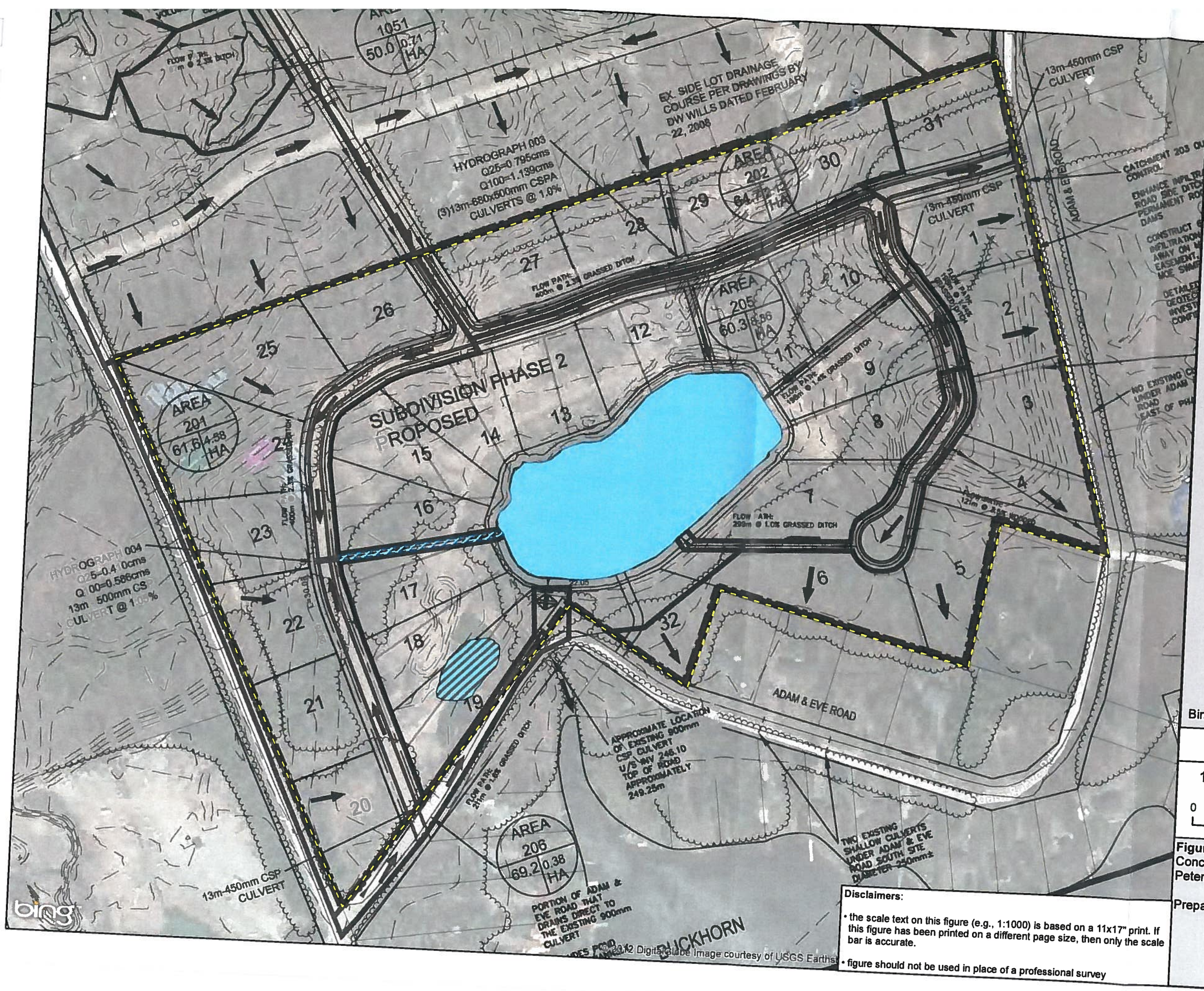
- figure should not be used in place of a professional survey

Figure 2. Biophysical Features and Functions. Lots 8 and 9, Concession 9, Municipality of Trent Lakes, County of Peterborough.

Prepared for 1447147 Ontario Inc.

Numbers on figure correspond to photos in Appendix 1.



Legend

Planning Boundaries

- Subject Property (Approximate)

Biophysical Features and Functions - RiverStone

- Braided Channels
- Groundwater "recharge" area
- Groundwater upwelling area
- Pond

Proposed Development and Site Alteration

- Culvert
- Fill
- Open Channel
- Lot Lines Proposed as of Date of Figure

Bing Maps Hybrid Base Layer

N

Scale	RS Project No.	Date Last Updated	By
1:2,400	2013-045	Mar 26, 2014	GC

0 30 60 Metres

RIVERSTONE

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- figure should not be used in place of a professional survey

Figure 3. Development Overlay. Lots 8 and 9, Concession 9, Municipality of Trent Lakes, County of Peterborough.

Prepared for 1447147 Ontario Inc.

Appendix 1. Select Photos from Site Visit.

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Photo 1. Start of watercourse in northwestern portion of subject property, Lot 25 and 26 (June 11, 2013).

Photo 2. Watercourse in natural state on subject property downstream of previous photo, Lot 25 (June 11, 2013).

Photo 3. Watercourse in natural state on subject property downstream of previous photo, Lot 25 (June 11, 2013).

Photo 4. Watercourse in natural state on subject property downstream of previous photo, Lot 25 (June 11, 2013).

Photo 5. Groundwater "recharge" area, Lot 25 (June 11, 2013).

Photo 6. Groundwater "recharge" area, Lot 25 (June 11, 2013).

Photo 7. Watercourse in natural state on subject property downstream of previous photo, Lot 25 (June 11, 2013).

Photo 8. Watercourse in natural state on subject property downstream of previous photo (June 11, 2013).

Photo 9. Watercourse in natural state on subject property downstream of previous photo (June 11, 2013).

Photo 10. Watercourse in natural state on subject property downstream of previous photo (June 11, 2013).

Photo 11. Watercourse located east of previous feature detailed in photos 1–9 (June 11, 2013).

Photo 12. Groundwater upwelling area (June 11, 2013).

Photo 13. Groundwater upwelling area (June 11, 2013).

Photo 14. Runoff from groundwater upwelling just upstream from area of braided channels (June 11, 2013).

Photo 15. Runoff from groundwater upwelling just upstream from area of braided channels (June 11, 2013).

Photo 16. Area of braided channels with disturbed areas (June 11, 2013).

Photo 17. Area of braided channels through disturbed soils (June 11, 2013).

Photo 18. Area of braided channels along access road (June 11, 2013).

Photo 19. Altered watercourse adjacent to existing road, downstream of area of braided channels (June 11, 2013).

Photo 20. Altered watercourse adjacent to existing road, downstream of area of braided channels (June 11, 2013).

Photo 21. Altered watercourse adjacent to existing road, downstream of area of braided channels (June 11, 2013).

Photo 22. Aquatic vegetation within the altered watercourse (June 11, 2013).

Photo 23. Altered watercourse adjacent to existing road, downstream of area of braided channels (June 11, 2013).

Photo 24. Altered watercourse adjacent to existing road, downstream of area of braided channels (June 11, 2013).

Photo 25. Altered watercourse adjacent to existing road, downstream of area of braided channels (June 11, 2013).

Photo 26. Altered watercourse adjacent to existing road, downstream of area of braided channels (June 11, 2013).

Photo 27. Terminus of altered watercourse adjacent to existing road, downstream of area of braided channels (June 11, 2013).

Photo 28. Aquatic vegetation within the altered watercourse on eastern side of existing road, downstream of area of braided channels (June 11, 2013).

Photo 29. Aquatic vegetation within the altered watercourse on eastern side of existing road, downstream of area of braided channels (June 11, 2013).

Photo 30. Altered watercourse on eastern side of existing road, downstream of area of braided channels (June 11, 2013).

Photo 31. Altered watercourse on eastern side of existing road, downstream of area of braided channels (June 11, 2013)..

Photo 32. Altered watercourse on eastern side of existing road, downstream of area of braided channels (June 11, 2013)..

Photo 33. Central Pond (June 11, 2013).

Photo 34. Central Pond (June 11, 2013).

Photo 35. Central Pond (June 11, 2013).

Photo 36. Centrarchid nest in Central Pond (June 11, 2013).

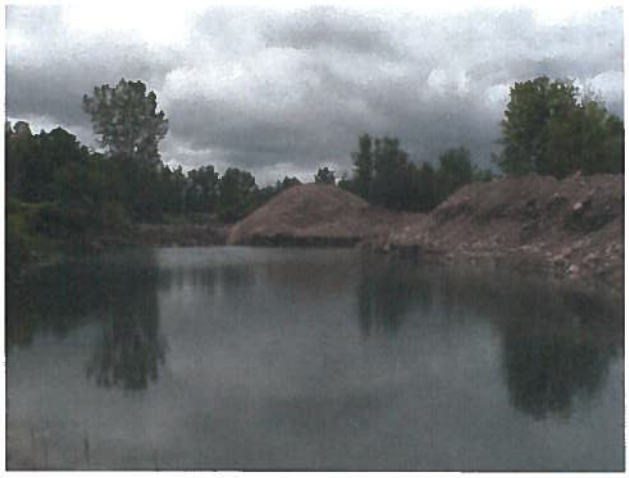

Photo 37. West Pond (June 11, 2013).

Photo 38. Outlet of Central Pond (June 11, 2013).

Photo 39. Confluence of central and West Pond outlets (June 11, 2013).

Photo 40. Pond outlet channel (June 11, 2013).

Photo 41. West Pond outlet (June 11, 2013).

Photo 42. Confluence of central and west pond outlets (June 11, 2013).

Photo 43. Inlet of culvert conveying pond outflow under Adam and Eve Road to Buckhorn Lake(June 11, 2013)

Photo 44. Inlet of culvert conveying pond flow under Adam and Eve Road to Buckhorn Lake(June 11, 2013).

Photo 45. Outlet of culvert conveying base flow from the subject property under Adam and Eve Road to Buckhorn Lake(June 11, 2013).

Appendix 2. Correspondence from MNR.

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Glenn Cunnington

From: Berube, Margaret (MNR) <Margaret.Berube@ontario.ca>
Sent: 04-07-2013 13:31
To: Glenn Cunnington
Subject: RE: Fisheries Information Request (2013-045)

Hey Glenn!

Well, it is a new position, but sadly, it ends on December 31st.

So, I don't have any fish habitat information for you. All we really track is spawning areas and our records indicate that there aren't any fish spawning areas in the area you're dealing with. That said, there is still the possibility that spawning beds do exist at your location and we just haven't mapped them yet.

What I can provide you with is a summary list of all species known to exist in Buckhorn Lake. Hopefully it's somewhat useful to you:

Logperch, Muskellunge, Golden Shiner, Blackchin Shiner, Bluntnose Minnow, Pumpkinseed, Spottail Shiner, Brown Bullhead, Iowa Darter, Yellow Perch, Black Crappie, White Sucker, Rock Bass, Smallmouth Bass, Common Carp, Emerald Shiner, Trout-perch, Walleye, Mottled Sculpin, Banded Killifish, Bluegill, Largemouth Bass.

Just let me know if you need anything else.

Margaret

From: Glenn Cunnington [mailto:glenn@rsenviro.ca]
Sent: July 4, 2013 9:11 AM
To: Berube, Margaret (MNR)
Subject: RE: Fisheries Information Request (2013-045)

Margaret,

Congrats on the new position!

I have attached a map of the area on Buckhorn Lake I am wondering about; it is a small embayment just southwest of Buckhorn. I hope this map will help clarify things. If you have any questions don't hesitate to give me a call.

Glenn

--

Glenn Cunnington, M.Sc.
Terrestrial Ecologist | Species at Risk Specialist
RiverStone Environmental Solutions Inc.
1-310 Taylor Road, Bracebridge Ontario, P1L 1K1
Office 705.645.9887 | Cell 705.644.4815 | Fax 888.857.4979
e-mail glenn@rsenviro.ca | www.rsenviro.ca

From: Berube, Margaret (MNR) [mailto:Margaret.Berube@ontario.ca]
Sent: 03-07-2013 16:15
To: Glenn Cunnington
Subject: RE: Fisheries Information Request (2013-045)

Hi Glenn,

Can you send me the map and property location details (lot, con, geographic township, etc.)?

Thanks!

Margaret

From: Norris, Lorraine (MNR)
Sent: July 3, 2013 8:07 AM
To: Glenn Cunnington
Cc: bev@rsenviro.ca; Berube, Margaret (MNR)
Subject: RE: Fisheries Information Request (2013-045)

Hi Glenn!

Thanks for the e-mail, I am passing this request along to Margaret Berube who is our Acting Area Management Biologist. I have cc'd her on this e-mail as well.

Lorraine Norris
Sr. Fish & Wildlife Technical Specialist
Ministry of Natural Resources
Peterborough District Office
300 Water Street, 1st Floor, South Tower
Peterborough, Ontario K9J 8M5
(705) 755-3361 (direct line)
(705) 755-3125 (fax)
lorraine.norris@ontario.ca

From: Glenn Cunnington [mailto:glenn@rsenviro.ca]
Sent: Tuesday, July 02, 2013 4:55 PM
To: Norris, Lorraine (MNR)
Cc: bev@rsenviro.ca
Subject: Fisheries Information Request (2013-045)

Lorraine,

We are conducting a fish habitat assessment for a property located on Buckhorn Lake. I was wondering if you could provide me with any fish habitat information pertaining to the inlet located along Adam and Eve Road (see attached map).

Your help is much appreciated.

Best Regards,

Glenn

--

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e-mail glenn@rsenviro.ca | www.rsenviro.ca

Appendix 3. Drawings provided by Skelton Brumwell

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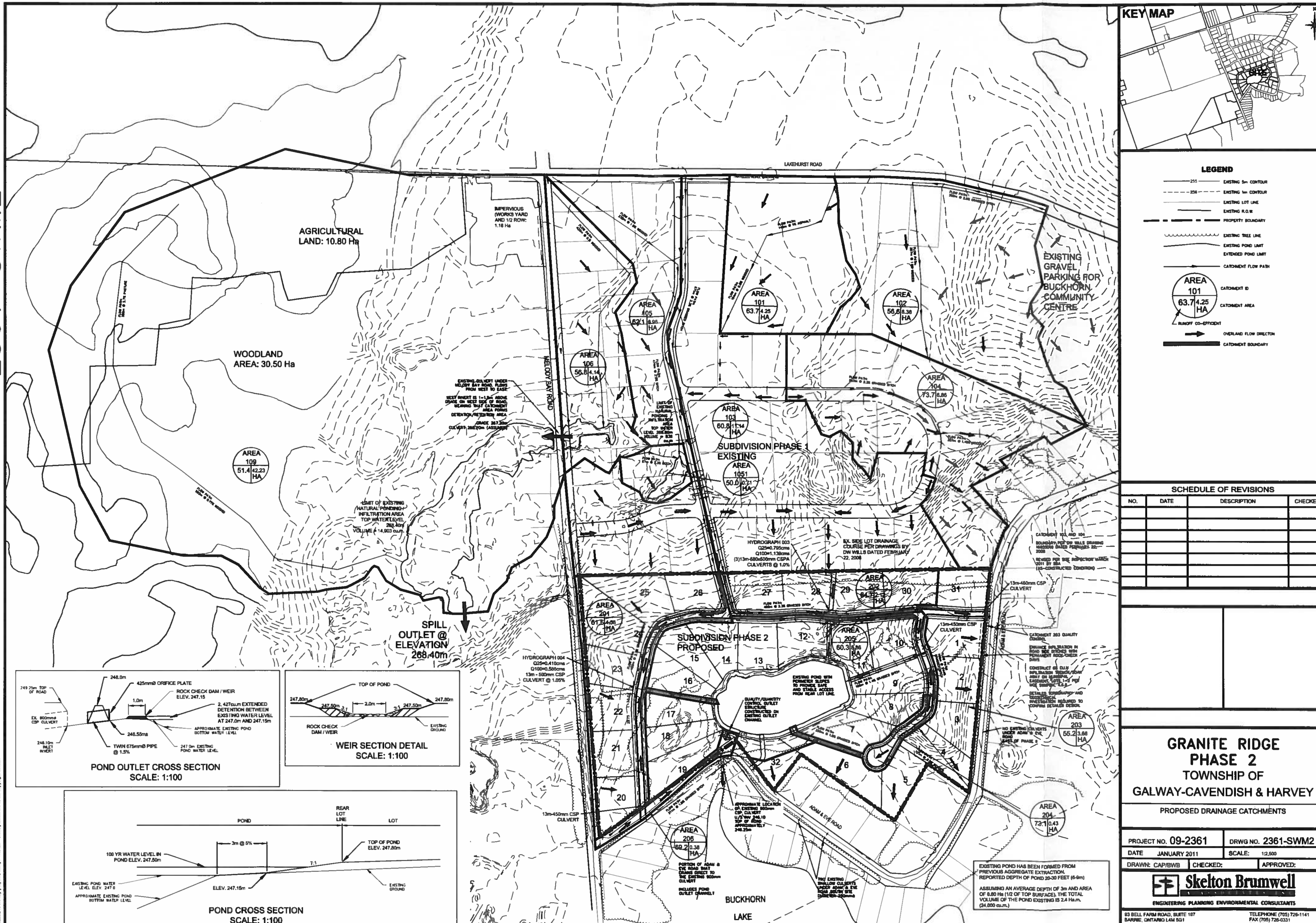

2361-SWM2

Appendix 4. DFO Measures to Avoid Harm

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The following measures to avoid causing harm to fish and fish habitat were developed by Fisheries and Oceans Canada (DFO) to aid in project planning, design, and completion in a manner that will avoid causing harm to fish and fish habitat. These recommendations have been adapted from DFOs website (http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html)

1. PROJECT PLANNING

1.1. Timing

- Time work in water to respect timing windows to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed.
- Minimize duration of in-water work.
- Conduct instream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.
- Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.

1.2. Site Selection

- Design and plan activities and works in waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided.
- Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation.
- Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the stream bed or the built structures.
- Undertake all instream activities in isolation of open or flowing water to maintain the natural flow of water downstream and avoid introducing sediment into the watercourse.

1.3. Contaminant and Spill Management

- Plan activities near water such that materials such as paint, primers, blasting abrasives, rust solvents, degreasers, grout, or other chemicals do not enter the watercourse.
- Develop a response plan that is to be implemented immediately in the event of a sediment release or spill of a deleterious substance and keep an emergency spill kit on site.
- Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish.

2. EROSION AND SEDIMENT CONTROL

- Develop and implement an Erosion and Sediment Control Plan for the site that minimizes risk of sedimentation of the waterbody during all phases of the project. Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include:
    - Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the water body.

- Measures for managing water flowing onto the site, as well as water being pumped/diverted from the site such that sediment is filtered out prior to the water entering a waterbody. For example, pumping/diversion of water to a vegetated area, construction of a settling basin or other filtration system.
- Site isolation measures (e.g., silt boom or silt curtain) for containing suspended sediment where in-water work is required (e.g., dredging, underwater cable installation).
- Measures for containing and stabilizing waste material (e.g., dredging spoils, construction waste and materials, commercial logging waste, uprooted or cut aquatic plants, accumulated debris) above the high water mark of nearby waterbodies to prevent re-entry.
- Regular inspection and maintenance of erosion and sediment control measures and structures during the course of construction.
- Repairs to erosion and sediment control measures and structures if damage occurs.
- Removal of non-biodegradable erosion and sediment control materials once site is stabilized.

3. SHORELINE RE-VEGETATION AND STABILIZATION

- Clearing of riparian vegetation should be kept to a minimum: use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction. When practicable, prune or top the vegetation instead of grubbing/uprooting.
- Minimize the removal of natural woody debris, rocks, sand or other materials from the banks, the shoreline or the bed of the waterbody below the ordinary high water mark. If material is removed from the waterbody, set it aside and return it to the original location once construction activities are completed.
- Immediately stabilize shoreline or banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through re-vegetation with native species suitable for the site.
- Restore bed and banks of the waterbody to their original contour and gradient; if the original gradient cannot be restored due to instability, a stable gradient that does not obstruct fish passage should be restored.
- If replacement rock reinforcement/armouring is required to stabilize eroding or exposed areas, then ensure that appropriately-sized, clean rock is used; and that rock is installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment.
- Remove all construction materials from site upon project completion.

4. FISH PROTECTION

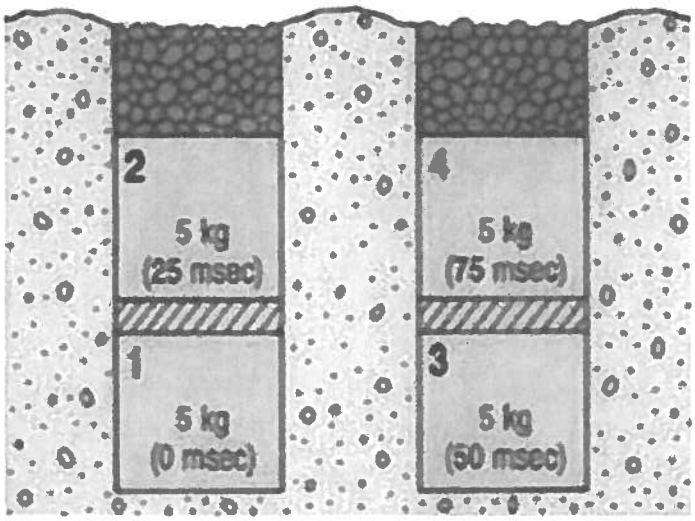
- Ensure that all in-water activities, or associated in-water structures, do not interfere with fish passage, constrict the channel width, or reduce flows.
- Retain a qualified environmental professional to ensure applicable permits for relocating fish are obtained and to capture any fish trapped within an isolated/enclosed area at the work site and safely

relocate them to an appropriate location in the same waters. Fish may need to be relocated again, should flooding occur on the site.

- Screen any water intakes or outlet pipes to prevent entrainment or impingement of fish. Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself.
    - In freshwater, follow these measures for design and installation of intake end of pipe fish screens to protect fish where water is extracted from fish-bearing waters:
        - Screens should be located in areas and depths of water with low concentrations of fish throughout the year.
        - Screens should be located away from natural or artificial structures that may attract fish that are migrating, spawning, or in rearing habitat.
        - The screen face should be oriented in the same direction as the flow.
        - Ensure openings in the guides and seals are less than the opening criteria to make "fish tight".
        - Screens should be located a minimum of 300 mm (12 in.) above the bottom of the watercourse to prevent entrainment of sediment and aquatic organisms associated with the bottom area.
        - Structural support should be provided to the screen panels to prevent sagging and collapse of the screen.
        - Large cylindrical and box-type screens should have a manifold installed in them to ensure even water velocity distribution across the screen surface. The ends of the structure should be made out of solid materials and the end of the manifold capped.
        - Heavier cages or trash racks can be fabricated out of bar or grating to protect the finer fish screen, especially where there is debris loading (woody material, leaves, algae mats, etc.). A 150 mm (6 in.) spacing between bars is typical.
        - Provision should be made for the removal, inspection, and cleaning of screens.
        - Ensure regular maintenance and repair of cleaning apparatus, seals, and screens is carried out to prevent debris-fouling and impingement of fish.
        - Pumps should be shut down when fish screens are removed for inspection and cleaning.
- Avoid using explosives in or near water. Use of explosives in or near water produces shock waves that can damage a fish swim bladder and rupture internal organs. Blasting vibrations may also kill or damage fish eggs or larvae.
    - If explosives are required as part of a project (e.g., removal of structures such as piers, pilings, footings; removal of obstructions such as beaver dams; or preparation of a river or lake bottom for installation of a structure such as a dam or water intake), the potential for impacts to fish and fish habitat should be minimized by implementing the following measures:

- Time in-water work requiring the use of explosives to prevent disruption of vulnerable fish life stages, including eggs and larvae, by adhering to appropriate fisheries timing windows.
- Isolate the work site to exclude fish from within the blast area by using bubble/air curtains (i.e., a column of bubbled water extending from the substrate to the water surface as generated by forcing large volumes of air through a perforated pipe/hose), cofferdams or aquadams.
- Remove any fish trapped within the isolated area and release unharmed beyond the blast area prior to initiating blasting
- Minimize blast charge weights used and subdivide each charge into a series of smaller charges in blast holes (i.e., decking) with a minimum 25 millisecond (1/1000 seconds) delay between charge detonations (see Figure 1).
- Back-fill blast holes (stemmed) with sand or gravel to grade or to streambed/water interface to confine the blast.
- Place blasting mats over top of holes to minimize scattering of blast debris around the area.
- Do not use ammonium nitrate based explosives in or near water due to the production of toxic by-products.
- Remove all blasting debris and other associated equipment/products from the blast area.

Figure 1: Sample Blasting Arrangement



Per Fig. 1: 20 kg total weight of charge; 25 msecs delay between charges and blast holes; and decking of charges within holes.

5. OPERATION OF MACHINERY

- Ensure that machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species and noxious weeds.
- Whenever possible, operate machinery on land above the high water mark, on ice, or from a floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody.
- Limit machinery fording of the watercourse to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, construct a temporary crossing structure.
- Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording.
- Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water.