Draft for Discussion

Reid Road Reservoir Quarry

# Environmental and Water Management Implementation Guide

February 2020



JAMES DICK
CONSTRUCTION LIMITED

# Table of Contents

**List of Tables:**

# 1 Introduction

James Dick Construction Limited ("JDCL") is applying for a Class 'A' Aggregate Resources Act (ARA) License to recommence mining sand, gravel and dolostone from the former Woodlawn Guelph Limited Pit located in Campbellville, Ontario. Extraction will occur in five Phases and will include the creation of a new pond in Phase 1 (see **Figure 1**)

This document is a summary of: hydrogeological and natural heritage conditions, environmental objectives, monitoring, mitigation and the contingency measures to be undertaken and implementation of the monitoring, mitigation and contingency measures on the *Aggregate Resources Act* Site Plans. The Site Plans will be the formal legal document that contains all conditions of the license agreement.

## 1.1 Site setting

The former extractive activities created three large ponds (See **Figure 1**). The ponds are hydraulically connected to the sand, gravel and dolostone aquifers. The water table is close to the ground surface throughout the site and supports Provincially Significant Wetlands (PSW's) and cold-water fisheries. Groundwater and/or surface water connects the PSW's and cold-water fisheries to the extraction areas; therefore, changes in the water table or pond elevation may affect water levels in the wetlands. These conditions are typical of the limestone plains where this type of aggregate deposit occurs in and around the Greater Toronto Area (GTA).

Local water supply is provided by private wells obtaining water from the sand and gravel or dolostone aquifer. Extractive activities may draw the water level down within the existing ponds and proposed Phase 1 pond and therefore effects on levels in local wells must be considered. Extractive conditions may temporarily create turbidity within the existing ponds and proposed Phase 1 pond. Changes in water quality in downgradient private wells are unlikely to occur and will be verified through on-site monitoring.

As outlined in the Natural Heritage and Hydrogeology Reports, the key functions of the surrounding wetlands and creeks were identified through the field work and site characterization. Many of these functions are protected by protecting the feature (i.e. no direct disturbance). Other functions are dependent on water resources that do have potential to be indirectly affected.

The potential for temporarily affecting water levels in the adjacent wetlands was recognized at an early stage of the site characterization. The former aggregate extraction ponds that largely form the extent of proposed extraction are either connected to or in close proximity to Provincially Significant Wetlands (See **Figure 2**). As such, the hydrology of the wetlands is a result of the previous below water extraction, construction of the driveway and other related drainage modifications on the site. Other historic activities in the area, including the road construction works, railway construction and the industrial park influence the hydrology and hydrogeology of the area and the function of the wetland areas.

## 1.2 Proposed Development and Mining Plan

The following section outlines the proposed development and mining plan. The *Aggregate Resources Act* Site Plans prepared by MHBC Planning includes a detailed description of the mining operations.

### 1.2.1 Pre-Production Activity / Operations Task List

The following list of activities and tasks will take place prior to the production of material for commercial sales. This list involves the preparations required to set up necessary infrastructure, acoustical shielding, environmental protection and mitigation infrastructure, and create the causeway and primary plant working area. The list is not considered to be exhaustive; there will be flexibility in the order of operations and timing.

1. Install perimeter fencing as per the Site Plans (Page 2) and required by ARA standards. An entrance gate will remain at Twiss Road and an operational gate will be placed at the operational entrance at the end of the driveway. As per Page 2 of the Site Plan, Variations from Operational Standards, the fencing will not be placed in areas that contain natural features (i.e. across wetlands etc.).
2. Install required ARA Signage (i.e. ARA licence #, company). The signs will be posted at the entrance gate at Twiss Road. Signage may also be installed on the Highway 401 frontage.
3. Complete the pre-extraction Residential Well survey as detailed on the Site Plans - Page 3.
4. Begin baseline ecological monitoring, per Page 3 of the Site Plans (see section 4.3 of this Guide).
5. Install any new water monitors (CB12S/D, CB13S/D, CB14, CB15, CB16, CB17), and ensure all monitoring programs are underway.
6. A pre-blast survey will be conducted at interested local residences or businesses.
7. Obtain necessary permits and undertake the internal driveway ecological enhancements (exclusion fencing and culverts). The driveway will be assessed and any resurfacing, vegetation trimming and posting of traffic control signage will be completed. Signage will include an internal stop sign (2 way) at the Twiss Road entrance, a "*yield to incoming traffic*" at any narrow spots on the haul road, and the appropriate rail crossing signage at the existing Guelph Junction Railway crossing.
8. Establish and extend an electrical service along the driveway to the pump locations, scale house, plant and shop area.
9. Obtain PTTW and ECA permits to allow for the pumping of water for ecological mitigation, the washing of aggregate, and the air and wash water discharge into the clarification pond.
10. Build the scale and scale house (building permit required).
11. Build maintenance shop (building and septic permits required) as shown on Page 2 of Site Plan.
12. Construct noise control berms (including imported material) as per the Site Plan.
13. Mark extraction boundaries with stakes (T- bar and white PVC).
14. Clear, grub and strip Phase 1. Stripping will go into berms.
15. Blast and extract rock for buffer pond construction.
16. Build buffer ponds, dispersion trenches, pumps and infiltration facilities and ensure all mitigation facilities are operational.
17. Commence pumping as prescribed on the Site Plan and as summarized in this document
18. Continue excavation in Phase 1.
19. Build causeway across central pond (approx. 18,000 cubic metres)
20. Install Tunnel Conveyor in the existing concrete culvert under railway.

21. Haul shot rock to create plant processing area progressively while producing products (approx. 60,000 cubic metres).

### 1.2.2 Phasing

The phasing for the mining plan is shown on Page 2 - Operational Plan of the Site Plan. Details for the sequence and direction of mining are listed in note '1.2.1 – Sequence and Direction' on the Operational Plan.

The following is a summary of the phased approach to pit and quarry operations:

#### PHASE 1

- Stripping in phase one is complete (as needed for berm construction and work area)
- Noise control berm is complete
- Layout of the extraction area is complete and marked
- Environmental and water management systems in place
- Some rock extraction has occurred already
- Rock extraction and primary crushing may proceed with primary product being transferred to production plant in phase 5 plant area via conveyor.
- Side slope and disturbed areas will be rehabilitated progressively as extraction operations are finalized in the area.

#### PHASE 2

- Berming is already in place
- Environmental and water management systems are already in place
- Shot rock/primary production will be transferred to create a working area in the Central Pond ,
- Drilling/Blasting in the Central Pond will start in this area and continue to work generally in a westerly and southerly direction eventually crossing into the west pond
- The sand and gravel resource in phase 2 may be extracted at such time as to coincide with the operations in the recycling operation, transport to the processing area may be by rock truck to the processing area
- Side slope and disturbed areas will be rehabilitated progressively as extraction operations are finalized in the area.

#### PHASE 3

- Berming is already in place
- Environmental and water management systems are already in place
- Shot rock/primary production will be transferred to create a working area in the East Pond
- Drilling/Blasting in the East Pond will start in this area and continue to work generally in a easterly direction
- Shot rock may be transferred to the processing plant by rock truck or conveyor
- Rehabilitate disturbed areas around edges

#### PHASE 4

- Begin to remove the field conveyor in Central Pond, it can retreat as extraction continues in a NE direction
- Begin at SW end of the phase to drill/blast areas designated for extraction

- Extract material and use conveyor as long as possible until rock trucks are needed to remove the last material
- Rehabilitate phase 4 west end of west pond and any other perimeter disturbed area

#### PHASE 5

- Begin drill and blast on east edge of Phase 5 working west
- Plant equipment reduction will take place to allow for extraction
- Eventually last extraction may be done by portable processing and taking material off site
- Removal of shop, scrap area, any infrastructure will coincide with final extraction
- Rehabilitate Phase 5 disturbed areas
- Final rehabilitation and removal of infrastructures (water distribution, scales, electrical) to take place

### 1.2.3 Requirements During Operations

Operational activities are laid out in detail on the Site Plans. All monitoring, Best Management Practices and prescribed conditions on the Site Plan and ARA License must be followed at all times.

Generally, loose sand and gravel deposits will be excavated exposing the bedrock underneath. In some areas, the bedrock is already exposed. Dry exposures of the top of bedrock will be drilled from the top of rock for blasting. Where top of rock is below water table, a pad of shot rock will be placed on top of bedrock to create a dry drilling platform. Blast holes will be advanced through the shot rock pad and into the bedrock to the prescribed depth. Holes will be lined with blast hole casing to prevent shot rock from entering the hole. Waterproof emulsions and/or packaged products will be used as blasting agents. Once the blast is complete, rock will be removed using a dragline or excavator. Material will be transferred to the processing plant for further processing and stockpiling. The extraction area will not be dewatered so as extraction progresses a deep pond is created, at a similar water level to the final rehabilitated feature.

### 1.2.4 Rate of Extraction

Although the maximum potential shipping tonnage is proposed to be capped at 990,000 tonnes per year, the anticipated rate of extraction from below the water table will more likely be between 350,000 and 500,000 tonnes per year. The shipping tonnage limit is a composite of:

1. Material extracted above water table, processed and shipped in the calendar year,
2. Material extracted below water table, processed and shipped in the calendar year,
3. Shot rock plant feed extracted in previous years that is processed and shipped in the calendar year,
4. Products produced and stockpiled in previous years that remain in inventory and shipped in the calendar year,
5. Material to be recycled that is received and shipped at the site

The 350,000 to 500,000-tonne extraction number represents only shot rock feed material extracted from below-the-water table in a year (which could be the one scenario for item “2.” in the list above). It is important to note that this quarry will operate in harmony with the ability of the environment to sustain it, based on the minimum water level thresholds established for sensitive receptors and incorporated into the monitoring program. In a wet year more can be extracted from below water table, in a dry year less.

## 1.3 Groundwater and Surface Water Conditions

There are three large permanent ponds on site designated as the West (P1), Central (P6) and East Ponds (P11) and four smaller permanent ponds designated P2, P3, P12 and P13. These are shown on **Figure 3**. The West, Central and East Ponds have been excavated into the sand and gravel deposits, glacial till deposits and dolostone bedrock.

The site is located at the subwatershed boundary between 16 Mile Creek and Bronte Creek. There is surface water flow originating from P13 that will seasonally flow into 16 Mile Creek. This is seasonal because during low flow conditions, the surface water leaving the site infiltrates in Lot 7, Concession 3 Town of Milton (formerly Nassagaweya Township). There is perennial surface water flow from the site that occurs from the site to the Thomas William Harrison Tract on the south side of the CN railway. There is also perennial flow from the on-site Kilbride Tributary into Kilbride Creek. A man-made ditch is found between P3 and Kilbride Creek. No flow has been observed in this ditch to-date, however, the potential exists. On-site streams and their flow directions are shown on **Figure 3**.

Groundwater is found to occur in both the sand and gravel, unconsolidated sediments as well as the dolostone bedrock. The sand and gravel deposits and the dolostone bedrock are used for local water supply and are considered aquifers. There are no significant aquitards found at the site. In a regional sense, groundwater flow is southerly. Locally, groundwater flow is influenced by surface water features and groundwater is observed to discharge into Kilbride Creek and Kilbride Tributary. Groundwater flow directions are shown on **Figure 4**.

### 1.3.1 Potential Changes to Physical Hydrogeology

During the operation of the site, the active removal of rock from below-the-water table will create a temporary disturbance of the groundwater flow system. It is well understood that the volume of aggregate removed from below-the-water table will be replaced with water. Where aggregate is removed from the Central, East and West ponds, this water initially comes directly from the stored water in the ponds, runoff from the catchment area, precipitation, and indirectly from the adjacent aquifers. In Phase 1, extraction will occur directly in the aquifer and groundwater will flow into the excavation from the surrounding rock body.

Temporarily lowering the water level in the main ponds during active extraction periods does not present an environmental challenge within the ponds because the limited ecological functions of these ponds are tolerant to changes in the water levels. However, below-water extraction has the potential for lowering of the water table beneath the adjacent wetlands thus potentially affecting flora and fauna.

Given the potential for impact to wetlands from lowering the water table, the proponent in this case has chosen a mining method that will minimize drawdown effects on the water table. JDCL will not be dewatering the site, rather water will remain in the ponds and broken rock will be excavated from the ponds with a dragline operation. In this way, water level change is controlled by the rate of extraction.

The potential for changes to the water levels as a result of this method of extraction are quite limited. Traditional quarry extraction in this setting requires dewatering of the working area with associated drawdowns of many metres and greater potential for impacts on surrounding water dependant natural heritage features. This is sometimes addressed by engineered solutions such as reinjection of water into bedrock aquifers and ongoing management of recovering water levels. Unlike those types of operations

JDCL proposes to remove the blasted rock from the ponds so the potential for adjacent effects is limited relative to a dewatered quarry.

The change in water levels, is directly proportional to the amount of aggregate removed from the extraction ponds and the rate that it is removed at. The more aggregate removed over a period of time; the more water will move into the ponds from the aquifer to replace the removed aggregate.

Considering the nearness of Provincially Significant Wetlands to the extraction areas (and the degree of connectivity between surface and ground water), preventive mitigation efforts will be necessary to maintain water levels and hydroperiods in the wetlands during extraction. Hydroperiod is the length of time that a wetland will retain water through the spring and into the summer months.

### 1.3.2 Potential Changes to Surface Water

Water levels are anticipated to be temporarily decreased within the West, Central and East ponds by up to two metres. Ponds 7A and 7B are directly connected to the Central Pond and will be isolated from water level fluctuations in the Central Pond through the implementation of a physical barrier. All other surface water features are indirectly connected to the extraction areas via groundwater flow. Mitigation measures as discussed in Section 3 will be used to maintain groundwater flow to Kilbride Creek and Kilbride Tributary within their historical range.

### 1.3.3 Potential Changes to Water Quality

No chemical, biological, physical or thermal changes in groundwater or surface water are expected to occur off-site. The following is a list of potential water quality changes on-site.

#### CHEMICAL

Emulsion, water resistant explosives will be used in blasting activities. The main components of explosives are nitrogen, carbon and sulphur. It is our experience that the blasting chemicals will be consumed in the explosion and not contaminate the water.

#### BIOLOGICAL

It is anticipated that the ponds will continue to contain coliform bacteria and other bacteria related to mammal and waterfowl. During extractive activities, concentrations of bacteria may decrease.

#### PHYSICAL

Turbid conditions will temporarily occur in the ponds during extraction, however, only low turbidity (<5 NTU) water will be used in the mitigation system.

#### THERMAL

Extractive activities will not decrease the physical separation distance from the existing ponds and Kilbride Creek or Kilbride Tributary. Hydraulic gradients will be maintained similar to existing conditions. Therefore, groundwater flow rates and heat transport will remain as presently exists.

## 1.4 Environmental & Water Supply Objectives

The former gravel pit was carefully evaluated by GWS Ecological and Forestry Services (GWS), Gray Owl Environmental Inc. (Gray Owl) and Harden Environmental Services Ltd. (Harden) and existing conditions recorded in documents presented in support of the ARA license application.

The Environmental objectives have been developed based on this in-depth understanding of the site and are meant to protect all sensitive environmental features and functions and maintain the quality and quantity of the water supply.

### 1.4.1 Environmental Objectives

The five high-level objectives to maintain or enhance the site conditions are described herein.

#### AMPHIBIAN PONDS

The lifecycle of amphibians was used as the most sensitive hydroperiod dependant factor when establishing the high-level objectives for this site. GWS and Gray Owl concluded that the amphibian lifecycle would not be interrupted provided that the following objectives are met.

| | |
|---|---|
| ***Environmental Objective 1*** | *Ensure that the amphibian pond levels have recovered completely by late winter (~March 1-15)* |
| ***Environmental Objective 2*** | *Maintaining 10% wetted area in identified amphibian ponds until July 31st of each year* |

From a hydrogeological perspective, the surface water/groundwater levels and precipitation influence the hydroperiod of the wetlands. The hydroperiod of the wetlands in turn determines the suitability of the wetland for the lifecycle of flora and fauna. Therefore, maintaining surface water levels in the wetlands during critical periods of the lifecycle of the amphibians became an environmental objective at the site. Breeding blue-spotted salamanders were selected as the most sensitive amphibian species within the study area. These generally require ponds to be full of water in early spring during snowmelt conditions and to maintain some water until about the end of July. The salamanders breed as soon as the ice melts around the perimeter of the ponds and it takes until about the end of July for the eggs to hatch and the salamander larvae to metamorphose into juveniles. The juveniles leave the ponds as soon as they transform. Ponds that are ephemeral (drying up later in the year) are optimum for salamanders because this prevents the establishment of predatory fish populations. Some amphibians, such as the green frog and bullfrog, require permanent water bodies because it takes more than one year for the tadpoles to transform into juveniles. These species were considered less sensitive within the study area because they are associated with either ponds that were created as a result of the previous extraction activities (P1, P2, P3, P6, and P11), ponds whose hydroperiod was extended as a result of previous extraction (P7A and P7B), or permanent ponds that were present prior to the previous extraction (P12 and P13).

In order to predict the hydroperiod of the amphibian ponds under varying conditions, detailed field topographic surveys, water level monitoring and integrated surface water/groundwater model

simulations were undertaken. The model was calibrated to observed water levels in the wetlands and surface water features as well as in groundwater monitors. Output from the model over a 25-year historical period shows how frequently the amphibian ponds held surface water in at least 10% of their wetted area until July 31st under existing and proposed conditions. This analysis indicated that under a wide range of precipitation conditions, some ponds may hold sufficient surface water to facilitate successful amphibian breeding every year (e.g., P5, P7A and P10) while other ponds provide somewhat less reliable habitat (e.g., P7B and P8) and the remaining ponds rarely provide suitable breeding conditions (e.g., P9 and P14). Under post development simulated conditions the hydroperiods of these ponds remained essentially the same so there will be no significant change in amphibian utilization of them for breeding purposes.

The objective of having 10% of a pond's area inundated to a depth of 10cm was selected because the on-site ponds are very large and 10% of their area represents a sufficient area to ensure that salamander larvae have the opportunity to transform into juveniles. The water levels in these ponds fluctuate each year and the objective is designed to mimic the natural fluctuation and seasonal drying that naturally occurs and is necessary for their ecological function.

When 10% of the ponds are flooded, the area that remains flooded by July 31st will range from a low of 157 $m^2$ in Pond 8 to 2,700 $m^2$ in Pond 5. Because 10% of the ponds will be flooded to a depth of 10 cm, the area that has some water in it will be greater than this (i.e., areas with 1 to 10 cm of water). These areas are large as compared to typical vernal pools that support amphibian breeding (Note: amphibian breeding ponds at the proposed Reid Road Reservoir Quarry are not vernal pools, but rather wetlands supporting marsh or swamp vegetation. Vernal pools tend to be un-vegetated and rather small, with pools 200 $m^2$ being considered large).

There are both semi-permanent and permanent ponds at the Reid Road Reservoir site. The target of maintaining water levels until July 31st pertains only to the semi-permanent ponds that currently dry up later in the year. Breeding blue-spotted salamanders were selected as the most sensitive species within the semi-permanent ponds. These generally require ponds to be full of water in early spring during snowmelt conditions and to maintain some water until about the end of July. The salamanders breed as soon as the ice melts around the perimeter of the ponds and it takes until about the end of July for the eggs to hatch and the salamander larvae to metamorphose into juveniles. The juveniles leave the ponds as soon as they transform.

The target date of July 31 also allows sufficient time for other early spring-breeding amphibians to develop into juveniles. These include the American toad, spring peeper, wood frog, and northern leopard frog.

Ponds that are ephemeral (drying up later in the year) are optimum for salamanders and other amphibian species because this prevents the establishment of fish populations. Desiccation of shorelines and the pond substrate is also important in allowing the germination of aquatic emergent plant species. Most of them require a dry or damp substrate as a growing medium and are incapable of germinating in water. The two ponds that contain the most emergent vegetation (Ponds 8 and 9) are also the ones that dry out completely in a high proportion of years. Although breeding salamanders often avoid areas of dense emergent vegetation, especially cattails, this vegetation is important to other spring-breeding amphibians. If the semi-permanent ponds were permanently flooded, most would lose their emergent vegetation and would become less attractive to breeding frog species; they may also end up supporting fish.

The permanent ponds are quite different in character and provide different functions than the semi-permanent ponds. Because they are not drawn down later in the season, they tend to support few emergent aquatic plants but may have communities of aquatic submergent plants. They do not support salamander populations as they tend to avoid permanent water bodies. They do support amphibian species such as the bullfrog and green frog whose tadpoles take a year or more to develop into juveniles. They also support the later breeding gray treefrog, although a high proportion of the population of this species transforms before the end of July and it may also do well in semi-permanent ponds.

The objective for the permanent ponds is to ensure that they continue to always contain water. The permanent ponds include those constructed as part of the previous extraction activities (Ponds 1 [the West Pond], 2, 3, 6 [the Central Pond], and 11 [the East Pond]), and Ponds 7, 12, and 13. The ponds created by previous extraction will be maintained, Pond 7 will continue to contain a permanent water body as a result of management of Buffer Pond 1, and Ponds 12 and 13, which are part of the tributary near the entrance to the site, will be unaffected by extraction activities.

### Westward Groundwater Flow to Kilbride Creek

***Environmental Objective 3*** *Maintain seeps and springs west of the West Pond*

Groundwater seepage occurs west of the West Pond in the riparian wetland of Kilbride Creek. The high-level environmental objective is to maintain groundwater flow from the West Pond to Kilbride Creek. This will be done through the use of Buffer Pond 2 (BP2).

The model simulated the pumping of water into BP2 and results show that an appropriate hydraulic gradient can be maintained. No pumping is required at site closure.

### Kilbride Creek Tributary

***Environmental Objective 4*** *Maintain spring and associated on-site tributary to Kilbride Creek*

Groundwater seepage occurs in the wetland south of the West Pond and west of the Central Pond. This results in surface water flow in a small tributary of Kilbride Creek. The high-level environmental objective is to maintain flow and temperature range in the tributary. This will be done during operations through the use of Dispersion Trench 2 (DT2). The model simulated pumping water into DT2 and the results show that flow conditions in the tributary will be maintained. No pumping is required upon site closure.

### Eastern Wetland Complex

***Environmental Objective 5*** *Strive for a maximum temporary drawdown during extraction period in the Eastern Wetland Complex of 0.30 metres*

It is recognized that the Eastern Wetland Complex has been bisected by the access road originating at Twiss Road. Twiss Road is also constructed across the wetland complex with only a small culvert to facilitate west to east drainage. Surface water mapping available from Provincial Databases suggest that historically, a tributary of Kilbride Creek (Bronte Creek Watershed) originated north of Hwy 401 and flowed south westward through the Eastern Wetland Complex, beneath the Guelph Junction rail line and discharged into Kilbride Creek south of the CPR rail line. The construction of the access road across this drainage pathway resulted in increased water levels in the wetland north and east of the access road.

From a biological perspective, the area north and east of the access road is showing evidence of water level rise and water retention. This area was undoubtedly similar in character to the wetland south and west of the access road, which is a high-quality white cedar-mixed conifer forest with some boreal affinities. There is notable die off of tree species north and east of the road as a result of higher water levels. Portions of the swamp have been converted to marsh and there are pockets of marsh habitat within the remaining swamp where water levels are excessively high. The more boreal species that are associated with the swamp south and west of the access road (three-leaved false solomon's-seal, Labrador tea, leatherleaf, and black spruce) have been extirpated north and east of the road. The unnaturally high-water table has also resulted in the non-native invasive common reed becoming established along the northern edge of the road and it is quickly spreading into the swamp and marsh communities north and east of the access road.

A 0.3 m drawdown in the overburden groundwater regime as predicted by the integrated groundwater/surface water model will mean greater potential for the onset of drier conditions earlier in the year than presently occurs. Runoff and precipitation inputs to support hydrogeology will not change meaning that spring conditions will be similar to present day conditions. The organic soils have high water retention and will continue to be poorly drained as they are presently. Any temporary drier conditions during the extraction period will be beneficial, allowing for control of common reed and hopefully providing a drier medium that promotes the regeneration of conifers in areas where they have been killed due to excessive water levels.

The wetland area north of the haul road has been subjected to abnormally high groundwater levels for several decades due to the damming effect of haul road construction in the 1980's. The entire wetland complex was similarly impacted prior to this date by construction of the railway so water movement through this wetland has been impeded for over 100 years. In any event, the presence of year-round high-water levels in the cedar swamp north of the haul road is indicated by the abundance of dead and dying trees found in this area. Although it is anticipated that the groundwater level in this swamp will be temporarily lowered by about 0.3m in the more central portion of this area with progressively less effect as one moves further southward, it is expected that this will simply return the area to more natural pre-development conditions. Lowering the water table during the operational period of site development will only improve tree health and growth, as well as habitat conditions for ground flora that are typically found in this community. The wetland will continue to remain wet to moist due to spring snowmelt and rainfall. Growing conditions for wetland vegetation should therefore improve during aggregate extraction in the

East Pond and also when water is pumped from the East Pond during other phases and should continue to more closely approximate natural conditions in the future due to the re-installment of a new box culvert at the location of the existing western culvert on the haul road.

### 1.4.2 Environmental Water Quality Objectives

In addition to Environmental Objectives, which have been identified in order to protect sensitive ecological features and functions, Water Quality Objectives have also been identified in order to protect surface and groundwater resources.

| | |
|---|---|
| ***Environmental Water Quality Objective 1*** | *Temperature of groundwater discharge to Kilbride Creek and Kilbride Tributary will remain within existing range* |

Groundwater is flowing from the site and discharging to the Kilbride Tributary and Kilbride Creek. Relatively cool groundwater discharge in the summer and relatively warm groundwater discharge in the winter is conducive to a healthy aquatic habitat. Groundwater will follow the same pathway between the West Pond and Kilbride Creek and the Kilbride Tributary before, during and after extractive operations. The source water temperature and the rate of groundwater flow will be the same as pre-development therefore no change in groundwater discharge temperature will occur. The rate of groundwater flow to Kilbride Creek from Phase 1 will increase slightly, however, the distance between the Phase 1 pond and Kilbride Creek is sufficient to attenuate any temperature change.

| | |
|---|---|
| ***Environmental Water Quality Objective 2*** | *Turbidity of water within wetlands, Kilbride Creek and Kilbride Tributary will remain within existing range.* |

There is presently no direct surface water connection between Kilbride Creek or the Kilbride Creek tributary and the areas of extractive operations. No direct surface water connections will be created, therefore turbid surface water will not flow into these water bodies. Groundwater flow occurs between the extractive areas (including mitigation features) and Kilbride Creek and the Kilbride Tributary via unconsolidated sediments and no transport of turbid water will occur.

### 1.4.3 Water Supply Objectives

A lower water level in the main ponds may result in the lowering of water levels off-site. Also, the physical disturbance of the water in the existing ponds and proposed Phase 1 pond has the potential to create turbid water within the ponds. Observations at the Guelph Quarry have indicated that turbidity created by blasting activities and mining is short lived. Generally, the measured turbidity in quarry ponds (1-2 NTU) is less that that found in natural watercourses. With this in mind, the following two objectives have been developed in regard to local groundwater supply;

| | |
|---|---|
| ***Water Supply Objective 1*** | *Maintain existing water supply in private wells* |

Water level changes on-site are minimized by not dewatering the extractive area. Also, during extraction, mitigation measures are in place to minimize water level changes in the on-site wetlands. These measures will also minimize water level changes off-site. Through these efforts, there will be no change in the yield in nearby private wells.

***Water Supply Objective 2*** *Maintain existing water quality down gradient of site*

Aggregate extractive operations are non-polluting. Spills contingency plans are in place to address the unlikely event of a contaminant spill from vehicles and stored fuel. Turbid water in the extraction areas will not flow out of the extraction ponds. Section 3.3 lists water quality mitigation measures and, as outlined in Section 5.1, a water well survey will occur prior to extraction in order to get a baseline condition on nearby wells as well as water quality testing at various on-site monitoring locations. Through these efforts, there will be no change in water quality in private wells downgradient of the site.

### 1.4.4 Post Extraction Objectives

Depending on the time of year, the final cessation of extractive activities may have to be followed by a period of pumping into the buffer ponds and dispersion trenches. This will occur until water levels have stabilized and begin to follow natural seasonal trends. It is anticipated that this will occur within 12 months of cessation of extractive operations. The environmental objectives developed for the operational period will remain until water levels have stabilized. No significant long-term post extractive changes in water levels are anticipated; therefore, no post-extrication objectives are needed. As discussed elsewhere, post extractive monitoring will occur for a period of two years.

# 2 Identification of Hydrological Sensitive Receptors

## 2.1 Wetlands

There are two general types of wetlands within the study area: ponds, which include marshes and some swamps, and swamps without standing water. **Table 1** provides an overview of the differences between permanent and semi-permanent ponds and the functions that they provide.

**Table 1: Pond Descriptions**

| Pond No. | Description | Key Features and Functions |
|---|---|---|
| 1 | • permanent pond (also known as the West Pond)<br>• constructed as part of previous aggregate operation<br>• not connected to any other water bodies or fish habitat<br>• substrate predominantly bedrock and gravel | • supports a stocked population of warmwater fish<br>• essentially no usage by breeding amphibians<br>• used by small numbers of Midland painted turtles, with a maximum of 1 recorded at any given time and always in the same location |

| Pond No. | Description | Key Features and Functions |
|---|---|---|
| | • open-water pond with almost no aquatic vegetation<br>• small amount of submergent aquatic vegetation near the outlet of P5, predominantly curly-leaved and sago pondweed | |
| 2 | • permanent pond<br>• constructed as part of previous aggregate operation<br>• not connected to any other water bodies or fish habitat<br>• substrate fine mineral material<br>• mostly an open-water pond but with some cattails at its western end<br>• dominated by a submergent plant community, mostly Eurasian water-milfoil | • supports a stocked population of warmwater fish<br>• relatively low usage by breeding frogs due to the fish population<br>• supports a small population of bullfrogs (maximum call count of 2)<br>• the berm between it and P1 provides nesting habitat for the snapping turtle, although most nests are depredated each year<br>• supports a small population of Midland painted turtles, with a maximum of 11 recorded at any given time |
| 3 | • permanent pond<br>• constructed as part of previous aggregate operation<br>• connected to Kilbride Creek by a dug channel that allows overflow from the pond during high water levels to flow to the creek<br>• also within the floodplain of Kilbride Creek and may be inundated by creek flood waters<br>• substrate fine mineral material<br>• mostly an open-water pond with a dense stand of common reed at its south end and rushes around the perimeter<br>• dominated by a submergent plant community, mostly great bladderwort | • supports a warmwater fish population that may be a combination of stocked species and those that have emigrated from Kilbride Creek<br>• relatively low usage by breeding frogs due to the fish population<br>• supports a small population of bullfrogs (maximum call count of 1)<br>• supports a small population of Midland painted turtles, with a maximum of 2 recorded at any given time<br>• a single snapping turtle was observed on one occasion |
| 4 | • semi permanent pond<br>• constructed as part of previous aggregate operation<br>• not connected to any other water body or fish habitat<br>• sandy substrate | • does not support any fish<br>• very small numbers of blue-spotted salamanders may breed in exceptionally wet years<br>• supports low numbers of breeding amphibians |

| Pond No. | Description | Key Features and Functions |
|---|---|---|
| | • mixed vegetation within the pond: mostly willow shrubs in the south, common reed near its north shore, and scattered cattails throughout<br>• vehicle tracks run through the northern portion of the pond and these are unvegetated | • no turtles present due to the ephemeral nature of the pond<br>• will probably be mapped as regulated habitat for the Jefferson salamander |
| 5 | • semi permanent pond<br>• natural pond/wetland<br>• typically not connected to any other water body or fish habitat but water may overflow from it into P1 during spring freshet through a human-made outlet.<br>• substrate fine mineral material with pockets of organic matter<br>• the dominant vegetation is silver maple which forms a closed canopy over much of the swamp<br>• openings in the canopy occur in the central portion of the west basin and the northeast corner of the east basin and these areas are dominated by cattails | • does not support any fish<br>• used regularly for breeding by the blue-spotted salamander,<br>• the best salamander breeding pond in the study area, but still apparently supports a small population (10 individuals caught in minnow traps, maximum egg-mass count of 25)<br>• regularly supports full choruses of amphibians and is considered significant wildlife habitat for breeding amphibians<br>• no turtles present due to the ephemeral nature of the pond<br>• supports the eastern ribbonsnake, a species of concern, and is considered significant wildlife habitat. |
| 6 | • permanent pond (also known as the Central Pond)<br>• constructed as part of previous aggregate operation<br>• artificially connected to P7A and P7B and may receive overflow from P5 during spring freshet<br>• not connected to any fish habitat<br>• substrate predominantly bedrock or gravel<br>• essentially an open pond with very little aquatic plant growth | • supports a stocked population of warmwater fish<br>• no apparent amphibian breeding<br>• Midland painted turtle is rare with a single observation of 5 individuals |
| 7A | • permanent pond but presumed to be a semi permanent pond prior to construction of P6<br>• natural pond/wetland<br>• artificially connected with P6<br>• in extremely high water conditions, overflows into a small wetland west | • contains a warmwater fish community as a result of the connection with P6<br>• supports full choruses of some frog species including those that require longer hydroperiods or permanent water such as gray treefrog and green frog; considered significant wildlife habitat for breeding amphibians |

| Pond No. | Description | Key Features and Functions |
|---|---|---|
| | of P9 but there is no flow out of this wetland<br>• not connected to any fish habitat<br>• substrate predominantly organic<br>• vegetated with a monotypic cattail stand with few openings<br>• sparse overstorey of silver maple | • appears to support a large population of snapping turtles and is considered significant wildlife habitat for this function |
| 7B | • permanent pond in most years but occasionally dries up<br>• natural pond/wetland<br>• artificially connected with P6<br>• not connected to any fish habitat<br>• substrate predominantly organic<br>• vegetated with relatively mature silver maple | • contains a warmwater fish community as a result of the connection with P6<br>• fewer amphibians breeding than in P7A due to the lack of emergent vegetation that functions to protect amphibians from predatory fish; considered significant wildlife habitat for breeding amphibians nonetheless<br>• appears to support a large population of snapping turtles and is considered significant wildlife habitat for this function |
| 8 | • semi permanent pond<br>• uncertain if it is natural or artificial but most likely created by railway construction which blocked flows<br>• not connected to any water bodies or fish habitat but receives overland flow from adjacent habitat<br>• substrate a mix of fine mineral material and organic matter<br>• completely vegetated with emergent aquatic vegetation, mostly grasses and weak-stemmed forbs and cattails | • no fish present<br>• limited breeding activity by frogs<br>• no turtles present due to the ephemeral nature of the pond<br>• will be regulated as Jefferson salamander habitat |
| 9 | • semi permanent pond<br>• natural pond/wetland<br>• not connected to any water bodies or fish habitat<br>• substrate predominantly mineral with some organic pockets centrally<br>• completely vegetated with emergent aquatic vegetation, predominantly broad-leaved cattail<br>• some shrub and sapling coverage on mounds within the pond and along the margins | • no fish present<br>• very small numbers of blue-spotted salamanders breed infrequently during exceptionally wet years<br>• full chorus of a limited number of frog species; considered significant wildlife habitat for amphibian breeding<br>• no evidence that turtles use the pond, probably due to its ephemeral nature<br>• will be regulated as Jefferson salamander habitat |

| Pond No. | Description | Key Features and Functions |
|---|---|---|
| 10 | • semi permanent pond, but maintains a little water most of the year<br>• natural pond/wetland<br>• not connected to any water bodies or fish habitat<br>• substrate predominantly mineral with pockets of organics in the south<br>• northern portion of the pond is a silver maple swamp with a fairly closed canopy<br>• the southern portion of the pond has an open canopy and is dominated by broad-leaved cattail | • no fish present<br>• used regularly for breeding by the blue-spotted salamander, although in very low numbers which is probably due to the nature of the surrounding upland habitat<br>• full choruses of amphibian species documented, including some that require longer hydroperiods or permanent water such as grey treefrog and green frog; considered significant wildlife habitat for amphibian breeding<br>• no evidence that it is used by turtles, possibly because of the shaded nature of the pond<br>• will be regulated as Jefferson salamander habitat |
| 11 | • permanent pond (also known as the East Pond)<br>• constructed as part of the previous aggregate operation<br>• not connected to any water bodies or fish habitat<br>• substrate predominantly bedrock or gravel<br>• mostly an open pond with very little aquatic vegetation<br>• the exception is a small bay west of the peninsula that extends out from the north shore of the pond; it is vegetated with a mix of common reed and broad-leaved cattail | • supports a stocked warmwater fish community<br>• breeding amphibians are rare due to the lack of vegetation but supports very low numbers of bullfrogs (maximum call count of 1)<br>• supports small numbers of Midland painted turtles, with a maximum count of 10 |
| 12 | • permanent pond<br>• probably a natural pond but much disturbed<br>• P12 and P13 were undoubtedly a single pond but were separated by the haul road constructed as part of the previous aggregate operation<br>• connected to P13 by a culvert and to downstream warmwater fisheries<br>• substrate organic | • supports a natural warmwater fish community<br>• supports breeding frog populations but in relatively low numbers, probably due to the small size of the water body within the dense cattails<br>• supports moderate numbers of the Midland painted turtle (maximum count 8) plus the snapping turtle<br>• appears to be a wintering area for turtles along with P13; no other ponds appeared to support turtles early in the spring and they all probably originated from these |

| Pond No. | Description | Key Features and Functions |
|---|---|---|
| | • the pond itself is open water with several logs in it, and it is surrounded by dense cattail marsh | two ponds after winter; considered to be a significant winter hibernaculum for turtles<br>• the only area in the study area that supported key marsh-breeding birds, the Virginia Rail |
| 13 | • permanent pond<br>• probably a natural pond but much disturbed<br>• has been filled to the property line of the adjacent industrial lands<br>• P12 and P13 were undoubtedly a single pond but they were separated by the haul road constructed as part of the previous aggregate operation<br>• connected to P12 by a culvert and to downstream warmwater fisheries<br>• substrate predominantly organic<br>• mostly an open-water body but supports considerable submergent vegetation<br>• formerly a treed area as there is much downed timber and floating logs in it | • supports a natural warmwater fish community<br>• some frogs breed in this pond, but relatively few due to the general lack of vegetation<br>• supported the largest population of Midland painted turtles in the study area, with a maximum of 22 seen at once<br>• appears to be a wintering area for turtles along with P12; no other ponds appeared to support turtles early in the spring and they probably all originated from these two ponds after winter; considered to be a significant winter hibernaculum for turtles |
| 14 | • semi permanent pond/wetland, drying out fairly early in each year<br>• uncertain if it is natural or created; construction of the railway may have blocked drainage from this area and created the wetland, and a large trench has been dug through the centre of it<br>• substrate mineral<br>• treed with green ash, with a mostly closed canopy and regeneration still occurring indicating that it dries up early in most years<br>• the few openings in the canopy are vegetated mostly with aquatic grasses | • no evidence of salamander breeding and the hydroperiod is usually far too short to support this function<br>• supports very low numbers of other breeding amphibians (an egg-mass survey found no egg masses of any species)<br>• not used by turtles due to the very ephemeral nature of the water within the wetland and the heavy shading<br>• will be regulated as Jefferson salamander habitat |

There are two wetland complexes that have the potential to be affected by aggregate extraction: the Kilbride Tributary Wetland and the Eastern Wetland Complex. A description of these wetlands and their features and functions is provided in Table 2.

**Table 2: Wetland Descriptions**

| Wetland | Description | Key Features and Functions |
|---|---|---|
| Kilbride Tributary Wetland | • this is a fairly open swamp of white birch and poplar<br>• the soils are organic<br>• open areas are dominated by emergent aquatic vegetation, especially tussock sedge at its eastern end and cattails centrally<br>• the central portion of the swamp supports open water and there is water at or very near the surface throughout the wetland | • numerous seeps occur throughout the swamp<br>• a spring gives rise to the Kilbride Tributary which empties into Kilbride Creek<br>• the Kilbride Tributary is a coldwater stream that probably supports Brook Trout<br>• the seeps and springs within the wetland provide baseflow to Kilbride Creek which supports both coldwater and warmwater fish species<br>• the centrally located pool of open water provides breeding habitat for amphibians |
| Eastern Wetland Complex | • this is a large wetland complex that is comprised of several vegetation communities<br>• almost the entire wetland complex is situated on organic soils<br>• the wetland is bisected by the haul road that was constructed as part of the former aggregate operation<br>• there are four wetland community types north of the haul road: white cedar–hardwood mixed swamp, white cedar–conifer coniferous swamp, cattail marsh, and green ash swamp (the only community within the complex that is on mineral soils)<br>• the area between the haul road and the Guelph Junction Railway is a large contiguous white cedar–conifer organic swamp<br>• the wetland north of the road exhibits stress due to | • the wetland north of the haul road supports several significant species. These include the provincially significant eastern ribbon snake (presumably), and the locally significant whorled loosestrife, swamp black currant, and snowshoe hare; the wetland is considered significant wildlife habitat for these functions<br>• the cattail marsh is the only location in the study area that supports the obligate marsh-nesting Virginia Rail<br>• the wetlands north and south of the road support an assemblage of area-sensitive breeding birds and is considered significant wildlife habitat for this function<br>• the swamp south of the road supports several locally significant species (Labrador tea, leatherleaf, black spruce, swamp dock, Nashville Warbler, and snowshoe hare) and is considered significant wildlife habitat for these functions |

| Wetland | Description | Key Features and Functions |
|---|---|---|
| | unnaturally high water levels that have resulted in extensive tree mortality<br>• this has resulted in openings in the white cedar–hardwood community that has promoted the growth of aquatic emergent plants such as broad-leaved cattail and *Scirpus pendulus*<br>• tree mortality is more extensive in the white cedar–coniferous swamp, allowing spread of the invasive common reed<br>• the cattail marsh was formerly a coniferous swamp as evidenced by old aerial photographs and the remaining dead trees<br>• the wetland south of the road is of high quality | • the swamp south of the road supports some plant species with a very high Coefficient of Conservatism score (9 or 10 on a scale of 10). These include Labrador tea, leatherleaf, three-leaved false solomon's seal, and bog sedge<br>• there are numerous seepage areas within the swamp south of the haul road and these give rise to a small tributary that flows into Kilbride Creek south of the railway tracks |

## 2.2 Streams

There are four streams within the study area. These include Kilbride Creek, the tributary to it that arises in the Kilbride Tributary Wetland, the tributary that arises in the portion of the Eastern Wetland Complex that is south of the haul road, and the tributary that arises in Pond 13. Table 3 describes these tributaries and their key features and functions.

**Table 3: Tributary Description**

| Stream | Description | Key Features and Functions |
|---|---|---|
| Kilbride Creek | • at the northern extent of the property, the creek is impounded by a beaver dam<br>• downstream of the beaver dam, it consists of a series of riffles and pools over a stony substrate<br>• in this reach, the stream is often braided and has numerous fallen logs in and across the creek<br>• it flows through a white cedar–hardwood swamp through this reach and receives groundwater from several seepage areas<br>• shortly downstream of its confluence with the Kilbride Tributary, the gradient of the stream is lower and the substrate is predominantly organic | • Kilbride Creek provides fish habitat for both coldwater and warmwater fish species<br>• Brook Trout are present within the creek and the creek has been identified as significant wildlife habitat for this function because this is a locally significant species<br>• spawning by Brook Trout has not been confirmed in this reach, but cannot be ruled out |

| Stream | Description | Key Features and Functions |
|---|---|---|
| | • adjacent vegetation in this reach consists of willow and alder thicket swamp where it continues to receive baseflows from seeps and springs<br>• the creek is a coldwater/coolwater system<br>• a large tributary flows into the main Kilbride Creek from the west just north of the railway tracks. This adds substantially to the baseflow of the creek | • certain of the other fish species that are present undoubtedly spawn in it<br>• the reach of the creek within the study area not only supports fish habitat but is critical to maintaining high quality fish habitat downstream |
| Kilbride Creek Tributary | • the tributary arises in the swamp about 125 m east of the main stream<br>• it arises from a spring and receives additional baseflow through seepage along most of its length<br>• the substrate along most of the creek is organic, but consists of gravel and cobblestones near its confluence with the main stream<br>• the gradient through the organic soils is very low and the channel is small, in the order of 30 cm in width<br>• the gradient near the mouth is higher, resulting in the coarser substrate but the channel size is not much larger<br>• the tributary is a coldwater stream | • the tributary is important in providing coldwater baseflow to Kilbride Creek<br>• no fisheries work has been undertaken in the tributary but there is a high probability that it functions as nursery habitat for Brook Trout<br>• the lower reach of the tributary has the potential to provide Brook Trout spawning habitat<br>• the tributary has been identified as significant wildlife habitat for Brook Trout |
| Tributary Arising in the Eastern Wetland Complex south of the road | • within the swamp, this tributary does not have a well-defined channel. The swamp is generally inundated and slow flow can be observed in locations. The stream disappears underground and reappears throughout the swamp<br>• at the railway track, the tributary is channelized along the western side of the tracks where it is essentially a ditch, crossing under the tracks through a culvert where it exits the swamp<br>• the stream continues as a ditch along the junction of the two railway lines and passes through a culvert under the main line just west of the junction<br>• it continues south of the tracks through a mixed swamp and eventually discharges into Kilbride Creek | • within the swamp, the tributary is most likely a coldwater stream because it is fed by seepage<br>• its temperature regime along the railway is uncertain, but there is a high probability that it is warmwater in this location due to its low flow and full exposure to sunlight<br>• it is probable that it reverts to a coldwater stream south of the railway tracks<br>• this tributary probably supports a variety of cold- and warmwater fish species |

| Stream | Description | Key Features and Functions |
|---|---|---|
| | • the stream substrate is organic material in the swamps upstream and downstream of the railway and mineral along the tracks | • it is important because it contributes baseflow to Kilbride Creek and contributes to downstream fisheries |
| Tributary arising in P13 | • the tributary's headwater consists of P13, which is fed predominantly by stormwater from the adjacent industrial park<br>• it is connected directly to P12 via a culvert under the haul road<br>• the tributary flows toward Twiss Road through the cattail marsh and white cedar–conifer swamp<br>• the stream substrate is organic material<br>• the culvert at Twiss Road is currently in poor condition and is backing up water flow | • the ponds and stream support a warmwater fish community<br>• the stream contributes baseflow to downstream fish habitat in the KOA tributary of Sixteen Mile Creek watershed. |

In addition to ponds, wetlands, and tributaries, seeps and springs are important aquatic features within the study area. The main springs are between P1 (the West Pond) and Kilbride Creek, at Kilbride Creek just upstream of the railway tracks, and at the origin of the Kilbride Creek tributary. There may be other springs along Kilbride Creek in the reach through the organic soils downstream of the confluence with the Kilbride Tributary.

Seeps occur in the study area along Kilbride Creek, along the Kilbride Tributary and in the portion of the Eastern Wetland Complex that is south of the haul road.

## 2.3 Terrestrial

Some terrestrial features are important to maintain or protect significant terrestrial or aquatic features such as woodlands and wetlands and their functions. These include buffers to ponds, woodlands, and wetlands and barrier fencing to protect reptiles.

## 2.4 Water Supply

### 2.4.1 Water Quantity

Off-site groundwater level changes at the nearest private well are expected to be less than 0.3 metres. The nearest wells to the extraction area are located at 9256 and 9261 Twiss Road, identified on **Figure 5**. All other private wells around the site will experience minimal drawdown, if any, as a result of mitigating water level change in the wetlands and maintaining groundwater flow to Kilbride Creek.

### 2.4.2 Water Quality

The only private properties located downgradient of the site are located on Guelph Junction Road, Twiss Road and Campbellville Road as shown on **Figure 5**. It is unlikely that any water quality impacts will occur

to the groundwater system, however, as a precautionary measure, the downgradient properties are identified on Table 4:

**Table 4 Private Wells Downgradient of the Site**

| Guelph Junction Road | Campbellville Road | Twiss Road |
|---|---|---|
| 9024, 9034, 9039, 9072, 9029, 9084<br>9090 | 2225, 2110, 2167 | 9045,9037,9110,9200,9116,<br>9124,9144,9150,9160,9180,<br>9184,9188,9190,9148,9120,<br>9063 |

## 2.5 Flood and Erosion Issues

This quarry will be operated without dewatering. The only pumping that will be conducted will occur under controlled conditions to on-site mitigation features. A minimum amount of water transfer to maintain the ecological integrity of on-site natural features will occur. There will be no offsite discharge of water.

Erosion control measures will be used at each on-site discharge location.

Phase 1 of the site is found within the flood line of Kilbride Creek. Noise berms have been modified to allow for the passage of water from Kilbride Creek into Phase 1 thereby maintaining the volume of on-site flood storage in Kilbride Creek.

# 3 Water Management and Ecological Mitigation/Contingency Measures

Controlling the rate at which aggregate is removed from below-the-water table is one of the mitigation methods that will be applied in order to manage the water levels in and around the site and minimize impacts. The rate of below water extraction is controllable, and can be reduced as necessary to ensure the water levels are maintained at the appropriate levels as set out on the Site Plan and described in Section 6. When conditions permit (e.g. a wetter year or season), extraction rates can be increased without affecting the minimum water levels required for maintenance of ecological function. The rate of extraction will ultimately depend on observed water level conditions in the ponds and in the adjacent wetlands.

The primary mitigation methods for the proposed operation involve the maintenance of water levels by water level control mechanisms, including the construction of separated ponds (buffer ponds) and water dispersion trenches (see Section 3.1). The buffer ponds are artificial water bodies situated between sensitive features and the active extraction area. The purpose of the buffer ponds is to temporarily maintain (only needed during active extraction) the existing surface water levels through the use of mechanical pumping. The purpose of the dispersion trenches and apparatus is to disperse pumped water along a broad area beside a sensitive feature, thereby mitigating the effect of low groundwater levels

caused by the aggregate extraction. The Dispersion Trenches are linear trenches, less than two metres wide and filled with permeable washed product such as pea gravel.

These mitigation measures are only required while aggregate is being removed from below the water table. Post extraction, no mitigation is necessary and during periods of low aggregate production mitigation may also not be necessary.

## 3.1 Water Management Components

There are three main components of the Water Management System. These are water transfer pumps, buffer ponds and infiltration/dispersion trenches. These components are described in Table 5 and identified on **Figure 6**.

**Table 5: Water Management System Components**

| Component | Location | Function |
|---|---|---|
| Transfer Pump 1 | East Pond | Transfers water from East Pond to Central Pond and Buffer Pond 1 |
| Transfer Pump 2 | Central Pond | Transfers Water from Central Pond to East Pond and Buffer Pond 1 |
| Transfer Pump 3 | Central Pond | Transfers water from Central Pond to Dispersion Trench 1 |
| Transfer Pump 4 | Central Pond | Transfers Water from Central Pond to Infiltration Trench 2 |
| Transfer pump 5 | West Pond | Transfers Water from the West Pond to Buffer Pond 2 and Central Pond |
| Transfer Pump 6 | East Pond | Transfers water to Eastern Wetland Complex if necessary. |
| Buffer Pond 1 | Central Pond | Maintains water levels in P7A and P7B |
| Buffer Pond 2 | West Pond | Maintains hydraulic gradient between West Pond and Kilbride Creek and Kilbride Tributary |
| Dispersion Trench 1 | Central Pond | Provides surface water to P5. |
| Dispersion Trench 2 | Kilbride Tributary | Maintains hydraulic gradient between Central Pond and Kilbride Tributary. |
| Dispersion Trench 3 | Eastern Wetland Complex | Limits water level drawdown in Eastern Wetland Complex |

### 3.1.1 Water Transfer System

Submersible pumps will be used to transfer water between the main ponds and between the main ponds and mitigation features. The pumps will be isolated from the ponds with either a sand barrier or filter cloth to minimize the transfer of turbidity. Where necessary, water lines will be heat-traced or buried as required for winter operations. The transfer pumps will be operated on a float-system to allow for automatic topping up of ponds as required. The operation of Transfer Pump 3 will occur on an as-needed basis according to water levels obtained from WP8 in order to meet target levels and MWLT's as described in Section 6.

### 3.1.2 Buffer Ponds

The buffer ponds are constructed water bodies situated between sensitive features and the active extraction area and will be located within the West Pond and Central Pond. While the water levels in the active extraction ponds may decline as aggregate is removed, maintaining a higher water level in the buffer pond will maintain the water levels in the adjacent feature. Therefore, the natural pathway for water movement between the buffer pond and the sensitive feature will be maintained. In Buffer Pond 1 ("BP1"), the natural pathway is an existing channel that extends from the Buffer Pond into wetlands P7A and P7B. Pumps will add water to Buffer Pond 1 in order to keep the water level in Buffer Pond 1 within the same seasonal range as it presently occurs in the Central Pond. In Buffer Pond 2 ("BP2"), the natural pathway to the sensitive feature is groundwater migration through the sand and gravel aquifer. Pumps will add water to Buffer Pond 2 to keep the water level within the seasonal range as presently occurs in the West Pond. The present source water in both cases is pond water which is what will be pumped into the Buffer Ponds. The Buffer Ponds will be separated from either the West Pond or Central Pond with a low permeability barrier to limit the volume of water recirculating back to the main ponds. The effectiveness of Buffer Pond 1 will be monitored by cellular-based data loggers located in WP3 and WP6[1]. The effectiveness of Buffer Pond 2 will be monitored by cellular-based data loggers in WP4 and WP7. The water levels in the Buffer Ponds are also monitored in this manner.

### 3.1.3 Dispersion Trenches

The purpose of the dispersion trenches is to disperse pumped water along a broad area beside a sensitive feature thereby mitigating the effect of lower groundwater levels caused by the aggregate extraction. The Dispersion Trenches are linear trenches, less than two metres wide and filled with permeable washed product such as pea gravel. Dispersion Trench 1 ("DT1") is located between the Central Pond and P5. Water will be pumped into Dispersion Trench 1, gravity flow will occur within the trench to a 10 cm diameter solid PVC outlet pipe leading to a 30 m long 10 cm diameter perforated pipe located on the ground surface within P5. The effectiveness of Dispersion Trench 2 will be measured using a cellular-based data logger in WP8. Dispersion Trench 2 ("DT2") will be approximately 30 m long and located between the Central Pond and the Kilbride Tributary. Dispersion Trench 2 will be three metres deep and filled with pea gravel. The water level in Dispersion Trench 2 will be maintained within the natural range of the Central Pond. A cellular-based data logger will be located within Dispersion Trench 2 and the effectiveness of the trench will be verified by cellular-based data logger in WP4.

Dispersion Trench 3 will be designed to add water to the edge of the Eastern Wetland Complex if drawdown beneath the wetland is greater than anticipated and the vegetation is impacted.

[1] WP = "Wetland Piezometer"

## 3.2 Summary of Mitigation within Operational Phases

Table 6 summarizes the mitigation required during each operational phase.

**Table 6: Mitigation Features**

| | Purpose | When Required | Source of Water | Pumping Rate | Monitoring Station | Monitoring Parameters and Frequency |
|---|---|---|---|---|---|---|
| Dispersion Trench 1 | Temporary source of surface water for P5 to protect amphibian lifecycle. | Various Phases when water levels in Central Pond are lowered by extractive activities (pumping or aggregate removal) | Central Pond and East Pond | TBD[2] | WP8 | Water Level , 30 minute interval |
| Dispersion Trench 2 | Temporary source of groundwater in the headwater of the Kilbride Tributary. Maintain water level range in Kilbride Tributary and maintain temperature range in ground water discharging to Kilbride Tributary. | Various Phases when water levels in Central Pond are lowered by extractive activities (pumping or aggregate removal) | Central Pond and East Pond | TBD | DT2 | Water Level , 30 minute interval |
| Dispersion Trench 3 | Contingency measure to add water to the Eastern Wetland Complex | When drawdown occurs beneath the EWC ad there are ecological signs of impairment | West or Central Pond | TBD | WP9 | Water Level , 30 minute interval |
| Buffer Pond 1 | Temporary source of surface water for P7A and P7B. Maintain water levels in WP3 and WP6 within existing range. | Various Phases when water levels in Central Pond are lowered by extractive activities (pumping or aggregate removal) | Central Pond and East Pond | TBD | WP3 and WP6 | Water Level , 30 minute interval |
| Buffer Pond 2 | Temporary source of groundwater in the headwater of the Kilbride Tributary and Kilbride Creek. Maintain water levels and groundwater temperature in groundwater discharge to Kilbride Creek and Kilbride Tributary. | Various Phases when water levels in West Pond are lowered by extractive activities (pumping or aggregate removal) | Central Pond and East Pond | TBD | WP4 and WP7 CB16S/D | Water Level and Temperature, 30 minute interval |

## 3.3 Water Quality Mitigation Strategy

The following efforts will be made to minimize changes to water quality.

1) Eliminate storage of large volumes of on-site fuel by using wheel to wheel refuelling and double walled tanks located on impervious surfaces for small storage tanks.

[2] All "TBD" values identified in Tables will be updated prior to below water table extraction

2) Store asphalt and concrete for recycling a minimum of one meter above high water table on a fine-grained base.
3) Separate water sources for mitigation from areas where turbidity may be generated by mining or blasting activities.
4) Clean up all spills immediately using the Spills Response Protocol.
5) Maintain a Water Well Complaint Protocol (See Section 5.3)
6) Maintain groundwater flow to Kilbride Tributary and Kilbride Creek for temperature control
7) Implement Water Quality Monitoring (see Table 11)

## 3.4 Terrestrial Environment

This section provides more detailed information on how mitigation and enhancement measures will be implemented. Much of the information is already presented on the Site Plans, but additional details are provided for many of the features.

### 3.4.1 Turtle Nesting Habitat

There are two facets to management of turtle nesting habitat: protection and enhancement of existing habitat and creation of new habitat.

The main existing turtle nesting area is along the berm separating P1 and P2. This is used by several snapping turtles for nesting but the berm functions as an ecological trap for the turtles. Although the substrate is ideal nesting habitat, the small area in which the nests are concentrated makes it easy for predators to find them. Consequently, essentially all the nests are depredated and all the turtles that nest here lose their entire reproductive effort for the year. Snapping turtles have high nesting site fidelity, so they are likely to return to nest each year thereby minimizing the likelihood of their producing any offspring.

The berm that is used for nesting will be retained. In an effort to reduce predation rates, the ends of the berm will be planted with a dense cover of Allegheny blackberry, a highly prickly species. Dense stands of this species are difficult and very unpleasant to travel through. It is recommended that a solid wall of approximately 2 m in length be planted at each end of the berm. This will hopefully deter predators while still allowing access to the berm by the aquatic turtles.

The berm that will be built to create BP2 will be covered with a substrate that is suitable for turtle nesting. This will consist of a mix of sand and gravel. Allegheny blackberry will also be planted at both ends of this berm to deter predators.

Two artificial turtle nesting structures will be constructed near Phases 1 and 2. Sand and gravel will be placed over filter cloth to a depth of 1 m; dimensions of these structures will be approximately 8 by 3 m.

### 3.4.2 Buffers

Since aggregate extraction is only proposed in areas that were previously disturbed by mining activities it is not feasible to apply currently accepted setbacks to adjacent natural heritage features in all locations. In the past there was little regard for the protection of wetlands and woodlands and as a result, aggregate extraction operations often occurred immediately adjacent to these features or within 5 to 10m from them. In any event, no intrusions are now proposed in PSWs or significant woodlands and reasonable setbacks will be applied to these natural heritage features wherever practical. Specifically, a 30m buffer

will be established along the northern boundary of SWD7-1 to ensure the protection and maintenance of this wetland and the Kilbride Creek Tributary that originates in this area. A 10m buffer will also be established along the northern edge of Pond 4 (SWT2-2) as this thicket swamp will probably be identified as regulated habitat for the Jefferson Salamander. Elsewhere in Phase 1, a 10m buffer will be applied to the southern edge of woodland communities identified as FOM4-2 and FOM5-2. Additional buffers are not warranted elsewhere on the property because significant natural features are either situated a sufficient distance from proposed extraction operations (e.g., SWD4-3, SWD6-2, FOD5-2) or they occur immediately adjacent to existing ponds (e.g., FOD6-3, FOD3-2, FOD4-2, FOM6-1, CUP3-12).

In terrestrial areas where extraction activities are proposed in close proximity to wetlands or woodlands tree protection fencing will be erected at the limit of all required setbacks where ground elevations are equal to or lower than the elevations in the adjacent extraction area. This fencing is particularly required in Phase 1, the connection between Phase 1 and 2/4 and in the southern part of Phase 5. Standard paige wire farm fence will be installed in the locations identified on the Operations Plan after any required tree clearing and grubbing is completed (e.g., in Phase 1 and CUW1-5) and prior to the initiation of extraction operations. Silt screen must also be attached to the paige wire fence and have its base covered with soil to ensure it can effectively trap sediment.

Tree planting will be carried out in setback areas and in open, previously disturbed areas. Approximately 2.0ha will be reforested with a diverse mixture of deciduous and coniferous trees as described in Section 9.1.2.5 and illustrated on the Rehabilitation Plan. Side slopes and adjacent upland areas with bare ground in Phase 1 and 2 will be also be revegetated with an early succession Wet Meadow Seed Mixture.

### 3.4.3 Invasive Species Control Measures

Several species of highly invasive woody and herbaceous plants occur in most woodlands and wetlands surrounding the existing ponds and along the internal haul road coming off the Reid Sideroad. Species that are particularly problematic in these vegetation communities include common buckthorn, glossy buckthorn, dog-strangling vine, garlic mustard and Phragmites which is also called common reed. These undesirable species compete with existing native tree regeneration, shrubs and groundflora for light, water, nutrients and space. If left untouched they will continue to spread throughout the area and further suppress less competitive native plants. The following mechanical and chemical control methods are recommended to reduce and possibly eradicate populations of these high priority alien species that threaten the ecological integrity of significant natural heritage features.

#### Treatment of Buckthorn in Conifer Plantations

To control competition from common and glossy buckthorn, as well as any occasional tartarian honeysuckle, established in conifer plantations surrounding the pit ponds all invasive shrubs over 1m in height are to be cut with brushsaws and/or chainsaws leaving low stumps (i.e., < 5cm in height above grade). Native trees and shrubs are not to be harmed during invasive species control work. If cutting is carried out during mid-June to late August the stumps should be treated with a systemic, glyphosate-based non-persistent herbicide (i.e. Roundup or equivalent) in order to kill the roots of this undesirable vegetation. At the same time the foliage of small seedlings may be directly sprayed with this contact kill herbicide using a hand held or backpack sprayer. However, any non-target native plans must be shielded from spray drift. If cutting is undertaken during other seasons stumps should not be treated with a systemic herbicide because the chemical will be ineffective. In this case, the deciduous sprouts that

develop from the cut stumps should be sprayed during the subsequent growing season. To effectively control these aggressive non-native species, it is anticipated that herbicide applications will be required for several years after the initial treatment, as determined by the consulting ecologist.

Some control work may also be required in the natural woodlands surrounding ponds 1, 5 and 11 depending upon species expansion in these areas and the success of control measures implemented elsewhere. Conservation Halton is encouraged to perform similar control work on their lands which lie immediately north of the East Pond so that the work on JDCL lands is not compromised by invasive seed sources now found on Conservation Halton lands.

### Treatment of Dog-Strangling Vine

The foliage of young plants less than 1m in height may be directly sprayed with a systemic, contact kill herbicide (e.g. active ingredient of glyphosate or imazapyr) using a hand held or backpack sprayer. With this kind of equipment, the herbicide can be safely and directly sprayed on the targeted growth. Spraying should be done during the growing season at the onset of flowering and again later in the season if required. Larger plants should be cut and subsequently sprayed with herbicide after smaller sprout growth has developed from their roots. Any native plants growing adjacent to this undesirable vegetation will be shielded from the spray drift by means of plastic or wooden sheets held by the pesticide applicator's assistant. Follow-up treatments will likely be required for several years to eliminate surviving plants and new seedlings.

### Treatment of Garlic Mustard in Conifer Plantations

Some large patches of garlic mustard occur in CUP3-12 and this weed appears to be spreading throughout this area. To control this aggressive biennial herb, it should be sprayed with a systemic herbicide such as Roundup when the plants are flowering during late April/May to facilitate their identification, but before seed is produced. Alternatively, small patches may be effectively hand pulled, especially in moist sandy soils. Fall spraying of basal rosettes has also proven effective provided the temperature is above 5° C so the plants are actively photosynthesizing. When applying herbicide non-target plants must be shielded from spray drift as required. This becomes less of a concern when spraying basal rosettes in the fall.

### Treatment of Phragmites

Dense monoculture patches of invasive Phragmites have become established in the wetland along the north side of the internal haul road and at the south end of Pond 3. This aggressive alien species has spread significantly over the past 4 years. To control the spread of this species the stems will be cut low to the ground during late summer and either taken to a landfill site or burnt on-site after being allowed to dry. In so doing, there should be little re-growth in the fall and it may be possible to drown newly emerging plants in the spring, assuming sufficient surface water remains in these wetlands until late June. If flooding proves ineffective, the new stems should again be cut low to the ground but this time in late June or July, prior to flowering, and either taken to a landfill site or burnt on-site after being allowed to dry. The subsequent re-growth will then be sprayed with Roundup using a backpack sprayer in August or early September when it is less than 0.4m in height and there is no surface water present in the area. It is anticipated that a follow-up herbicide treatment will be required the following spring in order to eradicate this undesirable species assuming no surface water is present at this time. Otherwise another cycle of cutting and spraying will be required.

Pesticides must be applied by a licensed commercial applicator who holds a valid Operator License and an appropriate Exterminator License issued by the Ministry of the Environment Conservation and Parks (MECP)

# 4 Environmental Monitoring

## 4.1 Background Monitoring Network

One or more off-site locations will be used to determine long-term climate influenced trends in precipitation rates, air temperature, streamflow, groundwater levels and groundwater temperatures.

### 4.1.1 Climate Stations

Long term climate stations operated by Environment Canada will be used to obtain precipitation and air temperature data. The nearest long-term stations include Kitchener-Waterloo, Toronto International Airport and Hamilton Royal Botanical Gardens. This data will be reviewed for potential longer-term climate changes around the site.

### 4.1.2 Streamflow

Streamflow measurements provide an integration of regional runoff and groundwater discharge. There are several streamflow stations operated by Environment Canada, Conservation Halton and the Grand River Conservation Authority that will be considered for background monitoring. The data available from these stations will be reviewed as an indication of long-term climate change impacts on water resources.

### 4.1.3 Groundwater Level and Temperature

There are several Provincial Groundwater Monitoring Network wells located within Conservation Halton watersheds and Grand River Conservation Authority watershed. Conservation Halton also independently operates several groundwater monitoring stations. The data available from these stations will be reviewed as an indication of regional ambient groundwater level and temperature changes.

## 4.2 On-Site Monitoring Network

### 4.2.1 Groundwater and Surface Water Monitoring

A comprehensive groundwater and surface water monitoring program has been designed to verify that the stated Environmental Objective, Environmental Water Quality Objectives, and Water Supply Objectives are being satisfied. The program has the following elements.

#### *4.2.1.1 Additional Groundwater Monitoring Stations*

The following additional groundwater monitoring wells will be established post licensing but before any below water table extraction occurs. The locations of these monitors are shown on attached **Figure 6**.

**CB12S/D**

A multi-level groundwater monitoring station will be installed between the East Pond and the residence at 9256 Twiss Road. The shallow well will be completed in the overburden and the deep well within five meters below the bedrock/overburden contact. This multi-level system will be used to verify water level

conditions east of the East Pond. Water quality samples will also be obtained from this station on an annual basis.

**CB13S/D**

A multi-level groundwater monitoring station will be installed between the Central Pond and the industrial park. The shallow well will be completed in the overburden and the deep well within five meters below the bedrock/overburden contact. This multi-level system will be used to verify water level conditions south of the Central Pond. Water quality samples will also be obtained from this station on an annual basis.

**CB14**

CB14 will be installed downgradient of the proposed recycling area. CB14 will be a shallow overburden monitoring well. CB14 will only be installed if recycling is going to occur.

**CB15**

CB15 will be installed in the southwest corner of the site between the Phase 1 pond and Kilbride Creek.

Water levels and water quality samples will be obtained from CB15.

Monthly turbidity measurements will be obtained during the active extraction of Phase 1. Annual general chemistry samples will be obtained.

**CB16S/16D**

CB16S/D will be installed between Buffer Pond 2 and Kilbride Creek. CB16S will be completed in the overburden and CB16D will be completed in the upper ten metres of the bedrock.

**CB17**

CB17 will be installed along the main access road and will be used to determine water quality in the bedrock aquifer.

**KC1**

KC1 has been installed in Kilbride Creek to monitor groundwater potential beneath the creek relative to the creek level.

#### *4.2.1.2 Mitigation Effectiveness Water Level Monitoring*

Water levels in each mitigation feature or nearby monitoring station will be obtained every thirty minutes and will be available through the cellular network.

The relationship between mitigation features, natural heritage features being protected and associated monitoring stations are identified in **Table 7**:

**Table 7: Mitigation Effectiveness Monitoring**

| Mitigation Feature | Natural Heritage Feature | Monitoring Station |
|---|---|---|

| | | |
|---|---|---|
| BP1 | P7A and P7B, P4, P8, P9 P10, P14, P15 | WP3 WP6 WP5, WP13, WP12, WP14, WP15 |
| BP2 | Kilbride Creek North and Kilbride Tributary | WP7, WP4 |
| Dispersion Trench 1 | P5 | WP8 |
| Dispersion Trench 2 | Kilbride Tributary | WP4 |
| Dispersion Trench 3 | Eastern Wetland Complex | WP9 |

Water levels in WP3, WP4, WP5, WP6, WP7, WP8, WP9, WP12, WP13, WP14 and WP15 will be obtained on 30-minute intervals and will be available through the cellular network. These water levels will be monitored daily to ensure compliance with the minimum water level thresholds. In the event that the warning water level is achieved, contingency measures will be evaluated and implemented. In the event that the minimum water level threshold is met, the contingency measure will be implemented and continued until water levels have recovered above the minimum water level threshold. A summary of the ground and surface water monitoring is included in Table 11.

#### *4.2.1.3 Water Level Monitoring*

Monthly water levels will be obtained from all groundwater and surface water monitoring stations in the monitoring program. This is to verify that the data loggers are operating accurately and to obtain water levels from stations without data loggers.

#### *4.2.1.4 Automated Real-Time Data Collection and Telemetry*

Real time data collection is being proposed for this site;

- To confirm that mitigation systems are operating as expected
- To confirm that water levels in wetlands are maintained within allowable tolerances
- To confirm that hydraulic gradients between extraction areas and Kilbride Creek and Kilbride Tributary are being maintained, are at acceptable levels and
- To confirm that temperature in Kilbride Creek is maintained within historical values.

Real-time data collection includes level and temperature at the following locations identified in **Table 8**:

**Table 8: Summary of Real-Time Water Level Data Collection**

| Location | Monitoring Station | Purpose | Time Period |
|---|---|---|---|
| BP1 | BP1 | Provide up to date water levels in BP1 to verify operational status and to correlate to water levels obtained from P7A and P7B | All Phases after installation of BP1 |
| BP2 | BP2 | Provide up to date water levels in BP2 to verify | All Phases after installation of BP2 |

| Location | Monitoring Station | Purpose | Time Period |
|---|---|---|---|
| | | operational status and to correlate to water levels obtained from WP7 and WP4 | |
| DT2 | DT2 | Provide up to date water levels in DT2 to verify operational status and to correlate to water levels obtained from WP4 | All Phases where water levels in West and Central ponds are lowered. |
| DT1 | WP8 | Provide up to date water levels in P5 to inform operation of discharge to P5. | All phases where water levels in West and Central ponds are lowered. |
| P7B | WP3 | Confirmation that mitigation is working and maintaining hydroperiod | All Phases |
| P7A | WP6 | Confirmation that mitigation is working and maintaining hydroperiod | All Phases |
| Kilbride Creek South | CB9S | Confirmation that hydraulic gradient between Phase 1 and Kilbride Creek is maintained. | Active extraction of Phase1 or water transfer from Phase 1 |
| Kilbride Creek South | CB4D | Confirmation that hydraulic gradient between Phase 1 and Kilbride Creek is maintained. | Active extraction of Phase1 or water transfer from Phase 1 |
| Kilbride Creek South | CB4S | Confirmation that hydraulic gradient between Phase 1 and Kilbride Creek is maintained. | Active extraction of Phase1 or water transfer from Phase 1 |
| Kilbride Tributary | WP4 | Confirmation that temperatures and water levels in Kilbride Tributary are maintained within tolerance. | All phases where water levels in West and Central ponds are lowered. |
| P9 | WP5 | Confirm that hydroperiod of P9 is maintained. | All phases where water levels in West and Central ponds are lowered. |

| Location | Monitoring Station | Purpose | Time Period |
|---|---|---|---|
| Kilbride Creek | WP7 | Confirm hydraulic gradient between BP2 and Kilbride Creek is maintained. | All phases where water levels in West and Central ponds are lowered. |
| P13 | WP8 | Confirm that hydroperiod of P13 is maintained. | All phases where water levels in West and Central ponds are lowered. |
| Eastern Wetland Complex | WP9 | Confirm that drawdown in Eastern Wetland Complex is within predictions. | All Phases where water levels in East Pond are lowered. |
| P10 | WP12 | Confirm that hydroperiod of P10 is maintained. | All phases where water levels in West and Central ponds are lowered. |
| P8 | WP13 | Confirm that hydroperiod of P8 is maintained. | All phases where water levels in West and Central ponds are lowered. |
| P14 | WP14 | Confirm that hydroperiod of P14 is maintained. | All phases where water levels in West and Central ponds are lowered. |
| P4 | WP15 | Confirm that hydroperiod of P4 is maintained. | Phase 1 extraction or transfer of water from Phase 1 Pond |

#### *4.2.1.5 Surface Water Level Monitoring*

The extraction ponds, East Central and West, will be monitoring on an hourly basis to allow for comparison to pumping rates and effectiveness of mitigation. Surface water levels will be obtained with data loggers from the following locations in Table 9.

**Table 9: Surface Water Monitoring Stations**

| Location | Station | Parameter |
|---|---|---|
| SG1 | East Pond | Level and Temperature |

| | | |
|---|---|---|
| SG2 | Central Pond | Level and Temperature |
| SG4 | West Pond | Level and Temperature |
| SG11 | P13 | Level and Temperature |
| SG7 | P12 | Level and Temperature |

#### *4.2.1.6 Groundwater Quality Monitoring*

Groundwater quality sampling will be conducted to confirm that the chemical quality, physical quality or temperature of the groundwater has not been changed significantly by the aggregate extraction related activities.

Water quality samples will be obtained from monitors located between the West Pond and Kilbride Creek (CB3S/D, WP7), between the Phase 1 pond and Kilbride Creek (CB9S/D, CB4S/D, CB15), downgradient of the main extraction area (CB1, CB6, CB13S/D), downgradient of the recycling area, if recycling occurs (CB14) and between the East Pond and the residence at 9256 Twiss Road (CB12 S/D). The water samples will be obtained on an annual basis. The water quality parameters will include; general chemistry (pH, conductivity, anions), ammonia, metals, nutrients, BTEX. PAH will also be sampled in CB14.

#### *4.2.1.7 Surface Water Quality Monitoring*

Water quality samples will be obtained from the following locations in Table 10:

**Table 10: Surface Water Quality Monitoring Stations**

| Location | Parameters | Frequency |
|---|---|---|
| East Pond | General Chemistry, TPH, BTEX | Annual |
| West Pond | General Chemistry, TPH, BTEX | Annual |
| Central Pond | General Chemistry, TPH, BTEX | Annual |

#### *4.2.1.8 Turbidity Monitoring*

Turbidity measurements will be obtained from dedicated groundwater monitoring locations CB15 and CB16D located between the extraction area and Kilbride Creek. Turbidity measurements will also be obtained from a surface water station upgradient of Phase 1 (SG9) and one downgradient of Phase 1 (SG10). Turbidity measurements will be obtained on a monthly basis during periods of active extraction (April to December) with a portable turbidity meter.

#### *4.2.1.9 Surface Water and Groundwater Temperature Monitoring*

Temperature measurements will be obtained from all stations that have a data logger.

### 4.2.2 Summary of Groundwater and Surface Water Monitoring

Table 11 summarizes the groundwater and surface water monitoring program.

**Table 11: Summary of Groundwater and Surface Water Monitoring Program**

| | Monitoring Station | Parameter | Frequency |
|---|---|---|---|
| Background | | Water Level and Water Temperature | Every 30 Minutes |
| Ambient Site Monitoring | WP1, CB7S, CB12S/D, SG1, SG9, SG7, SG11, CB13S/D, CB15 | Water Level and Temperature | Automatic: Every 30 minutes |
| Water Level Monitoring | CB4S CB9D, CB9S, CB7S, CB12S/D,CB13S/D, CB15, SG1, SG2, SG4, SG6,SG7,SG9, SG10, SG11, WP1,WP3, WP4, WP5, WP6, WP7, WP8, WP9,WP12, WP13, WP14 AND WP15, West Lake Piezometer, DT2,BP1, BP2, | Water Level | Manual: Monthly |
| Mitigation Effectiveness Monitoring | WP3, WP4, WP5, WP6, WP7, WP8, WP9, WP12, WP13, WP14 AND WP15, DT2 BP1, BP2, CB9S, CB4S/D | Water Level, Temperature | Automatic: Every 30 minutes, Cellular-Tied |
| Groundwater Quality | CB1, CB3S/D, CB9S/D, CB12S/D, CB13S/D, CB14, CB15, CB17,WP7 | general chemistry (pH, conductivity, anions), metals, ammonia, nutrients, BTEX, PAH(CB14 only) | Annual |
| Surface Water Quality | West Pond, Central Pond, East Pond | general chemistry (pH, conductivity, anions), metals, ammonia, nutrients, BTEX | Annual |
| Climate | Climate Station at Scale House | Temperature, Barometric Pressure, Precipitation | Hourly |
| Turbidity | CB15, SG9, SG10, CB16D | Turbidity | Monthly |

**Table Notes:**

i. Monitoring well CB12S/D will be installed between the active extraction area and the wells servicing 9526 and 9261 Twiss Road, prior to below water extraction.
ii. Monitoring Well CB13S/D will be installed between P7B and the industrial park
iii. Monitoring Well CB14 will be installed downgradient of recycling area if implemented
iv. Monitoring Well CB15 will be installed in Southwest Corner of Site

v. Monitoring Well CB16S/D will be installed between BP2 and Kilbride Creek
vi. Monitoring Well CB17 will be installed along access road.

## 4.3 Ecological Monitoring

The following ecological monitoring surveys (see **Figure 8**) are proposed to supplement the data collected by the surface and groundwater monitoring program. These surveys may help to serve as a check on the effectiveness of proposed operational procedures and mitigation measures. Possible changes to vegetation cover and wildlife populations during the life of the quarry may not however, be related to quarry operations but may instead simply reflect natural processes such as plant succession and weather dependent swings in wildlife species abundance.

### 4.3.1 Redd Surveys

Conduct brook trout redd surveys in the on-site portion of Kilbride Creek for 3 consecutive years starting in 2020 or the first year of quarry operation. If no redds are discovered during this time frame then discontinue the survey, but if redds are found then continue to implement it every 3 years for the life of the quarry.

### 4.3.2 Salamander Sampling

Conduct salamander sampling at Pond 5 every 3 years starting in the first year of quarry operation. This will be a simple presence-absence survey deploying 15 minnow traps during the period when salamanders are breeding. Surveying in any given year will be terminated as soon as presence of salamanders is confirmed. No tail-tip samples will be taken and no genetic analyses will be completed. All necessary permits and animal care protocols will have to be obtained from MNRF and/or MECP in advance of survey commencement.

Sampling for salamander egg masses in Pond 5 was considered but it was decided not to pursue this for the following reasons: 1) the only reason that salamanders will enter the pond is to breed, so the presence of salamanders is a positive indication that there will be egg masses in the pond; 2) conducting egg-mass surveys is not recommended by the protocol for inventorying for the presence/absence of the Jefferson salamander; and 3) the work will require a Wildlife Scientific Collectors Authorization and these typically require that egg-mass surveys be conducted from the shoreline without entering the pond. Due to the very small size and inconspicuousness of blue-spotted salamander egg masses, it is unlikely that any would be found using this method.

### 4.3.3 Amphibian Call Surveys

Conduct amphibian call surveys at Ponds 2, 3, 4, 5, 7A, and 14. This survey will be initiated during the first year of quarry operation and every 3 years thereafter. The protocol that will be used will be the modified Bird Studies Canada protocol as described in the Natural Environment Technical Report. When surveying at P2, only those amphibians calling in that pond should be counted; any frogs calling from P1 or BP2 should be recorded separately. In the case of P4 and P14, the sampling station should be situated on the berm between the two ponds and frogs calling in each individual pond should be recorded separately.

### 4.3.4 Vegetation Plots

Establish 8 permanent vegetation sample plots in the Eastern Wetland Complex during 2020 or the first year of quarry operation. Plot boundaries will be delineated with rebar. Each plot will be 10m x 10m in size and they will be located in the following areas.

- 2 plots along the northern edge of the wetland (SWM 4-1) immediately south of the East Pond. The purpose of these plots will be to monitor potential effects of drawdown on wetland vegetation close to P11.
- 2 plots along the north edge of the haul road in wetland areas (SWC 3-2) preferably with some living and dead tree cover, as well as some phragmites so the effectiveness of control measures can be assessed. These plots will monitor potential changes as a result of drawdown due to extraction in addition to improved drainage as a result of culvert installation.
- 2 plots close to Twiss Road in vegetation communities SWM4-1 and/or SWC3-2. They should be selected so that the location can be reached regularly and safely by staff. These plots will monitor potential changes as a result of culvert improvements at Twiss Road
- 2 plots in SWC 3-2 south of the haul road in areas where sensitive species such as bog sedge, leatherleaf, Labrador tea and three-leaved soloman's-seal are growing. In these plots all living and dead trees 10 cm dbh and larger will be tagged, measured and have their vigour/health recorded. All tree regeneration within the plot will be counted by species as either a seedling or sapling (i.e., 1 to 9cm dbh) while shrubs will just be counted by species. For herbaceous groundflora, 4 circular sub-plots 2m in diameter will be established in areas with representative assemblages of herbaceous plants and all species observed will be recorded along with their ELC abundance in the plot.

In addition, 4 photographs of the plot will be taken, one from each side of the plot (i.e., one from the north boundary of the plot looking south etc.). After the baseline data are collected in year 1, only photographs (4) of each plot will be taken in subsequent years unless there is visual evidence of significant changes to the species composition or form of coverage within a plot. If significant changes are observed then the detailed data will be collected to quantify the extent of observed changes and help to explain them.

Sampling should be conducted at approximately the same time each year, preferably in the first half of June. At this time, all sensitive species will be in flower, and some, such as the sedges are not readily identifiable later in the season.

In addition to the 8 permanent vegetation sampling plots, additional photographic plots will be established. These will include monitoring stations at a site along the Kilbride Creek tributary and at some of the ponds, including P5, P7and P10. These will be marked with a rebar stake and photographs will be taken in the first half of June at these sites. The purpose of monitoring along the Kilbride Creek tributary is to determine if there is any change in vegetation related to the water management mitigation. The monitoring at P5, P7A, P7B, and P10 will also determine if there are any changes in vegetation. In addition to the photographic record a quick walk about the pond will be undertaken to search for any invasive vegetation such as common reed. These wetlands are currently free of this species and if it is detected in them it should be eradicated as soon as possible using the above protocol.

### 4.3.5 Osprey Nesting Platform

Usage of the Osprey nesting platforms will be monitored annually.

### 4.3.6 Turtle Nesting

In mid-May when turtle nesting activity is highest, the berms enclosing Pond 2 and BP2 will be searched for turtle nests. The two other artificial nesting sites will also be inspected. This will be repeated later in autumn (September or October) to determine rates of predation. The plantings of Allegheny blackberry will also be checked to ensure that they are still providing a barrier to predator movement.

### 4.3.7 Barrier Fencing

The barrier fencing along the haul road will be checked weekly from mid-March until the end of October to ensure that it is still intact. Any breaches in the fence will be repaired immediately.

## 4.4 Climate Monitoring

Once the scale house is established, a Davis automatic rain gauge will be installed to measure precipitation and temperature at the site. The results will be compared to local Environment Canada stations for confirmation that site conditions are not significantly different. We recommend this for a five-year period.

# 5 Private Water Supply Protection and Mitigation Strategy

## 5.1 Pre-Extraction Water Well Survey

As recommended by the MECP, JDCL will conduct a door-to-door well survey of the wells within the area of influence of the quarry. This will be conducted after the issuance of the license and prior to any extractive operations. The MECP recommends that this be conducted in the area of influence of the proposed quarry. The area of influence of the proposed quarry is small because of the limitations on water level changes imposed by the on-site wetlands. Although the area of influence is small, JDCL has agreed to extend this to wells downgradient of the quarry and the suspected shallow dug wells located on Twiss Road. **Figure 5** shows the area to be included in the door-to-door well survey. The door-to-door survey will be conducted. Water quality samples will be obtained from the wells if possible and subject to permission from the owner. The water samples will be analyzed for the following parameters; general chemistry (pH, conductivity, anions), metals, nutrients, microbiology and BTEX. The well survey and water quality sampling is access dependent, i.e. static water levels measurements will not be obtained from any well not up to present day Ontario Regulation 903 standards.

## 5.2 Water supply monitoring and early warning response strategy

The following is the protocol for detecting the potential for off-site impacts to private water supply.

### 5.2.1 Water Quantity

There is no dewatering of the quarry and on-site water level changes are limited by sensitive on-site receptors and mitigation strategies. It is therefore, unlikely that any off-site water well will be affected by on-site activities related to water level change. The only susceptible wells are shallow dug wells located upgradient or cross gradient to the site. There are only two wells, located at 9256 and 9261 Twiss Road

that fall into this category. A pre-extraction water well survey will be conducted to determine the tolerance of these wells to water level change.

Monitoring well CB12 will be installed and monitored to confirm that water level changes between the East Pond and these two private wells on Twiss Road are within acceptable levels and do not result in off-site reduction in yield in these nearby wells. The drawdown needed at CB12 to create a drawdown at the nearest private well tolerance will be estimated and used as a trigger and advanced warning levels will be established above this. It is likely that the first time that the East Pond is drawn down, weekly manual measurements will be obtained from the private wells.

### 5.2.2 Water Quality

Water quality samples will be obtained from CB1, CB6, CB13 and CB17 located between the extraction area and private wells along Twiss Road, Guelph Junction Road and Campbellville Sideroad.

In the event that the following conditions are found;

a) there is an increasing trend, occurring over three sampling events, in the concentration of a chemical parameter measured in CB13 or CB17 and
b) that the chemical parameter has an Ontario Drinking Water Quality Standard

James Dick Construction Ltd. will conduct a study to determine the source of the water quality change.

If the quarry is found to be responsible and if there is a potential for a water quality parameter to exceed the Ontario Drinking Water Quality Standard at a downgradient well, James Dick Construction Ltd. will commence with the following actions;

1) Semi-annual testing (commencing immediately) of the water quality of private wells that could potentially be impacted by the quarry;
2) In the event that the quarry operation causes water in a private well to become unpotable, JDCL will offer to return the water quality to within Ontario Drinking Water Quality Standards by providing appropriate treatment in the home, drilling a new well or isolating the water supply to the deeper aquifer.

## 5.3 Communication protocols and water supply interference procedures

James Dick Construction Ltd. has committed to remedying any and all issues arising as a result of quarry activities. The following complaint protocol will be followed:

Complaints about water well issues will be received any time at (905) 857-3500 email to info@jamesdick.com.

James Dick Construction Ltd. has a water well contractor on stand-by to address any water quantity or quality issue that arises.

In the event of a water shortage a supply of bottled water for drinking/cooking will be delivered within 12 hours of the complaint and an alternative water supply will be delivered within 24 hours of the complaint being received. The same commitment is made for agricultural operations and includes sufficient water supply for all farm requirements.

Within 48 hours, JDCL will initiate a hydrogeological investigation conducted by an independent

hydrogeologist to determine the cause of the water issue. The investigation will include but not be limited to the following actions:

- Confirmation of water levels in on-site groundwater monitoring wells
- Review of historical trends in groundwater levels and groundwater quality obtained in on-site groundwater monitoring wells
- Review of historical measured precipitation rates
- Interview with resident regarding well complaint
- Investigation of subject well including flow testing, water level measurements and water quality testing if necessary
- Written report summarizing the findings

In the event that quarry activities are likely to be the cause of the complaint, James Dick Construction will undertake appropriate mitigative measures such as:

- Lowering the level of the pump within the well
- Extending the cased portion of the well
- Deepening the well
- Well replacement
- Water Treatment
- Modification of quarry activities

# 6 Targets, Warning Levels and Minimum Water Level Thresholds

## 6.1 Water Levels

### 6.1.1 Minimum Water Level Thresholds

Ecological functions of wetlands and the Kilbride Tributary are such that there is a seasonally based water level below which these functions may be negatively impacted. Specifically, these functions are identified as providing adequate water for a complete amphibian life cycle in specific wetlands and providing suitable brook trout habitat in the Kilbride Tributary. The specific water levels required as a minimum to sustain the function are called Minimum Water Level Thresholds (MWLTs). The following process was used to establish the MWLTs.

The first step was to determine a representative set of monthly water levels based on historical data. This set of monthly water levels is intended to reasonably represent the measured data. **Figure 7** is an example of the representative monthly water levels for monitor WP8 located in wetland P5.

As can be seen, the representative water levels closely follow the actual data. This representative data set will be reviewed and modified for each feature prior to any below water table extraction occurs at the

site. All targets, minimum water level threshold and warning values are based on this representative water level data set.

#### *6.1.1.1 MWLTs for Amphibian Ponds*

There are eight semi-permanent 'amphibian' pond wetlands at the site. These are identified as P4, P5, P7A, P7B, P8, P9, P10 and P14 on **Figure 3.** Water levels are now being obtained on a 30-minute basis from each of these wetlands. Appropriate Minimum Water Level Thresholds for each of the wetlands will be established prior to below-water-table extraction occurring at the site. Minimum Water Level Thresholds for the semi-permanent amphibian ponds are established for March, April, May and July.

The March MWLT is established to ensure that the wetland has a water level within the historical range of measured March 1st values. This will ensure that there is sufficient water in the wetland to allow for breeding. The March 1st MWLT is very conservative and is based upon multiple years of data on when salamanders first breed in the province at this latitude. Since 2004, the earliest record for salamander breeding is March 12 and historically breeding has occurred as early as March 9. The March 1st target of achieving the MWLT was designed so that the ponds would be suitable for salamander breeding in advance of the breeding season. This avoids the necessity of ecologists and water managers having to subjectively decide each year on when the ponds should be ready for the salamanders.

The April MWLT is based on the historically measured values for April 1st and has been established to ensure that water levels do not decline in the wetland during the month of March, thereby affecting salamander eggs by stranding and desiccating them. Salamanders attach their egg masses to sticks and are vulnerable to desiccation if water levels decline significantly. Frog eggs are not as much of a concern as they are generally laid on floating vegetation and are not subject to desiccation if water levels decline.

The May MWLT has been set equal to the April MWLT to ensure that there has not been a decline in the wetland water level within 45 days of salamander breeding. By 45 days after breeding, the eggs will have hatched into larvae and there is no longer a threat of egg desiccation.

The July MWLT is based on there being a minimum of 10 cm over an area no less than 10% of the wetland on July 31st. This will ensure that there is water for the emerging juvenile salamanders and other spring-breeding amphibian species. The MWLT's are established for the existing network of monitors within the wetland.

It is not desirable to achieve the MWLT in all ponds in all years. This is because some of the ponds are currently more ephemeral than the other semi-permanent ponds. These more ephemeral ponds have different vegetation structure than the other ones and flooding them until July 31st in every year could alter their vegetation communities. This is not desirable for these ponds, all of which are likely to be regulated as Jefferson salamander habitat. Table 12 provides a summary of how frequently each of the semi-permanent ponds currently achieves the MWLT in a 25-year period based upon modelling results, actual observed frequency of achieving the MWLTs, and the recommended periodicity of allowing each pond to dry out. For those ponds that will be allowed to dry out in some years, the periodicity of flooding in them will be equal or greater than under current conditions.

**Table 12: Dry Year Frequency to Protect Emergent Vegetation in Selected Wetland Features**

| Wetland Feature | Modelled Historical 25 Year Dry out Condition (Earth FX) | Actual Observed July 31 Dry out Conditions 2016-2019 | Proposed Frequency of July 31 Dry out Conditions |
|---|---|---|---|
| P4 | n/a | Wet 2019, Dry 2018, 2017, 2016 | **Wet 1 Year in 5** |
| P5 | 0% | Wet 2016, 2017, 2018, 2019 | **Wet Every Year** |
| P7A | 0% | Wet 2016, 2017, 2018, 2019 | **Wet Every Year** |
| P7B | 8% | Wet 2016, 2017, 2018, 2019 | **Wet Every Year** |
| P8 | 40% | Wet 2019, Dry 2018, 2017, 2016 | **Wet 1 Year in 5** |
| P9 | 92% | Wet 2019, 2017, Dry 2018, 2016 | **Wet 2 Years in 5** |
| P10 | 0% | Wet 2016, 2017, 2018, 2019 | **Wet Every Year** |
| P14 | 84% | Wet 2019, Dry 2016, 2017 2018 | **Wet 1 Year in 5** |

The ponds most likely to have their vegetation communities changed as a result of achieving the MWLT each year are P4, P8, and P14. P4 appears to dry out fairly often, although there is limited data for this pond. The vegetation in it currently consists of shrub willows in its southern portion and a mix of cattails and common reed. More continuous flooding of this pond is likely to promote the spread of cattails and the invasive common reed. Both of these species are poor habitat for salamander breeding.

P8 is currently dry by July 31st in 40% of years. Its vegetation is dominated by emergent vegetation, particularly aquatic grasses and weak-stemmed forbs and cattails. More frequent inundation of this pond is likely to result in the cattails taking over and it becoming a monotypic stand of cattails.

P14 is a green ash swamp. In areas where the canopy of the swamp is open, the vegetation consists of aquatic grasses and sedges. The surface water in it typically dries up quickly and it currently fails to meet the MWLT in 84% of years. The quick drying out of the surface water in this wetland allows the trees to regenerate and does not kill them due to prolonged inundation. More lengthy and frequent flooding in this wetland is likely to kill the trees and result in their replacement by cattails and/or common reed. There will be extensive tree mortality in this swamp as a result of the emerald ash borer. By allowing the wetland to dry out fairly early in most years, ash and other wetland trees such as silver maple will still be able to regenerate in the wetland and maintain the tree cover. Even if the canopy cover disappears because of ash mortality, allowing the wetland to draw down will limit the area that can be invaded by cattails and common reed.

#### *6.1.1.2 MWLTs for Kilbride Tributary*

The water level in the Kilbride Tributary has a relatively narrow range given its small catchment area. The MWLT for the Kilbride Creek is based on historical monthly values determined for the historical value obtained on the 1st of every month. The MWLT's are established based on water levels obtained from monitor WP4.

#### *6.1.1.3 MWLTs for Kilbride Creek South*

Groundwater flow occurs from the proposed Phase 1 pond to Kilbride Creek. The volume of groundwater flow is relatively low compared to creek flow, however, it is necessary to keep a minimum water level

between Phase 1 Pond and Kilbride Creek to ensure that there is no reverse flow occurring. The disturbance of water levels in Phase 1 will be a relatively short-lived occurrence. MWLTs have been established for CB9S and CB4S to ensure that no detrimental change in flow occurs.

### 6.1.2 Target Water Levels

The only impact that JDCL will have on the water levels is due to the extraction of aggregate from below-the-water table. This is a very controlled activity and can be moved, modified or suspended to reduce the water level drawdown in the extraction area. However, it is expected that a water level drawdown in the extraction area will occur and mitigation of that water level change is required to meet MWLT's in the nearby natural heritage features. This will be achieved by pumping water from different phases of extraction area into mitigation features. Water in the mitigation features will either flow directly into a natural heritage feature or maintain groundwater levels beside natural heritage features and thereby maintain groundwater quantity and quality discharge to the feature. In months when there is no MWLT, it will be possible to reduce pumping rates and allow water levels in the natural heritage features to fall below their historical range. A MWLT in each feature will need to be satisfied sometime in the future therefore we have recommended monthly target water levels that should be used as a guideline to ultimately attain the MWLTs.

#### *6.1.2.1 Target Water Levels for Mitigation Features BP1, BP2 and DT2*

Target water levels in BP1 have been set according to the Minimum Water Level Thresholds established for Pond7B (using representative water levels at WP6).

Target Water levels in BP2 and DT2 are set within the historical range for the nearest surface water body. Thus target water levels in DT2 are set at historical water levels observed in the Central Pond (based on SG3 levels) and water levels in BP2 are set at historical water levels observed in the West Pond (based on West Lake Piezometer).

#### *6.1.2.2 Target Water Levels for Amphibian Ponds*

Target water levels in the amphibian ponds are determined from the representative set of monthly water levels (see Section 6.1.1) as shown on Table 13.

**Table 13: Monthly Targets from Representative Set of Water Levels**

| Calendar Month | Target Water Level Month |
|---|---|
| November | November |
| December | November |
| January | November |
| February | February |
| March | March |
| April | April |
| May | April |

| | |
|---|---|
| June | July |
| July | July |
| August | August |
| September | November |
| October | November |

### 6.1.3 Warning Water Levels

Warning water levels are designed to provide two weeks of warning before a feature's water level falls below the MWLT.

#### *6.1.3.1 Warning Water Levels for Kilbride Tributary*

Warning water levels are set at 0.05 m above or below the MWLT depending on season (e.g. if water level is rising, warning level is set 0.05 m below the MWLT).

#### *6.1.3.2 Warning Water Levels for Amphibian Ponds*

Warning water levels are determined by 50% of the previous month's natural water level change. For example, in Wetland P5, the historical water level change in June is 15 centimeters. The warning water level for July 31st will be the MWLT minus 7.5 cm.

### 6.1.4 Supporting Hydrographs and Tables

Hydrographs depicting the historical natural range, target water levels, minimum water level thresholds and warning water levels for each of the mitigation features and natural heritage features have been developed for each feature. The hydrographs contain the following elements;

1) Water level observations either manual or from automatic water level recording device.
2) Simulated monthly water levels designed to mimic natural range of observed water levels.
3) Monthly water level targets
4) Minimum water level thresholds
5) Warning water levels

Graphs have been prepared for the following features (**Table 14**) and are found in

# Appendix B - Hydrographs.

**Table 14: List of Graphs of Representative Water Levels**

| Pond | Representative Monitor | Graph |
|---|---|---|
| P4 | WP15 | Graph 1 |
| P5 | WP8 | Graph 2 |
| P8 | WP13 | Graph 3 |
| P7A | WP6 | Graph 4 |
| P7B | WP3 | Graph 5 |
| P9 | WP5 | Graph 6 |
| P10 | WP12 | Graph 7 |
| P14 | WP14 | Graph 8 |
| Kilbride Tributary | WP4 | Graph 9 |
| BP1 | BP1 | Graph 10 |
| BP2 | BP2 | Graph11 |
| DT2 | DT2 | Graph12 |
| Kilbride Creek South | CB9S | Graph13 |
| Kilbride Creek South | CB4S | Graph14 |
| WP4 Temperature | | Graph 15 |

## 6.2 Water Quality

### 6.2.1 Temperature

Minimum temperature thresholds have been developed for the Kilbride Tributary. As seen in Graph 15, simulated monthly temperatures are plotted with historical temperature data obtained from WP4. The allowable temperatures in the Kilbride Tributary are based on the Habitat Suitability Index. Although no change in temperature is expected do occur, the range indicated allows for reasonable natural fluctuations before contingencies need be invoked.

## 6.3 Summary Table

Error! Reference source not found. is a summary of all of the targets, warning levels, minimum water level thresholds and temperature thresholds.

Table 15: Summary of Targets, Warning, Minimum Water Level Thresholds and Temperature Thresholds

| | |
|---|---|
| (Insert PDF table) | |
| | |

## 6.4 Response Action Framework

Day to day monitoring will be conducted by a Technician at the site. The onsite Technician and the Operations Manager will be trained in data collection by a qualified hydrogeologist. Periodic spot checks will be made by the hydrogeologist to verify the accuracy of data. The Technician will monitor telemetry monitors and manual monitors according to the Monitoring frequency found on Table 11 of this report and as also found on the Site Plan. Flow rates and discharge pump times from various mitigation system pumps will be physically checked to ensure they are working properly. Staff gauges will be physically observed.

Daily monitoring will be logged along with weather information. Dust monitoring and mitigation information will also be logged at the same time as required under the BMPP for air quality.

When Ecological Monitoring events occur, water monitoring data gathering will be coordinated so that linkages between water levels and ecological observations can be drawn.

If all levels are above Warning Levels no actions will be taken.

Should any levels approach Warning Levels, the Operations Manager will be advised. A meeting will be held with senior management to discuss and evaluate contingency measures that could be taken to avoid a trend toward a Warning Level. This could include:

- Slowing or suspension of below water table extraction.
- Modifying rate of below-water-table-extraction on a seasonal basis. More extraction can be focussed on the wet spring season when there is a general inundation of water from snow melt and precipitation events.
- Mining in a different Phase. If drawdown effects are localized moving extraction temporarily to a different phase can dissipate and reduce the impacts of mining.
- Match extraction rate to pond-filling rate (Phase 1 and Phase 5). Pond filling within in the plant area will displace excess water and this excess can mitigate drawdown effects.
- Internal water pumping between Phases.
- Joining/separating main ponds as needed. Culverts can be installed between ponds to facilitate water movement between them by natural gradients.
- Increasing pumping rates to a particular feature.

Should a Warning Level be breached, a meeting will be held within 24 hours with the site technician, the Operations Manager, Senior Management and a qualified hydrogeologist to review the data and make recommendations as to how any undesirable trend can be avoided. Measures listed above will be implemented to avoid reaching Threshold Minimum Water Levels.

In the event that a Threshold Minimum Water Level is breached the site technician, the Operations Manager, Senior Management and a qualified hydrogeologist will meet immediately and an investigation will be immediately undertaken by the qualified hydrogeologist. The following activities will take place:

- Suspend below water table extraction immediately.
- The MNRF, the Town of Milton, The Region of Halton and Halton Conservation will all be notified of the breach of the TMWL.

- Confirmation of water level within 24 hours. Increase monitoring to daily until source of the trigger level exceedance is identified.
- Data from automatic water level recorders (AWLR) will be downloaded and reviewed on a daily basis.
- Within seven days complete an evaluation of precipitation, groundwater monitoring data and quarry activities to determine if quarry activities are responsible for the low water level observed.
- The water level data from the AWLR's will be plotted and the water level trends analyzed so that the time it will take for the water level to recover above the trigger level can be predicted.
- Data from all ALWRs will be provided to the MNRF, the MOECP, the Township of Milton, the Region of Halton and the Halton Conservation Authority on a bi-weekly basis until the data indicates that water level are remaining consistently above the trigger level.
- If quarry activities are found to be responsible, James Dick Construction Ltd. will undertake the following contingency measures and a response will be presented to the MNRF, the Region of Halton, and the Town of Milton and Halton Conservation until water levels recover above the threshold level.
    - Cease all below water table extraction
    - Redistribute water on site to mitigate the TMWL
- If quarry activity is not found to be the cause or contributor to the trigger level breach, then quarry activity will continue and monitoring frequency will return to normal.

Once water levels recover above the MWLT limited operations may resume such that they will not result in a further breach of the MWLTs. Once water levels recover above Warning Levels normal operations may resume.

# 7 Water Budget Reviews

Water budget review will be a daily occurrence at this site assisted by the cellular based groundwater and surface water stations, daily inspections of the mitigation features, daily review of flow rates and observations of water levels in the East, Central and West Ponds.

There will be an annual review of the water balance based on measured/calculated storage in ponds, measured water transfers, distribution between ponds, extraction tonnage and original parameters value review.

# 8 Data Evaluation and Reporting

An annual report for water monitoring and ecological monitoring data will be prepared. This report will also include all historic data. The report will be public information and provided to MNRF, MECP, Conservation Halton, The Region of Halton and the Town of Milton.

Ecological monitoring will be included in the Annual Monitoring Report. In addition to summarizing and interpreting the findings, the need to continue each facet of the monitoring should be discussed, as well as the periodicity of monitoring and the possible need to monitor additional features. The monitoring report will place any changes in context. Changes in the natural environment are based on many complex

factors and while the information presented will be interesting, it will be difficult to draw cause and effect relationships between quarry activities and ecological monitoring data.

Annual Report will include the following items as a minimum;

- Relevant mapping
- Historical data
- Interpretive figures including groundwater flow maps
- Installation details of all historical and new monitoring locations
- Summary of mining activities
- Summary of water taking, water transfer and water discharge
- Summary of ecological enhancements and rehabilitation (in conjunction with Compliance Assessment Report)
- Summary of warning and minimum water level threshold exceedances
- Summary of contingency measures required
- Summary of agency correspondence
- Summary of Residential Complaints and resolution
- Spill Reporting Incidences
- Update to Adequacy of Monitoring Program and Adjustments/Proposed Changes

The annual report is an opportunity to review site conditions and report on adjustments needed during the year to meet environmental objectives.

As noted above, the annual report will include recommendations for adjustments to the monitoring program and, where necessary and appropriate to meet the stated environmental objectives, changes to the mitigation plan including target, warning and minimum water level thresholds may also be considered. As such, the requirements as set out in this Implementation Guide and incorporated on the Site Plans are intended to be reviewed annually and may be amended from time to time with approval from MNRF in consultation with Town of Milton, Region of Halton and Conservation Halton. Amendments that cannot wait until the annual review and are required to ensure environmental protection are permitted subject to prior notice being provided to MNRF, such amendments must subsequently be approved by MNRF through the annual report and review process.

# 9 Closure

The RRRQ is a site that has been designed to supply high quality Amabel dolostone from a close to market location. This quarry can be operated while respecting all of the ecological objectives established by the study team. The site is a quarry that will operate in harmony with the ability of the environment to sustain it. This will be accomplished by setting rigorous Minimum Water Level Thresholds and Warning Levels in conjunction with a robust monitoring plan. Onsite water monitors and ecological monitoring will track the health of the ecosystem in the surrounding area. Ecological enhancements are being implemented to ensure high quality rehabilitation.

The closure state of this site will not require any ongoing activities or energy consumption and once surrendered this site will be a stable, environmental feature on the landscape. There will be confirmatory monitoring and reporting post extraction as detailed below;

## 9.1 Rehabilitation Implementation Benefits

The following environmental enhancement measures are recommended for implementation to improve habitat conditions for the growth of native plants and wildlife utilization of the area. These enhancement measures have been subdivided into those that will be implemented prior to and during aggregate extraction versus those that will be carried out during site rehabilitation.

### 9.1.1 Environmental Enhancement Measures – During and Pre-extraction

#### *9.1.1.1 Barrier fencing*

Barrier fencing will be installed and maintained along both sides of the existing access road in the vicinity of Ponds 12 and 13, and a culvert will be installed between these ponds. The purpose of this is to allow passage between the ponds by turtles, snakes and other wildlife so that they do not have to cross the road.

The fencing will be approximately 150m in length and a minimum of 1 m in height and will be buried 10 to 20 cm deep in the substrate (OMNR, 2013). The fencing should also include an outward-projecting lip of approximately 10 cm in length. Suitable fencing includes Animex Fencing (https://animexfencing.com/) and chain-link fencing such as used successfully by MTO along Highway 24 from Cambridge to Simcoe. Other brands or types of fencing may be used provided that they have been proven effective in stopping snake and turtle access.

#### *9.1.1.2 Box Culverts*

A box culvert will suffice in this area as the distance across the road is quite short compared with most road crossings (Gunson et al., 2016). Due to the shortness of the culvert, it is unnecessary to have openings in the top of it to allow light into it. The culvert could be either closed or open on the bottom and should be a minimum of 1 m in width.

A second box culvert will be constructed where the other existing non-functional culvert is located along this access road. The purpose of this culvert is to better equalize water levels on each side of the road and reduce tree mortality north of the road.

Culvert installation under the existing access road is an activity that may be self-assessed according to Fisheries and Oceans Canada (2016). There is no need to contact DFO provided that the culverts meet the following criteria:

- There is no temporary or permanent increase in the footprint below the High-Water Mark;
- No temporary or permanent fill is placed below the High-Water Mark;
- Channel realignment is not necessary;
- There is no narrowing of the channel;
- Any construction to fish habitat respects timing windows. In the Reid Road Reservoir area where the culverts are planned, work in or near fish habitat should not occur during the period of March 15 to July 15;
- The culvert allows fish passage; and
- Work can be done in isolation of flowing water.

Water flow between Ponds 12 and 13 is minimal, but the work will be conducted on a day when no rainfall is anticipated. Culvert installation will be done in the dry by installing silt barriers at each end of the work space to isolate it from the ponds. This will ensure that silt does not enter the ponds as a result of the culvert installation. The silt barriers can be removed once the culvert is installed and backfilled.

#### *9.1.1.3 Pea Gravel Fish Barrier*

A barrier constructed of pea gravel will be installed between the Central Pond (Pond 6) and Pond 7. The pea gravel barrier will be of sufficient width and depth to prevent fish from accessing Pond 7 while still allowing water to infiltrate from Buffer Pond 1 into Pond 7. With the installation and management of Buffer Pond 1 along the southern shore of the Central Pond (Pond 6) and this additional barrier, it will be possible to better regulate the water levels and hydroperiod in Pond 7. The western basin of this pond (Pond 7A) retains water permanently as a result of the artificial connection to the Central Pond (Pond 6). This has resulted in Pond 7A being dominated by cattails.

#### *9.1.1.4 Invasive Species Control*

The dense stand of Phragmites that is now established on the north side of the internal road will be cut and if necessary, treated with an appropriate herbicide such as glyphosate. This aggressive invasive reed is now mostly found in close proximity to the north side of the road but if left uncontrolled it will continue to spread throughout the wetland communities in this area (i.e. SWC3-2 and MAS3-1). This invasive species control work will be carried out after the new culverts are installed and during a dry summer when no surface water is present in this area. Phragmites is also found around Pond 3 and since this area will be retained control work is also warranted here. Other ponds will be monitored for its presence and if found appropriate control measures will be implemented.

#### *9.1.1.5 Turtle Nesting*

A substrate suitable for turtle nesting will be added along the eastern edge of the berm forming Buffer Pond 2. Sand and gravel are available on site and are suitable for this purpose and construction details are found below.

### 9.1.2 Environmental Enhancement Measures – Progressive and Final Rehabilitation

#### *9.1.2.1 Shallow Littoral Zones*

Shallow littoral areas (0.1 to 2 m deep and extending 5m to 10 m offshore) will be provided at specified locations on the Site Plans within the excavated ponds. They will have an undulating bottom so that a variety of water depths are available. Fine mineral soils will be provided as a growing medium, and the varying water depths will attract different types of aquatic plants and result in a hemi-marsh condition which is optimal for plant and wildlife populations. Some other cover will be provided within these areas such as boulders and logs. These littoral areas will provide habitat for spawning fish, breeding amphibians, turtles, and marsh-dwelling birds. The locations for these are shown on the Rehabilitation Plan drawing.

In the northeast area of Phase 2, the Rehabilitation Plan, an isolated pond 0.1 to 2m deep and approximately 1,100 square meters in size will be constructed once extraction is completed. It will have characteristics similar to the shallow littoral areas described in the above bullet, but will provide habitat predominantly for amphibians and turtles as opposed to fish.

#### *9.1.2.2 Turtle Nesting*

Artificial turtle nesting areas will be constructed. Sites will be where they are fully exposed to the sun with a southern aspect. Recommended sites are indicated on the Rehabilitation Plan. Construction of turtle nesting sites consists of placing sand and gravel over filter cloth. Individual turtle nesting sites should be approximately 8 m long, 3 m wide, and 1 m deep.

#### *9.1.2.3 Osprey Platforms*

Two Osprey nesting platforms will be erected. Nesting platforms will consist of a basket on a tall pole or other feature that is out in the open. Recommended sites include along the northern edge of the Eastern Pond (Pond 11) and in the southern portion of Phase 1 as shown on the Rehabilitation Plan.

#### *9.1.2.4 Cliff and Talus Slopes*

In Phase 1, cliff faces will be created where steep exposures of bedrock remain after extraction that are more than 3 m high. Sharp to variably broken edges, faces, and rims will be established by rough blasting the final face. Talus slopes consist of rock rubble, with coarse rocky debris making up > 50 % of the substrate surface, shallow soils with an average substrate depth of < 15 cm, and sparse and patchy vegetation cover. Talus slopes will be created where limestone faces are less than 3m high after extraction. Species to be randomly planted in these areas are Canada bluegrass, white cedar, red maple, red oak, bur oak and cottonwood. It is recommended, that at least 20 percent of the quarry face remain barren and untreated.

#### *9.1.2.5 Tree and Meadow Planting*

A total of 3,000 tree seedlings will be planted on approximately 2.0 ha of open disturbed land and in setback areas on the property (see Drawing 4 of 5 for proposed locations). Where the soil is infertile and compacted it will be scarified and have at least 20cm of topsoil applied to these areas. The proposed species mix will be white pine 25%, red pine 20%, white spruce 15%, white cedar 15%, cottonwood 5%, red maple 5%, white birch 5% red oak 5% and bur oak 5%. White and red pine will be planted in a mixture on dry to fresh sites with red oak interspersed throughout. On fresh to moist sites white spruce and white cedar will be commingled with red maple, white birch and bur oak. Cottonwood will only be planted in the 10m setback around SWT2-2 (Pond 4).

In the Pond 4 setback area, red maple, white birch and bur oak seedlings will be planted in a mixture with cottonwood seedlings in the setback areas around SWT2-2 (Pond 4). Approximately 450 seedlings are required at a proposed planting density of 1,500 trees/ha. The species breakdown will include 150 cottonwood, 100 red maple, 100 white birch and 100 bur oak.

Progressive rehabilitation will be implemented as specified in the Site Plans and replanting will commence as early as possible with an emphasis on the area adjacent to Phase 1 on the Operations Plan.

All tree and shrub planting stock will be obtained from nurseries that utilize seed from the same genetic seed zone wherein the JDCL property is located.

Side slopes and the upland areas of Phase 1 and Phase 2 will be sown with an early succession Wet Meadow Seed Mixture at a rate of 22 to 25kg/ha (21-23lb/acre) using a mixture of the following species: awl sedge (*Carex stipata*-3%), Bebb's sedge (*Carex bebbii*-2%), blue vervain (*Verbena hastata*-5%), green bulrush (*Scirpus atrovirens*-5%), blunt broom sedge (*Carex scoparia*-10%), flat-topped white aster (*Aster*

*umbellatus*-1%), fox sedge (*Carex vulpinoidea*-20%), fringed sedge (*Carex crinata*-2%), great blue lobelia (*Lobelia siphilitica*-1%), New England aster (*Aster novae-angliae*-2%), path rush (*Juncus tenuis*-5%), showy tick trefoil (*Desmodium canadense*-2%), soft rush (*Juncus effusus*-4%), tall manna grass (*Glyceria grandis*-2%), Virginia wild rye (*Elymus virginicus*-25%), wild berganot (*Monarda fistulosa*-1%) and big bluestem (*Andropogon gerardii*-10%)

## 9.2 Confirmatory Reporting and Post-extraction Monitoring Requirements

For a period of two years following the cessation of extractive activities, the following monitoring program (see Table 16) will be undertaken as verification that environmental conditions have stabilized.

**Table 16: Post Extraction Monitoring for Two Year Period after Extraction Complete**

| Monitoring Station | Parameter | Frequency |
|---|---|---|
| WP7, WP4, CB4S,CB4D | Temperature | Daily - DataLogger |
| CB12, WP4,CB4S, CB4D,CB9S, CB9D, WP13, WP14,WP5,WP12, WP3, WP6,CB13S/D,CB3S/D, SG1, SG2, SG4 | Water Level | Daily -Datalogger |
| CB1, CB6, CB3S/D, CB13S/D,CB4S/D, CB9S/D, CB17 | Water Quality | Annual |

A closure report will be prepared following the two-year post closure monitoring. The report will include a review of the final rehabilitation and ecological enhancements as well as final water levels and water quality findings.

In the event that water levels in the ponds do not recover as predicted or rehabilitation has not taken as anticipated, an evaluation of the site and surrounding area conditions will be undertaken by qualified persons including a hydrogeologist and natural heritage professional. A report will be prepared for review by the MNRF and Conservation Halton along with recommendations for mitigation (if necessary).

# Appendix A – Figures

**Figure 1 – Concept Plan**

**Figure 2 – Environmental Features**

**Figure 3 – ELC Mapping**

**Figure 4 – REgional Groundwater Flow**

**Figure 5 - Private Wells Survey**

**Figure 6 – Water Management System**

**Figure 7 – Example of Monthly Water level from WP8**

**Figure 8 – Ecological Monitoring locations**

# Appendix B - Hydrographs