ADAPTIVE MANAGEMENT PLAN (AMP)
Duntroon Expansion Quarry
Lot 25 and Pt. Lot 26, Concession 11,
Township of Clearview

Prepared for:
Walker Aggregates Inc.

December 6, 2013

Revision Log

This revision log is intended to track the occurrence of adaptations made over time to the AMP, resulting from the implementation of the continual improvement process, the details of which will be provided as recommendations in the monitoring reports.

Record of AMP Revisions

Revision No.	Date	Reason for Revision

ADAPTIVE MANAGEMENT PLAN (AMP)
DUNTROON EXPANSION QUARRY
LOT 25 AND PT. LOT 26, CONCESSION 11, TOWNSHIP OF CLEARVIEW

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1.0 Introduction

The existing Duntroon Quarry (Existing Quarry) has been in operation on County Road 91 in Clearview Township, in the County of Simcoe Ontario since the early 1960s. Since 1995 the quarry has been operated by Walker Aggregates Inc., a wholly owned subsidiary of Walker Industries Holdings Ltd. (Walker Aggregates).

The high quality dolostone produced from this quarry is in demand as building material and also for use in agricultural, recreational and environmental projects. As a result, Walker Aggregates has obtained a licence under the *Aggregate Resources Act* (ARA) through the Ministry of Natural Resources (MNR), following approval from the Joint Board (June 18, 2012), to expand the Duntroon Quarry operation across the road to a new parcel of property (Expansion Quarry). The directions provided by the Joint Board decision with respect to the Adaptive Management Plan (AMP) have been incorporated into this document.

The ARA licence for the Existing Quarry and the ARA licence for the Expansion Quarry will remain separate, at least initially; they may be amalgamated into a single licence at a future date. The descriptor “Existing Quarry” is retained for the property located south of County Road 91, and the descriptor “Expansion Quarry” is retained for the property north of County Road 91.

The Expansion Quarry is located adjacent to the approved (August 24, 2012) MAQ Aggregates Inc. (MAQ) Highland Quarry, an independent third party. The locations of these quarry properties and of other lands owned by Walker Aggregates are shown on **Figure 1.1**[1].

Walker Aggregates’ environmental commitment is to manage its lands so that in the long term the ecology is healthier than its current condition. This will be accomplished through environmental initiatives detailed on the ARA Site Plans and this Adaptive Management Plan (AMP) to ensure that protection, mitigation, and enhancement measures sustain local environmental resource features and functions for future generations.

The identified natural heritage features that are in proximity to the Expansion Quarry and are protected through implementation of this AMP are shown on **Figure 1.2**. **Table 1.1** is a summary of the natural heritage features, associated functions and general protection measures. The potential impacts for each phase of Quarry operations are discussed in **Section 2.2**. Details on specific protection and monitoring measures are presented later in this AMP.

[1] Figures referenced herein are provided in Appendix A to this report, unless otherwise stated.

Table 1.1: Natural Heritage Features and Functions to be Protected

Natural Heritage Feature	Functions/Significance	Protection measures
Rob Roy Swamp Wetland Complex – Units RR1 through RR6	Amphibian breeding habitat Hydrologic inputs to Beaver River Tributaries General wetland habitat	Maintain vernal breeding pools Monitor and manage surface runoff into and out of wetlands Manage wetland water levels and monitor vegetation
Duntroon Escarpment Regional Life Science ANSI	Protects a representative area of Escarpment slopes and tablelands with wetlands, forests and groundwater recharge and discharge	Respect and buffer ANSI boundaries Maintain groundwater recharge and discharge characteristics
ANSI wetlands A and B	Amphibian breeding habitat Hydrologic inputs to Batteaux Creek Tributaries General wetland habitat	Maintain vernal breeding pools Monitor and manage surface runoff into and out of wetlands Manage wetland water levels and monitor vegetation
Escarpment Seeps	Provide flow to downstream fish habitat in Batteaux Creek and Pretty River tributaries Support domestic water supplies	Maintain ground water recharge to supply seeps Monitor downstream fish habitat and domestic supplies
Woodlands	Large general habitat blocks Connected travel corridors	Setback operations and maintain buffers in accordance with ARA Site Plans Plant and manage additional forested areas to improve linkage and habitat diversity
Butternut	Endangered species	Manage in accordance with Endangered Species Act and requirements of Quarry Phase 3B.
American Hart's-tongue Fern Colony 1	S3 species of concern	Setback operations and maintain buffers in accordance with ARA Site Plans Maintain and monitor long term habitat

1.1 AMP KEY PRINCIPLES

This AMP is based on an established process that has been applied to both public and private sector undertakings, and is a tool to implement a practical program that appropriately responds to ecological and environmental changes over the life of the project. The AMP process is based on the following:

- apply, refine and adapt the monitoring, quarry operations and mitigation measures specified in the ARA Site Plans;
- coordinate implementation of existing regulatory requirements;

- implement existing legal requirements, without altering them;
- coordinate with the relevant agencies;
- site specific application of the precautionary principle;
- structure for the continuous improvement of quarry operations;
- publicly available annual reports and AMP updates every five years;
- access to a long term database on ecological conditions at specified monitoring locations;
- ecological (water and natural environment) targets for each of the specified monitoring locations based on the long term dataset;
- refine targets, if necessary, as the dataset continues to grow over the years;
- review by, and input from, stakeholders; and
- evolve in response to environmental changes over the life of the quarry.

Key Principles

- The AMP is approved by MNR in consultation with review agencies, including the Township.
- The AMP details the routine water management and mitigation measures for the quarry during operations through to the completion of rehabilitation and licence surrender.
- The AMP details a comprehensive, long term, monitoring program, including such matters as monitoring procedures and locations.
- The AMP identifies contingency mitigation measures in the event that monitoring results indicate that quarry operations may result in negative offsite impacts.
- The AMP establishes measures to ensure that the ecological enhancement and rehabilitation, including final lake levels, are successful.
- The AMP requires an annual AMP Summary Report and 5 year Comprehensive Review Report.
- The AMP requires that all data collected and all reports will be made publicly available.
- Every 5 years, or as required, the AMP will be reviewed and updated in consultation with review agencies, including the Township, in order that the updated AMP requirements are continually based on current data and operating experience.
- The AMP is integrated into the existing regulatory framework of the *Aggregate Resources Act* (licence), *Niagara Escarpment Planning and Development Act* (development permit), *Ontario Water Resources Act* (Permit To Take Water) and *Environmental Protection Act* (Environmental Compliance Approval for discharge) as a condition of approval for licence/ permits issued under those statutes. However, revisions to the AMP only require approval from MNR pursuant to the ARA / Licence, and do not require approval under any other statute.

- Where potential negative offsite impacts may occur as a result of quarry operations, the AMP identifies:
  - the feature and potential impacts;
  - routine water management mitigation activities; and
  - criteria (trigger levels) that indicate when contingency mitigation should be implemented.
- The AMP uses the following stop light analogy based on trigger levels that identify when agencies will be notified, and if and when contingency mitigation is required:
  - **Green Zone** = normal operating conditions:
    - continue operations.
  - **Yellow Zone** = early warning of possible impact from operations:
    - notify MNR, MOE, CAs, and the Township within 72 hours of entering the Yellow Zone;
    - implement contingency mitigation and adapt operations, as appropriate.
  - **Red Zone** = impacts are initially presumed to result from quarry operations:
    - notify MNR, MOE, CAs, and the Township within 24 hours of entering the Red Zone;
    - within 48 hours stop extraction activity (clearing, stripping, and blasting);
    - continue Yellow Zone actions and implement additional contingency mitigation;
    - only resume extraction operations when:
      - conditions return to the Green Zone, or
      - conditions return to the Yellow Zone and it is demonstrated to the satisfaction of the MNR that quarry operations can recommence safely, or
      - it is demonstrated to the satisfaction of MNR that the reason for entering the Red Zone does not relate to the quarry.

A variety of measures are available to the quarry operator for implementation in a step-wise, or progressive manner to mitigate potential quarry-related water impacts (see **Sections 2.0** and **3.0**). These measures ensure that local water resources and the associated natural heritage features and functions are protected throughout the active life of the quarry and through the rehabilitation period. These mitigation measures are listed on the ARA Site Plans (MHBC, 2012) and include routine operational water management measures that are available as part of the ongoing day-to-day operation of the quarry, and contingency mitigation measures that can be used if the routine measures fail to achieve desired results derived through four monitoring programs, as described in **Section 1.2**.

1.2 MONITORING PROGRAMS

The monitoring programs have been developed through extensive discussions and workshops among agencies, consultants and Walker Aggregates. The AMP includes four component monitoring programs, and each is designed to answer an important AMP question:

1. *Performance Indicator Trigger Monitoring Program (**Section 3.0**):*
   Is the operational plan being implemented as designed and are performance indicators being met?
2. *Long Term Trend Groundwater and Surface Water Monitoring Program (**Section 4.0**):*
   Is the long term maintenance of water dynamics at the performance trigger levels having the desired effect of protecting groundwater and surface water resources?
3. *Long Term Trend Ecological Monitoring Program (**Section 5.0**):*
   Is the long term maintenance of water dynamics at the performance trigger levels having the desired effect of supporting the ecological features that have been identified for protection.
4. *Ecological Enhancement and Mitigation Monitoring Program (**Section 6.0**):*
   Have the proposed enhancements been properly implemented and managed?

If the answer to any of these questions is 'no', the management practices are adapted to achieve a 'yes' answer.

The four monitoring programs inform the fifth component of the AMP:

5. *Quarry Environment Operations, Phasing, Impacts, and Mitigation Measures (**Section 2.0**):*
   Describes the specified actions that the quarry operator needs to take in order to protect the identified ecological features and maintain the system within seasonal norms.

1.2.1 Performance Indicator Trigger Monitoring Program

Performance Indicator Trigger Monitoring (PITM) (see **Section 3.0**) is based on establishing targets for water levels and temperatures in targeted sensitive features. The targets are based on historical observations and the goal is to maintain water levels and temperatures within the specified target ranges.

Interim monthly targets are set based on historic data. Targets at specified locations will be replaced with 'real time' targets, provided that the appropriate, statistically valid relationships are established with control stations (see **Section 3.0**).

1.2.2 Long Term Trend Groundwater and Surface Water Monitoring Program

The Long Term Trend Groundwater and Surface Water Monitoring (LTTWM) program (see **Section 4.0**) is used to track and evaluate the seasonal and year over year responses of the ground and surface water systems in the vicinity of the quarry as quarry operations progress.

1.2.3 Long Term Trend Ecological Monitoring Program

The Long Term Trend Ecological Monitoring (LTTEM) program (see **Section 5.0**) is used to supplement the information from the LTTWM program with information about the health and functioning of the natural heritage features in the vicinity of the Expansion Quarry.

1.2.4 Ecological Enhancement and Mitigation Measures Monitoring Program

Mitigation and enhancement measures not directly related to day to day operation of the quarry are monitored through the Ecological Enhancement and Mitigation Monitoring (EEMM) Program (see **Section 6.0**).

The EEMM Program is designed to make sure the ecological mitigation measures are properly implemented (e.g. appropriate number and species of trees are planted, amphibian habitat is self-sustaining) and that the resulting features are managed and adapted with changing conditions and trends (e.g. replanting for dead trees, controlling pest damage, controlling / allowing public access, etc.).

The EEMM Program includes:

- the Woodland Program;
- the Millar Pond relocation;
- the Bridson Pond enhancement; and
- Butternut tree plantings incorporated into the Woodland Program.

1.3 BACKGROUND STUDIES AND ENVIRONMENTAL BASELINE

The pre-quarry expansion environmental baseline is characterized in Stantec (2005, 2007 and 2010); Jagger Hims (2005, 2007a and 2007b); Genivar (2010a and 2010b), and is discussed further in **Section 2.1**.

To supplement the baseline monitoring completed to date, monitoring at control stations will take place in order to understand changes to the environment unrelated to the quarry (see **Sections 3.0** and **4.0**).

1.4 GROUNDWATER AND CONCEPTUAL MODEL

Details of the hydrogeological setting and the groundwater model for the Duntroon Expansion Quarry are found in '*Level 2 Hydrogeological Assessment Addendum Cumulative Impact Assessment Proposed Expansion and Proposed MAQ Highland Quarry Computer Groundwater Modeling Response to Agency Review Comments*' (Jagger Hims, 2007a).

The Groundwater Model will be updated through the 5-year review as described in **Section 1.8** and **Appendix C** of this AMP.

1.5 OPERATIONAL PLAN

The Operational Plan is set out in the ARA Site Plans (MHBC, 2012) (Sheets 2A and 2B of 4). The proposed rehabilitation of the quarry is illustrated in the Rehabilitation Plan (Sheet 3 of 4).

The extraction operation is undertaken in phases, designated as 1, 2A, 2B, 3A, 3B and 4 as set out in the ARA Site Plans, shown on **Figure 1.2** and described in **Section 2.0**.

The AMP will remain in place until the final equilibrium lake level has been achieved, and it is demonstrated through monitoring to the satisfaction of the MNR that all of the operator's obligations set out on the Rehabilitation Plan have been appropriately implemented on site and the natural heritage features are self-sustaining.

1.6 OPERATIONS MITIGATION

Operations mitigation activities are part of planned quarry activities to manage and mitigate environmental impacts arising from the day to day quarry operation. They are based on the simple techniques that have been proven to be effective at the Existing Quarry. Examples include pumping and distributing water from the quarry to off-site locations, and maintaining and managing buffers to adjacent natural areas. These quarry management activities are an expected and ongoing process during the life of the quarry, and reflect the environmental conditions and planned operational management and mitigation measures in place at the time the aggregate licence was issued. Environmental conditions around the quarry will change over time due to natural ecological processes with or without the presence of a quarry.

1.7 AMP TIMELINES

Figure 1.3 is a schematic illustration of the major AMP components and how they relate to each other over time. This is a generalized 'big picture' view to show the main areas of overlap and interaction. Additional details on the duration and frequency of each of the specific monitoring components are presented in **Sections 3.0** through **6.0**. As shown on **Figure 1.3**, monitoring programs are coordinated with quarry phases and management actions.

1.8 REPORTING

1.8.1 Annual AMP Summary Reports

A consolidated summary report documenting the observations from each of the monitoring programs (see **Sections 3.0** through **6.0**) will be prepared each year to cover the period of January 1 to December 31, and will generally include:

- Integration of information in a comprehensive annual report with respect to the operations of the Expansion Quarry;
- Documentation of monitoring and results;
- Comparison of monitoring results to performance indicator triggers;
- Documentation of mitigation undertaken and the results of that mitigation;
- Documentation of investigations into environmental changes that were not related to the effects of the Expansion Quarry;
- Recommendations for modifying performance indicator triggers and/or mitigation as, and if, required;
- Recommendations for modifying the Adaptive Management Plan, if warranted; and
- A summary of the overall state of the environment (water resources, associated natural heritage features and environmental enhancements) surrounding the Expansion Quarry.

The details of the reporting required for each of the monitoring programs are provided in **Appendix C**.

The Annual AMP Summary Report will be submitted to MNR with copies provided to MOE, Conservation Authorities, the Township of Clearview and will be posted on Walker Aggregates' website by April 30 of each year.

1.8.2 5-Year Comprehensive Review Report

A 5-Year Comprehensive Review Report will be completed on a five year cycle, and will include:

- A comparison of monitoring results with model predictions;
- Updates and recalibrations of the groundwater model;
- Updated impact predictions; and
- Recommendations regarding the effectiveness of specific performance indicator triggers, monitoring results, mitigation measures and quarry operations.

The 5-Year Comprehensive Review Report will be submitted to MNR with copies provided to MOE, Conservation Authorities, and Township of Clearview and will be posted on Walker Aggregates' website by September 30 of each reporting year for which a 5-Year Comprehensive Review Report is required.

A 5-Year Comprehensive Review will be conducted at the end of each phase of the Expansion Quarry, in which case the next review would occur 5 years later.

1.8.3 Updating the Adaptive Management Plan

As noted previously, the AMP and the associated quarry operations are subject to review, update and modification, as appropriate, during the active life of the quarry through to final rehabilitation. Updates may occur:

- After completion of an investigation under the Performance Indicator Trigger Monitoring (if recommended);
- When an update is recommended in an annual AMP Summary Report based on the long term trend monitoring; and
- After completion of a 5-Year Comprehensive Review Report.

The AMP updates will be submitted to and approved by MNR following consultation with agencies, such as the MOE, the Conservation Authorities and the Township. These updates will be posted on Walker Aggregates' website within 5 business days of MNR approval.

1.8.4 Operations Improvement Workshop

As part of its commitment to working with the community, Walker Aggregates will hold an Annual Operations Improvement Workshop for neighbours and other interested stakeholders. The Annual AMP Summary Report and/or the 5-Year Comprehensive Review Report will be an agenda item at the annual workshops.

1.9 INTEGRATION WITH MAQ HIGHLAND QUARRY

The Expansion Quarry and the MAQ Highland Quarry operations are located adjacent to each other. The individual AMPs include areas of monitoring and compliance overlap. There is a legal agreement (the Agreement) between the two operators (**Appendix D**) specifying how monitoring data shall be collected and shared, including a dispute resolution mechanism with respect to any future impacts from the quarry operations. Operators of both quarries have access to the expanded monitoring database for incorporation into their respective annual evaluation and reporting of monitoring results. Agencies and the public will also have access to this expanded monitoring database.

In the Agreement, both operators are committed to a protocol for the investigation and resolution of individual water well interference complaints and non-compliance with AMP targets in the event that any occur in the future. The Agreement does not change Walker Aggregates' obligations under the Site Plans, licence, or AMP, all of which remain in effect regardless of whether the MAQ Highland Quarry operates or not.

2.0 Quarry Environment, Operations, Phasing, Impacts and Mitigation

This section of the AMP provides a general description of the quarry environment, operations, potential impacts, and the routine management measures and contingency mitigation measures that can be used to protect local water resources and associated natural heritage features and functions.

2.1 QUARRY ENVIRONMENT

Technical studies that were undertaken in support of the ARA application for the Expansion Quarry include ecological inventories as set out in the 'Consolidated Natural Environment Report' (Stantec, 2010). The results of those inventories represent baseline ecological conditions for the environment surrounding the Expansion Quarry. For the purposes of this AMP, the environment surrounding the Expansion Quarry has been divided into two areas: the 'Expansion Quarry Environment' and the 'Duntroon Regional Environment'.

The Expansion Quarry Environment includes the ecological features and functions identified for protection through this AMP, and is shown on **Figure 1.2**. It includes the terrestrial features within 120 m of the approved extraction area, plus aquatic or wetland features that, despite being more than 120 m away from the approved extraction area, have a potential physical linkage to the quarry by virtue of stream flow or karst topography. Examples include the adjacent forests and wetlands as well as downstream fish habitat and Escarpment springs linked to karst basins that potentially may be affected by quarry operations. The features and functions within the Expansion Quarry Environment are described in the baseline information and are the focus of the LTTEM program.

The Duntroon Regional Environment is shown on **Figure 2.1**, which is a representative area of the landscape identified for the purposes of this AMP. The Duntroon Regional Environment is that part of the landscape that shares similar ecological and climatic conditions with the Expansion Quarry Environment but is generally outside the direct influence of the Expansion Quarry. Examples of the Duntroon Regional Environment include fish habitat that is well downstream of the quarry, and general forest patterns in the Escarpment landscape.

2.1.1 Beaver River Tributaries

The Beaver River Tributary North is an intermittent system that does not provide productive fish habitat in the vicinity of the approved Expansion Quarry property and fish monitoring is not required in this tributary. The Beaver River Tributary South was determined to provide fish habitat immediately downstream (west) of Grey County Road 31. Flows to the Beaver River north and south tributary systems are continued through maintenance of wetland hydrology and associated discharge flow from Rob Roy Swamp PSW Complex units RR 2 and RR 6 respectively, including the pumping of excess quarry water during quarry operation and by

rehabilitation lake overflow (Expansion Quarry and Existing Quarry respectively) after quarry closure.

2.1.2 Below Escarpment Tributaries – Pretty River and Bateaux Creek Tributary Systems

The lands between the quarry extraction area and the brow of the Escarpment continue to receive direct precipitation that contributes a substantial part of the recharge to the groundwater system in the dolostone aquifer (Karst Solutions and Worthington Groundwater, 2007). The dolostone aquifer sustains local water supplies at residential wells and the seasonal flows at the Escarpment springs. This will continue throughout the extraction period and through to final rehabilitation.

Tributaries of the Pretty River that arise from springs below the Escarpment brow support Brook Trout fisheries within 300 m to 500 m of their emergence (i.e. approximately 1300 m to 1500 m northeast of the approved Expansion Quarry extraction area). A constructed pond occurs between some of the springs and the Brook Trout habitat in the Pretty River system.

Tributaries of the Batteaux Creek that arise from springs below the Escarpment brow also support Brook Trout fisheries within approximately 1 km of their emergence (i.e. approximately 1800 m to 2000 m southeast of the approved Expansion Quarry extraction area). Constructed online ponds and a golf course occur between the springs and the main areas of known Brook Trout habitat. Spatial separation and the presence of online ponds, including water withdrawals for irrigation occurring from the Batteaux Creek on-line ponds at the golf course, limit any potential impact of minor changes to flows from these springs on downstream fish habitat arising from the quarry.

2.1.3 Wetlands

The wetland units that could potentially be affected by the quarry expansion, and that are protected through this AMP, are shown on **Figure 1.2**. These features are briefly described in **Table 2.1**.

Table 2.1: Wetland Features, Functions, and Protection

Wetland Feature	Major Functions	Protection
Rob Roy Swamp Wetland Complex – Units RR1 through RR6	- Amphibian breeding habitat - Hydrologic inputs to Beaver River Tributaries - General wetland habitat	- Maintain vernal breeding pools - Monitor and manage surface runoff into and out of wetlands - Monitor and manage runoff from wetlands - Manage wetland water levels and monitor vegetation

Table 2.1: Wetland Features, Functions, and Protection

Wetland Feature	Major Functions	Protection
ANSI wetlands A and B	- Amphibian breeding habitat - Hydrologic inputs to Batteaux Creek Tributaries - General wetland habitat	- Maintain vernal breeding pools - Monitor and manage surface runoff into and out of wetlands - Manage wetland water levels and monitor vegetation

The wetlands are protected by retention of the majority of the catchment areas, such that nearby wetland features will continue to receive direct precipitation, as well as snowmelt and storm-event surface runoff from the lands to the north and east, and in the case of Rob Roy Swamp Wetland Complex unit RR 2 wetland from the American Hart's-tongue Fern and Butternut protection areas to the south.

During operations, controlled and monitored discharge of quarry waters will maintain wetland hydrology. Maintenance of the hydrology of these wetlands also helps support seasonal stream flow in downstream areas.

2.1.4 Species of Conservation Concern

At the time of quarry expansion approval, 27 retainable butternut trees were identified. The location of these representatives of an Endangered Species was set aside as Quarry Phase 3B. These trees, and their habitat, are protected under the *Endangered Species Act, 2007*, and no quarry activity will occur in Phase 3B unless the trees can be removed in compliance with the *Endangered Species Act, 2007,* as set out on the ARA Site Plan.

At the time of quarry expansion approval, Colony 1 of American Hart's-tongue Fern was identified as a feature to be protected. A forested buffer of a minimum of 100 m between quarry extraction and Colony 1 has been established. Habitat conditions are being monitored at Colony 1 to ensure the forested buffer is effectively protecting the conditions that allow American Hart's-tongue Fern to survive in this location.

2.1.5 Woodlands

The quarry expansion is located in a well forested landscape that includes a large contiguous woodland. This contiguous woodland supports interior forest habitat, species that prefer large connected forest blocks and landscape linkages. The expansion requires the removal of approximately 26.7 ha of woodland. In order to avoid reducing the ecological functions of the large contiguous woodland, approximately 52 ha of woodland will have been replanted beyond the extraction area and a further 8 ha will be established through progressive and final rehabilitation. The Woodland Program in **Section 6.3** includes measures to ensure large connected blocks of woodland habitat with a high diversity of ecological niches and functions.

2.1.6 Domestic Water Well Supplies

There are several private domestic water wells located around the periphery of the predicted drawdown zone of influence of the Expansion Quarry, as documented in Jagger Hims (2007a). Locations of groundwater supply wells are identified on **Figure 3.1**, and a summary of the well information is provided in **Table 2.2** (**Appendix B**). Protection and monitoring of these water supplies is regulated by the Ministry of Environment under the *Ontario Water Resources Act*, through the Permit To Take Water program. The water wells are also monitored in the AMP under the Long Term Trend Groundwater and Surface Water Monitoring Program.

2.2 OPERATIONS PHASING

Table 2.3 is a summary of the expected timing for extraction in each Phase (the phases are presented in the order determined by the Joint Board decision). The phasing is detailed on the Site Plan 2B of 4 Operational Plan, and is illustrated on **Figure 1.2** and **Figure 1.3**.

Table 2.3: Summary of Expected Timing for Extraction by Phase

Phase (ha)	Floor Elevation (m asl)	Resource Tonnage Available (million tonnes)	Extraction Period[1] (years)
1 (13.05)	500	8.4	5.6
2A (13.98)	500	7.6	5.0
2B (12.55)	500	6.4	4.3
3A (15.72)	500	7.8	5.2
3B (3.19)	500	1.7	1.2
4 (23.6)	490	6.4	4.3
--	**Total:**	**38.3**	**25.5**

NOTES:
[1] Extraction period based on 1.5 million tonnes / year extraction rate. This is a projected average and actual volumes could be more or less; changes in annual volumes do not require amendments to the AMP.
[2] Phase 4 refers to the final deepening of Phase 1, the southern section of Phase 2B and the southeastern section of Phase 3A which will occur in conjunction with Phase 3A extraction operations.

2.2.1 Phase 1

Description of Operations

- Extraction starts with an open-cut or tunnel from the Existing Quarry to the southwest corner of Phase 1 down to the quarry floor elevation of 500 metres above sea level (m asl).
- Extraction moves outward in a quasi-radial pattern from the southwest corner to the north and east.

Potential Impacts

Given the extraction that has occurred in the Existing Quarry, extraction in Phase 1 of the Expansion Quarry is not expected to result in any negative impacts to off-site water resources and/or ecological features and functions.

Monitoring and Mitigation

The response of the natural environment system will be monitored by means of the groundwater, surface water and wetland monitoring network, and results compared to predictions.

The Woodland Program discussed in **Section 6.2** will commence no later than 3 years after the ARA Licence for the Expansion Quarry has been issued in order to mitigate the impacts of woodland removal associated with later phases.

2.2.2 Phase 2A

Description of Operations

- Extraction starts around the southern limit of Phase 2A, as a northerly and easterly continuation of Phase 1;
- Extraction moves from south to north across the full width of the phase down to the final quarry floor elevation of 500 m asl.

Potential Impacts

Existing data and modeling indicate that extraction in Phase 2A is unlikely to have any negative impact on flow and temperature conditions at Escarpment springs. Similarly, residential water well and/or spring supplies that exist between the extraction area and the Escarpment are not expected to be affected. However, since a low theoretical risk of affecting these functions in the future cannot be ruled out, monitoring and contingency plans are in place.

The following impacts are predicted during Phase 2A:

- Extraction in Phase 2A will remove part of the surface water runoff catchment area for ANSI wetland areas A and B and for Rob Roy Swamp PSW Complex unit RR 2, and there may be a corresponding reduction in the surface water recharge component to those features and the downstream wetland units RR 3 and RR 4 sequence to the west of unit RR 2.
- Some downward vertical leakage out through the soils in the base of the RR 2 and ANSI wetland A and B wetland features due to the lowering of groundwater levels in the underlying bedrock as a result of quarry dewatering activities.
- There is a possibility that the seasonal groundwater spring discharge condition that feeds the small intermittent pond in the southeast corner of RR 3 may also be affected by reductions in groundwater levels associated with quarry dewatering.

- All wetland features will continue to receive direct precipitation, as well as snowmelt and storm-event surface runoff from the lands to the north and east, and in the case of RR 2 wetland from the American Hart's-tongue Fern and Butternut protection areas to the south.
- Extraction in the northeast section of Phase 2A will remove the existing dug farm pond, designated Millar Pond. The pond is to be relocated to an area outside the limit of extraction. General Note 23 on the Site Plans sets out the conditions for removal of the existing Millar Pond. Details for the replacement feature are provided in **Section 6.4**.

Monitoring and Mitigation

As extraction progresses northward, the northeastern quarry face will be inspected for the presence of potentially problematic water-bearing fractures / bedding planes or karst features. Particular attention will be paid to potential offsite water related impacts as the extraction face approaches the ANSI wetland areas, and as the eastern face approaches the limit of extraction.

The discharge of quarry water as part of routine water management activities will mitigate the loss of runoff from extraction areas and any increase in water infiltration/leakage from wetlands caused by groundwater changes during extraction.

Contingency mitigation measures, in accordance with the PITM program, are also available in the event routine water management activities are insufficient.

Ecological functions of the springs, including downstream fisheries support, will be monitored as described in the PITM and Long Term Trend Ecological Monitoring (LTTEM) programs.

Residential water supplies will be monitored under the LTTWM program. The protection of water supplies is required by the Permit To Take Water.

2.2.3 Phase 2B

Description of Operations

- Extraction in Phase 2B will only occur when stipulated conditions with respect to the status of the Woodland Program are achieved [see Site Plans (MHBC, 2012), Operational Plan Note19];
- Extraction in Phase 2B will commence in the south, as a westerly extension of Phase 1, and will move northward through the phase down to an elevation of 500 m asl.

Potential Impacts

Extraction in Phase 2B will remove the existing woodland that is present in this phase.

Extraction in the south west part of Phase 2B may impact the surface water flows at the spring in the south west corner of the Expansion Quarry (SW2A) and the associated flow beneath CR91 into RR 6.

Extraction in the northern part of Phase 2B will remove part of the surface water runoff catchment area for ANSI wetland areas A and B and for Rob Roy Swamp PSW Complex unit RR 2, and there may be a corresponding reduction in the surface water recharge component to those features.

There will be some downward vertical leakage out through the soils in the base of the wetland features due to the lowering of groundwater levels in the underlying bedrock as a result of quarry dewatering activities. There is also the possibility that lowering ground water levels will reduce the seasonal groundwater spring discharge condition that feeds the small intermittent pond in the southeast corner of RR 3.

The Rob Roy Swamp PSW Complex unit RR 2 feature is the upstream unit of the RR 3 and RR 4 wetland sequence to the west, and there is some potential that changes to the ground and surface water regime in unit RR 2 may reduce surface flow from Rob Roy Swamp PSW Complex unit RR 2 into RR 3.

Existing data and modeling indicate that extraction in Phase 2B is unlikely to have any negative impact on flow and temperature conditions at Escarpment springs. Similarly, residential water well and/or spring supplies that exist between the extraction area and the Escarpment are not expected to be affected. However, since a low theoretical risk of affecting these functions in the future cannot be ruled out, monitoring and contingency plans are in place.

Monitoring and Mitigation

The Woodland Program commenced during Phase 1 will continue to mature and mitigate the removal of woodland associated with Phase 2B.

Extraction in Phase 2B will only occur when stipulated conditions with respect to the status of the Woodland Program are achieved [see Site Plans (MHBC, 2012), Operational Plan Note 19]. This program will mitigate the impacts of tree removal in Phase 2B and later phases.

Monitoring of Colony 1 of the AHTF will commence two years prior to the expected start of Phase 2B before any alteration to the forested buffer surrounding Colony 1 of the AHTF.

Monitoring and mitigation of water resources and water dependent natural heritage features commenced during Phase 2A will continue. In addition, quarry water may be discharged in the vicinity of SW2A in order to mitigate potential reduced flows to RR 6 from SW2A.

2.2.4 Phase 3A

Description of Operations

- Extraction moves westward from Phase 2B through the southern section of Phase 3A, and then northward to the northern limit of extraction. The quarry floor final elevation in Phase 3A is 500 m asl.

Potential Impacts

- Extraction in Phase 3A will remove the existing woodland that is present in this phase.
- Extraction in the southern part of Phase 3A is expected to affect the flows at the groundwater spring in the southwest corner of the Expansion Quarry property that sustain the flows in the surface water channel to the south at SW2. Ultimately, in the absence of mitigation, flows at the groundwater spring and at SW2 are expected to cease, with the exception of localized snowmelt in the Spring and surface runoff during storm events.

Extraction in the northern part of Phase 3A will remove part of the surface water runoff catchment area for Rob Roy Swamp PSW Complex unit RR 2, and there may be a reduction in the surface water recharge component to that feature and downstream wetland features.

There will be some downward vertical leakage out through the soils in the base of the wetland features due to the further lowering of groundwater levels in the underlying bedrock as a result of quarry dewatering activities.

Existing data and modeling indicate that extraction in Phase 3A is unlikely to have any negative impact on flow and temperature conditions at Escarpment springs. Similarly, residential water well and/or spring supplies that exist between the extraction area and the Escarpment are not expected to be affected. However, since a low theoretical risk of affecting these functions in the future cannot be ruled out, monitoring and contingency plans are in place.

Monitoring and Mitigation

The Woodland Program commenced during Phase 1 will continue to mature and mitigate the removal of woodland associated with Phase 3A.

Monitoring and mitigation of water resources and water dependent natural heritage features and/or functions associated with Phase 2B will continue.

2.2.5 Phase 3B

Description of Operations

- Phase 3B is the habitat and buffer area for the Butternut trees (2013 status Endangered). Site alteration and/or extraction of the rock resource within this area can only proceed when specific criteria have been met, as laid out on the Site Plans Operational Plan Note 21.
- If the requirements of the Site Plans Operational Note 21 are satisfied, then extraction may occur within all or a portion of the Phase. Extraction will remove the rock resource down to the final quarry floor elevation of 500 m asl.

Potential Impacts

Extraction of Phase 3B will remove the butternut trees and their associated habitat and buffer area, in accordance with Site Plan Operational Note 21.

Extraction in Phase 3B will remove part of the surface water runoff catchment area for Rob Roy Swamp PSW Complex Unit RR 2, and there may be a reduction in the surface water recharge component to that feature and downstream wetland features.

There will be some downward vertical leakage out through the soils in the base of the wetland features due to the further lowering of groundwater levels in the underlying bedrock as a result of quarry dewatering activities.

Existing data and modeling indicate that extraction in Phase 3B is unlikely to have any negative impact on flow and temperature conditions at Escarpment springs. Similarly, residential water well and/or spring supplies that exist between the extraction area and the Escarpment are not expected to be affected. However, since a low theoretical risk of affecting these functions in the future cannot be ruled out, monitoring and contingency plans are in place.

Monitoring and Mitigation

The Woodland Program commenced during Phase 1, which includes plantings of butternut trees, will continue to develop and mitigate the removal of woodland associated with Phase 3B. If the butternut trees in Phase 3B are protected under the *Endangered Species Act, 2007* at the time of their removal, compensatory plantings in accordance with the provisions of the ESA, 2007 will be provided (if required).

Monitoring and mitigation of water resources and water dependent resources associated with Phase 3A will continue.

2.2.6 Phase 4

Description of Operations

- Phase 4 is the final phase of quarrying with extraction commencing toward the latter stages of Phases 3A and/or 3B.
- Phase 4 involves extraction of the rock resource from 500 m asl down to the final-floor elevation of 490 m asl in the area beneath Phase 1, the southern half of Phase 2B and the southeast quadrant of Phase 3A.

Potential Impacts

Extraction in Phase 4 may extend slightly the overall magnitude and the lateral extent of the groundwater drawdown zone in the bedrock around the periphery of the quarry. This may result in a slight increase in the downward vertical leakage through the base of the adjacent wetland features.

Existing data and modeling indicate that extraction in Phase 4 is unlikely to have any negative impact on flow and temperature conditions at Escarpment springs. Similarly, residential water well and/or spring supplies that exist between the extraction area and the Escarpment are not

expected to be affected. However, since a low theoretical risk of affecting these functions in the future cannot be ruled out, monitoring and contingency plans are in place.

Monitoring and Mitigation

Monitoring and mitigation of water resources and water dependent resources associated with Phase 3A/3B will continue.

Progressive and Final Rehabilitation

The annual average final lake level elevation in the Expansion Quarry is predicted to be 511.9 m asl, based on the computer modeling that has been undertaken. This target lake level is sufficient to provide seasonal (spring) discharge to the Rob Roy Swamp PSW Complex unit RR 2, and subsequently by overflow into RR 3, and to ANSI wetland A and ANSI wetland B. The water management mitigation activities, water and ecological monitoring programs and contingency mitigation measures indicated above will continue through the final rehabilitation lake-filling period.

After creation of the final quarry slopes as specified in the Rehabilitation Plan (Sheet 3 of 4 Site Plans) the 2:1 slopes above 513 m asl will be planted with native tree species (Rehabilitation Plan Note 4) as shown on the Typical Planting Block Detail. The slopes below 513 m asl will have fish habitat enhancement features installed as shown on the Rehabilitated Side Slope Detail (Sheet 3 of 4 Site Plans).

An extended shallow near shore zone including islands and a meadow marsh will be created in the northwest corner of the rehabilitated quarry as shown on the Rehabilitation Plan and Conceptual Island Rehabilitation Detail (Sheet 3 of 4 Site Plans).

2.3 ROUTINE WATER MANAGEMENT MITIGATION MEASURES

In addition to the Site Plans and this AMP, routine water management and mitigation will be regulated by approvals pursuant to the *Ontario Water Resources Act and the Environmental Protection Act*. To the extent possible, the requirements of approvals under the *Ontario Water Resources Act* and the *Environmental Protection Act* will be integrated into the AMP.

The design objectives are to be based on release of the required volumes of water to the landscape in the vicinity of the wetlands without negatively affecting the surrounding environment. Initially, discharge volumes to the Beaver River watershed (North and/or South tributaries) and to the Batteaux Creek watershed will be based proportionately on the respective sizes of the surface drainage catchment areas extracted in each phase (see **Appendix F** for details).

The proportionate discharge to each wetland feature / watershed will be adjusted, if necessary, based on the results of the AMP Performance Indicator Trigger Monitoring Program (see

Section 3.0 for details). Discharge into the wetlands will be managed by adjusting pumping rates and/or by means of flow restrictor valving in discharge lines, as required. Discharge into individual wetlands will be adjusted as necessary to maintain target hydrographs in each wetland / watercourse.

Routine water management activities are fully expected to maintain quarry operations in compliance with the AMP trigger criteria, and protect the surrounding natural environment and water resources.

Routine operation water management measures that will be implemented progressively during the operational and lake filling stages of the quarry include:

- Discharging quarry water from one or more dewatering sumps in the Expansion Quarry and/or from the storage reservoir in the Existing Quarry into the wetlands adjacent to the northern limit of extraction. Discharge will occur to Rob Roy Swamp PSW Complex unit RR 2 (and thereby to RR 3 and RR4), and ANSI wetland A and B features to maintain wetland hydroperiod, vernal pooling, and general soil moisture conditions in the wetlands.
- Discharging quarry water into the karst bedrock infiltration area located to the east of Phase 2A and east of surface water monitoring station SW9 (between the quarry extraction area and the brow of Escarpment) to recharge the dolostone aquifer and support springs located below the brow of the Escarpment.
- Discharging quarry water into the SW2A watercourse located in the southwest corner of Phase 3A to maintain seasonal soil moisture conditions in the Rob Roy Swamp PSW Complex unit RR 6. Once rehabilitation of the Existing Quarry is complete, discharge at SW2A will no longer be required. However, Site Plan Natural Environment Note 1 requires that the Beaver River fish habitat enhancement program (described in **Section 6.0**) be implemented prior to cessation of pumping from the sump in Phase 3A to the surface water course at station SW2A.

The approximate locations of these discharge points are shown on **Figure 2.2** and on the Site Plans.

Response times for the karst infiltration area have been tested by Buck & Worthington using tracer testing (Karst Solutions and Worthington Groundwater, 2007).

Designs

Discharge to the wetlands and the karst infiltration area is to be accomplished through surface or shallow subsurface release of water over a broad front to simulate runoff and diffuse seepage processes.

The design objectives are to be based on release of the required volumes of water to the landscape in the vicinity of the wetlands without negatively affecting the surrounding environment. Discharge volumes will be based *pro rata* on the various catchment areas

extracted in each phase; however, the actual distribution of water may be adjusted based on the results of the monitoring programs.

Discharge to the spring at SW2A will be simple pumping of sediment-free water through a rock-filled stilling basin. High-flow volumes due to snow-melt and storm run-off may be reduced, but other seasonal contributions will be maintained in accordance with the PITM. The discharge water from the quarry will well-up out of the stilling basin and flow through the existing channel similar to pre-quarry conditions.

The site specific design of discharge structures will be approved in accordance with ARA Site Plan Hydrogeology Note 7E:

> *"Prior to the construction of any Mitigation measure or contingency mitigation measure outside the limits of extraction, its design shall be approved by the MNR, and included in the AMP unless the design of the measure has been approved pursuant to a permit issued under another statute such as the Ontario Water Resources Act (E.G. Permit To Take Water, Certificate of Approval)."*

It is noted that the Certificate of Approval is now designated Environmental Compliance Approval, and is regulated under the *Environmental Protection Act*.

In the event that a mitigation measure to be developed outside of the limits of extraction has not been approved under another statute, the design shall be approved by MNR before being incorporated into the AMP. The design of a mitigation measure approved under the *Ontario Water Resources Act, Environmental Protection Act*, or another statute may be included in the AMP without MNR approving the design.

The objective is to ensure that any potentially required water management or mitigation measures are 'ready-to-go' prior to such measures being needed. Mitigation measures are not expected to be required in Phase 1, which will take approximately six years to extract. Design for routine water management mitigation measures required in Phase 2A will be completed during Phase 1. Once final design is approved in accordance with Hydrogeology Note 7E, the design will be incorporated into **Appendix F**.

In the event that the routine water management activities described above do not fully achieve the AMP objectives, contingency mitigation measures will be implemented.

2.4 CONTINGENCY MITIGATION MEASURES

Contingency mitigation measures are available to be implemented by Walker Aggregates when, and if, the AMP monitoring indicates such measures are necessary. ARA Site Plan Hydrogeology Note 7E, as stated in **Section 2.3**, also applies to the design of contingency mitigation measures located outside the area of extraction. In accordance with that Site Plan

Note, following approval of final designs, they shall be incorporated into **Appendix F** of the AMP.

2.4.1 During Operations

Should they be necessary, contingency measures that are available to the operator to mitigate occurrences of excessive inflows to the quarry include the following:

- An earthen buttress could be constructed (using on-site soils and/or wash pond fines) against the final quarry wall where a karst feature capable of conveying large volumes of water is identified during operations, possibly in combination with a water storage pond (similar to the pond in the Existing Quarry) to act as a hydraulic barrier to control the inflow and reduce recirculation of quarry discharge water.
- Temporary grouting techniques could be utilized locally, if required, to reduce the hydraulic conductivity of the rock in the area of a karst feature to control the influx of water to the quarry. Once extraction is completed, if deemed appropriate, any grouted area around the limit of extraction would be drilled and blasted to re-fracture the rock mass to develop water movement out of the final lake through the grouted section of the quarry wall. Grouting and temporary interruption to the inflow of water to the Expansion Quarry shall be temporary, and shall not alter direction of groundwater movement once extraction is complete.
- A combination of the two methods noted above could also be used to achieve the desired control of water influx to the quarry.

Additional contingency mitigation measures that are available, if required, include:

- Use of deeper, cooler water from quarry sump or storage reservoir for discharge from the quarry if water temperature is a concern at Escarpment springs;
- Modifying the outflow characteristics of surface water from a wetland feature to maintain vernal pooling / hydroperiod and/or general soil moisture conditions;
- Direct discharge of excess quarry water from sump or storage reservoir into accessible surface watercourses to supplement flow or reduce water temperature, if needed;
- Recharge of the dolostone bedrock using recharge injection wells to help maintain flow conditions at Escarpment springs and/or to maintain residential water supplies at downgradient locations;
- In the event that the MAQ Highland Quarry does not operate and off-site drawdown effects have to be mitigated to the west of the Expansion Quarry, recharge wells may be developed along the western property boundary;
- Deepening or replacement of residential water supplies in the event that well yields are adversely affected;
- Provision of alternate water supply such as a cistern in the event that residential well yield is adversely affected;

- Move the extraction operation to a location that is above the water table (if available) and/or away from the area of concern until conditions return to acceptable; and
- In the event that a Red Zone condition is triggered, cease extraction until conditions return to acceptable in the area of concern, or it is determined that the Expansion Quarry is not the cause of the Red Zone trigger. Other operational activities including aggregate processing and shipping may continue.

In addition to active contingency mitigation options, passive infiltration opportunities will be created during the reforestation program through the creation of variable micro-topography (i.e. low relief 'pit and mound' topography) mimicking mature forest floor conditions. These sites will be very small individually, but will amount to a substantial area of vernal pooling and enhanced infiltration spread across the entire reforested area. While not purpose-built for infiltration, these micro-sites will capture and slow runoff and enhance the potential for infiltration on the reforested lands.

As no impacts are predicted during the first 5 years of operations, no contingency mitigation measures are required at this time. Any potentially necessary contingency mitigation measures for the next 5 years of operation and subsequent 5 year periods will be designed and included in the AMP through the 5-Year Comprehensive Review process. The necessity for contingency mitigation measures will be identified based on the progress of extraction, monitoring results and the PITM program.

2.4.1.1 Recharge Injection Well System Testing and Design

A recharge injection well system will be developed and constructed in accordance with the PITM program if monitoring results indicate that such contingency mitigation may be necessary.

Generalized locations for recharge injection wells are shown on **Figure 2.2**, and also on the Site Plans. On-site testing of a recharge well on the former Bridson property (east of Phase 2A) was completed prior to licence approval and demonstrated the ability to recharge the dolostone bedrock and positively influence the local groundwater system. Based on those results, it is expected that a line or lines of recharge injection wells likely would be required to achieve effective recharge within specific areas should it be necessary. To limit disturbance to existing natural features, the locations identified on **Figure 2.2** are in areas which are currently not forested, but which are to be reforested during Phase 1 operations.

Four dual-purpose groundwater monitoring wells and potential recharge injection wells will be constructed within two years of commencing extraction operations, in the locations shown on **Figure 2.2**.

These dual purpose wells will be tested to the satisfaction of MNR in consultation with the NVCA to confirm the effectiveness of the wells, and provide more detailed information about the time it will take for downstream water features (escarpment springs) to respond after injection

begins. In the event that response times are determined to be inadequate, a groundwater monitoring system and associated PITM program triggers will be developed.

The testing program for the dual purpose wells will provide sufficient site-specific detailed information to design a contingency recharge injection well system that is to be ready for construction in the event that future monitoring data and/or groundwater modeling indicate that a recharge system is likely to be required.

2.4.2 Rehabilitation Lake Filling Phase

Seasonal water discharge out of the rehabilitation lake into the Rob Roy Swamp PSW Complex unit RR 2 and ANSI wetland A / ANSI wetland B is to be proportional to the catchment areas of each wetland that was extracted. Passive discharge from the lake will be by means of broad-crested weirs that shall be sized to achieve an overall distribution ratio of 60:40 to RR2 Wetland (Beaver River North tributary) and ANSI Wetland A / ANSI Wetland B (Batteaux Creek tributary), respectively. A functional design concept for a typical broad-crested weir discharge structure from the quarry lake to the wetlands is provided in **Appendix K**.

Final design of the discharge structures shall be completed once extraction around the northern perimeter of Phase 2A, 2B and 3B is complete and the final rock surface is exposed. Final designs shall be field-fitted to reflect the actual conditions present at each discharge location. Final design shall be completed to the satisfaction of MNR and MOE in consultation with the GSCA and NVCA [Site Plan Operational Note 12(c)]. The approved final designs shall be incorporated into **Appendix K** and may be modified or changed as part of a 5-Year Comprehensive Review.

In order to ensure that the lake discharge function of the outlet structures is maintained into the future, the Conservation Easement that is to be on title for the property will include a positive obligation (covenant) to maintain the outlets from the quarry lake.

In the event that it is determined prior to the commencement of lake filling, through evaluation of the extensive investigative and monitoring data collected over the life of the quarry, and the associated updating / refining of the computer modeling predictions, that the predicted final lake level of 511.9 m asl may not be achieved, then the following contingency mitigation measures could be implemented to ensure the final lake level is achieved.

- An earthen buttress could be constructed against the final quarry wall (using on-site soils and/or wash pond fines), where a karst feature capable of conveying large volumes of water is identified during operations, to act as a hydraulic barrier to control the outflow from the lake.
- Localized perimeter grouting of the rock mass can also be undertaken during the later stages of the lake filling process, if necessary, to reduce the hydraulic conductivity of the rock mass and thereby achieve the desired final lake level. Reducing the hydraulic

conductivity of the rock mass at the north end of the quarry to achieve the desired lake level should not be undertaken if it will reduce the pre-quarry discharge rates to the NVCA watercourses below the escarpment.

- Should perimeter grouting be required, the feasibility of this contingency mitigation option and potential effects on Escarpment spring flows will be evaluated to the satisfaction of the MNR in consultation with NVCA prior to its implementation. If it is determined that grouting is required beyond the limit of extraction, an approved grouting plan for any grouting beyond the limit of extraction would be included in **Appendix F**.
- Additional berming can be constructed along the western perimeter of the Existing Quarry extraction area so as to increase the final lake level in the Existing Quarry. Increasing the lake level in the Existing Quarry will in turn result in a higher lake level in the Expansion Quarry.

It may be preferred to use a combination of the one or more of the methods noted above to achieve the desired final lake level.

In addition to seasonal surface water discharge out of the final lake in the Expansion Quarry, groundwater will move out of the final lake through the quarry walls. Groundwater will move eastwards from the lake to Escarpment springs / Batteaux Creek watershed, and also westwards into the Beaver River watershed. The rate of groundwater movement will vary in proportion to the area of the final quarry wall within each watershed, the then-prevailing seasonal hydraulic gradients and the hydraulic conductivity of the rock mass.

A similar situation will have already developed in the final lake in the Existing Quarry, with groundwater movement occurring out of the quarry lake eastwards to Escarpment springs / Batteaux Creek watershed, and also westwards into the Beaver River watershed.

2.5 WATER USE PRIORITY

During extraction operations, the order of priority for use of available water is as follows:

- Any and all mitigation operations, including but not limited to, discharge to wetland features, discharge to karst infiltration area, discharge to SW2, discharge to relocated Millar Pond, and recharge injection wells (if and where developed);
- Dust control and road cleaning;
- Aggregate processing operations;
- Irrigation of landscaped areas;
- Fill the existing quarry, if there is excess water available.

Water quantities to be used for quarry operations, including future mitigation activities, shall be included in future applications for Permit To Take Water and/or Environmental Compliance Approval for Discharge for the quarry, as appropriate.

During rehabilitation / lake filling operations the order of priority for use of available water is:

- Any and all mitigation operations, including but not limited to, discharge to wetland features, discharge to karst infiltration area, discharge to SW2, discharge to relocated Millar Pond, and recharge injection wells (if and where developed);
- Irrigation of landscaped areas;
- Lake filling.

This approach ensures that the first priority-use of water that accumulates in the quarry is for the protection and maintenance of off-site natural heritage features including wetlands, Escarpment springs and other surface water resources, downstream fish habitat and residential/farm water supplies.

3.0 Performance Indicator Trigger Monitoring Program

3.1 INTRODUCTION

The PITM program is the regulatory compliance component of the AMP with respect to water-related issues. The initial PITM monitoring program is described in Hydrogeology Note 6 of the Site Plans, Sheet 2B of 4, Operational Plan.

The purpose of the PITM is to monitor the effects of quarry operations on water resources with respect to levels, flows and temperature, and to initiate any actions necessary to adapt quarry operations so that the values of each of these parameters remain within their normal monthly patterns of seasonal variation. Any long term changes in prevailing climatic conditions will be incorporated into the AMP by developing statistical relationships between key AMP monitoring stations and surface water flow and temperature control stations that are to be established in the Pretty River and Batteaux Creek drainage basins. These control stations are beyond any possible influence of quarry operations or significant water users.

3.2 KEY CONCEPTS

This PITM Program provides for the monitoring of water resources that support natural heritage features. These are the features outside the limit of extraction that potentially are sensitive to fluctuations in water regimes, such as provincially significant wetlands and fisheries.

These locations are monitored so that appropriate actions may be taken to modify routine quarry operations and/or to implement contingency mitigation measures, to ensure that quarry operations do not negatively impact water resources which directly support natural heritage features, namely:

- Springs that discharge at the Niagara Escarpment east of the Expansion Quarry. These springs help to sustain surface water flow and fish habitat below the brow of the Niagara Escarpment in tributary streams of the Pretty River and Batteaux Creek;
- Surface water flows that support fish habitat in the Beaver River west of the Expansion Quarry; and
- Surface water levels and flows and groundwater levels that support wetland features and functions.

The stop-light analogy that defines Green, Yellow and Red operating zones for the key performance indicators is summarized in **Table 3.1**.

It is recognized that, in some instances, there may be factors which have no connection to quarry operations that could affect flow and/or temperature conditions at some monitoring locations, and the monitoring programs in the AMP assist in identifying cause and effect

relationships. In order to incorporate any effects that long term trends in regional climatic conditions (i.e. climate change) have on local groundwater springs and/or surface water level and flow conditions that are monitored as part of the PITM, monitoring will be conducted at the control sites in the Pretty River and the Batteaux Creek sub-watersheds as discussed below.

Table 3.1: Description of the Stop Light Operating Zones

Zone	Condition	Description
GREEN	Normal operating condition.	- Routine water management. - Natural heritage features experiencing normal seasonal variations in response to prevailing climatic conditions. - The PITM, LTTWM and LTTEM programs are being conducted as part of normal quarry operations.
YELLOW	One or more of the monitored parameter values enters the range of Yellow Early Warning Trigger Values.	- Yellow Zone represents early warning conditions that start when PITM values deviate from the expected normal monthly seasonal variation (Green Zone condition). - Yellow Zone requires notification of MNR, MOE, CAs, and the Township within 72 hours. - The Yellow Zone also requires an investigation to determine the cause. A summary report documenting the results of that investigation and, if appropriate, the mitigation measures implemented, will be submitted to MNR, MOE, CAs and the Township within 30 days of entering a Yellow Zone condition. - In the event that the deviation is caused by quarry operations, specific contingency mitigation measures are triggered and continued until the condition(s) return to the Green Zone.
RED	One or more of the monitored parameter values breaches the Red Zone Trigger Value.	- Red Zone represents a point at which there is potential for significant stress on the natural feature. - Red Zone requires notification of MNR, MOE, CAs, and the Township within 24 hours. - Red Zone requires cessations of all extraction activities within 48 hours (clearing, stripping and blasting). Processing and shipping can continue. - Specific mitigation measures required under the Yellow Zone are continued until the condition(s) return to the Green Zone. - Additional specific contingency mitigation measures beyond the Yellow Zone measures are triggered and continued until the condition(s) return to the Yellow Zone. Additional contingency mitigation measures include a step-up of one or more of the mitigation measures already implemented in the Yellow Zone, including the use of additional surface water discharge to wetlands and/or surface water courses, the use of additional recharge wells, etc. - Red Zone requires investigations to determine the cause of PITM deviation, or if such investigations are underway due to Yellow Zone, investigations are continued. A summary report to document the results of the investigations, the mitigation measures implemented and their results will be submitted to MNR, MOE, the CAs and the Township, once MNR is satisfied that one of the

Table 3.1: Description of the Stop Light Operating Zones		
Zone	**Condition**	**Description**
		conditions required for extraction to re-commence has been met, as listed below and also in Tables 3.7, 3.8 and 3.9 of Appendix B of the AMP. - Extraction activities cannot recommence until one of the following conditions are met: – conditions have returned to the Green Zone, OR – conditions have returned to the Yellow Zone and it is demonstrated to the satisfaction of the MNR that extraction operations can safely recommence, OR – it is demonstrated to the satisfaction of the MNR that the Red Zone conditions are not a result of quarry activities.

3.3 TRIGGER CRITERIA AND DECISION STEPS

Possible effects of quarrying at different locations are discussed in **Section 2.2**. Trigger criteria for various monitoring locations are summarized in **Table 3.2** and discussed in the following sections. **Figure 3.1** illustrates the surface drainage sub-catchment areas together with the locations of groundwater and surface water monitoring stations that are part of the PITM and LTTWM. The majority of monitoring locations are located on publicly-owned lands, such as municipal road rights-of-way, or on lands owned by Walker Aggregates to ensure long term access for monitoring. There are also monitoring locations on private property, related to private water supplies, access to which are subject to landowner permission.

Table 3.3 and **Table 3.4** (**Appendix B**) provide a description of the monitoring stations, the parameters to be monitored at each station, and their monitoring frequency.

3.3.1 Interim Triggers

For Phase 1 quarry operations, the potential for off-site water-related effects to any of the PSW wetlands and/or Escarpment springs is very low. Interim trigger values are based on historic monthly measurements at each monitoring location, and will be updated annually and as part of the 5-year review of the AMP.

Currently applicable interim monthly trigger values for the Green Zone (normal operating conditions), Yellow Zone (early warning trigger value) and Red Zone (cease extraction trigger value) for surface water flows and temperature are in **Table 3.5** and **Table 3.6** (**Appendix B**) respectively.

Table 3.2: Trigger Monitoring Criteria - Stream Flow, Temperature and Wetland Water Levels

Parameter	Water Flows	Water Temperature	Wetland Water Levels
Trigger Period	June through September as soon as extraction proceeds beyond Phase 1. SW1, SW2, and SW0-2 are January through December	June through September as soon as extraction proceeds beyond Phase 1. SW1, SW2, and SW0-2 are January through December	Spring and early summer (June / July) as soon as extraction proceeds beyond Phase 1
Trigger	**Interim Triggers** - Red Zone = historic lowest monthly flow recorded - Yellow Zone = Red Zone flow value increased by 15% OR the historic third lowest flow value recorded *for that month*, whichever is the higher value **Long Term Triggers** Developed based on control station relationships in streams below Escarpment. Flow at SW2A in Beaver River South Tributary system will cease at start of rehabilitation lake filling phase.	**Interim Triggers** - Red Zone = highest historic monthly temperatures measured between June & September - Yellow Zone = Red Zone temperature value reduced by 10% **Long Term Triggers** Developed based on control station relationships in streams below the Escarpment.	**Triggers** *Wetland Vegetation* - Red Zone (Too Dry) = >1 month in which the water level is below the lowest historic water level in the corresponding month's dry year hydrograph by 10%. Trigger period is spring to fall - Red Zone (Too Wet) = >1 month in which the water level is above the highest historic water level in the corresponding month's wet year hydrograph by 10%. Trigger period is spring to fall - Yellow Zone (Too Dry) = water levels are 1% to 20% higher than water levels in the Red Zone. Trigger period is spring to fall - Yellow Zone (Too Wet) = water levels are 1% to 20% lower than water levels in the Red Zone. Trigger period is spring to fall *Amphibian Habitat* - Red Zone= Breeding ponds have no standing water during short breeding period (March to 2nd week of July) - Yellow Zone = Depth of critical ponds is below 80% of historic minimum water level depth during extended breeding period (March to 2nd week of August)

3.3.1.1 Stream Flow / Escarpment Springs

For streamflow and/or flow at Escarpment Springs the Red Zone trigger level is set as the historic lowest monthly value recorded at a specific location. The Yellow Zone trigger value is calculated either by increasing the Red value by 15%, or by using the third-lowest monthly flow value over the historic period of record, whichever is the higher value (see **Table 3.5**, **Appendix B** for details).

The monthly Green Zone value is any value that is higher than the monthly Yellow Zone condition trigger value.

3.3.1.2 Water Temperature

For water temperature in streams and/or Escarpment springs, monthly trigger values are established for the months of June through September to reflect the period when warm surface water temperatures have the potential to affect sensitive fish habitat areas that are present downstream below the Escarpment brow. The Red Zone trigger values are set as the highest monthly temperature that has been recorded through the historic period of record. The Yellow Zone trigger values are set at 10% below the Red Zone trigger value. The Green Zone trigger value is anything that is below the Yellow Zone trigger value (see **Table 3.6**, **Appendix B** for details).

3.3.1.3 Wetland Water Levels

When required, wetland water levels will be managed during the active extraction phases of the quarry through to final rehabilitation by discharging quarry water into the wetlands as required to maintain the seasonal hydro-periods and surface water outflows. Discharge water quality will be regulated by approvals under the *Environmental Protection Act*. The design of the discharge facilities is shown in **Appendix F**.

Water will be pumped at rates and at times to replicate as closely as possible 'Target Hydrographs'. Target hydrographs have been established for each wetland and will be periodically refined in consultation with MNR, MOE and Conservation Authority staff using site specific data that collected on an ongoing basis.

Preliminary target hydrographs for the three major wetland types are included as **Figure 3.2**, **Figure 3.3**, and **Figure 3.4**, and include target ranges for wet, average and dry conditions.

Target hydrographs for wetlands with amphibian breeding habitat are set to ensure that adequate water is present in the habitat areas to enable successful amphibian breeding, even under dry conditions. Target Hydrographs will be refined through the Phase 1 extraction period as the monitoring database expands and with input from agency staff. Based on the annual reporting and/or during the 5-Year Review, any review agency may request / suggest adaptations to the monitoring effort. For example, it may be appropriate to increase the monitoring frequency or level of detail (such as the use of real-time data loggers) in locations

where change appears to be taking place, possibly offset by reductions in monitoring efforts in locations that appear stable.

During Phase 1 quarry operations, a reference wetland station will be established in either the Nottawasaga Lookout Provincial Park or the Pretty River Provincial Park with input from MNR and the Nottawasaga Valley Conservation Authority. The reference wetland station will be located away from any potential quarry effects, so that the prevailing local/regional climate conditions are incorporated into the evaluation of site-specific local wetland water level data. Water levels in the reference wetland station will indicate whether the regional climate is experiencing wet, average or dry conditions. This information will be updated seasonally and used to determine which of the three lines in the target hydrographs (wet, average or dry) should be applied at any given time.

The wetland target refinement process will be verified through the long term ecological monitoring of wetlands to obtain data on the trends in amphibian habitat conditions, wetland plant species diversity and percent cover, and other ecological indicators of healthy functional wetlands. Details of the Long Term Ecological Trend Monitoring Program are provided in **Section 5.0**. Ecological monitoring will be related to the water level monitoring and interpreted in conjunction with MNR, MOE and Conservation Authority staff.

3.3.2 Development of Long Term Flow Triggers

During Phase 1 quarry operations, when the likelihood of quarry-related water effects off-site is extremely low, Walker Aggregates will develop statistically valid relationships for flow and temperature conditions between specified key AMP monitoring locations and control stations in the Pretty River sub-catchment drainage basin (SW17, SW17A and SW18) and in the Batteaux Creek sub-catchment drainage basin (SW14). Through consultation and agreement with Nottawasaga Valley Conservation Authority (NVCA) staff, the control stations are to be established at the following locations:

Batteaux Creek Subwatershed (Station "BC Control")

- Surface water control station located at the north side of the road culvert on 21/22 Sideroad, Clearview Township, approximately 1350 m east of Concession 10.
  (UTM co-ordinates 563207E 4913957N NAD27)

Pretty River Subwatershed (Station "PR Control")

- Surface water control station located at the north side of the road culvert on 30/31 Sideroad, Town of Blue Mountains, approximately 390 m west of the boundary line between between Clearview Township and Town of Blue Mountains.
  (UTM co-ordinates 558052E 4918002N NAD27)

The locations of monitoring stations and control stations are shown on **Figure 3.1**. As part of the annual assessment of the surface water systems, patterns of flow and water temperature and

general chemistry at control stations and at the AMP monitoring locations are compared to patterns at existing long term regional flow gauging stations such as the Mad River station at Avening and the Pretty River station at Collingwood, as data are made available by NVCA.

The statistical relationships developed over time between the control stations and quarry monitoring locations will be used to supplement and then replace the initial interim targets that are based on the historic monthly monitoring database. The methodology to establish the long term triggers based on control station relationships will be established through the first 5-year review of the AMP (see **Section 1.8.2**).

3.3.3 Decision Steps

Table 3.7, **Table 3.8**, and **Table 3.9** (**Appendix B**) summarize the trigger decision steps stream/Escarpment Spring flow, stream/Escarpment Spring temperature, and wetland water levels.

3.4 RECORD KEEPING AND DATA REPORTING

Section 1.8 Reporting provides details of the schedule for the AMP reporting.

A detailed record of all monitoring events and field measurements will be maintained in a dedicated field book, and results will undergo QA/QC against previous data before entry into the monitoring database for the quarry. Any potentially anomalous results will be investigated immediately, and re-measured in the field for verification, if necessary. The reasons for any anomalous results and steps taken to prevent future anomalies, if required, will be reported on Walker Aggregates' website.

Once the monitoring results have undergone the internal QA/QC process, results will be posted to the Walker Aggregates website. The results for the current monitoring event will be available on the website no later than seven days following the event, excluding any laboratory chemistry data which will be posted within 2 business days of receipt from the laboratory. Any potentially anomalous results will be identified as such, and the investigation/verification process documented.

Results pertaining to compliance aspects with respect to the PITM program will be compiled into a tabular format summary report that identifies any non-compliance concerns, and will be posted to the website on a monthly basis.

The reporting timelines will be reviewed as part of the Annual AMP Summary Report and the 5-Year Comprehensive Review Report.

4.0 Long Term Trend Groundwater and Surface Water Monitoring Program

4.1 INTRODUCTION

This section describes the Long Term Trend Groundwater and Surface Water Monitoring (LTTWM) program component of the AMP.

LTTWM programs are ongoing for the Existing Quarry operation and for the Expansion Quarry property, and similar programs will continue through the active life of both quarries through to their final rehabilitation as lakes.

Long term trend monitoring is used to track seasonal and year-over-year natural variations in the groundwater and surface water systems, as well as the progressive response of those systems as the Existing Quarry winds down and the Expansion Quarry extraction operation starts, and then continues over the next 20 to 30 years, followed by several decades of rehabilitation to lakes. The LTTWM program will provide data that will update the environmental baseline conditions as new data become available, and identify short-term and long term climate trends.

4.2 MONITORING REQUIREMENTS

Figure 3.1 illustrates the surface water drainage divides and local catchment areas for the Pretty River, Batteaux Creek, Beaver River and the Mad River systems. The map also shows the locations of groundwater and surface water monitoring stations that are part of the LTTWM and PITM programs. The surface water and groundwater monitoring stations that are included in the PITM program (**Section 3.0**) are integral to this LTTWM Program as well, such that monitoring results from those stations are incorporated into the assessment of long term trends.

The LTTWM program is set out on **Table 4.1** through **Table 4.3** (**Appendix B**), and is described on the Site Plan in Hydrogeology Note 6, Operational Plan, Sheet 2B of 4 (MHBC, 2012).

As extraction in Phase 1 extends outward from the initial tunnel/open cut, and drawdown effects are observed at the internal monitors, dataloggers will be installed in additional monitors located in Phase 2 and Phase 3 in preparation for future extraction in those areas. The dataloggers in the Phase 1 monitors will be removed from their locations as the extraction face approaches since they will no longer provide useful information with respect to drawdown effects in Phase 1, and they will be re-used at other locations.

The scope and monitoring frequency of the LTTWM program will be reviewed as part of the annual report and/or as part of the 5-year review of the AMP. Any recommended changes to the program will be subject to approval by MNR.

The instrumentation used for the Water LTTM program shall reflect contemporary industry standards for this type of work, and is listed in **Appendix G**.

4.2.1 Climate Data

4.2.1.1 Long Term Normals

Climate data that are used as part of hydrogeologic studies generally are obtained from an operational climate station with at least 30 years of data located in close proximity to the subject area. Environment Canada routinely publishes 30 Year Normals (or averages) for active climate stations with at least 30 years of climate data. The 30 Year Normal data are used as a historical baseline against which recent climate data are compared to determine if a particular year or month is wetter or drier than normal. The information is also used in the assessment of future conditions and impacts that may occur as a result of changes in land use.

Previous reports utilized Environment Canada climate stations at Thornbury Slama, Ruskview and Shanty Bay. Thornbury Slama was closed in 2005 and Ruskview was closed in 2006. **Table 4.4** provides the 30 Year Normal water budget climate data for Thornbury Slama and **Table 4.5** provides the Shanty Bay climate data for 2010 (both **Appendix B**). **Table 4.1** provides a graphical plot of this climate data (**Appendix B**).

4.2.1.2 Local Climatic Conditions

In 2008, Walker Aggregates established, and will maintain, an automatic weather station (the Walker station) in the vicinity of the Existing Quarry which provides the following local climate data:

- Precipitation (rain and snow equivalent and intensity);
- Total temperature;
- Wind speed and direction;
- Relative humidity; and
- Barometric pressure.

The information from the Walker station is used to compile local, daily, monthly and yearly climate information for comparison against the Environment Canada regional data.

The local and regional climate data are used to prepare seasonal and annual water budget assessments based on the Thornthwaite-Mather method as used by Environment Canada. The information from the Walker station is used to compile seasonal and annual water surplus/ deficit amounts for consideration in surface water runoff and groundwater recharge evaluations and for comparison against quarry discharge volumes.

Information from the surface water and wetland control stations will also be used to track and assess climate trends.

4.2.2 Record Keeping

Section 1.8 Reporting provides details of the schedule for AMP reporting.

Record keeping is as described in **Section 3.4** of this AMP. In addition, any laboratory chemistry data will be posted on Walker Aggregates' website within two business days of receipt from the laboratory. Any seemingly anomalous results are to be identified as such, and the verification process documented and posted on Walker Aggregates' website.

5.0 Long Term Trend Ecological Monitoring Program

5.1 INTRODUCTION

This section describes the Long Term Trend Ecological Monitoring (LTTEM) program component of the AMP for the Expansion Quarry. The LTTEM program is integrated with the LTTWM program (**Section 4.0**) and water data are analyzed and interpreted from a natural heritage perspective.

5.1.1 Expansion Quarry Environment and Duntroon Regional Environment

Changes in the Expansion Quarry Environment are compared to changes in the Duntroon Regional Environment to assess environmental changes that are related to quarry operations, and to distinguish between environmental changes that are related to long term climate change and ecological processes such as vegetation community succession.

The remainder of this section provides more detail on the natural features and functions found within the Expansion Quarry Environment.

5.1.2 Purpose and Scope of Long Term Trend Ecological Monitoring

The purpose of the LTTEM program is to supplement the information from the LTTWM program with information about the health and functioning of the natural heritage features in the vicinity of the Expansion Quarry. The LTTEM program:

- provides regular updates on the current conditions and longer term trends of the Expansion Quarry Environment;
- is used to determine if the key features and functions in the Expansion Quarry Environment are experiencing unexpected changes and/or degradation as a result of the quarry operations by making reference to similar features in the Regional Environment; and
- is designed to ensure that changes to the Expansion Quarry Environment are identified and properly investigated for any possible cause-and-effect relationship with quarry operations.

If negative changes in environmental conditions are detected, the cause of the changes will be investigated and if the quarry is the cause of the change, quarry operations will be adapted and/or contingency mitigation measures will be implemented.

Over time, the Duntroon Regional Environment will continue to change due to natural and/or anthropogenic processes that are unrelated to the quarry operation. Detailed monitoring of ecological changes that are not related to the quarry is not necessary. However, periodic updating (i.e. every five years) of the baseline is helpful in two ways: (1) as a reference for comparing changes in the Expansion Quarry Environment; and (2) as a reference point in the unlikely event that a quarry-related impact is suspected beyond the Expansion Quarry Environment and into the Duntroon Regional Environment.

The LTTEM program focuses on ecological features and functions of the Expansion Quarry Environment. These features and functions have been divided into the following categories:

- The components of the environment for which potential effects have been identified and operational management and contingency mitigation measure options are available:
  - Fish Habitat (Beaver River Tributary South and below-Escarpment brow tributaries to Pretty River and Bateaux Creek);
  - Wetlands (Rob Roy Swamp PSW Complex and ANSI wetland A and ANSI wetland B).
- The components of the environment for which no potential effects are anticipated, such that additional routine operational management and contingency mitigation measures are not expected to be required:
  - The occurrence of American Hart's-tongue Fern contained in the protected Northern Peninsula area.

Long term trends in these features and functions are compared to the long term trends of similar features and functions in the Duntroon Regional Environment outside the area of potential quarry influence (e.g. the control stations in the Batteaux Creek and Pretty River watersheds). Ecological trends are also considered and interpreted with reference to long term climatic trends.

5.2 CLIMATE DATA

Climate data collected as part of the LTTWM program (**Section 4.2.1.1)** will be reviewed with respect to climatic influences on the Natural Heritage features and functions.

5.3 UPDATE OF BASELINE

Environmental baseline conditions are established at the commencement of operations, during Phase I, when operations are not expected to have any potential effect on existing features.

The environmental baseline relating to the Natural Heritage Features (Expansion Quarry Environment and Duntroon Regional Environment) will be updated prior to initiation of Phase 2 of the Expansion Quarry and every five years thereafter until the Expansion Quarry is rehabilitated. These baseline updates will be incorporated into the LTTEM program, as discussed in the following sections.

Table 5.1 summarizes the locations and types of environmental features to be monitored during the LTTEM program.

Table 5.1: Summary of Environmental Baseline Monitoring Features, Locations and Types

Feature	Location	Monitoring Type
FISHERIES*		
Pretty River Tributary System (below escarpment brow)	Between SW16 & SW17	Fish monitoring (LTTWM flow & temp data analysis) Focus on maintaining conditions suitable for Brook Trout
	Background Control Station**	
Batteaux Creek Tributary System (below escarpment brow)	SW14 and SW15 Concession 10 Road	
	Background Control Station**	
Beaver River Tributary North	n/a	n/a – No fish monitoring required
Beaver River Tributary South	Downstream of SW1 @ Grey Rd. 31	Fish monitoring (electrofishing, netting, or minnow traps; LTTWM water level) With MNR permit; focus on spp. diversity, abundance
	Downstream of SWO-2 Osprey Quarry property	
	Upstream of SW6A @ Grey Highlands Sideroad 30	
WILDLIFE		
Rob Roy Swamp PSW Complex	RR 2 @ DP5 & DP7	Frog call Calling activity trends compared locally & regionally
	RR 2 @ DP5 (vicinity)	Amphibian egg mass Focus on spotted salamander (*Ambystoma maculatum*) usage
	RR 3 @ DP10***	Frog call Calling activity trends compared locally & regionally
	RR 6 @ DP4 (vicinity)	
ANSI wetland A	DP6	
	DP6 (vicinity)	Amphibian egg mass Focus on spotted salamander (*Ambystoma maculatum*) usage
ANSI wetland B	Bridson DP	Frog call Calling activity trends compared locally & regionally
Wetland Reference Station	Nottawasaga Lookout and/or Pretty River Provincial Park	
VEGETATION		
Northern Peninsula	Expansion Quarry	American Hart's-tongue Fern (AHTF) Habitat conditions
Wetland Vegetation	RR2 (2 locations), RR3, RR6, ANSI wetlands A & B and wetland control station.	Plant species (includes LTTWM water level analysis, annual photography analysis) Focus on wetland vegetation spp. diversity, characterization of growth
Wetland Soils	RR2 (2 locations), RR3, RR6, ANSI wetlands A & B and wetland control station.	Soil moisture Focus on wetland soil moisture characterization (i.e. dry, moist, or wet)

*as flow conditions allow
**location to be determined in consultation with NVCA and/or MNR
***location to be established prior to extraction

5.4 FISHERIES

5.4.1 Surface Water Flows and Temperature

Surface water flows and temperatures are measured as part of the LTTWM program (**Section 4.0**) and will be interpreted from a natural heritage perspective.

5.4.2 Fish Monitoring Locations

Fish monitoring locations are shown on **Figure 3.2**.

Monitoring of the two systems below the brow of the Escarpment, namely the Pretty River tributaries and the Batteaux Creek northeast tributaries and southeast tributaries, is focused on maintaining baseflows and temperature conditions suitable for the existing Brook Trout population. Monitoring and adaptive management of stream flows and temperatures will be completed as described in the PITM program (**Sections 3.2** and **3.3**) and the LTTWM program (**Section 4.2**). Complementary ecological fish monitoring will be conducted below the Escarpment brow as listed in **Table 5.1**.

5.4.3 Fish Sampling Methods

The fish sampling programs will be conducted under Scientific Collectors Permits as issued by the MNR, and involve either electrofishing, netting or minnow-trapping, as deemed most appropriate for the monitoring locations. Species diversity and general abundance (catch per unit effort) will be compared over time to identify any significant changes or trends. An appropriate method of determining and tracking the fisheries baseline will be determined in consultation with the MNR and CAs (please see ARA Site Plans Natural Environment Note 8A: Page 2B of 4). This work will occur after the licence is issued during Phase 1 of the quarry, prior to extraction in Phase 2A. It is only in Phase 2A that a theoretical potential for groundwater interference with fisheries first arises.

Statistical methods will be developed to determine what constitutes a significant change. Benthic monitoring may also be used to supplement fish community analysis in consultation with the expertise available at the Ontario Benthos Monitoring Network. If significant changes in the fish community are identified, the water level monitoring data will be analyzed in more detail to identify if there are any related changes. Other environmental variables such as climatic effects may also be relevant. If a potential cause and effect relationship with quarry activities is identified, management responses and trigger levels will be developed as part of annual review or 5-year review and implemented through the PITM program as appropriate.

5.5 WETLANDS

The focus of the LTTEM program is on amphibian vernal breeding pools and hydroperiods suitable for continued hydrophytic plant growth in the surrounding wetland zones.

Wetland water level monitoring is conducted as part of the PITM and the LTTWM programs and will be interpreted from a natural heritage perspective.

Ecological monitoring to complement the water level monitoring will include two components: vegetation monitoring and wildlife monitoring.

5.5.1 Vegetation Monitoring Locations

Wetland vegetation monitoring will be completed along a number of transects from the edge of the wetland community to selected water level monitoring stations, as listed in **Table 5.1**, and as shown on **Figures H.1** to **H.3** in **Appendix H**.

5.5.2 Wetland Vegetation Monitoring Method

Transects have been established in each wetland area from the perimeter of the wetland to the selected drive point monitor where surface water monitoring will be undertaken. The following studies will be completed along each transect:

- Two wetland community plots (2x2 m), one near the edge, and one centrally located near the designated drivepoint.
- Species diversity will be collected at each plot. The mean coefficient of conservatism and wetness index will be calculated for each plot. Trends in the floristic data will be compared to water level trigger data. This monitoring will occur annually in August/September.
- Annual photographic records will be taken at precise and replicable directions along each transect. These photo stations are to be located at the edge of interior wetland communities or the edges of vernal pool areas where annual growth can be readily reviewed. The station photographs are to be supported by a written description of the wetland area on the standardized site record sheets in **Appendix H** that includes plant layers % coverage, composition and dominant species, water depth and/or flow, extent of standing water in vernal pools and the general condition of the vegetation (health). Notes on wildlife use are also recorded.
- Wetland soil moisture will be characterized at the locations of the vegetation plots and the photo plots as one of the following:
    - Dry - no water present, organic matter is “friable” and crumbles when squeezed not holding a shape;
    - Moist - organic material or soil is damp and holds shape when squeezed; or
    - Wet - moisture can be squeezed out of the soil or the organic matter.
    - Wetland Wildlife Monitoring

Wildlife monitoring in wetlands is focused on amphibian surveys, which are excellent indicators of the health of the wetland area and water regime trends that could be affecting wetland function. Given that this monitoring uses standardized methods and is occurring throughout Ontario, the results in the Expansion Quarry Environment can be compared to results from

reference wetlands to enable consideration of changes that may be occurring in the Regional Environment as a function of the normal climatic variability and general amphibian population trends.

5.5.3 Frog Call Survey Locations

Frog call surveys are conducted at the active amphibian pools in **Table 5.1**. Monitoring is completed by generally following the Marsh Monitoring Program (BSC, 2005), as follows:

- Each location is to be visited three times in the spring. Surveys should occur when night time air temperatures have generally risen to 6°C, 10°C and 17°C, which generally correspond to mid-April, mid-May and mid-June, respectively.
- So far as possible the surveys should follow periods of rain.
- The survey should commence no sooner than 30 minutes after sunset and terminate no later than midnight.
- Within the timing window noted above each monitoring location is surveyed for 3 minutes.
- One of three call level codes (1- counted number of individuals; 2- estimated number of individuals with calls overlapping; or 3- full chorus of calling amphibians number of individuals not estimated) is used to characterize the intensity of calling activity for each species.

The level of calling activity for each survey is compared to previous data. Trends are reviewed in comparison to local activity, known trends in southern Ontario and climatic variables.

5.5.4 Amphibian Egg Mass Survey Locations

Amphibian egg mass surveys are completed in the locations listed in **Table 5.1**. Surveys are focused on known sites of significant egg mass deposition to complement the amphibian call surveys, particularly with data with respect to usage by Spotted Salamander (*Ambystoma maculatum*). Egg mass surveys provide a quantitative measurement of the potential production of the wetlands, and generally can be compared to salamander egg mass surveys from previous years and from other locations.

Surveys consist of systematically searching the vernal pools on the same dates that the amphibian call counts are completed. Tallies are kept of the number and, where possible, the species of egg masses observed. A sample field data collection form is included in **Appendix H**.

5.6 AMERICAN HART'S-TONGUE FERN (AHTF)

American Hart's-tongue Fern (AHTF) has a strong habitat fidelity to deciduous forests with exposed limestone, regardless of location. Based on site specific surveys and literature review, these ferns have a secondary set of habitat preferences that have sustained the health and longevity of local populations. The intent of the monitoring program is to focus on these

secondary biotic and abiotic conditions that support the population of ferns at Colony 1. AHTF monitoring will begin 2 years before any woodland removal associated with Phase 2B, 3A, or 3B.

5.6.1 Development of the Duntroon Expansion Quarry

Changes to the biotic and abiotic conditions that support AHTF populations can arise from a number of factors not related to quarry activity such as natural succession, introduced diseases and invasive species, or long term regional climate change. Quarry operations have the potential to impact Colony 1 as a result of:

- reduced distance from Colony 1 to the woodlot edge, which could in theory alter the microclimate surrounding Colony 1; and
- dust from quarry activities, which could in theory interfere with photosynthesis and reproduction of the plants.

Potential impacts derived from the reduced forest buffer could only arise after progressive woodland removal associated with Phases 2B, 3A, and 3B commences. Accordingly, the AHTF monitoring program will commence no later than 2 years prior to woodland being removed from Phase 2B.

The entire surface water catchment area of Colony 1 has been protected from alteration and as such, impacts from changes to surface water flows in Colony 1 are not expected. Similarly, quarry related changes to the groundwater levels beneath Colony 1 are not expected to impact the AHTF as pre-quarry groundwater levels are below the root zone of the AHTF. Based on this, there is no possibility of the quarry impacting on the hydrology of Colony 1.

This long term monitoring program has been designed to detect the following potential quarry related impacts:

- reductions in relative humidity - primary assumed mechanism for quarry impacts is the increase in drying winds due to reduced forest buffer,
- increased dust deposition on the plants in Colony 1; and
- increased competition from invasive species - primary assumed mechanism being increased number of invasive plants due to the reduced distance to the forest edge and quarry related forest disturbance.

To distinguish quarry-related changes from widespread natural changes, two (2) reference sites will be monitored in addition to Colony 1. The proposed reference sites are as follows:

- reference site 1 is in the Nottawasaga Lookout Provincial Park approximately 2 km north of Colony 1 (subject to MNR approval);
- reference site 2 is in the Grey Sauble Conservation Authority (GSCA) Kemble Mountain Management Area east of Wiarton (subject to GSCA approval).

5.6.2 Previous AHTF Monitoring

Extensive field data have been collected on habitat conditions within the AHTF Colony 1. Data were collected over a three year span, from 2008 to 2010 and included:

- Soil temperature and moisture – recorded hourly by data loggers;
- Ambient air temperature, relative humidity, and dewpoint temperature – recorded hourly by data loggers;
- Snow depth measurements;
- Digital analysis of tree canopy cover; and
- Quadrat assessments of existing AHTF, reproduction, and associate species.

The climate data were compared to the data collected from the weather station at the quarry office, which was located in an open area well outside any climatic effects of forested habitat. The differences between ambient air temperature, relative humidity, and dewpoint temperature in the forest at Colony 1 and at the office site reflect the effects of the forest on the microclimate that supports the AHTF Colony 1.

5.6.3 Initiation of AHTF Monitoring Program

The monitoring program will begin two years prior to the start of woodlot removal for Phases 2B and continue throughout the life of the quarry. Specific monitoring methods are discussed in **Section 5.6.5**.

5.6.4 Primary AHTF Monitoring Program Objectives

- To determine whether the reduced forest buffer and/or dust from quarry activity is causing a change in habitat conditions in the AHTF Colony 1;
- If the plants are declining as a result of quarry activity, to identify the cause and effect mechanism and implement appropriate mitigation measure(s); and
- To document any natural changes in habitat conditions, unrelated to quarry activity, which may be causing a change in AHTF populations at Colony 1.

5.6.5 AHTF Monitoring Methods

Detailed microclimate and AHTF population data will be collected from the AHTF Colony 1 and the reference sites (herein collectively referred to as the “study sites”). Surveys will be completed on an annual basis starting two years prior to extraction of Phase 2B during the month of July, with the exception of the winter snow depth survey, which will be completed during the period outlined below.

1. Two permanent monitoring plots will be situated within each of the study sites. These plots will be situated in representative habitat and where AHTF densities are judged to be

representative of the average density of their respective population. Within each study site, plots will be a minimum of 30 m away from each other (when feasible) and will not be located within 5 m of the outer edge of the study sites. The dimensions of each monitoring plot will be 2 m x 5 m.

2. Although each study site will be attended annually, only one of the plots will be surveyed in any given year, rotating surveyed plots each year. For example, if Plot A within each study site were to be first monitored in 2023 (assuming that is two years prior to extraction in Phase 2B), then Plot B would be monitored the following year (2024), a cycle to be repeated throughout the life of the quarry, or as required. After the first three years of monitoring have been completed, consideration will be given to reducing the frequency of the monitoring to protect the plants from excessive disturbance. The decision to reduce monitoring frequency will rest with the MNR. This strategy is intended to minimize disturbance to the fern populations. Within each plot, the following will be documented:

    a. *Count of all AHTF present with fronds over 2 cm long:*
    The counting methods described below follow those used in previous years. Each plot will be subdivided into five transects, where each transect covers an area of 2 m². Surveyors will count each individual fern within each transect and sum the total. Specimens with fronds less than 2 cm long will not be counted until a year when longest frond length equals or exceeds 2 cm. Individual specimens are generally simple to detect based on their central point of emergence; however, it can be difficult to count individual specimens tightly growing within a group. In these circumstances, grouped ferns will be counted as '1' specimen to reduce surveyor error over the length of the monitoring period. Where a distance of 10 cm or more exists between two groups, each group will be counted as '2' specimens.

    b. *Photographic record of AHTF and estimated percent cover:*
    At the time of monitoring, 2 photographs of the plot will be taken from a 'birds-eye' perspective. One photo will illustrate herbaceous cover in the northeast corner of the plot, while the second photo will illustrate herbaceous cover in the southwest corner of the plot. For the sake of standardization, photos will be taken from a fixed height of 1.5 m. Within each photo, the permanent stakes marking the corners of the plots will intentionally be situated in the lower left corner of each photograph. Additionally, surveyors will provide a visually determined estimate of the percent cover of AHTF fronds within the surveyed 2 m x 5 m plot.

    c. *Estimate percent cover of bryophytes:*
    During the count of AHTF within the plot, surveyors will also note the presence/absence of bryophyte cover and provide an estimate of the overall bryophyte cover within the 2 m x 5 m plot.

    d. *Documentation of AHTF reproductive features, such as spores and sporophytes:*
    Presence/absence of developing sporophytes will be noted during the AHTF plot count. In an effort to reduce disturbance to the sporophytes, the surveyed plot will receive a general assessment of sporophyte frequency. Each transect within the plot will be noted for presence/absence of developing sporophytes. If 4 or 5 of the transects within the plot

are noted to have a presence of developing sporophytes, the plot will be recorded as having "recurring observations of sexual regeneration". Where sporophytes are recorded as present in 1 - 3 of the transects, the plot will be recorded as having "periodic observations of sexual regeneration". If no sporophytes are observed in any transects, the plot will be recorded as having "no observations of sexual regeneration".

A general quantification of fronds with spore development will also be documented. This information will be presented as a percent estimate of the number of fronds over 2 cm that have spore development within the 2 m x 5 m plot.

e. *Inventory of all herbaceous and young woody plants and their estimated abundance:* All herbaceous species observed growing within the plot will be recorded and their general abundance noted; all shrubs and young trees will also be documented in a similar fashion. For the purposes of this survey, a young tree is defined as being 3 m or less in height. An estimated percent cover of each species will be provided. Shrubs and young trees that occur outside of the plot with a canopy that overhangs the plot will also be noted.

3. The perimeter of the AHTF Colony 1 will be monitored for additional evidence of intrusive plant species, as well as indications of AHTF population expansion, recession, or static establishment. Four single points will be permanently staked; one point will be positioned along the north, south, east, and west outer edges of AHTF Colony 1. Each center point will represent the center of a 1 m x 1 m quadrat. These staked points will be deliberately selected, giving preference to edges with greater AHTF density and apparent potential to expand beyond the center point (e.g. availability of moss covered limestone rock). Permanent stakes will be positioned in close proximity to the denser, outer edges of AHTF groupings with the distance from the stake to the base of the closest mature AHTF specimen being recorded. In addition, the three most abundant vascular plant species within the 1 m x 1 m quadrat will also be documented, with an estimate of their percent cover. If highly invasive species is observed but not well established, the species and general abundance will be noted.

4. Data loggers will be permanently positioned in the study sites, each at a height of 1.5 m above ground to reduce exposure to snow accumulation. One data logger will be positioned centrally within each study site, none of which will be exposed to direct sunlight. Data loggers will measure temperature and relative humidity, with annual calibrations to ensure accuracy. Data loggers will simultaneously record a reading once every three hours.

   Supplementary weather data will also be collected from an existing weather station, currently positioned at the Duntroon Quarry Head Office, approximately 750 m from AHTF Colony 1. This weather station records air temperature, relative humidity, wind speed, wind direction, and precipitation and will provide comparative data to supplement the Colony 1 data logger.

5. A digital analysis of canopy cover over the AHTF Plots will be completed once every four years to detect gradual or abrupt changes in the canopy and sub-canopy. This will be

completed by analysis of canopy photographs using an image manipulation program capable of digitally determining the percent cover of canopy species.

Photographs will be taken along the longest possible transect extending through each study site. The ends of each transect will be permanently staked with UTM coordinates recorded.

The first photograph will be taken from one end of the transect, where the camera will be placed on a tripod at a height of 150 cm height with the lens at a fixed focal length of 80 mm (or equivalent 35 mm) pointed at 90 degrees vertical. Aperture and shutter speeds will be automatically selected by the digital SLR camera and exposures will be bracketed. Photographs will be taken in 10 m intervals along the transect (number of photographs will depend on the actual length of the transect). Digital images will be captured at 8 megapixels.

6. A general assessment of snow depth will be completed once per winter in late January. Five percent of the total area of each occurrence will be measured based on one depth measurement per m². Each measurement location will be randomly selected. Temperature and snowfall data will be used to account for annual differences.
7. Excessive dust deposition on plant material could interfere with plants' ability to photosynthesize and could interfere with sexual reproduction of AHTF. A dust plate will be located in each study site to measure dust accumulation. Two years of baseline studies will be completed prior to Phase 2B development, which will provide the dataset for "typical" levels of dust at the AHTF locations. Once the baseline is established the survey will be completed once per year following the start of Phase 2B.

5.6.6 AHTF Mitigation Triggers

A two stage trigger system will be applied to the AHTF monitoring. Specific trigger values will be set prior to commencing extraction in Phase 2B after additional monitoring data has been completed in accordance with this AMP.

Stage 1: The quarry related concerns consist of potential changes to the habitat conditions at Colony 1. These potential effects have been mitigated by the protection of a 100 m forest buffer, which is well in excess of the majority of habitat buffers recommended in the scientific literature. On this basis, no impacts are expected. However, in order to check the effectiveness of the 100 m forest buffer over time, the first stage in the trigger system will be an observed change in habitat conditions at Colony 1 that are different from the naturally changing habitat conditions observed in the reference populations.

The trigger will be monitored through use of multivariate analysis of the habitat conditions measured at all of the study sites and at the quarry itself (providing data for habitat that is obviously unsuitable for AHTF). Two-way ordination (a form of multivariate analysis suited for analyzing environmental and habitat conditions) will be used to create a matrix that will identify

the range of habitat conditions that are suitable for AHTF. Monitored habitat conditions will follow those outlined in **Section 5.6.5**, consisting of:

1. Relative humidity;
2. Difference in relative humidity in the forest and in the open area outside the forest;
3. Air temperature;
4. Difference in air temperature in the forest and in the open area outside the forest;
5. Snow depth;
6. Canopy cover by percent; and
7. Percent cover of invasive species.

Two-way ordination of these seven variables at Colony 1, the reference AHTF sites and the quarry site will produce a habitat suitability matrix (an X-Y statistical plot) with zones that indicate “habitat suitable for AHTF” and “habitat not suitable for AHTF”. Every year the data collected will be analysed and, so long as the variables measured at Colony 1 that year fall within the suitable habitat area of the ordination, the 100 m forested buffer around the population will be judged as effective mitigation.

Stage 2: In the event that the ordination reveals that habitat conditions at Colony 1 are changing more than they are at the reference sites, such that it appears the Quarry is moving Colony 1 outside of the suitable habitat portion of the habitat suitability matrix, the next step in the trigger process will be to review AHTF population data. If a population assessment of AHTF Colony 1 reveals a significant decrease in the population of AHTF plants beyond normal population variations (defined as a “decline”);

Monitoring data will be used to establish the probable cause of the decline and the mitigation measures described below can be used to eliminate or significantly reduce the quarry related influence.

1. *Exotic or Invasive Species:*
   Exotic and invasive species are currently part of the species diversity within AHTF Colony 1 and the surrounding woodland. If quarry operations are determined to be causing an unnatural increase in invasive species, mitigation measures will consist of:
   a. consultation with specialist familiar with invasive species of concern to determine the most appropriate method of eradication;
   b. manual removal of invasive species;
   c. if available, non-destructive chemical methods of invasive species control will be applied to AHTF Colony 1 through pilot applications, with scaling up as needed if and when the controls are proven safe for use in an AHTF population .

2. *Light Exposure (i.e. Canopy Cover):*
   If it is determined that a negative change in canopy cover is caused by the quarry, the following mitigation measures will be applied:

   a. Planting of sugar maple trees (or faster growing species that exist in the forest interior) for the purpose of increasing shade cover over AHTF Colony 1. Shade cover will be restored to a level deemed to be suitable for AHTF based on past canopy assessments;

   b. If adequate tree canopy shade cannot immediately be restored from the plantings, "artificial shade" may temporarily be used until adequate tree canopy cover is restored or until the end of the quarry life.

3. *Relative Humidity During Growing Season (April 15 to November 15):*
   If it is determined that a change in relative humidity caused by the quarry is triggering a decline in the AHTF population, the following mitigation measures will be applied:

   a. Enhance as appropriate the buffering effect of the forest edges through planting of dense vegetation along the perimeter of the Northern Peninsula as shown on the Rehabilitation Plan (Sheet 3 of 4 Site Plans);

   b. Consultation with appropriate experts on available approaches to increase humidity levels in a forest community; and/or

   c. Research into the feasibility of installing mist sprays for the purpose of increasing moisture within the ambient air.

4. *Dust Accumulation:*
   Dust deposition within AHTF Colony 1 is expected to be negligible due to the width of the forest buffer and the dust control measures utilized by Walker Aggregates. If it is determined that quarry operations result in excess dust in Colony 1 in a manner that interferes with plant health, the following mitigation measures will be applied:

   a. Walker Aggregates will refine its dust control measures by increasing the frequency of dust control applications and review the possibility of employing new methods not currently in practice.

   b. If necessary, to supplement the natural washing effect of rains, the Colony may be sprayed with fine mists to wash dust away during dry operating periods.

6.0 Ecological Enhancement and Mitigation Monitoring Plan

6.1 INTRODUCTION

This section describes the Ecological Enhancement and Mitigation Monitoring (EEMM) Program component of the AMP. The interrelationships between this EEMM Program for the natural heritage features and functions and other components of the AMP are described in **Section 1.2.4** of this report. The EEMM Program includes:

- reforestation and woodland enhancement;
- the Millar Pond relocation; and
- the Bridson Pond enhancement.

6.2 PURPOSE AND SCOPE OF ECOLOGICAL ENHANCEMENT AND MITIGATION MONITORING PROGRAM

The Expansion Quarry includes removal of approximately 26.7 ha of woodland and a small, shallow dug pond formerly used to water cattle. Approximately 25.6 ha of this total is part of approximately 143 ha of contiguous forest in the concession block, which in turn is part of a much larger contiguous woodland that includes many thousands of hectares along the Niagara Escarpment and associated landforms. The Woodland Program discussed in this section is based on the reforestation plan developed for the licence application (Stantec, 2009) and will mitigate the impacts of woodland removal associated with the Expansion Quarry. The Millar Pond relocation and Bridson Pond enhancement will mitigate any potential impacts to ponds near the Expansion Quarry used for wildlife habitat.

The purpose of the Ecological Enhancement and Mitigation Monitoring (EEMM) program is to track the ecological development of the reforested areas and pond enhancements and to compare the ecological characteristics to established targets for ecological form and function. If the monitored conditions differ from the target conditions, modifications to the enhancement plans are implemented.

The objective of the EEMM Program is to properly implement mitigation measures (e.g. ensure that an appropriate number and species of trees are planted) and manage the resulting features in adaptation with changing conditions and trends (e.g. replanting for dead trees, controlling pest damage, controlling/allowing public access, etc.) for enhancements to the natural features identified in **Section 6.1**, and described in the following sections.

Monitoring of the EEM programs is ongoing to provide a quantitative measure of the success of the plans over time, and includes a mechanism for implementing additional efforts (i.e. adaptive management) when needed to ensure that the established restoration targets are achieved. The

monitoring will be discontinued when the enhancement areas have met the established targets and are functioning as self-sustaining components of the local landscape.

6.3 REFORESTATION AND WOODLAND ENHANCEMENT

In addition to the replanting of approximately 8 ha on the rehabilitated side slopes, the Woodland Program includes the reforestation of approximately 52 ha of lands owned by Walker Aggregates. The Site Plan requirements for the woodland program, including the areas to be reforested and the methods, are included in **Appendix E**.

Monitoring of the woodland program may be discontinued after extraction within the significant woodlot (Phases 2B, 3A/B)

The Woodland Program will replace the forest cover removed in the extraction area through restoration of natural forest cover on lands in the adjacent landscape that were under agricultural production at the time of the quarry application. While the reforestation is guided by the general techniques and practices recommended in the ARA Site Plan notes and supporting documents, the site preparation, planting and management may be modified through the AMP process in consultation with the MNR to ensure the practices and management properly respond to future forest dynamics such as pest infestations, changing climatic conditions and state-of-the-art restoration ecology. The goal of the Woodland Program is not merely to replace the features but to achieve a net gain in the ecological functions of the forested landscape through:

- Increasing the total area of woodland cover in the landscape;
- Improving associated landscape functions such as vegetative linkages and interior forest areas;
- Improving forest ecological characteristics such as species diversity and age class distribution;
- Incorporating specific wildlife habitat features such as snag trees, nesting structures, hibernacula, and small scale vernal pools;
- Enhancing the vernal pool habitat associated with ANSI Wetland A by creating depressions in the reforested area west of the ANSI wetland that will provide areas of standing water in the spring to support amphibian breeding and larval development; and
- Introducing a management perspective and land ownership pattern focused on establishing and maintaining a wide range of ecological services from the forest, including public access. This management approach replaces the past approach which was based on a private property perspective that focused on maximizing economic returns from the forest and minimizing public access.

The objectives of the Woodland Program are:

- Establish a healthy woodlot with enhanced species diversity, understory and wildlife habitat;
- Use small scale topographic variation and natural drainage patterns, combined with species selection, to encourage variable forest floor ecology;
- Create and strengthen forest linkages to enhance existing landscape functions including the Niagara Escarpment linkages; and
- Provide a long term gain in natural heritage functions.

6.3.1 Forest Restoration Monitoring

Forest restoration monitoring is designed to track over time the degree to which the Woodland Program is replacing and enhancing the ecological function of the forest removed through extraction. Report Cards will be prepared, summarizing progress on the following criteria, or functional indicators:

- Survival rate of trees;
- Canopy closure (%);
- Basal area;
- Canopy heights (m);
- Presence of tolerant hardwood understory;
- Presence of coarse woody debris; and
- Presence of snag trees.

Table 6.1 identifies the purpose of the monitoring indicator used in the program, the method of measurement and the measurement target and the frequency of the monitoring activity.

Table 6.1: Forest Restoration Monitoring Program

Feature	Purpose	Method/Target	Frequency
Survival rate of trees	Reflects the vigour and heath of forest nursery stock replantings and the progress of forest succession.	Numeric counts of tree survival. Target 80% survival	Annually after every planting cycle and for 2 years following final planting, then every 5 years until monitoring discontinued
Canopy closure (%)	Reflects forest micro-climate, structural habitat diversity, water regulation, wildlife cover, aesthetics etc.	Qualitative observation of % closure supplemented with aerial photo interpretation. Target 95%.	Every 5 years, until 95% canopy closure is achieved or monitoring is discontinued.
Basal area	Reflects primary production, biomass and carbon sequestration forest maturity, nutrient cycling, fuel, food and fiber production	Standard forest sampling methods (sub samples for dbh and/or prism sweeps). Target 15 m^2 basal area/ha.	Every 5 years after the reforested area has grown enough to support such measurements, until monitoring discontinued.

Table 6.1: Forest Restoration Monitoring Program

Feature	Purpose	Method/Target	Frequency
Canopy height	Reflects structural habitat diversity, aesthetics, local climate etc.	Stand and overall species height measurements in metres Target 10 m.	Annually after every planting cycle, then every 5 years, until monitoring discontinued.
Presence of tolerant hardwood understory	Reflects habitat diversity, water regulation etc.	Qualitative observation. Lower canopy composition and % cover.	Every 5 years until monitoring discontinued
Presence of coarse woody debris	Reflects soil building, habitat diversity, nutrient cycling etc.	Qualitative observation.	Every 5 years until monitoring discontinued
Presence of snag trees	Reflects habitat diversity, nutrient cycling etc.	Qualitative observation.	Every 5 years, until monitoring discontinued.

This monitoring is coordinated with, and includes the requirements of, the forest monitoring and assessment required under the Agreement with the Township of Clearview dated January 25, 2010.

6.3.2 Monitoring Locations

Monitoring of the Woodland Program will occur throughout the replanting area with a number of key areas selected as representative locations for more detailed health assessment.

6.3.3 Sampling Protocol

6.3.3.1 Definition of Proposed Planting Terms

Plantings will be completed in a checker board pattern of 1 ha Planting Units consisting of four 0.25 ha Quadrants. Planting Units will be interspersed with 1 ha Natural Regeneration Units where site preparation and seeding will be completed but no trees will be planted, allowing natural regeneration to occur. This will ensure that a diverse, spatially heterogeneous, woodland, with a mix of tree densities, is established. The sampling protocol described below will be applied to Planting Units only and not to Natural Regeneration Units.

Each Quadrant will consist of sixteen 12.5 m x 12.5 m Planting Blocks. Quadrants will be characterized as Coniferous dominated (at least 50% coniferous specimens) or Deciduous dominated (at least 75% deciduous. Generally, the Coniferous and Deciduous Quadrants will be split evenly across the Planting Units (i.e. two of each Quadrant type in each Unit) with allowance for variability to respond to site conditions. Each Quadrant will be divided into Sixteen Planting Blocks and each planting block will have approximately 36 plant locations (based on a 2.5 m grid) – however, the outside edges of each planting block will be shared with adjacent planting blocks, resulting in an average of approximately 24 trees planted per planting block.

At completion of the planting there will be approximately 20 to 25 Planting Units established, interspersed with approximately 20 to 25 Natural Regeneration Units where natural tree regeneration will occur supported by seed supply from the Planting Units. As each Planting Unit

is planted it will be given a unique grid number and the centre point will be recorded using GPS. Each Planting Unit will have 64 Planting Blocks for a total of approximately 1600 Planting Blocks. Each Planting block having room for approximately 24 trees, will result in approximately 38,400 trees planted.

6.3.3.2 Sampling

Every year one half of the Planting Units will be sampled starting with odd numbers one year and even numbers the next year, Sampling in the Planting Units will be randomized by relocating the centre point and choosing two numbers from 1- 64, said numbers indicating the planting blocks to be sampled within that Planting Unit. The general location of the randomly selected blocks will be marked in the field by selecting a corner and marking a six tree by six tree square. Within this square all trees will be assessed according to the criteria presented in **Table 6.1**. Approximately 10 Units will be sampled each, with two Blocks per Unit being assessed for a total of 720 trees assessed each sampling year.

Survival percentages and average heights will be based on the 36 tree count for each planting block. Canopy closure will be estimated visually for each sample plot. Natural regeneration and presence of coarse woody debris will be estimated using 3 randomly selected 1 m^2 plots per Planting Block.

Total tree cover in five randomly selected Natural Regeneration Units will also be estimated by counting the total number of trees (according to the *Forestry Act* definition) in 3 random 1 m^2 plots and multiplying the average of the three plots by 1000.

6.3.3.3 Interpretation

The degree to which the Planting Units meet the criteria outlined in **Table 6.1** will be a reasonable indication of the ecological function of the reforested areas. Natural Regeneration Units will be dominated by highly adaptive, locally abundant and appropriate tree species and will also contribute significantly to the forest functions. Since it is impossible to predict exactly what species will colonize the natural regeneration areas, and at what rates, quantitative criteria beyond the total number of trees per ha cannot be prescribed at this time.

Given the natural variability inherent in the environment, the criteria outlined in **Table 6.1** should be interpreted with a degree of flexibility and expert judgment. The expert judgment should reflect the fact that the intent of the reforestation plan is not to create a static predetermined ecosystem stage, but is to maximize the degree to which natural self-sustaining vegetation dynamics are operating in the reforested area. The goal is to ensure that natural ecological processes are driving the ongoing evolution of a range of communities which maintain and enhance all the functions and attributes of local woodlands over the long term. Focusing on natural vegetation dynamics will maximize natural diversity, ensure long term sustainable biomass production and result in ecological functions that are naturally adapted to the local ecology and support a healthy and diverse local ecosystem. In other words, if the reforestation

area is developing with a healthy mix of native plants, is not dominated by aggressive non-native species and provides a range of high quality habitats for local wildlife, it can be considered a success and strict adherence to predetermined criteria is ecologically irrelevant.

6.3.4 Contingency Measures

The restoration and enhancement programs will be adapted in response to the monitoring program, and the recommendations provided in the reporting documents. For example, if tree survival rate is less than 80%, one or more of the following actions will be taken:

- Replace trees that died;
- Modify planting treatments;
- Substitute species;
- Modify management practices (pest control, fertilization), etc.

Other actions that may be taken to improve habitat enhancements, should the initial placements of woody debris and construction of habitat features be found to be inadequate, include: adding habitat logs and shrub piles, constructing bird breeding boxes, creating raptor scanning perches and snag trees, etc. Recommendations with respect to the control of invasive species will also be included in the monitoring reports to support the success of the woodland and pond enhancement programs.

The performance of habitat features such as snag tree habitat and woody debris will be reported on qualitatively as specified in **Section 6.3.1**. Woody debris will be estimated as outlined in the sampling protocol and snag trees will be counted and described. If there is snag habitat and coarse woody debris present in the sample plots and the functional or qualitative attributes of the features as described in the report cards are increasing over time, (e.g. larger woody debris, taller snags, evidence of habitat use by insects and insect predators) contingencies will not be required.

6.4 MILLAR POND RELOCATION

The Millar Pond is a former dug farm pond that was constructed for livestock use. It is located in the northeast corner of the expansion property, inside the approved limit of extraction for Phase 2A of the Expansion Quarry. As part of an integrated resource management approach for the site, Walker Aggregates is removing the pond and creating a similar pond with enhanced ecological functions in an area situated a short distance to the northeast. The relocation site is illustrated on **Figure 6.1**. Details on the relocation plan are presented in **Appendix J**. During quarry operations and rehabilitation to the final lake, water will be directed toward the relocated pond through surface discharge as shown on the site plans. Once the final lake level has been established, the water level in the relocated pond will be maintained by seepage from the final lake to the pond as well as by direct precipitation and local surface run-off.

The objectives of the Millar Pond relocation and enhancement are:

- Mimic the hydrology of the existing Millar pond, ensuring occasional drying to control fish introduction;
- Create wetland type suitable for amphibians;
- Create a naturalized pond perimeter consisting of native species;
- Control introduction and establishment of invasive species; and
- Provide a long term functional natural heritage feature.

Further enhancements of ANSI Wetland B around the relocated Millar Pond shall be considered as part of the field-fitting process during planting.

6.4.1 Millar Pond Relocation Monitoring

The Millar Pond relocation monitoring involves vegetation and amphibian populations in the pond.

Vegetation monitoring includes survival of nursery stock plantings near the pond edge (including both trees and shrubs) and qualitative descriptions of the density and vigour of submergent and emergent vegetation in the pond. The monitoring assessment is based on numeric counts with a survival target of 80%. The vegetation monitoring will be completed annually for two (2) years following the completion of the relocation of the Millar Pond, and every five (5) years thereafter for two cycles, or until self-sustaining natural vegetation and hydrology is established.

Amphibian monitoring consists of Anuran (i.e. frog and toad) call counts as follows:

- Three (3) times a year in spring as per the Marsh Monitoring Protocol (CWS, 2003) each monitoring year as follows:
  - Monitoring for two (2) years post pond relocation; and
  - Monitoring at regular five (5) year intervals thereafter or until active amphibian breeding is established.

Active amphibian breeding in the Millar pond is defined as sustainable breeding populations of one or more common species present elsewhere in the landscape. The number of calling individuals required to reach a conclusion of sustainable breeding is dependent on the species. A relatively high number of Spring Peepers would need to be heard calling to reach this conclusion, while two or more calling Green Frogs would support the same conclusion. The breeding activity should be detected for two consecutive years prior to concluding that active amphibian breeding has been established.

Monitoring results will be reported in the annual monitoring report.

6.4.2 Monitoring Locations

The relocated Millar Pond will be monitored along a longitudinal transects to be established following completion of the relocation of the Millar Pond.

6.5 BRIDSON POND ENHANCEMENT

The Bridson Pond is a dug pond originally used by the former land owner as a swimming hole. It is located on lands now owned by Walker Aggregates that are situated directly to the east and outside the approved limit of extraction and licence boundary of the Expansion Quarry, and inside the reforestation area. As part of an integrated resource management approach for the site, Walker Aggregates is enhancing the ecological functions of this pond by naturalizing pond edges and integrating the pond with the reforested landscape through the Woodland Program, discussed in **Section 6.3**. The effectiveness of the Woodland Program in achieving the following objectives, among others, will be monitored through the EEEM program.

The objectives of the Bridson Pond enhancement are to:

- Create a naturalized pond perimeter consisting of native species;
- Control introduction and establishment of invasive species; and
- Integrate the pond with the ecological functions of the surrounding reforested landscape by providing enhanced amphibian and reptile habitat.

6.5.1 Bridson Pond Enhancement Monitoring

The Bridson Pond enhancement is integrated with the reforestation and woodland enhancement. Monitoring is focused on the successful creation of a naturalized pond and wetland with a diversity of natural vegetation. The site is monitored by photography from fixed locations to verify succession to natural vegetation. When the Bridson Pond is surrounded by natural vegetation including tree saplings at least 1.6 m high, monitoring is discontinued.

6.5.2 Monitoring Locations

The Bridson Pond will be monitored along a longitudinal transects to be established following completion of the enhancements to the Bridson Pond.

6.6 MANAGEMENT OF BUTTERNUT TREES

A total of 27 Butternut trees that were assessed as retainable in 2009 are located inside the approved Expansion Quarry extraction area. These trees and the required buffer area are located in a separate quarry phase (designated as 3B on the Site Plan) that will only be removed if the assessment of the health of the butternut trees changes from retainable, or if a permit is issued under the *Endangered Species Act, 2007* (ESA, 2007), or if the status of Butternut under the ESA changes. Any permit that is issued under the ESA, 2007 will include

detailed mitigation and monitoring requirements. Any monitoring required by a permit under the ESA, 2007 will be controlled and conducted under the terms of that permit and will not be a formal part of the Quarry AMP. However, for the sake of efficiency, the actual monitoring activities will be integrated with the monitoring activity under the AMP, so long as permit requirements are met.

Walker Aggregates is implementing the following three (3) Butternut related activities as part of the AMP:

- Individual retainable Butternut trees in Phase 3B of the ARA Site Plan Sheet 2A of 4 (MHBC, 2012) will be monitored and a Butternut health assessment carried out every three (3) years and reported in the Annual AMP Summary Report for that year, and in the next 5-Year Comprehensive Review Report.
- Inventories to determine the presence of other retainable Butternut beyond those known and identified in Phase 3B will be conducted prior to site clearing within the licensed area. Site clearing prior to extraction is progressive and is not done for the entire phase of extraction at one time; as such, area-specific Butternut inventories will be conducted in the growing season prior to any clearing of areas outside Phase 3B. If any new Butternut trees are located within the next scheduled section of the approved extraction area, a Butternut health assessment will be carried out by a certified Butternut Health Assessor and submitted to the Midhurst District Ministry of Natural Resource (MNR) office for review and approval. If, as a result of that assessment, healthy Butternut trees are found, those Butternut trees are subject to the same provisions and protections as those trees found in Phase 3B and as outlined in the General Note 21 on the ARA Site Plan, Sheet 2A of 4 (MHBC, 2012).
- If Butternut trees are planted as part of a permit under the ESA, 2007 or as a result of regulations under the ESA, 2007 any planted trees will be monitored in accordance with the requirements of the Permit or the regulations. Any Butternut trees planted as part of a permit process will be planted in edge habitats suitable for this shade intolerant species.

6.7 REPORTING

Section 1.8 Reporting provides details of the reporting schedule for Annual Reports (**Section 1.8.1**) and for 5-Year Comprehensive Review Reports (**Section 1.8.2**) that are required as part of the AMP monitoring programs.

6.7.1 AMP Reporting

During the planting and establishment phases of the enhancement projects, annual reports will be prepared documenting the survival rate of planted vegetation. Monitoring will continue for two (2) years after the final plantings. Once the enhancement areas are established the monitoring and reporting frequency decreases to every five (5) years.

The Annual reports will document site preparation and the survival rates of plantings. The 5-Year Comprehensive Review Reports will document the progress of the restoration efforts toward the established goals. These reports will include the quantitative results of the monitoring program, as well as any adjustments implemented to increase the success of the programs (e.g. use of fertilizer, frequency of water, pest control, and invasive species management). The reports will include recommendations for monitoring for the subsequent years (i.e. frequency will be reduced as woodland area matures and becomes self-sufficient). Finally, the reports will provide recommendations to ensure that the restoration targets continue to be met. This may include adaptive efforts such as additional tree planting, invasive species control, creation of additional habitat structures, etc.

The reports will be submitted to the MNR and the Township for review. The reports will form part of the integrated AMP reporting which is publicly available and subject to discussion at annual Operations Improvement Workshops.

6.7.2 Reforestation Assessment

The assessment of the Woodland Program in accordance with **Section 6.3.1** incorporates the requirements of the Agreement with the Township of Clearview dated January 25, 2010, and will form the basis for determining when extraction can commence within portions of the significant woodland (Phases 2B, 3A/3B).

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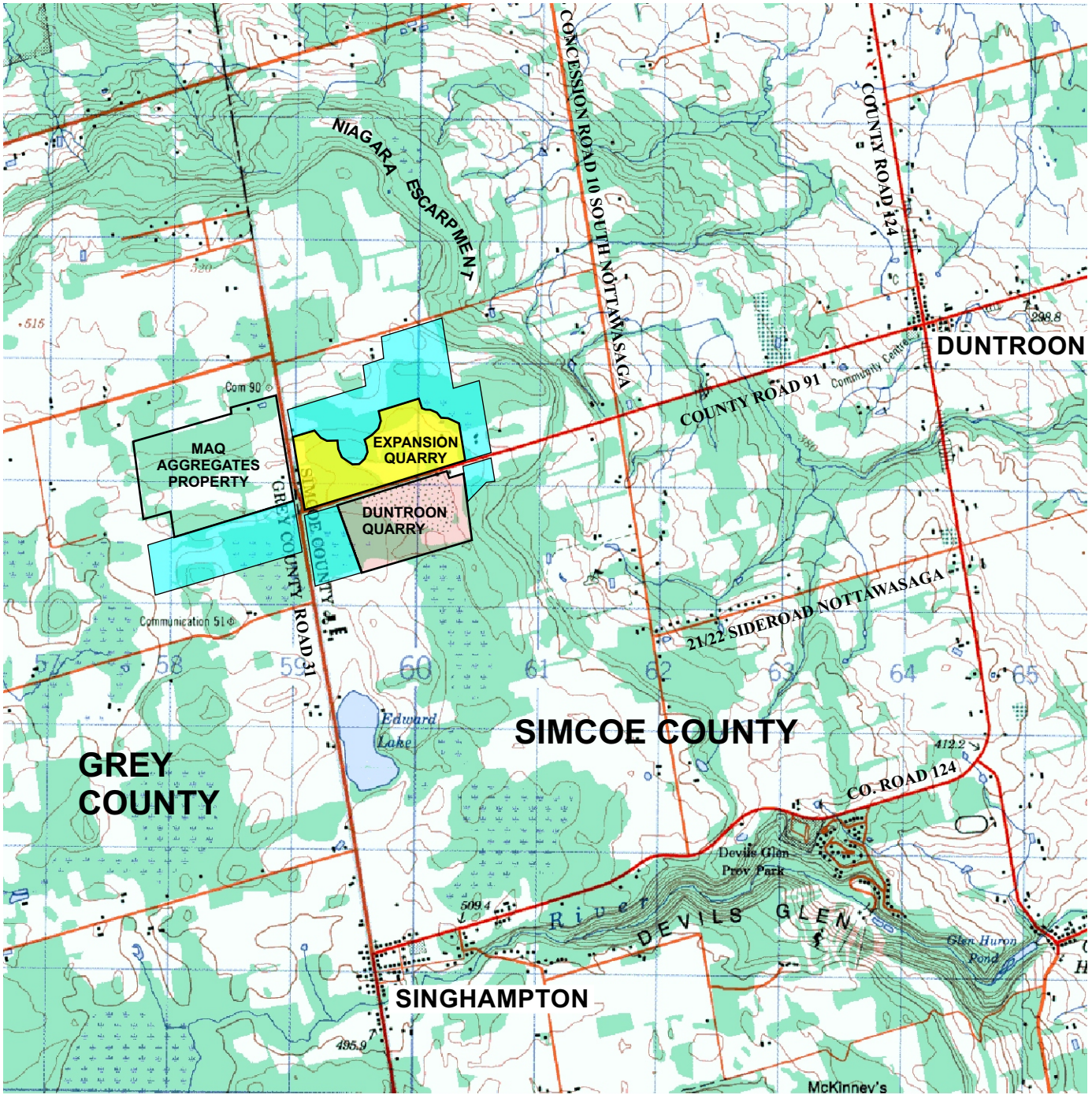
Appendix A: Figures

ATTACHMENTS:

* Note that additional figures are provided in Appendix E, Appendix F, Appendix H, Appendix J, and Appendix K.



LEGEND

- EXISTING QUARRY
- EXPANSION QUARRY
- WALKER OWNED BUFFER AND REFORESTATION LANDS

N
W E
S

Map Reference:
1:50,000 NTS sheet 41A/8, Collingwood.

0 1 km

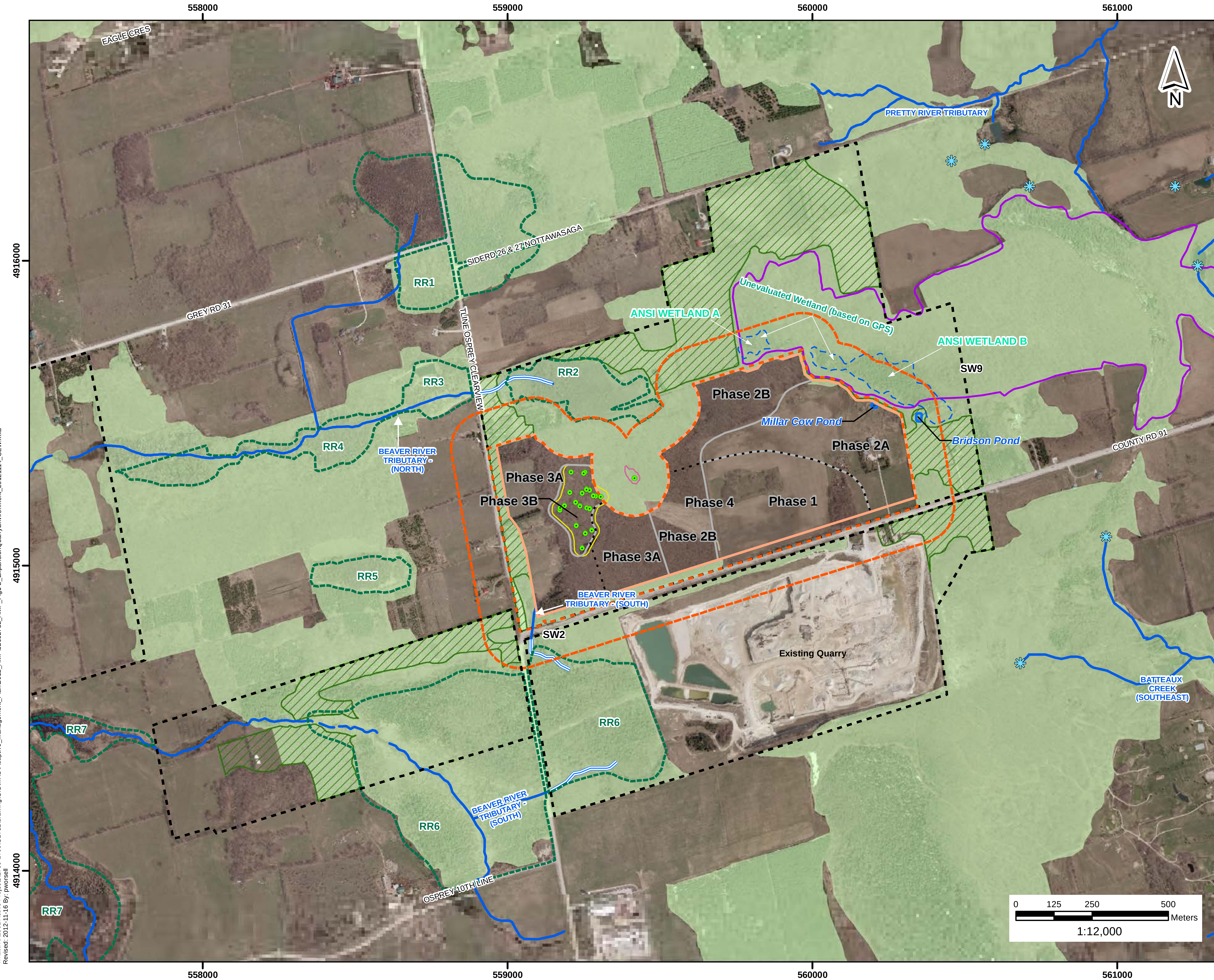
LOCATION MAP

DUNTROON EXPANSION QUARRY
ADAPTIVE MANAGEMENT PLAN
For Walker Aggregates Inc.

walker industries
Walker Aggregates Inc.

DATE: SEPTEMBER 2012	SCALE: 1:50000
PROJECT: 111-53312-00	REF. NO.: 111-53312-00 A52 F1_1-LM

FIGURE
1.1



W:\active\2002 Active Projects\2700-2799\G2732\drawing\GIS\MXD\Adaptive_Management_Plan\2012_AMP\62602732_AMP_Fig1-2_ExpansionQuarryEnvironment_20121114_CEW.mxd
Revised: 2012-11-16 By: pworsell

walker industries

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Legend

- Escarpment Seep (approximate location)
- Walker Owned Lands
- Duntroon Quarry Expansion License Area
- 120m Adjacent Lands
- Limit of Extraction
- Phase Boundary
- Phase 4 - Lower Bench
- Progressive Reforestation resulting from the License Expansion (53 ha)

Environmental Features

- Duntroon Escarpment Forest Regional Life Science ANSI (southwest boundary as staked by MNR in 2002 coincident with Proposed license Area)
- RR1 Rob Roy Swamp PSW Complex
- Watercourse
- Undefined Braided Channel
- Unevaluated Wetland

Significant Species (GPS) [4]

- Retainable Butternut
- Escarpment Seep (approximate location)
- Contiguous Woodland
- American Hart's-Tongue Fern - Colony 1
- Butternut Setback

Notes

1. Coordinate System: UTM NAD 83 - Zone 17(N)
2. Data Sources: Ontario Ministry of Natural Resources, © Queens Printer Ontario, 2009.
3. Image Source: First Base Solutions WMS, 2009.
4. Significant species location data were obtained via handheld GPS by Stantec on October 9, 2008 and June 3, 2009.
5. Rob Roy Wetland and ANSI boundaries adjacent to proposed Duntroon quarry expansion agreed to by MNR and surveyed. All others from MNR electronic file. RR6 edited to reflect existing quarry.

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DUNTROON QUARRY EXPANSION
ADAPTIVE MANAGEMENT PLAN

Figure No.

1.2

Title

EXPANSION QUARRY ENVIRONMENT

FILENAME: \\cd1220-f02\01609\active\2002 Active Projects\2700-2799\G2732\drawing\Corel\Adaptive_Management_Plan\2013_AMP\62602732_AMP_Fig1-3_SchematicTimeline_20131128_CEW.cdr

Quarry Phase	Application Process	License Granted	Phase 1	Phase 2A	Phase 2B	Phase 3A	Phase 3B	Phase 4	Lake Filling
Baseline, AMP and Model Review/Update	every 5 years after 2014 and/or at *		*		*		*		
Long Term Water	Continuously								
PIT		Continuously							
Long Term Ecology			2 years then once every 5 years and/or at start of new phase						
Forest Enhancement		Plant **Year 1 - 3**, monitor survival annualy to **Year 5**, monitor target performance every 5 years until targets met							
Millar Cow Pond Relocation		Create new pond **Year 3**, monitor survival to **Year 5**, monitor target performance every 5 years until targets met, and/or at start of phase 3							
Butternut		According to butternut management plan							
Management Actions	Apply for butternut permits; Prepare info for PTTW and ECC approvals.	Obtain PTTW and ECC. Install new monitor locations as per site plans.	Plant enhanced forest areas; Create pond enhancements. Initiate pumping to existing quarry reservoir, as required. Install and test four recharge wells as per site plans.	Initiate pumping to ANSI wetlands, RR2, SW9 and Ponds, as required. Remove Millar Cow Pond.	Continue pumping to RR2, ANSI wetlands, SW9 and ponds as required.	Initiate pumping to SW2 if required. Continue pumping to SW2, RR2, ANSI wetlands, SW9 and Ponds as required.	Continue as per Phase 3A. Cut Butternuts Phase 3B, provided ESA permit is obtained.	Continue as per Phase 3A/3B.	Continue as per Phase 4 until final lake level is achieved and licence surrendered.

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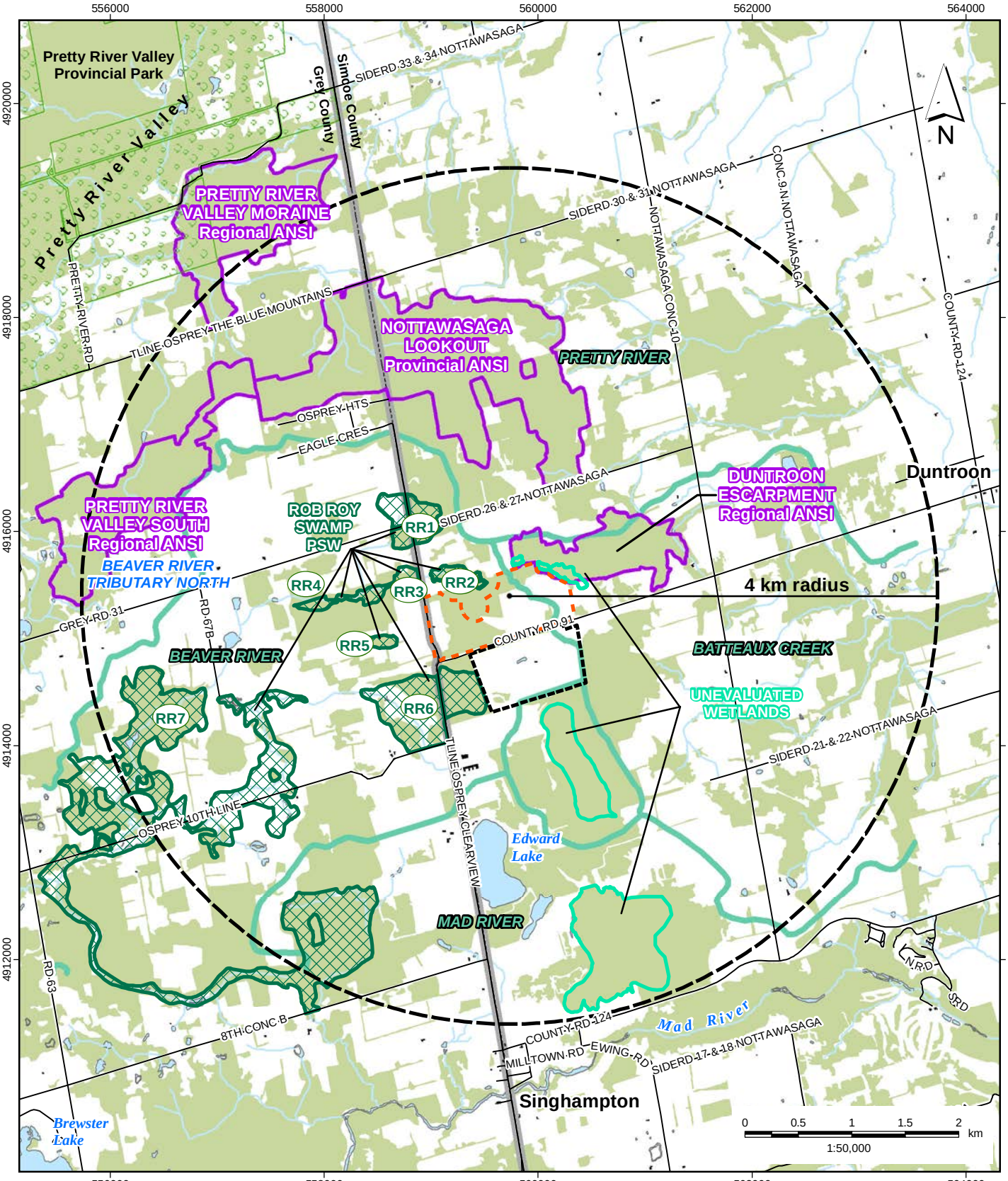
ADAPTIVE MANAGEMENT PLAN

Figure No.
1.3

Title
SCHEMATIC TIMELINES FOR DUNTROON QUARRY AMP COMPONENTS



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Revised: 2012-11-16 By: pworsell

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62602732

Legend

- Existing Duntroon Quarry
- Duntroon Quarry Expansion License Area
- Life Science ANSI
- Generalized Watersheds
- Evaluated Wetland
- Unevaluated Wetland
- RR3 — Rob Roy Swamp PSW Complex Wetland Unit

Notes

1. Coordinate System: UTM NAD 83 - Zone 17 (N).
2. Data Sources: Ontario Ministry of Natural Resources © Queens Printer Ontario, 2009; © ESRI, 2007.

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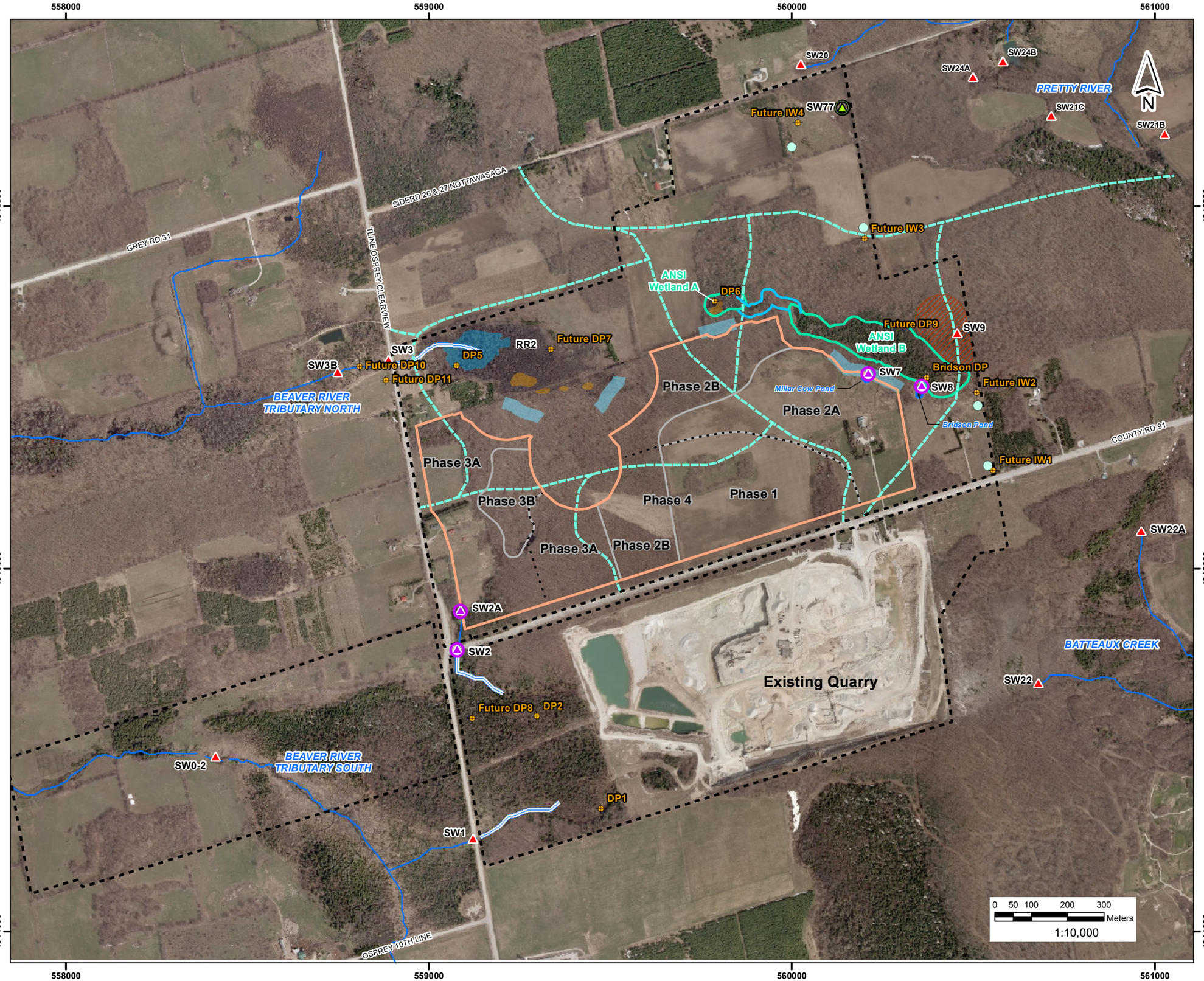
Figure No.

2.1

Title

DUNTROON REGIONAL ENVIRONMENT



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Revised: 2013-12-03 By: cwelks

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Legend

- Walker Owned Lands
- Limit of Extraction - Walker
- Phase Boundary
- Phase 4 - Lower Bench
- Surface Water Monitoring Station and Designation (Jagger Hims, 2013)
- Surface Water Monitoring Station with Observed Seepage (within 120m of the proposed licensed area)
- Surface Water Monitoring Station - Karst 2007
- Drive Point Monitoring Location
- Karst Infiltration Area
- Surface Trench Discharge
- Dual purpose Monitoring/Recharge Wells
- Wetland [4]
- Interpreted Wetland Catchment Areas
- Approximate location of diffuse overflow channel between ANSI A and ANSI B
- Surface Water Features may include Fisheries Habitat
- Undefined Braided Channel
- Dug Agricultural Ponds

Vernal Pools

- Approximate Location of Deeper Vernal Pools
- Approximate Location of Shallower Vernal Pools

Notes

1. Coordinate System: UTM NAD 83 - Zone 17(N)
2. Data Sources: Ontario Ministry of Natural Resources, © Queens Printer Ontario, 2009.
3. Image Source: First Base Solutions WMS, 2009.
4. Wetland boundaries approximated using handheld GPS and air photo except where adjacent to proposed license boundary, surveyed in consultation with MNR.

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DUNTROON QUARRY EXPANSION
ADAPTIVE MANAGEMENT PLAN

Figure No.

2.2

Title

GROUNDWATER AND SURFACEWATER FEATURES, AND MITIGATION CONCEPTS

LEGEND

- DUNTROON EXISTING QUARRY PROPERTY
- DUNTROON EXPANSION QUARRY
- PROPERTY OWNED BY WALKER AGGREGATES INC
- WATERSHED DIVIDE.
- SW10 — SURFACE WATER MONITORING LOCATION & DESIGNATION
- OW1–6 — BOREHOLE LOCATION AND DESIGNATION
- RW1 — RESIDENTIAL WELL LOCATION AND DESIGNATION
- DP5 — DRIVEPOINT LOCATION AND DESIGNATION
- SG1 — STAFF GAUGE LOCATION AND DESIGNATION
- NW8 — NEW GROUNDWATER MONITOR LOCATION & DESIGNATION
- IW3 — INJECTION TEST WELL LOCATION AND DESIGNATION
- RR#5 — ROB ROY PSW

250 0 500 m

BATTEAUX CREEK SUBCATCHMENT (TO NOTTAWASAGA BAY)

PRETTY RIVER SUBCATCHMENT (TO NOTTAWASAGA BAY)

DUNTROON

BEAVER RIVER SUBCATCHMENT (TO NOTTAWASAGA BAY AT THORNBURY)

MAD RIVER SUBCATCHMENT (TO NOTTAWASAGA RIVER TO NOTTAWASAGA BAY)

BATTEAUX CREEK SUBCATCHMENT (TO NOTTAWASAGA BAY)

MONITORING LOCATIONS

DUNTROON EXPANSION QUARRY
ADAPTIVE MANAGEMENT PLAN
For Walker Aggreages Inc.

walker industries
Walker Aggregates Inc.

DATE: AUGUST 2013	SCALE: 1:25000
PROJECT: 111-52212-00	FILE NO.: 111-53312-00 A52 F3-1-SP
	FIGURE 3.1

FILENAME: \\cd1220-f02\01609\active\2002 Active Projects\2700-2799\G2732\drawing\Corel\Adaptive_Management_Plan\2012_AMP\62602732_AMP_Fig3-2_SwampChart_20121115_PW.cdr

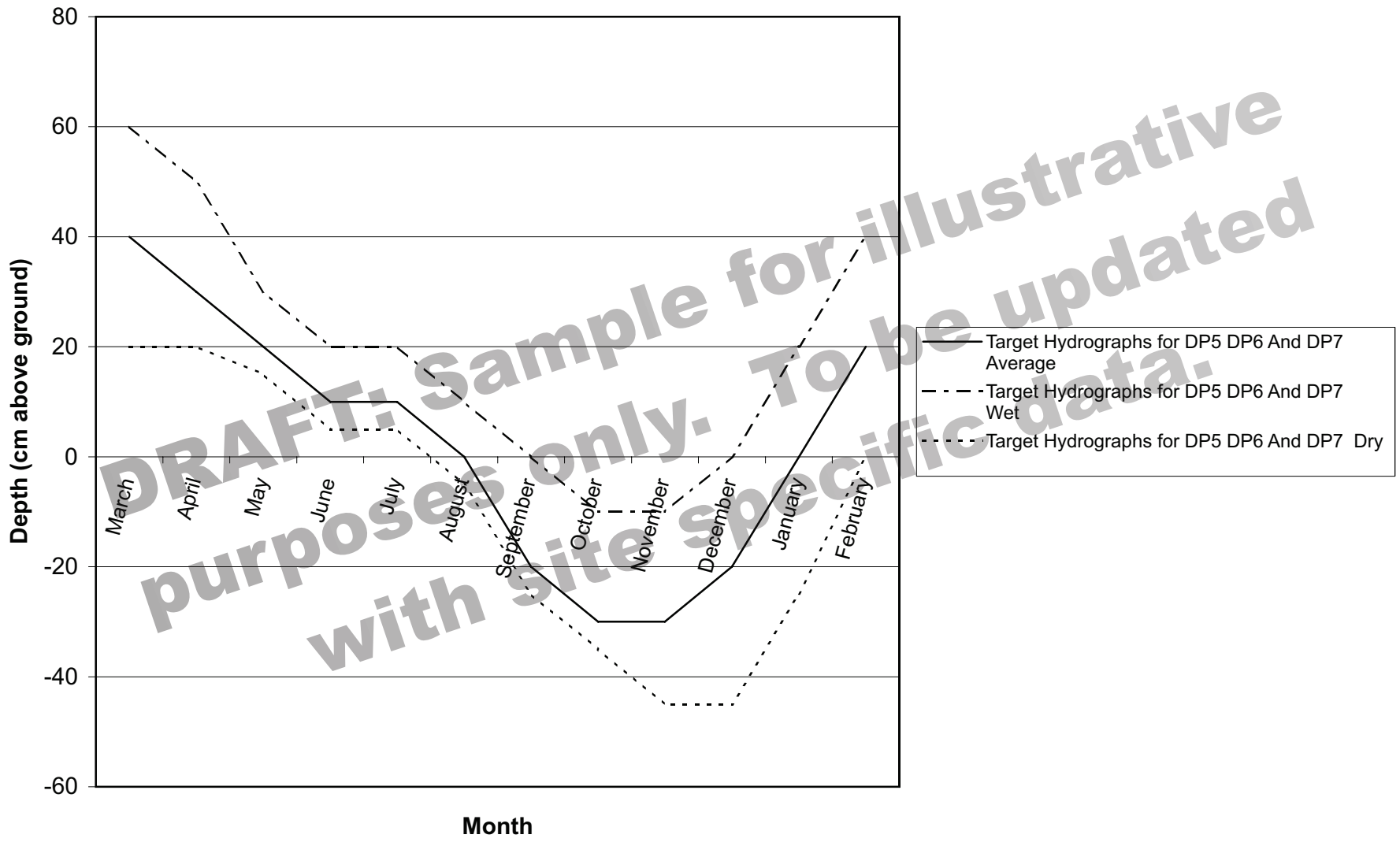

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Figure No.
3.2

Title
SWAMP WITH VERNAL POOL TARGET HYDROGRAPH

FILENAME: W:\active\2002 Active Projects\2700-2799\G2732\drawing\Corel\Adaptive_Management_Plan\2012_AMP\62602732_AMP_Fig3-3_SwampMarshChart_20120905_CEW.cdr

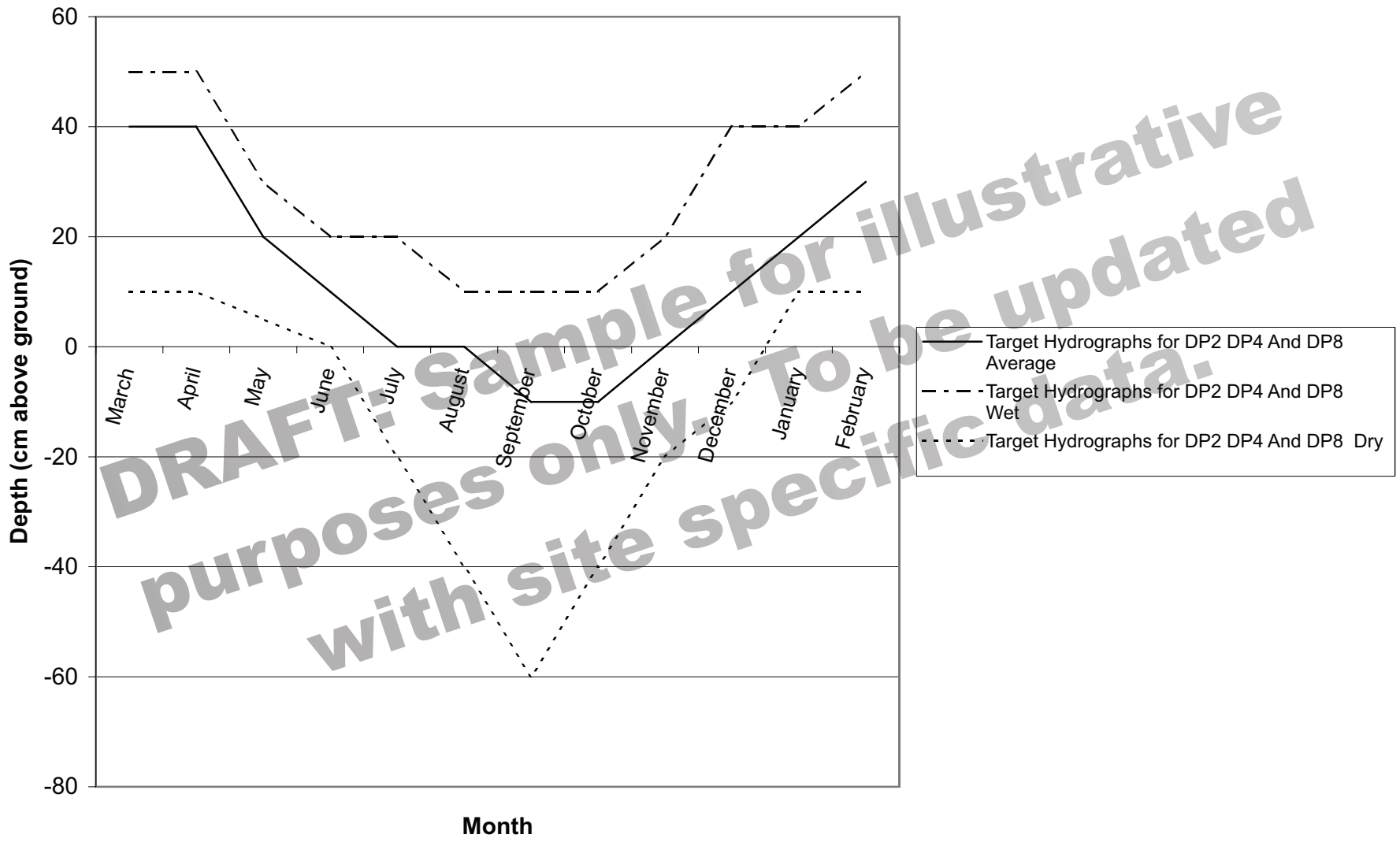

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Figure No.
3.3

Title
SWAMP/MARSH SHALLOW OVER BEDROCK TARGET HYDROGRAPH

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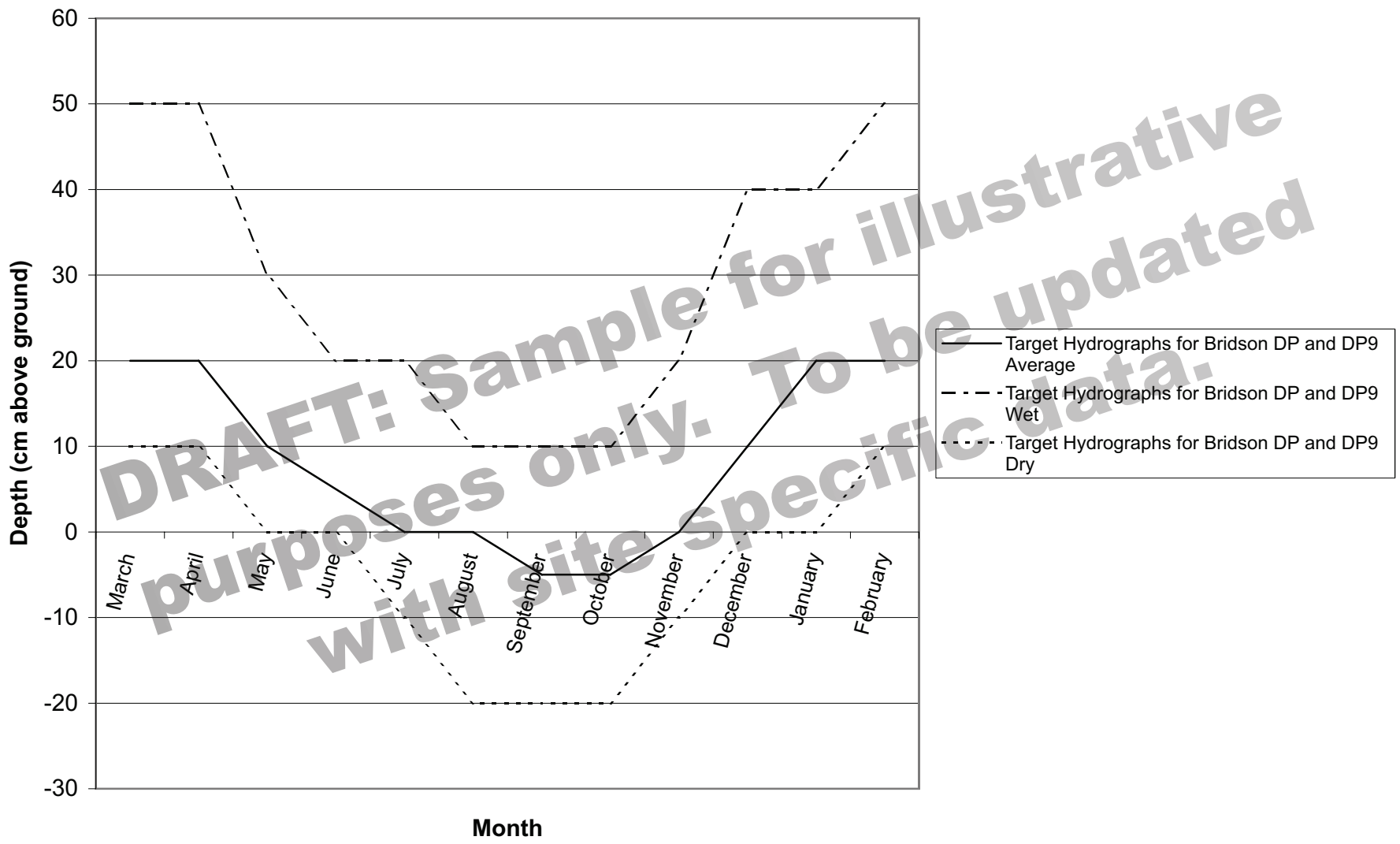
FILENAME: W:\active\2002 Active Projects\2700-2799\G2732\drawing\Corel\Adaptive_Management_Plan\2012_AMP\62602732_AMP_Fig3-4_WetlandsChart_20120905_CEW.cdr



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ADAPTIVE MANAGEMENT PLAN

Figure No.
3.4

Title
WETLANDS ASSOCIATED WITH CHANNEL AND KARST TARGET HYDROGRAPH

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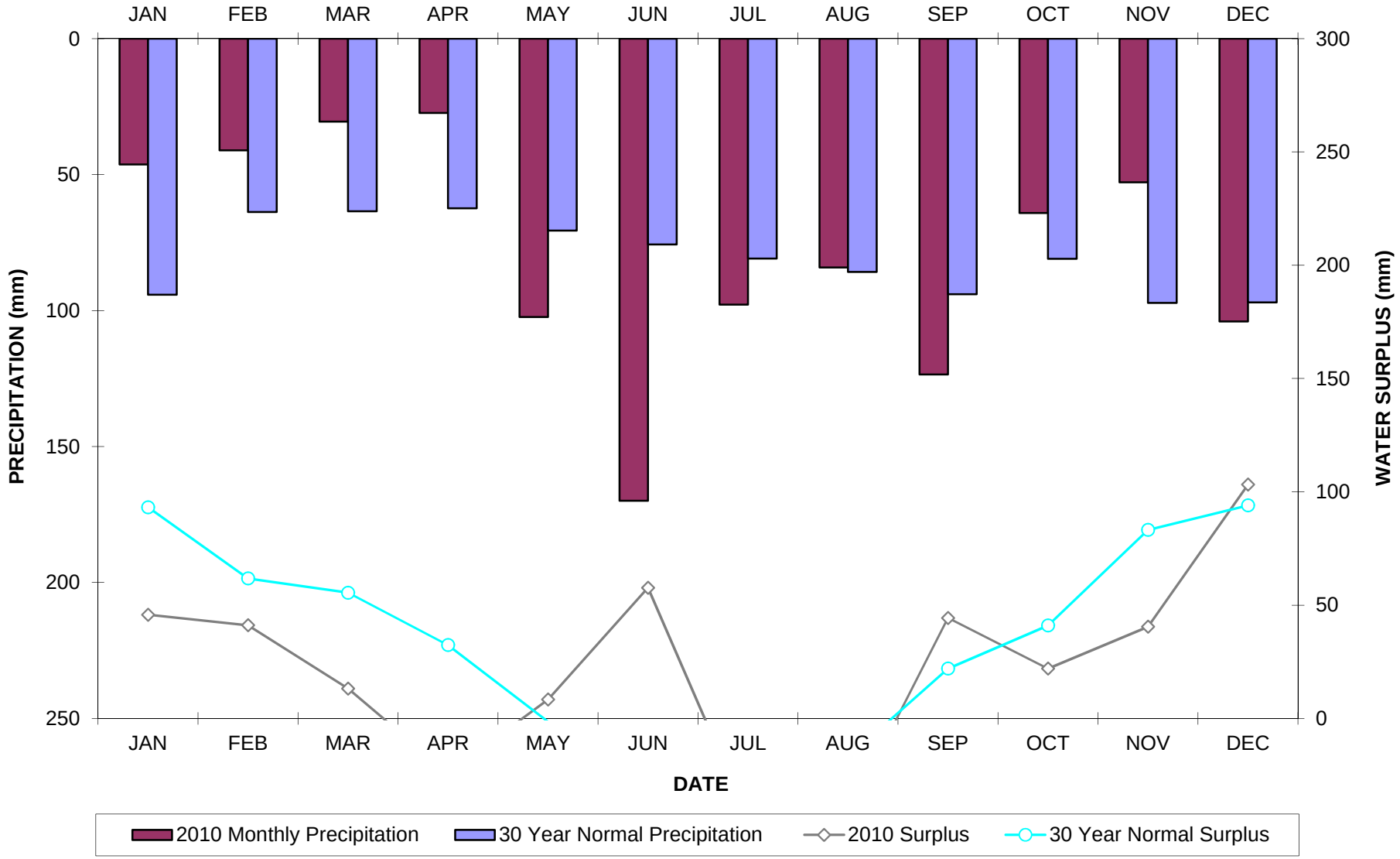
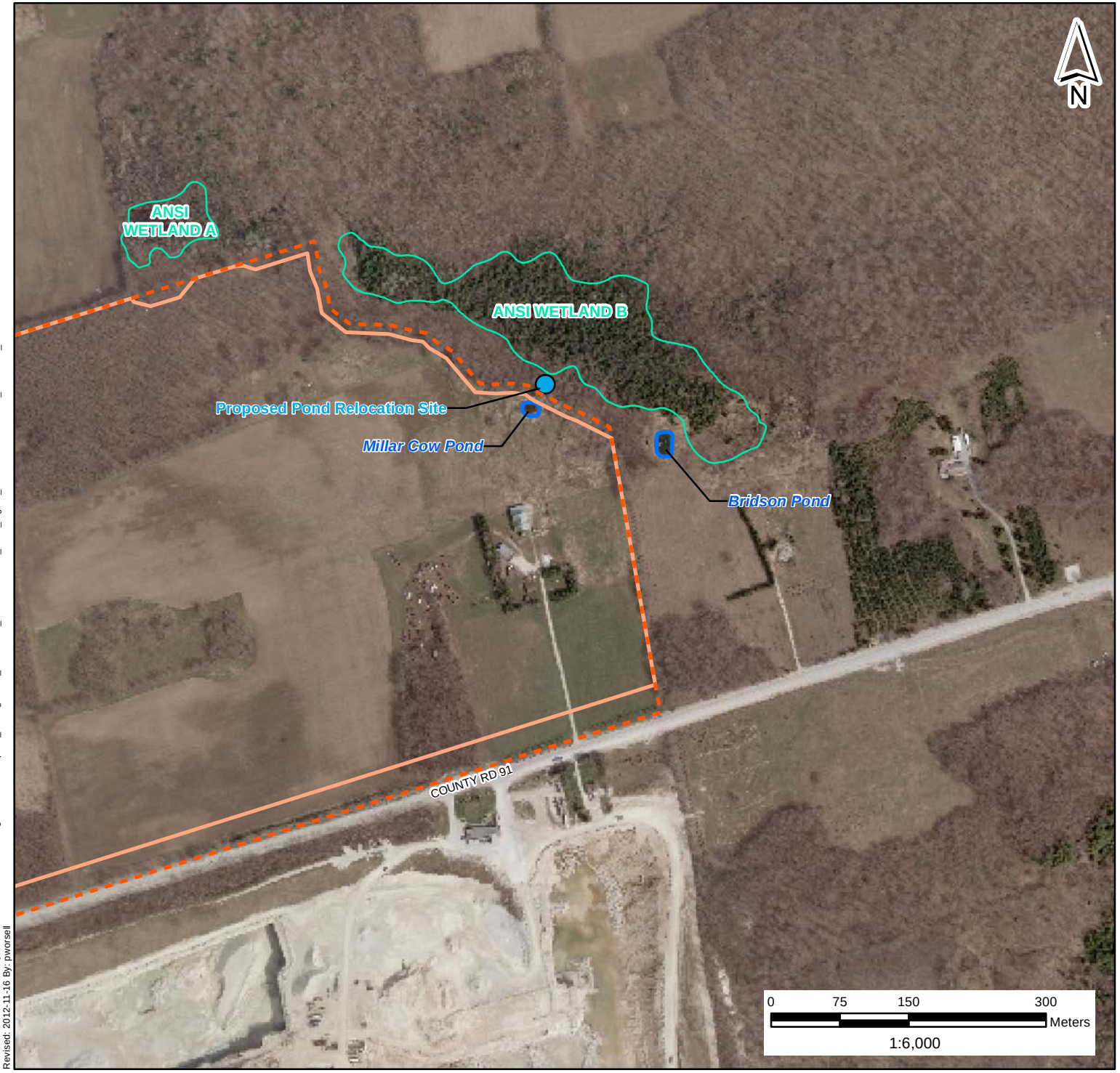
FIGURE 4.1: SHANTY BAY CLIMATOLOGICAL STATION

2010 AND 30 YEAR NORMAL 1971-2000 (THORNBURY SLAMA)
MONTHLY PRECIPITATION AND WATER SURPLUS





Walker Aggregates Inc.

Legend

- Duntroon Quarry Expansion License Area
- Limit of Extraction - Walker
- ANSI Wetland A and ANSI Wetland B
- Millar Pond Relocation Site

Notes

1. Coordinate System: UTM NAD 83 - Zone 17(N)
2. Data Sources: Ontario Ministry of Natural Resources, © Queens Printer Ontario, 2009.
3. Image Source: First Base Solutions WMS, 2009.

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Figure No.

6.1

Title

MILLAR POND RELOCATION

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Revised: 2012-11-16 By: pworsell

Appendix B: Tables

ATTACHMENTS:

* Note that additional tables are provided in Appendix F.

Table 2.2: Residential Well Interference and Mitigation Summary

TABLE 2.2
RESIDENTIAL WELL INTERFERENCE AND MITIGATION SUMMARY

										BASE OF FOSSIL HILL FORMATION				BASE OF MANITOULIN			
				EXISTING WELL CONSTRUCTION						EXISTING WELL CONSTRUCTION		POTENTIAL WELL CONSTRUCTION		EXISTING WELL CONSTRUCTION		POTENTIAL WELL CONSTRUCTION	
DESIGNATION	NAD 27 NORTHING	NAD 27 EASTING	TYPE	DIAMETER (mm)	MEASURING POINT ELEVATION (m ASL)	GROUND ELEVATION (m ASL)	SCREENED INTERVAL (m ASL or Depth)	CURRENT STORAGE VOLUME (L)	GEOLOGIC FORMATION MONITORED	PREDICTED DRAWDOWN (m)	PREDICTED STORAGE VOLUME (L)	POTENTIAL WELL DEPTH (m)	POTENTIAL STORAGE VOLUME	PREDICTED DRAWDOWN (m)	PREDICTED STORAGE VOLUME (L)	POTENTIAL WELL DEPTH (m)	POTENTIAL STORAGE VOLUME
RW10	4916387	560013	DW	Dug 1580	494.5	Not surveyed	Depth 3.2 m	981	N/A	<1	0	9.5	78	<1	0	39.5	623
RW1	4915265	560619	DW	Drilled 152	509.1	509.1	N/A	123	Amabel	<1	105	24.1	252	<1	105	54.1	797
RW2	4915112	560930	DW	Drilled 152	505.2	504.5	Depth: 29.0 m	150	Amabel	<1	133	NA	NA	<1	133	49.5	499
RW9	4914687	558916	DW	Drilled 152	524.0	524.0	Depth: 27.4 m	358	Amabel	11	158	39	350	11	158	69.0	895
RW3	4915977	559243	DW	Drilled 152	519.0	518.7	Depth: 16.5 m	138	Amabel	<1	120	33.7	419	<1	120	63.7	964
RW4	4915918	559593	DW	Drilled 152	510.5	509.8	Depth: 55.5 m	942	Amabel/Fossil Hill/ Cabot Head/Manitoulin	<1	924	NA	NA	<1	924	55.5	906

Note:

- Potential Well Depth refers to potential deepening of well to the approximate base elevation of the Fossil Hill Formation at 485 mASL and the Manitoulin Formation at 455 m ASL.
- Predicted Storage Volume based on 1 m drawdown from lowest recorded water level at well from 2003 to May 2007 and existing well construction details, with the exception of Kekanovich where an 11 m drawdown was used.
- Potential Storage Volume based on a drawdown of 2 m from lowest recorded water elevation at well from 2003 to May 2007 and potential well depth, except for Kekanovich where a 12 m drawdown was used.
- N/A indicates measurement/information not available.
- NA indicates the well is currently drilled below the depth of the base of the fossil hill formation.
- The RW9 well predicted drawdown (m) is based on the predicted well interference from the proposed Duntroon Quarry expansion. The well is to be removed by MAQ quarry extraction activities.
- The bottom depth of the RW1 well is not currently known. An arbitrary depth of 15 m has been used in this assessment.
- The RW10 well potential replacement well construction calculations were determined using the following data 152 mm diameter drilled well with a Top of Pipe elevation of 494.5 has been used. The existing well is not monitored at request of owner
- The RW4 well is currently developed in the Cabot Head/Manitoulin formation.

Table 3.3: Performance Indicator Trigger Monitoring Locations and Description

TABLE 3.3-

Performance Indicator Trigger Monitoring Locations and Description

Monitoring Stations by Location	NAD27 Easting	NAD27 Northing	Approximate Ground Elevation (mASL)	Description	Culvert Dimensions	Criteria for Choosing location			Flow	Notes
						Publically Accessible	Accessible Walker Land	Suitable for automated monitor (datalogger&/or stage-discharge curve)	Wetland Flow Direction	
BC Control	563207	4913957	TBD	Batteaux Creek Control Station identified with NVCA Southeast of Existing Quarry on 21/22 Sideroad						
Bridson DP	560360	4915303	510.4	Existing Drive Point Monitor - East of Expansion Quarry Walker buffer lands ANSI B Wetland						
Dewatering Sump (Existing Quarry Floor / Expansion Quar	559810	4914310	500.0	Existing Quarry Sump beside crusher and / or Expansion Quarry sump						
DP2	559287	4914373	512.1	Existing Drive Point Monitor - West of Existing Quarry, Walker buffer lands, Northeast corner RR6 Wetland						
DP4	559067	4914013	511.4	Existing Drive Point Monitor - West of Existing Quarry and station SW1 in RR6 Wetland west of Grey County Rd 31						
DP5	559086	4915559	509.66	Existing Drive Point Monitor - North of Expansion Quarry, Walker buffer lands, Vernal Pool west central part RR#2 Wetland						
DP6	559774	4915513	511.45	Existing Drive Point Monitor - North of Expansion Quarry, Walker buffer lands, Vernal Pool ANSI Wetland A						
DP7	nd	nd	nd	New Drive Point Monitor--North of Expansion Quarry, Walker buffer lands, Vernal Pool RR2 Wetland east of DP5, To be installed prior to extraction			√	√		Rob Roy Unit #2
DP8	nd	nd	nd	New Drive Point Monitor - West of Existing Quarry, Walker buffer lands, Northwest corner RR6 Wetland, To be installed prior to extraction			√	√		Rob Roy Unit #6
DP9	nd	nd	nd	New Drive Point Monitor - Northeast of Expansion Quarry, Walker buffer lands, Northwest section ANSI B Wetland, To be installed prior to extraction						
PR Control	558052	4918002	nd	Pretty River Control Station identified with NVCA North of Expansion Quarry on 30/31 Sideroad						
Quarry Discharge	nd	nd	nd	Existing Quarry Discharge Location in RR6 Wetland						
Reference Wetland 1	nd	nd	nd	Location to be established with NVCA						
Reference Wetland 2	nd	nd	nd	Location to be established with NVCA						
SW3B	nd	nd	nd	Northwest of Expansion Quarry, West of Grey County Rd 31, RR3 Wetland Karst Sink Point Channel West of Dug Pond Outlet, To be installed prior to extraction						
DP10	nd	nd	nd	New Drive Point Monitor - Northwest of Expansion Quarry, in RR3 Wetland Thicket Swamp, To be installed prior to extraction						
SW1	559102	4914051	513	West of Existing Quarry, Twin Culverts Beneath Grey County Rd 31, Southwest corner of RR6 Wetland	South culvert dia. 0.62m, North culvert dia. 0.60m	√		√	in/out	Quarry Discharge Wetland Outflow
SW10	561192	4915418	477	Escarpment Seep Channel - East of Expansion Quarry below Escarpment, Upslope from house / farm water supply well tile collection system	Stream Channel Flow	Private Land		√		Spring from Amabel Formation; above W. Franks surface water supply collection rings.
SW11	561128	4915780	445	Escarpment Seep Channel - Northeast of Expansion Quarry below Escarpment, Culmination of several seeps into stream channel at toe of scarp at trail crossing	Stream Channel Flow	Private Land		√		Springs below Manitoulin Formation; above collection pond on W. Franks property.
SW11A	561081	4915809	446	Escarpment Seep Channel - Northeast of Expansion Quarry below Escarpment, Located near toe of scarp in rock talus	Stream Channel Flow					
SW11B	561065	4915819	446	Escarpment Seep Channel - Northeast of Expansion Quarry below Escarpment, Located near toe of scarp in rock talus	Stream Channel Flow					
SW11C	561048	4915838	446	Escarpment Seep Channel - Northeast of Expansion Quarry below Escarpment, Located near toe of scarp in rock talus	Stream Channel Flow					
SW11D	561038	4915866	446	Escarpment Seep Channel - Northeast of Expansion Quarry below Escarpment, Located near toe of scarp in rock talus	Stream Channel Flow					
SW11E	561219	4915760	435	Escarpment Stream Channel - Northeast of Expansion Quarry below Escarpment, Downstream from SW11 and just upstream from discharge into on-line pond	Stream Channel Flow					
SW14	561574	4916032	410	Channel Flow at Culvert - Northeast of Expansion Quarry below Escaprment, Downstream from SW13, East side of Concession 10	Stream Channel Flow	√		√		Culvert flow at Conc. 10 consolidates one or more tributary channel flows. Pond Outflow consolidates flow from one or more Springs below the Escarpment Brow.
SW15	561481	4916204	420	Channel Flow Downstream from Culvert - Northeast of Expansion Quarry below Escarpment, Downstream from on-line pond outlet, East side of Concession 10	Stream Channel Flow	√		√		Culvert flow at Conc. 10 consolidates one or more tributary channel flows. Pond Outflow consolidates flow from one or more Springs below the Escarpment Brow.
SW16	560955	4916433	415	Channel Flow at Culvert - Northeast of Expansion Quarry below Escarpment, at 26/27 Sideroad west of Concession 10	Stream Channel Flow	√		√		Stream Channel flow consolidates flow from one or more tributary channel flows
SW17	560592	4916314	431	On-line Pond Discharge Outlet Channel - Northeast of Expansion Quarry below Escarpment, Above culvert south side of 26/27 Sideroad	Stream Channel Flow	√		√		Pond Outflow
SW17A	560595	4916324	430	Stream Channel Flow - Northeast of Expansion Quarry below Escarpment, North side of 26/27 Sideroad upstream from SW17 culvert discharge point	Stream Channel Flow	√		√		Stream Channel flow consolidates flow from one or more tributary channel flows
SW18	561392	4916787	390	Box Culvert Channel Flow-Northeast of Expansion Quarry below Escarpment, East side of Concession 10 north of 26/27 Sideroad	Stream Channel Flow	√		√		Culvert flow at Conc. 10 consolidates one or more tributary channel flows
SW2	559063	4914546	515	h Channel Flow - South of southwest corner Expansion Quarry, Flow into northwest corner of RR6 Wetland, Channel south of culvert beneath County Rd 91 at junction with Grey Conty	Oblong shaped culvert	√		√	in	Individual Spring Flow Into Rob Roy #6
SW21C	560703	4916021	470	Channel Flow - Northeast of Expansion Quarry below Escarpment, Seep channel northwest of (above) water supply system cistern inlet collection pipe	Stream channel Flow					
SW24A	560487	4916124	460	Seep Channel Flow - Northeast of Expansion Quarry below Escarpment, Channel at former water supply collection system above on-line pond inlet	Bucket capture of flow out of pipes, Valeport measurement of stream channel	Private Land		√		Spring from Manitoulin Formation; channel above surface water supply collection system and collection pond. Former Sistito property now H/E Franks.
SW3	558875	4915721	510	Channel Flow- North of Expansion Quarry, West side culvert beneath Grey County Rd 31, Flow exiting RR2 Wetland into RR3 Wetland	Oblong shaped culvert	√		√	in/out	Outflow RR#2 Inflow RR#3
SW6A	555237	4912472	495	nel Flow - Southwest of Existing Quarry, West side twin culverts beneath Osprey Sideroad 30, south of Osprey 10th Line, Outlet channel flow from Rob Roy Swamp PSW wetland comp	Stream Channel Flow	√		√	out	Outflow from Rob Roy Wetland Complex
SW77	560121	4916054	494	Seep Flow - Northeast of Expansion Quarry at Escarpment, Northeast corner Walker buffer lands south of 26/27 Sideroad	Stream Channel Flow	√		N/A		Spring from Amabel Formation on the south side of 26/27 Sideroad owned by Walker Aggregates Inc.
SW9	560440	4915421	508	Channel Flow - East of Expansion Quarry, Walker buffer lands, outflow from ANSI Wetland B into sinkhole area	Stream Channel Flow		√	√	out	Infiltration-Sinkhole Area
SWO-2	558414	4914264	510	Channel Flow - West of Existing Quarry , Walker buffer lands west of Grey County Rd 31, outflow from RR6 Wetland	Stream Channel Flow		√	√	out	Outflow from Rob Roy Unit #6

Table 3.4: Performance Indicator Trigger Monitoring Parameters

TABLE 3.4-

Performance Indicator Trigger Monitoring Parameters

Monitoring Stations by Location	Datalogger				Field Parameters								Sampling for Lab Analysis				
	Download Frequency	Surface Water Temperature	Ponded Water Depth	Water Level Stage (Stream Flow)	Ground Water Level (inside Monitor)	Ponded Water Depth	Stream Flow	Stream Flow Measurement Type	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Counductivity (µS/cm)	General Chemistry (Alkalinity, Hardness, Colour, Amonia)	Major and Minor Ion Constituents & Nutrients	Total Petroleum Hydrocarbons and BETX	Total Suspended Solids	Bacteriological Count (E.coli, Total coliform, Heterotrophic plate count)
BC Control	1.Monthly 2.Logger to Web	Hourly		Hourly			Quarterly	V, M	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	
Bridson DP					1. Bi-Weelkly (May-July) 2. Monthly	1. Bi-Weelkly (May-July) 2. Monthly			1. Bi-Weelkly (May-July) 2. Monthly								
Dewatering Sump (Existing Quarry Floor / Expansion Quarry)									Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
DP2					1. Bi-Weelkly (May-July) 2. Monthly	1. Bi-Weelkly (May-July) 2. Monthly			1. Bi-Weelkly (May-July) 2. Monthly								
DP4					1. Bi-Weelkly (May-July) 2. Monthly	1. Bi-Weelkly (May-July) 2. Monthly			1. Bi-Weelkly (May-July) 2. Monthly								
DP5					1. Bi-Weelkly (May-July) 2. Monthly	1. Bi-Weelkly (May-July) 2. Monthly			1. Bi-Weelkly (May-July) 2. Monthly								
DP6					1. Bi-Weelkly (May-July) 2. Monthly	1. Bi-Weelkly (May-July) 2. Monthly			1. Bi-Weelkly (May-July) 2. Monthly								
DP7					1. Bi-Weelkly (May-July) 2. Monthly	1. Bi-Weelkly (May-July) 2. Monthly			1. Bi-Weelkly (May-July) 2. Monthly								
DP8					1. Bi-Weelkly (May-July) 2. Monthly	1. Bi-Weelkly (May-July) 2. Monthly			1. Bi-Weelkly (May-July) 2. Monthly								
DP9					1. Bi-Weelkly (May-July) 2. Monthly	1. Bi-Weelkly (May-July) 2. Monthly			1. Bi-Weelkly (May-July) 2. Monthly								
PR Control	1.Monthly 2.Logger to Web	Hourly		Hourly			Quarterly	V, M	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	
Quarry Discharge	ydrogeology Note 6 PITM (D) says discharge water as specified by MOE																
Reference Wetland 1					1. Bi-Weelkly (May-July) 2. Monthly	1. Bi-Weelkly (May-July) 2. Monthly			1. Bi-Weelkly (May-July) 2. Monthly								
Reference Wetland 2					1. Bi-Weelkly (May-July) 2. Monthly	1. Bi-Weelkly (May-July) 2. Monthly			1. Bi-Weelkly (May-July) 2. Monthly								
SW3B	Monthly	Hourly		Hourly			Quarterly	V, M	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Monthly	Annually	Annually	Annually	Annually	
DP10					1. Bi-Weelkly (May-July) 2. Monthly	1. Bi-Weelkly (May-July) 2. Monthly			1. Bi-Weelkly (May-July) 2. Monthly								
SW1	Monthly	Hourly		Hourly			Quarterly	V, M	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	
SW10							1. Bi-Weelkly (July -Aug) 2. Monthly	V,M,E	1. Bi-Weelkly (July -Aug) 2. Monthly 3. Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually
SW11							1. Bi-Weelkly (July -Aug) 2. Monthly	V,M,E	1. Bi-Weelkly (July -Aug) 2. Monthly 3. Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	
SW11A							1. Bi-Weelkly (July -Aug) 2. Monthly	V,E	1. Bi-Weelkly (July -Aug) 2. Monthly 3. Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually

TABLE 3.4-

Performance Indicator Trigger Monitoring Parameters

Monitoring Stations by Location	Datalogger				Field Parameters								Sampling for Lab Analysis				
	Download Frequency	Surface Water Temperature	Ponded Water Depth	Water Level Stage (Stream Flow)	Ground Water Level (inside Monitor)	Ponded Water Depth	Stream Flow	Stream Flow Measurement Type	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Counductivity (µS/cm)	General Chemistry (Alkalinity, Hardness, Colour, Amonia)	Major and Minor Ion Constituents & Nutrients	Total Petroleum Hydrocarbons and BETX	Total Suspended Solids	Bacteriological Count (E.coli, Total coliform, Heterotrophic plate count)
SW11B							1. Bi-Weelkly (July -Aug) 2. Monthly	V,E	1. Bi-Weelkly (July -Aug) 2. Monthly 3. Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually
SW11C							1. Bi-Weelkly (July -Aug) 2. Monthly	V,E	1. Bi-Weelkly (July -Aug) 2. Monthly 3. Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually
SW11D							1. Bi-Weelkly (July -Aug) 2. Monthly	V,E	1. Bi-Weelkly (July -Aug) 2. Monthly 3. Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually
SW11E							1. Bi-Weelkly (July -Aug) 2. Monthly	V,E	1. Bi-Weelkly (July -Aug) 2. Monthly 3. Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually
SW14	1.Monthly 2.Logger to Web	Hourly		Hourly			Quarterly	V	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	
SW15	Monthly	Hourly		Hourly			Quarterly	V	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	
SW16	Monthly	Hourly		Hourly			Quarterly	E	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	
SW17	1.Monthly 2.Logger to Web	Hourly		Hourly			Quarterly	V,M,E	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	
SW17A	1.Monthly 2.Logger to Web	Hourly		Hourly			Quarterly	V	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	
SW18	1.Monthly 2.Logger to Web	Hourly		Hourly			Quarterly	V	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	
SW2	Monthly	Hourly		Hourly			Quarterly	V,M	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	
SW21C							1. Bi-Weelkly (July -Aug) 2. Monthly	V,E	1. Bi-Weelkly (July -Aug) 2. Monthly 3. Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually
SW24A							1. Bi-Weelkly (July -Aug) 2. Monthly	V,B,E	1. Bi-Weelkly (July -Aug) 2. Monthly 3. Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	
SW3	Monthly	Hourly		Hourly			Quarterly	V,M,E	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	
SW6A	Monthly	Hourly		Hourly			Quarterly	V	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	
SW77							1. Bi-Weelkly (July -Aug) 2. Monthly	V, E	1. Bi-Weelkly (July -Aug) 2. Monthly 3. Annually	Annually	Annually		Annually	Annually	Annually	Annually	
SW9	Monthly	Hourly		Hourly			Quarterly	V,M,E	Monthly Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	
SWO-2	Monthly	Hourly		Hourly			Quarterly	V,M	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	1.Monthly 2.Annually	Annually	Annually	Annually	Annually	

Table 3.5:
Surface Water Flows
Performance Trigger Value Summary
(Active Flow Periods)

TABLE 3.5
SURFACE WATER FLOWS PERFORMANCE TRIGGER VALUE SUMMARY (ACTIVE FLOW PERIODS)
DUNTROON QUARRY EXPANSION

MONITORING	JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
LOCATION	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type
SW1	16-Jan-03	22.8	M	7-Feb-03	20.7	V	7-Mar-03	16.4	V	4-Apr-03	119.5	V	2-May-03	88.9	V	9-Jun-03	19.3	M	4-Jul-03	69.8	V	8-Aug-03	3.6	V	5-Sep-03		NM	2-Oct-03	33.1	V	7-Nov-03	46.6	V	19-Dec-03	55.8	V
	24-Jan-03	24.2	M	14-Feb-03	19.6	V	14-Mar-03	17.8	V	9-Apr-03	61.0	V	9-May-03	96.7	V	13-Jun-03	17.3	V	11-Jul-03	54.2	V	15-Aug-03		Dry	11-Sep-03	22.9	V	9-Oct-03		Dry	17-Nov-03	67.8	V	31-Dec-03	55.8	V
	31-Jan-03	22.0	V	21-Feb-03	17.1	V	21-Mar-03	23.0	V	17-Apr-03	94.6	V	15-May-03	87.7	V	23-Jun-03	89.6	V	18-Jul-03	42.7	V	20-Aug-03		Dry	18-Sep-03	13.5	V	17-Oct-03	58.3	V	28-Nov-03	60.4	V	2-Dec-04		Dry
	12-Jan-04	106.1	V	28-Feb-03	18.5	V	28-Mar-03	134.9	V	25-Apr-03	60.4	V	22-May-03	11.9	V	4-Jun-04	95.6	V	22-Jul-03	2.6	V	27-Aug-03	35.2	V	25-Sep-03	0.7	M	23-Oct-03		Dry	4-Nov-04		Dry	9-Dec-04		Dry
	16-Jan-04	76.9	V	6-Feb-04	49.2	V	4-Mar-04	66.1	V	2-Apr-04	117.1	V	29-May-03		Dry	11-Jun-04	9.8	V	24-Jul-03	4.5	V	6-Aug-04		Dry	3-Sep-04		Dry	31-Oct-03	49.5	V	7-Nov-04	90.0	V	17-Dec-04	0.6	V
	20-Jan-04	68.8	V	12-Feb-04	44.4	V	12-Mar-04	101.7	V	8-Apr-04	104.8	V	7-May-04	88.9	V	17-Jun-04	84.6	V	31-Jul-03	42.6	V	12-Aug-04		Dry	9-Sep-04	3.0	V	1-Oct-04		Dry	11-Nov-04		Dry	29-Dec-04	44.1	V
	30-Jan-04	58.9	V	27-Feb-04	39.9	V	19-Mar-04	73.9	V	16-Apr-04	86.7	V	14-May-04	4.1	V	24-Jun-04		Dry	1-Jul-04	44.7	V	19-Aug-04	26.8	V	17-Sep-04	49.6	V	7-Oct-04		Dry	19-Nov-04		Dry	2-Dec-05	51.5	V
	5-Jan-05	59.4	V	3-Feb-05	50.6	V	26-Mar-04	136.1	V	23-Apr-04	91.3	V	20-May-04	18.2	V	3-Jun-05	23.5	V	9-Jul-04		Dry	26-Aug-04	36.5	V	23-Sep-04		Dry	14-Oct-04		Dry	25-Nov-04		Dry	9-Dec-05	44.1	V
	13-Jan-05		Dry	10-Feb-05		Dry	3-Mar-05	3.3	V	30-Apr-04	62.4	V	28-May-04	112.8	V	10-Jun-05		Dry	16-Jul-04	58.3	V	2-Aug-05		Dry	1-Sep-05		Dry	20-Oct-04		Dry	4-Nov-05		Dry	16-Dec-05	45.8	V
	20-Jan-05	79.7	V	16-Feb-05	64.0	V	10-Mar-05		Dry	7-Apr-05	15.2	V	6-May-05	60.1	V	17-Jun-05	11.0	V	22-Jul-04	45.5	V	12-Aug-05		Dry	9-Sep-05		Dry	24-Oct-04	42.4	M	11-Nov-05		Dry	22-Dec-05	39.0	V
	28-Jan-05	45.5	V	24-Feb-05	9.0	V	17-Mar-05		Low Flow	15-Apr-05	121.8	V	13-May-05	21.7	V	17-Jun-05	11.0	V	29-Jul-04	76.7	V	19-Aug-05		Dry	16-Sep-05		Dry	28-Oct-04		Dry	18-Nov-05	57.0	V	30-Dec-05	55.4	V
	6-Jan-06	40.7	V	3-Feb-06	53.5	V	24-Mar-05	38.5	V	21-Apr-05	90.8	V	20-May-05	21.2	V	24-Jun-05	1.1	V	7-Jul-05	4.6	V	23-Aug-05		Dry	23-Sep-05		Dry	31-Oct-04	44.2	M	25-Nov-05	49.5	V	4-Dec-06	92.9	V
	13-Jan-06		Dry	10-Feb-06	52.8	V	30-Mar-05	71.4	V	28-Apr-05	70.3	V	27-May-05	44.4	V	30-Jun-05	9.3	V	15-Jul-05	25.0	V	24-Aug-05		Dry	30-Sep-05		Dry	7-Oct-05		Dry	3-Nov-06	95.4	V	8-Dec-06	70.2	V
	20-Jan-06	44.7	V	20-Feb-06	51.9	V	3-Mar-06	55.3	V	7-Apr-06	162.9	V	5-May-06	64.1	V	2-Jun-06	35.4	V	21-Jul-05	16.2	V	4-Aug-06	32.8	M/V	1-Sep-06	13.8	V	14-Oct-05		Dry	10-Nov-06	77.8	V	14-Dec-06	73.8	V
	27-Jan-06	53.1	V	20-Feb-06	51.9	V	10-Mar-06	58.7	V	10-Apr-06	111.0	V	12-May-06	57.7	V	9-Jun-06	48.5	V	28-Jul-05		Dry	11-Aug-06		Dry	8-Sep-06	2.2	V	21-Oct-05		Dry	17-Nov-06	26.4	V	21-Dec-06	69.5	V
	5-Jan-07	60.1	V	24-Feb-06	50.4	V	17-Mar-06	92.4	V	13-Apr-06	55.1	V	12-May-06	57.7	V	16-Jun-06	6.1	V	10-Jul-06	1.0	V	18-Aug-06		Dry	15-Sep-06	33.8	V	28-Oct-05		Dry	24-Nov-06	51.5	V	28-Dec-06	54.9	V
	12-Jan-07	56.1	V	2-Feb-07	63.4	V	24-Mar-06	74.4	V	21-Apr-06	59.8	V	19-May-06	48.5	V	23-Jun-06		Dry	14-Jul-06		Dry	25-Aug-06	4.4	V	21-Sep-06	2.0	V	6-Oct-06		Dry	2-Nov-07	27.2	V	7-Dec-07	48.9	V
	19-Jan-07	58.8	V	9-Feb-07	63.6	V	31-Mar-06	79.7	V	26-Apr-06	60.2	V	25-May-06	43.0	V	30-Jun-06		Dry	21-Jul-06		Dry	3-Aug-07		Dry	28-Sep-06	15.6	V	13-Oct-06		Dry	9-Nov-07	47.1	V	14-Dec-07	19.3	V
	26-Jan-07	4.9	V	16-Feb-07	60.0	V	2-Mar-07	60.8	V	5-Apr-07	108.9	V	4-May-07	80.5	V	1-Jun-07		Dry	28-Jul-06		Dry	10-Aug-07		Low Flow	7-Sep-07	21.1	V	20-Oct-06	48.2	V	16-Nov-07	45.3	V	20-Dec-07	18.2	V
	4-Jan-08	31.1	V	22-Feb-07	58.4	V	9-Mar-07	32.4	V	13-Apr-07	74.5	V	11-May-07	43.3	V	8-Jun-07	58.1	V	6-Jul-07	20.5	V	17-Aug-07	10.1	V	14-Sep-07	1.2	V	26-Oct-06		Dry	23-Nov-07	35.6	V	28-Dec-07	56.5	V
	11-Jan-08	38.4	V	1-Feb-08	57.6	V	16-Mar-07	105.0	V	20-Apr-07	95.2	V	18-May-07	74.8	V	14-Jun-07	47.9	V	13-Jul-07		Dry	24-Aug-07		Ponded	21-Sep-07	10.7	V	5-Oct-07	27.4	V	30-Nov-07	36.1	V	5-Dec-08	5.1	V
	18-Jan-08	41.5	V	8-Feb-08	48.0	V	23-Mar-07	53.6	V	28-Apr-07	7.4	V	25-May-07	61.2	V	22-Jun-07		Dry	20-Jul-07		Low Flow	30-Aug-07	7.6	V	28-Sep-07	9.8	V	12-Oct-07		Dry	7-Nov-08	34.8	V	12-Dec-08	30.4	V
	25-Jan-08	57.3	V	15-Feb-08	41.5	V	30-Mar-07	106.9	V	4-Apr-08	86.5	V	2-May-08	92.0	V	29-Jun-07	17.0	V	27-Jul-07	1.6	V	1-Aug-08	3.0	V	5-Sep-08		Ponded	19-Oct-07	10.4	V	14-Nov-08	34.8	V	19-Dec-08	26.8	V
	9-Jan-09	40.2	V	22-Feb-08	63.4	V	7-Mar-08	61.3	V	11-Apr-08	145.7	V	8-May-08	74.4	V	6-Jun-08	67.2	V	4-Jul-08		Dry	8-Aug-08		Dry	12-Sep-08	4.2	V	26-Oct-07	0.9	V	21-Nov-08	12.0	V	23-Dec-08	70.1	V
	15-Jan-09	55.2	V	29-Feb-08	55.9	V	14-Mar-08	53.1	V	15-Apr-08	91.8	V	15-May-08	75.6	V	13-Jun-08	12.7	V	11-Jul-08		Dry	15-Aug-08	8.9	V	19-Sep-08		Ponded	17-Oct-08	45.2	V	28-Nov-08	14.2	V	29-Dec-08	103.2	V
	16-Jan-09	16.5	V	6-Feb-09		Low Flow	20-Mar-08	58.5	V	18-Apr-08	88.1	V	23-May-08	59.5	V	20-Jun-08		Dry	18-Jul-08	30.7	V	22-Aug-08		Dry	26-Sep-08	7.2	V	3-Oct-08	48.2	V	6-Nov-09	54.4	V	4-Dec-09	35.2	V
	23-Jan-09	0.9	V	13-Feb-09	53.7	V	28-Mar-08	63.5	V	25-Apr-08	74.1	V	30-May-08	64.9	V	27-Jun-08	42.5	V	25-Jul-08	41.7	V	28-Aug-08	21.2	V	4-Sep-09		Ponded	10-Oct-08	46.5	V	13-Nov-09	39.7	V	11-Dec-09	47.4	V
	30-Jan-09	63.4	V	20-Feb-09	67.1	V	6-Mar-09	0.6	V	3-Apr-09	109.6	V	1-May-09	98.4	V	5-Jun-09	65.3	V	2-Jul-09		Low Flow	7-Aug-09		Ponded	11-Sep-09		Ponded	17-Oct-08	45.2	V	20-Nov-09	2.9	V	18-Dec-09	12.9	V
	8-Jan-10	52.8	V	27-Feb-09	4.8	V	13-Mar-09	20.9	V	9-Apr-09	92.3	V	8-May-09	77.9	V	12-Jun-09	38.2	V	10-Jul-09	4.0	V	14-Aug-09		Ponded	18-Sep-09		Ponded	31-Oct-08	30.7	V	27-Nov-09	17.4	V	22-Dec-09	54.8	V
	15-Jan-10	55.2	V	5-Feb-10	55.5	V	20-Mar-09	55.3	V	17-Apr-09	109.7	V	15-May-09	76.1	V	19-Jun-09	86.8	V	17-Jul-09	0.2	V	21-Aug-09		Ponded	25-Sep-09		Ponded	2-Oct-09	2.5	V	5-Nov-10	1.3	V	28-Dec-09	52.6	V
	22-Jan-10	13.8	V	12-Feb-10	40.3	V	27-Mar-09	40.5	V	24-Apr-09	94.2	V	22-May-09	79.0	V	26-Jun-09	83.2	V	24-Jul-09		Low Flow	28-Aug-09	0.5	V	1-Sep-10		Dry	9-Oct-09	51.3	V	12-Nov-10	6.4	V	3-Dec-10	5.0	V
	29-Jan-10	32.7	V	19-Feb-10	26.8	V	1-Mar-10	28.0	V	2-Apr-10	75.2	V	29-May-09	87.5	V	4-Jun-10	76.5	V	31-Jul-09		Low Flow	6-Aug-10	*0.1*	Low Flow	3-Sep-10		Dry	16-Oct-09	10.3	V	19-Nov-10	11.5	V	9-Dec-10	15.5	V
	7-Jan-11	34.0	V	4-Feb-11	34.8	V	5-Mar-10	42.4	V	9-Apr-10	61.2	V	7-May-10	75.2	V	11-Jun-10	39.4	V	1-Jul-10	80.3	V	13-Aug-10		Dry	10-Sep-10		Dry	23-Oct-09	69.3	V	26-Nov-10	16.6	V	17-Dec-10	43.8	V
	14-Jan-11	43.7	V	11-Feb-11	46.6	V	12-Mar-10	23.1	V	16-Apr-10	48.0	V	14-May-10	2.5	V	18-Jun-10	18.6	V	9-Jul-10	0.8	V	20-Aug-10		Dry	17-Sep-10		Dry	30-Oct-09	73.5	V	4-Nov-11	32.6	V	23-Dec-10	10.4	V
	21-Jan-11	42.0	V	18-Feb-11	12.6	V	19-Mar-10	32.5	V	23-Apr-10	48.6	V	21-May-10	77.8	V	25-Jun-10	72.8	V	15-Jul-10	2.2	V	27-Aug-10		Dry	24-Sep-10	0.2	V	1-Oct-10	3.6	V	11-Nov-11	0.3	V	30-Dec-10	32.7	V
	28-Jan-11	42.4	V	25-Feb-11	63.1	V	26-Mar-10	35.3	V	30-Apr-10	17.6	V	28-May-10	10.3	V	3-Jun-11	13.1	V	23-Jul-10	0.3	V	30-Aug-10		Dry	2-Sep-11		Ponded	8-Oct-10	17.6	V	18-Nov-11	32.5	V	30-Dec-11	45.3	V
	6-Jan-12	17.7	V	3-Feb-12	56.7	V	4-Mar-11	6.8	V	1-Apr-11	11.7	V	6-May-11	57.9	V	10-Jun-11	39.9	V	30-Jul-10	0.2	V	5-Aug-11		Dry	9-Sep-11		Ponded	15-Oct-10	4.2	V	25-Nov-11	45.1	V	9-Dec-11	52.9	V
	13-Jan-12	48.7	V	10-Feb-12	42.1	V	11-Mar-11	17.4	V	5-Apr-11	73.7	V	13-May-11	45.5	V	17-Jun-11	66.3	V	8-Jul-11		Dry	12-Aug-11		Dry	16-Sep-11	0.6	V	22-Oct-10	7.2	V	2-Nov-12	11.7	V	16-Dec-11	18.0	V
	20-Jan-12	41.0	V	17-Feb-12	30.1	V	18-Mar-11	10.3	V	8-Apr-11	14.2	V	20-May-11	81.7	V	24-Jun-11	3.0	V	14-Jul-11		Dry	19-Aug-11		Dry	23-Sep-11		Ponded	29-Oct-10	1.3	V	9-Nov-12	14.7	V	23-Dec-11	36.8	V
	27-Jan-12	37.3	V	24-Feb-12	41.2	V	25-Mar-11	9.7	V	15-Apr-11	53.3	V	27-May-11	18.7	V	30-Jun-11	17.7	V	22-Jul-11		Dry	26-Aug-11		Dry	30-Sep-11		Ponded	6-Oct-11	40.2	V	16-Nov-12	2.2	V	30-Dec-11	21.1	V
	4-Jan-13	47.8	V	1-Feb-13	60.8	V	1-Mar-12	46.5	V	21-Apr-11	86.0	V	4-May-12	5.0	V	1-Jun-12	7.9	V	29-Jul-11		Dry	3-Aug-12		Dry	7-Sep-12		Ponded	14-Oct-11		Ponded	23-Nov-12	23.4	V	7-Dec-12	35.0	V
	11-Jan-13	62.4	V	8-Feb-13	53.7	V	9-Mar-12	36.7	V	29-Apr-11	51.0	V	11-May-12	4.0	V	8-Jun-12	23.3	V	7-Jul-12	2.4	V	10-Aug-12	1.3	V	14-Sep-12	1.2	V	21-Oct-11	42.0	V	30-Nov-12	9.9	V	14-Dec-12	42.7	V
	17-Jan-13	48.4	V	15-Feb-13	52.0	V	16-Mar-12	136.7	V	6-Apr-12	47.5	V	18-May-12	32.7	V	15-Jun-12	10.8	V	13-Jul-12		Dry	17-Aug-12	30.8	V	21-Sep-12		Dry	28-Oct-11	10.6	V	8-Nov-13	48.0	V	21-Dec-12	39.9	V
	25-Jan-13	24.7	V	22-Feb-13	52.0	V	23-Mar-12	26.7	V	13-Apr-12	16.6	V	25-May-12	24.8	V	22-Jun-12	28.5	V	20-Jul-12		Dry	24-Aug-12		Dry	28-Sep-12	1.0	V	5-Oct-12	3.6	V	14-Nov-13	49.0	V	28-Dec-12	49.3	V
							30-Mar-12	42.1	V	20-Apr-12	37.0	V	3-May-13	19.9	V	28-Jun-12	1.1	V	27-Jul-12		Dry	31-Aug-12	0.9	V	6-Sep-13	0.5	V	12-Oct-12	1.3	V	17-Nov-13	44.5	V			
							1-Mar-13	47.9	V	27-Apr-12	1.5	V	9-May-13	46.7	V	7-Jun-13	49.2	V	5-Jul-13	37.1	V	2-Aug-13	4.0	V	13-Sep-13	7.0	V	19-Oct-12	7.7	V						
							8-Mar-13	49.8	V	5-Apr-13	45.1	V	16-May-13	25.0	V	14-Jun-13	48.7	V	12-Jul-13	5.5	V	8-Aug-13	3.4	V	20-Sep-13	2.4	V	26-Oct-12	2.8	V						
							15-Mar-13	50.7	V	12-Apr-13	81.9	V	24-May-13	55.7	V	21-Jun-13	41.2	V	19-Jul-13	3.2	V	16-Aug-13	0.6	V	27-Sep-13	18.7	V	4-Oct-13	24.8	V						
							22-Mar-13	50.4	V	19-Apr-13	123.1	V	31-May-13	58.7	V	27-Jun-13	5.6	V	25-Jul-13	29.0	V	23-Aug-13		Dry				11-Oct-13	58.1	V						
							28-Mar-13	48.9	V	26-Apr-13	61.3	V										30-Aug-13	0.5	V				18-Oct-13	7.3	V						
																												25-Oct-13	24.9	V						
																												31-Oct-13	35.5	V						
No. of Readings:	42			42			48			50			48			42			30			20			24			36			39			42		
Maximum:	106.1			67.1			136.7			162.9			112.8			95.6			80.3			36.5			49.6			73.5			95.4			103.2		
Minimum:	0.9			4.8			0.6			1.5			2.5			1.1			0.2			0.1			0.2			0.9			0.3			0.6		
Average:	44.6			45.2			52.0			73.5			54.5			36.8			24.9			11.6			10.1			27.4			35.2			42.5		
YELLOW:	13.8			12.6			6.8			11.7			5.0			3.0			0.3			0.5			0.6			1.3			2.2			5.1		
RED:	**0.9**			**4.8**			**0.6**			**1.5**			**2.5**			**1.1**			**0.2**			**0.1**			**0.2**			**0.9**			**0.3**			**0.6**		

NOTES:

RED
- Maintained equivalent to the lowest monthly flow recorded over period of record.

YELLOW
- Calculated as 15% above the red value or third lowest monthly flow over period of record, whichever is higher.

V - Valeport Measurement
M - Manual Measurement (floating object)
E - Visual Estimate
BE - Bucket Estimate
B - Location Buried in Snow
F - Location Frozen
Low Flow - <0.1 L/s

- Maintained equivalent to the lowest monthly flow recorded over period of record.
- Calculated as 15% above the red value or third lowest monthly flow over period of record, whichever is higher.

V - Valeport Measurement
M - Manual Measurement (floating object)
E - Visual Estimate
BE - Bucket Estimate
B - Location Buried in Snow
F - Location Frozen

TABLE 3.5
SURFACE WATER FLOWS PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING LOCATION	JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type
SW2	3-Jan-03	1.5	M	7-Feb-03	-	F	7-Mar-03	-	F	4-Apr-03	26.7	V	2-May-03	21.1	V	9-Jun-03	8.3	M	4-Jul-03	4.0	V	8-Aug-03	4.3	V	5-Sep-03	2.3	V	2-Oct-03	0.8	V	7-Nov-03	8.0	V	19-Dec-03	12.5	V
	10-Jan-03	2.3	M	14-Feb-03	-	F	14-Mar-03	-	F	9-Apr-03	12.6	V	9-May-03	7.9	V	13-Jun-03	9.6	V	11-Jul-03	3.4	V	15-Aug-03	2.3	V	11-Sep-03	1.4	V	9-Oct-03	0.4	V	17-Nov-03	11.1	V	31-Dec-03	15.7	V
	16-Jan-03	-	F	21-Feb-03	-	F	21-Mar-03	26.7	V	17-Apr-03	27.0	V	15-May-03	5.7	V	23-Jun-03	5.8	V	18-Jul-03	3.6	V	20-Aug-03	2.6	V	18-Sep-03	0.8	V	17-Oct-03	1.7	V	28-Nov-03	13.3	V	2-Dec-04	0.3	V
	24-Jan-03	-	F	28-Feb-03	-	F	28-Mar-03	38.3	V	25-Apr-03	13.2	V	22-May-03	5.0	V	4-Jun-04	10.6	V	22-Jul-03	3.6	V	27-Aug-03	1.6	V	25-Sep-03	0.5	V	23-Oct-03	1.4	V	4-Nov-04	2.7	V	9-Dec-04	3.9	V
	31-Jan-03	-	F	6-Feb-04	5.4	V	4-Mar-04	12.8	V	2-Apr-04	58.1	V	29-May-03	11.8	M	11-Jun-04	6.9	V	24-Jul-03	2.8	V	6-Aug-04	1.8	V	3-Sep-04	1.3	V	31-Oct-03	3.2	V	11-Nov-04	1.7	V	17-Dec-04	-	F
	12-Jan-04	16.8	V	12-Feb-04	4.6	V	12-Mar-04	24.2	V	8-Apr-04	30.1	V	7-May-04	11.9	V	17-Jun-04	6.9	V	31-Jul-03	2.8	V	12-Aug-04	2.7	V	9-Sep-04	2.3	V	1-Oct-04	*0.1*	E/V/M	19-Nov-04	1.8	V	29-Dec-04	-	F
	16-Jan-04	13.0	V	27-Feb-04	3.9	V	19-Mar-04	12.8	V	16-Apr-04	19.9	V	14-May-04	9.8	V	24-Jun-04	6.9	V	1-Jul-04	5.9	V	19-Aug-04	6.6	V	17-Sep-04	3.2	V	7-Oct-04	*0.1*	E/V/M	25-Nov-04	0.4	V	2-Dec-05	2.0	V
	20-Jan-04	9.8	V	3-Feb-05	-	F	26-Mar-04	58.8	V	23-Apr-04	13.5	V	20-May-04	7.6	V	3-Jun-05	5.8	V	9-Jul-04	3.7	V	26-Aug-04	2.4	V	23-Sep-04	2.1	V	14-Oct-04	3.2	V	4-Nov-05	0.5	V	9-Dec-05	1.9	V
	30-Jan-04	6.6	V	3-Feb-05	8.1	V	3-Mar-05	5.7	V	30-Apr-04	10.5	V	28-May-04	26.6	V	10-Jun-05	4.6	V	16-Jul-04	4.2	V	2-Aug-05	1.7	V	1-Sep-05	0.8	V	20-Oct-04	0.9	V	11-Nov-05	0.2	V	16-Dec-05	1.8	V
	5-Jan-05	10.7	V	10-Feb-05	5.5	V	10-Mar-05	9.4	V	7-Apr-05	46.6	V	6-May-05	19.4	V	17-Jun-05	5.1	V	22-Jul-04	3.3	V	12-Aug-05	1.4	V	9-Sep-05	0.8	V	28-Oct-04	1.2	V	18-Nov-05	1.0	V	22-Dec-05	1.3	V
	13-Jan-05	41.9	V	16-Feb-05	9.0	V	17-Mar-05	9.4	V	15-Apr-05	49.9	V	13-May-05	11.3	V	17-Jun-05	5.1	V	29-Jul-04	3.2	V	19-Aug-05	1.4	V	16-Sep-05	0.6	V	7-Oct-05	0.9	V	25-Nov-05	0.5	V	30-Dec-05	2.5	E
	20-Jan-05	-	F	24-Feb-05	3.8	V	24-Mar-05	8.9	V	21-Apr-05	39.8	V	20-May-05	8.7	V	24-Jun-05	3.7	V	7-Jul-05	3.1	V	23-Aug-05	0.3	V	23-Sep-05	0.3	V	14-Oct-05	0.8	V	3-Nov-06	5.7	V	4-Dec-06	13.1	V
	20-Jan-05	18.1	V	3-Feb-06	16.7	V	30-Mar-05	15.6	V	29-Apr-05	43.1	V	27-May-05	7.4	V	30-Jun-05	3.8	V	15-Jul-05	2.7	V	24-Aug-05	0.6	V	30-Sep-05	1.0	V	21-Oct-05	0.5	V	10-Nov-06	9.4	V	8-Dec-06	11.5	V
	28-Jan-05	-	F	10-Feb-06	11.4	V	3-Mar-06	7.9	V	7-Apr-06	35.3	V	5-May-06	11.9	V	2-Jun-06	5.3	V	21-Jul-05	1.8	V	4-Aug-06	5.1	M/V	1-Sep-06	*0.1*	E	28-Oct-05	0.6	V	17-Nov-06	17.8	V	14-Dec-06	18.3	V
	28-Jan-05	9.3	V	20-Feb-06	10.2	V	10-Mar-06	35.6	V	10-Apr-06	29.3	V	12-May-06	8.7	V	9-Jun-06	5.1	V	28-Jul-05	1.7	V	11-Aug-06	0.3	V	8-Sep-06	0.0	V	6-Oct-06	0.7	V	24-Nov-06	12.7	V	21-Dec-06	13.2	V
	6-Jan-06	5.9	V	20-Feb-06	10.2	V	17-Mar-06	41.8	V	13-Apr-06	35.1	V	12-May-06	8.7	V	16-Jun-06	3.9	M	7-Jul-06	1.5	V	18-Aug-06	0.9	M	15-Sep-06	0.1	V	13-Oct-06	0.1	V	2-Nov-07	*0.1*	E	28-Dec-06	10.2	V
	13-Jan-06	10.0	V	24-Feb-06	9.7	V	24-Mar-06	21.4	V	21-Apr-06	15.5	V	19-May-06	9.3	V	23-Jun-06	3.6	M	14-Jul-06	1.3	M/V	25-Aug-06	0.1	V	21-Sep-06	0.4	V	20-Oct-06	0.5	V	9-Nov-07	1.8	V	7-Dec-07	0.7	V
	20-Jan-06	11.6	V	2-Feb-07	7.4	V	31-Mar-06	24.7	V	26-Apr-06	15.4	V	25-May-06	4.7	V	30-Jun-06	3.7	V	21-Jul-06	1.7	M/V	3-Aug-07	0.6	V	28-Sep-06	0.8	V	26-Oct-06	2.6	V	16-Nov-07	*0.1*	E	14-Dec-07	4.2	V
	27-Jan-06	11.0	V	9-Feb-07	5.1	V	2-Mar-07	4.2	V	5-Apr-07	35.0	V	4-May-07	8.1	V	1-Jun-07	4.8	V	28-Jul-06	2.5	V/M	10-Aug-07	0.6	V	7-Sep-07	1.1	V	5-Oct-07	*0.1*	E	23-Nov-07	0.7	E	20-Dec-07	F	
	5-Jan-07	11.1	V	16-Feb-07	4.8	V	9-Mar-07	4.3	V	13-Apr-07	16.8	V	11-May-07	7.0	V	8-Jun-07	3.6	V	6-Jul-07	3.8	V	17-Aug-07	0.6	V	14-Sep-07	0.7	E	12-Oct-07	0.1	V	7-Nov-08	6.2	V	28-Dec-07	5.7	V
	12-Jan-07	10.8	V	22-Feb-07	3.5	V	16-Mar-07	27.6	V	20-Apr-07	14.0	V	18-May-07	6.4	V	14-Jun-07	3.1	V	13-Jul-07	5.2	V	24-Aug-07	1.1	V	21-Sep-07	0.2	V	19-Oct-07	*0.1*	E	14-Nov-08	13.2	V	5-Dec-08	-	B
	19-Jan-07	9.3	V	1-Feb-08	8.9	V	23-Mar-07	38.8	V	28-Apr-07	11.6	V	25-May-07	4.2	V	22-Jun-07	1.8	V	20-Jul-07	1.7	V	30-Aug-07	0.6	V	28-Sep-07	*0.1*	E	26-Oct-07	*0.1*	E	21-Nov-08	-	B	12-Dec-08	10.6	V
	26-Jan-07	7.4	V	8-Feb-08	25.7	V	30-Mar-07	41.1	V	4-Apr-08	41.8	V	2-May-08	22.0	V	29-Jun-07	1.6	V	27-Jul-07	1.4	V	1-Aug-08	1.8	V	5-Sep-08	9.3	V	3-Oct-08	13.3	V	28-Nov-08	-	F	23-Dec-08	13.1	V
	4-Jan-08	7.0	V	15-Feb-08	11.0	V	7-Mar-08	12.0	V	11-Apr-08	93.3	V	8-May-08	12.8	V	6-Jun-08	32.6	V	4-Jul-08	2.2	V	8-Aug-08	15.3	V	12-Sep-08	2.9	V	10-Oct-08	17.9	V	6-Nov-09	1.3	V	29-Dec-08	69.3	V
	11-Jan-08	81.9	V	22-Feb-08	10.8	V	14-Mar-08	14.8	V	15-Apr-08	50.0	V	15-May-08	11.6	V	13-Jun-08	8.3	V	11-Jul-08	3.3	V	15-Aug-08	4.0	V	19-Sep-08	2.3	V	17-Oct-08	15.5	V	13-Nov-09	1.5	V	4-Dec-09	6.9	V
	18-Jan-08	30.9	V	29-Feb-08	16.8	V	20-Mar-08	2.8	V	18-Apr-08	66.2	V	23-May-08	12.6	V	20-Jun-08	6.5	V	18-Jul-08	3.9	V	22-Aug-08	7.1	V	26-Sep-08	0.6	V	24-Oct-08	18.9	V	20-Nov-09	1.5	V	11-Dec-09	2.7	V
	25-Jan-08	26.2	V	6-Feb-09	5.1	V	28-Mar-08	5.1	V	25-Apr-08	18.5	V	30-May-08	51.1	V	27-Jun-08	5.0	V	25-Jul-08	1.2	V	28-Aug-08	5.1	V	4-Sep-08	0.8	V	31-Oct-08	6.9	V	27-Nov-09	2.7	V	18-Dec-09	13.4	V
	9-Jan-09	-	F	13-Feb-09	35.0	V	6-Mar-09	13.0	V	3-Apr-09	28.3	V	1-May-09	22.6	V	5-Jun-09	5.3	V	2-Jul-09	2.0	V	7-Aug-09	1.4	V	11-Sep-09	4.0	V	2-Oct-09	0.9	V	5-Nov-10	6.2	V	22-Dec-09	2.8	V
	15-Jan-09	4.5	V	20-Feb-09	14.6	V	13-Mar-09	31.2	V	9-Apr-09	26.6	V	8-May-09	14.6	V	12-Jun-09	6.0	V	10-Jul-09	1.3	V	14-Aug-09	6.4	V	18-Sep-09	1.0	V	9-Oct-09	0.4	V	12-Nov-10	11.1	V	28-Dec-09	4.7	V
	16-Jan-09	9.2	V	27-Feb-09	13.8	V	20-Mar-09	26.3	V	17-Apr-09	22.4	V	15-May-09	11.2	V	19-Jun-09	4.0	V	17-Jul-09	2.2	V	21-Aug-09	4.8	V	25-Sep-09	0.8	V	16-Oct-09	0.5	V	19-Nov-10	22.6	V	3-Dec-10	12.7	V
	23-Jan-09	11.0	V	5-Feb-10	7.5	V	27-Mar-09	19.2	V	24-Apr-09	18.0	V	22-May-09	8.8	V	26-Jun-09	3.7	V	24-Jul-09	1.6	V	28-Aug-09	0.9	V	3-Sep-10	5.9	V	23-Oct-09	3.1	V	26-Nov-10	13.8	V	9-Dec-10	9.3	V
	30-Jan-09	5.8	V	12-Feb-10	8.2	V	1-Mar-10	2.5	V	2-Apr-10	28.2	V	29-May-09	6.4	V	4-Jun-10	13.9	V	31-Jul-09	0.5	V	6-Aug-10	9.7	V	10-Sep-10	5.4	V	30-Oct-09	4.2	V	4-Nov-11	1.6	V	17-Dec-10	8.1	V
	8-Jan-10	4.9	V	19-Feb-10	3.0	V	5-Mar-10	2.2	V	9-Apr-10	6.5	V	7-May-10	3.6	V	11-Jun-10	10.8	V	1-Jul-10	9.7	V	13-Aug-10	4.6	V	17-Sep-10	5.3	V	1-Oct-10	7.8	V	11-Nov-11	7.3	V	23-Dec-10	6.3	V
	22-Jan-10	3.7	V	4-Feb-11	4.8	V	19-Mar-10	68.9	V	16-Apr-10	10.1	V	14-May-10	26.3	V	18-Jun-10	9.4	V	9-Jul-10	9.6	V	20-Aug-10	2.8	V	24-Sep-10	3.2	V	8-Oct-10	6.6	V	18-Nov-11	2.5	V	30-Dec-10	9.7	V
	29-Jan-10	8.2	V	11-Feb-11	7.4	V	26-Mar-10	26.9	V	23-Apr-10	8.6	V	21-May-10	7.9	V	25-Jun-10	8.3	V	15-Jul-10	7.8	V	27-Aug-10	3.5	V	2-Sep-11	2.5	V	15-Oct-10	5.6	V	25-Nov-11	2.6	V	2-Dec-11	9.7	V
	7-Jan-11	23.6	V	18-Feb-11	16.5	V	4-Mar-11	4.8	V	30-Apr-10	15.8	V	28-May-10	11.1	V	3-Jun-11	5.5	V	23-Jul-10	9.3	V	5-Aug-11	4.6	V	9-Sep-11	1.7	V	22-Oct-10	2.6	V	2-Nov-12	36.3	V	9-Dec-11	13.4	V
	14-Jan-11	10.5	V	25-Feb-11	12.5	V	11-Mar-11	13.9	V	1-Apr-11	15.8	V	6-May-11	3.3	V	10-Jun-11	14.0	V	30-Jul-10	8.5	V	12-Aug-11	4.9	V	16-Sep-11	1.7	V	29-Oct-10	4.2	V	9-Nov-12	16.8	V	16-Dec-11	13.7	V
	21-Jan-11	8.1	V	3-Feb-12	12.7	V	18-Mar-11	42.0	V	8-Apr-11	34.0	V	13-May-11	3.9	V	17-Jun-11	7.0	V	8-Jul-11	5.0	V	19-Aug-11	0.9	V	23-Sep-11	3.9	V	6-Oct-11	1.7	V	16-Nov-12	16.5	V	23-Dec-11	14.0	V
	28-Jan-11	8.3	V	10-Feb-12	11.2	V	22-Mar-11	31.4	V	15-Apr-11	30.0	V	20-May-11	24.4	V	24-Jun-11	4.9	V	14-Jul-11	6.4	V	26-Aug-11	3.4	V	30-Sep-11	3.1	V	14-Oct-11	3.3	V	23-Nov-12	15.7	V	30-Dec-11	10.1	V
	6-Jan-12	9.8	V	17-Feb-12	5.5	V	25-Mar-11	24.3	V	21-Apr-11	26.3	V	27-May-11	14.2	V	30-Jun-11	5.0	V	22-Jul-11	4.7	V	3-Aug-12	2.0	V	7-Sep-12	3.5	V	20-Oct-11	9.4	V	30-Nov-12	14.5	V	7-Dec-12	11.3	V
	13-Jan-12			24-Feb-12	8.5	V	1-Mar-12	4.1	V	29-Apr-11	18.7	V	4-May-12	9.5	V	1-Jun-12	6.3	V	29-Jul-11	4.4	V	10-Aug-12	2.1	V	14-Sep-12	5.5	V	21-Oct-11	4.4	V	8-Nov-13	14.9	V	14-Dec-12	7.8	V
	20-Jan-12	15.5	V	1-Feb-13	31.3	V	9-Mar-12	37.8	V	6-Apr-12	9.8	V	11-May-12	5.8	V	8-Jun-12	6.2	V	7-Jul-12	5.1	V	17-Aug-12	8.7	V	21-Sep-12	3.5	V	28-Oct-11	4.9	V	14-Nov-13	16.1	V	21-Dec-12	8.5	V
	27-Jan-12	12.1	V	8-Feb-13	9.9	V	16-Mar-12	70.3	V	13-Apr-12	8.0	V	18-May-12	8.1	V	15-Jun-12	5.4	V	13-Jul-12	6.3	V	24-Aug-12	4.9	V	28-Sep-12	3.9	V	5-Oct-12	3.4	V	22-Nov-13	17.8	V	28-Dec-12	7.7	V
	4-Jan-13	5.8	V	15-Feb-13	10.2	V	23-Mar-12	29.0	V	20-Apr-12	18.2	V	25-May-12	6.8	V	22-Jun-12	1.7	V	20-Jul-12	3.0	V	31-Aug-12	4.3	V	6-Sep-13	2.4	V	12-Oct-12	4.9	V						
	11-Jan-13	11.8	V	22-Feb-13	6.2	V	30-Mar-12	11.1	V	27-Apr-12	7.9	V	3-May-13	28.2	V	28-Jun-12	2.1	V	27-Jul-12	1.9	V	2-Aug-13	2.6	V	13-Sep-13	2.2	V	19-Oct-12	5.0	V						
	17-Jan-13	16.7	V				1-Mar-13	6.1	V	5-Apr-13	8.8	V	9-May-13	12.8	V	7-Jun-13	11.7	V	5-Jul-13	8.2	V	8-Aug-13	3.1	V	20-Sep-13	2.7	V	26-Oct-12	3.2	V						
	25-Jan-13	14.0	V				8-Mar-13	7.5	V	12-Apr-13	9.8	V	16-May-13	9.0	V	14-Jun-13	7.1	V	12-Jul-13	8.8	V	16-Aug-13	2.8	V	27-Sep-13	2.5	V	4-Oct-13	4.1	V						
							15-Mar-13	15.2	V	19-Apr-13	57.8	V	24-May-13	23.6	V	21-Jun-13	8.4	V	19-Jul-13	7.9	V	23-Aug-13	2.4	V				11-Oct-13	4.2	V						
							22-Mar-13	12.7	V	26-Apr-13	24.5	V	31-May-13	6.8	V	27-Jun-13	7.7	V	25-Jul-13	2.7	V	30-Aug-13	2.7	V				18-Oct-13	5.2	V						
							28-Mar-13	9.2	V																			25-Oct-13	9.5	V						
																												31-Oct-13	12.5	V						
No. of Readings:	40			40			48			49			49			49			49			49			47			51			41			39		
Maximum:	81.9			35.0			70.3			93.3			51.1			32.6			9.7			15.3			9.3			18.9			36.3			69.3		
Minimum:	1.5			3.0			2.2			6.5			3.3			1.6			0.5			0.1			0.0			0.1			0.1			0.3		
Average:	14.0			10.4			21.1			26.9			12.2			6.6			4.0			3.2			2.2			4.1			8.0			9.6		
YELLOW:	3.7		(unfrozen)	3.8		(unfrozen)	2.8		(unfrozen)	8.0			3.9			1.9			1.3			0.3			0.1			0.12			0.2		(unfrozen)	1.3		(unfrozen)
RED:	**1.5**		(unfrozen)	**3.0**		(unfrozen)	**2.2**		(unfrozen)	**6.5**			**3.3**			**1.6**			**0.5**			**0.1**			**DRY**		(No Trigger)	**0.10**			**0.1**		(unfrozen)	**0.3**		(unfrozen)

NOTES:

RED - Maintained equivalent to the lowest monthly flow recorded over period of record.
YELLOW - Calculated as 15% above the red value or third lowest monthly flow over period of record, whichever is higher.

V - Valeport Measurement
M - Manual Measurement (floating object)
E - Visual Estimate
BE - Bucket Estimate
B - Location Buried in Snow
F - Location Frozen

RED - Maintained equivalent to the lowest monthly flow recorded over period of record.
YELLOW - Calculated as 15% above the red value or third lowest monthly flow over period of record, whichever is higher.

V - Valeport Measurement
M - Manual Measurement (floating object)
E - Visual Estimate
BE - Bucket Estimate
B - Location Buried in Snow
F - Location Frozen

TABLE 3.5
SURFACE WATER FLOWS PERFORMANCE TRIGGER VALUE SUMMARY (ACTIVE FLOW PERIODS)
DUNTROON QUARRY EXPANSION

MONITORING LOCATION	JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type
SWO-2	5-Jan-05	108.9	V	10-Feb-05	-	F	3-Mar-05	-	F	7-Apr-05	-	FLOODED	6-May-05	116.2	V	30-Jun-04	7.7	V	9-Jul-04	3.5	V	6-Aug-04	13.3	V	3-Sep-04	4.9	V	1-Oct-04	6.6	V	4-Nov-04	60.0	V	2-Dec-04	23.3	V
	13-Jan-05	258.5	V	16-Feb-05	-	F	10-Mar-05	-	F	15-Apr-05	-	FLOODED	13-May-05	73.4	V	3-Jun-05	62.2	V	16-Jul-04	60.8	V	12-Aug-04	4.3	V	9-Sep-04	1.9	V	7-Oct-04			11-Nov-04	42.4	V	9-Dec-04	23.8	V
	6-Jan-06	88.1	V	24-Feb-05	-	F	17-Mar-05	-	F	21-Apr-05	253.7	V	20-May-05	68.5	V	10-Jun-05	8.5	V	22-Jul-04	20.6	V	20-Aug-04	19.8	V	17-Sep-04	2.6	V	14-Oct-04	1.2	V	19-Nov-04	10.2	V	17-Dec-04	19.2	V
	13-Jan-06	48.2	V	3-Feb-06	154.3	V	24-Mar-05	-	F	29-Apr-05	348.6	V	27-May-05	90.8	V	17-Jun-05	53.8	V	29-Jul-04	24.0	V	26-Aug-04	9.5	V	23-Sep-04			20-Oct-04	31.3	V	25-Nov-04	-	F	29-Dec-04	-	B
	20-Jan-06	85.5	V	10-Feb-06	94.6	V	30-Mar-05	124.3	V	7-Apr-06	238.5	V	5-May-06	102.0	V	24-Jun-05	4.9	V	7-Jul-05	10.6	V	2-Aug-05			1-Sep-05			28-Oct-04	7.7	V	4-Nov-05	4.4	V	2-Dec-05	32.7	V
	27-Jan-06	78.8	V	20-Feb-06	-	B	3-Mar-06	-	B	13-Apr-06	133.9	V	12-May-06	84.6	V	30-Jun-05	3.6	V	15-Jul-05			12-Aug-05			9-Sep-05			7-Oct-05			11-Nov-05	4.1	V	9-Dec-05	28.5	V
	5-Jan-07	78.3	V	22-Feb-06	-	F	10-Mar-06	134.3	V	21-Apr-06	88.6	V	12-May-06	84.6	V	2-Jun-06	29.0	V	21-Jul-05			23-Aug-05			16-Sep-05			14-Oct-05			18-Nov-05	42.9	V	16-Dec-05	55.2	V
	12-Jan-07	-	F	24-Feb-06	-	B	17-Mar-06	166.4	V	26-Apr-06	92.0	V	19-May-06	61.4	V	9-Jun-06	39.3	V	28-Jul-05			24-Aug-05			23-Sep-05			21-Oct-05	1.9	V	3-Nov-06	123.3	V	22-Dec-05	56.6	V
	19-Jan-07	-	F	2-Feb-07	-	F	24-Mar-06	143.4	V	5-Apr-07	177.2	V	25-May-06	77.7	V	16-Jun-06	8.6	V	7-Jul-06	10.5	V	4-Aug-06	10.8	V	30-Sep-05			28-Oct-05	10.1	V	10-Nov-06	62.7	V	4-Dec-06	80.3	V
	26-Jan-07	-	F	9-Feb-07	-	F	31-Mar-06	184.9	V	13-Apr-07	89.1	V	4-May-07	91.5	V	23-Jun-06	12.9	V	14-Jul-06	5.2	V	11-Aug-06	2.7	V	1-Sep-06	4.0	V	6-Oct-06	17.5	V	17-Nov-06	45.6	V	8-Dec-06	-	F
	4-Jan-08	-	F	16-Feb-07	-	F	2-Mar-07	-	F	20-Apr-07	109.9	V	11-May-07	34.7	V	30-Jun-06	4.5	V	21-Jul-06	12.7	M/V	18-Aug-06	4.4	V	8-Sep-06	8.9	V	13-Oct-06	12.9	V	24-Nov-06	47.2	V	14-Dec-06	-	B
	11-Jan-08	194.5	V	22-Feb-07	-	F	9-Mar-07	-	F	28-Apr-07	150.4	V	18-May-07	68.9	V	1-Jun-07	25.8	V	28-Jul-06	7.2	V	25-Aug-06	3.8	V	15-Sep-06	18.6	V	20-Oct-06	7.4	V	2-Nov-07	32.1	V	21-Dec-06	59.2	V
	18-Jan-08	-	F	1-Feb-08	-	F	16-Mar-07	-	F	4-Apr-08	125.8	V	25-May-07	46.9	V	8-Jun-07	20.3	V	6-Jul-07	15.2	V	1-Sep-06			22-Sep-06	19.2	V	26-Oct-06	24.5	V	9-Nov-07	32.2	V	28-Dec-06	86.8	V
	25-Jan-08	-	F	8-Feb-08	-	F	23-Mar-07	112.0	V	11-Apr-08	295.2	V	2-May-08	138.4	V	14-Jun-07	31.6	V	13-Jul-07	4.9	V	10-Aug-07			28-Sep-06	18.7	V	5-Oct-07	15.9	V	16-Nov-07	57.9	V	7-Dec-07	-	F
	9-Jan-09	-	F	15-Feb-08	-	F	30-Mar-07	118.4	V	18-Apr-08	265.7	V	8-May-08	103.9	V	22-Jun-07			20-Jul-07	3.6	V	17-Aug-07			7-Sep-07	17.7	V	12-Oct-07	28.8	V	23-Nov-07	-	F	14-Dec-07	-	F
	15-Jan-09	-	F	22-Feb-08	-	F	7-Mar-08	-	F	25-Apr-08	77.7	V	15-May-08	181.9	V	29-Jun-07	21.2	V	27-Jul-07			24-Aug-07	2.1	V	14-Sep-07	13.1	V	19-Oct-07	20.7	V	30-Nov-07	-	F	20-Dec-07	-	F
	16-Jan-09	-	F	29-Feb-08	-	F	14-Mar-08	-	F	3-Apr-09	166.7	V	23-May-08	66.7	V	6-Jun-08	93.8	V	4-Jul-08	9.8	V	30-Aug-07	7.3	V	21-Sep-07	3.3	V	26-Oct-07	26.3	V	7-Nov-08	48.8	V	28-Dec-07	-	F
	23-Jan-09	-	F	6-Feb-09	-	F	19-Mar-08	-	F	9-Apr-09	-	F	30-May-08	16.1	V	13-Jun-08	36.7	V	11-Jul-08	1.7	V	1-Aug-08	15.9	V	28-Sep-07	13.4	V	3-Oct-08	67.2	V	14-Nov-08	85.5	V	5-Dec-08	-	F
	30-Jan-09	-	F	13-Feb-09	-	F	28-Mar-08	-	F	17-Apr-09	104.1	V	1-May-09	185.3	V	20-Jun-08	36.5	V	18-Jul-08	10.8	V	8-Aug-08	57.4	V	5-Sep-08	5.1	V	10-Oct-08	29.5	V	21-Nov-08	-	F	12-Dec-08	-	F
	8-Jan-10	-	F	20-Feb-09	-	F	6-Mar-09	-	F	24-Apr-09	112.2	V	8-May-09	98.2	V	27-Jun-08	55.4	V	25-Jul-08	30.6	V	15-Aug-08	28.8	V	12-Sep-08	27.5	V	17-Oct-08	27.1	V	28-Nov-08	-	F	19-Dec-08	-	F
	22-Jan-10	-	F	27-Feb-09	-	F	13-Mar-09	-	F	2-Apr-10	102.1	V	15-May-09	62.2	V	5-Jun-09	50.1	V	2-Jul-09	63.4	V	22-Aug-08	61.5	V	19-Sep-08	35.9	V	24-Oct-08	17.7	V	6-Nov-09	25.9	V	23-Dec-08	-	F
	29-Jan-10	-	F	5-Feb-10	-	F	20-Mar-09	88.0	V	9-Apr-10	78.0	V	22-May-09	46.9	V	12-Jun-09	37.5	V	10-Jul-09	9.6	V	28-Aug-08	10.8	V	26-Sep-08	19.6	V	31-Oct-08	51.0	V	13-Nov-09	15.2	V	29-Dec-08	-	F
	7-Jan-11	-	F	12-Feb-10	-	F	27-Mar-09	104.3	V	16-Apr-10	50.0	V	29-May-09	59.5	V	19-Jun-09	36.3	V	17-Jul-09	3.3	V	7-Aug-09	6.7	V	4-Sep-09	11.8	V	2-Oct-09	26.8	V	20-Nov-09	24.0	V	4-Dec-09	27.1	V
	14-Jan-11	-	F	19-Feb-10	-	F	1-Mar-10	-	F	23-Apr-10	43.6	V	7-May-10	28.3	V	26-Jun-09	37.8	V	24-Jul-09	19.0	V	14-Aug-09	129.9	V	11-Sep-09	8.4	V	9-Oct-09	47.3	V	27-Nov-09	10.5	V	11-Dec-09	-	F
	21-Jan-11	-	F	4-Feb-11	-	F	5-Mar-10	-	F	30-Apr-10	31.7	V	14-May-10	132.0	V	4-Jun-10	59.9	V	31-Jul-09	11.8	V	21-Aug-09	21.0	V	18-Sep-09	8.6	V	16-Oct-09	29.0	V	5-Nov-10	68.8	V	15-Dec-09	-	F
	28-Jan-11	-	F	11-Feb-11	-	F	12-Mar-10	-	F	1-Apr-11	158.7	V	21-May-10	37.7	V	11-Jun-10	64.5	V	1-Jul-10	36.0	V	28-Aug-09	20.1	V	25-Sep-09	8.0	V	23-Oct-09	33.0	V	12-Nov-10	40.3	V	22-Dec-09	-	F
	6-Jan-12	-	F	18-Feb-11	-	F	19-Mar-10	156.8	V	8-Apr-11	134.2	V	28-May-10	33.5	V	18-Jun-10	29.4	V	9-Jul-10	105.5	V	6-Aug-10	26.0	V	1-Sep-10	2.3	V	30-Oct-09	32.8	V	19-Nov-10	83.3	V	28-Dec-09	-	F
	13-Jan-12	-	F	25-Feb-11	-	F	26-Mar-10	69.3	V	15-Apr-11	124.6	V	6-May-11	103.2	V	25-Jun-10	56.7	V	15-Jul-10	38.8	V	13-Aug-10	21.1	V	3-Sep-10	1.5	V	1-Oct-10	53.5	V	26-Nov-10	106.6	V	3-Dec-10	68.3	V
	20-Jan-12	-	F	3-Feb-12	-	F	4-Mar-11	-	F	21-Apr-11	148.1	V	13-May-11	94.0	V	3-Jun-11	74.4	V	23-Jul-10	89.6	V	20-Aug-10	17.1	V	7-Sep-10	0.4	V	8-Oct-10	33.5	V	4-Nov-11	43.8	V	9-Dec-10	-	F
	27-Jan-12	-	F	10-Feb-12	-	F	11-Mar-11	-	F	29-Apr-11	123.7	V	20-May-11	144.1	V	10-Jun-11	77.5	V	30-Jul-10	41.6	V	27-Aug-10	14.0	V	10-Sep-10	2.0	V	15-Oct-10	45.2	V	11-Nov-11	43.6	V	17-Dec-10	-	F
	4-Jan-13	-	F	17-Feb-12	-	F	18-Mar-11	-	F	6-Apr-12	-	-	27-May-11	132.7	V	17-Jun-11	70.3	V	8-Jul-11	37.6	V	30-Aug-10	7.1	V	17-Sep-10	21.3	V	22-Oct-10	24.2	V	18-Nov-11	39.6	V	23-Dec-10	-	F
	11-Jan-13	-	F	24-Feb-12	-	F	25-Mar-11	-	F	13-Apr-12	163.8	V	4-May-12	290.7	V	24-Jun-11	52.2	V	14-Jul-11	34.7	V	5-Aug-11	20.3	V	24-Sep-10	41.7	V	29-Oct-10	27.1	V	25-Nov-11	28.9	V	30-Dec-10	-	F
	17-Jan-13	-	F	1-Feb-13	-	F	1-Mar-12	-	F	20-Apr-12	185.5	V	11-May-12	121.9	V	30-Jun-11	71.2	V	22-Jul-11	22.4	V	12-Aug-11	7.5	V	2-Sep-11	9.3	V	6-Oct-11	20.5	V	2-Nov-12	120.0	V	2-Dec-11	56.9	V
	25-Jan-13	-	F	8-Feb-13	-	F	9-Mar-12	-	F	27-Apr-12	218.5	V	18-May-12	191.8	V	1-Jun-12	54.5	V	29-Jul-11	36.9	V	19-Aug-11	5.1	V	9-Sep-11	6.0	V	14-Oct-11	41.2	V	9-Nov-12	103.7	V	9-Dec-11	75.7	V
				15-Feb-13	-	F	16-Mar-12	529.8	V	5-Apr-13	76.7	V	25-May-12	170.1	V	8-Jun-12	43.3	V	7-Jul-12	10.1	V	26-Aug-11	12.3	V	16-Sep-11	4.4	V	21-Oct-11	79.3	V	16-Nov-12	83.3	V	16-Dec-11	65.5	V
				22-Feb-13	-	F	23-Mar-12	131.3	V	12-Apr-13	113.2	V	3-May-13	71.0	V	15-Jun-12	31.7	V	13-Jul-12	16.4	V	3-Aug-12	12.5	V	23-Sep-11	12.2	V	28-Oct-11	50.4	V	23-Nov-12	66.9	V	23-Dec-11	-	F
							30-Mar-12	180.4	V	19-Apr-13	405.3	V	9-May-13	67.6	V	22-Jun-12	29.9	V	20-Jul-12	16.3	V	10-Aug-12	67.0	V	30-Sep-11	15.5	V	5-Oct-12	29.0	V	30-Nov-12	60.8	V	30-Dec-11	-	F
							1-Mar-13	-	F	26-Apr-13	164.6	V	16-May-13	53.9	V	28-Jun-12	27.7	V	27-Jul-12	27.6	V	17-Aug-12	82.8	V	7-Sep-12	19.6	V	12-Oct-12	43.0	V	8-Nov-13	255.1	V	7-Dec-12	73.7	V
							8-Mar-13	-	F				24-May-13	104.5	V	7-Jun-13	53.4	V	5-Jul-13	49.9	V	24-Aug-12	31.7	V	14-Sep-12	30.7	V	19-Oct-12	21.4	V	14-Nov-13	240.1	V	14-Dec-12	56.8	V
							15-Mar-13	-	F				31-May-13	51.2	V	14-Jun-13	63.7	V	12-Jul-13	203.8	V	31-Aug-12	34.6	V	21-Sep-12	41.2	V	26-Oct-12	40.8	V	17-Nov-13	244.9	V	21-Dec-12	67.5	V
							22-Mar-13	-	F							21-Jun-13	43.8	V	19-Jul-13	36.4	V	2-Aug-13	84.2	V	28-Sep-12	12.4	V	4-Oct-13	41.3	V				28-Dec-12	-	-
							28-Mar-13	118.7	F							27-Jun-13	32.0	V	25-Jul-13	41.2	V	8-Aug-13	69.5	V	6-Sep-13	42.2	V	11-Oct-13	37.6	V						
																						16-Aug-13	40.4	V	13-Sep-13	44.3	V	18-Oct-13	67.0	V						
																						23-Aug-13	35.5	V	20-Sep-13	25.8	V	25-Oct-13	150.6	V						
																						30-Aug-13	35.4	V	27-Sep-13	26.7	V	31-Oct-13	257.4	V						
No. of Readings:	8			2			15			34			40			41			38			38			39			42			35			18		
Maximum:	258.5			154.3			529.8			405.3			290.7			93.8			203.8			129.9			44.3			257.4			255.1			86.8		
Minimum:	48.2			94.6			69.3			31.7			16.1			3.6			1.7			2.1			0.4			1.2			4.1			19.2		
Average:	117.6			124.5			157.5			151.5			94.7			40.3			31.1			27.7			15.7			39.0			68.7			53.2		
YELLOW:	78.8		(unfrozen)	-			104.3		(unfrozen)	50.0			33.5			4.9			3.6			3.8			1.9			6.6			10.2			23.8		(unfrozen)
RED:	**48.2**		(unfrozen)	**-**			**69.3**		(unfrozen)	**31.7**			**16.1**			**3.6**			**1.7**			**2.1**			**0.4**			**1.2**			**4.1**			**19.2**		(unfrozen)

NOTES:

RED - Maintained equivalent to the lowest monthly flow recorded over period of record.
YELLOW - Calculated as 15% above the red value or third lowest monthly flow over period of record, whichever is higher.

V - Valeport Measurement
M - Manual Measurement (floating object)
E - Visual Estimate
BE - Bucket Estimate
B - Location Buried in Snow
F - Location Frozen

RED - Maintained equivalent to the lowest monthly flow recorded over period of record.
YELLOW - Calculated as 15% above the red value or third lowest monthly flow over period of record, whichever is higher.

V - Valeport Measurement
M - Manual Measurement (floating object)
E - Visual Estimate
BE - Bucket Estimate
B - Location Buried in Snow
F - Location Frozen

TABLE 3.5
SURFACE WATER FLOWS PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING YEAR	SW3			SW6A			SW9			SW10			SW11			SW14			SW15		
	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type
JANUARY																					
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2006	16-Jan-06	2.4	V	16-Jan-06	133.0	E/V/M	18-Jan-06	5.5	V	17-Jan-06	2.7	V	18-Jan-06	20.2	V	17-Jan-06	15.6	V	17-Jan-06	-	F
2007	24-Jan-07	0.1	V	24-Jan-07	-	F	24-Jan-07	-	F	25-Jan-07	-	F	25-Jan-07	35.0	E	24-Jan-07	-	F	24-Jan-07	-	F
2008	21-Jan-08	-	F	21-Jan-08	883.4	V	21-Jan-08	-	F	21-Jan-08	-	F	22-Jan-08	73.6	V	21-Jan-08	12.6	V	21-Jan-08	-	F
2009	19-Jan-09	-	F	21-Jan-09	261.7	V	19-Jan-09	-	F	20-Jan-09	-	F	21-Jan-09	11.0	V	20-Jan-09	-	F	20-Jan-09	-	F
2010	18-Jan-10	-	B	19-Jan-10	113.0	V	18-Jan-10	-	B	19-Jan-10	-	B	19-Jan-10	1.2	V	18-Jan-10	-	B	18-Jan-10	-	B
2011	17-Jan-11	1.7	V	19-Jan-11	305.3	V	17-Jan-11	-	F	19-Jan-11	-	F	18-Jan-11	10.3	V	18-Jan-11	-	F	18-Jan-11	-	F
2012	16-Jan-12	0.0	B	17-Jan-12	174.6	V	16-Jan-12	-	B	19-Jan-12	-	-	19-Jan-12	17.6	V	16-Jan-12	-	B	16-Jan-12	-	B
2013	15-Jan-13	9.8	V	15-Jan-13	557.6	V	15-Jan-13	5.1	V	16-Jan-13	0.8	V	16-Jan-13	19.8	V	16-Jan-13	35.7	V	15-Jan-13	6.8	V
No. of Readings:		5			7			2			2			8			3			1	
Maximum:		9.8			883.4			5.5			2.7			73.6			35.7			6.8	
Minimum:		0.0			113.0			5.1			0.8			1.2			12.6			6.8	
Average:		2.8			346.9			5.3			1.8			23.6			21.3			6.8	
YELLOW:	1.7		(unfrozen)		174.6			-			-			11.0			35.7			-	
RED:	**Dry**		(No Trigger)		**113.0**			**-**			**-**			**1.2**			**12.6**			**-**	
FEBRUARY																					
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	10-Feb-04	-	F	10-Feb-04	-	F	13-Feb-04	2.1	V	11-Feb-04	0.3	E	13-Feb-04	6.7	V	10-Feb-04	3.0	V	10-Feb-04	-	F
2005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2006	22-Feb-06	-	F	22-Feb-06	-	F	22-Feb-06	-	F	22-Feb-06	-	F	22-Feb-06	-	F	22-Feb-06	-	F	22-Feb-06	-	F
2007	20-Feb-07	-	F	20-Feb-07	-	F	20-Feb-07	-	F	20-Feb-07	-	F	22-Feb-07	-	F	22-Feb-07	-	F	22-Feb-07	-	F
2008	19-Feb-08	-	B	20-Feb-08	-	F	21-Feb-08	-	F	21-Feb-08	-	F	20-Feb-08	15.3	V	20-Feb-08	-	F	19-Feb-08	-	F
2009	9-Feb-09	-	B	11-Feb-09	545.2	V	9-Feb-09	-	B	11-Feb-09	1.8	V	11-Feb-09	51.1	V	11-Feb-09	-	B	11-Feb-09	-	B
2010	8-Feb-10	-	F	9-Feb-10	134.9	V	8-Feb-10	-	B	8-Feb-10	-	B	9-Feb-10	1.4	V	8-Feb-10	-	B	8-Feb-10	-	B
2011	22-Feb-11	-	F	24-Feb-11	418.7	V	22-Feb-11	-	F	23-Feb-11	0.4	V	23-Feb-11	4.6	V	22-Feb-11	-	F	22-Feb-11	-	F
2012	21-Feb-12	-	B	23-Feb-12	164.9	V	21-Feb-12	-	B	22-Feb-12	0.5	V	22-Feb-12	4.4	V	21-Feb-12	-	B	21-Feb-12	-	B
2013	20-Feb-13	-	B	20-Feb-13	190.7	V	20-Feb-13	-	B	21-Feb-13	-	B	21-Feb-13	-	B	21-Feb-13	-	B	21-Feb-13	-	B
No. of Readings:		0			5			1			4			6			1			0	
Maximum:		-			545.2			2.1			1.8			51.1			3.0			-	
Minimum:		-			134.9			2.1			0.3			1.4			3.0			-	
Average:		-			290.9			2.1			0.7			13.9			3.0			-	
YELLOW:		-			190.7			-			0.5	(unfrozen)		4.6			-			-	
RED:		**-**			**134.9**			**-**			**0.3**	(unfrozen)		**1.4**			**-**			**-**	
MARCH																					
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	18-Mar-04	2.8	V	16-Mar-04	473.4	V	18-Mar-04	5.2	V	18-Mar-04	0.2	BE	18-Mar-04	22.4	M	16-Mar-04	49.0	V	16-Mar-04	-	F
2005	30-Mar-05	0.8	V	28-Mar-05	220.0	V	29-Mar-05	4.2	V	29-Mar-05	0.4	BE	29-Mar-05	18.4	M	29-Mar-05	5.5	V	29-Mar-05	-	F
2006	20-Mar-06	39.7	V	20-Mar-06	966.1	V	22-Mar-06	15.3	V	22-Mar-06	2.0	V	24-Mar-06	29.2	V	20-Mar-06	25.1	V	20-Mar-06	-	F
2007	20-Mar-07	-	F	21-Mar-07	492.0	V	19-Mar-07	-	F	19-Mar-07	-	F	21-Mar-07	-	F	21-Mar-07	17.8	V	21-Mar-07	-	F
2008	18-Mar-08	-	B	18-Mar-08	178.8	V	18-Mar-08	-	F	18-Mar-08	-	B	17-Mar-08	2.1	V	17-Mar-08	-	F	17-Mar-08	-	F
2009	16-Mar-09	8.8	V	18-Mar-09	1095.0	V	17-Mar-09	0.4	V	18-Mar-09	1.7	V	18-Mar-09	43.8	V	16-Mar-09	43.4	V	16-Mar-09	4.6	V
2010	18-Mar-10	26.4	V	18-Mar-10	1499.6	V	18-Mar-10	25.4	V	18-Mar-10	2.0	V	17-Mar-10	19.5	V	17-Mar-10	100.6	V	17-Mar-10	15.9	V
2011	16-Mar-11	6.0	V	16-Mar-11	387.8	V	15-Mar-11	-	F	17-Mar-11	0.2	V	17-Mar-11	9.5	V	16-Mar-11	38.2	V	15-Mar-11	-	F
	17-Mar-11	11.2	V	22-Mar-11	962.9	V	22-Mar-11	17.1	V	-	-	-	-	-	-	22-Mar-11	47.8	V	-	-	-
	18-Mar-11	59.8	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	22-Mar-11	15.8	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	20-Mar-12	13.7	V	20-Mar-12	981.3	V	20-Mar-12	12.2	V	21-Mar-12	1.2	V	21-Mar-12	22.7	V	21-Mar-12	37.5	V	20-Mar-12	1.5	V
2013	19-Mar-13	5.5	V	20-Mar-13	363.6	V	19-Mar-13	-	B	20-Mar-13	-	B	19-Mar-13	11.5	V	19-Mar-13	25.1	V	20-Mar-13	-	B
No. of Readings:		11			11			7			7			9			10			3	
Maximum:		59.8			1499.6			25.4			2.0			43.8			100.6			15.9	
Minimum:		0.8			178.8			0.4			0.2			2.1			5.5			1.5	
Average:		17.3			692.8			11.4			1.1			19.9			39.0			7.3	
YELLOW:		5.5			363.6			5.2			0.4			11.5			25.1			1.7	(unfrozen)
RED:		**0.8**			**178.8**			**0.4**			**0.2**			**2.1**			**5.5**			**1.5**	(unfrozen)

NOTES:

RED - Maintained equivalent to the lowest monthly flow recorded over period of record.

YELLOW - Calculated as 15% above the red value or the third lowest monthly flow over period of record, whichever is higher.

- Red and Yellow marked as "-" indicate that no Trigger Value has been assigned due to expected value of zero during this period.

V - Valeport Measurement
M - Manual Measurement (floating object)
E - Visual Estimate
BE - Bucket Estimate
B - Location Buried in Snow
F - Location Frozen

Low Flow - <0.1 L/s

TABLE 3.5
SURFACE WATER FLOWS PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING	SW16			SW17			SW17A			SW18			SW21C			SW24A			SW77		
YEAR	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type
JANUARY																					
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2006	17-Jan-06	13.0	V	17-Jan-06	3.7	BE	17-Jan-06	17.3	V	17-Jan-06	31.6	V	17-Jan-06	2.8	V	17-Jan-06	1.5	B	-	-	-
2007	24-Jan-07	-	F	24-Jan-07	2.4	V	25-Jan-07	15.5	E/V/M	24-Jan-07	-	F	25-Jan-07	2.9	V	25-Jan-07	2.2	V	-	-	-
2008	21-Jan-08	39.5	V	21-Jan-08	1.4	V	21-Jan-08	35.1	V	21-Jan-08	36.1	V	21-Jan-08	8.0	V	21-Jan-08	1.5	V	-	-	-
2009	20-Jan-09	-	F	20-Jan-09	1.8	V	20-Jan-09	35.4	V	20-Jan-09	-	F	20-Jan-09	5.2	V	20-Jan-09	3.9	V	-	-	-
2010	19-Jan-10	-	B	19-Jan-10	-	B	19-Jan-10	0.6	V	18-Jan-10	-	B	19-Jan-10	0.5	V	19-Jan-10	1.6	V	18-Jan-10	0.2	V
2011	18-Jan-11	6.1	V	18-Jan-11	4.1	V	18-Jan-11	12.3	V	18-Jan-11	-	F	18-Jan-11	4.5	V	18-Jan-11	2.9	V	18-Jan-11	-	B
2012	18-Jan-12	-	F	18-Jan-12	5.6	V	18-Jan-12	27.5	V	17-Jan-12	-	F	18-Jan-12	2.1	V	18-Jan-12	6.2	V	18-Jan-12	0.4	V
2013	16-Jan-13	21.8	V	16-Jan-13	8.0	V	16-Jan-13	23.4	V	16-Jan-13	78.1	V	16-Jan-13	8.5	V	16-Jan-13	4.6	V	16-Jan-13	0.2	V
No. of Readings:		4			7			8			3			8			8			3	
Maximum:		39.5			8.0			35.4			78.1			8.5			6.2			0.4	
Minimum:		6.1			1.4			0.6			31.6			0.5			1.5			0.2	
Average:		20.1			3.9			20.9			48.6			4.3			3.1			0.3	
YELLOW:	7.0		(unfrozen)		2.4			15.5		36.3		(unfrozen)		2.8			1.7			0.23	
RED:	**6.1**		(unfrozen)		**1.4**			**0.6**		**31.6**		**(unfrozen)**		**0.5**			**1.5**			**0.2**	
FEBRUARY																					
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	10-Feb-04	-	F	10-Feb-04	1.9	B	10-Feb-04	9.2	B	10-Feb-04	47.9	V	11-Feb-04	2.0	E	10-Feb-04	0.9	B	-	-	-
2005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2006	22-Feb-06	-	F	22-Feb-06	-	F	22-Feb-06	-	F	22-Feb-06	10.0	V	22-Feb-06	-	F	22-Feb-06	-	F	-	-	-
2007	22-Feb-07	-	F	22-Feb-07	-	F	22-Feb-07	-	F	22-Feb-07	-	F	20-Feb-07	-	F	22-Feb-07	-	F	-	-	-
2008	19-Feb-08	16.7	V	19-Feb-08	7.6	V	19-Feb-08	21.8	V	19-Feb-08	77.1	V	19-Feb-08	2.3	V	19-Feb-08	1.6	V	-	-	-
2009	11-Feb-09	9.7	V	11-Feb-09	1.9	V	10-Feb-09	16.4	V	10-Feb-09	73.7	V	10-Feb-09	2.2	V	10-Feb-09	0.7	V	-	-	-
2010	8-Feb-10	-	B	9-Feb-10	0.9		9-Feb-10	2.6	V	9-Feb-10	-	B	9-Feb-10	0.7	V	9-Feb-10	1.4	V	8-Feb-10	0.2	V
2011	23-Feb-11	-	F	23-Feb-11	-	F	23-Feb-11	11.6	V	23-Feb-11	-	F	23-Feb-11	1.4	V	23-Feb-11	4.6	V	23-Feb-11	-	B
2012	22-Feb-12	6.5	V	22-Feb-12	1.9	V	22-Feb-12	2.4	V	22-Feb-12	15.5	V	22-Feb-12	2.2	V	22-Feb-12	2.3	V	22-Feb-12	0.3	V
2013	20-Feb-13	-	B	20-Feb-13	1.5	V	20-Feb-13	17.0	V	21-Feb-13	-	F	21-Feb-13	-	-	20-Feb-13	5.0	V	20-Feb-13	0.3	V
No. of Readings:		3			6			7			5			6			7			3	
Maximum:		16.7			7.6			21.8			77.1			2.3			5.0			0.3	
Minimum:		6.5			0.9			2.4			10.0			0.7			0.7			0.2	
Average:		11.0			2.6			11.6			44.8			1.8			2.4			0.3	
YELLOW:	7.5		(unfrozen)		1.9			9.2		15.5		(unfrozen)		2.0			1.4			0.23	
RED:	**6.5**		(unfrozen)		**0.9**			**2.4**		**10.0**		**(unfrozen)**		**0.7**			**0.7**			**0.2**	
MARCH																					
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	17-Mar-04	2.0	E	17-Mar-04	4.3	B	17-Mar-04	19.4	V	16-Mar-04	48.7	V	17-Mar-04	3.0	BE	17-Mar-04	2.5	BE	-	-	-
2005	29-Mar-05	4.1	V	29-Mar-05	3.2	BE	29-Mar-05	14.7	V	29-Mar-05	-	F	29-Mar-05	2.8	BE	29-Mar-05	0.2	BE	-	-	-
2006	22-Mar-06	12.4	V	22-Mar-06	13.2	V	22-Mar-06	37.2	V	20-Mar-06	78.2	V	22-Mar-06	1.7	BE	22-Mar-06	3.0	V	-	-	-
2007	21-Mar-07	-	F	21-Mar-07	9.2	V	21-Mar-07	27.4	V	21-Mar-07	50.5	V	21-Mar-07	4.5	V	21-Mar-07	2.5	V	-	-	-
2008	17-Mar-08	15.6	E/V/M	17-Mar-08	1.8	V	17-Mar-08	11.7	V	17-Mar-08	66.0	V	17-Mar-08	0.7	V	17-Mar-08	0.8	V	-	-	-
2009	17-Mar-09	12.1	V	17-Mar-09	6.6	V	17-Mar-09	23.2	V	16-Mar-09	150.6	V	17-Mar-09	7.4	V	17-Mar-09	1.5	V	-	-	-
2010	17-Mar-10	26.0	V	17-Mar-10	6.9	V	17-Mar-10	12.8	V	17-Mar-10	332.6	V	17-Mar-10	4.3	V	17-Mar-10	10.1	V	17-Mar-10	0.7	V
2011	16-Mar-11	17.4	V	22-Mar-11	7.8	V	22-Mar-11	48.3	V	22-Mar-11	108.6	V	16-Mar-11	2.7	V	16-Mar-11	6.2	V	16-Mar-11	-	B
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	20-Mar-12	15.7	V	20-Mar-12	11.0	V	20-Mar-12	36.1	V	20-Mar-12	95.4	V	20-Mar-12	4.5	V	20-Mar-12	15.4	V	20-Mar-12	1.0	V
2013	20-Mar-13	-	F	20-Mar-13	4.0	V	20-Mar-13	36.1	V	20-Mar-13	-	F	20-Mar-13	1.0	V	20-Mar-13	4.6	V	20-Mar-13	0.3	V
No. of Readings:		8			10			10			8			10			10			3	
Maximum:		26.0			13.2			48.3			332.6			7.4			15.4			1.0	
Minimum:		2.0			1.8			11.7			48.7			0.7			0.2			0.3	
Average:		13.2			6.8			26.7			116.3			3.3			4.7			0.7	
YELLOW:		12.1			4.3			14.7			66.0			1.7			1.5			0.35	
RED:		**2.0**			**1.8**			**11.7**			**48.7**			**0.7**			**0.2**			**0.3**	

NOTES:

RED - Maintained equivalent to the lowest monthly flow recorded over period of record.

YELLOW - Calculated as 15% above the red value or the third lowest monthly flow over period of record, whichever is higher.

- Red and Yellow marked as "-" indicate that no Trigger Value has been assigned due to expected value of zero during this period.

V - Valeport Measurement
M - Manual Measurement (floating object)
E - Visual Estimate
BE - Bucket Estimate
B - Location Buried in Snow
F - Location Frozen

Low Flow - <0.1 L/s

TABLE 3.5
SURFACE WATER FLOWS PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING YEAR	SW3			SW6A			SW9			SW10			SW11			SW14			SW15		
	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type
APRIL																					
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	19-Apr-04	14.4	V	19-Apr-04	606.6	V	20-Apr-04	7.0	V	20-Apr-04	1.1	BE	21-Apr-04	27.4	M	19-Apr-04	46.3	V	19-Apr-04	1.9	V
2005	11-Apr-05	31.4	V	11-Apr-05	1671.0	V	11-Apr-05	41.7	V	11-Apr-05	3.2	BE	11-Apr-05	61.2	M	11-Apr-05	70.7	V	11-Apr-05	5.3	BE
2006	18-Apr-06	5.2	V	18-Apr-06	569.4	V	19-Apr-06	5.6	V	19-Apr-06	3.8	V	19-Apr-06	22.1	V	18-Apr-06	19.5	V	18-Apr-06	5.7	V
2007	16-Apr-07	4.3	V	16-Apr-07	574.2	V	16-Apr-07	7.2	V	16-Apr-07	1.7	V	17-Apr-07	26.2	V	17-Apr-07	14.3	V	17-Apr-07	2.1	V
2008	4-Apr-08	12.9	V	2-Apr-08	964.1	V	4-Apr-08	0.1	V	4-Apr-08	2.8	V	2-Apr-08	100.8	V	2-Apr-08	67.1	V	1-Apr-08	34.5	V
	23-Apr-08	11.1	V	24-Apr-08	624.1	V	23-Apr-08	12.5	V	23-Apr-08	0.2	V	23-Apr-08	32.6	V	21-Apr-08	41.4	V	21-Apr-08	1.5	V
2009	15-Apr-09	9.1	V	16-Apr-09	382.7	V	15-Apr-09	17.2	V	15-Apr-09	0.7	V	16-Apr-09	27.3	V	16-Apr-09	44.7	V	15-Apr-09	5.4	V
2010	6-Apr-10	6.7	V	-	-	-	6-Apr-10	11.2	V	-	-	-	-	-	-	12-Apr-10	15.7	V	12-Apr-10	0.5	V
	13-Apr-10	3.4	V	13-Apr-10	303.4	V	12-Apr-10	8.3	V	13-Apr-10	0.5	V	13-Apr-10	9.0	V	19-Apr-11	31.1	V	19-Apr-11	0.6	V
2011	1-Apr-11	4.4	V	20-Apr-11	699.4	V	20-Apr-11	45.3	V	19-Apr-11	0.9	V	19-Apr-11	8.2	V	-	-	-	-	-	-
	5-Apr-11	32.4	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8-Apr-11	17.1	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12-Apr-11	48.7	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	15-Apr-11	18.0	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	18-Apr-11	14.0	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	20-Apr-11	33.3	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	21-Apr-11	20.9	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	26-Apr-11	14.0	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	29-Apr-11	19.5	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	18-Apr-12	-	E	18-Apr-12	200.0	V	17-Apr-12	0.3	V	18-Apr-12	0.4	V	18-Apr-12	5.8	V	18-Apr-12	6.5	V	17-Apr-12	*0.1*	V
2013	15-Apr-13	18.3	V	16-Apr-13	901.3	V	16-Apr-13	24.4	V	17-Apr-13	1.1	V	17-Apr-13	42.8	V	17-Apr-13	66.5	V	16-Apr-13	2.9	V
No. of Readings:		20			11			12			11			11			11			11	
Maximum:		48.7			1671.0			45.3			3.8			100.8			70.7			34.5	
Minimum:		3.4			200.0			0.1			0.2			5.8			6.5			0.1	
Average:		17.0			681.5			15.1			1.5			33.0			38.5			5.5	
YELLOW:		4.3			382.7			5.6			0.5			9.0			15.7			0.6	
RED:		**3.4**			**200.0**			**0.1**			**0.2**			**5.8**			**6.5**			**0.1**	
MAY																					
2003	22-May-03	0.0	E	22-May-03	164.4	V	22-May-03	0.0	E	22-May-03	0.6	E	22-May-03	23.0	M	22-May-03	15.0	V	22-May-03	1.8	BE
2004	19-May-04	0.8	V	19-May-04	291.5	V	19-May-04	1.4	V	19-May-04	0.2	BE	19-May-04	11.1	M	19-May-04	14.2	V	19-May-04	1.6	V
2005	24-May-05	0.0	E	24-May-05	286.6	V	24-May-05	1.1	V	24-May-05	0.2	BE	24-May-05	10.4	V	24-May-05	7.4	V	24-May-05	3.5	BE
2006	23-May-06	0.8	V	23-May-06	407.6	V	24-May-06	2.4	V	24-May-06	0.1	V	24-May-06	10.7	V	23-May-06	8.8	V	23-May-06	3.5	V
2007	15-May-07	0.0	E	15-May-07	170.1	V	15-May-07	2.0	V	15-May-07	0.2	V	14-May-07	11.1	V	14-May-07	4.1	V	14-May-07	2.2	V
2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	21-May-08	0.4	V	21-May-08	283.7	V	21-May-08	2.8	V	20-May-08	0.4	V	22-May-08	13.1	V	20-May-08	14.4	V	20-May-08	0.5	V
2009	20-May-09	0.8	V	20-May-09	393.6	V	20-May-09	5.9	V	20-May-09	0.2	V	21-May-09	5.1	V	19-May-09	11.2	V	19-May-09	0.3	V
2010	17-May-10	1.3	V	18-May-10	247.0	V	17-May-10	5.4	V	18-May-10	0.3	V	17-May-10	12.0	V	18-May-10	28.6	V	18-May-10	0.6	V
	28-May-10	0.0	E	-	-	-	28-May-10	0.6	V	-	-	-	-	-	-	-	-	-	17-May-11	1.6	V
2011	3-May-11	8.4	V	18-May-11	577.0	V	17-May-11	16.9	V	18-May-11	2.1	V	18-May-11	41.7	V	18-May-11	49.5	V	-	-	-
	6-May-11	4.2	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10-May-11	1.5	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	13-May-11	8.1	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	15-May-11	95.3	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	16-May-11	28.8	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	18-May-11	22.5	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	19-May-11	23.1	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	20-May-11	16.8	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	27-May-11	17.8	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	14-May-12	0.0	E	15-May-12	168.9	V	14-May-12	0.0	V	15-May-12	0.7	V	15-May-12	2.5	V	15-May-12	11.6	V	15-May-12	*0.1*	V
2013	13-May-13	0.0	E	14-May-13	394.8	V	13-May-13	11.8	V	4-May-13	0.1	V	14-May-13	15.3	V	14-May-13	19.9	V	13-May-13	0.7	V
No. of Readings:		21			11			12			11			11			11			11	
Maximum:		95.3			577.0			16.9			2.1			41.7			49.5			3.5	
Minimum:		0.0			164.4			0.0			0.1			2.5			4.1			0.1	
Average:		11.0			307.7			4.2			0.5			14.2			16.8			1.5	
YELLOW:		-			189.1			-			0.2			10.4			8.8			0.6	
RED:		**-**			**164.4**			**-**			**0.1**			**2.5**			**4.1**			**0.1**	
JUNE																					
2003	23-Jun-03	0.0	E	23-Jun-03	58.3	V	23-Jun-03	0.0	E	23-Jun-03	0.3	E	23-Jun-03	3.8	M	23-Jun-03	6.2	V	23-Jun-03	0.5	BE
2004	24-Jun-04	0.0	E	24-Jun-04	185.9	V	24-Jun-04	0.6	V	24-Jun-04	0.1	BE	24-Jun-04	4.0	M	24-Jun-04	1.8	V	24-Jun-04	1.4	BE
2005	27-Jun-05	0.0	E	27-Jun-05	123.0	V	27-Jun-05	0.0	E	27-Jun-05	0.1	E	27-Jun-05	3.2	V	27-Jun-05	2.9	V	27-Jun-05	0.2	BE
2006	19-Jun-06	0.0	E	21-Jun-06	83.4	V	20-Jun-06	0.0	E	23-Jun-06	0.1	V	21-Jun-06	3.0	V	23-Jun-06	1.6	V	20-Jun-06	2.5	V
2007	18-Jun-07	0.0	E	19-Jun-07	92.8	V	18-Jun-07	0.0	E	18-Jun-07	0.1	V	19-Jun-07	2.8	V	18-Jun-07	1.7	V	18-Jun-07	1.3	V
2008	17-Jun-08	0.0	E	17-Jun-08	158.4	V	18-Jun-08	0.0	E	18-Jun-08	0.1	V	17-Jun-08	13.1	V	18-Jun-08	4.0	V	18-Jun-08	0.3	V
2009	16-Jun-09	0.0	E	16-Jun-09	155.8	V	16-Jun-09	0.0	E	16-Jun-09	0.1	V	16-Jun-09	2.3	V	16-Jun-09	7.1	V	16-Jun-09	*0.1*	BE
2010	14-Jun-10	3.0	V	14-Jun-10	240.0	V	15-Jun-10	2.6	V	15-Jun-10	0.7	V	15-Jun-10	8.0	V	16-Jun-10	27.6	V	16-Jun-10	0.6	V
2011	3-Jun-11	3.8	V	13-Jun-11	296.3	V	14-Jun-11	1.2	V	15-Jun-11	0.1	V	15-Jun-11	3.6	V	14-Jun-11	10.0	V	14-Jun-11	0.4	V
	13-Jun-11	1.5	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	17-Jun-11	0.0	E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	18-Jun-12	0.0	E	19-Jun-12	81.0	V	18-Jun-12	0.0	E	20-Jun-12	0.1	V	19-Jun-12	1.9	V	19-Jun-12	2.8	V	19-Jun-12	0.0	E
2013	18-Jun-13	0.0	E	18-Jun-13	252.6	V	18-Jun-13	0.8	V	19-Jun-13	*0.1*	E	19-Jun-13	4.0	V	19-Jun-13	17.0	V	19-Jun-13	0.2	V
No. of Readings:		13			11			11			11			11			11			11	
Maximum:		3.8			296.3			2.6			0.7			13.1			27.6			2.5	
Minimum:		0.0			58.3			0.0			0.1			1.9			1.6			0.0	
Average:		0.6			157.0			0.5			0.2			4.5			7.5			0.7	
YELLOW:		-			83.4			-			0.09			2.8			1.8		0.2		
RED:		**-**			**58.3**			**-**			**0.09**			**1.9**			**1.6**		**Dry**		**(no trigger)**

NOTES:

RED - Maintained equivalent to the lowest monthly flow recorded over period of record.

YELLOW - Calculated as 15% above the red value or the third lowest monthly flow over period of record, whichever is higher.

- Red and Yellow marked as "-" indicate that no Trigger Value has been assigned due to expected value of zero during this period.

V - Valeport Measurement
M - Manual Measurement (floating object)
E - Visual Estimate
BE - Bucket Estimate
B - Location Buried in Snow
F - Location Frozen

Low Flow - <0.1 L/s

TABLE 3.5
SURFACE WATER FLOWS PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING YEAR	SW16			SW17			SW17A			SW18			SW21C			SW24A			SW77		
	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type
APRIL																					
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	19-Apr-04	40.4	V	19-Apr-04	13.3	BE	19-Apr-04	72.4	V	19-Apr-04	123.6	V	21-Apr-04	4.0	BE	21-Apr-04	3.3	BE	-	-	-
2005	11-Apr-05	27.0	V	11-Apr-05	17.5	BE	11-Apr-05	68.6	V	11-Apr-05	207.2	V	11-Apr-05	16.6	BE	11-Apr-05	7.9	BE	-	-	-
2006	18-Apr-06	4.6	V	18-Apr-06	24.5	V	18-Apr-06	48.8	V	18-Apr-06	80.7	V	19-Apr-06	6.4	V	18-Apr-06	3.7	V	-	-	-
2007	16-Apr-07	10.5	V	16-Apr-07	28.7	V	16-Apr-07	34.7	V	17-Apr-07	102.5	V	16-Apr-07	8.3	V	17-Apr-07	5.5	V	-	-	-
2008	1-Apr-08	167.3	V	1-Apr-08	7.0	V	1-Apr-08	50.1	V	2-Apr-08	159.6	V	1-Apr-07	23.4	V	2-Apr-08	0.8	V	-	-	-
	23-Apr-08	34.0	V	23-Apr-08	5.5	V	23-Apr-08	35.2	V	23-Apr-08	178.3	V	23-Apr-08	9.9	V	23-Apr-08	1.9	V	-	-	-
2009	16-Apr-09	8.1	V	16-Apr-09	6.1	V	16-Apr-09	16.6	V	15-Apr-09	203.8	V	16-Apr-09	3.7	V	16-Apr-09	3.4	V	-	-	-
2010	12-Apr-10	2.9	V	13-Apr-10	3.3	V	13-Apr-10	15.1	V	12-Apr-10	67.6	V	13-Apr-10	2.3	V	13-Apr-10	3.3	V	13-Apr-10	0.5	V
	19-Apr-11	4.9	V	19-Apr-11	2.9	V	19-Apr-11	29.9	V	18-Apr-11	102.3	V	19-Apr-11	3.3	V	19-Apr-11	6.7	V	19-Apr-11	0.8	V
2011	-	-	-	-	-	-	-	-	-	20-Apr-11	243.0	V	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	17-Apr-12	3.0	V	17-Apr-12	1.6	V	17-Apr-12	14.7	V	17-Apr-12	29.5	V	17-Apr-12	1.9	V	17-Apr-12	0.9	V	17-Apr-12	0.3	V
2013	16-Apr-13	100.4	V	16-Apr-13	3.1	V	16-Apr-13	58.7	V	16-Apr-13	166.7	V	16-Apr-13	5.6	V	16-Apr-13	26.3	V	16-Apr-13	1.3	V
No. of Readings:	11			11			11			12			11			11			4		
Maximum:	167.3			28.7			72.4			243.0			23.4			26.3			1.3		
Minimum:	2.9			1.6			14.7			29.5			1.9			0.8			0.3		
Average:	36.6			10.3			40.4			138.7			7.8			5.8			0.7		
YELLOW:	4.6			3.1			16.9			80.7			3.3			1.9			0.35		
RED:	**2.9**			**1.6**			**14.7**			**29.5**			**1.9**			**0.8**			**0.3**		
MAY																					
2003	22-May-03	1.0	BE	22-May-03	2.2	BE	22-May-03	12.0	V	22-May-03	46.0	V	-	-	-	-	-	-	-	-	-
2004	19-May-04	3.4	BE	19-May-04	4.6	BE	19-May-04	15.4	V	19-May-04	31.3	V	19-May-04	4.8	BE	19-May-04	1.7	M	-	-	-
2005	24-May-05	3.6	V	24-May-05	6.0	BE	24-May-05	22.6	V	24-May-05	27.7	V	24-May-05	4.8	BE	24-May-05	1.4	BE	-	-	-
2006	23-May-06	3.4	V	23-May-06	6.4	V	23-May-06	17.1	V	23-May-06	44.8	V	23-May-06	3.5	V	24-Apr-06	12.3	V	-	-	-
2007	14-May-07	2.4	V	14-May-07	2.8	V	14-May-07	24.6	V	14-May-07	30.9	V	14-May-07	11.4	V	14-May-07	1.4	V	-	-	-
2008	-	-	-	6-May-08	5.9	V	6-May-08	39.4	V	6-May-08	64.8	V	-	-	-	6-May-08	0.8	V	-	-	-
	21-May-08	4.5	V	21-May-08	1.3	V	21-May-08	9.6	V	21-May-08	41.5	V	21-May-08	6.7	V	21-May-08	1.4	V	-	-	-
2009	20-May-09	3.2	V	20-May-09	2.7	V	20-May-09	12.5	V	19-May-09	65.3	V	21-May-09	3.7	V	20-May-09	1.0	V	-	-	-
2010	17-May-10	5.7	V	17-May-10	4.6	V	17-May-10	26.8	V	18-May-10	128.1	V	17-May-10	5.6	V	17-May-10	8.3	V	17-May-10	0.2	V
	17-May-11	11.1	V	17-May-11	2.7	V	17-May-11	30.7	V	17-May-11	144.0	V	17-May-11	5.4	V	17-May-11	5.7	V	17-May-11	0.5	V
2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	15-May-12	6.9	V	15-May-12	1.9	V	15-May-12	10.7	V	15-May-12	25.3	V	15-May-12	2.6	V	15-May-12	2.4	V	15-May-12	0.2	V
2013	13-May-13	1.6	V	13-May-13	2.0	V	13-May-13	27.6	V	13-May-13	25.6	V	13-May-13	7.5	V	14-May-13	1.8	V	14-May-13	0.3	V
No. of Readings:	11			12			12			12			10			11			4		
Maximum:	11.1			6.4			39.4			144.0			11.4			12.3			0.5		
Minimum:	1.0			1.3			9.6			25.3			2.6			0.8			0.2		
Average:	4.2			3.6			20.7			56.3			5.6			3.5			0.3		
YELLOW:	2.4			2.0			12.0			29.1			3.7			1.4			0.3		
RED:	**1.0**			**1.3**			**9.6**			**25.3**			**2.6**			**0.8**			**0.2**		
JUNE																					
2003	23-Jun-03	1.6	E	23-Jun-03	1.5	BE	23-Jun-03	10.4	V	23-Jun-03	11.8	V	-	-	-	23-Jun-03	-	-	-	-	-
2004	24-Jun-04	0.6	BE	24-Jun-04	1.9	BE	24-Jun-04	12.0	V	24-Jun-04	20.5	V	24-Jun-04	2.5	BE	24-Jun-04	1.1	BE	-	-	-
2005	27-Jun-05	0.4	V	27-Jun-05	2.3	BE	27-Jun-05	7.2	V	27-Jun-05	11.5	V	27-Jun-05	2.1	BE	27-Jun-05	0.5	BE	-	-	-
2006	20-Jun-06	0.9	V	20-Jun-06	4.4	V	20-Jun-06	8.6	V	20-Jun-06	11.9	V	20-Jun-06	6.1	V	20-Jun-06	2.3	V	-	-	-
2007	18-Jun-07	0.1	V	18-Jun-07	0.6	V	18-Jun-07	10.5	V	18-Jun-07	21.0	V	18-Jun-07	0.6	V	18-Jun-07	0.2	V	-	-	-
2008	18-Jun-08	1.9	V	17-Jun-08	2.9	V	17-Jun-08	11.0	V	18-Jun-08	15.6	V	17-Jun-08	2.3	V	17-Jun-08	0.4	V	-	-	-
2009	15-Jun-09	5.7	V	15-Jun-09	1.6	V	15-Jun-09	3.9	V	15-Jun-09	30.0	V	15-Jun-09	2.2	V	15-Jun-09	0.4	V	-	-	-
2010	14-Jun-10	6.3	V	14-Jun-10	4.6	V	14-Jun-10	10.5	V	16-Jun-10	78.5	V	15-Jun-10	2.2	V	15-Jun-10	3.2	V	15-Jun-10	0.3	V
2011	14-Jun-11	2.7	V	14-Jun-11	0.5	V	14-Jun-11	22.1	V	14-Jun-11	23.8	V	14-Jun-11	2.4	V	14-Jun-11	2.3	V	14-Jun-11	0.2	V
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	19-Jun-12	1.8	V	19-Jun-12	0.3	V	19-Jun-12	6.9	V	18-Jun-12	15.0	V	19-Jun-12	1.2	V	19-Jun-12	4.5	V	19-Jun-12	0.2	V
2013	19-Jun-13	1.0	V	19-Jun-13	0.4	V	19-Jun-13	5.4	V	19-Jun-13	28.0	V	19-Jun-13	6.0	V	19-Jun-13	2.4	V	19-Jun-13	0.1	V
No. of Readings:	11			11			11			11			10			10			4		
Maximum:	6.3			4.6			22.1			78.5			6.1			4.5			0.3		
Minimum:	0.1			0.3			3.9			11.5			0.6			0.2			0.1		
Average:	2.1			1.9			9.9			24.3			2.8			1.7			0.2		
YELLOW:	0.6			0.5			6.9			13.3			2.1			0.4			0.12		
RED:	**0.1**			**0.3**			**3.9**			**11.5**			**0.6**			**0.2**			**0.1**		

NOTES:
RED
YELLOW

NOTES:
RED - Maintained equivalent to the lowest monthly flow recorded over period of record.
YELLOW - Calculated as 15% above the red value or the third lowest monthly flow over period of record, whichever is higher.
- Red and Yellow marked as "-" indicate that no Trigger Value has been assigned due to expected value of zero during this period.

V - Valeport Measurement
M - Manual Measurement (floating object)
E - Visual Estimate
BE - Bucket Estimate
B - Location Buried in Snow
F - Location Frozen
Low Flow - <0.1 L/s

TABLE 3.5
SURFACE WATER FLOWS PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING YEAR	SW3			SW6A			SW9			SW10			SW11			SW14			SW15		
	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type
JULY																					
2003	22-Jul-03	0.0	E	22-Jul-03	92.5	V	24-Jul-03	0.0	E	24-Jul-03	1.1	E	23-Jul-03	0.8	M	22-Jul-03	2.8	V	23-Jul-03	2.9	E
2004	29-Jul-04	0.0	E	29-Jul-04	100.5	V	29-Jul-04	0.0	E	29-Jul-04	0.1	BE	29-Jul-04	3.0	M	29-Jul-04	1.1	V	29-Jul-04	1.4	BE
2005	11-Jul-05	0.0	E	11-Jul-05	87.5	V	12-Jul-05	0.0	E	12-Jul-05	0.1	E	12-Jul-05	5.0	E	11-Jul-05	2.1	V	11-Jul-05	1.0	BE
2006	10-Jul-06	0.0	E	11-Jul-06	55.6	V	12-Jul-06	0.0	E	12-Jul-06	0.4	V	12-Jul-06	2.6	V	11-Jul-06	3.0	V	11-Jul-06	1.5	V
2007	15-Jul-07	0.0	E	15-Jul-07	47.5	E	15-Jul-07	0.0	E	15-Jul-07	*0.1*	E	15-Jul-07	1.0	V	15-Jul-07	0.5	V	15-Jul-07	0.8	V
2008	14-Jul-08	0.0	E	15-Jul-08	56.2	V	15-Jul-08	0.0	E	15-Jul-08	*0.1*	V	15-Jul-08	0.8	V	15-Jul-08	0.6	V	15-Jul-08	0.0	V
2009	14-Jul-09	0.0	E	14-Jul-09	106.6	V	13-Jul-09	0.0	E	14-Jul-09	*0.1*	V	15-Jul-09	0.8	V	14-Jul-09	1.9	V	14-Jul-09	0.2	V
2010	19-Jul-10	3.1	V	20-Jul-10	287.1	V	20-Jul-10	1.6	V	20-Jul-10	*0.1*	V	20-Jul-10	6.2	V	19-Jul-10	45.0	V	19-Jul-10	0.7	V
2011	18-Jul-11	0.0	E	18-Jul-11	89.5	V	18-Jul-11	0.0	E	20-Jul-11	0.1	V	20-Jul-11	0.9	V	20-Jul-11	1.1	V	20-Jul-11	0.0	E
2012	16-Jul-12	0.0	E	18-Jul-12	48.1	V	16-Jul-12	0.0	E	15-Jul-12	0.1	V	17-Jul-12	1.1	V	17-Jul-12	1.2	V	16-Jul-12	0.0	E
2013	15-Jul-13	0.0	E	17-Jul-13	157.3	V	15-Jul-13	0.0	E	16-Jul-13	*0.1*	V	16-Jul-13	1.7	V	16-Jul-13	10.9	V	16-Jul-13	*0.1*	V
No. of Readings:		11			11			11			11			11			11			11	
Maximum:		3.1			287.1			1.6			1.1			6.2			45.0			2.9	
Minimum:		0.0			47.5			0.0			0.1			0.8			0.5			0.0	
Average:		0.3			102.6			0.1			0.2			2.2			6.4			0.8	
YELLOW:		-			55.6			-			0.09			0.9			1.1		0.1		
RED:		**-**			**47.5**			**-**			**0.09**			**0.8**			**0.5**		**Dry**		**(no trigger)**
AUGUST																					
2003	20-Aug-03	0.0	E	20-Aug-03	57.6	V	21-Aug-03	0.0	E	20-Aug-03	0.0	E	20-Aug-03	3.2	M	20-Aug-03	2.2	V	20-Aug-03	1.2	M
2004	26-Aug-04	0.0	E	26-Aug-04	24.9	V	26-Aug-04	0.0	E	26-Aug-04	*0.1*	BE	26-Aug-04	2.2	M	26-Aug-04	1.6	V	26-Aug-04	0.7	BE
2005	22-Aug-05	0.0	E	22-Aug-05	53.2	V	22-Aug-05	0.0	E	22-Aug-05	0.1	E	23-Aug-05	0.9	V	22-Aug-05	1.1	V	22-Aug-05	1.4	BE
2006	22-Aug-06	0.0	E	22-Aug-06	32.0	V	21-Aug-06	0.0	E	23-Aug-06	0.1	E	24-Aug-06	1.0	V	23-Aug-06	0.4	V	23-Aug-06	1.0	V
2007	21-Aug-07	0.0	E	22-Aug-07	32.1	V	20-Aug-07	0.0	E	22-Aug-07	*0.1*	E	22-Aug-07	0.6	V	22-Aug-07	1.1	V	22-Aug-07	0.7	V
2008	18-Aug-08	0.0	E	19-Aug-08	105.1	V	18-Aug-08	0.0	E	19-Aug-08	0.3	V	19-Aug-08	7.3	V	19-Aug-08	6.1	V	19-Aug-08	0.1	V
2009	10-Aug-09	0.0	E	12-Aug-09	169.3	V	10-Aug-09	0.0	E	12-Aug-09	0.2	V	11-Aug-09	0.8	V	11-Aug-09	3.8	V	11-Aug-09	0.1	V
2010	17-Aug-10	0.0	E	16-Aug-10	106.9	V	16-Aug-10	0.0	E	18-Aug-10	0.2	V	17-Aug-10	1.3	V	18-Aug-10	1.3	V	18-Aug-10	0.0	E
2011	15-Aug-11	0.0	E	15-Aug-11	61.5	V	15-Aug-11	0.0	E	16-Aug-11	*0.1*	E	16-Aug-11	0.1	V	16-Aug-11	0.6	V	16-Aug-11	0.0	E
2012	13-Aug-12	0.0	E	15-Aug-12	126.6	V	13-Aug-12	0.0	E	14-Aug-12	0.6	V	14-Aug-12	1.7	V	14-Aug-12	7.7	V	14-Aug-12	0.6	V
2013	19-Aug-13	0.0	E	20-Aug-13	63.0	V	19-Aug-13	0.0	E	21-Aug-13	0.1	V	21-Aug-13	1.0	V	21-Aug-13	3.4	V	20-Aug-13	*0.1*	V
No. of Readings:		11			11			11			11			11			11			11	
Maximum:		0.0			169.3			0.0			0.6			7.3			7.7			1.4	
Minimum:		0.0			24.9			0.0			0.0			0.1			0.4			0.0	
Average:		0.0			75.7			0.0			0.2			1.8			2.7			0.5	
YELLOW:		-			32.1			-			0.09			0.8			1.1		0.1		
RED:		**-**			**24.9**			**-**		**Dry**		(No Trigger)		**0.1**			**0.4**		**Dry**		**(no trigger)**
SEPTEMBER																					
2003	25-Sep-03	0.0	E	25-Sep-03	9.0	V	26-Sep-03	0.0	E	25-Sep-03	*0.1*	M/V	26-Sep-03	1.0	M	25-Sep-03	3.0	V	25-Sep-03	0.8	BE
2004	22-Sep-04	0.0	E	22-Sep-04	41.3	V	22-Sep-04	0.0	E	22-Sep-04	*0.1*	BE	22-Sep-04	0.2	M	22-Sep-04	*0.1*	E	22-Sep-04	*0.1*	E
2005	27-Sep-05	0.0	E	27-Sep-05	14.7	V	27-Sep-05	0.0	E	28-Sep-05	0.1	E	28-Sep-05	0.9	M	27-Sep-05	1.3	V	27-Sep-05	0.4	BE
2006	20-Sep-06	0.0	E	20-Sep-06	36.4	V	19-Sep-06	0.0	E	21-Sep-06	0.2	V	21-Sep-06	1.5	V	20-Sep-06	1.9	V	20-Sep-06	2.2	V
2007	17-Sep-07	0.0	E	18-Sep-07	14.2	V	17-Sep-07	0.0	E	17-Sep-07	0.1	E	17-Sep-07	0.5	V	17-Sep-07	1.3	V	17-Sep-07	0.4	V
2008	15-Sep-08	0.0	E	12-Sep-08	60.7	V	15-Sep-08	0.0	E	17-Sep-08	0.3	V	16-Sep-08	7.5	V	17-Sep-08	7.0	V	17-Sep-08	0.6	V
2009	15-Sep-09	0.0	E	15-Sep-09	44.4	V	14-Sep-09	0.0	E	15-Sep-09	*0.1*	E	16-Sep-09	0.8	V	15-Sep-09	0.5	V	15-Sep-09	*0.1*	V
2010	13-Sep-10	0.0	E	14-Sep-10	89.1	V	13-Sep-10	0.0	E	14-Sep-10	*0.1*	V	15-Sep-10	0.2	V	14-Sep-10	0.8	V	14-Sep-10	0.0	E
2011	19-Sep-11	0.0	E	20-Sep-11	42.5	V	19-Sep-11	0.0	E	20-Sep-11	*0.1*	E	20-Sep-11	*0.1*	V	20-Sep-11	0.5	V	20-Sep-11	0.0	E
2012	18-Sep-12	0.0	E	19-Sep-12	79.3	V	19-Sep-12	0.0	E	18-Sep-12	0.2	V	18-Sep-12	1.3	V	18-Sep-12	4.3	V	18-Sep-12	0.1	V
2013	18-Sep-13	0.0	E	18-Sep-13	84.1	V	17-Sep-13	0.0	E	19-Sep-13	*0.1*	V	18-Sep-13	0.5	V	18-Sep-13	0.9	V	18-Sep-13	0.0	E
No. of Readings:		11			11			11			11			11			11			11	
Maximum:		0.0			89.1			0.0			0.3			7.5			7.0			2.2	
Minimum:		0.0			9.0			0.0			0.1			0.1			0.1			0.0	
Average:		0.0			46.9			0.0			0.1			1.3			2.0			0.4	
YELLOW:		-			14.7			-			0.09			0.2			0.8		0.1		
RED:		**-**			**9.0**			**-**			**0.09**			**0.1**			**0.1**		**Dry**		**(no trigger)**

NOTES:

RED - Maintained equivalent to the lowest monthly flow recorded over period of record.

YELLOW - Calculated as 15% above the red value or the third lowest monthly flow over period of record, whichever is higher.

- Red and Yellow marked as "-" indicate that no Trigger Value has been assigned due to expected value of zero during this period.

V - Valeport Measurement
M - Manual Measurement (floating object)
E - Visual Estimate
BE - Bucket Estimate
B - Location Buried in Snow
F - Location Frozen

Low Flow - <0.1 L/s

TABLE 3.5
SURFACE WATER FLOWS PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING YEAR	SW16			SW17			SW17A			SW18			SW21C			SW24A			SW77		
	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type
JULY																					
2003	22-Jul-03	0.3	E	22-Jul-03	1.6	BE	22-Jul-03	9.5	BE	22-Jul-03	13.3	V	22-Jul-03	2.0	BE	22-Jul-03	0.8	BE	-	-	-
2004	29-Jul-04	1.9	M	29-Jul-04	0.5	BE	29-Jul-04	5.9	V	29-Jul-04	9.2	V	29-Jul-04	1.2	BE	29-Jul-04	0.9	BE	-	-	-
2005	11-Jul-05	0.5	V	11-Jul-05	1.4	BE	11-Jul-05	6.1	V	11-Jul-05	6.6	V	12-Jul-05	4.5	BE	11-Jul-05	0.4	BE	-	-	-
2006	11-Jul-06	0.1	E	11-Jul-06	1.7	V	11-Jul-06	5.6	V	11-Jul-06	8.3	V	11-Jul-06	3.3	V	11-Jul-06	0.5	V	-	-	-
2007	15-Jul-07	0.0	E	15-Jul-07	0.3	V	15-Jul-07	2.9	V	15-Jul-07	7.1	V	15-Jul-07	0.7	V	15-Jul-07	0.4	V	-	-	-
2008	15-Jul-08	0.4	V	15-Jul-08	0.2	V	15-Jul-08	2.4	V	15-Jul-08	11.7	V	15-Jul-08	2.2	V	15-Jul-08	0.3	V	-	-	-
2009	14-Jul-09	0.6	V	14-Jul-09	0.5	V	14-Jul-09	15.3	V	14-Jul-09	23.5	V	14-Jul-09	1.8	V	14-Jul-09	0.3	V	-	-	-
2010	19-Jul-10	7.3	V	19-Jul-10	2.7	V	19-Jul-10	7.3	V	19-Jul-10	58.4	V	19-Jul-10	2.2	V	19-Jul-10	1.1	V	19-Jul-10	0.6	V
2011	19-Jul-11	4.0	V	19-Jul-11	0.3	V	19-Jul-11	4.7	V	19-Jul-11	12.0	V	19-Jul-11	1.6	V	19-Jul-11	0.9	V	19-Jul-11	0.2	V
2012	17-Jul-12	0.5	V	17-Jul-12	0.2	V	17-Jul-12	1.7	V	17-Jul-12	3.8	V	17-Jul-12	1.1	V	17-Jul-12	0.8	V	17-Jul-12	0.1	V
2013	16-Jul-13	0.9	V	16-Jul-13	0.3	V	16-Jul-13	5.7	V	16-Jul-13	14.1	V	16-Jul-13	1.3	V	16-Jul-13	3.3	V	16-Jul-13	*0.1*	V
No. of Readings:		11			11			11			11			11			11			4	
Maximum:		7.3			2.7			15.3			58.4			4.5			3.3			0.6	
Minimum:		0.0			0.2			1.7			3.8			0.7			0.3			0.1	
Average:		1.5			0.9			6.1			15.3			2.0			0.9			0.3	
YELLOW:		0.3			0.3			2.9			7.1			1.2			0.4			0.12	
RED:		**Dry**	**(no trigger)**		**0.2**			**1.7**			**3.8**			**0.7**			**0.3**			**0.1**	
AUGUST																					
2003	20-Aug-03	0.0	E	20-Aug-03	1.0	BE	20-Aug-03	4.1	BE	20-Aug-03	4.0	V	20-Aug-03	0.8	BE	20-Aug-03	0.6	BE	-	-	-
2004	26-Aug-04	*0.1*	E	26-Aug-04	0.5	BE	26-Aug-04	2.9	BE	26-Aug-04	7.2	V	26-Aug-04	0.1	BE	26-Aug-04	0.2	BE	-	-	-
2005	22-Aug-05	0.0	V	22-Aug-05	0.2	BE	22-Aug-05	5.2	V	22-Aug-05	4.4	V	23-Aug-05	2.6	BE	22-Aug-05	0.1	BE	-	-	-
2006	23-Aug-06	0.0	E	23-Aug-06	1.0	V	23-Aug-06	3.3	V	23-Aug-06	3.5	V	23-Aug-06	2.9	V	23-Aug-06	0.3	V	-	-	-
2007	21-Aug-07	0.0	E	23-Aug-07	0.1	V	23-Aug-07	0.9	V	23-Aug-07	5.4	V	22-Aug-07	0.3	V	23-Aug-07	0.4	V	-	-	-
2008	18-Aug-08	0.6	V	18-Aug-08	1.1	V	18-Aug-08	5.9	V	18-Aug-08	14.6	V	19-Aug-08	4.5	V	18-Aug-08	1.4	V	-	-	-
2009	11-Aug-09	0.0	E	11-Aug-09	1.0	V	11-Aug-09	2.5	V	11-Aug-09	7.0	V	11-Aug-09	2.2	V	11-Aug-09	0.4	V	-	-	-
2010	17-Aug-10	0.7	V	17-Aug-10	2.6	V	17-Aug-10	6.4	V	17-Aug-10	10.3	V	17-Aug-10	2.1	V	17-Aug-10	1.7	V	17-Aug-10	0.2	V
2011	16-Aug-11	3.0	V	16-Aug-11	0.3	V	16-Aug-11	0.5	V	16-Aug-11	3.0	V	16-Aug-11	1.0	V	16-Aug-11	0.4	V	16-Aug-11	0.2	V
2012	14-Aug-12	3.5	V	14-Aug-12	2.8	V	14-Aug-12	3.1	V	14-Aug-12	23.2	V	14-Aug-12	1.5	V	14-Aug-12	5.1	V	14-Aug-12	0.1	V
2013	21-Aug-13	1.4	V	21-Aug-13	1.3	V	21-Aug-13	3.4	V	21-Aug-13	3.3	V	21-Aug-13	0.6	V	21-Aug-13	0.6	V	21-Aug-13	*0.1*	V
No. of Readings:		11			11			11			11			11			11			4	
Maximum:		3.5			2.8			6.4			23.2			4.5			5.1			0.2	
Minimum:		0.0			0.1			0.5			3.0			0.1			0.1			0.1	
Average:		0.8			1.1			3.5			7.8			1.7			1.0			0.2	
YELLOW:		0.1			0.3			2.5			3.5			0.6			0.3			0.12	
RED:		**Dry**	**(no trigger)**		**0.1**			**0.5**			**3.0**			**0.1**			**0.1**			**0.1**	
SEPTEMBER																					
2003	25-Sep-03	0.0	E	25-Sep-03	0.1	BE	25-Sep-03	1.9	V	25-Sep-03	1.6	V	26-Sep-03	1.2	BE	25-Sep-03	0.2	BE	-	-	-
2004	22-Sep-04	*0.1*	E	22-Sep-04	0.4	BE	22-Sep-04	3.5	V	22-Sep-04	3.8	V	22-Sep-04	0.7	BE	22-Sep-04	0.3	BE	-	-	-
2005	27-Sep-05	0.1	E	27-Sep-05	0.2	BE	27-Sep-05	3.1	V	27-Sep-05	6.3	V	28-Sep-05	1.2	BE	28-Sep-05	0.1	BE	-	-	-
2006	19-Sep-06	0.0	E	20-Sep-06	2.9	V	20-Sep-06	6.3	V	20-Sep-06	15.9	V	20-Sep-06	3.5	V	20-Sep-06	0.6	V	-	-	-
2007	17-Sep-07	0.0	E	17-Sep-07	0.3	V	17-Sep-07	1.2	V	17-Sep-07	4.3	V	17-Sep-07	0.7	V	17-Sep-07	0.3	V	-	-	-
2008	17-Sep-08	0.9	V	16-Sep-08	3.2	V	16-Sep-08	5.9	V	17-Sep-08	31.6	V	16-Sep-08	1.9	V	16-Sep-08	0.5	V	-	-	-
2009	15-Sep-09	0.0	E	15-Sep-09	1.8	V	15-Sep-09	1.1	V	15-Sep-09	4.6	V	15-Sep-09	1.6	V	15-Sep-09	0.4	V	-	-	-
2010	14-Sep-10	0.0	E	14-Sep-10	1.1	V	14-Sep-10	2.3	V	14-Sep-10	2.4	V	14-Sep-10	2.0	V	14-Sep-10	1.3	V	14-Sep-10	0.1	V
2011	20-Sep-11	3.7	V	20-Sep-11	1.5	V	20-Sep-11	1.2	V	20-Sep-11	3.1	V	20-Sep-11	0.8	V	20-Sep-11	0.4	V	20-Sep-11	0.1	V
2012	18-Sep-12	3.0	V	18-Sep-12	0.9	V	18-Sep-12	2.0	V	18-Sep-12	13.1	V	18-Sep-12	0.9	V	18-Sep-12	1.0	V	18-Sep-12	0.1	V
2013	18-Sep-13	1.3	V	18-Sep-13	0.9	V	18-Sep-13	2.6	V	18-Sep-13	10.7	V	18-Sep-13	3.0	V	18-Sep-13	1.4	V	18-Sep-13	*0.1*	V
No. of Readings:		11			11			11			11			11			11			4	
Maximum:		3.7			3.2			6.3			31.6			3.5			1.4			0.1	
Minimum:		0.0			0.1			1.1			1.6			0.7			0.1			0.1	
Average:		0.8			1.2			2.8			8.9			1.6			0.6			0.1	
YELLOW:		0.1			0.3			1.2			3.1			0.8			0.3			0.1	
RED:		**Dry**	**(no trigger)**		**0.1**			**1.1**			**1.6**			**0.7**			**0.1**			**0.09**	

NOTES:

RED - Maintained equivalent to the lowest monthly flow recorded over period of record.

YELLOW - Calculated as 15% above the red value or the third lowest monthly flow over period of record, whichever is higher.

- Red and Yellow marked as "-" indicate that no Trigger Value has been assigned due to expected value of zero during this period.

V - Valeport Measurement
M - Manual Measurement (floating object)
E - Visual Estimate
BE - Bucket Estimate
B - Location Buried in Snow
F - Location Frozen

Low Flow - <0.1 L/s

TABLE 3.5
SURFACE WATER FLOWS PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING YEAR	SW3			SW6A			SW9			SW10			SW11			SW14			SW15		
	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type
OCTOBER																					
2003	22-Oct-03	0.0	E	22-Oct-03	50.8	V	23-Oct-03	0.0	E	22-Oct-03	0.7	E	-	-	-	22-Oct-03	6.2	V	23-Oct-03	1.1	BE
2004	21-Oct-04	0.0	E	21-Oct-04	41.5	V	20-Oct-04	0.0	E	21-Oct-04	0.1	BE	21-Oct-04	1.1	M	20-Oct-04	0.8	V	20-Oct-04	0.8	BE
2005	24-Oct-05	0.0	E	24-Oct-05	46.0	V	25-Oct-05	0.0	E	25-Oct-05	0.5	E	25-Oct-05	0.8	V	24-Oct-05	1.7	V	24-Oct-05	1.9	BE
2006	28-Oct-06	0.0	E	18-Oct-06	124.8	V	17-Oct-06	0.0	E	19-Oct-06	0.1	V	19-Oct-06	2.2	V	19-Oct-06	5.0	V	19-Oct-06	1.8	V
2007	18-Oct-07	0.0	E	18-Oct-07	47.0	V	18-Oct-07	0.0	E	18-Oct-07	*0.1*	E	18-Oct-07	0.4	V	18-Oct-07	0.3	V	19-Oct-07	0.5	V
2008	20-Oct-08	0.0	E	22-Oct-08	119.3	V	20-Oct-08	0.0	E	21-Oct-08	0.4	V	22-Oct-08	0.8	V	22-Oct-08	10.2	V	22-Oct-08	0.5	V
2009	13-Oct-09	0.0	E	14-Oct-09	150.7	V	14-Oct-09	0.0	E	15-Oct-09	0.1	V	14-Oct-09	1.1	V	15-Oct-09	3.6	V	15-Oct-09	0.3	V
2010	20-Oct-10	0.0	E	21-Oct-10	99.5	V	21-Oct-10	8.0	V	20-Oct-10	0.2	V	21-Oct-10	6.0	V	21-Oct-10	5.6	V	21-Oct-10	0.7	V
2011	18-Oct-11	0.0	E	19-Oct-11	90.1	V	17-Oct-11	0.0	E	20-Oct-11	2.2	V	20-Oct-11	7.0	V	20-Oct-11	98.4	V	18-Oct-11	0.1	V
	20-Oct-11	1.3	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	16-Oct-12	0.0	E	18-Oct-12	85.1	V	17-Oct-12	0.0	E	18-Oct-12	0.3	V	17-Oct-12	1.1	V	17-Oct-12	11.1	V	17-Oct-12	0.3	V
2013	15-Oct-13	0.0	E	16-Oct-13	183.8	V	17-Oct-13	0.0	E	16-Oct-13	0.7	V	16-Oct-13	3.2	V	16-Oct-13	10.9	V	16-Oct-13	0.8	V
No. of Readings:		12			11			11			11			10			11			11	
Maximum:		1.3			183.8			8.0			2.2			7.0			98.4			1.9	
Minimum:		0.0			41.5			0.0			0.1			0.4			0.3			0.1	
Average:		0.1			94.4			0.7			0.5			2.4			14.0			0.8	
YELLOW:		-			47.8			-			0.1			0.8			1.7			0.3	
RED:		**-**			**41.5**			**-**			**0.09**			**0.4**			**0.3**			**0.1**	
NOVEMBER																					
2003	28-Nov-03	0.0	E	28-Nov-03	214.9	V	28-Nov-03	2.0	V	28-Nov-03	*0.1*	E	28-Nov-03	6.9	V	28-Nov-03	17.1	V	28-Nov-03	8.2	BE
2004	17-Nov-04	0.0	E	16-Nov-04	69.8	V	18-Nov-04	0.0	E	17-Nov-04	0.1	BE	18-Nov-04	5.9	M	16-Nov-04	1.3	V	17-Nov-04	1.0	BE
2005	14-Nov-05	0.0	E	14-Nov-05	32.8	V	16-Nov-05	0.0	E	16-Nov-05	0.1	BE	16-Nov-05	2.2	V	16-Nov-05	6.7	V	15-Nov-05	1.0	BE
2006	27-Nov-06	0.0	E	27-Nov-06	286.8	V	27-Nov-06	2.4	V	27-Nov-06	1.5	M	27-Nov-06	16.8	V	27-Nov-06	10.6	V	27-Nov-06	1.5	V
2007	21-Nov-07	0.0	E	21-Nov-07	123.9	V	19-Nov-07	0.0	E	21-Nov-07	0.2	V	19-Nov-07	1.4	V	21-Nov-07	6.9	V	21-Nov-07	1.1	V
2008	24-Nov-08	-	B	25-Nov-08	357.9	V	24-Nov-08	-	B	25-Nov-08	0.9	V	26-Nov-08	7.5	V	26-Nov-08	13.4	V	25-Nov-08	-	F
2009	16-Nov-09	0.0	E	18-Nov-09	123.9	V	16-Nov-09	0.0	E	18-Nov-09	0.4	V	18-Nov-09	2.4	V	17-Nov-09	0.9	V	17-Nov-09	0.2	V
2010	15-Nov-10	0.3	V	17-Nov-10	276.6	V	16-Nov-10	1.7	V	17-Nov-10	1.4	V	17-Nov-10	16.9	V	16-Nov-10	16.6	V	16-Nov-10	0.5	V
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	22-Nov-11	0.0	E	23-Nov-11	96.9	V	22-Nov-11	0.0	E	24-Nov-11	0.1	V	24-Nov-11	5.2	V	24-Nov-11	3.1	V	22-Nov-11	0.6	V
2012	20-Nov-12	4.7	V	20-Nov-12	245.1	V	19-Nov-12	0.0	E	20-Nov-12	0.3	V	20-Nov-12	10.1	V	20-Nov-12	19.6	V	20-Nov-12	0.8	V
2013	19-Nov-13	6.2	V	20-Nov-13	369.5	V	19-Nov-13	6.4	V	20-Nov-13	4.6	V	20-Nov-13	5.5	V	20-Nov-13	20.3	V	19-Nov-13	0.9	V
No. of Readings:		10			11			10			11			11			11			10	
Maximum:		6.2			369.5			6.4			4.6			16.9			20.3			8.2	
Minimum:		0.0			32.8			0.0			0.1			1.4			0.9			0.2	
Average:		1.1			199.8			1.2			0.9			7.4			10.6			1.6	
YELLOW:		-			96.9			-			0.1			2.4			3.1			0.6	
RED:		**-**			**32.8**			**-**			**0.09**			**1.4**			**0.9**			**0.2**	
DECEMBER																					
2003	19-Dec-03	0.2	M	19-Dec-03	266.5	V	19-Dec-03	4.5	V	19-Dec-03	2.0	E	19-Dec-03	13.1	V	19-Dec-03	12.8	M	19-Dec-03	12.9	M
2004	16-Dec-04	-	F	16-Dec-04	-	F	16-Dec-04	-	B	16-Dec-04	-	B	16-Dec-04	-	B	16-Dec-04	2.5	V	16-Dec-04	1.5	BE
2005	12-Dec-05	0.0	E	19-Dec-05	166.9	BE	13-Dec-05	0.0	E	13-Dec-05	0.1	E	13-Dec-05	3.5	E	12-Dec-05	5.1	V	12-Dec-05	3.4	B
2006	19-Dec-06	1.3	V	19-Dec-06	382.9	V	21-Dec-06	3.9	V	21-Dec-06	0.5	V	20-Dec-06	19.8	V	20-Dec-06	17.8	V	20-Dec-06	1.3	V
2007	10-Dec-07	-	B	12-Dec-07	-	F	10-Dec-07	-	B	10-Dec-07	-	B	11-Dec-07	2.8	V	11-Dec-07	-	B	10-Dec-07	0.7	V
2008	16-Dec-08	-	F	17-Dec-08	474.6	V	17-Dec-08	-	B	17-Dec-08	0.6	V	18-Dec-08	17.4	V	17-Dec-08	54.0	V	17-Dec-08	-	F
2009	12-Dec-09	-	B	16-Dec-09	151.0	V	15-Dec-09	-	B	17-Dec-09	*0.1*	V	16-Dec-09	0.9	V	15-Dec-09	6.2	V	15-Dec-09	0.6	V
2010	20-Dec-10	-	-	22-Dec-10	241.2	V	20-Dec-10	-	-	21-Dec-10	-	-	21-Dec-10	5.3	V	21-Dec-10	-	-	21-Dec-10	-	-
2011	19-Dec-11	3.7	V	22-Dec-11	284.5	V	19-Dec-11	-	E	22-Dec-11	0.6	V	22-Dec-11	3.8	V	22-Dec-11	23.3	V	20-Dec-11	0.8	V
2012	17-Dec-12	5.2	V	20-Dec-12	257.4	V	18-Dec-12	10.1	V	20-Dec-12	0.1	V	20-Dec-12	6.1	V	18-Dec-12	23.5	V	18-Dec-12	1.2	V
No. of Readings:		5			8			4			7			9			8			8	
Maximum:		5.2			474.6			10.1			2.0			19.8			54.0			12.9	
Minimum:		0.0			151.0			0.0			0.1			0.9			2.5			0.6	
Average:		2.1			278.1			4.6			0.6			8.1			18.1			2.8	
YELLOW:		-			241.2			-			0.1			3.5			6.2			0.8	
RED:		**-**			**151.0**			**-**			**0.09**			**0.9**			**2.5**			**0.6**	

NOTES:

RED - Maintained equivalent to the lowest monthly flow recorded over period of record.

YELLOW - Calculated as 15% above the red value or the third lowest monthly flow over period of record, whichever is higher.

- Red and Yellow marked as "-" indicate that no Trigger Value has been assigned due to expected value of zero during this period.

V - Valeport Measurement

M - Manual Measurement (floating object)

E - Visual Estimate

BE - Bucket Estimate

B - Location Buried in Snow

F - Location Frozen

Low Flow - <0.1 L/s

TABLE 3.5
SURFACE WATER FLOWS PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING YEAR	SW16			SW17			SW17A			SW18			SW21C			SW24A			SW77		
	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type	Measurement Date	SW Flow (L/s)	Measurement Type
OCTOBER																					
2003	22-Oct-03	2.5	E	22-Oct-03	2.6	BE	22-Oct-03	3.3	BE	22-Oct-03	25.8	V	23-Oct-03	2.0	BE	23-Oct-03	0.4	BE	-	-	-
2004	20-Oct-04	0.3	E	20-Oct-04	0.4	BE	20-Oct-04	3.2	V	20-Oct-04	4.0	V	20-Oct-04	0.7	BE	20-Oct-04	0.5	BE	-	-	-
2005	24-Oct-05	*0.1*	E	24-Oct-05	0.2	BE	24-Oct-05	3.6	V	24-Oct-05	5.9	V	25-Oct-03	1.2	BE	24-Oct-05	0.1	BE	-	-	-
2006	19-Oct-06	0.6	V	19-Oct-06	1.4	V	19-Oct-06	6.5	V	19-Oct-06	12.9	V	19-Oct-06	1.9	V	19-Oct-06	0.3	V	-	-	-
2007	18-Oct-07	0.0	E	18-Oct-07	0.4	V	18-Oct-07	2.3	V	19-Oct-07	3.3	V	18-Oct-07	2.7	V	18-Oct-07	0.2	V	-	-	-
2008	22-Oct-08	0.7	V	21-Oct-08	2.7	V	21-Oct-08	4.1	V	20-Oct-08	13.6	V	21-Oct-08	1.5	V	21-Oct-08	0.8	V	-	-	-
2009	13-Oct-09	1.0	V	13-Oct-09	1.7	V	13-Oct-09	2.6	V	13-Oct-09	13.0	V	14-Oct-09	1.4	V	14-Oct-09	0.4	V	13-Oct-09	0.1	V
2010	21-Oct-10	0.2	V	20-Oct-10	1.9	V	20-Oct-10	5.4	V	21-Oct-10	26.6	V	20-Oct-10	1.5	V	20-Oct-10	1.6	V	20-Oct-10	*0.1*	V
2011	18-Oct-11	1.8	V	18-Oct-11	2.4	V	18-Oct-11	1.5	V	18-Oct-11	9.3	V	18-Oct-11	0.8	V	18-Oct-11	1.1	V	18-Oct-11	0.1	V
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	17-Oct-12	2.8	V	17-Oct-12	0.9	V	17-Oct-12	4.5	V	17-Oct-12	14.6	V	17-Oct-12	1.4	V	17-Oct-12	0.7	V	17-Oct-12	0.2	V
2013	16-Oct-13	3.4	V	16-Oct-13	0.7	V	16-Oct-13	4.3	V	16-Oct-13	32.2	V	16-Oct-13	1.7	V	16-Oct-13	4.7	V	16-Oct-13	0.1	V
No. of Readings:		11			11			11			11			11			11			5	
Maximum:		3.4			2.7			6.5			32.2			2.7			4.7			0.2	
Minimum:		0.0			0.2			1.5			3.3			0.7			0.1			0.1	
Average:		1.2			1.4			3.8			14.7			1.5			1.0			0.1	
YELLOW:	0.2			0.4			2.6			5.9			1.2			0.3			0.1		
RED:	**Dry**		**(no trigger)**	**0.2**			**1.5**			**3.3**			**0.7**			**0.1**			**0.09**		
NOVEMBER																					
2003	28-Nov-03	0.0	E	28-Nov-03	6.9	BE	28-Nov-03	10.6	V	28-Nov-03	36.7	V	28-Nov-03	2.8	BE	28-Nov-03	1.4	BE	-	-	-
2004	17-Nov-04	2.3	E	17-Nov-04	0.5	BE	16-Nov-04	4.3	V	16-Nov-04	4.6	V	18-Nov-04	1.4	BE	17-Nov-04	0.5	BE	-	-	-
2005	14-Nov-05	*0.1*	E	14-Nov-05	0.3	BE	14-Nov-05	2.9	V	15-Nov-05	7.9	V	15-Nov-05	1.3	BE	15-Nov-05	0.1	BE	-	-	-
2006	27-Nov-06	7.1	V	27-Nov-06	4.4	V	27-Nov-06	14.1	V	27-Nov-06	33.5	V	23-Nov-06	4.6	V	27-Nov-06	1.3	V	-	-	-
2007	19-Nov-07	0.1	V	19-Nov-07	0.6	V	19-Nov-07	2.2	V	21-Nov-07	33.5	V	21-Nov-07	1.6	V	19-Nov-07	2.1	V	-	-	-
2008	26-Nov-08	-	F	25-Nov-08	5.1	V	25-Nov-08	24.5	V	24-Nov-08	44.3	V	25-Nov-08	4.6	V	25-Nov-08	0.6	V	-	-	-
2009	16-Nov-09	4.2	V	17-Nov-09	3.5	V	17-Nov-09	5.2	V	17-Nov-09	8.8	V	17-Nov-09	2.0	V	17-Nov-09	0.3	V	17-Nov-09	0.1	V
2010	16-Nov-10	1.0	V	16-Nov-10	4.1	V	16-Nov-10	6.2	V	16-Nov-10	25.2	V	16-Nov-10	2.3	V	16-Nov-10	3.7	V	16-Nov-10	0.2	V
	-	-	-	17-Nov-10	16.3	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	22-Nov-11	2.8	V	22-Nov-11	1.2	V	22-Nov-11	4.1	V	22-Nov-11	8.6	V	22-Nov-11	0.5	V	22-Nov-11	0.1	V	22-Nov-11	0.1	V
2012	20-Nov-12	5.1	V	20-Nov-12	2.3	V	20-Nov-12	14.5	V	20-Nov-12	46.3	V	20-Nov-12	2.6	V	20-Nov-12	3.9	V	20-Nov-12	0.3	V
2013	19-Nov-13	7.9	V	19-Nov-13	7.1	V	19-Nov-13	12.8	V	19-Nov-13	50.5	V	19-Nov-13	5.3	V	19-Nov-13	0.9	V	19-Nov-13	0.8	V
No. of Readings:		10			12			11			11			11			11			5	
Maximum:		7.9			16.3			24.5			50.5			5.3			3.9			0.8	
Minimum:		0.0			0.3			2.2			4.6			0.5			0.1			0.1	
Average:		3.1			4.3			9.2			27.3			2.6			1.4			0.3	
YELLOW:	0.1			0.6			4.1			8.6			1.4			0.3			0.2		
RED:	**Dry**		**(no trigger)**	**0.3**			**2.2**			**4.6**			**0.5**			**0.1**			**0.1**		
DECEMBER																					
2003	19-Dec-03	0.0	E	19-Dec-03	5.0	BE	19-Dec-03	18.5	V	19-Dec-03	33.7	V	19-Dec-03	2.0	BE	19-Dec-03	5.8	BE	-	-	-
2004	16-Dec-04	-	F	16-Dec-04	1.9	BE	16-Dec-04	5.4	V	16-Dec-04	-	F	16-Dec-04	-	F	16-Dec-04	0.2	BE	-	-	-
2005	12-Dec-05	0.6	V	12-Dec-05	1.4	BE	12-Dec-05	11.7	V	12-Dec-05	-	F	13-Dec-05	1.5	BE	12-Dec-05	2.1	V	-	-	-
2006	19-Dec-06	12.3	V	19-Dec-06	6.7	V	19-Dec-06	19.9	V	20-Dec-06	62.5	V	20-Dec-06	4.2	V	20-Dec-06	1.3	V	-	-	-
2007	10-Dec-07	-	B	10-Dec-07	-	B	10-Dec-07	2.6	V	12-Dec-07	11.3	V	9-Dec-07	2.0	V	10-Dec-07	0.5	V	-	-	-
2008	18-Dec-08	7.0	V	18-Dec-08	2.4	V	18-Dec-08	14.4	V	17-Dec-08	114.8	V	18-Dec-08	8.8	V	18-Dec-08	1.8	V	-	-	-
2009	16-Dec-09	-	F	16-Dec-09	1.1	V	16-Dec-09	1.8	V	15-Dec-09	18.1	V	16-Dec-09	0.4	V	16-Dec-09	0.1	V	16-Dec-09	-	B
2010	21-Dec-10	2.4	V	21-Dec-10	1.1	V	21-Dec-10	5.5	V	20-Dec-10	9.3	V	21-Dec-10	6.2	V	21-Dec-10	0.7	V	21-Dec-10	-	B
2011	20-Dec-11	7.8	V	20-Dec-11	3.1	V	20-Dec-11	4.5	V	20-Dec-11	37.4	V	20-Dec-11	2.8	V	20-Dec-11	3.6	V	20-Dec-11	0.2	V
2012	18-Dec-12	4.5	V	18-Dec-12	1.9	V	18-Dec-12	11.0	V	18-Dec-12	57.6	V	18-Dec-12	1.7	V	18-Dec-12	4.7	V	18-Dec-12	0.8	V
No. of Readings:		7			9			10			8			9			10			2	
Maximum:		12.3			6.7			19.9			114.8			8.8			5.8			0.8	
Minimum:		0.0			1.1			1.8			9.3			0.4			0.1			0.2	
Average:		4.9			2.7			9.5			43.1			3.3			2.1			0.5	
YELLOW:	2.4			1.4			4.5			18.1			1.7			0.5			0.23		
RED:	**Dry**		**(no trigger)**	**1.1**			**1.8**			**9.3**			**0.4**			**0.1**			**0.2**		

NOTES:
RED
YELLOW

NOTES:
RED - Maintained equivalent to the lowest monthly flow recorded over period of record.
YELLOW - Calculated as 15% above the red value or the third lowest monthly flow over period of record, whichever is higher.
- Red and Yellow marked as "-" indicate that no Trigger Value has been assigned due to expected value of zero during this period.

V - Valeport Measurement
M - Manual Measurement (floating object)
E - Visual Estimate
BE - Bucket Estimate
B - Location Buried in Snow
F - Location Frozen
Low Flow - <0.1 L/s

Table 3.6: Surface Water Temperature Performance Trigger Value Summary

TABLE 3.6
SURFACE WATER TEMPERATURE PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING LOCATION	JUNE			JULY			AUGUST			SEPTEMBER		
	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes
SW1	23-Jun-03	16.8		1-Jul-04	15.1		19-Aug-04	15.8		9-Sep-04	14.7	
	4-Jun-04	12.3		16-Jul-04	15.7		26-Aug-04	17.8		17-Sep-04	14.7	
	11-Jun-04	14.6		22-Jul-04	20.4		4-Aug-06	19.7		1-Sep-06	19.0	
	17-Jun-04	14.6		29-Jul-04	15.8		25-Aug-06	16.2		8-Sep-06	18.2	
	3-Jun-05	18.0		7-Jul-05	20.4		17-Aug-07	14.4		15-Sep-06	15.3	
	17-Jun-05	15.2		15-Jul-05	23.6		24-Aug-07	17.4	Ponded	21-Sep-06	12.3	
	24-Jun-05	22.7		21-Jul-05	24.1		30-Aug-07	15.4		28-Sep-06	11.6	
	30-Jun-05	23.4		6-Jul-07	15.5		1-Aug-08	17.2		7-Sep-07	16.3	
	2-Jun-06	12.5		20-Jul-07	15.0	Low Flow	15-Aug-08	16.3		14-Sep-07	13.4	
	9-Jun-06	12.3		27-Jul-07	14.6		28-Aug-08	16.4		21-Sep-07	15.4	
	16-Jun-06	14.6		18-Jul-08	16.5		7-Aug-09	14.4	Ponded	28-Sep-07	13.6	
	23-Jun-06	15.2	Ponded	25-Jul-08	16.2		14-Aug-09	15.7	Ponded	5-Sep-08	17.2	Ponded
	1-Jun-07	14.6		2-Jul-09	13.9	Low Flow	21-Aug-09	16.6	Ponded	12-Sep-08	15.3	
	8-Jun-07	15.4		10-Jul-09	14.0		28-Aug-09	14.5		26-Sep-08	14.0	
	14-Jun-07	14.0		17-Jul-09	13.2		10-Aug-12	16.2		24-Sep-10	16.2	
	29-Jun-07	15.9		24-Jul-09	14.8	Low Flow	17-Aug-12	16.3		16-Sep-11	12.0	
	6-Jun-08	17.0		31-Jul-09	14.7	Low Flow	31-Aug-12	18.0		14-Sep-12	14.8	
	13-Jun-08	13.9		1-Jul-10	13.4		2-Aug-13	16.3		28-Sep-12	10.6	
	27-Jun-08	14.4		9-Jul-10	18.4		8-Aug-13	16.4		6-Sep-13	13.4	
	5-Jun-09	11.6		15-Jul-10	19.3		16-Aug-13	13.8		13-Sep-13	12.5	
	12-Jun-09	12.5		23-Jul-10	17.8		30-Aug-13	14.3		20-Sep-13	15.1	
	19-Jun-09	12.7		30-Jul-10	16.7					27-Sep-13	11.8	
	26-Jun-09	16.0		7-Jul-12	17.9							
	4-Jun-10	13.7		5-Jul-13	14.9							
	11-Jun-10	13.4		12-Jul-13	16.4							
	18-Jun-10	14.4		19-Jul-13	19.7							
	25-Jun-10	14.4		25-Jul-13	14.4							
	3-Jun-11	13.9										
	10-Jun-11	14.5										
	17-Jun-11	13.8										
	24-Jun-11	15.1										
	30-Jun-11	14.9										
	1-Jun-12	11.0										
	8-Jun-12	14.0										
	15-Jun-12	14.7										
	22-Jun-12	16.2										
	28-Jun-12	16.6										
	7-Jun-13	10.2										
	14-Jun-13	15.1										
	21-Jun-13	13.1										
	27-Jun-13	15.8										
No. of Readings:		41			27			21			22	
Maximum:		23.4			24.1			19.7			19.0	
Minimum:		10.2			13.2			13.8			10.6	
Average:		14.8			16.7			16.1			14.4	
YELLOW:		**21.0**			**21.7**			**17.7**			**17.1**	
RED:		**23.4**			**24.1**			**19.7**			**19.0**	

NOTES:

RED - Maintained equivalent to the highest temperature measured over period of record.

YELLOW - Calculated as 10% below the maximum temperature measured over period of record.

TABLE 3.6
SURFACE WATER TEMPERATURE PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING LOCATION	JUNE			JULY			AUGUST			SEPTEMBER		
	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes
SW2	9-Jun-03	-		4-Jul-03	-		8-Aug-03	-		5-Sep-03	-	
	13-Jun-03	-		11-Jul-03	-		15-Aug-03	-		11-Sep-03	-	
	23-Jun-03	-		18-Jul-03	-		20-Aug-03	-		18-Sep-03	-	
	4-Jun-04	9.0		22-Jul-03	-		27-Aug-03	-		25-Sep-03	-	
	11-Jun-04	9.3		24-Jul-03	-		6-Aug-04	13.6		3-Sep-04	13.7	
	17-Jun-04	8.2		31-Jul-03	-		12-Aug-04	10.2		9-Sep-04	11.7	
	24-Jun-04	9.9		1-Jul-04	9.8		19-Aug-04	10.8		17-Sep-04	10.9	
	3-Jun-05	9.7		9-Jul-04	-		26-Aug-04	13.7		23-Sep-04	13.2	
	10-Jun-05	10.3		16-Jul-04	10.0		2-Aug-05	12.4		1-Sep-05	12.0	
	17-Jun-05	8.6		22-Jul-04	14.6		12-Aug-05	12.5		9-Sep-05	11.8	
	17-Jun-05	8.6		29-Jul-04	10.3		19-Aug-05	12.2		16-Sep-05	13.1	
	24-Jun-05	13.1		7-Jul-05	10.7		23-Aug-05	12.4		23-Sep-05	12.4	
	30-Jun-05	11.2		15-Jul-05	12.8		24-Aug-05	11.1		30-Sep-05	-	
	2-Jun-06	7.9		21-Jul-05	14.8		4-Aug-06	17.3		1-Sep-06	14.2	
	9-Jun-06	9.3		28-Jul-05	11.1		11-Aug-06	11.7		8-Sep-06	14.1	
	16-Jun-06	9.6		7-Jul-06	13.9		18-Aug-06	13.9		15-Sep-06	12.3	
	23-Jun-06	9.8		14-Jul-06	12.0		25-Aug-06	12.8		21-Sep-06	11.2	
	30-Jun-06	11.2		21-Jul-06	15.9		3-Aug-07	13.1		28-Sep-06	10.5	
	1-Jun-07	9.5		28-Jul-06	17.4		10-Aug-07	11.7		7-Sep-07	12.9	
	8-Jun-07	9.7		6-Jul-07	11.5		17-Aug-07	11.2		14-Sep-07	11.9	
	14-Jun-07	8.6		13-Jul-07	10.9		24-Aug-07	13.4		21-Sep-07	12.1	
	22-Jun-07	8.2		20-Jul-07	11.0		30-Aug-07	12.7		28-Sep-07	12.3	
	29-Jun-07	13.5		27-Jul-07	11.1		1-Aug-08	10.2		5-Sep-08	11.6	
	6-Jun-08	11.9		4-Jul-08	9.2		8-Aug-08	10.8		12-Sep-08	11.0	
	13-Jun-08	9.0		11-Jul-08	9.9		15-Aug-08	9.6		19-Sep-08	9.8	
	20-Jun-08	8.7		18-Jul-08	10.7		22-Aug-08	12.9		26-Sep-08	10.0	
	27-Jun-08	9.3		25-Jul-08	9.4		28-Aug-08	10.5		4-Sep-09	10.5	
	5-Jun-09	7.5		2-Jul-09	8.8		7-Aug-09	10.1		11-Sep-09	11.4	
	12-Jun-09	8.5		10-Jul-09	9.1		14-Aug-09	10.4		18-Sep-09	11.2	
	19-Jun-09	8.9		17-Jul-09	9.1		21-Aug-09	12.1		25-Sep-09	11.3	
	26-Jun-09	13.0		24-Jul-09	10.7		28-Aug-09	10.7		3-Sep-10	12.4	
	4-Jun-10	7.9		31-Jul-09	10.1		6-Aug-10	10.3		10-Sep-10	11.3	
	11-Jun-10	8.1		1-Jul-10	8.6		13-Aug-10	10.5		17-Sep-10	10.3	
	18-Jun-10	8.3		9-Jul-10	9.8		20-Aug-10	10.4		24-Sep-10	12.4	
	25-Jun-10	8.7		15-Jul-10	10.9		27-Aug-10	10.9		2-Sep-11	3.3	
	3-Jun-11	7.9		23-Jul-10	10.2		5-Aug-11	12.0		9-Sep-11	11.7	
	10-Jun-11	7.7		30-Jul-10	9.9		12-Aug-11	10.9		16-Sep-11	10.5	
	17-Jun-11	8.7		8-Jul-11	10.1		19-Aug-11	11.4		23-Sep-11	11.7	
	24-Jun-11	8.7		14-Jul-11	9.3		26-Aug-11	12.2		30-Sep-11	11.6	
	30-Jun-11	9.0		22-Jul-11	11.3		3-Aug-12	12.0		7-Sep-12	11.7	
	1-Jun-12	7.9		29-Jul-11	11.4		10-Aug-12	13.1		14-Sep-12	11.7	
	8-Jun-12	9.1		7-Jul-12	11.1		17-Aug-12	11.0		21-Sep-12	10.9	
	15-Jun-12	9.6		13-Jul-12	10.7		24-Aug-12	11.4		28-Sep-12	9.8	
	22-Jun-12	7.0		20-Jul-12	11.3		31-Aug-12	12.2		6-Sep-13	9.2	
	28-Jun-12	10.6		27-Jul-12	11.4		2-Aug-13	9.3		13-Sep-13	7.6	
	7-Jun-13	7.5		5-Jul-13	9.5		8-Aug-13	9.2		20-Sep-13	9.3	
	14-Jun-13	10.3		12-Jul-13	9.6		16-Aug-13	9.3		27-Sep-13	9.4	
	21-Jun-13	8.6		19-Jul-13	9.5		23-Aug-13	9.2				
	27-Jun-13	8.6		25-Jul-13	9.4		30-Aug-13	9.3				
No. of Readings:		46			42			45			42	
Maximum:		13.5			17.4			17.3			14.2	
Minimum:		7.0			8.6			9.2			3.3	
Average:		9.3			10.9			11.5			11.2	
YELLOW:		**12.2**			**15.7**			**15.6**			**12.8**	
RED:		**13.5**			**17.4**			**17.3**			**14.2**	

NOTES:

RED - Maintained equivalent to the highest temperature measured over period of record.

YELLOW - Calculated as 10% below the maximum temperature measured over period of record.

TABLE 3.6
SURFACE WATER TEMPERATURE PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING LOCATION	JUNE			JULY			AUGUST			SEPTEMBER		
	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes
SWO-2	3-Jun-05	19.8		16-Jul-04	25.4		6-Aug-04	21.6		3-Sep-04	23.1	
	10-Jun-05	23.8		22-Jul-04	29.2		12-Aug-04	15.5		9-Sep-04	15.8	
	17-Jun-05	15.7		29-Jul-04	24.2		20-Aug-04	20.0		17-Sep-04	11.9	
	24-Jun-05	25.4		7-Jul-05	23.0		26-Aug-04	21.5		1-Sep-05	-	Dry
	30-Jun-05	23.7		15-Jul-05	-	Ponded	2-Aug-05	-	Dry	9-Sep-05	-	Dry
	2-Jun-06	15.8		21-Jul-05	-	Ponded	12-Aug-05	-	Dry	16-Sep-05	-	Dry
	9-Jun-06	15.3		28-Jul-05	-	Dry	23-Aug-05	-	Dry	23-Sep-05	-	Dry
	16-Jun-06	10.4		7-Jul-06	21.8		24-Aug-05	-	Dry	30-Sep-05	-	Dry
	23-Jun-06	12.3		14-Jul-06	21.1		4-Aug-06	24.9		1-Sep-06	19.4	
	30-Jun-06	22.2		21-Jul-06	12.7		11-Aug-06	16.7		8-Sep-06	19.1	
	1-Jun-07	20.5		28-Jul-06	22.7		18-Aug-06	21.8		15-Sep-06	14.4	
	8-Jun-07	20.3		6-Jul-07	21.2		25-Aug-06	16.5		21-Sep-06	10.1	
	14-Jun-07	19.6		13-Jul-07	18.0		3-Aug-07	-	Dry	28-Sep-06	8.9	
	22-Jun-07	-	Ponded	20-Jul-07	17.1		10-Aug-07	-	Dry	7-Sep-07	19.4	
	29-Jun-07	20.5		27-Jul-07	-	Dry	17-Aug-07	-	Dry	14-Sep-07	13.4	
	6-Jun-08	24.2		4-Jul-08	16.3		24-Aug-07	18.9		21-Sep-07	15.4	
	13-Jun-08	18.5		11-Jul-08	17.3		30-Aug-07	18.0		28-Sep-07	13.3	
	20-Jun-08	14.3		18-Jul-08	21.1		1-Aug-08	18.3		5-Sep-08	17.5	
	27-Jun-08	20.5		25-Jul-08	18.4		8-Aug-08	17.1		12-Sep-08	13.8	
	5-Jun-09	13.7		2-Jul-09	16.4		15-Aug-08	15.8		19-Sep-08	10.9	
	12-Jun-09	15.8		10-Jul-09	17.8		22-Aug-08	20.2		26-Sep-08	12.8	
	19-Jun-09	16.6		17-Jul-09	14.8		28-Aug-08	16.0		4-Sep-09	13.1	
	26-Jun-09	25.1		24-Jul-09	17.5		7-Aug-09	14.9		11-Sep-09	13.6	
	4-Jun-10	17.0		31-Jul-09	17.2		14-Aug-09	15.8		18-Sep-09	12.5	
	11-Jun-10	15.8		9-Jul-10	20.0		21-Aug-09	18.8		25-Sep-09	12.3	
	18-Jun-10	18.2		15-Jul-10	23.4		28-Aug-09	14.1		1-Sep-10	20.2	
	25-Jun-10	18.6		23-Jul-10	10.4		6-Aug-10	18.6		3-Sep-10	19.8	
	3-Jun-11	15.5		30-Jul-10	18.8		13-Aug-10	21.2		7-Sep-10	15.9	
	10-Jun-11	16.5		8-Jul-11	20.1		20-Aug-10	16.1		10-Sep-10	13.1	
	17-Jun-11	16.7		14-Jul-11	17.6		27-Aug-10	14.8		17-Sep-10	11.2	
	24-Jun-11	16.8		22-Jul-11	22.2		30-Aug-10	17.8		24-Sep-10	16.2	
	30-Jun-11	15.7		29-Jul-11	20.6		12-Aug-11	17.8		2-Sep-11	20.9	
	1-Jun-12	10.6		7-Jul-12	22.4		19-Aug-11	18.0		9-Sep-11	15.9	
	8-Jun-12	16.8		13-Jul-12	18.8		26-Aug-11	19.1		16-Sep-11	9.7	
	15-Jun-12	18.2		20-Jul-12	19.2		3-Aug-12	18.6		23-Sep-11	12.9	
	22-Jun-12	20.0		27-Jul-12	18.9		10-Aug-12	16.2		30-Sep-11	13.7	
	28-Jun-12	18.7		5-Jul-13	19.2		17-Aug-12	17.3		7-Sep-12	16.3	
	7-Jun-13	11.6		12-Jul-13	14.7		24-Aug-12	16.7		14-Sep-12	15.2	
	14-Jun-13	19.5		19-Jul-13	19.6		31-Aug-12	18.5		21-Sep-12	10.8	
	21-Jun-13	14.9		25-Jul-13	14.6		2-Aug-13	18.2		28-Sep-12	7.8	
	27-Jun-13	15.2					8-Aug-13	19.0		6-Sep-13	18.7	
							16-Aug-13	19.2		13-Sep-13	12.9	
							23-Aug-13	19.2		20-Sep-13	17.4	
							30-Aug-13	19.2		27-Sep-13	12.6	
No. of Readings:		40			36			37			39	
Maximum:		25.4			29.2			24.9			23.1	
Minimum:		10.4			10.4			14.1			7.8	
Average:		17.7			19.3			18.2			14.7	
YELLOW:		22.9			26.3			22.4			20.8	
RED:		**25.4**			**29.2**			**24.9**			**23.1**	

NOTES:
RED - Maintained equivalent to the highest temperature measured over period of record.
YELLOW - Calculated as 10% below the maximum temperature measured over period of record.

TABLE 3.6
SURFACE WATER TEMPERATURE PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING YEAR	SW3			SW6A			SW9			SW10			SW11			SW14			SW15		
	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes
JUNE																					
2003	-	-	-	23-Jun-03	19.6	-	-	-	-	-	-		-	-	-	-	-		-	-	-
2004	-	-	-	24-Jun-04	14.8	-	24-Jun-04	16.4	-	24-Jun-04	13.0		24-Jun-04	8.7		24-Jun-04	15.8		24-Jun-04	18.9	-
2005	-	-	-	27-Jun-05	21.5	-	-	-	-	27-Jun-05	15.9		27-Jun-05	10.3		27-Jun-05	21.8		27-Jun-05	23.0	-
2006	-	-	-	21-Jun-06	18.9	-	-	-	-	23-Jun-06	14.0		21-Jun-06	9.9		23-Jun-06	17.6		20-Jun-06	20.1	-
2007	-	-	-	19-Jun-07	20.3	-	-	-	-	-	-		19-Jun-07	9.5		18-Jun-07	19.1		18-Jun-07	21.9	-
2008	-	-	-	17-Jun-08	16.8	-	-	-	-	18-Jun-08	12.9		17-Jun-08	8.7		18-Jun-08	15.0		18-Jun-08	16.5	-
2009	-	-	-	16-Jun-09	14.4	-	-	-	-	16-Jun-09	12.6		16-Jun-09	9.4		16-Jun-09	15.8		16-Jun-09	15.7	-
2010	14-Jun-10	18.5	-	14-Jun-10	19.6	-	15-Jun-10	15.0	-	15-Jun-10	12.7	-	15-Jun-10	8.3	-	16-Jan-10	14.0		16-Jun-10	17.4	-
2011	13-Jun-11	13.4	-	13-Jun-11	13.6	-	14-Jun-11	16.1		15-Jun-11	12.0	-	15-Jun-11	8.6		14-Jun-11	16.7		14-Jun-11	19.6	-
2012	-	-	-	19-Jun-12	25.2	-	-	-	-	20-Jun-12	18.3	-	19-Jun-12	12.1		19-Jun-12	21.0		-	-	-
2013	-	-	-	18-Jun-13	19.5		18-Jun-13	16.0	-	19-Jun-13	11.4	-	19-Jun-13	8.3		19-Jun-13	15.2		19-Jun-13	15.8	-
No. of Readings:		2			11			4			9			10			10			9	
Maximum:		18.5			25.2			16.4			18.3			12.1			21.8			23.0	
Minimum:		13.4			13.6			15.0			11.4			8.3			14.0			15.7	
Average:		15.9			18.6			15.9			13.6			9.4			17.2			18.8	
YELLOW:		16.7			22.7			14.8			16.4			10.9			19.6			20.7	
RED:		**18.5**			**25.2**			**16.4**			**18.3**			**12.1**			**21.8**			**23.0**	
JULY																					
2003	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-		-	-	-
2004	-	-	-	29-Jul-04	17.7	-	-	-	-	29-Jul-04	16.0		29-Jul-04	12.7	-	29-Jul-04	18.0		29-Jul-04	20.5	-
2005	-	-	-	11-Jul-05	19.6	-	-	-	-	12-Jul-05	17.8		12-Jul-05	11.5	-	11-Jul-05	21.6		11-Jul-05	23.8	-
2006	-	-	-	11-Jul-06	19.0	-	-	-	-	12-Jul-06	15.6		12-Jul-06	11.9	-	11-Jul-06	18.1		11-Jul-06	21.5	-
2007	-	-	-	15-Jul-07	18.5	-	-	-	-	-	-		15-Jul-07	12.7	-	15-Jul-07	19.3		15-Jul-07	21.8	-
2008	-	-	-	15-Jul-08	18.6	-	-	-	-	-	-		15-Jul-08	12.6	-	15-Jul-08	18.5		-	-	-
2009	-	-	-	14-Jul-09	17.6	-	-	-	-	14-Jul-09	14.1		15-Jul-09	9.7	-	14-Jul-09	17.5		14-Jul-09	15.9	-
2010	19-Jul-10	19.8	-	20-Jul-10	18.4	-	20-Jul-10	19.2	-	20-Jul-10	17.9	-	20-Jul-10	9.3	-	19-Jul-10	18.6		19-Jul-10	21.4	-
2011	-	-	-	18-Jul-11	22.1	-	-	-	-	20-Jul-11	16.1	-	20-Jul-11	14.2	-	20-Jul-11	21.8		-	-	-
2012	-	-	-	18-Jul-12	23.4	-	-	-	-	17-Jul-12	21.3	-	17-Jul-12	16.0	-	17-Jul-12	24.0		-	-	-
2013	-	-	-	17-Jul-13	22.6	-	-	-	-	16-Jul-13	17.7	-	16-Jul-13	11.0	-	16-Jul-13	22.1		-	-	-
No. of Readings:		1			10			1			8			10			10			6	
Maximum:		19.8			23.4			19.2			21.3			16.0			24.0			23.8	
Minimum:		19.8			17.6			19.2			14.1			9.3			17.5			15.9	
Average:		19.8			19.7			19.2			17.1			12.2			20.0			20.8	
YELLOW:		17.8			21.1			17.3			19.2			14.4			21.6			21.4	
RED:		**19.8**			**23.4**			**19.2**			**21.3**			**16.0**			**24.0**			**23.8**	
AUGUST																					
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
2004	-	-	-	26-Aug-04	15.2	-	-	-	-	26-Aug-04	16.5		26-Aug-04	14.2	-	26-Aug-04	16.0		26-Aug-04	18.0	-
2005	-	-	-	22-Aug-05	15.8	-	-	-	-	22-Aug-05	14.9		-	-	-	22-Aug-05	16.0		22-Aug-05	18.4	-
2006	-	-	-	22-Aug-06	19.2	-	-	-	-	23-Aug-06	17.5		24-Aug-06	13.6	-	23-Aug-06	17.0		23-Aug-06	18.7	-
2007	-	-	-	19-Aug-07	17.0	-	-	-	-	-	-	-	22-Aug-07	13.3	-	22-Aug-07	19.2		22-Aug-07	21.5	-
2008	-	-	-	19-Aug-08	17.8	-	-	-	-	19-Aug-08	12.4		19-Aug-08	11.8	-	19-Aug-08	16.4		19-Aug-08	15.2	-
2009	-	-	-	12-Aug-09	16.3	-	-	-	-	12-Aug-09	16.8		11-Aug-09	12.9	-	11-Aug-09	20.5		11-Aug-09	19.8	-
2010	-	-	-	16-Aug-10	20.2	-	-	-	-	18-Aug-10	15.4	-	17-Aug-10	13.1	-	18-Aug-10	17.2		-	-	-
2011	-	-	-	15-Aug-11	21.2	-	-	-	-	-	-	-	16-Aug-11	15.0	-	16-Aug-11	18.7		-	-	-
2012	-	-	-	15-Aug-12	16.4	-	-	-	-	14-Aug-12	15.7	-	14-Aug-12	10.0	-	14-Aug-12	16.7		18-Aug-12	14.8	-
2013	-	-	-	-	-	-	-	-	-	21-Aug-13	16.5	-	21-Aug-13	13.4	-	21-Aug-13	22.2		-	-	-
No. of Readings:		0			9			0			8			9			10			7	
Maximum:		0.0			21.2			0.0			17.5			15.0			22.2			21.5	
Minimum:		0.0			15.2			0.0			12.4			10.0			16.0			14.8	
Average:		-			17.7			-			15.7			13.0			18.0			18.1	
YELLOW:		-			19.1			-			15.8			13.5			20.0			19.4	
RED:		-			**21.2**			-			**17.5**			**15.0**			**22.2**			**21.5**	
SEPTEMBER																					
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
2004	-	-	-	22-Sep-04	11.7	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
2005	-	-	-	27-Sep-05	11.7	-	-	-	-	28-Sep-05	14.2		28-Sep-05	11.4	-	27-Sep-05	13.2		27-Sep-05	14.4	-
2006	-	-	-	20-Sep-06	11.9	-	-	-	-	21-Sep-06	11.0		21-Sep-06	11.8	-	20-Sep-06	12.5		20-Sep-06	13.6	-
2007	-	-	-	18-Sep-07	12.2	-	-	-	-	-	-	-	17-Sep-07	12.7	-	17-Sep-07	13.4		17-Sep-07	16.2	-
2008	-	-	-	12-Sep-08	13.5	-	-	-	-	-	-	-	16-Sep-08	10.1	-	17-Sep-08	13.9		17-Sep-08	13.9	-
2009	-	-	-	15-Sep-09	16.0	-	-	-	-	-	-	-	16-Sep-09	10.0	-	15-Sep-09	16.1		15-Sep-09	16.7	-
2010	-	-	-	14-Sep-10	13.0	-	-	-	-	14-Sep-10	13.4	-	15-Sep-10	10.3	-	14-Sep-10	14.1		-	-	-
2011	-	-	-	20-Sep-11	15.2	-	-	-	-	20-Sep-11	13.4	-	20-Sep-11	12.4	-	20-Sep-11	14.3		-	-	-
2012	-	-	-	19-Sep-12	12.6	-	-	-	-	18-Sep-12	12.6	-	18-Sep-12	11.0	-	18-Sep-12	14.8		18-Sep-12	14.8	-
2013	-	-	-	18-Sep-13	13.6	-	-	-	-	-	-	-	18-Sep-13	10.8	-	18-Sep-13	12.9		-	-	-
No. of Readings:		0			10			0			5			9			9			6	
Maximum:		0.0			16.0			0.0			14.2			12.7			16.1			16.7	
Minimum:		0.0			11.7			0.0			11.0			10.0			12.5			13.6	
Average:		-			13.1			-			12.9			11.2			13.9			14.9	
YELLOW:		-			14.4			-			12.8			11.4			14.5			15.0	
RED:		-			**16.0**			-			**14.2**			**12.7**			**16.1**			**16.7**	

TABLE 3.6
SURFACE WATER TEMPERATURE PERFORMANCE TRIGGER VALUE SUMMARY
DUNTROON QUARRY EXPANSION

MONITORING YEAR	SW16			SW17			SW17A			SW18			SW21C			SW24A			SW77		
	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes	Measurement Date	Temperature (°C)	Notes
JUNE																					
2003	23-Jun-03	19.4	-	-	-	-	23-Jun-03	12.7	-	23-Jun-03	15.7	-	-	-	-	-	-	-	-	-	-
2004	24-Jun-04	14.9	-	24-Jun-04	17.8		24-Jun-04	11.2	-	24-Jun-04	13.6	-	24-Jun-04	9.9		24-Jun-04	7.4	-	-	-	-
2005	27-Jun-05	19.1	-	27-Jun-05	21.4		27-Jun-05	13.5	-	27-Jun-05	17.5	-	27-Jun-05	12.0		27-Jun-05	8.3	-	-	-	-
2006	20-Jun-06	16.1	-	20-Jun-06	18.9		20-Jun-06	12.2	-	20-Jun-06	14.7	-	20-Jun-06	11.2		20-Jun-06	11.3	-	-	-	-
2007	-	-	-	18-Jun-07	21.1		18-Jun-07	13.3	-	18-Jun-07	16.3	-	18-Jun-07	11.6		18-Jun-07	8.5	-	-	-	-
2008	18-Jun-08	13.7	-	17-Jun-08	16.4		17-Jun-08	9.0	-	18-Jun-08	12.9	-	17-Jun-08	9.0		17-Jun-08	8.1	-	-	-	-
2009	15-Jun-09	16.5	-	15-Jun-09	17.0		15-Jun-09	12.4	-	15-Jun-09	12.6	-	15-Jun-09	9.4		15-Jun-09	9.1	-	-	-	-
2010	14-Jun-10	16.6	-	14-Jun-10	17.1		14-Jun-10	12.5	-	16-Jun-10	14.0	-	15-Jun-10	9.6		15-Jun-10	9.8	-	13-Jun-10	7.9	-
2011	14-Jun-11	13.8	-	14-Jun-11	14.9		14-Jun-11	10.2	-	14-Jun-11	12.1	-	14-Jun-11	9.7		14-Jun-11	8.6	-	12-Jun-11	7.7	-
2012	19-Jun-12	19.4	-	19-Jun-12	20.8		19-Jun-12	14.0	-	18-Jun-12	17.9	-	19-Jun-12	11.6		19-Jun-12	13.5	-	17-Jun-12	8.3	-
2013	19-Jun-13	13.3	-	19-Jun-13	16.4		19-Jun-13	10.2	-	19-Jun-13	12.6	-	19-Jun-13	9.3		19-Jun-13	9.8	-	18-Jun-13	8.2	-
No. of Readings:		10			10			11			11			10			10			4	
Maximum:		19.4			21.4			14.0			17.9			12.0			13.5			8.3	
Minimum:		13.3			14.9			9.0			12.1			9.0			7.4			7.7	
Average:		16.3			18.2			11.9			14.5			10.3			9.5			8.0	
YELLOW:		17.5			19.2			12.6			16.1			10.8			12.2			7.5	
RED:		**19.4**			**21.4**			**14.0**			**17.9**			**12.0**			**13.5**			**8.3**	
JULY																					
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	29-Jul-04	16.4	-	29-Jul-04	19.3		29-Jul-04	11.9	-	29-Jul-04	15.9	-	29-Jul-04	10.5	-	29-Jul-04	7.8	-	-	-	-
2005	11-Jul-05	20.0	-	11-Jul-05	22.3		11-Jul-05	14.2	-	11-Jul-05	18.8	-	12-Jul-05	11.2	-	11-Jul-05	9.1	-	-	-	-
2006	11-Jul-06	18.3	-	11-Jul-06	20.4		11-Jul-06	13.9	-	11-Jul-06	14.7	-	11-Jul-06	12.4	-	11-Jul-06	12.4	-	-	-	-
2007	-	-	-	15-Jul-07	19.7		15-Jul-07	13.5	-	15-Jul-07	17.7	-	15-Jul-07	11.0	-	15-Jul-07	11.0	-	-	-	-
2008	15-Jul-08	15.2	-	15-Jul-08	14.9		15-Jul-08	11.2	-	15-Jul-08	15.6	-	15-Jul-08	10.2	-	15-Jul-08	10.3	-	-	-	-
2009	14-Jul-09	12.1	-	17-Jul-09	16.9		14-Jul-09	10.5	-	14-Jul-09	12.2	-	14-Jul-09	9.6	-	14-Jul-09	9.6	-	-	-	-
2010	19-Jul-10	17.0	-	19-Jul-10	19.5		19-Jul-10	12.8	-	19-Jul-10	17.9	-	19-Jul-10	11.4	-	19-Jul-10	12.5	-	18-Jul-10	9.2	-
2011	19-Jul-11	20.0	-	19-Jul-11	22.9		19-Jul-11	13.9	-	19-Jul-11	18.4	-	19-Jul-11	11.3	-	19-Jul-11	9.6	-	17-Jul-11	9.4	-
2012	17-Jul-12	20.7	-	17-Jul-12	23.0		17-Jul-12	16.0	-	17-Jul-12	20.7	-	17-Jul-12	13.0	-	17-Jul-12	15.0	-	16-Jul-12	10.8	-
2013	16-Jul-13	18.0	-	16-Jul-13	22.3		16-Jul-13	13.8	-	16-Jul-13	17.6	-	16-Jul-13	11.8	-	16-Jul-13	12.4	-	16-Jul-13	9.9	-
No. of Readings:		9			10			10			10			10			10			4	
Maximum:		20.7			23.0			16.0			20.7			13.0			15.0			10.8	
Minimum:		12.1			14.9			10.5			12.2			9.6			7.8			9.2	
Average:		17.5			20.1			13.2			17.0			11.2			11.0			9.8	
YELLOW:		18.6			20.7			14.4			18.6			11.7			13.5			9.7	
RED:		**20.7**			**23.0**			**16.0**			**20.7**			**13.0**			**15.0**			**10.8**	
AUGUST																					
2003	-	-	-	-	-	-	-	-	-	20-Aug-03	16.4	-	-	-	-	-	-	-	-	-	-
2004	-	-	-	26-Aug-04	17.2	-	26-Aug-04	12.1	-	26-Aug-04	15.2	-	26-Aug-04	9.8	-	26-Aug-04	8.2	-	-	-	-
2005	22-Aug-05	15.2		22-Aug-05	18.5	-	22-Aug-05	12.7	-	22-Aug-05	15.0	-	23-Aug-05	10.7	-	22-Aug-05	10.2	-	-	-	-
2006	-	-	-	23-Aug-06	17.2	-	23-Aug-06	12.8	-	23-Aug-06	15.9	-	23-Aug-06	12.0	-	23-Aug-06	11.8	-	-	-	-
2007	-	-	-	23-Aug-07	18.1	-	23-Aug-07	14.9	-	23-Aug-07	19.3	-	22-Aug-07	10.6	-	23-Aug-07	13.0	-	-	-	-
2008	18-Aug-08	10.1	-	18-Aug-08	21.2	-	18-Aug-08	14.5	-	18-Aug-08	18.8	-	19-Aug-08	9.9	-	18-Aug-08	12.8	-	-	-	-
2009	-	-	-	11-Aug-09	19.7	-	11-Aug-09	12.9	-	11-Aug-09	16.3	-	11-Aug-09	11.4	-	11-Aug-09	11.2	-	-	-	-
2010	17-Aug-10	16.2	-	17-Aug-10	19.8	-	17-Aug-10	12.8	-	17-Aug-10	15.5	-	17-Aug-10	10.9	-	17-Aug-10	12.3	-	15-Aug-10	10.0	-
2011	16-Aug-11	16.1	-	16-Aug-11	18.5	-	16-Aug-11	13.1	-	16-Aug-11	16.1	-	16-Aug-11	11.3	-	16-Aug-11	10.6	-	14-Aug-11	10.6	-
2012	14-Aug-12	15.4	-	14-Aug-12	18.6	-	14-Aug-12	12.8	-	14-Aug-12	16.1	-	14-Aug-12	11.0	-	14-Aug-12	12.5	-	14-Aug-12	10.1	-
2013	21-Aug-13	17.0	-	21-Aug-13	19.5	-	21-Aug-13	13.8	-	21-Aug-13	17.0	-	21-Aug-13	11.3	-	21-Aug-13	12.5	-	-	-	-
No. of Readings:		6			10			10			11			10			10			3	
Maximum:		17.0			21.2			14.9			19.3			12.0			13.0			10.6	
Minimum:		10.1			17.2			12.1			15.0			9.8			8.2			10.0	
Average:		15.0			18.8			13.2			16.5			10.9			11.5			10.2	
YELLOW:		15.3			19.1			13.4			17.4			10.8			11.7			9.5	
RED:		**17.0**			**21.2**			**14.9**			**19.3**			**12.0**			**13.0**			**10.6**	
SEPTEMBER																					
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2005	27-Sep-05	13.2	-	27-Sep-05	15.4	-	27-Sep-05	11.8	-	27-Sep-05	13.0	-	28-Sep-05	9.9		28-Sep-05	10.4	-	-	-	-
2006	-	-	-	20-Sep-06	14.3	-	20-Sep-06	11.2	-	20-Sep-06	11.9	-	20-Sep-06	10.0		20-Sep-06	10.5	-	-	-	-
2007	-	-	-	17-Sep-07	14.0	-	17-Sep-07	10.9	-	17-Sep-07	13.4	-	17-Sep-07	9.8	-	17-Sep-07	9.8	-	-	-	-
2008	17-Sep-08	12.2	-	16-Sep-08	15.1	-	16-Sep-08	10.2	-	17-Sep-08	12.3	-	16-Sep-08	9.9		16-Sep-08	9.8	-	-	-	-
2009	-	-	-	15-Sep-09	17.3	-	15-Sep-09	12.1	-	15-Sep-09	14.7	-	15-Sep-09	10.7		15-Sep-09	10.4	-	-	-	-
2010	-	-	-	14-Sep-10	1.0	-	14-Sep-10	11.0	-	14-Sep-10	12.5	-	14-Sep-10	9.3		14-Sep-10	10.1	-	12-Sep-10	10.6	-
2011	20-Sep-11	12.8	-	20-Sep-11	13.4	-	20-Sep-11	11.4	-	20-Sep-11	12.8	-	20-Sep-11	9.7		20-Sep-11	10.5	-	-	-	-
2012	18-Sep-12	13.9	-	18-Sep-12	15.9	-	18-Sep-12	11.8	-	18-Sep-12	14.0	-	18-Sep-12	10.2		18-Sep-12	11.4	-	18-Sep-12	11.0	-
2013	18-Sep-13	11.3	-	18-Sep-13	13.6	-	18-Sep-13	9.7	-	18-Sep-13	11.0	-	18-Sep-13	9.0		18-Sep-13	8.3	-	-	-	-
No. of Readings:		5			9			9			9			9			9			2	
Maximum:		13.9			17.3			12.1			14.7			10.7			11.4			11.0	
Minimum:		11.3			1.0			9.7			11.0			9.0			8.3			10.6	
Average:		12.7			13.3			11.1			12.8			9.8			10.1			10.8	
YELLOW:		12.5			15.6			10.9			13.2			9.6			10.2			9.9	
RED:		**13.9**			**17.3**			**12.1**			**14.7**			**10.7**			**11.4**			**11.0**	

Table 3.7: Trigger Decision Steps for Stream Flow or Escarpment Springs Flow

Table 3.7: Trigger Decision Steps for Stream Flow or Escarpment Springs Flow	
Stations: SW1, SW2, SW3, SW3B, SW0-2, SW6A, SW9, SW10, SW11 (series), SW14, SW15, SW16, SW17, SW17A, SW18, SW21C, SW24A, SW77	
Zone	**Action**
GREEN	Conduct regular operations with PITM monitoring and long-term trend monitoring per AMP and ARA Site Plans PITM monitoring locations, parameters and frequency for Stream Flow or Escarpment Springs Flow are identified in Table 3.4 in Appendix B.
YELLOW	Immediately upon entering the Yellow Zone, the following steps are taken progressively to return condition to Green Zone: 1. Notify MNR, MOE, Conservation Authorities, and the Township within 72 hours of entering the Yellow Zone 2. Verify parameter value data trend and prevailing climatic condition and compare to historic values 3. Assess upstream/up-gradient monitoring stations data to determine the extent of the change. Assess monitor control stations for similar trends 4. Investigate possible causes of entering the Yellow Zone. Submit a summary report documenting the results of that investigation and, if appropriate, the mitigation measures implemented, to MNR, MOE, CAs and the Township within 30 days of entering a Yellow Zone condition 5. Assess the implications of continued data trend in Yellow Zone 6. If data trend is potentially quarry related, then increase monitoring intensity as noted below 7. Assess the long-term weather forecast to determine impacts that it may have on the data trend and/or mitigation approach 8. Confirm quarry discharge pumps are operating as prescribed in the current seasonal discharge schedule at designated locations (daily). If not, repair and confirm functionality 9. Confirm exit flow rate of quarry discharge at designated locations complies with the current seasonal discharge schedule (daily) 10. Confirm upstream and downstream flows are within current seasonal trigger criteria (weekly progressively moving to daily, if necessary) 11. Review quarry discharge pumping records (weekly, progressively moving to daily if necessary) and confirm discharge locations and volumes are as intended 12. Is quarry discharging to pre-designated off-site locations? If not, start discharging at pre-designated locations. If quarry is discharging, increase discharge rate to specified locations 13. Assess if there are other surface water based options that are feasible to achieve goal of returning to normal seasonal fluctuations and implement as necessary 14. Determine if recharge injection well system should be operated at specified locations to increase flux of groundwater through aquifer to increase flows and/or promote a cooling influence at location-specific downgradient Escarpment spring discharge locations. Operate recharge injection well system if appropriate. If system is already operating, increase the discharge volumes and/or bring additional recharge wells on line if appropriate 15. Monitor to assess the success of the mitigation / adaptive measures and recovery of the system; take additional operational actions if required such as additional discharge locations, injection wells or other mitigation approaches (see Section 2.0 for details) 16. Continue to monitor operations 17. Move extraction area and/or move to a different lift

Table 3.7: Trigger Decision Steps for Stream Flow or Escarpment Springs Flow	
Stations: SW1, SW2, SW3, SW3B, SW0-2, SW6A, SW9, SW10, SW11 (series), SW14, SW15, SW16, SW17, SW17A, SW18, SW21C, SW24A, SW77	
Zone	**Action**
RED	1. Notify the MNR, MOE, the Conservation Authorities, the Township within 24 hours of entering the Red Zone 2. Within 48 hours of entering the red Zone stop the extraction activity (clearing, stripping and blasting). Processing and Shipping may continue 3. Continue Yellow Zone actions and implement additional contingency mitigation including a step-up of one or more on-going Yellow Zone mitigation measures 4. Red Zone requires investigations to determine the cause of PITM deviation, or if such investigations are underway due to Yellow Zone, investigations are continued. A summary report to document the results of the investigations, the mitigation measures implemented and their results will be submitted to MNR, MOE, the CAs and the Township, once MNR is satisfied that one of the conditions required for extraction to re-commence has been met, as listed below 5. Only resume extraction operations when: i. Conditions return to the Green Zone, OR ii. Conditions return to the Yellow Zone and it is demonstrated to the satisfaction of the MNR that quarry operations can recommence safely, OR iii. It is demonstrated to the satisfaction of the MNR that the reason for entering the Red Zone does not relate to quarry operations

Table 3.8: Trigger Decision Steps for Stream or Escarpment Springs Water Temperature

Table 3.8: Trigger Decision Steps for Stream or Escarpment Springs Water Temperature	
Stations: SW1, SW2, SW3, SW3B, SW0-2, SW6A, SW9, SW10, SW11 (series), SW14, SW15, SW16, SW17, SW17A, SW18, SW21C, SW24A, SW77	
Zone	**Action**
GREEN	Conduct regular operations with PITM monitoring and long-term trend monitoring per AMP and ARA Site Plans PITM monitoring locations and frequency for Stream or Escarpment Springs Water Temperature are identified in Table 3.4 in Appendix B
YELLOW	1. Immediately upon entering the Yellow Zone, the following steps are taken progressively to return condition to Green Zone: 2. Notify MNR, MOE, Conservation Authorities and the Township within 72 hours of entering the Yellow Zone 3. Verify parameter value data trend and prevailing climatic condition and compare to historic values 4. Assess upstream/up-gradient monitoring stations data to determine the extent of the change. Assess monitor control stations for similar trends 5. Investigate possible causes of entering the Yellow Zone. Submit a summary report documenting the results of that investigation and, if appropriate, the mitigation measures implemented, to MNR, MOE, CAs and the Township within 30 days of entering a Yellow Zone condition 6. Assess the implications of continued data trend in Yellow Zone 7. If data trend is potentially quarry related, then increase monitoring intensity as noted below 8. Assess the long-term weather forecast to determine impacts that it may have on the data trend and/or mitigation approach 9. Confirm quarry discharge pumps are operating as prescribed in the current seasonal discharge schedule at designated locations (daily). If not, repair and confirm functionality 10. Confirm quarry discharge exit temperature is within historic seasonal range (daily) 11. Confirm upstream and downstream temperatures in receiver are within historic seasonal range (weekly progressively moving to daily if necessary) 12. Monitor water temperature and dissolved oxygen in downstream fishery and compare to published criteria for location-specific aquatic habitat (weekly progressively moving to daily if necessary) 13. Compare ambient air temperature to historic values to see if abnormally warm (daily) 14. Assess regional conditions to see if trend is similar (weekly) 15. Is quarry discharging to pre-designated off-site locations to reach location-specific Escarpment springs and/or to other stream discharge locations? If not, start discharging at pre-designated off-site locations. If quarry is discharging, increase discharge rate to specific stream locations 16. Conduct a visual inspection of the discharge from the pumps and confirm it complies with the current seasonal discharge schedule 17. If quarry discharge water temperature and/or receiver surface water temperature continues to increase, adapt discharge system to pump cooler water from quarry (such as from a bottom-draw system at sump) 18. Assess if there are other surface water based options that are feasible to achieve goal of returning to normal seasonal fluctuations and implement as necessary 19. Determine if recharge injection well system should be operated at specified locations to increase flux of groundwater through aquifer to increase flows and/or promote a cooling influence at location-specific downgradient Escarpment spring discharge locations. Operate recharge injection well system if appropriate. If system is already operating, increase the discharge volumes and/or bring additional recharge wells on line if appropriate 20. Monitor to assess the success of the mitigation / adaptive measures and recovery of the system;

Table 3.8: Trigger Decision Steps for Stream or Escarpment Springs Water Temperature	
Stations: SW1, SW2, SW3, SW3B, SW0-2, SW6A, SW9, SW10, SW11 (series), SW14, SW15, SW16, SW17, SW17A, SW18, SW21C, SW24A, SW77	
Zone	**Action**
	take additional operational actions if required such as additional discharge locations, injection wells or other mitigation approaches (see Section 2.0 for details) 21. Continue to monitor operations 22. Move extraction area and/or move to a different lift
RED	1. Notify the MNR, MOE, the Conservation Authorities, the Township within 24 hours of entering the Red Zone 2. Within 48 hours of entering the red Zone stop the extraction activity (clearing, stripping and blasting). Processing and Shipping may continue. 3. Continue Yellow Zone actions and implement additional contingency mitigation including a step-up of one or more on-going Yellow Zone mitigation measures 4. Red Zone requires investigations to determine the cause of PITM deviation, or if such investigations are underway due to Yellow Zone, investigations are continued. A summary report to document the results of the investigations, the mitigation measures implemented and their results will be submitted to MNR, MOE, the CAs and the Township, once MNR is satisfied that one of the conditions required for extraction to re-commence has been met, as listed below 5. Only resume extraction operations when: i. Conditions return to the Green Zone, OR ii. Conditions return to the Yellow Zone and it is demonstrated to the satisfaction of the MNR that quarry operations can recommence safely, OR iii. It is demonstrated to the satisfaction of the MNR that the reason for entering the Red Zone does not relate to quarry operations

Table 3.9: Trigger Decision Steps for Wetland Water Levels

Table 3.9: Trigger Decision Steps for Wetland Water Levels	
Stations: DP2, DP4, DP5, DP6, DP7, DP8, DP9, DP10, Bridson DP	
Zone	**Action**
GREEN	Conduct regular operations with PITM monitoring and long-term trend monitoring per AMP and ARA Site Plans PITM monitoring locations and frequency for Wetland Water Levels are identified in Table 3.4 in Appendix B
YELLOW	Immediately upon entering the Yellow Zone, the following steps are taken progressively to return condition to Green Zone: 1. Notify MNR, MOE, Conservation Authorities and the Township within 72 hours of entering the Yellow Zone 2. Verify parameter value data trend and prevailing climatic condition and compare to historic values 3. Assess upstream/up-gradient monitoring stations data to determine the extent of the change. Assess the wetland reference monitoring stations for similar trends 4. Investigate possible causes of entering the Yellow Zone. Submit a summary report documenting the results of that investigation and, if appropriate, the mitigation measures implemented, to MNR, MOE, CAs and the Township within 30 days of entering a Yellow Zone condition 5. Assess the implications of continued data trend in Yellow Zone 6. If data trend is potentially quarry related, then increase monitoring intensity as noted below 7. Assess the long-term weather forecast to determine impacts that it may have on the data trend and/or mitigation approach 8. Confirm quarry discharge pumps are operating as prescribed in the current seasonal discharge schedule at designated locations (daily). If not, repair and confirm functionality 9. Confirm water levels (weekly, progressively moving to daily if necessary) 10. Review pumping records and confirm operation of discharge system complies with current seasonal discharge schedule (weekly, progressively moving to daily if necessary) 11. Confirm that quarry is currently discharging to pre-designated locations in wetland. If not, start discharging to pre-designated locations in wetland, If quarry is discharging, increase discharge volume to specific locations as directed 12. Assess if there are other surface water based options that are feasible to achieve goal of returning to normal seasonal fluctuations and implement as necessary 13. Monitor to assess the success of the mitigation / adaptive measures and recovery of the system; take additional operational actions if required such as additional discharge locations, injection wells or other mitigation approaches (see Section 2.0 for details) 14. Continue to monitor operations 15. Move extraction area and/or move to a different lift
RED	1. Notify the MNR, MOE, the Conservation Authorities, the Township within 24 hours of entering the Red Zone 2. Within 48 hours of entering the red Zone stop the extraction activity (clearing, stripping and blasting). Processing and Shipping may continue. 3. Continue Yellow Zone actions and implement additional contingency mitigation including a step-up of one or more on-going Yellow Zone mitigation measures 4. Red Zone requires investigations to determine the cause of PITM deviation, or if such investigations are underway due to Yellow Zone, investigations are continued. A summary report to document the results of the investigations, the mitigation measures implemented and their results will be submitted to MNR, MOE, the CAs and the Township, once MNR is satisfied that one of the conditions required for extraction to re-commence has been met, as listed below

Table 3.9: Trigger Decision Steps for Wetland Water Levels	
Stations: DP2, DP4, DP5, DP6, DP7, DP8, DP9, DP10, Bridson DP	
Zone	**Action**
	5. Only resume extraction operations when: i. Conditions return to the Green Zone, OR ii. Conditions return to the Yellow Zone and it is demonstrated to the satisfaction of the MNR that quarry operations can recommence safely, OR iii. It is demonstrated to the satisfaction of the MNR that the reason for entering the Red Zone does not relate to quarry operations

Table 4.1: Long Term Trend Monitoring Program Locations and Description

TABLE 4.1-

Long Term Trend Monitoring Program Locations and Description

Monitoring Stations by Location	NAD27 Easting	NAD27 Northing	Approximate Ground Elevation (mASL)	Description	Culvert Dimensions	Criteria for Choosing location			Wetland Flow Direction	Notes
						Publically Accessible	Accessible Walker Land	Suitable for automated monitor (datalogger&/or stage-discharge curve)		
BH02-1	560321	4915021	522.64	Existing monitor- Southeast corner of Expansion Quarry						
BH02-2	559904	4915314	522.46	Existing monitor- Northeast portion of Expansion Quarry						
BH02-3	559869	4915082	529.67	Existing monitor - Eastern central portion of Expansion Quarry						
BH02-4	559862	4915100	530.02	Existing monitor - Eastern central portion of Expansion Quarry						
BH02-5	559577	4915356	513.24	Existing monitor - North-central limit extraction Expansion Quarry						
BH02-6	559692	4914782	529.5	Existing monitor - just north of Simcoe County Road 91, Expansion Lands						
BH03-7-I	559331	4915281	510.27	Existing monitor - North of Expansion Quarry RR2 Wetland on Old Mail Road						
BH03-7-II	559331	4915283	510.27	Existing monitor - North of Expansion Quarry RR2 Wetland on Old Mail Road						
BH03-7 SG1	TBD	TBD	TBD	Existing staff gauge - North of Expansion Quarry, RR2 Wetland vernal pond north of BH03-7						
BH03-7 SG2	TBD	TBD	TBD	Existing staff gauge - North of Expansion Quarry RR2 Wetland vernal pond north of BH03-7						
BH03-8	558963	4915099	520.22	Existing monitor-- Northwest corner Expansion Quarry						
BH03-9	559088	4914674	518.5	Existing monitor - Southwest corner Expansion Quarry						
BRIDSON DP	560360	4915303	510.4	Existing Drive Point Monitor - East of Expansion Quarry Walker buffer lands ANSI B Wetland						
TW04-1	559084	4914910	517.05	Existing Monitor - Southwest corner Expansion Quarry						
TW04-2	559082	4914934	517.46	Existing Monitor - Southwest corner Expansion Quarry						
TW04-3	559098	4914909	517.97	Existing Monitor - Southwest corner ExpansionLands						
DP5	559086	4915559	509.66	Existing Drive Point Monitor - North of Expansion Quarry, Walker buffer lands, Vernal Pool west central part RR#2 Wetland						
DP6	559774	4915513	511.45	Existing Drive Point Monitor - North of Expansion Quarry, Walker buffer lands, Vernal Pool ANSI Wetland A						
BH08-1	560471	4915197	511.51	Existing monitor -East of Expansion Quarry south section Walker buffer lands						
BH08-2	560484	4915175	511.15	Existing monitor - East of Expansion Quarry south section Walker buffer lands						
BH08-3	560447	4915198	512.57	Existing monitor - East of Expansion Quarry south section Walker buffer lands						
98-8	559613	4914120	516.5	Existing monitor - Southwest corner of Existing Quarry						
98-9	559358	4914583	525.9	Existing monitor - Northwest corner of Existing Quarry						
98-12	560341	4914863	526.7	Existing monitor - Northeast corner of Existing Quarry property						
QFSW2	559810	4914354	499	Existing Quarry Floor - surface water station quarry floor channel prior to discharge into main sump						
DP1	559465	4914116	511.8	Existing Drive Point Monitor - West of Existing Quarry, Walker buffer lands, Southeast corner of RR6 Wetland						
DP2	559287	4914373	512.1	Existing Drive Point Monitor - West of Existing Quarry, Walker buffer lands, Northeast corner RR6 Wetland						
DP3	560290	4914013	513.6	Existing Drive Point Monitor -South of Existing Quarry, Northern portion of CLF wetland						
DP4	559067	4914013	511.4	Existing Drive Point Monitor - West of Existing Quarry and station SW1 in RR6 Wetland west of Grey County Rd 31						
PW99-1	559609	4914157	513.9	Existing monitor - Existing Quarry, Walker buffer lands west of southwest corner of limit of extraction						
RW20	560156	4915083	531.35	Existing Quarry Office Well (New) - Northeast corner of Existing Quarry						
101-B	557900	4913891	Not surveyed	Existing monitor - West boundary of Walker buffer lands west of Grey County Rd 31						
102-C	558331	4914250	Not surveyed	Existing monitor - Northern portion of Walker buffer lands west of Grey County Rd 31						
103-D	558506	4913962	Not surveyed	Existing monitor - Central portion of Walker buffer lands west of Grey County Rd 31						
104-A	558198	4913796	Not surveyed	Existing monitor - Southwest portion of Walker buffer lands west of Grey County Rd 31						
OW1-4	558465	4914034	Not surveyed	Existing monitor - West of Existing Quarry, Walker buffer lands west of Grey County Rd 31						
OW3-1	558085	4913737	Not surveyed	Existing monitor - West of Existing Quarry, Walker buffer lands west of Grey County Rd 31						
OW5-2	557876	4914015	Not surveyed	Existing monitor - West of Existing Quarry, Walker buffer lands west of Grey County Rd 31						
OW6-3	558346	4914244	Not surveyed	Existing monitor - West of Existing Quarry, Walker buffer lands west of Grey County Rd 31						
DP7	nd	nd	nd	New Drive Point Monitor--North of Expansion Quarry, Walker buffer lands, Vernal Pool RR2 Wetland east of DP5, To be installed prior to extraction			√	√		Rob Roy Unit #2
DP8	nd	nd	nd	New Drive Point Monitor - West of Existing Quarry, Walker buffer lands, Northwest corner RR6 Wetland, To be installed prior to extraction			√	√		Rob Roy Unit #6
DP9	nd	nd	nd	New Drive Point Monitor - Northeast of Expansion Quarry, Walker buffer lands, Northwest section ANSI B Wetland, To be installed prior to extraction						
SW10	561192	4915418	477	Escarpment Seep Channel - East of Expansion Quarry below Escarpment, Upslope from house / farm water supply well tile collection system	Stream Channel Flow	Private Land		√		Spring from Amabel Formation; above W. Franks surface water supply collection rings.
Bridson DP	560360	4915303	510.4	Existing Drive Point Monitor - East of Expansion Quarry Walker buffer lands ANSI B Wetland						
CLF1	559343	4913728	520.76	Carmarthen Lake Farms Supply Well - Southwest of Existing Quarry East of Grey County Road 31 (east well)						
CLF2	559284	4913713	519.57	Carmarthen Lake Farms Supply Well - Southwest of Existing Quarry East of Grey County Road 31 (west well)						
CLF3	559144	4912910	517.11	Carmarthen Lake Farms Supply Well - Southwest of Existing Quarry West of Grey County Road 31 north of horse paddock						
CLF4	559369	4913050	509.48	Carmarthen Lake Farms Supply Well - East of Grey County Road 31, west of shop						
CLF5	559517	4913128	508.8	Carmarthen Lake Farms Supply Well - East of Grey County Road 31, at house						
RW8	560662	4916820	431	Residential Well-- Northeast of Expansion Quarry below Escarpment, 1332 Concession 10						
RW16	560459	4915178	512.48	East of Expansion Quarry Walker buffer lands, Former Residential Well 9774 County Road 91						
RW1	560619	4915265	508.57	Residential Well - East of Expansion Quarry and Walker buffer lands, 9730 County Road 91						
RW2	560930	4915112	504.5	Residentail Well - East of Existing Quarry, Above Escarpment at Brow, 9749 County Road 91						
RW9	558916	4914687	524	ll - West of Expansion Quarry, West of Grey County Rd 31, 794518 County Road 31, Southeast corner MAQ Aggregates Quarry property-will be removed by						
RW17	558987	4915446	Not surveyed	Residentail Well - North of Expansion Quarry, Walker buffer lands east of Grey County Rd 31, west of RR2						
RW18	560150	4915299	513	Dug Farm Well - Northeast corner Expansoin Quarry, To be removed by extaction						
RW19	560221	4915355	Not Surveyed	Drilled Farm Well - Southeast portion of Expansion Quarry, To be removed by extraction						
RW6	561652	4914852	451	Dug Well - East of Exisitng Quarry Below Escarpment, 1100 Concession 10						
RW7	561691	4914725	452.3	Residential Well - East of Existing Quarry Below Escarpment, 1122 Concession 10						
RW5	561404	4915152	478	Residential Well - East of Existing Quarry below Escarpment south side County Road 91 west of Concession 10						
RW3	559243	4915977	518.7	Residential Well - North of Expansion Quarry, 8592 26/27 Sideroad						
RW4	559593	4915918	509.8	Residential Well - North of Expansion Quarry, South side of 26/27 Sideroad						
SW13	561283	4915824	427	On-Line Pond Discharge Outlet Channel - Northeast Of Expansion Quarry below Escapment, west of Concession 10	Bucket capture of flow out of culvert					

TABLE 4.1-

Long Term Trend Monitoring Program Locations and Description

Monitoring Stations by Location	NAD27 Easting	NAD27 Northing	Approximate Ground Elevation (mASL)	Description	Culvert Dimensions	Criteria for Choosing location			Wetland Flow Direction	Notes
						Publically Accessible	Accessible Walker Land	Suitable for automated monitor (datalogger&/or stage-discharge curve)		
SW19	564260	4915281	335	atteaux Creek Channel Flow - East of Expansion Quarry below Escarpment, West side large diameter culvert beneath Simcoe County Rd. 124 south of Duntro	Stream Channel Flow					
SW20	560010	4916161	495	el Flow - North of Expansion Quarry, north of 26/27 Sideroad, Stream channel below (east) of shallow well seep adjacent to Nottawasaga Lookout Provincial F	Stream Channel Flow					
SW21	561298	4916061	430	Channel Flow - Northeast of Expansion Quarry below Escarpment, On-Line pond outlet channel west of Concession 10	Bucket capture of flow out of culvert					
SW21A	561236	4916039	433	Channel Flow- Northeast of Expansion Quarry below Escarpment, Inlet channel to on-line pond	Stream Channel Flow					
SW21B	561013	4915969	449	Cistern overflow channel - Northeast of Expansion Quarry below Escaprment, Residential Water supply collection cistern overflow outlet west of (above) SW21	Stream Channel Flow Cistern outlet pipe diameter: 0.10 m					
SW21C	560703	4916021	470	Channel Flow - Northeast of Expansion Quarry below Escarpment, Seep channel northwest of (above) water supply system cistern inlet collection pipe	Stream channel Flow					
SW22	560645	4914445	492	Seep Flow - East of Existing Quarry below Escarpment, Culvert beneath ski trail	Bucket capture of flow out of culvert					
SW22A	560950	4914876	485	Seep Channel Flow - East of Existing Quarry below Escarpment, Seep feeding small stream channel	Stream Channel Flow					
SW22C	560800	4914701	477	Channel Flow - East of Existing Quarry below Escarpment, Stream collection channel flow below SW22A AND SW22B						
Dewatering Sump (Existing Quarry Floor / Expansion Qua	559810	4914310	500.0	Existing Quarry Sump beside crusher and / or Expansion Quarry sump						
SW7	560196	4915307	512	Channel Flow - Northeast corner Expansion Quarry, Dug cow pond overflow outlet	Stream Channel Flow					
SW8	560343	4915276	510	Channel Flow - East of Expansion Quarry, Walker buffer lands, dug pond overflow outlet	Bucket Capture of Flow out of partial culvert					
SW11E	561219	4915760	435	Escarpment Stream Channel - Northeast of Expansion Quarry below Escarpment, Downstream from SW11 and just upstream from discharge into on-line pond	Stream Channel Flow					
NW1	nd	nd	nd	New Monitor - Expansion Quarry, Southern boundary eastern section, To be installed prior to extraction						
NW2	nd	nd	nd	New Monitor - Expansion Quarry, East-central section, To be installed prior to extraction						
NW3	nd	nd	nd	New Monitor - Expansion Quarry, Northeast limit of extraction, To be installed prior to extraction						
NW4	nd	nd	nd	New Monitor - Expansion Quarry, Central section, To be installed prior to extraction						
NW5	nd	nd	nd	New Monitor - Expansion Quarry, North-central section, To be installed prior to extraction						
NW6	nd	nd	nd	New Monitor - North of Expansion Quarry, Walker buffer lands, In AHTF Northern Peninsula, To be installed prior to extraction						
NW7	nd	nd	nd	New Monitor - Expansion Quarry, South-central section, To be installed prior to extraction						
NW8	nd	nd	nd	New Monitor - Expansion Quarry, West-central section, To be installed prior to extraction						
NW9	nd	nd	nd	New Monitor - Expansion Quarry, West limit of extraction southwest corner, To be installed prior to extraction						
IW1	nd	nd	nd	al Purpose Injection Test Well and Monitoring Well - East of Expansion Quarry, Southeast corner Walker buffer lands, To be installed within two years of extrac						
IW2	nd	nd	nd	al Purpose Injection Test Well and Monitoring Well - East of Expansion Quarry, Eastern boundary Walker buffer lands, To be installed within two years of extra						
IW3	nd	nd	nd	Purpose Injection Test Well and Monitoring Well - Northeast of Expansion Quarry, Eastern boundary Walker buffer lands, To be installed within two years of ex						
IW4	nd	nd	nd	Purpose Injection Test Well and Monitoring Well - Northeast of Expansion Quarry, Northeast corner Walker buffer lands, To be installed within two years of ext						
NW10	nd	nd	nd	New Monitor Nest - North of Expansion Quarry, Walker buffer lands west of RR2 and east of Grey County Rd 31, To be installed within two years of extraction						
Upgrade BH02-5	nd	nd	nd	Two New Monitors at BH02-5 Location - Expansion Quarry north-central limit of extraction, To be installed prior to extraction						
Upgrade BH03-7	nd	nd	nd	Monitor at BH03-7 Location - North of Expansion Quarry, Walker buffer lands, South-central section RR2 Wetland on Old Mail Road, To be installed prior to ex						
DP11	nd	nd	nd	New Drive Point Monitor - Northwest of Expansion Quarry, RR3 Wetland Dug Pond Drive Point Monitor, To be installed prior to extraction						
SW3C	nd	nd	nd	Northwest of Expansion Quarry, West of Grey County Rd 31, RR3 Wetland Dug Pond Outlet Channel, - To be installed prior to extraction						
RW10	nd	nd	nd	Residential (spring) Well - North of Expansion Quarryat Escarpment, North side 26/27 Sideroad						
RW12	561821	4958180	Not surveyed	Residential (Dug) Well - East of Expansion Quarry below Escarpment, on County Road 91 east of Concession 10, north well						
RW13	561821	4958180	Not surveyed	Residential (Dug) Well - East of Expansion Quarry below Escarpment, on County Road 91 east of Concession 10, south well						
RW11	nd	nd	nd	Residential Well - Southeast of Existing Quarry below Escarpment, Concession 10 south of County Rd 91						

Table 4.2: Long Term Trend Monitoring Program Parameters

TABLE 4.2-

Long Term Trend Monitoring Program Parameters

Monitoring Stations by Location	Datalogger				Field Parameters								Sampling for Lab Analysis				
	Download Frequency	Groundwater Level	Ponded Water Depth	Water Level Stage (Stream Flow) and Temperature	Ground Water Level (inside Monitor)	Ponded Water Depth	Stream Flow	Stream Flow Measurement Type	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Counductivity (µS/cm)	General Chemistry (Alkalinity, Hardness, Colour, Amonia)	Major and Minor Ion Constituents & Nutrients	Total Petroleum Hydrocarbons and BETX	Total Suspended Solids	Bacteriological Count (E.coli, Total coliform, Heterotrophic plate count)
BH02-1	Monthly	Hourly			Monthly												
BH02-2					Monthly												
BH02-3					Monthly												
BH02-4	Monthly	Hourly			Monthly												
BH02-5					Monthly												
BH02-6					Monthly												
BH03-7-I					Monthly												
BH03-7-II	Monthly	Hourly			Monthly												
BH03-7 SG1						Monthly			Monthly								
BH03-7 SG2						Monthly			Monthly								
BH03-8	Monthly	Hourly			Monthly												
BH03-9					Monthly												
BRIDSON DP	Monthly	Twice Daily			Monthly												
TW04-1					Monthly												
TW04-2					Monthly												
TW04-3					Monthly												
DP5	Monthly	Twice Daily			Monthly												
DP6	Monthly	Twice Daily			Monthly												
BH08-1	Monthly	Hourly			Monthly												
BH08-2					Monthly												
BH08-3					Monthly												
98-8					Monthly												
98-9					Monthly												
98-12					Monthly												
QFSW2							Weekly	V	1. Quarterly 2. Annually	Quarterly	Quarterly		Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
DP1					Monthly												
DP2	Monthly	Twice Daily			Monthly												
DP3					Monthly												
DP4					Monthly												
PW99-1					Monthly												
RW20					Monthly												
101-B					Monthly												
102-C					Monthly												
103-D					Monthly												
104-A					Monthly												
OW1-4					Monthly												
OW3-1					Monthly												
OW5-2					Monthly												
OW6-3					Monthly												
DP7					Monthly												
DP8					Monthly												
DP9					Monthly												
SW10	Monthly			Hourly				V,M,E									
Bridson DP	Monthly	Twice Daily			Monthly												
CLF1					Monthly												
CLF2					Monthly												
CLF3					Monthly												
CLF4					Monthly												
CLF5					Monthly												
RW8					Monthly												
RW16	Monthly	Hourly			Monthly												

TABLE 4.2-

Long Term Trend Monitoring Program Parameters

Monitoring Stations by Location	Datalogger				Field Parameters								Sampling for Lab Analysis				
	Download Frequency	Groundwater Level	Ponded Water Depth	Water Level Stage (Stream Flow) and Temperature	Ground Water Level (inside Monitor)	Ponded Water Depth	Stream Flow	Stream Flow Measurement Type	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	General Chemistry (Alkalinity, Hardness, Colour, Amonia)	Major and Minor Ion Constituents & Nutrients	Total Petroleum Hydrocarbons and BETX	Total Suspended Solids	Bacteriological Count (E.coli, Total coliform, Heterotrophic plate count)
RW1	Monthly	Twice Daily			Monthly				Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually
RW2	Monthly	Twice Daily			Monthly				Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually
RW9					Monthly												
RW17					Monthly												
RW18					Monthly												
RW19					Monthly												
RW6					Monthly												
RW7					Monthly												
RW5					Monthly												
RW3					Monthly												
RW4					Monthly												
SW13							Monthly	V,E,B	Monthly								
SW19							Monthly	V	Monthly								
SW20							Monthly	V,E	Monthly								
SW21							Monthly	V,E,B	Monthly								
SW21A							Monthly	Visual	Monthly								
SW21B							Monthly	Visual	Monthly								
SW21C	Monthly			Hourly				V,E	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually
SW22							Monthly	V,B	Monthly								
SW22A							Monthly	B,E	Monthly								
SW22C							Monthly	E	Monthly								
Dewatering Sump (Existing Quarry Floor / Expansion Quarry)								Visual	Quarterly	Quarterly	Quarterly		Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
SW7							Monthly	V,E	Monthly								
SW8							Monthly	V,E	Monthly								
SW11E	Monthly			Hourly				V									
NW1	Monthly	Hourly			Monthly												
NW2	Monthly	Hourly			Monthly												
NW3	Monthly	Hourly			Monthly												
NW4	Monthly	Hourly			Monthly												
NW5	Monthly	Hourly			Monthly												
NW6	Monthly	Hourly			Monthly												
NW7	Monthly	Hourly			Monthly												
NW8	Monthly	Hourly			Monthly												
NW9	Monthly	Hourly			Monthly												
IW1	Monthly	Twice Daily			Monthly												
IW2	Monthly	Twice Daily			Monthly												
IW3	Monthly	Twice Daily			Monthly												
IW4	Monthly	Twice Daily			Monthly												
NW10	Monthly	Twice Daily			Monthly												
Upgrade BH02-5					Monthly												
Upgrade BH03-7					Monthly												
DP11	Monthly	Twice Daily			Monthly												
SW3C							1. Weekly (until stage discharge) 2. Monthly (after stage discharge)		1. Weekly (until stage discharge) 2. Monthly (after stage discharge)								
RW10					Not Monitored												
RW12					Not Monitored												
RW13					Not Monitored												
RW11					Not Monitored												

Table 4.3: Groundwater Monitor Details Proposed Long Term Monitoring Program

TABLE 4.3
GROUNDWATER MONITOR DETAILS PROPOSED LONG TERM MONITORING PROGRAM
DUNTROON QUARRY EXPANSION PROPERTY - LONG TERM TREND MONITORING PROGRAM
04 930521.52

DESIGNATION	NAD 27 NORTHING	NAD 27 EASTING	TYPE	DIAMETER (mm)	MEASURING POINT ELEVATION (m ASL)	GROUND ELEVATION (m ASL)	SCREENED INTERVAL (m ASL or Depth)	GEOLOGIC FORMATION MONITORED
DUNTROON EXPANSION LANDS MONITORS								
BH02-1	4915021	560321	O	102	523.3	522.6	Open Hole 39.5 m	Amabel/Fossil Hill
BH02-2	4915314	559904	O	102	523.2	522.5	Open Hole 39.5 m	Amabel/Fossil Hill
BH02-3	4915082	559869	O	102	530.6	529.7	Open Hole 12.0 m	Amabel/Fossil Hill
BH02-4	4915100	559862	O	102	530.7	530.0	Open Hole 50.1 m	Amabel/Fossil Hill
BH02-5	4915356	559577	O	102	513.9	513.2	Open Hole 31.9 m	Amabel/Fossil Hill
BH02-6	4914782	559692	O	102	530.3	529.5	Open Hole 48.5 m	Amabel/Fossil Hill
BH03-7-I	4915281	559331	O	102	511.0	510.3	502.9 - 501.1	Amabel
BH03-7-II	4915283	559331	O	102	511.0	510.3	508.7 - 504.8	Overburden
BH03-8	4915099	558963	O	102	520.8	520.2	Open Hole 37.9 m	Amabel/Fossil Hill
BH03-9	4914674	559088	O	102	518.9	518.5	Open Hole 39.5 m	Amabel/Fossil Hill
BRIDSON DP	4915303	560360	S	38	511.3	510.4	509.6 - 508.8	Overburden
TW04-1	4914910	559084	O	152	517.5	517.1	Open Hole 34.1	Amabel/Fossil Hill
TW04-2	4914934	559082	O	152	518.1	517.5	Open Hole 34.1	Amabel/Fossil Hill
TW04-3	4914909	559098	O	152	518.6	518.0	Open Hole 37.5	Amabel/Fossil Hill
DP5	4915559	559086	S	51	510.5	509.7	509.57 - 508.67	Overburden
DP6	4915513	559774	S	51	512.2	511.5	510.96 - 510.06	Overburden
BH08-1	4915197	560471	O	102	512.3	511.5	Open Hole 27.4	Amabel/Fossil Hill
BH08-2	4915175	560484	O	102	512.0	511.2	Open Hole 25.8	Amabel/Fossil Hill
BH08-3	4915198	560447	O	102	513.4	512.6	Open Hole 28.8	Amabel/Fossil Hill

Note:

- O indicates Open Hole Monitor
- DW indicates Domestic Well
- S indicates Standpipe Monitor
- R indicates Replacement Monitor
- ND indicates Not Determined
- N/A indicates information not available

TABLE 4.3
GROUNDWATER MONITOR DETAILS PROPOSED LONG TERM MONITORING PROGRAM
DUNTROON QUARRY EXPANSION PROPERTY - LONG TERM TREND MONITORING PROGRAM
04 930521.52

DESIGNATION	NAD 27 NORTHING	NAD 27 EASTING	TYPE	DIAMETER (mm)	MEASURING POINT ELEVATION (m ASL)	GROUND ELEVATION (m ASL)	SCREENED INTERVAL (m ASL or Depth)	GEOLOGIC FORMATION MONITORED
DUNTROON EXPANSION LANDS MONITORS (CONT)								
DP7	TBD	TBD						Overburden
DP8	TBD	TBD						Overburden
DP9	TBD	TBD						Overburden
DP10	TBD	TBD						Overburden
DP11	TBD	TBD						Overburden
NW1	TBD	TBD						
NW2	TBD	TBD						
NW3	TBD	TBD						
NW4	TBD	TBD						
NW5	TBD	TBD						
NW6	TBD	TBD						
NW7	TBD	TBD						
NW8	TBD	TBD						
NW9	TBD	TBD						
NW10	TBD	TBD						
IW1	TBD	TBD						
IW2	TBD	TBD						
IW3	TBD	TBD						
IW4	TBD	TBD						
UGRADE BH02-5	TBD	TBD						
UPGRADE BH03-7	TBD	TBD						

Note:

- O indicates Open Hole Monitor
- DW indicates Domestic Well
- S indicates Standpipe Monitor
- R indicates Replacement Monitor
- ND indicates Not Determined
- N/A indicates information not available

TABLE 4.3
GROUNDWATER MONITOR DETAILS PROPOSED LONG TERM MONITORING PROGRAM
DUNTROON QUARRY EXPANSION PROPERTY - LONG TERM TREND MONITORING PROGRAM
04 930521.52

DESIGNATION	NAD 27 NORTHING	NAD 27 EASTING	TYPE	DIAMETER (mm)	MEASURING POINT ELEVATION (m ASL)	GROUND ELEVATION (m ASL)	SCREENED INTERVAL (m ASL or Depth)	GEOLOGIC FORMATION MONITORED
DUNTROON EXISTING QUARRY MONITORS								
98-8	4914120	559613	O	102	517.3	516.5	Open Hole 35.1 m	Amabel/Fossil Hill
98-9	4914583	559358	O	102	526.4	525.9	Open Hole 48.5 m	Amabel/Fossil Hill
98-11	4914574	560010	O	102	522.6	522.2	Open Hole 41.2 m	Amabel/Fossil Hill
98-12	4914863	560341	O	102	527.2	526.7	Open Hole 42.4 m	Amabel/Fossil Hill
DP1	4914116	559465	S	51	513.1	511.8	511.3 - 510.8	Overburden
DP2	4914373	559287	S	51	512.9	512.1	511.3 - 510.8	Overburden
DP3	4914013	560290	S	51	514.7	513.6	511.9 - 511.4	Overburden
DP4	4914013	559067	S	51	512.1	511.4	510.4 - 509.9	Overburden
E2	4914561	559937						Removed by Quarry
MW6	4914673	559635	O	102	534.9	533.6	Open Hole 36.4 m	Amabel
PW99-1	4914157	559609	O	152	514.0	513.9	Open Hole 32.9 m	Amabel/Fossil Hill
RW15	4915096	560251	O	102	529.4	528.7	Open Hole 14.6m	Amabel
OSPREY QUARRY PROPERTY MONITORS								
101-B	4913891	557900	O	152	503.0	Not surveyed	Open Hole 6.1 m	Amabel
102-C	4914250	558331	O	102	511.4	Not surveyed	Open Hole 7.0 m	Amabel
103-D	4913962	558506	O	152	513.4	Not surveyed	Open Hole 7.9 m	Amabel
104-A	4913796	558198	O	152	517.7	Not surveyed	Open Hole 9.6 m	Amabel
OW1-4	4914034	558465	O	102	514.4	Not surveyed	Open Hole 28.6 m	Amabel/Fossil Hill
OW3-1	4913737	558085	O	102	508.8	Not surveyed	Open Hole 29.3 m	Amabel/Fossil Hill
OW5-2	4914015	557876	O	102	504.2	Not surveyed	Open Hole 27.9 m	Amabel/Fossil Hill
OW6-3	4914244	558346	O	102	511.1	Not surveyed	Open Hole 5.3 m	Amabel

Note:

- O indicates Open Hole Monitor
- DW indicates Domestic Well
- S indicates Standpipe Monitor
- R indicates Replacement Monitor
- ND indicates Not Determined
- N/A indicates information not available

TABLE 4.3
GROUNDWATER MONITOR DETAILS PROPOSED LONG TERM MONITORING PROGRAM
DUNTROON QUARRY EXPANSION PROPERTY - LONG TERM TREND MONITORING PROGRAM
04 930521.52

DESIGNATION	NAD 27 NORTHING	NAD 27 EASTING	TYPE	DIAMETER (mm)	MEASURING POINT ELEVATION (m ASL)	GROUND ELEVATION (m ASL)	SCREENED INTERVAL (m ASL or Depth)	GEOLOGIC FORMATION MONITORED
CARMARTHEN LAKE FARMS MONITORS								
CLF1	4913728	559343	DW	152	521.1	520.8	Open Hole 36.6 m	Amabel/Fossil Hill
CLF2	4913713	559284	DW	152	519.2	519.6	Open Hole 49.4 m	Amabel/Fossil Hill
CLF3	4912910	559144	DW	152	517.6	517.1	Open Hole ND	Amabel
CLF4	4913050	559369	DW	152	510.0	509.5	Open Hole 15.2 m	Amabel
CLF5	4913128	559517	DW	152	509.2	508.8	Open Hole ND	Amabel
RESIDENTIAL WELLS								
RW8	4916820	560662	DW	Dug 750	431.0	431.0	Depth: 3.5 m	Overburden
RW14	4914844	560194	DW	Drilled 152	529.7	529.2	Depth: 24.4 m	Amabel
RW16	4915178	560459	DW	Drilled 152	514.0	514.0	Depth: 16.2 m	Amabel
RW1	4915265	560619	DW	Drilled 152	509.1	509.1	Depth: 16.1 m	Amabel
RW2	4915112	560930	DW	Drilled 152	505.2	504.5	Depth: 29.0 m	Amabel
RW9	4914687	558916	DW	Drilled 152	524.0	524.0	Depth: 27.4 m	Amabel
RW17	4915446	558987	DW	Drilled 127	Not Surveyed	Not surveyed	Depth: 8.5 m	N/A
RW18	4915299	560150	DW	Dug 1000	513.8	513.0	Depth: 2.7 m	Overburden/Amabel
RW19	4915355	560221	DW	Drilled 152	Not Surveyed	Not Surveyed	Depth: 36.3 m	Amabel
RW6	4914852	561652	DW	Dug 800	451.0	451.0	Depth: 8.2 m	Overburden
RW7	4914725	561691	DW	Drilled 152	453.0	452.3	Depth: 10.1 m	Overburden/Shale
RW5	4915152	561404	DW	Drilled 152	478.6	478.0	Depth: 35.0 m	Manitoulin/Shale
RW3	4915977	559243	DW	Drilled 152	519.0	518.7	Depth: 16.5 m	Amabel
RW12	4958180	561821	DW	Dug	Not Surveyed	Not surveyed	N/A	Overburden
RW13	4958180	561821	DW	Dug	Not Surveyed	Not surveyed	N/A	Overburden
RW4	4915918	559593	DW	Drilled 152	510.5	509.8	Depth: 55.5 m	Amabel/Fossil Hill/ Cabot Head/Manitoulin
RW10								Amabel
RW11								Overburden
RW20								Amabel

Note:

- O indicates Open Hole Monitor
- DW indicates Domestic Well
- S indicates Standpipe Monitor
- R indicates Replacement Monitor
- ND indicates Not Determined
- N/A indicates information not available

Table 4.4:
30 Year Normal 1971-2000 Water Budget Thornbury Slama Climatological Station

TABLE 4.4
30 YEAR NORMAL 1971-2000 WATER BUDGET
THORNBURY SLAMA CLIMATOLOGICAL STATION

Month	Mean Temperature (°C)	Total Precipitation (mm)	Calculated Snow Melt (mm)	Pot. E (mm)	Act. E (mm)	WHC (mm)	Calculated Surplus (mm)	Calculated Deficit (mm)
JANUARY	-6.6	94.2	29.0	1.0	1.0	146.0	46.0	0.0
FEBRUARY	-6.1	63.8	42.0	2.0	2.0	150.0	53.0	0.0
MARCH	-1.6	63.5	86.0	8.0	8.0	150.0	117.0	0.0
APRIL	5.2	62.4	37.0	30.0	30.0	149.0	67.0	0.0
MAY	11.5	70.6	0.0	72.0	72.0	133.0	14.0	0.0
JUNE	16.6	75.7	0.0	106.0	105.0	101.0	2.0	0.0
JULY	19.7	80.9	0.0	128.0	121.0	58.0	3.0	7.0
AUGUST	19.0	85.8	0.0	114.0	103.0	41.0	0.0	11.0
SEPTEMBER	15.1	94.0	0.0	78.0	72.0	58.0	5.0	6.0
OCTOBER	9.0	81.0	0.0	42.0	40.0	93.0	6.0	2.0
NOVEMBER	2.9	97.2	12.0	14.0	14.0	137.0	33.0	0.0
DECEMBER	-3.1	97.0	25.0	3.0	3.0	146.0	42.0	0.0
TOTAL	**6.8**	**966.1**	**231.0**	**598.0**	**571.0**			
						SURPLUS:	**395.1**	**mm**

NOTES:

- Mean Temperature and Total Precipitation Data as reported by Environment Canada
- Calculated Snow Melt as calculated by Environment Canada
- Pot. E - Potential Evapotranspiration as calculated by Environment Canada
- Act. E - Actual Evapotranspiration as calculated by Environment Canada
- WHC - Water Holding Capacity as calculated by Environment Canada
- Calculated Surplus and Deficit as calculated by Environment Canada
- Data from the Thornbury Slama Climatological Station located at 44°34'N 80°29'W/O, 213m

Table 4.5:
2010 Water Budget
Shanty Bay Climatological Station

TABLE 4.5
2010 WATER BUDGET
SHANTY BAY CLIMATOLOGICAL STATION

Month	Mean Temperature (°C)	Total Precipitation (mm)	Calculated Snow Melt (mm)	Pot. E (mm)	Act. E (mm)	WHC (mm)	Calculated Surplus (mm)	Calculated Deficit (mm)
JANUARY	-7.2	46.3	25.3	0.5	0.5	150.0	44.0	0.0
FEBRUARY	-5.8	41.1	0.0	0.0	0.0	150.0	5.4	0.0
MARCH	3.0	30.5	48.4	17.3	17.3	150.0	61.6	0.0
APRIL	9.6	27.3	0.0	51.4	51.4	125.9	0.0	0.0
MAY	14.9	102.4	0.0	94.0	94.0	134.3	0.0	0.0
JUNE	17.6	169.9	0.0	112.2	112.2	150.0	41.9	0.0
JULY	21.8	97.8	0.0	141.8	141.8	106.0	0.0	0.0
AUGUST	21.1	84.2	0.0	126.4	126.4	63.7	0.0	0.0
SEPTEMBER	15.4	123.5	0.0	79.1	79.1	108.1	0.0	0.0
OCTOBER	9.3	64.1	0.0	42.1	42.1	130.1	0.0	0.0
NOVEMBER	3.2	52.8	3.3	12.3	12.3	150.0	20.6	0.0
DECEMBER	-5.5	104.0	93.0	0.8	0.8	150.0	98.5	0.0
TOTAL	**8.1**	**943.9**	**170.0**	**678.1**	**678.1**			
						SURPLUS:	**265.8**	**mm**

NOTES:

- Pot. E - Potential Evapotranspiration
- Act. E - Actual Evapotranspiration
- WHC - Water Holding Capacity
- Data from the Shanty Bay Climatological Station located at 44°24'N 79°37.8'W/O, 250.0m

Table 7.1: Long Term Ecological Monitoring Schedule

Table 7.1: Long Term Ecological Monitoring Schedule

Feature / Location	Operational Prompt		Frequency	
	Quarry Startup	New Quarry Phase	Annual	Quarry Life
FISHERIES**				
Beaver River				
SW1 to SW02	A	B	C1	D, E
SW6A	A	B	C1	D, E
Pretty River				
SW16 to SW17	A	B	C1	D
Control Site	A	B	C1	D
Batteaux Creek				
SW14 and SW15	A	B	C1	D
Control Site	A	B	C1	D
WETLANDS – VEGETATION				
Rob Roy Swamp PSW Complex				
Unit RR 2 transect to DP5	A	B	C1	D
Unit RR 2 transect to DP7	A	B	C1	D
Unit RR3 transect to DP10	A	B	C1	D
Unit RR 6 transect to DP2, west of quarry DP4, west of Grey Road 31	A	B	C1	D
ANSI Wetland				
Unit A transect to DP6	A	B	C1	D
Unit B transect to Bridson DP	A	B	C1	D
WETLANDS – WILDLIFE				
Rob Roy Swamp PSW Complex				
RR 2 DP5 and DP7	A	B	C2, C3	D
RR 6 near DP4	A	B	C2	D
ANSI Wetlands				
ANSI wetland A at DP6	A	B	C2, C3	D
ANSI wetland B at Bridson DP	A	B	C2	D
Butternut				
Areas outside Phase 3B proposed for clearing	NA	Prior to any forest clearing	Once	
Retainable trees inside Phase 3B	NA	Prior to any quarry activity in Phase 2B	As often as needed	
American Hart's-tongue Fern (AHTF)				
Northern Peninsula Occurrence	A	NA	C4	

MONITORING PROGRAM SCHEDULE:
A = At quarry start-up – Phase 1 baseline monitoring.
B = At any major Shifts in water mitigation practices, and at Regular Intervals – as specified in C.
C1 = One survey per monitoring year (Aug/early Sep).
C2 = Three surveys per monitoring year in spring, as per the Marsh Monitoring Program (CWS, 2005).
C3 = One survey per monitoring year (early spring); post-vernal pool salamander breeding activity survey.
C4 = Every 3 years after quarry start-up.
D = Baseline (start-up to 3 years); Major Shifts (one monitoring event /year following a major shift in water mitigation); and Every 5 Years (regular intervals for life of quarry).
E = Discontinue fisheries monitoring on Beaver River once MAQ Highland Quarry goes below water table; transfer monitoring responsibility from Walker to MAQ.
NA= Not Applicable

Appendix C: Reporting and Updating Requirements

Appendix C: Reporting and Updating Requirements

Annual Summary Report

A consolidated summary report documenting the observations from each of the monitoring programs will be prepared each year to cover the period of January 1 to December 31. The annual report will be submitted to MNR with copies provided to MOE, Conservation Authorities, the Township of Clearview and will be posted on Walker Aggregates' website by March 31 of each year, and will generally include:

- Integration of information in a comprehensive annual report with respect to the operations of the Expansion Quarry;
- Documentation of monitoring and results;
- Comparison of monitoring results to performance indicator triggers;
- Documentation of mitigation undertaken and the results of that mitigation;
- Documentation of investigations into environmental changes that were not related to the effects of the Expansion Quarry;
- Recommendations for modifying performance indicator triggers and/or mitigation as, and if, required;
- Recommendations for modifying the Adaptive Management Plan, if warranted; and
- A summary of the overall state of the environment (water resources, associated natural heritage features and environmental enhancements) surrounding the Expansion Quarry.

Modifications may be made to the structure and/or the content of the annual summary report to properly reflect the current monitoring programs, in consultation with the MNR.

Outline of Annual Summary Report

1 INTRODUCTION
- 1.1 The Site
- 1.2 Monitoring Requirements
- 1.3 Coordinated Monitoring Report
- 1.4 Watershed Aggregate Activities
  - 1.4.1 Duntroon Expansion Quarry
  - 1.4.2 Duntroon Existing Quarry
  - 1.4.3 Other Extraction Operations
    - 1.4.3.1 MAQ Aggregates Highland Quarry
    - 1.4.3.2 Other
- 1.5 Monitoring Program Contact Names
- 1.6 Other Activities in Local Watersheds

6 ECOLOGICAL ENHANCEMENT AND MITIGATION MONITORING PROGRAM
- 6.1 Methods
  - 6.1.2 Woodland Program
  - 6.1.3 Millar Pond Relocation
  - 6.1.4 Bridson Pond Enhancement
  - 6.1.5 Management of Butternut Trees
- 6.2 Monitoring Results
  - 6.2.1 Forest Restoration
  - 6.2.2 Millar Pond Relocation
  - 6.2.3 Bridson Pond Enhancement
- 6.3 Conclusions and Recommendations

7 OPERATIONS IMPROVEMENT WORKSHOP FOR PREVIOUS YEAR

8 SUMMARY CONCLUSIONS AND RECOMMENDATIONS

9 LIST OF FIGURES

- LIST OF APPENDICES
  - TECHNICAL APPENDIX A: PERFORMANCE INDICATOR MONITORING PROGRAM RESULTS
  - TECHNICAL APPENDIX B – LONG TERM TREND GROUNDWATER AND SURFACE WATER MONITORING PROGRAM RESULTS
  - TECHNICAL APPENDIX C – LONG TERM TREND ECOLOGICAL MONITORING PROGRAM RESULTS
  - TECHNICAL APPENDIX D – ECOLOGICAL ENHANCEMENT AND MITIGATION MONITORING PROGRAM RESULTS

5-Year Comprehensive Review Report

A 5-Year Comprehensive Review Report will be completed on a five-year cycle, and will include:

- A comparison of monitoring results with model predictions;
- Updates and recalibrations of the groundwater model;
- Updated impact predictions; and
- Recommendations regarding the effectiveness of specific performance indicator triggers, monitoring results, mitigation measures and quarry operations.

A 5-Year Comprehensive Review Report will include the following items. This list may be modified during the annual review.

Outline of 5-Year Comprehensive Review Report

1. INTRODUCTION
    - 1.1. The Site
    - 1.2. Monitoring Requirements
    - 1.3. Annual Coordinated Monitoring Reports
    - 1.4. Watershed Aggregate Activities
        - 1.4.1. Duntroon Expansion Quarry
        - 1.4.2. Duntroon Existing Quarry
        - 1.4.3. Other Extraction Operations
            - 1.4.3.1. MAQ Aggregates Highland Quarry
            - 1.4.3.2. Other
    - 1.5. Monitoring Program Contact Names
    - 1.6. Other Activities in Local Watersheds

2. CLIMATE DATA
    - 2.1. Air Temperature
    - 2.2. Precipitation
    - 2.3. Annual Water Budgets

3. BASELINE INFORMATION COLLECTED DURING 5-YEAR PERIOD
    - 3.1. Climate Data
    - 3.2. Hydrogeology
    - 3.3. Surface Water
    - 3.4. Natural Heritage

4. PERFORMANCE INDICATOR TRIGGER PROGRAM
    - 4.1. Comparison of Observed Monitoring Results with Previous Groundwater Model Predictions
    - 4.2. Groundwater Model Changes and Recalibration
    - 4.3. Impact predictions
    - 4.4. Need For Contingency Mitigation Measures
    - 4.5. Recommendations For Changes To Performance Indicator Trigger Program
    - 4.6. Development / Implementation of Long Term Performance Indicator Triggers

5. LONG TERM TREND GROUNDWATER AND SURFACE WATER MONITORING PROGRAM

6. LONG TERM TREND ECOLOGICAL MONITORING PROGRAM

7. ECOLOGICAL ENHANCEMENT AND MITIGATION MONITORING PROGRAM

8. CONCLUSIONS AND RECOMMENDATIONS

Performance Indicator Trigger Monitoring Program Yellow Zone and Red Zone Reporting

Yellow Zone

Entering a Yellow Zone condition requires an investigation to determine the cause. A summary report documenting the results of that investigation and, if appropriate, the mitigation measures implemented, shall be submitted to MNR, MOE, CAs and the Township within 30 days of entering a Yellow Zone condition.

Red Zone

Entering a Red Zone condition requires investigations to determine the cause of PITM deviation, or if such investigations are underway due to Yellow Zone, investigations are continued. A summary report to document the results of the investigations, the mitigation measures implemented and their results will be submitted to MNR, MOE, the CAs and the Township, once MNR is satisfied that one of the conditions required for extraction to re-commence has been met.

Appendix D:
MAQ Agreement

MONITORING AND MITIGATION COORDINATION AGREEMENT

THIS AGREEMENT made this 17th day of May, 2011.

BETWEEN:

WALKER AGGREGATES INC.

(hereinafter referred to as "Walker")

OF THE FIRST PART

-and -

M.A.Q. AGGREGATES INC.

(hereinafter referred to as "MAQ")

OF THE SECOND PART

-and -

DAVID ALLAN THOMPSON and JENNIFER SUSAN SPEAKMAN

(hereinafter referred to as "the Thompsons")

OF THE FOURTH PART

WHEREAS Walker has applied for a licence pursuant to the *Aggregate Resources Act* ("**ARA**") to expand its existing quarry ("**Walker Duntroon Quarry Expansion**") on to lands in the Township of Clearview, County of Simcoe, described on Schedule "A" attached hereto ("**Walker Lands**");

AND WHEREAS MAQ has applied for a licence pursuant to the *ARA* to operate a quarry ("**MAQ Highland Quarry**") on the lands in the Municipality of Grey Highlands, County of Grey, as described on Schedule "B" attached hereto ("**MAQ Lands**");

AND WHEREAS the portion of the MAQ Lands subject to this Agreement are currently owned by the Thompsons and will be owned by MAQ if an aggregate licence is issued to operate the MAQ Highland Quarry on the MAQ Lands;

AND WHEREAS the balance of the MAQ Lands are currently owned by Jim and Ann Kekanovich and will be owned by MAQ if an aggregate licence is issued to operate the MAQ Highland Quarry on the MAQ Lands;

AND WHEREAS Walker and MAQ recognize that development of the Walker Duntroon Quarry Expansion and MAQ Highland Quarry may, individually or jointly, affect the surrounding natural environment, including the northern tributary of the Beaver River;

AND WHEREAS Walker proposes an Adaptive Management Plan ("**Walker AMP**") as part of its application for a licence for the Walker Duntroon Quarry Expansion pursuant to the ARA;

AND WHEREAS MAQ proposes an Adaptive Management Plan ("**MAQ AMP**") as part of its application for a licence for the MAQ Highland Quarry pursuant to the ARA;

AND WHEREAS Walker and MAQ will each be required to obtain Permits to Take Water (each a "**PTTW**") and Certificates of Approval for Sewage Works (each a "**CofA**") in regard to their respective Quarries;

AND WHEREAS if the Walker Duntroon Quarry Expansion is approved, Walker will be the licencee under the *ARA* and the instrument holder for any PTTW or CofA issued in respect of the Walker Duntroon Quarry Expansion.

AND WHEREAS if the MAQ Highland Quarry is approved, MAQ will be the licencee under the *ARA* and the instrument holder for any PTTW or CofA issued in respect of the MAQ Highland Quarry.

AND WHEREAS the PTTWs, the CofAs and the AMPs will require monitoring of certain surface water and groundwater locations, and identify water management and contingency mitigation actions;

AND WHEREAS Walker and MAQ have agreed to use their best efforts to coordinate monitoring and mitigation actions where possible and appropriate;

NOW THEREFORE THIS AGREEMENT WITNESSETH THAT in consideration of the mutual covenants contained herein the parties covenant and agree as follows:

Interpretation

1. The Parties hereto acknowledge and agree that the recitals set out above are true and correct in all respects.

2. In this agreement:

   (a) "**Adaptive Management Plan**" or "**AMP**" means the MAQ AMP when discussing MAQ or the MAQ Highlands Quarry and the Walker AMP when discussing Walker or the Walker Duntroon Quarry Expansion.

   (b) "**AMP Threshold**" means when a performance indicator in the MAQ AMP or Walker AMP moves from:

      (i) the green zone to the yellow zone, or

(ii) the yellow zone to the red zone.

(c) "**Appropriate Mitigative Measures**" means any action by a Causal Operator that is required or desirable to respond to an AMP Threshold in an Impacted Operator's AMP that primarily results from operations at the other Operator's Quarry

(d) "**Compliance Report**" means any report required to be prepared by an Operator pursuant to the ARA, an AMP, a PTTW, or a CofA in respect of the such Operator's Quarry.

(e) "**Governmental Authority**" means any ministry, commission, board, or agency of the Province of Ontario that administers the ARA, an AMP, a PTTW, or a CofA, but does not include a municipality or the agencies, boards, or commissions of a municipality.

(f) "**Investigation Report**" means a report regarding the results of any investigation carried out by or on behalf of an Operator:

(i) in accordance with the provisions of a PTTW, CofA, or AMP, or

(ii) in response to a complaint from any person in respect of that Operator's quarry, including but not limited to a water supply interference complaint; or,

(iii) at the request of MNR under the authority of the ARA.

But does not include an investigation carried out by an operator for any other purpose, whether or not such other investigation is related to the Walker Duntroon Quarry Expansion or the MAQ Highlands Quarry.

(g) "**MAQ Monitoring Program**" means the surface water and groundwater monitoring required for the MAQ Highland Quarry pursuant to:

(i) The ARA, and

(ii) the MAQ AMP, and

(iii) a PTTW applicable to the MAQ Highland Quarry, and

(iv) a CofA applicable to the MAQ Highland Quarry

all as set out in Schedule "D", and as such monitoring requirements may be amended or modified from time to time by

(i) an MNR approved amendment to the ARA requirements for the MAQ Highland Quarry or the MAQ AMP, or

(ii) the requirements of a PTTW or CofA issued by MOE in respect of the MAQ Highland Quarry.

(h) "**Mitigation Measure**" means any groundwater or surface water related activity required to be undertaken pursuant to an AMP, PTTW, or CofA in order to minimize or eliminate impacts on natural heritage features from the operation of the MAQ Highlands Quarry or the Walker Duntroon Quarry Expansion.

(i) "**Monitoring Data**" includes the following information for each monitoring location:

(i) the parameter(s) measured;

(ii) the method used to measure each parameter;

(iii) the date and time of the measurement;

(iv) the person conducting the measurement,

(v) any comments or observations, such as weather conditions, made by the person conducting the measurement; and

(vi) for groundwater monitoring locations:

A. the water table relative to the measuring point;

B. the elevation of the measuring point in metres above sea level, and

C. the elevation of the groundwater level in metres above sea level.

(j) "**MNR**" means the Ontario Ministry of Natural Resources.

(k) "**MOE**" means the Ontario Ministry of the Environment.

(l) "**Walker Monitoring Program**" means the surface water and groundwater monitoring required for the Walker Duntroon Quarry Expansion pursuant to::

(i) The ARA, and

(ii) the Walker AMP, and

(iii) a PTTW applicable to the Walker Duntroon Quarry Expansion, and

(iv) a CofA applicable to the Walker Duntroon Quarry Expansion

all and set out in Schedule "C", and as such monitoring requirements may be amended or modified from time to time by:

(i) an MNR approved amendment to the ARA requirements for the Walker Duntroon Quarry Expansion or the Walker AMP, or

(ii) the requirements of a PTTW or CofA issued by MOE in respect of the Walker Duntroon Quarry Expansion.

(m) "**Operator**" means MAQ when discussing the MAQ Highlands Quarry and Walker when discussing the Walker Duntroon Quarry Expansion.

(n) "**Operator's Quarry**" means the MAQ Highlands Quarry when discussing MAQ and the Walker Duntroon Quarry Expansion when discussing Walker.

(o) "**Water Management and Mitigation Records**" means the dates, flow rates, daily volume, and discharge location of water pumped

(i) by an Operator to implement mitigation in accordance with the ARA an Operator's AMP, PTTW, or CofA;

(ii) from within the extraction area of a Quarry to a location outside of the extraction area of that Quarry, and

(iii) water that is pumped from the Walker Duntroon Quarry Expansion to Walker's existing quarry if such information is required to be recorded pursuant to the Walker AMP, a PTTW, or a CofA.

3. In this Agreement any reference to the requirements of the ARA regarding an Operator's Quarry includes the requirements of (i) any licence issued pursuant to the ARA for that Operator's Quarry, and (ii) any ARA site plan for that Operator's Quarry.

4. The approximate location of the monitoring stations for the MAQ Monitoring Program and Walker Monitoring Program are identified on Schedules "C" and "D". Exact monitoring locations will be established through the PTTWs, CofAs, and AMPs.

Walker Monitoring Program

5. Walker will undertake the Walker Monitoring Program in a timely and professional manner.

6. Walker acknowledges that it is conducting the Walker Monitoring Program, and will continue to conduct the Walker Monitoring Program until such time as:

(a) Walker has advised MAQ that it does not intend to proceed with the Walker Duntroon Quarry Expansion; or

(b) Walker has surrendered its licence for the Walker Duntroon Quarry Expansion.

7. Walker will provide MAQ with the Monitoring Data collected through the Walker Monitoring Program.

MAQ Monitoring Program

8. MAQ will undertake the MAQ Monitoring Program in a timely and professional manner.

9. MAQ acknowledges that is conducting the MAQ Monitoring Program, and will continue to conduct the MAQ Monitoring Program until such time as:

   (a) MAQ has advised Walker that it does not intend to proceed with the MAQ Highland Quarry; or

   (b) MAQ has surrendered its licence for the MAQ Highland Quarry.

10. MAQ will provide Walker with the Monitoring Data collected through the MAQ Monitoring Program.

Coordination of Monitoring Programs

11. Notwithstanding paragraphs 6 and 9 herein, if and when both the MAQ Highland Quarry and the Duntroon Quarry Expansion are licenced pursuant to the ARA and extraction commences:

   (a) Walker shall not be required to undertake the monitoring identified in Items # 2(i)(c)(iv)-(vi), 2(iii)(b)(ii), 2(iii)(c), 3(iv)(d), 3(v)(c)(iv), 3(vii)(c), (of the Walker Monitoring Program; and

   (b) MAQ shall not be required to undertake the monitoring identified in Items # 5, 6, 7, 8, 26, 27 of the MAQ Monitoring Program.

12. Walker and MAQ shall jointly agree on the date that the provisions of Paragraph 11 come into effect.

Access to Property

13. In the event that the Walker Monitoring Program is amended pursuant to the requirements of the ARA, the Walker AMP, a PTTW, or a CofA to include monitor locations on the MAQ Lands, MAQ, and the Thompsons hereby grant to Walker a right to enter upon the MAQ Lands for the purpose of conduction such monitoring.

14. In the event that the MAQ Monitoring Program is amended pursuant to the requirements of the ARA, the MAQ AMP, a PTTW, or a CofA to include monitor locations on the Walker Lands, Walker hereby grant to MAQ a right to enter upon the Walker Lands for the purpose of conduction such monitoring.

15. The parties hereby acknowledge and agree that the rights and obligations of paragraphs 13 and 14 are intended to be binding upon all future owners, occupiers, and tenants of the Walker Lands and MAQ Lands. In the event that either Walker, MAQ, or the Thompsons transfers, sells, leases, or disposes of all or a portion of the Walker lands or MAQ Lands to any other person (a "**Transferee of Land**"), then the party disposing of their lands shall, prior to effecting such transfer, sale, lease, or disposition:

(a) obtain an agreement from the Transferee of Land agreeing to be bound by the provisions of this Agreement and in particular the rights and obligations under this paragraph and paragraphs 13 or 14 as the case may be, and

(b) provide Walker and MAQ with a copy of the agreement referred to in paragraph 15(a).

16. Notice of this Agreement may be registered on title to the MAQ Lands and Walker Lands.

Change of Monitoring Locations

17. In the event that (i) MNR approves an amendment to the Walker AMP, the MAQ AMP, or the ARA requirements for either Operator's Quarry, or (ii) MOE approves an amendment to a PTTW or CofA applicable to either Operator's Quarry, and such amendment adds or removes monitoring locations from the Walker Monitoring Program or the MAQ Monitoring Program:

(a) No amendment is required to this Agreement, and the MAQ Monitoring Program or Walker Monitoring Program will automatically be modified for the purposes of this Agreement to be consistent with the monitoring requirements of the ARA or applicable AMP, PTTW or CofA as amended.

(b) An Operator who proposes to discontinue monitoring at any location, will provide the other Operator with 30 days prior written notice before ceasing monitoring at that location.

(c) The Operators may discuss where there are opportunities to coordinate monitoring of any additional monitoring locations that may be added to the monitoring required by the ARA, AMPs, PTTWs, or CofAs from time to time.

Coordination of AMP Response

18. In the event that either Operator receives a water supply interference complaint:

(a) the Operator receiving the complaint will inform the other Operator within 24 hours of learning of such an event;

(b) Walker shall be responsible for investigating and reporting on any water supply interference complaint east of Grey County Road 31/Simcoe Count Road 95; and

(c) MAQ shall be responsible for the cost of investigating and reporting on any water supply interference complaint west of Grey County Road 31/Simcoe County Road 95.

19. In the event that an Operator encounters an AMP Threshold:

(a) the Operator encountering the AMP Threshold will inform the other Operator within 24 hours of learning of such an event;

(b) the Operator encountering the AMP Threshold will independently investigate and report on such AMP Threshold in accordance with the requirements of that Operator's AMP; and

(c) the other Operator will independently investigate and report on such AMP Threshold if required by the provisions of that Operator's AMP.

20. In the event that a Mitigation Measure is required to be implemented as a result of an AMP Threshold, each Operator shall implement such Mitigation Measure(s) in accordance with the Operator's AMP.

21. Notwithstanding paragraph 20, where it is determined by one Operator (the "**Impacted Operator**") that it's AMP Threshold has been encountered primarily as a result of operations at the other Operator's Quarry (the "**Causal Operator**"), then:

(a) the Impacted Operator shall document its investigation and findings in an Investigation Report;

(b) the Causal Operator, after receiving the Investigation Report, shall forthwith implement Appropriate Mitigative Measures , and

(c) until such time as Appropriate Mitigative Measures are implemented:

(i) each Operator shall implement Mitigation Measures in accordance with its AMP, and

(ii) subject to paragraph 23, the Causal Operator shall be liable to the Impacted Operator for the reasonable cost of any Mitigation Measures implemented in accordance with subsection (i).

22. For the purposes of paragraph 21, in the event that there is disagreement between the Operators with respect to the cause of an AMP Threshold being encountered and whether there is a Causal Operator, the dispute shall be referred to the MNR, or the MOE if the disagreement pertains to a matter governed by a PTTW or CofA, to make a determination as to whether there is a Causal Operator (a "**Dispute Over Cause**") in accordance with the following:

(a) A Dispute Over Cause shall be referred to the MNR/MOE by the Operator alleged to be the Causal Operator within 10 days of receiving the Investigation Report from the Impacted Operator.

(b) The Operator referring a Dispute Over Cause to MNR/MOE shall:

(i) Provide the other Operator 48 hours written notice prior to referring a Dispute Over Cause to the MNR/MOE, and

(ii) Copy the other Operator on any correspondence referring a Dispute Over Cause to the MNR/MOE.

(c) If a Dispute Over Cause is not referred to the MNR/MOE within 10 days of the Operator alleged to be the Causal Operator receiving the Investigation Report, the Operator alleged to be the Causal Operator shall be deemed to be the Causal Operator.

(d) The Operators agree that the MNR/MOE may refer a Dispute Over Cause to a qualified independent third-party to resolve the matter, and the Operators shall each pay an equal proportion of all costs and expenses of retaining the independent third-party.

(e) The decision of the MNR/MOE or the independent third-party shall be final and binding upon the Operators.

(f) If MNR/MOE refuses to make a determination on a Dispute Over Cause or refer the matter to an independent third-party for a decision ("**Agency's Refusal**"), or if either Operator objects to the independent third-party selected by MNR/MOE, then the Operators shall arbitrate such Dispute Over Cause in accordance with the provisions of the *Arbitration Act* (Ontario).

(g) If arbitration required by paragraph 22(f)is not initiated with 10 days of both Operators being informed of the Agency's Refusal, then the Operator disputing that it is the Causal Operator shall be deemed to be the Causal Operator.

23. A party who is alleged to be a Causal Operator shall only be liable to the other Operator in accordance with paragraph 21(c)(ii) if:

(a) the party acknowledges they are the Causal Operator;

(b) the party is determined to be the Causal Operator in accordance with the provisions of paragraph 22, or

(c) the party is determined to be the Causal Operator in accordance with the procedures for resolving a Dispute Over Cause as set out in paragraph 22.

24. Neither Operator may commence any legal proceedings with respect to a Dispute Over Cause until the requirements of paragraph 22 have been complied with.

Limitation of Liability

25. The Operators acknowledge that notwithstanding that this Agreement provides for the coordination of certain activities, each Operator is solely responsible for compliance with the requirements of the ARA, or any AMP, PTTW, or CofA applicable to the Operator's Quarry, including but not limited to undertaking and completing:

(a) the Walker Monitoring Program or the MAQ Monitoring Program;

(b) any required investigations;

(c) any Investigation Reports,

(d) any Compliance Reports, or

(e) undertaking mitigation or remedial action.

26. Unless specifically provided for in this Agreement:

(a) Walker shall not be liable to MAQ for any reason relating to MAQ's failure to comply with the requirements of the ARA, the MAQ AMP, or any PTTW or CofA applicable to the MAQ Highland Quarry.

(b) MAQ and the Thompsons shall not be liable to Walker for any reason relating to Walker's failure to comply with the requirements of the ARA, the Walker AMP, or any PTTW or CofA applicable to the Walker Duntroon Quarry Expansion.

Exchange of Information

27. Monitoring Data provided by Walker and MAQ pursuant to paragraphs 7 and 10 shall:

(a) be subject to a quality assurance and quality control process by the Operator providing the Monitoring Data prior to providing the Monitoring Data to the other Operator;

(b) include a description of any action taken as a result of quality assurance or quality control of the Monitoring Data;

(c) be organized in a table format,

(d) be provided to the other Operator within 14 days of the monitoring being conducted; and

(e) be provided to the other Operator in a Microsoft Excel Workbook or similar digital format agreed to by the Parties.

28. Walker and MAQ will provide the other Operator one (1) digital copy of any Compliance Report or Investigation Report with in 2 days of the final report being provided to the applicable Governmental Authority, or if the report is not required to be submitted to a Governmental Authority, then within 5 days of the report being finalized.

29. Walker and MAQ will provide the other Operator with electronic copies of its Water Management and Mitigation Records. Water Management and Mitigation Records shall be provided:

(a) Monthly

(b) within 14 days of the last day in reporting period, and

(c) electronically in a Microsoft Excel Workbook or similar digital format agreed to by the Parties.

30. Neither Walker nor MAQ shall be liable to the other Operator as a result of any inaccuracy or error in the information exchanged pursuant to the provisions of this Agreement, and in particular paragraphs 7, 10, 28, 29, (a "**Data Error**") provided that the Data Error is not the result of an intentional misrepresentation by the Operator providing the information.

31. In the event that either Operator identifies a Data Error, the Operator who identified the Data Error will promptly notify the other Operator of the Data Error.

Confidentiality

32. MAQ and Walker agree not to disclosure the contents or existence of any information received from the other Operator pursuant to this Agreement to any other person or Governmental Authority, except:

(a) For disclosure for the purpose of enforcing the provisions of this Agreement,

(b) Disclosure required by Law, or

(c) Disclosure in accordance with the reporting requirements of the ARA, an AMP, a PTTW, or a CofA.

Except for the expense of enforcing this Agreement, nothing in this Agreement shall make one Operator financially liable to the other Operator for disclosure other than in accordance with the requirements of this paragraph.

Representation and Warranties

33. Walker hereby represents and warrants that:

(a) Walker is the current registered and beneficial owner of the Walker Lands;

(b) Walker will be the licencee with respect to any ARA licence issued for the Walker Duntroon Quarry Expansion;

(c) Walker will be the instrument holder with respect to any PTTW issued for the Duntroon Quarry Expansion;

(d) Walker will be the instrument holder with respect to any CofA issue for the Walker Duntroon Quarry Expansion; and

(e) Walker will be the operator of the Walker Duntroon Quarry Expansion.

34. MAQ hereby represents and warrants that:

(a) MAQ has an option to purchase the MAQ Lands from Kekanovich and the Thompsons if an ARA licence is granted for the MAQ Quarry (the "**Option to Purchase**");

(b) If Option to Purchase is exercised, MAQ will be the registered and beneficial owner of the MAQ Lands;

(c) MAQ will be the licencee with respect to any ARA licence issued for the MAQ Highland Quarry;

(d) MAQ will be the instrument holder with respect to any PTTW issued for the MAQ Highland Quarry;

(e) MAQ will be the instrument holder with respect to any CofA issue for the MAQ Highland Quarry; and

(f) MAQ will be the operator of the MAQ Highland Quarry.

35. The Thompsons hereby represent and warrant that:

(a) they are the current registered and beneficial owner of a portion of the MAQ Lands as identified on the attached Schedule "B"; and

(b) MAQ has the Option to Purchase that portion of the MAQ Lands currently owned by the Thompsons.

Termination

36. This Agreement may only be terminated in accordance with the provisions of this paragraph. Any party may terminate this agreement in accordance with the following:

(a) A party my terminate this Agreement for any reasons by providing the other party with 9 months prior written notice of date on which it is terminating this Agreement, or

(b) A party my terminate this Agreement by providing the other party 3 months prior written notice that it intends to discontinue its monitoring program in accordance with the provisions of paragraphs 6 or 9.

37. Notwithstanding the termination of this Agreement in accordance with paragraph 36, the following provisions shall continue in full force and effect:

(a) with respect to the obligations of an Operator: (i) paragraph 32 - Confidentiality, (ii) paragraphs 25 and 26- Limitation of Liability, (iii) paragraphs 13, 14, and 15 - Access to Property; and

(b) with respect to the obligations of the Thompsons: paragraphs 13 and 15 - Access to Property.

Transfer and Assignment

38. This Agreement is not assignable by Walker without the prior written consent of MAQ, which consent may be unreasonably and arbitrarily withheld.

39. This Agreement is not assignable by MAQ or the Thompsons without the prior written consent of Walker, which consent may be unreasonably and arbitrarily withheld.

40. Where a party wishes to assign its rights under this Agreement to another person, it shall obtain from that other person a binding undertaking in favour of the other parties, under which the other person undertakes to comply with all provisions of this Agreement as if it was an original signatory to it.

41. This Agreement shall enure to the benefit of the Parties hereto, their successors, and permitted assigns.

42. In the event that one Operator seeks to transfer any or all of the ARA licence, PTTW, or CofA pertaining to that Operator's Quarry (an "**Instrument Transfer**") to another person (the "**Instrument Transferee**"), then the Operator proposing the Instrument Transfer shall:

    (a) obtain from the Instrument Transferee, prior to effecting an Instrument Transfer, an agreement in favour of the other Operator under which the Instrument Transferee undertakes and agrees to comply with the provisions of this Agreement as if it was an original signatory to it;

    (b) provide the other Operator, prior to effecting an Instrument Transfer, with a copy of the agreement referred to in paragraph 42(a); and

    (c) until such time as the agreement referred to in paragraph 42(a) has been provided to the other Operator, the Operator proposing the Instrument Transfer shall be liable for any failure of the Instrument Transferee to comply with the provisions of this Agreement.

43. In the event that one Operator (the "**Current Operator**") arranges for another party (the "**New Operator**") to operate that Operator's Quarry, then the Current Operator shall:

    (a) inform the other Operator of the arrangement at least 30 days before the New Operator commences operating the Quarry on behalf of the Current Operator;

    (b) obtain from the New Operator an agreement in favour of the other Operator under which the New Operator undertakes and agrees to comply with the provisions of this Agreement as if it was an original signatory to it (an "**Assumption Agreement**"); and

    (c) until such time as the Assumption Agreement has been provided to the other Operator, the Current Operator shall be liable for any failure of the New Operator to comply with the provisions of this Agreement.

General

44. Except for an amendment to the Walker Monitoring Program or MAQ Monitoring Program required by the ARA, an AMP, a PTTW, or a CofA., no change or modification of this Agreement is valid unless it is in writing and signed by Walker and MAQ.

45. Any notice required to be given to another party in writing shall be given to the parties at the following addresses:

Walker Aggregates Inc.:

M.A.Q. Aggregates Inc.: 12905 Keele Street, King City, Ontario L7B 1H7

The Thompsons: 333 St. Clair Avenue East, Toronto, Ontario M4T 1P3

Any notice, correspondence, or report required to be delivered to Walker or MAQ pursuant to paragraphs 21, 22, or 36 shall be sent by registered mail.

46. Each party shall at any time and from time to time, upon each request by the other party, execute and deliver such further documents and do such further acts and things that the other party may reasonably request to evidence, carry out and give full effect to the terms, conditions, intent and meaning of this Agreement..

47. Agreement may be executed in counterparts and each of which when taken together shall constitute one and the same instrument.

IN WITNESS WHEREOF the parties hereto have hereunto set their hands and seals as of the date first above written.

WALKER AGGREGATES INC.

Per: _____

Name: ► Ken Thompson

Title: ► Vice President

I have authority to bind the company.

M.A.Q. AGGREGATES INC.

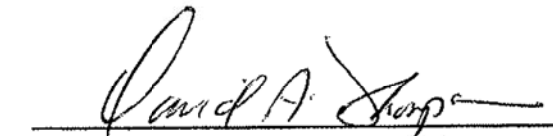
Per: _____
Name: Quinn Moyer
Title: President
I have authority to bind the company.

_____
DAVID ALLAN THOMPSON

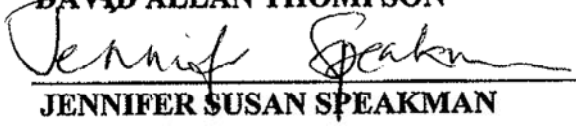
_____
JENNIFER SUSAN SPEAKMAN

M.A.Q. AGGREGATES INC.

Per: _____
Name: Quinn Moyer
Title: President
I have authority to bind the company.



DAVID ALLAN THOMPSON



JENNIFER SUSAN SPEAKMAN

SCHEDULE "A" - WALKER LANDS

Walker:

Firstly: East ½ Lot 26, Concession 12, Nottawasaga except Part 1 Plan 51R-25655 & RO1286766; Clearview, being all of PIN 58248-0015(LT)

Secondly: Part Lot 26, Concession 12, Nottawasaga being Part 1 on Plan 51R-25946; Clearview Being all of PIN 58248-0016(LT)

Thirdly: Part Lot 26, Concession 12, Nottawasaga being Part 2 on Plan 51R-25946; Clearview Being all of PIN 58248-0017(LT)

Fourthly: West ½ Lot 25, Concession 12, Nottawasaga except RO253293; s/t RO1100074; Clearview Being all of PIN 58248-0018(LT)

Fifthly: Part of Lot 25, Concession 12, Nottawasaga as in RO253293; Clearview Being all of PIN 58248-0020(LT)

Sixthly: East ½ Lot 25, Concession 12, Nottawasaga; Clearview Being all of PIN 58248-0021(LT)

Seventhly: Part of Lot 25, Concession 11, Nottawasaga being Part 1 on Plan 51R-4729; Clearview Being all of PIN 58248-0022(LT)

Eighthly: East ½ Lot 37, Concession 12, Osprey; Grey Highlands Being all of PIN 37257-0062(LT) Part Lot 19, Concession A, Osprey as in R354038; Grey Highlands Being all of PIN 37257-0122(LT)

SCHEDULE "B" - MAQ LANDS

Kekanovich:	Firstly: PIN 37257– 0120 (LT) – N ½ Lt 20 Con A Osprey – Grey Highlands
	Secondly: PIN 37257-0121(LT) – Pt Lot 20 Con A Osprey PT 1& 2 17R2619 – Grey Highlands
	Thirdly: PIN 37257-0118 (LT) – Pt Lot 20 Con A Osprey PT 1 & 2 17R2619 – Grey Highlands
The Thompsons:	PIN 37257-0117 (LT) Part Lot 21, Concession A, Osprey, being Part 2, Plan 16R-5541 County of Grey (Jennifer Susan Speakman)
	PIN 37257-0016 (LT) Part Lot 22, Concession A, Osprey, County of Grey (David Allan Thompson)

SCHEDULE "C" - WALKER MONITORING PROGRAM

1. GENERAL NOTES

(i) Groundwater and surface water monitoring shall be undertaken by a qualified person, as defined by the Ontario Ministry of the Environment, following contemporary industry standards.

(ii) Monitoring locations existing as of June 2010 are shown in Figure 2-1 of the *Water Resources Monitoring Program Summary Report (2008-2009)*, March 2010, GENIVAR Consultants LP.

(iii) New monitor installations and ecological monitoring stations identified below as "to be established" shall be installed and monitoring initiated after issuance of an ARA license.

(iv) Monitoring is subject to landowner permission for locations on private property.

2. PERFORMANCE INDICATOR TRIGGER MONITORING PROGRAM

(i) Surface Water Channel Flow and Temperature

a) Pretty River System

i) SW16;

ii) SW17;

iii) SW17A;

iv) SW18; and

v) Control Station (to be established).

b) Batteaux Creek System

i) SW9;

ii) SW14;

iii) SW15; and

iv) Control Station (to be established).

c) Beaver River System

i) SW1;

ii) SW2;

iii) SW3;

iv) SWO-2;

v) SW6A; and

vi) Rob Roy Swamp PSW Unit #3 at the karst sink-point channel (to be established).

d) Monitoring Frequency

i) Hourly water level and temperature measurements to be recorded by a datalogger installed at all stations identified in items (A) to (C) above.

ii) Monthly downloading of data from the datalogger installed at all stations identified in items (A) to (C) above. Measurement of field pH, temperature, electrical conductivity and dissolved oxygen.

iii) Quarterly measurement of streamflow as a check on stage-discharge relationships.

iv) Annually sample for water quality parameters including: pH, temperature, dissolved oxygen, specific conductance, alkalinity, hardness, colour, total suspended solids, major and minor ion constituents, nutrients, ammonia, total petroleum hydrocarbons and BTEX (benzene, toluene, ethylbenzene and xylene).

(ii) Surface Water Escarpment Springs

a) Pretty River System

i) SW21C;

ii) SW24A; and

iii) SW77.

b) Batteaux Creek System

i) SW10; and

ii) SW11 series of springs.

c) Monitoring Frequency

i) Bi-weekly monitoring during July and August for temperature and, as a minimum, a visual assessment of flow conditions (presence / absence). Manual measurement of flow when practical.

ii) Monthly monitoring during all other times of the year for temperature and, as a minimum, a visual assessment of flow conditions (presence / absence). Manual measurement of flow when practical.

iii) Annual monitoring at SW10 and SW21C (sources used as residential/ farm water supplies) for water quality for parameters including: pH, temperature, dissolved oxygen, specific conductance, alkalinity, hardness, colour, total suspended solids, major and minor ion constituents, nutrients, ammonia, total petroleum hydrocarbons and BTEX (benzene, toluene, ethylbenzene and xylene) and bacteriological content (E.coli, total coliform and heterotrophic plate count).

(iii) Wetland Water Levels

a) Rob Roy Swamp PSW Unit #2: Drivepoint Monitors

i) DP5; and

ii) DP7 (to be established).

b) Rob Roy Swamp PSW Unit #6: Drivepoint Monitors

i) DP2;

ii) DP4; and

iii) DP8 (to be established).

c) Rob Roy Swamp PSW Unit #3: Drivepoint Monitors

i) Thicket Swamp Drivepoint (to be established).

d) ANSI Wetland A: Drivepoint Monitor

i) DP6.

e) ANSI Wetland B: Drivepoint Monitors

i) Bridson DP; and

ii) DP9 (to be established).

f) Monitoring Frequency

i) Bi-Weekly monitoring during May, June and July for manual groundwater level (inside monitor) and ponded surface water level and temperature (outside monitor).

ii) Monthly monitoring during all other times of the year for manual groundwater level (inside monitor) and ponded surface water level and temperature (outside monitor)

iii) Quarterly monitoring of quarry sump discharge water for water quality parameters including: pH, temperature, dissolved oxygen, specific conductance, alkalinity, hardness, colour, total suspended solids, major

and minor ion constituents, nutrients, ammonia, total petroleum hydrocarbons and BTEX (benzene, toluene, ethylbenzene and xylene) and bacteriological content (E.coli, total coliform and heterotrophic plate count).

3. LONG-TERM TREND MONITORING PROGRAM

(i) Existing Duntroon Quarry Monitors

Monitoring program as required under that quarry's Permit To Take Water (No. 1168-665NHB), or as may be amended by the Ontario Ministry of the Environment from time to time.

a) PW99-1;

b) BH98-8;

c) BH98-9;

d) BH98-12;

e) DP1;

f) DP2;

g) DP3;

h) DP4; and

i) New Office Well.

(ii) Carmarthen Lake Farms Wells

a) CLF1;

b) CLF2;

c) CLF3;

d) CLF4; and

e) CLF5.

(iii) Osprey Quarry Property Monitors

a) 101-B;

b) 102-C;

c) 103-D;

d) 104-A;

e) OW1-4;

f) OW3-1;

g) OW5-2; and

h) OW6-3.

(iv) Private Residential Water Supply Wells

a) Armstrong;

b) Dempsey;

c) Fabrizio;

d) Kekanovich;

e) Sampson;

f) Skippen;

g) Swinton;

h) Urbaniak;

i) Young;

j) former Bridson; and

k) Millar Farm (dug and drilled wells).

(v) Duntroon Quarry Expansion Property

a) Existing Monitors

i) BH02-1;

ii) BH02-2;

iii) BH02-3;

iv) BH02-4;

v) BH02-5;

vi) BH02-6;

vii) BH03-7-I;

viii) BH03-7-II;

ix) BH03-8;

x) BH03-9;

xi) BH08-1;

xii) BH08-2;

xiii) BH08-3;

xiv) TW04-1;

xv) TW04-2;

xvi) TW04-3;

xvii) Bridson Drivepoint (DP);

xviii) DP5; and

xix) DP6.

b) New Monitors to be established prior to extraction as identified on ARA Site Plan 2A of 4 (Operational Plan).

c) New Drivepoint Monitors to be established prior to extraction, designated:

i) DP7 In Rob Roy PSW Unit #2;

ii) DP8 In Rob Roy PSW Unit #6;

iii) DP9 In ANSI Wetland B; and

iv) Dug Pond Drivepoint in Rob Roy PSW Unit #3.

d) Four (4) new Dual-Purpose Monitor / Recharge Injection Wells to be established within two (2) years of the commencement of operations at locations between Simcoe County Road 91 and 26/27 Sideroad.

(vi) Monitoring Frequency

a) Hourly: Groundwater level recorded by an automated sampling device at:

i) Existing monitors: BH02-1, BH02-4, BH03-7-II, BH03-8, BH08-1 and former Bridson well; and

ii) New monitors shown on ARA Site Plan 2A of 4 (Operational Plan).

b) Twice per day: Groundwater level recorded by a datalogger at:

i) Residential wells: Dempsey and Fabrizio;

ii) Wetland drivepoint monitors: DP2, DP5, DP6 and Bridson DP;

iii) Rob Roy PSW Wetland Unit #3: Dug pond drive point (to be established), and

iv) Four (4) new dual-purpose monitor / recharge injection wells (to be established).

c) Monthly: Download all dataloggers and manual water level readings at all groundwater monitors.

d) Quarterly: Water quality at the quarry sump in existing quarry and in Phase I when developed for water quality parameters including: pH, temperature, dissolved oxygen, specific conductance, alkalinity, hardness, colour, total suspended solids, major and minor ion constituents, nutrients, ammonia, total petroleum hydrocarbons and BTEX (benzene, toluene, ethylbenzene and xylene), bacteriological content (E.coli, total coliform and heterotrophic plate count).

e) Annually: Water quality at private residential/ farm water supplies at Dempsey well, Fabrizio well, SW10 (W.Franks spring source) and SW21C (H/E. Franks spring source). Water quality parameters shall include: ph, temperature, dissolved oxygen, specific conductance, alkalinity, hardness, colour, total suspended solids, major and minor ion constituents, nutrients, ammonia, total petroleum hydrocarbons and BTEX (benzene, toluene, ethylbenzene and xylene), bacteriological content (E.coli, total coliform and heterotrophic plate count).

(vii) Beaver River System

a) Rob Roy PSW Wetland Unit #2: BH03-7-I and BH03-7-II;

b) Existing Duntroon Quarry floor sump QFSW2; and

c) Rob Roy PSW Wetland Unit #3: Dug pond outlet channel (to be established).

(viii) Batteaux Creek System

a) SW7;

b) SW8;

c) SW10;

d) SW11E;

e) SW13;

f) SW19;

g) SW21;

h) SW21A;

i) SW21B;

j) SW22;

k) SW22A; and

l) SW22C.

(ix) Pretty River System

a) SW20; and

b) SW21C.

(x) Monitoring Frequency

a) Hourly: Water level (stage) and temperature recorded by an automated sampling device at SW10, SW11E and SW21C (subject to landowner permission).

b) Monthly: Temperature and manual measurement of flow when practical otherwise visual estimate (presence/ absence) at SW7, SW8, SW13, SW19, SW21, SW21A, SW21B, SW22, SW22A, SW22C and SW20. Water level and temperature at
BH03-7-I and BH03-7-II.

4. ECOLOGICAL MONITORING

(i) Fisheries monitoring in the vicinity of the following water sampling stations:

a) Beaver River System: SW1, SWO-2 and SW6A;

b) Pretty River System: SW17, SW18; and

c) Batteaux Creek System: SW14.

Background fisheries monitoring stations will be identified in consultation with the Conservation Authorities. Standard indicators of fish community health and diversity will be collected.

(ii) Wetland ecological monitoring will consist of vegetation and wildlife monitoring and will be conducted at:

a) Rob Roy PSW Wetland Unit #2: DP5 and DP7;

b) Rob Roy PSW Wetland Unit #3: locations to be established;

c) Rob Roy PSW Wetland Unit #6: DP2, DP4, and DP8 (to be established);

d) ANSI Wetland A: DP6;

e) ANSI Wetland B: Bridson DP and DP9 (to be established); and

f) Two (2) reference wetlands to be selected in consultation with appropriate agencies.

(iii) Wetland ecological monitoring shall be conducted a minimum of every five (5) years, and shall be conducted:

a) Annually for the first three (3) years after quarry license approval.

b) Annually for two (2) years after the commencement of phase 2.

c) For one (1) year after any change in water discharge location or following a red zone occurrence.

(iv) Wetland vegetation monitoring shall include:

a) A permanent vegetation transect with two vegetation sampling plots (2m x 2m in size).

b) Data collected at each vegetation sampling plot will include: species lists, percent cover, coefficient of conservatism, wetness indices and soil moisture.

c) Two (2) permanently marked photographic stations where photos will be taken for analysis of vegetation changes.

(v) Wetland wildlife monitoring shall include:

a) Amphibian call count surveys conducted in accordance with Canadian Wildlife Service's protocols.

b) Amphibian egg mass surveys

SCHEDULE "D" - MAQ MONITORING PROGRAM

SURFACE WATER MONITORING

Surface Water: Temperature and Flow

Beaver River Tributary West of Grey County Road 31

1. SW-02 Osprey Quarry property downstream of RR#6 wetland at cattle crossing and in proximity to Seep #3

2. SW6A Twin Culverts at Osprey (Grey Highlands) Sideroad 30 (west side): Main channel flow representing the entire surface water flow out of Rob Roy Provincially Significant Wetland Complex.

Surface Water: Flow

Pretty River Tributary

3. SW-7 at Grey Road 31 (north side) before Pretty River Road: Main channel flow representing outflow from road culvert

Beaver River Tributary West of Grey County Road 31

4. SW-6 at western property boundary of Highland Quarry

Beaver River Tributary East of Grey County Road 31

5. SW1 Twin Culverts Grey at County Road 31 (west side): Main channel flow representing outflow from road culvert

6. SW2 at Simcoe County Road 91 (south side): Main channel flow representing outflow from road culvert

7. SW3 at Grey County Road 31 (east side): Main channel flow representing inflow to road culvert

8. SW3A at Grey County Road 31 (east side): Main channel flow representing inflow to road culvert

Wetland Areas: Surface Water Level/Depth and Groundwater Table Elevation

Rob Roy Unit #4

9. Drivepoint monitor SP1 (west of Grey Road 31 in eastern unit)

10. Drivepoint monitor SP2 (west of Grey Road 31 in western unit).

Rob Roy Unit #6

11. Drivepoint monitor DP4 (west of Grey Road 31)

Wetland Areas: Surface Water Flow

Rob Roy Unit #4

12. Outflow from man-made pond (SW8)

13. Overland flow from North Wetland (SW10)

14. Tile drainage into North Wetland from adjacent lands (SW11)

Rob Roy Unit #5

15. Inflow at karstic feature (SW4)

16. Outflow at karstic feature (SW5)

GROUNDWATER

Ground Water: Water Level and Water Quality

On-site Locations

17. OW1 well nest: Southwest corner of Highland Quarry

18. OW2 well nest: Northwest area of Highland Quarry

19. OW3 well nest: Western property boundary of Highland Quarry

20. OW4 well nest: West side of Grey Country Road 31

21. OW5 well nest: Northeast area of Highland Quarry

22. OW6 well nest: Southern property boundary of Highland Quarry

Private Water Wells

23. Well 1: southeast corner of Highland Quarry

24. Well 2: existing residence on Highland Quarry

25. Well 3: northeast corner of Highland Quarry

26. BH03-9: Walker Lands

27. BH03-8: Walker Lands

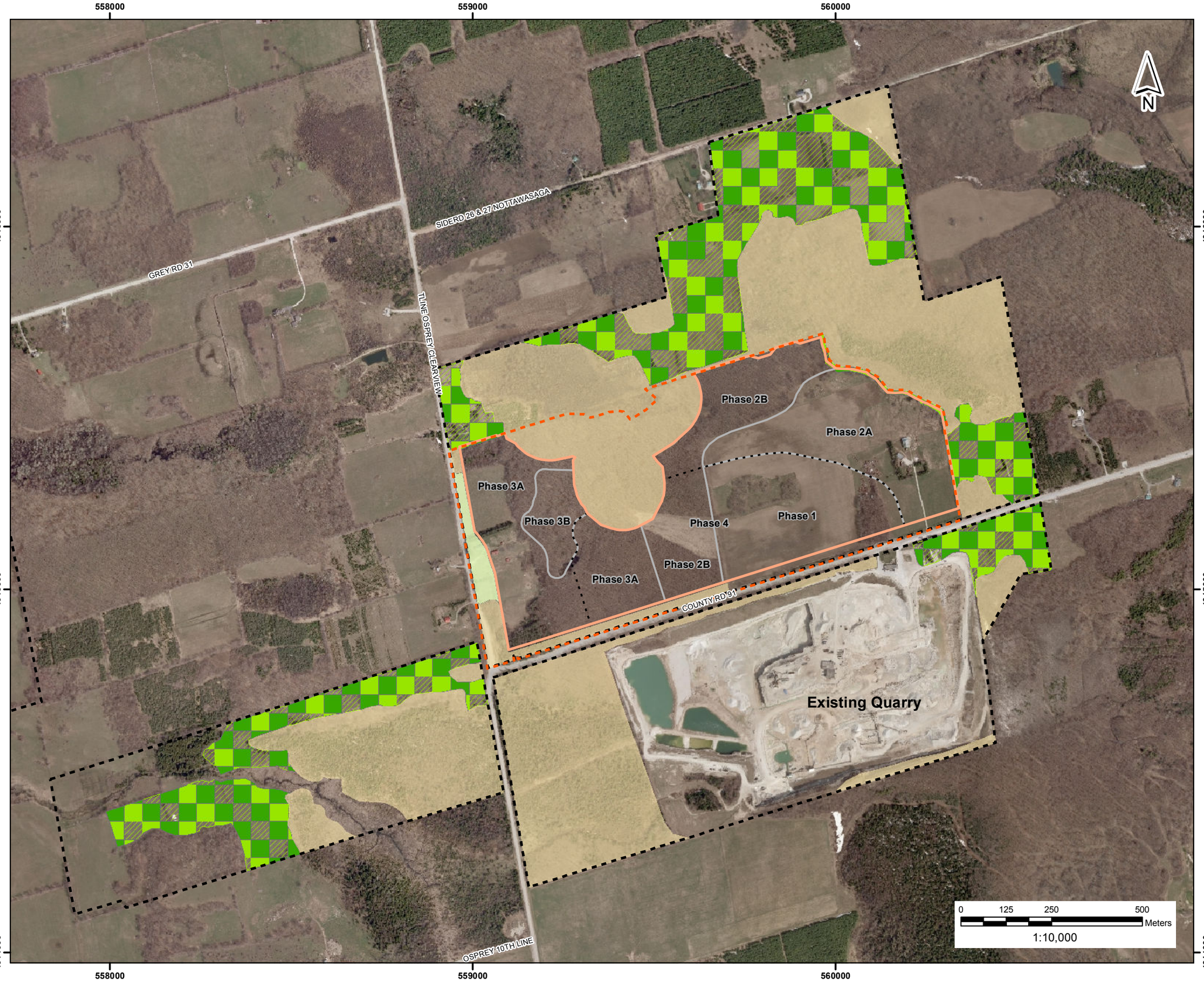
Pre-development Baseline Sampling: Water Quantity and Water Quality

Private Water Wells – Cumulative Area of Influence

28. Well 4: north of Grey County Road 31
29. Well 5: north of Grey County Road 31
30. Well 6: north of Grey County Road 31
31. Well 7: north of 10th Concession
32. Water Well No. 1897: north of Grey Country Road 31
33. Water Well No. 1896: north of Grey Country Road 31
34. Water Well No. 12684: west of Grey Country Road 67B
35. Water Well No. 6844: east of Grey Country Road 67B
36. Water Well No. 4777: south of Grey Country Road 31
37. Water Well No. 13638: south of Grey Country Road 31
38. Water Well No. 11714: north of 26/27 Sideroad
39. Water Well No. 33789: south of 26/27 Sideroad
40. Water Well No. 9666: east of Grey County Road 31
41. Water Well No. 9668: east of Grey County Road 31
42. Water Well No. 7620: east of Grey County Road 31
43. Water Well No. 6924: east of Grey County Road 31
44. Water Well No. 7531: east of Grey County Road 31

Appendix E:
Woodland Program Figures

ATTACHMENTS:



W:\active\2002 Active Projects\2700-2799\62732\drawing\GIS\MXD\Adaptive_Management_Plan\2013_AMP\62802732_AMP_FigE-1_AlternateBlockReforestation_20131128_CEW.mxd
Revised: 2013-12-03 By: cweeks

walker industries

Walker Aggregates Inc.

Legend

- Walker Owned Lands
- Proposed Duntroon Quarry Expansion License Area
- Limit of Extraction - Walker
- Phase Boundary
- Phase 4 - Lower Bench
- Existing Woodland outside the Extraction Area

Proposed Reforestation Areas

- Coniferous Dominated Planting Blocks
- Deciduous Dominated Planting Blocks
- Site Preparation Seeding and Natural Regeneration
- Visual Mitigation Planting

Notes

1. Coordinate System: UTM NAD 83 - Zone 17(N)
2. Data Sources: Ontario Ministry of Natural Resources © Queens Printer Ontario, 2012.
3. Image Source: © First Base Solutions, 2012. (Image Date: 2008)
4. Schematic only field fit variations will apply.
5. Field-fitting shall be used to maximize the benefit of plantings around the outter limits.

November 2012
62602732

Client / Project

WALKER AGGREGATES INC.
DUNTROON QUARRY EXPANSION
ADAPTIVE MANAGEMENT PLAN

Figure No.

E.1

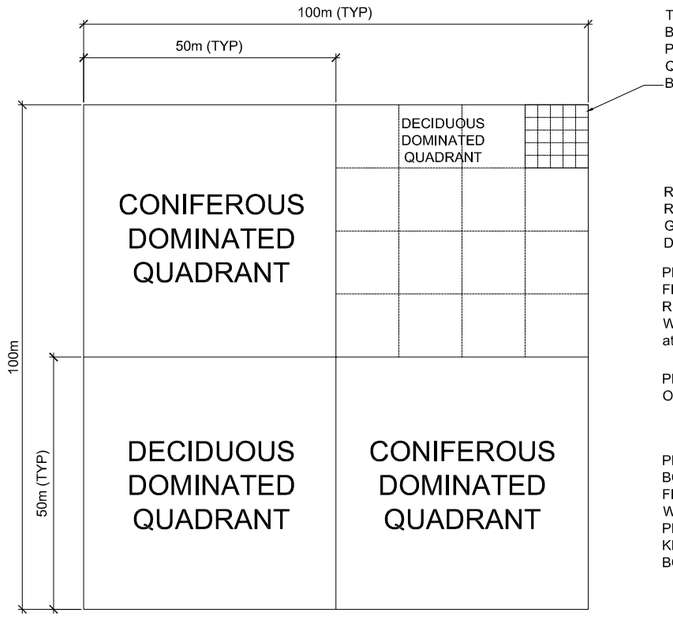
Title

ALTERNATE BLOCK REFORESTATION

TYPICAL ONE HECTARE PLANTING UNIT

10000 sq.m.

Not to Scale



CONIFEROUS DOMINATED PLANTING QUADRANTS
Plant the following species ensuring a mix of 50% deciduous and 50% coniferous.

DECIDUOUS DOMINATED PLANTING QUADRANTS
Plant the following species ensuring a mix of 75% deciduous and 25% coniferous.

TYPICAL 12.5m X 12.5m PLANTING BLOCK (REFER TO DETAIL); 16 PLANTING BLOCKS PER QUADRANT; TOTAL 64 PLANTING BLOCKS PER HECTARE

RANDOMLY CHOOSEN NATURAL REVEGETATION UNITS TO BE GRADED WITH IMPERFECT DRAINAGE DEPRESSIONS.

PLACE TOPSOIL RELOCATED FROM FORESTED AREAS BEING REMOVED IN A 1.5-2.0m WIDE WINDROW. PLANT 4 SEEDLINGS at 3.1m O.C. IN EACH WINDROW.

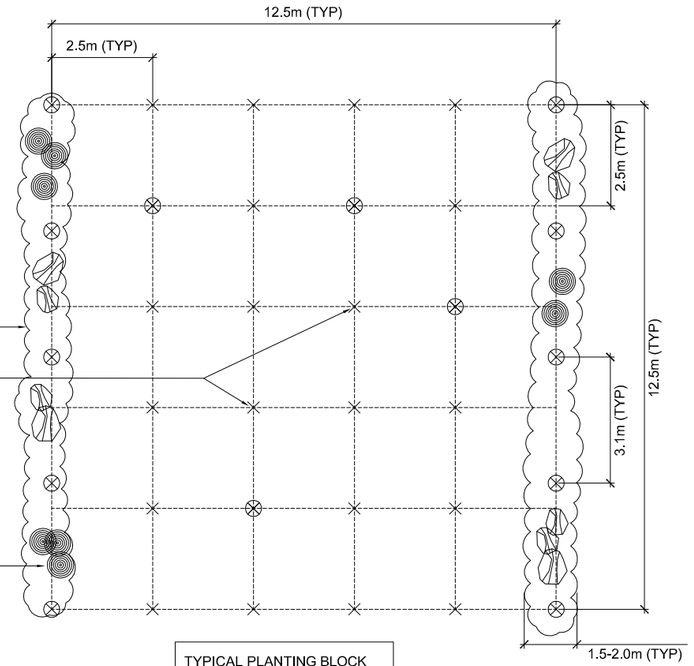
PLANT 4 EVENLY-SPACED ROWS OF 5 WHIPS at 2.5m O.C.

PLACE CLUSTERS OF STUMPS, BOULDERS, OR BRUSH PILES FROM CLEARED AREA IN WINDROW (2-3 CLUSTERS PER PLANTING BLOCK); PLACE KESTREL BOXES IN WINDROW (1 BOX/4-5HA)

TYPICAL PLANTING BLOCK LAYOUT

156.25 sq.m.

Scale 1:150



TYPICAL PLANTING BLOCK
TOTAL = 24 PLANTS

PLANTING LIST

Botanical Name	Common Name	Size	Quantity desired
Deciduous Trees			
Acer saccharum	Sugar Maple	25mm cal. BB	2000
		60-90cm CG	1000
Acer rubrum	Red Maple	25mm cal. BB	2000
		60-90cm CG	1000
Populus tremuloides	Trembling Aspen	25mm cal. BB	2000
		60-90cm CG	1000
Quercus rubra	Red Oak	25mm cal. BB	2000
		60-90cm CG	1000
Betula papyrifera	Paper Birch	25mm cal. BB	2000
		60-90cm CG	1000
Prunus serotina	Black Cherry	25mm cal. BB	2000
		60-90cm CG	1000
Tilia americana	Basswood	25mm cal. BB	1000
		60-90cm CG	1000
Betula allegheniensis	Yellow Birch	60-90cm CG	1000
Carya cordiformis	Bitternut Hickory	60-90cm CG	1000
Fagus grandifolia	American Beech	60-90cm CG	1000
Juglans nigra	Black Walnut	60-90cm CG	1000
Quercus macrocarpa	Bur Oak	60-90cm CG	1000
Ulmus americana	White Elm	60-90cm CG	1000
Coniferous Trees			
Pinus strobus	White Pine	25-40cm BR	2500
Pinus resinosa	Red Pine	25-40cm BR	2500
Tsuga canadensis	Eastern Hemlock	25-40cm BR	2500
Picea glauca	White Spruce	25-40cm BR	2000
Larix laricina	Eastern Larch	25-40cm BR	2000
Thuja occidentalis	Eastern White Cedar	25-40cm BR	2000
Abies balsamea	Balsam Fir	25-40cm BR	2000
Total Deciduous Whips			13000
Total Deciduous Seedlings			13000
Total Coniferous Seedlings			15500
TOTAL			41500

NOTES

GENERAL REFORESTATION NOTES:

1. All proposed new plantings will consist of native trees identified in the plant list, which provide similar species composition to adjacent and nearby natural areas.
2. Randomly chosen natural revegetation units to be graded with imperfect drainage depressions.
3. All existing residential buildings located within the proposed reforestation areas will be removed prior to planting.
4. All lands identified for reforestation are owned by Walker Aggregates Inc.

SEEDING

1. Seeding will be required over the entire 53.2 hectares of reforested lands regardless if the land is planted with trees or left for natural regeneration. Seed mixes have been chosen for their ability to stabilize the soils, provide nutrients to the new plantings, provide habitat for wildlife and control the growth of invasive plant species.
2. Where a former agricultural field (pasture or crop) is proposed for reforestation, plough a single furrow and seed exposed soil at time of planting only. Mow existing vegetation prior to ploughing if required at time of planting.
3. Where a partially-naturalized area is proposed for reforestation, mow as required to facilitate hand-planting. Seed disturbed or exposed soil.
4. Sow during calm weather (winds less than 10km/h) on bare soil (the seed area has been plowed).
5. Seed mix application to be done in a consistent and thorough fashion covering entire site.
6. Reseeding may be required in areas where germination has failed or areas have been eroded.

PLANTING

1. Mow all reforestation blocks prior to planting.
2. Machine or hand plant trees in a single furrow of soil turned over by plough on center of planting row and simultaneously apply Simazine in a 1.0m band straddling the center of all planting rows.
3. Collect topsoil from cleared forest area. Mix wood chips from cleared trees and brush into soil. In every fifth planting row, deposit a 1.5-2.0m band of topsoil on the surface prior to planting at a depth of 6-10" (150-200mm). Hand plant tree seedlings at +/-3.1m on center in raised topsoil windrows.
4. Collect tree stumps, boulders, and brush during forest clearing. Place in clusters throughout the windrows. Provide 2-3 clusters per planting block.
5. Install tree guards on all seedlings and saplings.
6. For the following three years, check all tree guards and replace as required. Provide 1 application of Simazine each spring or fall. Mow area between rows once in September.
7. All plant materials are to be thoroughly watered immediately after installation. Water once per week for the first four weeks and then sufficiently thereafter to maintain optimum growing conditions.
8. Plants are not to be installed or transplanted during extreme heat, drought or other undesirable conditions.
9. Selection and use of ash trees will give consideration to the trends in Emerald Ash Borer problem. Ash to be used only as a nurse crop, or, if intended as part of mature forest, resistent stock may be used if available.
10. Field-fitting shall be used to maximize the benefit of plantings around the outer limits.

GROUNDCOVER SEED MIX

50% - Annual Rye
23% - Oats
23% - Winter Rye
4% - White Clover

Seed all disturbed areas in reforestation units.
50 kg of seed needed at an application rate of 35kg/ha

NATIVE TREE SEEDS

Sugar Maple
Red Maple
Red Oak
White Pine

Tree seeds to be seeded in selected natural regeneration areas where microtopographic contouring has been conducted (approx. 12 ha).
Seeds to be purchased from, and certified by, the Ontario Tree Seed Facility, Angus, ON, for seed zone 34.
Seed at an application rate of 7,400 viable seeds/ha.

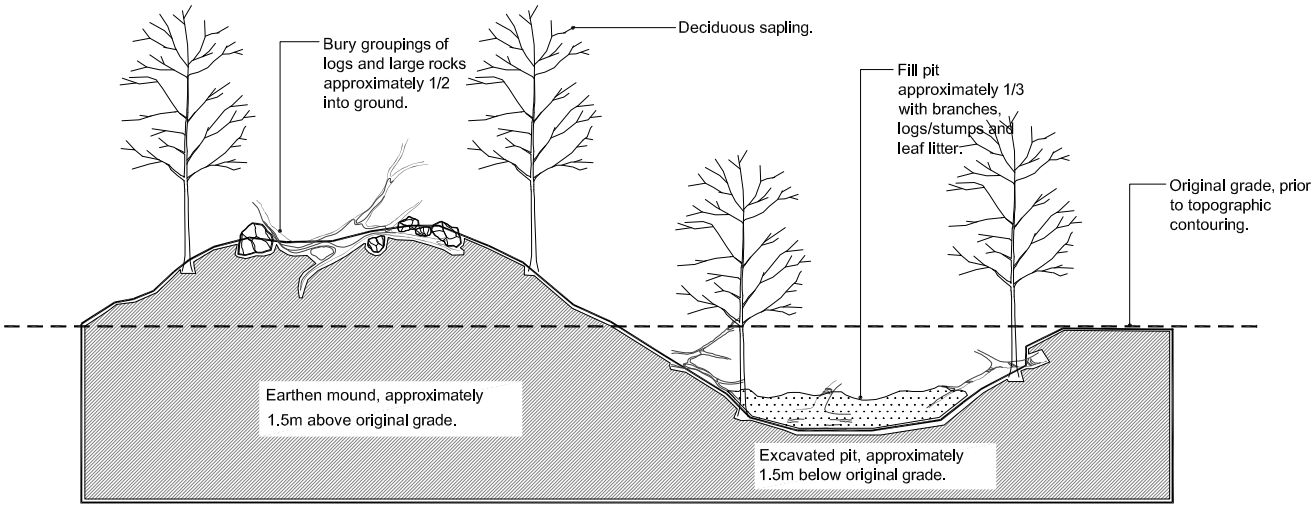
walker industries
Walker Aggregates Inc.

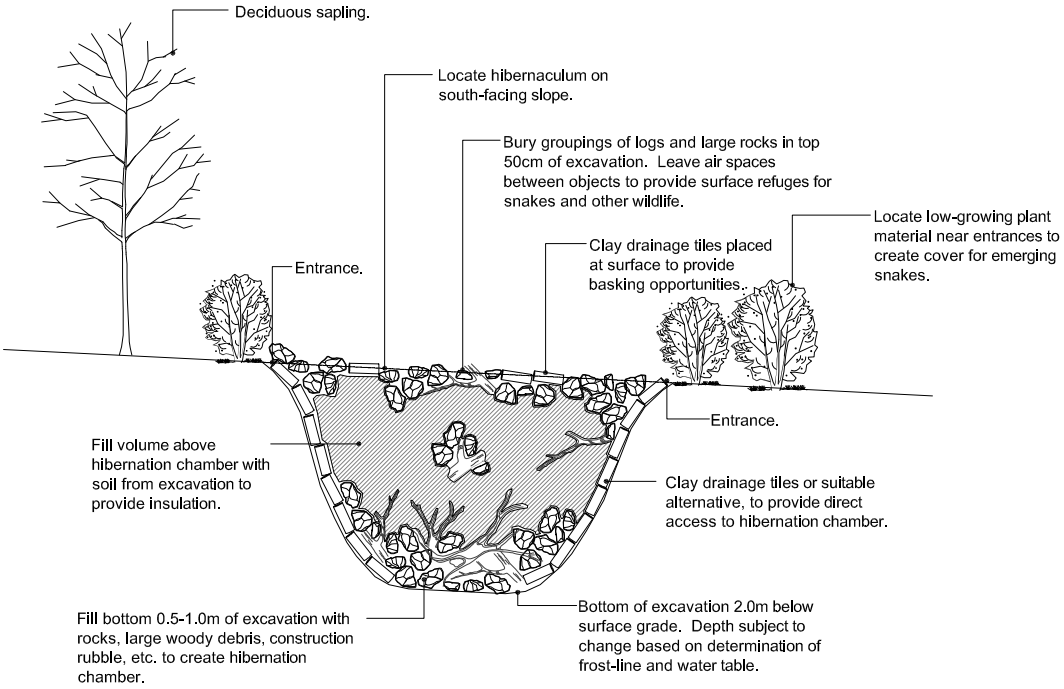
November, 2013
62602732

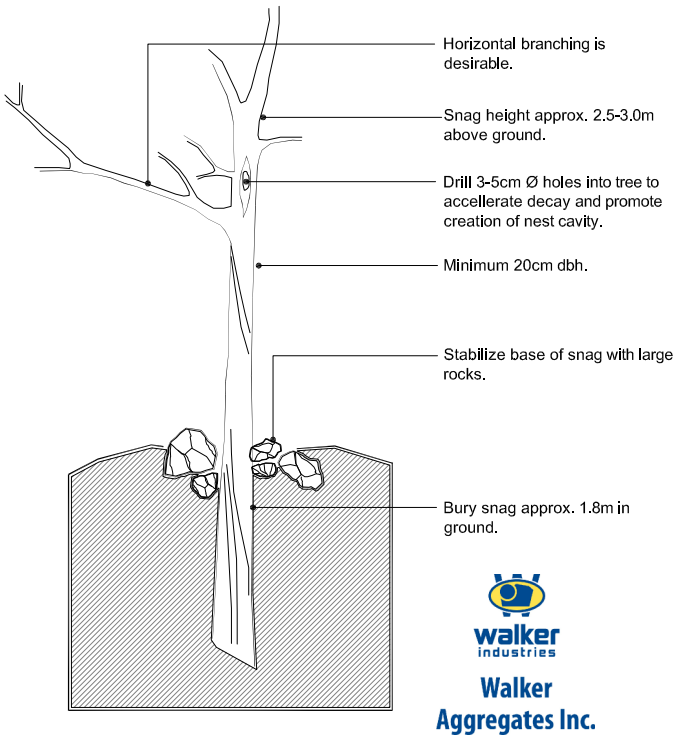
Client/Project
WALKER AGGREGATES INC.
DUNTROON LICENSE EXPANSION
ADAPTIVE MANAGEMENT PLAN

Figure No.
E.2

Title
PLANTING PLAN







NOTES:

1. Location of hibernacula (2) and snag trees (10) to be determined on site.

2. Logs, stumps, rocks, etc. to be collected from adjacent woodlots with permission from the landowner and at the direction of the Landscape Architect. The Landscape Architect reserves the right to reject any material collected from outside the designated areas. See Figure 5 for location of designated areas.

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PROJECT NAME: DUNTROON LICENSE EXPANSION ADAPTIVE MANAGEMENT PLAN				DATE : NOVEMBER 2013	FILENAME:
PREPARED FOR: WALKER AGGREGATES INC.				BLOCK 1 FOREST RESTORATION HABITAT FEATURES	FIGURE E.3
REVISION NO.	REVISION DATE	DESCRIPTION	REVISED BY:		
1	28/11/2013	EDIT TITLEBLOCK	MC		
REV. NO. 1	DRAWN BY: MC	CHECKED BY:	SCALE: AS SHOWN	PROJECT NO.: 62602732	APPROVED:

V:\01609\active\2002 Active Projects\2700-2799\G2732\Reforestation\62602732_AMP_E3_ForestRestoration_20121116.dwg

Appendix F:
Water Management and Mitigation Designs Beyond Extraction Limit

ATTACHMENTS:

Appendix F: Water Management and Mitigation Designs Beyond Extraction Limit

In addition to the Site Plans and this AMP, routine water management and mitigation will be regulated by approvals pursuant to the *Ontario Water Resources Act* and the *Environmental Protection Act*. To the extent possible, the requirements of approvals under the *Ontario Water Resources Act* and the *Environmental Protection Act* will be integrated into the AMP.

Discharge to the wetlands and the karst infiltration area is to be accomplished through surface or shallow subsurface release of water over a broad front to simulate runoff and diffuse seepage processes.

The design objectives are to be based on release of the required volumes of water to the landscape in the vicinity of the wetlands without negatively affecting the surrounding environment. Initially, discharge volumes to the Beaver River watershed (North and/or South tributaries) and to the Batteaux Creek watershed will be based proportionately on the respective sizes of the surface drainage catchment areas extracted in each phase. Actual discharge volumes will be adjusted as needed, based on the results of the AMP monitoring programs.

The site specific design of discharge structures will be approved in accordance with ARA Site Plan Hydrogeology Note 7E:

> *"Prior to the construction of any Mitigation measure or contingency mitigation measure outside the limits of extraction, its design shall be approved by the MNR, and included in the AMP unless the design of the measure has been approved pursuant to a permit issued under another statute such as the Ontario Water Resources Act (E.G. Permit To Take Water, Certificate of Approval)."*

It is noted that the Certificate of Approval for discharge is now designated Environmental Compliance Approval for discharge, and is regulated under the *Environmental Protection Act*.

In the event that a mitigation measure to be developed outside of the limits of extraction has not been approved under another statute, the design shall be approved by MNR before being incorporated into the AMP. The design of a mitigation measure approved under the *Ontario Water Resources Act*, *Environmental Protection Act*, or another statute may be included in the AMP without MNR approving the design.

The objective is to ensure that any potentially required water management or mitigation measures are 'ready-to-go', prior to such measures being needed. Mitigation measures are not expected to be required in Phase 1, which will take approximately six years to extract.

Final design for routine water management mitigation measures required during Phase 2A will be completed during Phase 1. Once final designs are approved in accordance with

Hydrogeology Note 7E, the designs will be incorporated into this Appendix F. Final design for routine water management and mitigation measures that progressively will be required in Phase 2B and Phase 3A will be completed prior to any extraction beginning in that particular phase. Once approved, the final designs will be incorporated in this Appendix F.

Apportioning Quarry Discharge Water to Adjacent Wetlands and Surface Water Drainage Basins

As an initial approach for future planning purposes, the following describes a methodology to apportion the discharge of water from the Expansion Quarry between the adjacent wetlands designated as RR2/RR3, ANSI Wetland A and Wetland B and RR6 wetland, and through those wetlands to the associated downgradient surface water courses, in order to help maintain their respective hydroperiods and seasonal hydrographs.

This assessment is provided for Normal Operating Conditions (Phase by Phase extraction and Rehabilitation Lake-Filling Conditions).

An assessment of the seasonal discharge from the Rehabilitation Final-Lake is provided in Appendix K.

As the initial starting point, Quarry water shall be discharged proportionately to the following locations, when needed. Approximate discharge locations are identified on the **Site Plan: Operational Plan 2A of 4** and in more detail in AMP **Appendix A** on **Figure 2.2** (Groundwater and Surface Water Features and Mitigation Concepts).

- ANSI Wetlands A and B to the northeast of the Expansion Quarry (Batteaux Creek Tributary system—Nottawasaga Valley Conservation Authority (NVCA) Jurisdiction);
- RR2/RR3 Wetland to the northwest of the Expansion Quarry (Beaver River North Tributary system—Grey Sauble Conservation Authority (GSCA) Jurisdiction); and
- RR6 Wetland via the SW2A spring and associated SW2 watercourse in the southwest corner of the Expansion Quarry (Beaver River South Tributary system—GSCA Jurisdiction).

The proportionate discharge to each wetland feature / watershed is to be based on the prevailing climatic conditions and on the sizes of their respective surface water catchment areas that are removed during extraction of the various phases. The proportionate discharge to each wetland feature / watershed will be adjusted, if necessary, based on the results of the AMP Performance Indicator Trigger Monitoring Program (see AMP **Section 3.0** for details). Discharge into the wetlands will be managed by adjusting pumping rates and/or by means of flow restrictor valves in discharge lines, as required. Discharge into individual wetlands will be adjusted as necessary to maintain target hydrographs in each wetland / watercourse.

The annual average water surplus for this area is estimated to be approximately 395 mm per year.

With respect to the volume of surface water that may be required for discharge to the wetlands, as a starting point for planning purposes, the average surface run-off potential estimated for the Expansion Quarry property is 238 mm per year, which equates to 2,380 m^3 per year per hectare (ha). The groundwater contribution to each surface water drainage basin is based on the infiltration recharge component of 157 mm per ha, or 1,570 m^3 per year per ha. Thus the combined surface water runoff and groundwater recharge component within each drainage basin is taken to be an average of 395 mm per year, which is equivalent to 3,950 m^3 per year per ha.

Under current non-extraction conditions, each watershed receives a surface runoff component and a groundwater component that reflect the areas of their individual surface drainage basin and groundwater drainage basin respectively. The detailed hydrogeology and karst evaluations of the area that were discussed in detail at the Joint Board Hearing concluded that the boundaries of the groundwater drainage basins effectively mimic those of the surface drainage basins and are reasonably represented by the topographic surface drainage divide that separates the Batteaux Creek watershed from that of the Beaver River.

Under operating extraction conditions, each phase of extraction will remove varying proportions of the surface drainage basins and their underlying groundwater drainage basins. The discharge of excess water from the Expansion Quarry is to be based on maintaining the seasonal hydrology of the adjacent wetlands and the associated seasonal discharge of surface water and groundwater to the adjacent surface watercourses. For this planning exercise, it is assumed that surface water catchment areas and groundwater recharge catchment areas are similar such that it is the entire annual water surplus contributes to the excess water to be discharged from the Expansion Quarry, and is equivalent to 3,950 m^3 per year per ha.

Phase-By-Phase Extraction of Drainage Areas

As a guide for planning future water discharge operations, **Table F.1**, summarizes by extraction phase the approximate surface drainage catchment areas that will be removed from within each wetland drainage basin and from the internal closed drainage basin. The catchment areas are illustrated on the **Figure F.1** Duntroon Quarry Expansion Surface Catchment Areas. **Table F.2** provides a phase-by-phase summary of the extraction.

Table F.1: Area of Subcatchment Drainage Basin to be Removed during Extraction

Phase	Internal Closed Drainage Basin (ha)	ANSI Wetland A (ha)	ANSI Wetland B (ha)	Combined ANSI Wetlands A/B (ha)	RR2 Wetland (ha)	RR3 Wetland (ha)	Combined RR2 / RR3 Wetland (ha)	RR6 Wetland (ha)
1	11.37	0	0.19	0.19	1.49	0	1.49	0
2A	0.81	0.11	10.88	10.99	2.18	0	2.18	0
2B	4.94	2.33	1.12	3.45	4.16	0	4.16	0
3A	0.87	0	0	0	2	2.46	4.46	10.39
3B	0	0	0	0	1.29	0	1.29	1.9
4	0	0	0	0	0	0	0	0
Totals:	**17.99**	**2.44**	**12.19**	**14.63**	**11.12**	**2.46**	**13.58**	**12.29**
							TOTAL AREA EXTRACTED:	**58.49**

Note: Drainage areas are illustrated on Figure F.1

Figure F.1:
Duntroon Expansion Quarry
Surface Catchment Areas

LEGEND

- Licenced Boundary
- Limit of Extraction
- Surface Catchment Area 1: Area: 11.37ha
- Surface Catchment Area 2: Area: 1.49ha
- Surface Catchment Area 3: Area: 10.88ha
- Surface Catchment Area 4: Area: 2.18ha
- Surface Catchment Area 5: Area: 0.11ha
- Surface Catchment Area 6: Area: 4.94ha
- Surface Catchment Area 7: Area: 4.16ha
- Surface Catchment Area 8: Area: 2.33ha
- Surface Catchment Area 9: Area: 1.12ha
- Surface Catchment Area 10: Area: 0.87ha
- Surface Catchment Area 11: Area: 10.39ha
- Surface Catchment Area 12: Area: 2.00ha
- Surface Catchment Area 13: Area: 2.46ha
- Surface Catchment Area 14: Area: 1.90ha
- Surface Catchment Area 15: Area: 1.29ha
- Surface Catchment Area 16: Area: 0.81ha
- Surface Catchment Area 17: Area: 0.19ha

DATE: December 12, 2012

SCALE: 1 : 5,000

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Table F.2: Proportionate Quarry Discharge by Phase

Phase (area, ha)	Catchment Area (Cumulative ha)	Watershed	% of Quarry Discharge (based on Catchment Area removed)
1 (13.05)	0.19	ANSI B / Batteaux Creek	0
	11.37	Internal to Existing Quarry to Beaver River South	100
	1.49	RR2 / Beaver River North	0
2A (13.98)	11.18	ANSI A/B / Batteaux Creek	41
	12.18	Internal to Existing Quarry to Beaver River South	45
	3.67	RR2 / Beaver River North	14
2B (12.55)	14.63	ANSI A/B / Batteaux Creek	37
	17.12	Internal to Existing Quarry to Beaver River South	43
	7.83	RR2 / Beaver River North	20
3A (15.72)	14.63	ANSI A/B / Batteaux Creek	26
	17.99	Internal to Existing Quarry to Beaver River South	33
	10.39	SW2A to RR6 to Beaver River South	19
	12.29	RRW / RR3 / Beaver River North	22
3B (3.19)	14.63	ANSI A/B / Batteaux Creek	25
	17.99	Internal to Existing Quarry to Beaver River South	31
	12.29	SW2A to RR6 to Beaver River South	21
	13.58	RR2 / RR3 / Beaver River North	23
4 (deepening of Phase 1 and 3A) (23.6)	14.63	ANSI A/B / Batteaux Creek	25
	17.99	Internal to Existing Quarry to Beaver River South	31
	12.29	SW2A to RR6 to Beaver River South	21
	13.58	RR2 / RR3 / Beaver River North	23

Note: Discharge rates are to be controlled by means of flow restrictor valves at calibrated pumps and/or discharge lines and monitored based on totalizer flow measurements. Actual volumes to be discharged will vary seasonally depending on prevailing climatic conditions and the results of the Performance Indicator Trigger wetland / surface water monitoring program.

In summary:

- RR2 / RR3 Wetland combined surface drainage area to be removed is approximately 13.6 ha.
  RR2 total surface drainage area is approximately 45.6 ha.
  RR3 total surface drainage area is approximately 22 ha.
  RR2/RR3 combined surface drainage area is approximately 67.6 ha.
- ANSI Wetland A / Wetland B combined surface drainage area to be removed is approximately 14.6 ha.
  ANSI Wetland A total surface drainage area is approximately 10.6 ha.
  ANSI Wetland B total surface drainage area is approximately 34.4 ha.
  ANSI Wetland A/B combined surface drainage area is approximately 45 ha.
- RR6 Wetland surface drainage area to be removed is approximately 12.3 ha.
  RR6 total surface drainage area is 175.8 ha
- Internal closed basin surface drainage area to be removed is 18.0 ha.

Phase 1

The majority of Phase 1 (11.4 ha of 13.05 ha, or approximately 86%) currently drains internally to the Expansion Quarry property, with no surface water outlets being present within this closed drainage basin. Extraction within the internal drainage basin area is not expected to affect any conditions within any of the wetlands, as surface runoff is interpreted to infiltrate the soil and into the underlying dolostone bedrock, and discharges to the Existing Quarry floor as diffuse flow at, or below the base of the north wall. This area is interpreted to contribute approximately 45,030 m^3 per year of recharge into the Existing Quarry.

Excess water from the Existing Quarry is discharged off-site to the west into the RR6 wetland and the associated Beaver River South tributary at monitoring station SW1 at the twin culverts beneath Grey Road 31.

A very minor component of ANSI Wetland B drainage area (0.19 ha) is included for removal in the extreme southeast corner of Phase 1. As well, approximately 1.5 ha of land to be removed in the extreme northwest corner of Phase 1 drains towards RR2 Wetland.

Removal of these two small surface drainage areas of the wetlands, both of which are located in the uppermost reaches of their respective drainage basins, is not expected to result in any measurable change to the hydrology of either of the wetlands systems. Off-site discharge to either wetland area should not be required.

Excess quarry water that accumulates in the sump in Phase 1 of the Expansion Quarry will be transferred into the main reservoir in the Existing Quarry for temporary storage and/or subsequent discharge off-site to the west into wetland RR6 and the associated Beaver River South tributary. It is expected that Phase 1 will require approximately 6 years to extract.

Off-site discharge of quarry water will be regulated by the Ministry of Environment under the Environmental Compliance Approval for the Expansion Quarry.

Phase 2A

The majority of Phase 2A is located within ANSI B Wetland surface drainage area, and extraction will remove approximately 10.9 ha of that catchment area.

The northwest section of Phase 2A will remove approximately 0.1 ha of ANSI Wetland A catchment area, and approximately 2.2 ha of land that drains toward RR2.

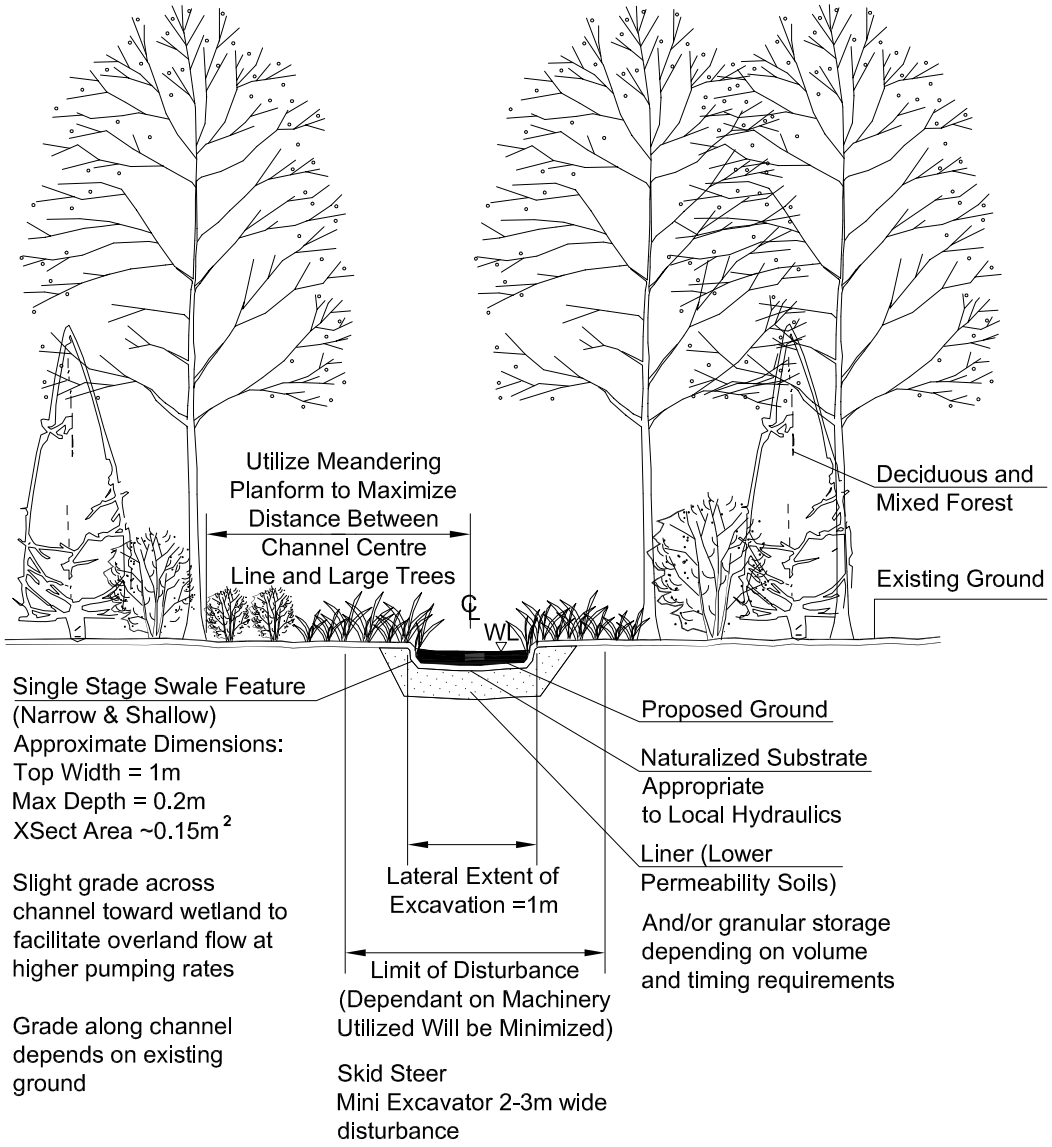
Approximately 0.8 ha of land that currently drains internally to the Expansion Quarry property will be removed during Phase 2A.

By the end of extraction in Phase 2A, the removal of surface drainage catchment areas will be approximately as follows:

ANSI Wetland A	0.1 ha in 2A	Cumulative total extracted by end of Phase 2A:		0.1 ha
ANSI Wetland B	10.9 ha in 2A	Cumulative total extracted by end of Phase 2A:		11.1 ha
			Total:	11.2 ha
RR2 Wetland	2.2 ha in 2A	Cumulative total extracted by end of Phase 2A:		3.7 ha
Internal Drainage	0.81 ha in 2A	Cumulative total extracted by end of Phase 2A:		12.2 ha

The AMP monitoring program will identify if, and when, quarry water shall be discharged to one or more of the wetlands. However, it is not expected that off-site discharge of quarry water will be required for ANSI Wetland A or for RR2 Wetland during Phase 2A. Seasonal discharge into ANSI Wetland B and/or the re-located Millar Cow Pond may be required during Phase 2A. Seasonal discharge volumes into ANSI Wetland B, and into RR2 if determined through monitoring to be required, will be controlled by means of one or more pumps that draw water from the sump in Phase 1 of the Expansion Quarry.

Water will be directed to the discharge location(s) by a combination of solid forcemain pipe(s) from the sump and lay-flat hoses closer to the discharge location in order to maintain maximum operational flexibility. Proposed discharge locations are shown on the **ARA Site Plan Operational Plan Sheet 2A of 4**. At this time, there is one proposed discharge location positioned at the south end of ANSI Wetland A, and one location positioned on the south-central side of ANSI Wetland B adjacent to the re-located Millar Pond. For RR2 Wetland, one discharge location is positioned at the southeast limit of the wetland, and a second is positioned on the south-central side of the wetland. Proposed conceptual orientations for surface trench discharge locations at each wetland are illustrated on **Figure 2.2** (**Appendix A** in the AMP document). One design option for a discharge trench cross-section is illustrated on **Figure F.2**.



ORIGINAL SHEET - ANSI A

December, 2013
62602732

walker industries

Walker Aggregates Inc.

Client/Project

Walker Aggregates Inc.

Duntroon Quarry Expansion
Adaptive Management Plan

Figure No.

F.2

Title

Cross-section Sketch Through
Surface Discharge System

Discharge rates will be regulated by pump size and by in-pipe flow restrictor valves and confirmed to be sufficient through the AMP monitoring programs. The design of each end-of-pipe discharge facility will be site-specific that is tailored to the conditions at each location, with discharge to be accomplished through surface release of water over a broad front to simulate runoff and diffuse seepage processes that prevent surface erosion from occurring.

As well, excess quarry water from the sump in Phase 1 will continue to be discharged into the main reservoir in the Existing Quarry as previously described. Once sufficient open space has been created on the quarry floor within Phase 1 and the southern part of Phase 2A (approximately 10 years), the processing plant and the product stockpiles in the Existing Quarry will be transferred into the Expansion Quarry. The tunnel / open cut linking the two quarries will be sealed and the Existing Quarry will be allowed to fill with water.

Excess water that accumulates in the sump in Phase 1 of the Expansion Quarry will continue to be discharged into the Existing Quarry to help promote lake-filling. The need for continued seasonal discharge off-site from the Existing Quarry into RR6 and the Beaver River South tributary to the west during the lake-filling period will be determined by monitoring wetland and surface water flow conditions as stipulated in the Adaptive Management Plan.

By the end of extraction in Phase 2A, the volume of quarry water discharge potentially required to replace the surface runoff and groundwater components removed from each wetland drainage basin would be as follows:

- ANSI A and B Wetlands: 11.2 ha of catchment removed, equates to 44,240 m^3 per year (into Batteaux Creek watershed); represents 41% of quarry discharge.
- If needed, RR2 Wetland: 3.7 ha of wetland removed, equates to 14,615 m^3 per year (into Beaver River North tributary watershed); represents 14% of quarry discharge.
- Internal Drainage to Existing Quarry: 12.2 ha removed, equates to 48,190 m^3 per year (into RR6 / Beaver River South tributary watershed); represents 45% of quarry discharge.

The actual need for seasonal discharge to one or more wetlands and the volume of water required will be determined based on the relative percentages provided above and through the AMP monitoring programs.

Phase 2B

Extraction in Phase 2B will remove additional surface drainage catchment areas from within both ANSI Wetlands A and B, from within RR2 Wetland catchment and from within the internal closed drainage basin, approximately as follows:

ANSI Wetland A	2.3 ha in 2B	Cumulative total extracted by end of Phase 2B:	2.4 ha
ANSI Wetland B	1.1 ha in 2B	Cumulative total extracted by end of Phase 2B:	12.2 ha
		Total (approximate):	14.6 ha

Phase 2B results in the maximum amount of surface drainage catchment area that is to be extracted from within the ANSI Wetland A and ANSI Wetland B drainage basins (Batteaux Creek watershed) by the Expansion Quarry.

RR2 Wetland	4.2 ha in 2B	Cumulative total extracted by end of Phase 2B:	7.8 ha
Internal Drainage	4.9 ha in 2B	Cumulative total extracted by end of Phase 2B:	17.1 ha

Based on the cumulative absolute and relative sizes of the catchment areas that are to be extracted from within the individual wetland drainage basins by the end of Phase 2B, there may be a requirement for some seasonal discharge of quarry water into one or more of ANSI Wetland A and/or Wetland B (and the re-located Millar Cow Pond), and also into the eastern section of RR2 Wetland. The need for, and actual seasonal discharge rates that are required to maintain the individual hydrological characteristics of each wetland will be determined through the AMP monitoring program. Discharge to each wetland will be managed as described above in Phase 2A.

Given that by the end of extraction in Phase 2B, approximately twice as much surface drainage catchment area will have been removed from within the ANSI Wetland A / Wetland B drainage system, relative to that removed from within the RR2 drainage catchment area, it is expected that discharge to those two wetland systems will be in a ratio of approximately 2:1 respectively.

By the end of extraction in Phase 2B, the volume of quarry water discharge potentially required to replace the surface runoff / groundwater components removed from each wetland drainage basin would be as follows:

- ANSI Wetland A: 2.4 ha of catchment removed, equates to 9,480 m^3 per year (into Batteaux Creek watershed); represents 6% of quarry discharge.
- ANSI Wetland B: 12.2 ha of catchment removed, equates to 48,190 m^3 per year (into Batteaux Creek watershed); represents 31% of quarry discharge.
- RR2 Wetland: 7.8 ha of wetland removed, equates to 30,810 m^3 per year into Beaver River North tributary); represents 20% of quarry discharge.
- Internal Drainage to Existing Quarry: 17.1 ha removed, equates to 67,543 m^3 per year (into RR6/ Beaver River South tributary); represents 43% of quarry discharge.

The actual need for seasonal discharge to one or more wetlands and the volume of water required will be determined based on the relative percentages provided above, and through the AMP monitoring programs.

As well, excess quarry water that accumulates in the sump in Phase 1 will continue to be discharged into the Existing Quarry, either as temporary storage for subsequent seasonal discharge off-site or to assist in the final rehabilitation lake-filling of the fully extracted Existing

Quarry, depending on prevailing climatic conditions and wetland / surface water flow monitoring results.

Phase 3A

Extraction in the northwest corner of Phase 3A will remove approximately 2.0 ha of surface drainage area from within the southwestern side of the RR2 Wetland drainage catchment, and approximately 2.5 ha from within the RR3 Wetland drainage catchment.

Extraction in the south-central part of Phase 3A will remove approximately 10.4 ha of surface drainage area from within the RR6 drainage catchment which drains southwards into the Beaver River South tributary, and also approximately 0.9 ha of catchment area from within the internal drainage basin.

By the end of Phase 3A, the removal of catchment areas will be approximately as follows:

ANSI Wetland A	0 ha in 3A	Cumulative total extracted by end of Phase 3A:		2.4 ha
ANSI Wetland B	0 ha in 3A	Cumulative total extracted by end of Phase 3A:		12.2 ha
			Total:	14.6 ha

This is the maximum amount of surface drainage catchment area that is to be extracted from within the ANSI Wetland A and ANSI Wetland B drainage basins by the Expansion Quarry.

RR2 Wetland	2.0 ha in 3A	Cumulative total extracted by end of Phase 3A:		9.8 ha
RR3 Wetland	2.5 ha in 3A	Cumulative total extracted by end of Phase 3A:		2.5 ha
			Total:	12.3 ha
RR6 Wetland	10.4 ha in 3A	Cumulative total extracted by end of Phase 3A:		10.4 ha
Internal Drainage	0.87 ha in 3A	Cumulative total extracted by end of Phase 3A:		18.0 ha

By the end of extraction in Phase 3A, the volume of quarry water discharge potentially required to replace the surface runoff / groundwater components removed from each wetland drainage basin would be as follows:

- ANSI Wetland A: 2.4 ha of catchment removed, equates to 9,480 m^3 per year (into Batteaux Creek watershed); represents 4% of quarry discharge.
- ANSI Wetland B: 12.2 ha of catchment removed, equates to 48,190 m^3 per year (into Batteaux Creek watershed); represents 22% of quarry discharge.
- RR2 Wetland: 9.8 ha of catchment removed, equates to 38,710 m^3 per year (into Beaver River North tributary); represents 18% of quarry discharge.
- RR3 Wetland: 2.5 ha of catchment removed, equates to 9,875 m^3 per year (into Beaver River North tributary); represents 5% of quarry discharge.

- RR6 Wetland: 10.4 ha of catchment removed, equates to 41,080 m^3 per year (via SW2A into RR6/ Beaver River South tributary); represent 19% of quarry discharge.
- Internal Drainage to Existing Quarry: 18 ha removed, equates to 71,100 m^3 per year (into RR6/ Beaver River South tributary); represents 33% of quarry discharge.

The actual need for seasonal discharge to one or more wetlands and the volume of water required will be determined based on the relative percentages provided above and through the AMP monitoring programs.

As well, excess quarry water that accumulates in the sump in Phase 1 will continue to be discharged into the Existing Quarry, either as temporary storage for subsequent seasonal discharge off-site or to assist in the final rehabilitation lake-filling of the fully extracted quarry, depending on prevailing climatic conditions at that time and wetland / surface water flow monitoring results.

Phase 3B

Extraction of the northern section of Phase 3B will remove approximately 1.3 ha of surface drainage area from within the south-central side of the RR2 Wetland drainage catchment.

Extraction of the southern section of Phase 3B will remove approximately 1.9 ha of surface drainage area from within the RR6 drainage catchment which drains southwards into the Beaver River South tributary.

By the end of Phase 3B, the removal of catchment areas will be approximately as follows:

ANSI Wetland A	0 ha in 3B	Cumulative total extracted by end of Phase 3B:		2.4 ha
ANSI Wetland B	0 ha in 3B	Cumulative total extracted by end of Phase 3B:		12.2 ha
			Total:	14.6 ha

This is the maximum amount of surface drainage catchment area that is to be extracted from within the ANSI Wetland A and ANSI Wetland B drainage basins by the Expansion Quarry.

ANSI Wetland A	1.3 ha in 3B	Cumulative total extracted by end of Phase 3B:		11.1 ha
ANSI Wetland B	0 ha in 3B	Cumulative total extracted by end of Phase 3B:		2.5 ha
			Total:	13.6 ha
RR6 Wetland	1.9 ha in 3B	Cumulative total extracted by end of Phase 3B:		12.3 ha
Internal Drainage	0 ha in 3B	Cumulative total extracted by end of Phase 3B:		18.0 ha

Total surface area extracted by end of Phase 3B will be approximately 58.5 ha, which is the full areal limit of extraction as per **ARA Site Plan: Existing Features Sheet 1 of 4**.

By the end of extraction in Phase 3B, the volume of quarry water discharge potentially required to replace the surface runoff / groundwater components removed from each wetland drainage basin would be as follows:

- ANSI Wetland A: 2.4 ha of catchment removed equates to 9,480 m^3 per year (into Batteaux Creek watershed); represents 4% of quarry discharge.
- ANSI Wetland B: 12.2 ha of catchment removed equates to 48,190 m^3 per year (into Batteaux Creek watershed); represents 21% of quarry discharge.
- RR2 Wetland: 11.1 ha of catchment removed equates to 43,845 m^3 per year (into Beaver River North tributary); represents 19% of quarry discharge.
- RR3 Wetland: 2.5 ha of catchment removed equates to 9,875 m^3 per year (into Beaver River North tributary); represents 4% of quarry discharge.
- RR6 Wetland: 12.3 ha of catchment removed equates to 48,585 m^3 per year (via pumped discharge from the sump in Phase 3B to SW2A into RR6 / Beaver River South tributary); represents 21% of quarry discharge.
- Internal Drainage to Existing Quarry: 18 ha removed, equates to 71,100 m^3 per year (into RR6/ Beaver River South tributary watershed); represents 31% of quarry discharge.

The actual need for seasonal discharge to one or more wetlands and the volume of water required will be determined based on the relative percentages provided above and through the AMP monitoring programs.

Excess quarry water that accumulates in the sump in Phase 1 will continue to be discharged into the Existing Quarry, either as temporary storage for subsequent seasonal discharge off-site or to assist in the final rehabilitation lake-filling of the fully extracted quarry, depending on prevailing climatic conditions at that time and wetland / surface water flow monitoring results.

Phase 4

Phase 4 is the final extraction stage of the Expansion quarry and involves the deepening of the extraction area in the south-central part of the Expansion Quarry from elevation 500 m above sea level (m asl) to 490 m asl, comprising the Phase 1 area, the southern section of Phase 2B and the eastern section of Phase 3A, totaling approximately 23.6 ha. Since Phase 4 extraction does not involve any further increase in the size of the footprint of the Expansion Quarry, there will not be any increase in the amount of surface runoff drainage areas removed from within any of the wetland catchment areas. The catchment areas removed and equivalent volumes of potential surface runoff required will be the same as given for Phase 3B above.

Total surface area extracted by end of Phase 4 will be approximately 58.5 ha, which is the full areal limit of extraction as per **ARA Site Plan: Existing Features Sheet 1 of 4**.
By the end of extraction in Phase 4, the volume of quarry water discharge potentially required to replace the surface runoff / groundwater components removed from each wetland drainage basin would be as follows:

- ANSI Wetland A: 2.4 ha of catchment removed equates to 9,480 m^3 per year (into Batteaux Creek watershed); represents 4% of quarry discharge.
- ANSI Wetland B: 12.2 ha of catchment removed equates to 48,190 m^3 per year (into Batteaux Creek watershed); represents 21% of quarry discharge.
- RR2 Wetland: 11.1 ha of catchment removed equates to 43,845 m^3 per year (into Beaver River North tributary); represents 19% of quarry discharge.
- RR3 Wetland: 2.5 ha of catchment removed equates to 9,875 m^3 per year (into Beaver River North tributary); represents 4% of quarry discharge.
- RR6 Wetland: 12.3 ha of catchment removed equates to 48,585 m^3 per year (via SW2A into RR6 / Beaver River South tributary); represents 21% of quarry discharge.
- Internal Drainage to Existing Quarry: 18 ha removed, equates to 71,100 m^3 per year (into RR6/ Beaver River South tributary watershed); represents 31% of quarry discharge.

The actual need for seasonal discharge to one or more wetlands and the volume of water required will be determined based on the relative percentages provided above and through the AMP monitoring programs.

Excess quarry water that accumulates in the sump in Phase 1 will continue to be discharged into the Existing Quarry, either as temporary storage for subsequent seasonal discharge off-site or to assist in the final rehabilitation lake-filling of the fully extracted quarry, depending on prevailing climatic conditions at that time and wetland / surface water flow monitoring results.

Appendix G:
Monitoring Instrumentation

Appendix G: Monitoring Instrumentation

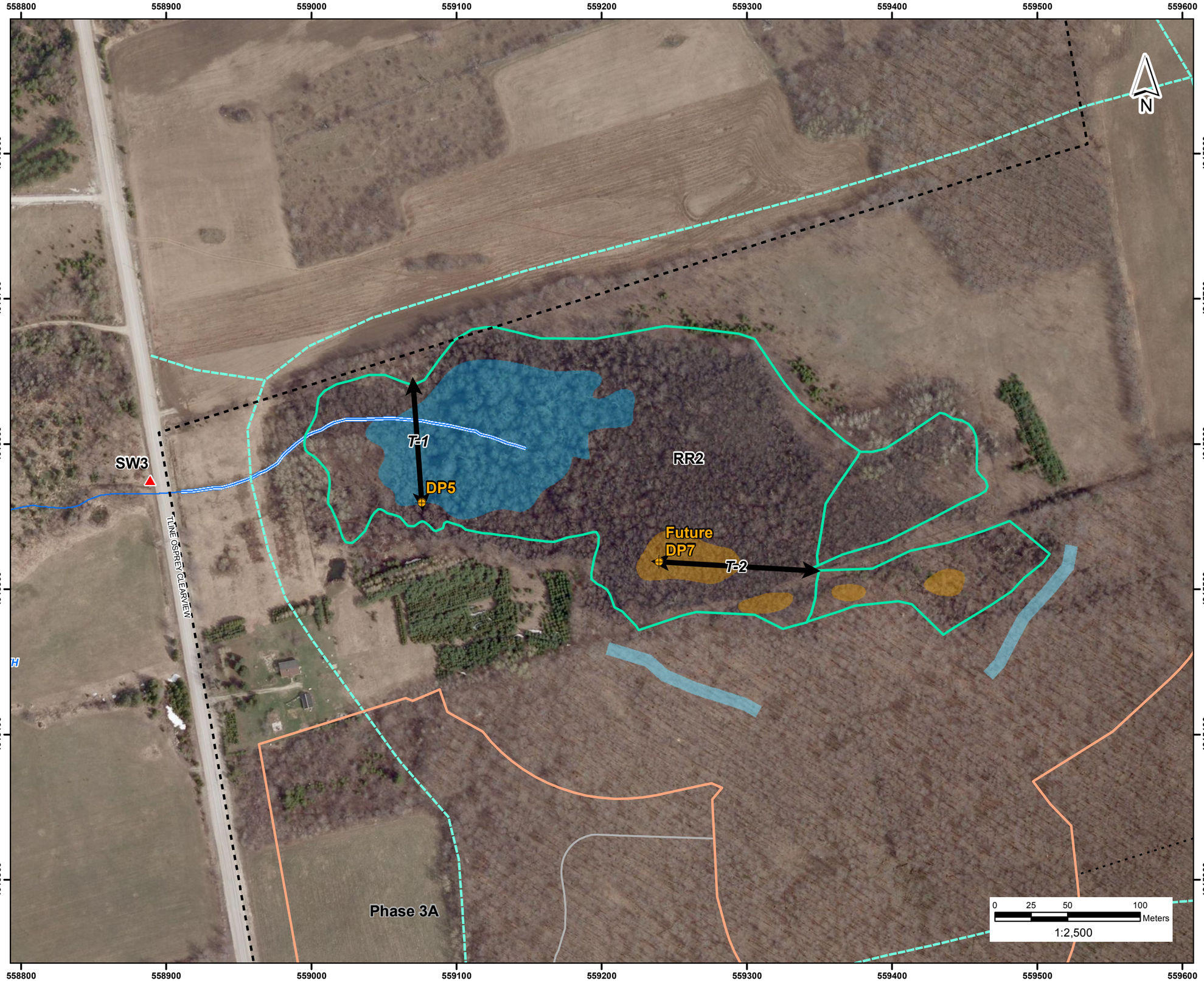
The instrumentation to be used for the Performance Indicator and Long Term Trend Water Monitoring Programs reflects contemporary industry standards for this type of work, as noted below, or using instruments having equivalent function and capability.

- Water Level and Temperature Dataloggers:
  Solinst Levelogger Gold and/or Silver
- Barologger:
  Solinst Barologger
- Manual Electronic Water Level Meter:
  Solinst Graduated Tape Meter
- Manual Water Temperature Thermometer:
  YSI 556 Multiparameter System
- Streamflow Velocity Meter:
  Valeport Model 801
- Dissolved Oxygen Meter:
  YSI 556 Multiparameter System
- Field pH:
  YSI 556 Multiparameter System
- Field Conductivity:
  YSI 556 Multiparameter System
- Climate Station at Existing Quarry:
  Davis Vantage Pro2

The instruments will be maintained in good working order and will be calibrated regularly, as per the manufacturers' recommendations. Results will be recorded in a field book for future reference if needed.

Appendix H: Wetland Monitoring Locations and Data Sheets

ATTACHMENTS:



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Revised: 2012-11-16 By: pwursell

Walker Aggregates Inc.

Legend

- Walker Owned Lands
- Limit of Extraction - Walker
- Phase Boundary
- Phase 4 - Lower Bench
- Surface Water Monitoring Station and Designation (Jagger Hims, 2005)
- Surface Water Monitoring Station with Observed Seepage (within 120m of the proposed licensed area)
- Surface Water Monitoring Station - Karst 2007
- Drive Point Monitoring Location
- Transect
- Karst Infiltration Area
- Surface Trench Discharge
- Dual purpose Monitoring/Recharge Wells
- Wetland [4]
- Interpreted Wetland Catchment Areas
- Approximate location of diffuse overflow channel between ANSI A and ANSI B
- Intermittent Surface Water Features and Fisheries Habitat
- Undefined Braided Channel
- Dug Agricultural Ponds

Vernal Pools

- Approximate Location of Deeper Vernal Pools
- Approximate Location of Shallower Vernal Pools

Notes

1. Coordinate System: UTM NAD 83 - Zone 17(N)
2. Data Sources: Ontario Ministry of Natural Resources, © Queens Printer Ontario, 2009.
3. Image Source: First Base Solutions WMS, 2009.
4. Wetland boundaries approximated using handheld GPS and air photo except where adjacent to proposed license boundary, surveyed in consultation with MNR.

November, 2012
62602732

Client / Project

WALKER AGGREGATES INC.
DUNTROON QUARRY EXPANSION
ADAPTIVE MANAGEMENT PLAN

Figure No.

H.1

Title

RR2 TRANSECT LOCATIONS

559700 559800 559900 560000 560100 560200 560300 560400 560500

4915900 4915800 4915700 4915600 4915500 4915400 4915300

Future IW3

ANSI Wetland A

DP6 T-3

Future DP9

SW9

ANSI Wetland B

SW7

Millar Cow Pond

Bridson DP

T-4

SW8

Bridson Pond

Phase 2B

Phase 2A

N

0 25 50 100 Meters

1:2,500

W:\active\2002 Active Projects\2700-2799\G2732\drawing\GIS\MXD\Adaptive_Management_Plan\2013_AMP\62602732_AMP_FigH-2_ANSI_WetlandTransectLocations_20131128.mxd
Revised: 2013-12-02 By: cweeks

Walker Aggregates Inc.

Legend

- Walker Owned Lands
- Limit of Extraction - Walker
- Phase Boundary
- Phase 4 - Lower Bench
- Surface Water Monitoring Station and Designation (Jagger Hims, 2013)
- Surface Water Monitoring Station with Observed Seepage (within 120m of the proposed licensed area)
- Surface Water Monitoring Station - Karst 2007
- Transect
- Karst Infiltration Area
- Surface Trench Discharge
- Drive Point Monitoring Location (Jagger Hims, 2013)
- Dual purpose Monitoring/Recharge Wells
- Wetland [4]
- Interpreted Wetland Catchment Areas
- Approximate location of diffuse overflow channel between ANSI A and ANSI B
- Intermittent Surface Water Features and Fisheries Habitat
- Undefined Braided Channel
- Dug Agricultural Ponds

Vernal Pools

- Approximate Location of Deeper Vernal Pools
- Approximate Location of Shallower Vernal Pools

Notes

1. Coordinate System: UTM NAD 83 - Zone 17(N)
2. Data Sources: Ontario Ministry of Natural Resources, © Queens Printer Ontario, 2009.
3. Image Source: First Base Solutions WMS, 2009.
4. Wetland boundaries approximated using handheld GPS and air photo except where adjacent to proposed license boundary, surveyed in consultation with MNR.

November, 2013
62602732

Client / Project

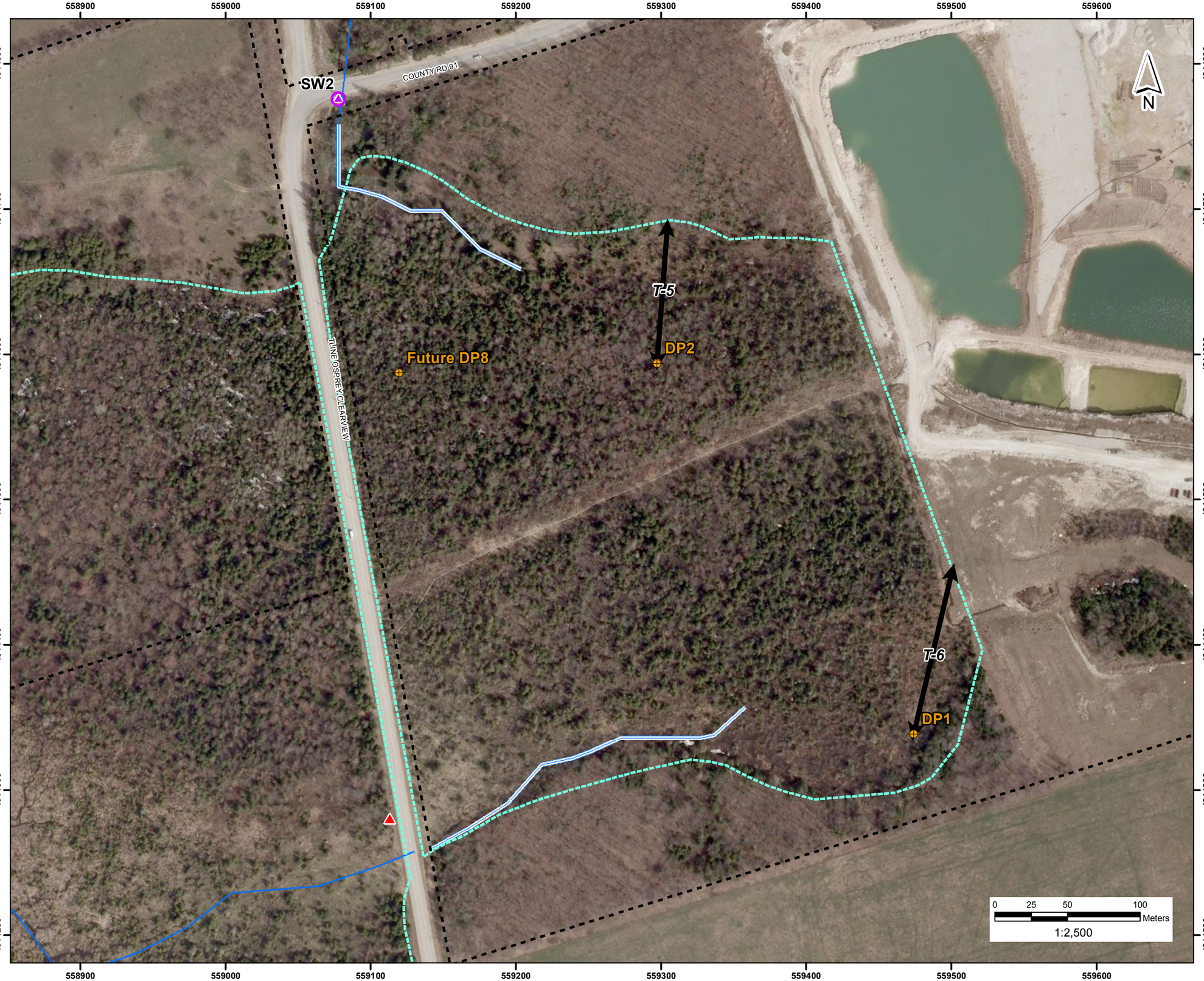
WALKER AGGREGATES INC.
DUNTROON QUARRY EXPANSION
ADAPTIVE MANAGEMENT PLAN

Figure No.

H.2

Title

ANSI WETLAND TRANSECT LOCATIONS



W:\active\2002 Active Projects\2700-2799\G2732\drawing\GIS\MXD\Adaptive_Management_Plan\2013_AMP\62602732_AMP_FigH-3_RR6_WetlandTransectLocations_20131128.mxd
Revised: 2013-12-12 By: cweeks

walker industries

Walker Aggregates Inc.

Legend

- Walker Owned Lands
- Limit of Extraction - Walker
- Phase Boundary
- Phase 4 - Lower Bench
- Surface Water Monitoring Station and Designation (Jagger Hims, 2013)
- Surface Water Monitoring Station with Observed Seepage (within 120m of the proposed licensed area)
- Surface Water Monitoring Station - Karst 2007
- Drive Point Monitoring Location (Jagger Hims, 2013)
- Transect
- Karst Infiltration Area
- Surface Trench Discharge
- Dual purpose Monitoring/Recharge Wells
- Rob Roy Swamp PSW Complex
- Wetland [4]
- Interpreted Wetland Catchment Areas
- Approximate location of diffuse overflow channel between ANSI A and ANSI B
- Intermittent Surface Water Features and Fisheries Habitat
- Undefined Braided Channel
- Dug Agricultural Ponds

Vernal Pools

- Approximate Location of Deeper Vernal Pools
- Approximate Location of Shallower Vernal Pools

Notes

1. Coordinate System: UTM NAD 83 - Zone 17(N)
2. Data Sources: Ontario Ministry of Natural Resources, © Queens Printer Ontario, 2009.
3. Image Source: First Base Solutions WMS, 2009.
4. Wetland boundaries approximated using handheld GPS and air photo except where adjacent to proposed license boundary, surveyed in consultation with MNR.

December, 2013
62602732

Client / Project

WALKER AGGREGATES INC.
DUNTROON QUARRY EXPANSION
ADAPTIVE MANAGEMENT PLAN

Figure No.

H.3

Title

RR6 WETLAND TRANSECT LOCATIONS

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE:		POLYGON:	
	SURVEYOR(S):	DATE:		UTME:
	START:	END:	UTMZ:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>>MUCH GREATER THAN; >GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER			

HT CODES: **1**=>25m **2**=10<HT≤25m **3**=2<HT≤10m **4**=1<HT≤2m **5**=0.5<HT≤1m **6**=0.2<HT≤0.5m **7**=HT<0.2m

CVR CODES: **0**=NONE **1**=0%<CVR≤10% **2**=10<CVR≤25% **3**=25<CVR≤60% **4**=CVR>60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:		<10		10 – 24		25 – 50		>50
STANDING SNAGS:		<10		10 – 24		25 – 50		>50
DEADFALL/LOGS:		<10		10 – 24		25 – 50		>50

ABUNDANCE CODES: **N**=NONE **R**=RARE **O**=OCCASIONAL **A**=ABUNDANT

COMM. AGE:		PIONEER		YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES/GLEY	g=	G=
MOISTURE:	DEPTH OF ORGANICS:	(cm)	
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:	(cm)	

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS:	CODE:
COMMUNITY SERIES:	CODE:
ECOSITE:	CODE:
VEGETATION TYPE:	CODE:

	INCLUSION		CODE:
	COMPLEX		CODE:

Evidence of Disturbance / Notes:

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: **1**=CANOPY>10m **2**=SUB-CANOPY **3**=UNDERSTOREY **4**=GROUND (GRD.) LAYER
ABUNDANCE CODES: **N**=NONE **R**=RARE **O**=OCCASIONAL **A**=ABUNDANT **D**=DOMINANT

SPECIES CODE	LAYER				COLL.	SPECIES CODE	LAYER				COLL.
	1	2	3	4			1	2	3	4	

Page ___ of ___

Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________________ (Field Personnel)

Signature: ______________________ (Project Manager)

Project Number:	Location:
Date/Time:	Personnel:

Picture#___
GPS Location:______________________________
Tree Overstorey Condition: Good:___ Fair:___ Poor:___ Not Applicable:___
Understorey Vegetation Condition: Good:___ Fair:___ Poor:___ Not Applicable:___
Evidence of Soil Erosion/Sedimentation: Nil:___ Slight:___ Moderate:___
Presence of Encroachment into Woodland / Wetland and buffers: Yes:___ No:___
Condition of Silt Fence: Good:___ Fair:___ Poor:___ Not Applicable:___
Condition of Page Wire Fence: Good:___ Fair:___ Poor:___ Not Applicable:___
Incidental Observations:______________________________
Comments: ______________________________

Picture#___
GPS Location:______________________________
Tree Overstorey Condition: Good:___ Fair:___ Poor:___ Not Applicable:___
Understorey Vegetation Condition: Good:___ Fair:___ Poor:___ Not Applicable:___
Evidence of Soil Erosion/Sedimentation: Nil:___ Slight:___ Moderate:___
Presence of Encroachment into Woodland / Wetland and buffers: Yes:___ No:___
Condition of Silt Fence: Good:___ Fair:___ Poor:___ Not Applicable:___
Condition of Page Wire Fence: Good:___ Fair:___ Poor:___ Not Applicable:___
Incidental Observations:______________________________
Comments: ______________________________

Picture#___
GPS Location:______________________________
Tree Overstorey Condition: Good:___ Fair:___ Poor:___ Not Applicable:___
Understorey Vegetation Condition: Good:___ Fair:___ Poor:___ Not Applicable:___
Evidence of Soil Erosion/Sedimentation: Nil:___ Slight:___ Moderate:___
Presence of Encroachment into Woodland / Wetland and buffers: Yes:___ No:___
Condition of Silt Fence: Good:___ Fair:___ Poor:___ Not Applicable:___
Condition of Page Wire Fence: Good:___ Fair:___ Poor:___ Not Applicable:___
Incidental Observations:______________________________
Comments: ______________________________

Picture#___
GPS Location:______________________________
Tree Overstorey Condition: Good:___ Fair:___ Poor:___ Not Applicable:___
Understorey Vegetation Condition: Good:___ Fair:___ Poor:___ Not Applicable:___
Evidence of Soil Erosion/Sedimentation: Nil:___ Slight:___ Moderate:___
Presence of Encroachment into Woodland / Wetland and buffers: Yes:___ No:___
Condition of Silt Fence: Good:___ Fair:___ Poor:___ Not Applicable:___
Condition of Page Wire Fence: Good:___ Fair:___ Poor:___ Not Applicable:___
Incidental Observations:______________________________
Comments: ______________________________

Amphibian Call Survey Observation Form

Project Number: _____ Project Name: _____

Date: _____ Field Personnel: _____

Weather Conditions:	Temp:	Wind:	Cloud:	PPT:	PPT in last 24 hrs:

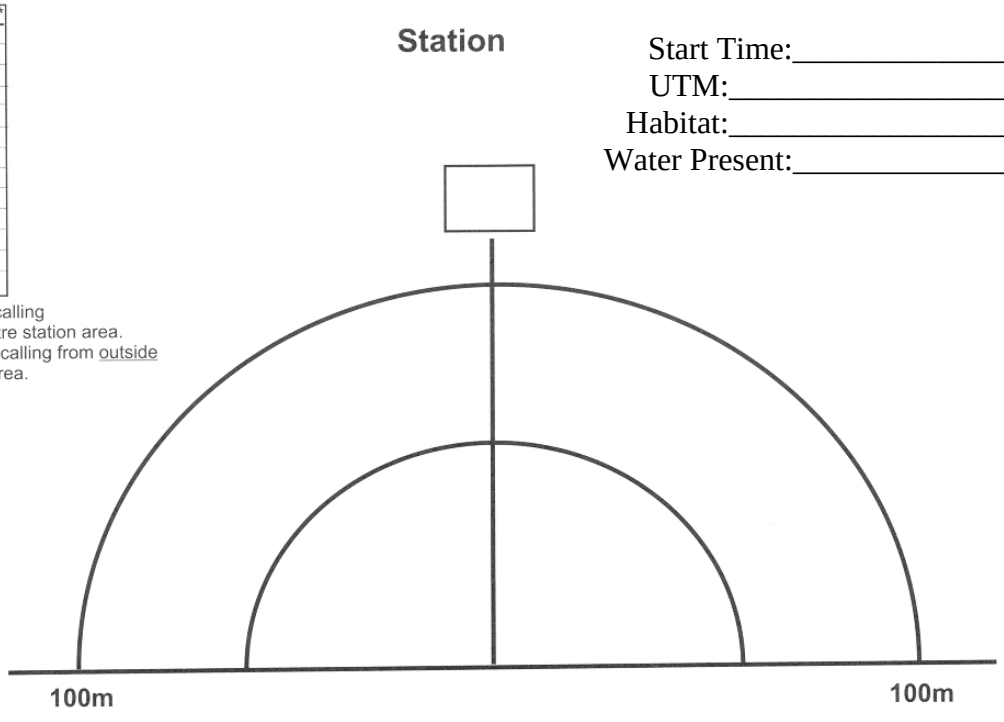
Visit Number:			
Start Time:		End Time:	

- **Record Start Time at Each Station**

_____

Species	In*	Out**
AMTO		
BCFR		
BULL		
CHFR		
CGTR		
FOTO		
GRTR		
GRFR		
MIFR		
NLFR		
PIFR		
SPPE		
WOFR		

* Check if species is calling from inside 100-metre station area.
** Check if species is calling from outside 100-metre station area.



Start Time:_____
UTM:_____
Habitat:_____
Water Present:_____

Quality Control: This form is complete (__) & legible (__).

Signature: _____ Signature: _____
(Field Personnel) (Project Manager)

	Amphibian Habitat Visual Assessment

Project Number_____ Project Name: _____

Date / Time: _____ Field Personnel: _____

Weather Conditions:	Temp:	Wind:	Cloud:	PPT:	PPT in last 24 hrs:

Site Information

Feature #: _____ *(name and locate on aerial photo)*

Vernal pool ID:_____.

Start time:_____End time:_____Duration of visit:_____.

Photos taken:

Waterbody Description	
Average depth (m)	
Maximum depth (m)	
Average length(m) width	
Fish likely present or observed?	

Direct salamander observations *(list species and number)*	
Other direct herp. Observations *(list species and number)*	

Quality Control: This form is complete (__) & legible (__).

Signature: _____ Signature: _____

(Field Personnel) (Project Manager)

	Salamander Egg Survey Observation Form **2-page**

Project Number_____ Project Name: _____

Date / Time: _____ Field Personnel: _____

Weather Conditions:	Temp:	Wind:	Cloud:	PPT:	PPT in last 24 hrs:

Site Information

Site ID: _____ *(name and locate on aerial photo)*

Pond UTM: Easting:_____Northing:_____GPS Accuracy = $^{+}_{-}$_____.

Start time:_____End time:_____Duration of visit:_____.

Photos taken:

Waterbody Description	
Average depth (m)	
Maximum depth (m)	
Average length(m) width	
Water temperature	
Water flow and speed	
Substrate / soils	
Amount and type of litter / debris	
Number of egg attachment sites	
Fish likely present or observed?	
Emergent / wetland vegetation	
Edge vegetation	
Dominant surrounding vegetation / community	
Percent canopy closure over pond	
Percent in-pond shrub cover and species	

Quality Control: This form is complete (__) & legible (__).

Signature: _____ Signature: _____

(Field Personnel) (Project Manager)

Sketch of Pond -Include dimension of pond and location of egg masses

OTHER NOTES:

Egg Mass Observations		
Number of masses observed:		
Total number of **live** masses by probable species	Species Code	# Egg masses
Total number of **dead** masses by probable species	Species Code	# Egg masses
Direct salamander observations *(list species and number)*		
Other direct herp. Observations *(list species and number)*		

Quality Control: This form is complete (__) & legible (__).

Signature: _____ Signature: _____

(Field Personnel) (Project Manager)

Page _____ of _____ REV: May, 07 Form 004

VISUAL VEGETATION HEALTH ASSESSMENT DATACARD

SITE: _____

DATE: _____

	Standing Water (>20%)	Standing Water (<20%)	Surface Saturated	Soil Wet	Soil Moist	Soil Dry	Dessication Cracks evident
Soil Moisture							

	Species
	Sensitive Fern (*Onoclea sensibilis*)
	Spottend Jewelweed (*Impatiens capensis*)
	Other:

	Extent of Symptom				Site Occurrence of Symptom		
	None	Minimal (<50 of new leaves/shoots)	Moderate (>50% new leaves/shoots)	Entire Plant	Local	Widespread/ uncommom (<50 of plants)	Widespread/ common (>50% of plants)
LEAF SYMPTOMS							
Wilt							
Yellowing							
Browning							
Premature Abscission							
BUD SYMPTOMS							
Dead Leaf Buds							
Dead Flower Buds							
ABNORMAL GROWTH							
Small Leaves							
Stunted Growth							
Other							
DISEASE							
Insect Evidence							
Gall Formation							
Leaf Curl							
PHOTOS							
Description of photos taken:							

Appendix I: American Hart's-tongue Fern Monitoring

ATTACHMENTS:
[Transect locations and sample data forms will be included, at least two years prior to the start of extraction in Phase 2B]

Appendix J:
Millar Pond Relocation Plan

ATTACHMENTS:

Figure J.1: ELC Vegetation Communities and Proposed Relocation Site

Figure J.2: Conceptual Drawing: Proposed Relocated Pond

Appendix J: Millar Pond Relocation Plan

The Millar Pond within the proposed expansion area is a single dug farm pond. As part of an integrated resource management approach for this site, Walker has received approval to remove the pond and associated wetland plant species and recreate similar, but enhanced, ecological functions in an area a short distance to the northeast.

Further enhancements of ANSI Wetland B around the relocated Millar Pond shall be considered as part of the field-fitting process during planting.

Proposed Relocation and Enhancement

As described in **Section 6.4** of this AMP, the objectives of the Millar Pond relocation and enhancement are:

- Mimic the hydrology of the existing Millar pond, ensuring occasional drying to control fish introduction;
- Create wetland type suitable for amphibians;
- Create a naturalized pond perimeter consisting of native species;
- Control introduction and establishment of invasive species; and
- Provide a long term functional natural heritage feature.

The area proposed for the relocation of the Millar Pond is immediately north of the original pond location (see **Figure J.1**). This site is similar to the Millar Pond area, in that it contains the same treed vegetation communities. The new dug pond will be created to mimic the current hydrology of the Millar Pond, so that in some years it will dry out. This will ensure that fish populations, which can negatively impact amphibian breeding success through predation of eggs and young, do not become established. Substrates in the pond will consist of muck, which will replicate any over-wintering habitat for amphibians that the original Millar Pond may have had.

Certain aspects of the new pond will provide a greater diversity and quality of habitat than that offered by the existing Millar Pond, with an emphasis on planting only native species of trees, shrubs and herbs, and avoiding the creation of an old field meadow species assemblage. Trees, once mature, will help shade the pond and reduce water temperatures in summer (as noted in 2003, temperatures and therefore dissolved oxygen were occasionally above the objective for warmwater biota in the Millar Pond). Wetland shrubs, in concert with submerged herbaceous plants, will increase egg-attachment sites for breeding anurans.

A drawing of the proposed pond configuration is presented in **Figure J.2**.

The new pond will be created within 3 years of commencing extraction, as no significant impacts to the existing Millar Pond are anticipated during Phase 1. In order to ensure the proposed pond

is available for breeding amphibians in early spring, it will be dug during the fall and planted during the spring. This will ensure one full growing-season passes prior to removal of the Millar Pond, to allow plantings to become well-established and sediments in the water to settle.

As noted, the hydrology of the new pond will be natural and driven by runoff and seepage for the period after its creation until Phase 2B has advanced enough to interfere with the natural hydrology. Once Phase 2B reaches this point, surface water inputs will be added, if required, through pumping from the quarry as necessary. At quarry closure, hydrology in the pond will be sustained by seepage and/or the localized surface runoff that will occur. To assist with water retention, a portion of the pond will be lined with clay soils.

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Base Map Source: © First Base Solutions, 2012. Imagery taken in 2008.

walker industries

Walker Aggregates Inc.

N
W E
S

0 25 50 100 150 200 Meters

1:5,000

- Duntroon Quarry Expansion License Area
- ELC Vegetation Communities
- Duntroon Escarpment Regional ANSI
- Limit of Extraction - Walker
- Millar Pond Area

FOREST (FO)
Deciduous Forest (FOD)
FOD5-1 Dry-Fresh Sugar Maple Deciduous Forest
FOD5-2 Dry-Fresh Sugar Maple-Beech Deciduous
FOD5-4 Dry-Fresh Sugar Maple-Ironwood Deciduous Forest
FOD6-5 Fresh-Moist Sugar Maple-Hardwood Deciduous Forest

CULTURAL (CU)
Cultural Meadow (CUM)
CUM1-1 Dry-Moist Old Field Meadow
Cultural Savanna (CUS)
CUS1 Mineral Cultural Savanna

SWAMP (SW)
Deciduous Swamp (SWD)
SWD2-2 Green Ash Mineral Deciduous Swamp
Mixed Swamp (SWM)
SWM1-1 White Cedar-Hardwood Mineral Mixed Swamp

OTHER
AG Agriculture/Pasture
R Residential
H Hedgerow

* ELC based on air photo interpretation, roadside analysis, FRI, ANSI, and wetland reports.

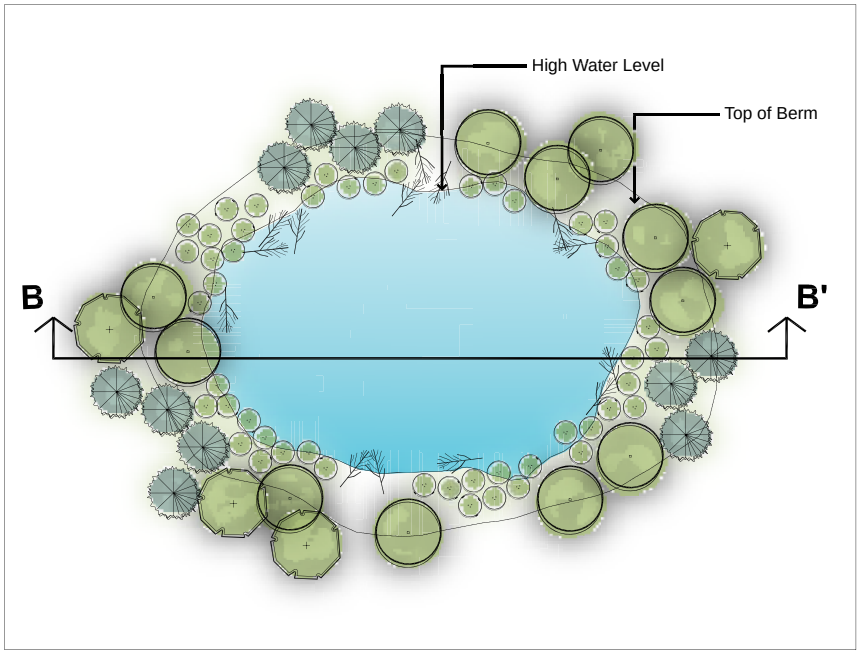
PREPARED FOR:

WALKER AGGREGATES
DUNTROON LICENSE EXPANSION

Figure No.
J.1

ELC VEGETATION COMMUNITIES AND PROPOSED RELOCATION SITE

Initiated: August 2005
Revised: November 2012



PLAN 1:100

NOTES

SITE CLEARING PRIOR TO POND EXCAVATION IS TO BE SELECTIVE AND MINIMAL. ALL WOODY MATERIAL SHALL REMAIN ON SITE.

LEAF LITTER/ORGANIC MATTER AND TOPSOIL TO BE STRIPPED AND STOCKPILED PRIOR TO COMMENCING POND EXCAVATION.

POND BOTTOM TO BE LINED WITH LOWER PERMEABILITY SOIL, EXCEPT FOR SEEPAGE AREAS, AS DETERMINED ON-SITE BY LANDSCAPE ARCHITECT.

THERE IS TO BE NO NET EXPORT OR IMPORT OF MATERIAL, EXCEPT FOR CLAY FOR POND LINING IF DEEMED NECESSARY.

ONCE POND BOTTOM IS LINED, TOP DRESS WITH SALVAGED ORGANIC MATTER AND SPREAD EVENLY OVER THE POND BOTTOM.

ADDITIONAL LEAF LITTER SALVAGED FROM THE WORK AREA SHALL BE ADDED TO THE POND BOTTOM.

COARSE WOODY DEBRIS (E.G. BRANCHES) TO BE PLACED WITHIN POND AND ALONG POND EDGE. ALL WOODY MATERIAL SHALL BE SALVAGED FROM MATERIAL CUT ON SITE DURING POND EXCAVATION.

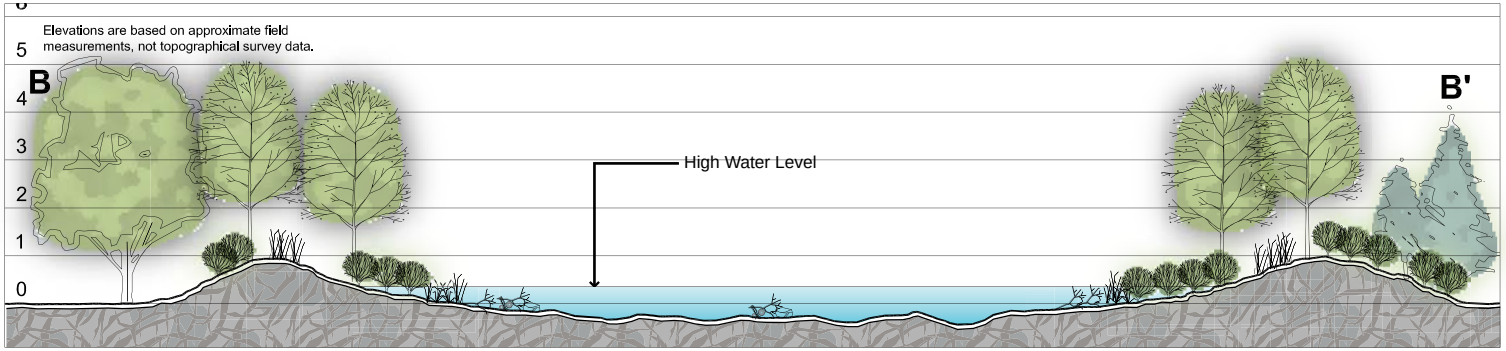
LIVE DOGWOOD STAKES TO BE COLLECTED FROM A LOCAL, NEARBY SOURCE.

FINAL PLACEMENT OF TREES AND SHRUBS TO BE DETERMINED BY LANDSCAPE ARCHITECT BASED ON LOCATION OF EXISTING TREES AND OPPORTUNITY TO PROVIDE ADDITIONAL SHADING OF POND.

SELECTION AND USE OF ASH TREES WILL GIVE CONSIDERATION TO TRENDS IN THE EMERALD ASH BORER PROBLEM. ASH TO BE USED ONLY AS A NURSE CROP, OR, IF INTENDED AS PART OF MATURE FOREST, RESISTANT STOCK MAY BE USED IF AVAILABLE.

PLANTING SCHEDULE

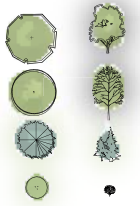
PLANT NAME	SIZE	QTY	CONDITION	REMARKS
Acer saccharum sugar maple	60 mm	4	tree spade	straight trunk, full crown
Fraxinus pennsylvanica green ash	60 mm	11	tree spade	straight trunk, full crown; ash may be substituted dependent on status of emerald ash borer
Thuja occidentalis eastern white cedar	60 cm	11	tree spade	full, bushy
Cornus stolonifera red-osier dogwood	50 cm	50	live stake	



SECTION A-A'

1:50
2x vertical ex.

PLANTING KEY



ACER SACCHARUM
SAPLING TREE SPADED ON SITE

FRAXINUS PENNSYLVANICA
SAPLING TREE SPADED ON SITE

THUJA OCCIDENTALIS
SAPLING TREE SPADED ON SITE

CORNUS STOLONIFERA
LIVE STAKES COLLECTED ON SITE

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Figure No. J.2

CONCEPTUAL GRADING & PLANTING PLAN FOR PROPOSED MILLAR POND RELOCATION

Date Prepared: November, 2013

Appendix K:
Final Lake Discharge Design

Appendix K: Final Lake Discharge Design

Seasonal water discharge out of the rehabilitation lake into the Rob Roy Swamp PSW Complex unit RR 2 and ANSI wetland A / ANSI wetland B is to be proportional to the catchment areas of each wetland that was extracted. Passive discharge from the lake will be by means of broad-crested weirs that shall be sized to achieve an overall distribution ratio of 60:40 to RR2 Wetland (Beaver River North tributary) and ANSI Wetland A / ANSI Wetland B (Batteaux Creek tributary), respectively. A functional design concept for a typical broad-crested weir discharge structure from the quarry lake to the wetlands is provided herein.

Final design of the discharge structures shall be completed once extraction around the northern perimeter of Phase 2A, 2B and 3B is complete and the final rock surface is exposed. Final designs shall be field-fitted to reflect the actual conditions present at each discharge location. Final design shall be completed to the satisfaction of MNR and MOE in consultation with the Grey Sauble Conservation Authority (GSCA) and the Nottawasaga Valley Conservation Authority (NVCA) [as per ARA Site Plan Operational Note 12(c)]. The approved final designs shall be incorporated into this Appendix K and may be modified or changed as part of a 5-Year Comprehensive Review.

In order to ensure that the lake discharge function of the outlet structures is maintained into the future, the Conservation Easement that is to be on title for the property will include a positive obligation (covenant) to maintain the outlets from the quarry lake.

The following conceptual-design information is provided as technical support for final design of outlet structures to manage the seasonal discharge from the Final Lake in the Expansion Quarry.

Apportioning Final Rehabilitation Expansion Quarry Lake Seasonal Discharges to RR2 Wetland (Beaver River North Tributary) and to ANSI Wetland A/ Wetland B (Batteaux Creek Tributary)

Assumptions:

- Final lake area = 48.03 ha per Rehabilitation Site Plan (Phase 3B NOT extracted).
- Final lake area = 51.23 ha per Rehabilitation Site Plan (Phase 3B EXTRACTED).
- For this exercise, it is assumed that Phase 3B WILL BE EXTRACTED, such that the Final Lake Area = 51.23 ha.
- Discharge from the lake to each wetland will be managed passively by means of engineered outlets that are designed to apportion the discharge based on the relative catchment areas of each wetland removed by extraction.

- Seasonal rise in lake water level in the Spring will be 0.3 m above the annual average elevation of 511.9 m asl (i.e. to a Spring high-water level elevation of 512.2 m asl).
- The rise of the lake water level above the control elevation of the outlets and subsequent discharge will occur relatively quickly through the Spring freshet period, followed by a progressive decline of the lake level back down to, and subsequently below, the outlet control elevations as a result of prevailing climatic conditions.
- Volume increase due to 0.3 m water level rise over total surface area of lake = 153,500 m3 approximately.
- There may be some additional surface run-off contribution from the lands surrounding the final lake and the quarry perimeter during the spring freshet period, but such additional contribution is not included.
- The volume of water from within each watershed that is affected by the completed extraction of the Expansion Quarry is proportional to the size of surface water catchment areas that are removed from each watershed. This is the case whether we are considering:
    - Surface Runoff Contribution
    - Groundwater Contribution
    - Combined Surface Water and Groundwater Contribution (groundwater basins assumed to be similar to surface water basins and are defined by the surface drainage divides).
- For this assessment, it is assumed that prior to any extraction in the Existing Quarry, that is under original pre-quarry conditions, any internal drainage / groundwater recharge that occurred within the 18 ha closed drainage basin present in the south-central part of the Expansion Quarry property was distributed equally to the Batteaux Creek watershed to the east and the Beaver River watershed to the west. Therefore, when estimating the relative sizes of the catchment areas extracted from within the Batteaux Creek watershed and that of the Beaver River, 9 ha is added to each catchment area.
- Provided that the seasonal overflow outlets from the final lake to the wetlands apportion Spring discharge into each wetland based on the relative areas of catchment removed, the post-rehabilitation water balance between surface water basins will be satisfied (RR2 / RR3 wetland for the Beaver River North tributary system, and ANSI Wetlands A/B for the Batteaux Creek Tributary system).
- The post-quarry hydrological characteristics of the RR2/RR3 wetlands and ANSI Wetland A / Wetland B will be similar to existing pre-quarry conditions. Spring freshet surface water will continue to pond in RR2 and in ANSI Wetland A. Once the vernal ponding storage capacity of RR2 wetland has been reached, excess water entering RR2 will move through that wetland to the west into RR3 and the rest of the Beaver River North tributary system. Similarly, once the vernal ponding storage capacity of ANSI Wetland A has been reached, excess surface water will overflow to the east into, and through, ANSI Wetland B (since no vernal ponding occurs). Outflow from ANSI Wetland B will flow into the karst infiltration area where it will recharge the underlying bedrock and resurface at the Escarpment springs to the east in the Batteaux Creek watershed.

- Seasonal discharge to the RR6 wetland / Beaver River South tributary system will occur via the outlet from the final lake in the Existing Quarry.
- Groundwater will discharge from the final lake through the quarry walls to the Escarpment springs / Batteaux Creek watershed to the east, and to the west to the Beaver River watershed, in proportion to the area of the final quarry wall within each watershed, the then-prevailing seasonal hydraulic gradients and the hydraulic conductivity of the rock mass.

The volume of water and the rate at which that water is discharged into any particular wetland can be controlled by means of the design of the overflow outlet, in terms of the shape and size, and elevation control on the invert of the outlet channel.

The suggested approach to achieve proportional distribution to the Beaver River North tributary system and to the Bateaux Creek system is to adopt the same basic design (broad-crested weir) with the same elevation control for each outlet to the two wetland systems. The proportional discharge to each wetland system shall be controlled by sizing each outlet accordingly.

The size of the drainage catchment areas to be removed as a result of extraction is based on the values given in **Table F.1** in **Appendix F**:

- RR2 / RR3 (Beaver River North Tributary catchment)
  = 13.6 ha (allowing for the retention of the Northern Peninsula lands and wetland buffer).
- RR6 wetland drainage catchment area (Beaver River South Tributary)
  = 12.3 ha
  It is noted that whereas there will not be a surface water outlet from the final lake to RR6, the volume of water that will be discharged into the Beaver River North tributary system includes the component for RR6 that reflects the size of the catchment area removed by extraction.
- Equal share of internal drainage basin catchment
  = 9 ha
- Total Beaver River drainage catchment area to be removed
  = 34.9 ha
- ANSI Wetland A plus ANSI Wetland B catchment (Batteaux Creek catchment)
  = 14.6 ha
- Equal share of internal drainage basin catchment
  = 9 ha
- Total Batteaux Creek drainage catchment area to be removed
  = 23.6 ha
- Total combined drainage catchment area to be extracted
  = 58.5 ha

- RR2 / RR3 / Beaver River catchment removed
  = 34.9 ha or 60% of total (approx.)
- ANSI Wetland A / Wetland B / Batteaux Creek catchment removed (combined catchment)
  =23.6 ha or 40% of total (approx.)
- Differential between catchment areas / discharges
  = 20% (approx.)

The seasonal outflow from the lake needs to be distributed in the following proportions for the relative surface water balance between the watersheds to be similar to pre-quarry conditions:

- 60% of seasonal discharge to go to RR2 / RR3 Wetland system (Beaver River North tributary watershed).
- 40% of seasonal discharge to go to ANSI Wetland A / Wetland B system (Batteaux Creek watershed).

The same basic design shape is proposed for each outlet (a broad-crested weir) and the same control elevation is proposed for each weir overflow outlet. The outlet control elevation is set at 511.9 m asl, which is the predicted annual average elevation of the final lake. Thus, as soon as the lake level rises above the outlet control elevation of 511.9 m asl, each watershed begins to receive its proportionate share of the lake discharge. Lake discharge will continue until the water level declines below the outlet control elevation.

The 60:40 proportional discharge to each watershed is achieved by sizing the outlets appropriately. In the event that more than one outlet is required for either watershed, each outlet is designed to achieve the desired distribution, while maintaining the overall 60:40 split between the watersheds.

Seasonal Discharge Volume

- Average volume available for seasonal discharge = area of lake (51.23 ha) x seasonal rise in lake level above outlet control elevation (0.3 m)
- Volume available = 153,500 m^3 (approximately)
- RR2/RR3/Beaver River North tributary to receive 60% of surface discharge, or approximately 92,000 m^3
- ANSI Wetland A/B/Batteaux Creek to receive 40% of surface discharge, or approximately 61,500 m^3.

The rate of seasonal discharge to each watershed will depend on the size / shape of each outlet, and the elevation of the lake water level above the outlet control elevation of 511.9 m asl which will vary depending on snowpack thickness, fast or slow spring melt conditions and intensity of spring rainfall events.

Given that the basic design, flow characteristics and outlet control elevation (511.9 m asl) are to be the same for all outlets, the rate of discharge will be proportional to the width of each individual broad-crested outflow weir and the height of water (lake level) above the weir.

For the case of a single broad-crested outlet weir into each of RR2 and ANSI Wetland A, it is suggested that the width of the weir outlet into RR2 be restricted to a maximum of 3.05 m (10 feet). The corresponding outlet weir into ANSI A would be 2.03 m (6'8") wide in order to achieve the 60:40 distribution between the two watersheds.

In the event that more than one outlet is required for either the RR2 wetland and/or for the ANSI Wetland A / Wetland B system, then the width of each outlet should be sized appropriately to satisfy the individual discharge rates required and the overall 60:40 split between the two watersheds.

Final Design of Lake Discharge Structures

Given that the need for implementation of the outlet structures is many years away, it is recommended that the actual final design of the outlets to each wetland / watershed be undertaken once extraction has been completed around the northern sections of Phase 2A and 2B, and possibly the northern section of Phase 3B, so that the final rock surface is visible and elevations can be determined. The outlet designs can then be field-fitted to reflect the actual conditions present and proportioned to achieve the required 60:40 distribution to the Beaver River watershed and the Batteaux creek watershed respectively. The outlet designs will be in accordance with the broad-crested weir functional design concept provided herein.

This will also provide many years of monitoring data related to maintenance of wetland hydrology and surface water hydrology in the downgradient watercourses. At that point, approved final design(s) to the satisfaction of MNR and MOE in consultation with the GSCA and NVCA will be incorporated into this AMP document.

At this time, it is envisaged that the outlets will comprise constructed overflow control structures such as broad-crested weirs, which provide elevation control and discharge rate control incorporated into the exposed rock face, with an overflow spillway weir outflow into an energy-dissipation channel, to minimize soil erosion, to convey the discharge water into the wetlands. The elevation of the outflow control component for any and all outlet structures shall be 511.9 m asl.

Recognizing that ultimately the quarry licence is to be surrendered by the operator once final rehabilitation is complete and monitoring shows that the wetlands are self-sustaining, the outlet structures should be designed to be as simple and maintenance-free as possible, such that long-term maintenance does not become a significant concern.

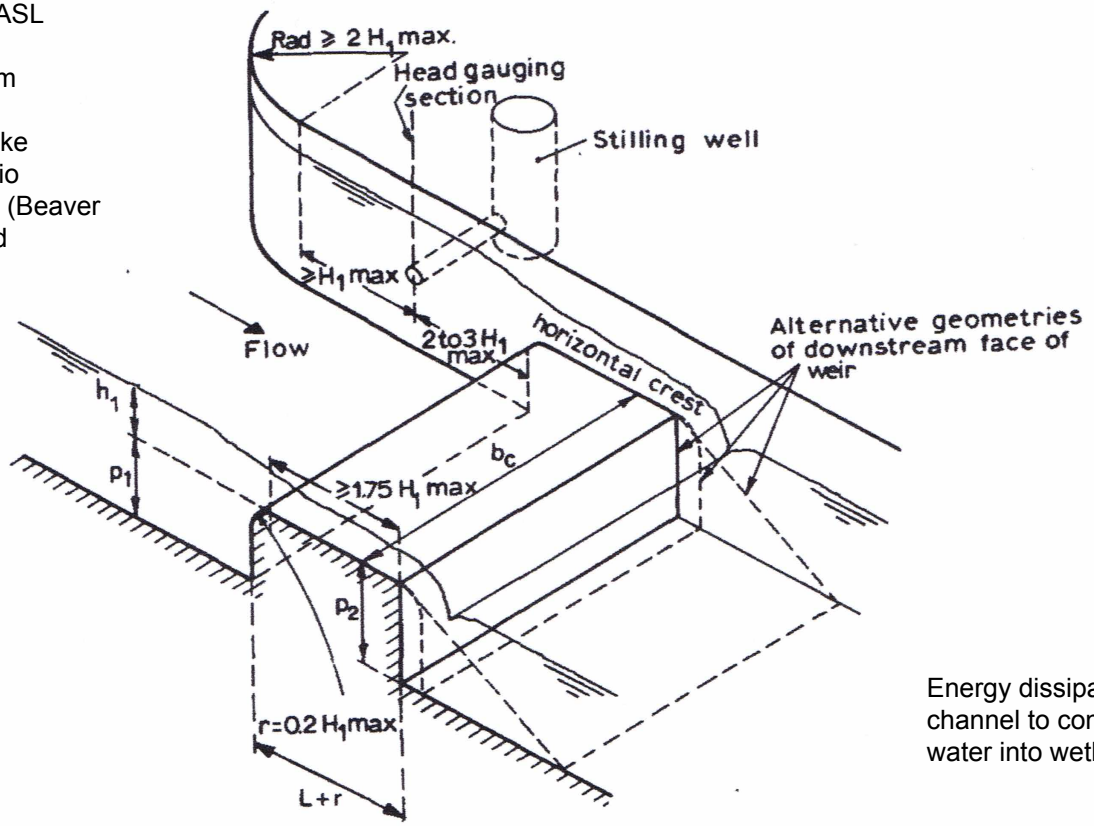
In order to ensure that the lake discharge function of the outlet structures is maintained into the future, the Conservation Easement that is to be on title for the property will include a positive obligation (covenant) to maintain the outlets from the quarry lake.

A functional design concept of a broad-crested weir is provided in **Figure K.1**.

Crest elevation 511.9 m ASL

Crest width 3 m maximum

To be sized to achieve lake discharge distribution ratio of 60:40 to RR2 Wetland (Beaver River North tributary) and ANSI Wetland A/B (Batteaux Creek)



Energy dissipation channel to convey water into wetland

Dimensions of round-nose broad-crested weir and its abutments (adapted from British Standards Institution 1969)

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Figure No. K.1

Broad-Crested Weir Design Concept

Date Prepared: December, 2013