Appendix A:
Performance Indicator
Trigger Monitoring Program

APPENDIX A: PERFORMANCE INDICATOR TRIGGER MONITORING PROGRAM
DUNTROON QUARRY EXPANSION
AGGREGATE RESOURCES ACT APPLICATION
LOT 25 AND PT. LOT 26, CONCESSION 11
TOWNSHIP OF CLEARVIEW

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A.1 Introduction and Background

This Appendix describes the Performance Indicator Trigger Monitoring (PITM) component of the Adaptive Management Plan. The interrelationships between the PITM and the other components of the Adaptive Management Plan are illustrated on **Figure A-1** (see Attachment A-1 for figures), which is from the main AMP document.

A.1.1 BACKGROUND

The Performance Indicator Trigger Monitoring Program is a component of the Walker Aggregate Inc. Duntroon Quarry Expansion's Adaptive Management Plan (AMP). The AMP will guide the protection of the human and natural environment around the quarry by working with the interconnections and influences that create feedback loops between the quarry operation and the environment. The AMP includes both the influence of the quarry operations on the environment and the influence of the changing environmental baseline on the quarry operations and monitoring program. It recognizes that some changes to the environment may be as a result of factors that are not related to quarry operations. The AMP includes a program of short and long term monitoring that will help guide the operations for the quarry and identify if, and when, mitigation measures are needed and if and when mitigation measures should be adapted to changing environmental conditions. The AMP will be a 'living document' and represents a process where the scientific information that is collected from the various monitoring programs is analyzed, standards are tested and refined, and that information is communicated to a wider audience so the results of monitoring can be responded to in an effective way.

Performance Indicator Trigger Monitoring is designed to protect the natural heritage ecological features and functions and human uses of water that are present around the expansion property during active extraction phases of the quarry through to final rehabilitation as a lake. The performance indicator trigger monitoring provides a mechanism for the timely adaptation of quarry operations based on immediate and measurable effects of the operations on:

- Surface water temperature and flow
- Wetlands water levels

The Walker Adaptive Management Plan is built on the fact that the quarry is part of a complex natural system. The quarry will be part of the evolving environment and the environment is part of the evolving quarry operations. It is a complex system of interactions that when monitored, analyzed and adapted to, will result in a quarry operation that continually improves based on environmental performance indicators.

A.1.2 PREVIOUS TECHNICAL STUDIES

The technical studies prepared in support of the Duntroon Quarry Expansion application (see References, **Section A.4**) have concluded that quarrying can take place without negative impacts on significant natural heritage features. Those studies have included extensive field investigations, including detailed evaluation of existing karst geology features, monitoring and detailed assessment of the groundwater and surface water resources and associated natural environment on and adjacent to the expansion property. As well, the studies have included on-going assessment of the existing quarry operation, from which rock has been mined for several decades.

The assessment that has been completed for the expansion property has included an evaluation of impacts associated with the existing quarry operation as a case history to predict future impacts for the quarry expansion. As well, a detailed steady-state and transient computer model of the groundwater flow system in the area has been developed to assist with the understanding of the regional and local water resource setting. The model has been calibrated to existing annual average and short-term seasonal conditions as documented through the monitoring programs. A cumulative impact assessment has been completed that incorporated potential future impacts associated with the proposed MAQ Highlands Quarry to be located immediately to the west of the quarry expansion property.

The technical reports have undergone detailed technical review by the various regulatory agencies, and the karst geology evaluation and groundwater model were subjected to extensive third-party peer reviews that were completed at the request of the Niagara Escarpment Commission and other agencies. The groundwater model review completed in May 2009 by S. S. Papadopolous & Associates Inc. includes the following summary statements (italics added):

> *"Our review of the model predictions suggests that the proposed extension quarry will not have extensive negative effects on local resources. This is consistent with the data collected during the development of the existing quarry. In our opinion, the potential impacts of the proposed extension can be managed effectively." [Overview, page 4].*
>
> *"The predictions enhance our understanding of the potential impacts, but should not be regarded as being definitive. The results of the model simulations represent hypotheses of how the groundwater system may respond to future changes in conditions. It is essential that long-term monitoring data, collected as part of a solid and comprehensive Adaptive Management Plan, be used to test this hypothesis and refine the modeling through time." [Executive Summary, page 1].*

As noted above, this Appendix describes the Performance Indicator Trigger Monitoring program, which is to be the regulatory compliance component of the comprehensive Adaptive Management Plan.

A.1.3 PURPOSE AND SCOPE OF PERFORMANCE INDICATOR TRIGGER MONITORING

The purpose of the Adaptive Management Plan in general, and this Performance Indicator Trigger Monitoring component in particular, is to test the interpretations and assumptions made in, and the resulting predictions and conclusions arising from, the technical studies against the actual observations of quarry impacts, and to ensure that such impacts are maintained within acceptable limits. In this way the significant natural heritage features will be protected through the active operating life of the quarry as well as through the rehabilitation period to final post-closure conditions. The PITM provides a mechanism whereby quarry operations will be modified and mitigation measures implemented in the event that specified threshold criteria are approached or exceeded, to prevent negative impacts from occurring to significant natural heritage features based on the on-going evaluation of monitoring results. The monitoring results obtained through the PITM and the long-term routine groundwater and surface water monitoring programs (see Appendix B of the AMP) will be tested against the predictions of the model. The model will be refined periodically and re-calibrated against "observed current" conditions, so that predictions of future changes reflect the most up-to-date information and the actual response of the physical system to on-going quarry operations.

The PITM program is designed to ensure the short-term and long-term protection of the natural heritage ecological features that are present around the expansion property and to maintain their functions. The PITM program is intended to be a 'living document' that will continue to evolve during the active extraction phases of the quarry through to final rehabilitation as a lake.

This PITM program for the Duntroon Quarry Expansion will integrate with a similar program for the proposed MAQ Highlands Quarry which is located on the property immediately to the west of Grey Road 31. This integration includes the sharing of relevant monitoring data and joint resolution by the two operators of water supply interference complaints and / or performance indicator trigger criteria exceedances, if they occur, as outlined in Section 7.0 of the main AMP document text.

The broad scope of the PITM is to provide a detailed monitoring and response program for the quarry expansion that is designed to achieve the following objectives:

- Identify when quarry operations need to be modified to minimize immediate effects on ground water and surface water resources and associated impacts on natural heritage features and functions;
- Quantify the predicted groundwater / surface water impacts arising from quarry operations, test those impacts against established criteria and confirm the protection of the sensitive natural heritage ecological features and functions;
- Track the effectiveness of the operational water management and / or mitigation measures that are implemented to minimize the predicted impacts, and
- Provide feedback to refine and improve the water management and mitigation measures.

In order to achieve the above objectives, the Performance Indicator Trigger Monitoring program:

- Identifies key surface water and groundwater performance indicator monitoring parameters;
- Identifies key locations for which "hard" Early Warning Values and Action Trigger Values are applied;
- Identifies associated response actions;
- Establishes key operational measures for implementation by quarry staff;
- Includes key operating targets and performance indicator trigger criteria that form the compliance component of the monitoring operations, to which the ARA licence will be bound.
- Includes a reporting program that shares information with other interested parties and provides a mechanism for periodic review and modification of the various components of the Adaptive Management Plan, and
- Includes Walker Aggregates Inc. Well Interference Complaint Response Procedure that outlines the procedure that is followed by Walker Aggregates Inc. in response to well interference complaints (see Attachment A-2). This procedure is reviewed periodically and improved where required.

A.1.4 LIVING DOCUMENT

Adaptive management is a systematic process for continually improving management practices by learning from the outcomes of operational programs. The AMP and its component monitoring programs will be reviewed and updated on a five year cycle. Particular attention is paid to the water budget relative to the Rob Roy Wetland (individual wetland units and overall wetland feature) and ANSI A and ANSI B, and the important components of the flow regimes in the surrounding watercourses present in the Pretty River, Batteaux Creek and Beaver River systems. As such, the PITM is designed to be a 'living document' whereby new information based on observation and monitoring of the system's response to quarry operations is constantly assessed and incorporated into the AMP. This may lead to refinements to the performance indicators and trigger levels and the method and frequency of monitoring.

In summary, the PITM provides:

i) Short term performance indicators that can be monitored and quickly reacted to by operations to minimize immediate effects of operations on the ground and surface water regime. They are also to be used to measure the success of operational water management and mitigation measures, and identify if and when measured performance deviates significantly from target performance, such that a specific and pre-defined response action is required;

ii) A monitoring and reporting program to collect and share data on performance of management and mitigation measures and to validate the effectiveness of the performance indicators. Once the monitoring data have undergone a QA/QC evaluation the information routinely will be posted to a website for access by regulatory agency staff and other authorized parties as appropriate; and

iii) A range of feasible and practical pre-approved contingency response mechanisms that are available for implementation in the event that operational management and mitigation measures do not perform as expected.

iv) A reporting process that documents the state of well-being of the natural environment around the quarry, and provides a mechanism to review and modify, if appropriate, the Performance Indicator Trigger parameters in the Adaptive Management Plan.

A.2 Method

A.2.1 KEY CONCEPTS

The key concepts of this program are:

- Identification of key features to be protected;
- Identification of parameters to be quantitatively and qualitatively measured as the environmental compliance monitoring component of site plans through the Adaptive Management Plan;
- Identify importance of features and assign appropriate management/mitigation techniques;
- Real-time considerations: provide protocols for setting and adjusting threshold values for identified parameters;
- Understandable and easily implemented by quarry operator and staff;
- Reporting structure to facilitate agency review and input to periodic modification of the indicator parameters and trigger values as may be appropriate.

This Performance Indicator Trigger Monitoring program addresses water-related components that support natural heritage features. These are the features with a predominant aquatic aspect that potentially are subject to variable effects resulting in fluctuations in water regimes, such as provincially significant wetlands and fisheries outside the extraction area.

These components will be monitored so actions may be taken to modify Quarry Operations should they be shown to be negatively impacting the water resources which directly support significant natural heritage features, namely:

- Springs that discharge at the Niagara Escarpment east of the site. These springs subsequently help to sustain surface water flow and fish habitat below the brow of the Escarpment downstream in tributary streams of the Pretty River and Batteaux Creek. As well, springs and surface water flows that support fish habitat in the Beaver River west of the site are included.
- Surface water levels and flows and groundwater levels that support wetland features and functions.
- Performance indicator trigger values and associated mitigation measures for flow, temperature, and water level are developed for these key features as described in subsequent sections. Compliance of the quarry operation will be based on maintaining performance indicator parameter values within the target seasonal values.

This program defines green, yellow and red zones for the key performance indicators.

- The green zone represents normal operating conditions where the natural heritage feature in question is experiencing normal seasonal climatic conditions and is not experiencing any quarry-related stress. In the green zone, the Performance Indicator Trigger monitoring and the long term trend monitoring are being conducted as part of normal quarry operations.
- The yellow zone is reached when the Performance Indicator Trigger monitoring reveals that conditions at the designated location(s) have decreased below the green zone and continue to approach the critical action threshold (red zone). The cause of the decrease into the yellow zone may be natural seasonal climatic conditions (albeit possibly more extreme than normal), and / or quarry-related activities. Regardless of the reason, dropping into the yellow zone triggers an investigation to determine the cause, and, in the event that the decrease is caused by quarry operations, whether specific mitigation measures need to be implemented to return the condition to the green zone.
- The red zone is the point below which the potential for significant stress on the natural feature is possible. In the event that conditions drop below this critical action threshold trigger value into the red zone, the operator is required to take quick and positive action to alleviate imminent stress and to mitigate the particular impact. There are a number of mitigation options described, which could include cessation of quarry extraction activities in a specific area, or throughout the quarry in extreme circumstances.

Table A-1 summarizes the three zones, and the accompanying responses.

Table A-1: Key Performance Indicators and Operating Zones

	Stage	Possible Response
GREEN	Normal operating condition	Conduct regular operations with performance indicator monitoring and long-term trend monitoring per AMP and ARA site plans
YELLOW	One or more of the monitored parameter values falls below (or above, as applicable) its Seasonal Early Warning Value for either a wet-year, dry-year or an average-year condition.	▪ Verify parameter value and prevailing climatic condition. ▪ Investigate possible causes ▪ If quarry related then: – Increase monitoring frequency and scope – Review/modify operational components – Evaluate data – Implement appropriate operational modifications / mitigation measures – Document and report to MNR, MOE and Conservation Authority on a monthly basis.
RED	One or more of the monitored parameter values falls below (or above, as applicable) it's Seasonal Action Threshold Trigger Value for a wet-year, or dry-year or average-year condition.	▪ If measured parameter does not recover to be at or above (or below if applicable) the Seasonal Action Threshold Trigger value within one week of hitting red, the quarry shall adapt operations in the quarry (move extraction area, move to a different lift or suspend quarrying in the area causing the impact) ▪ Notify MNR, MOE and Conservation Authority agency by phone and by email within 48 hours of entering a red condition ▪ Assess reason for red condition and options to remedy problem and implement remedy ▪ Resume extraction once specified set of conditions has been achieved

As a starting point, Seasonal Early Warning Values and Seasonal Action Threshold Trigger Values are established for the following three scenarios:

a) dry climatic conditions, using 2007 as the reference year;
b) wet climatic conditions, using 2008 as the reference year; and
c) average climatic conditions, taken as the mid-point value between (a) and (b) above.

For each seasonal evaluation period, it will be necessary to determine if prevailing climatic conditions reflect a dry-year, a wet-year or an average year condition, so that the appropriate target / threshold criteria can be applied. Walker Aggregates Inc. has a local climate station at the office of the existing Duntroon quarry. It can monitor prevailing climatic conditions of precipitation and temperature to determine which scenario applies to the Performance Indicator compliance monitoring results.

Within the context of this AMP, seasonal values are developed based on the following monthly distribution:

Winter:	January and February
Spring:	March, April, May and June
Summer:	July, August and September
Fall:	October, November and December

Note: March is included in the Spring period to accommodate a March thaw condition which often occurs in the Duntroon area.

In order to incorporate any effects that long-term trends in regional climatic conditions (that is, climate change) have on local groundwater springs and / or surface water flow conditions that are monitored as part of the PITM, one background control monitoring station is to be established at appropriate locations within each of the Pretty River and the Batteaux Creek sub-watersheds.

The specific locations of the control stations are being selected in conjunction with the NVCA, and are to be positioned such that they are beyond any influence of the quarry expansion operations. Flow, temperature and general water chemistry conditions will be monitored at the control stations. Results will be used to establish trends between long-term changes in climatic conditions and surface water flow conditions. Those trends will be incorporated into the evaluation of the PITM and other AMP component monitoring data to separate climate change effects from effects due to future quarry operations. For example, if the long-term trend is one of reduced precipitation and surface water flows at the control stations are reduced by 10% on a seasonal basis, then the early warning (yellow zone) and action threshold (red zone) trigger criteria would be reduced by a similar amount.

In addition to the Performance Indicator Trigger Monitoring program, Long-term Trend Monitoring will include general water chemistry conditions once per season in the quarry discharge water and at key groundwater spring / surface water locations around the expansion property to ensure that quarry operations do not affect the chemical quality of local water resources beyond acceptable limits. Details are provided in Appendix B of the AMP.

A.2.2 MONITORING LOCATIONS

Seasonal early warning and action threshold trigger values are provided for specified key locations in **Table A-2** for Dry-Year conditions (based on 2007 data) (see Attachment A-3 for Tables A-2 through A-5), in **Table A-3** for Wet-Year conditions (based on 2008 data), and in **Table A-4** for Average-Year conditions. The performance indicators are to be monitored at these locations for compliance purposes as part of the Adaptive Management Plan. The majority of monitoring locations are positioned on publicly-owned lands, such as municipal road rights-of-way, or on lands owned by Walker Aggregates Inc. in order that access for monitoring is maintained.

The PIT monitoring on public land and Walker Aggregates land will be sufficient to ensure protection of the natural heritage features. Visual monitoring of surface water conditions (presence / absence of flow), and physical temperature monitoring will also be undertaken on a monthly frequency at specified groundwater spring locations below the brow of the Escarpment to supplement the PIT monitoring. These locations are on private property, and access to private property for monitoring purposes will be subject to landowner permission.

It is recognized that, in some instances, there may be other factors that could affect flow and/or temperature conditions at some monitoring locations and which have no connection to quarry operations. The monitoring as proposed will assist in identifying cause and effect.

Walker Aggregates Inc. will accept the responsibility to identify the cause(s) for any and all exceedances of action threshold trigger levels should they occur for any reason. If it is determined that Walker quarry operations are the cause of the problem, Walker Aggregates Inc. will resolve these issues in an appropriate manner. If it is determined that Walker quarry operations are not the cause of the exceedance, those quarry operations will continue and MNR, MOE and the Conservation Authority will be so advised.

Figure A-2 provides a schematic of the surface water and wetland areas to illustrate the Performance Indicator Trigger Monitoring locations, as described below. **Table A-5** provides a summary of each of the monitoring locations and the parameters that are to be monitored at each site.

A.2.2.1 Surface Water: Temperature and Flow

A. Pretty River Tributary

Below Escarpment Springs [public access property]:

1. SW16 at 26/27 Sideroad (north side): channel flow from Escarpment springs on H/E. Franks property.
2. SW17 at 26/27 Sideroad (south side): Outflow channel from former Sestito Property (now H/E Franks), below collection pond.

3. SW17A at 26/27 Sideroad (north side): Channel flow representing cumulative flow from springs at Escarpment, upstream from junction with SW17 flow.
4. SW18 at Concession 10 (east side): Main channel flow representing combined flow from SW17 and SW17A and other springs in this area.

At Escarpment Springs [private property]:

1. SW21C at spring discharge from Amabel Formation, above surface water collection area for H/E Franks residential water supply
2. SW 24A at spring discharge from Manitoulin Formation rock scarp outcrop on H/E Franks (formerly Sestito) property south of 26/27 Sideroad. Temperature and visual discharge (presence/ absence) monitoring.
3. SW 77 at spring discharge from Amabel Formation to the south of 26/27 Sideroad. Temperature and visual discharge (presence / absence) monitoring.

B. Batteaux Creek Tributary

Below Escarpment Springs [public access property]:

1. SW15 at Concession 10 (east side): Main channel flow representing outflow from pond on H/E. Franks property that collects spring discharge and overflow from the water supply spring on that property.
2. SW14 at Concession Road 10 (east side): Main channel flow representing outflow from pond on W. Franks property that collects spring discharge from all springs on that property.

At Escarpment Springs [private property]:

1. SW 10 at spring discharge water source from Amabel Formation rock talus immediately above W. Franks surface water supply system collection rings. Temperature and visual discharge (presence / absence) monitoring.
2. SW 11 group of spring discharges below Manitoulin Formation rock scarp on W. Franks property, above collection pond. Temperature and visual discharge (presence / absence) monitoring.

C. Beaver River Tributary West of Duntroon Existing Quarry Property:

1. SW1 Twin Culverts at Grey Road 31 that transmit natural surface water flow and the existing quarry excess water discharge out of the eastern section of Rob Roy PSW unit #6 wetland feature to the western section of the wetland. The tributary stream to the west (downstream) of Grey Road 31 supports limited existing fish habitat and the objective is to re-establish a

more-natural seasonal flow hydrograph in this tributary, as illustrated in **Figure A-3** [public access property].

2. SWO-2 Osprey Quarry property downstream of RR#6 wetland at cattle crossing. Flow at SWO-2 will be dependent on the SW1 flows (target hydrograph **Figure A-3**) and prevailing climatic conditions [Walker Aggregates Inc. property].
3. 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 [public access property].

A.2.2.2 Wetland Areas

A. Surface Water Level / Depth and Groundwater Table Elevation

Rob Roy Unit #2:	Drivepoint monitor DP5*, and Drivepoint monitor DP7* (location to be established)
Rob Roy Unit #6:	Drivepoint monitor DP2* (west of existing quarry), Drivepoint monitor DP8* (to be established west of quarry) Drivepoint monitor DP4* (west of Grey Road 31)
ANSI A Wetland:	Drivepoint monitor DP6*
ANSI B Wetland:	Bridson Drivepoint monitor*, and Drivepoint Monitor DP9* (to be established at east end of wetland)

* Walker Aggregates Inc. property.

B. Surface Water Flow

Rob Roy Unit #2:	Outflow at culvert SW3 on Grey Road 31**
Rob Roy Unit #6:	Inflow at culvert SW2 on Simcoe Road 91**, and Outflow at culvert SW1** (see point #1 under Beaver River Tributary, above).
ANSI B Wetland:	Outflow to sinkhole area at SW9 on former Bridson property*

* Walker Aggregates Inc. property.
** public access property.

A.2.3 TRIGGER CRITERIA AND DECISION STEPS

As summarized in the tables which follow, possible impacts of quarrying are predicted for these parameters and / locations at different stages of quarrying, for the trigger criteria listed. Adapting various aspects of quarry operations as listed in the decision steps will mitigate the impacts that may be temporarily experienced.

A.2.3.1 Surface Water Flow Features

Tables A-6 to **A-9**, which follow, summarize the information for surface water temperature and flow conditions at the performance indicator trigger locations, including the wetland features from which some out-flow does occur at least seasonally.

Table A-6: Surface Water Temperature Trigger Monitoring Locations and Criteria	
Predicted time of Impact	Phase I and II not predicted to be an issue Phase III – the possibility exists for minor impacts to occur
Concern	Increase in temperature affecting downstream coldwater fish habitat Coldwater fish habitat generally requires water with a maximum summer temperature of <22ºC. At spring discharge points summer temperature expected to be in range of 8ºC to 12.7ºC based on field temperature data collected at surface water monitoring station SW11A
Monitoring Location Locations below Escarpment Springs and at the Beaver River Tributary are situated on publicly-owned lands (road right-or-way) and/or on lands owned by Walker Aggregates Inc. Locations at Escarpment Springs are situated on privately owned land, and access is subject to landowner permission. These locations supplement the PIT Monitoring.	1. Pretty River Below Escarpment Springs ▪ SW16 at 26/27 Sideroad ▪ SW17 at 26/27 Sideroad ▪ SW17A at 26/27 Sideroad ▪ SW18 at Concession 10 Road At Escarpment Springs ▪ SW21C at H/E Franks property ▪ SW24A ▪ SW77 2. Batteaux Creek Below Escarpment Springs ▪ SW15 at Concession 10 Road ▪ SW14 at Concession 10 Road

Table A-6: Surface Water Temperature Trigger Monitoring Locations and Criteria	
	At Escarpment Springs ▪ SW10 at W. Franks property ▪ SW11 group of springs at W. Franks property 3. Beaver River West of Site ▪ SW1 at Grey Road 31 ▪ SW0-2 On Osprey license property west of existing quarry ▪ SW6A Twin culverts at Osprey (Grey Highlands) Sideroad 30
Triggers	Criteria are established for Dry Year Conditions (2007), for Wet Year Conditions (2008) and for Average-Year conditions. Applicable criteria will be based on prevailing climatic conditions. Red = highest temperature measured during each season, as appropriate, plus 0.5°C. Yellow = Red minus 2ºC Need to factor in consideration of ambient air temperature. If the differential between air and water temperature (i.e. the cooling effect of the groundwater) remains constant, despite long term climate trends to increasing summer temperatures, temperature changes at the springs are not related to impacts from the quarry. If red zone temperature shows no effect on downstream fisheries, then the trigger value will be reassessed.
Trigger Period	Seasonally, as appropriate (May 1 to October 1 is critical time) Apply triggers at the end of Phase II unless Long-term Trend Monitoring Program indicates that actual impacts are occurring earlier than predicted.

Table A-7:	**Surface Water Temperature Trigger Decision Steps**
GREEN	Conduct regular operations with performance indicator monitoring and long-term trend monitoring per AMP and ARA site plans
YELLOW	Increase monitoring program by: ▪ Checking exit temperature from quarry (daily); ▪ Checking upstream and downstream temperatures in receiver (weekly); ▪ Monitoring temperature and dissolved oxygen in downstream fishery for changes (weekly); ▪ Comparing ambient air temperature to historic values (daily); ▪ Assessing regional conditions. Is quarry pumping to springs and/or to other discharge locations? If not, start pumping if possible. If pumping, increase pumping rate if possible. Check pumps to ensure functioning properly; if not, repair. If there is a continuing temperature increase within the yellow zone, discharge cooler water from quarry (such as from a bottom-draw system at sump). Assess other options to achieve goal of not dropping into the red zone Determine if recharge injection wells should be implemented at appropriate locations to increase flux of groundwater through aquifer to promote a cooling influence at downgradient discharge locations.
RED	Adapt operations ▪ Additional injection wells ▪ Move extraction area; ▪ Move to a different lift; ▪ Suspend quarrying in the area causing the impact; ▪ Assess other options to achieve goal of not being in red zone

Table A-8: Surface Water Flow Trigger Monitoring Locations and Criteria	
Predicted time of Impact	Phase I and II – not predicted to be an issue Phase III – minor impacts may occur
Concern	Low flow could affect downstream coldwater fish habitat.
Monitoring Location Locations below the Escarpment are located on publicly-owned lands (road right-of-way) and/or lands owned by Walker Aggregates Locations at Escarpment Springs are located on privately owned land, and access is subject to landowner permission. Obtain written permission to access private lands on an annual basis. Notify MNR, MOE and Conservation Authorities which locations are accessible.	1. Pretty River Below Escarpment Springs [public access property] ▪ SW16 at 26/27 Sideroad ▪ SW17 at 26/27 Sideroad ▪ SW17A at 26/27 Sideroad ▪ SW18 at Concession 10 Road At Escarpment Springs [private property] ▪ SW21C at H/E Franks property ▪ SW24A ▪ SW77 2. Batteaux Creek Below Escarpment Springs [public access property] ▪ SW15 at Concession 10 Road ▪ SW14 at Concession 10 Road At Escarpment Springs [private property] ▪ SW10 at W. Franks property ▪ SW11 group of springs at W. Franks property 3. Beaver River West of Site ▪ SW1 at Grey Road 31 [public access property] ▪ SW02 On Osprey license property west of existing quarry [Walker Aggregates Inc. property] ▪ SW6A at Osprey (Grey Highlands) Sideroad 30 [public access property]

Table A-8: Surface Water Flow Trigger Monitoring Locations and Criteria	
	4. Wetland Area Flows ▪ RR#2: Outlet at culvert SW3 on Grey Road 31 [public access property] ▪ RR#6: Inflow at culvert SW2 on Simcoe Road 91 ▪ Outflow at culvert SW1 on Grey Road 31 [public access property] ▪ ANSI B: Outflow to sinkhole area at SW9 9Walker Aggregates Inc. property]
Triggers	Criteria are established for Dry Year Condition (2007), for Wet Year Condition (2008) and for Average-Year condition. Applicable criteria will be based on prevailing climatic conditions. Red = lowest flow measured in each season minus 10% Yellow = Red plus 20% SW1 is the location of the discharge from the existing quarry, and as such is considered as a controlled-outlet feature. In order to maintain existing fish habitat in the Beaver tributary downstream from Grey Road 31, the target flow hydrograph shown in Figure A-3 has been developed as the seasonal target criteria for SW1. If climate conditions change, reassess trigger based on observed trends at control stations. If reduction of flow has no impact, reassess trigger.
Trigger Period	Year round except when springs / seeps / channel flows are frozen as naturally occurs pre-quarry. Apply triggers at the end of Phase II unless Long-term Trend Monitoring Program indicates that actual impacts are occurring earlier than predicted.

Table A-9:	**Surface Water Flow Trigger Decision Steps**
GREEN	Conduct regular operations with performance indicator monitoring and long-term trend monitoring per AMP and ARA site plans
YELLOW	Increase monitoring program by: ▪ Checking exit flow from quarry (daily); ▪ Checking upstream and downstream flows (weekly); ▪ Checking pumps (daily) ▪ Review pumping records (weekly). Is quarry currently pumping to off-site discharge locations? If not, start pumping if possible. If pumping, increase pumping volume if possible. Check pumps to ensure functioning properly; if not, repair. Assess other options to achieve goal of not dropping into the red zone Determine if recharge injection wells should be implemented at appropriate locations to increase flux of groundwater through aquifer to promote a cooling influence at downgradient discharge locations.
RED	Adapt operations ▪ Additional injection wells; ▪ Move extraction area; ▪ Move to a different lift; ▪ Asses other options to achieve goal of not being in the red zone ▪ Suspend quarrying in area causing the impact

A.2.3.2 Wetland Feature Water Levels

Wetland water levels will be managed during the active phase of the quarry through to final rehabilitation by pumping excess water from the extraction area to wetlands as required to maintain the seasonal hydro-periods. The water will be pumped at rates and at times to

replicate as closely as possible "Target Hydrographs". The target hydrographs will be established for each wetland in consultation with MNR, MOE and Conservation Authority staff and using site specific data.

Preliminary target hydrographs for major wetland types are included as **Figures A-4**, **A-5** and **A-6**, and include targets for average years, wet years and dry years. Target hydrographs for wetlands with amphibian breeding habitat will be set to ensure that adequate water is present in the habitat areas to enable successful amphibian breeding, even in dry years. Both the approach and the actual targets will be refined as the monitoring database expands and with input from agency staff.

The target refinement process will be verified through the long-term routine 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 ecological monitoring programs are provided in Appendix C. Ecological monitoring will be related to the water level monitoring and interpreted in conjunction with MNR, MOE and Conservation Authority staff.

Tables A-10 and **A-11**, which follow, summarize the trigger level information and decision steps for the wetland feature water levels.

Table A-10: Wetland Water Level Trigger Monitoring Locations and Criteria

Predicted time of Impact	Potential impacts on wetland water levels are not predicted until Phase II
Concern	Loss of wetland species and/or amphibian habitat.
Monitoring Locations	Groundwater and surface water levels in the following wetland areas [all locations are within Walker Aggregates Inc. property]:
Rob Roy PSW Unit #2 immediately north of expansion property	▪ RR#2: Drivepoint monitor DP5, and ▪ Drivepoint monitor DP7 (location to be established).
Rob Roy PSW Unit #6 west of existing quarry	▪ RR#6: Drivepoint monitor DP2 ▪ Drivepoint monitor DP4, and ▪ Drivepoint monitor DP8 (location to be established)
Northeast of expansion property	▪ ANSI A: Drivepoint DP6

Table A-10: Wetland Water Level Trigger Monitoring Locations and Criteria	
Northeast of expansion property	▪ ANSI B: Bridson Drivepoint, and ▪ Drivepoint DP9 (location to be established)
Triggers	Vegetation Too dry ▪ Red = more than one month operating outside the dry year hydrograph (i.e. water levels lower than target) or anytime the water level falls below the lowest water level recorded for that month minus 10%.. ▪ Yellow = Red level plus 20% Vegetation Too wet ▪ Red = more than one month operating with water levels higher than the levels in the wet year hydrograph for that month or anytime water levels rise above the highest historic level for that month plus 10% ▪ Yellow = Red level minus 20% Amphibian habitat ▪ Red – Critical ponds go dry during short breeding period (March to second week of July) ▪ Yellow - depth of critical ponds drops below 80 % of historic minimum depths during the extended breeding period (March to second week of August) If climate conditions change, reassess trigger based on observed trends at control stations. Need to consider length of time that the water levels are near trigger values and whether the change in water levels appears to be affecting wetland functions or vegetation dynamics.

Table A-10: Wetland Water Level Trigger Monitoring Locations and Criteria	
Trigger Period	▪ Spring and fall saturated period ▪ Amphibian breeding season based on the species present. ▪ Apply triggers at the end of Phase I unless Long-term Trend Monitoring Program indicates that actual impacts are occurring earlier than predicted.

Table A-11: Wetland Water Level Decision Steps	
GREEN	Conduct regular operations with performance indicator monitoring and long-term trend monitoring per AMP and ARA site plans
YELLOW	Increase monitoring program by: ▪ Checking water levels (weekly); ▪ Checking pumps (daily) ▪ Reviewing pumping records (weekly). Is quarry currently pumping? If not, start pumping if possible. If pumping, increase pumping volume if possible. Check pumps to ensure functioning properly; if not, repair. Assess other options to achieve goal of not dropping into the red zone Determine if recharge injection wells should be implemented at appropriate locations to increase flux of groundwater through aquifer to help maintain wetland water levels
RED	Adapt operations ▪ Additional Injection wells ▪ Move extraction area; ▪ Move to a different lift; ▪ Assess other options to achieve goal of not being in the red zone ▪ Suspend quarrying in area causing the impact

A.2.4 MONITORING METHODOLOGY

The methodology that will be used for the Performance Indicator Trigger Monitoring program reflects the parameters that are being monitored and the site-specific characteristics of the locations under observation. **Table A-5** provides a summary of the PITM monitoring locations the parameters. As a starting point, the following methodology is to be adopted.

A.2.4.1 Surface Water Channel Flow and Temperature by Datalogger

Pretty River Tributary System:	SW16, SW17, SW17A at 26/27 Sideroad SW18 at Concession 10 Road Background Control Station (To Be Established)
Batteaux Creek Tributary System:	SW14 and SW15 at Concession 10 Road SW9 seasonally (directly east of expansion property) Background Control Station (To Be Established)
Beaver River Tributary System:	SW1 at Grey Road 31 SW2 at County Road 91 SWO-2 Osprey Quarry property west of Grey 31 SW6A at Grey Highlands Sideroad 30 SW3 seasonally, Rob Roy Unit 2 at Grey Highlands Sideroad Road 30
ANSI B Wetland:	Bridson Drivepoint monitor, and Drivepoint Monitor DP9 (to be established at east end of wetland)

- Water level (stage) and water temperature datalogger recorders will be established in these tributary stream channel road culvert crossings. Initially, the dataloggers will be set to record values three times per day (7:00 AM, 3:00 PM and 11:00 PM) to provide a measure of the daily variation in flow conditions and will be downloaded on a monthly basis at the outset. The dataloggers will be installed in the same locations (if practical with respect to flow conditions and winter freezing concerns)) as the existing monitoring stations at these locations so that existing stage-discharge relationships can be utilized. In the event that existing stage-discharge relationships cannot be used at specific stations, new stage-discharge curves will be established.
- Quarterly estimate of streamflow (as a check on stage-discharge relationship) and measurement of the field chemistry parameters: pH, temperature, conductivity and dissolved oxygen.
- Annual sampling for water quality parameters as follows:
  - General chemistry including pH, temperature, dissolved oxygen, specific conductance, alkalinity, hardness, colour, total suspended solids.

- Major and minor ion constituents and nutrients.
- Total petroleum hydrocarbons.

A.2.4.2 Surface Water Escarpment Springs

Pretty River Tributary:	SW21C Private property east of expansion lands spring from Amabel Formation surface water source supply H/E Franks SW24A Private property spring from Manitoulin Formation surface water source on former Sestito (now H/E Franks) property SW77 Free-flowing natural spring from Amabel Formation south of 26/27 Sideroad
Batteaux Creek Tributary:	SW10 Private property east of expansion lands, surface water supply spring from Amabel Formation SW11 Private property east of expansion lands, series of springs below Manitoulin Amabel Formation above collection pond

- Monthly temperature measurement and visual assessment (presence / absence) of flow conditions at springs, with manual estimate of flow when practical.
- Annual sampling for water quality parameters as follows:
  - General chemistry including pH, temperature, dissolved oxygen, specific conductance, alkalinity, hardness, colour, total suspended solids.
  - Major and minor ion constituents and nutrients.
  - Total petroleum hydrocarbons.
  - Bacteriological content (*e. coli*, total coliform and heterotrophic plate count) for SW10 and SW21C as these sources are used as residential / farm water supplies.

A.2.4.3 Wetland Water Levels

Beaver River Tributary:	Rob Roy Wetland Unit #2: Drivepoint DP5 and DP7 Rob Roy Wetland Unit #6: Drivepoint DP2, DP4 and DP8
Batteaux Creek Tributary:	ANSI A Wetland Unit: Drivepoint DP6
ANSI B Wetland Unit	Drivepoint DP9 and Bridson DP

- Monthly manual groundwater level measurement (inside monitor) and ponded surface water level measurement (outside monitor), and water temperature measurement. Frequency of ponded surface water level and temperature measurements increased from monthly to

every two weeks from May to the end of July to reflect the amphibian breeding hydroperiod.

A.2.4.4 Quarry Discharge Water Quality

Quarterly analysis of the chemical quality of the quarry discharge water for the following parameters:

- General chemistry including pH, temperature, dissolved oxygen, specific conductance, alkalinity, hardness, colour, total suspended solids.
- Major and minor ion constituents and nutrients.
- Total petroleum hydrocarbons.
- Bacteriological content of *e. coli*, total coliform and heterotrophic plate count, and only in the event that quarry discharge water is used for recharge injection wells.

A.2.4.5 Instrumentation

The instrumentation that currently is used for this monitoring program reflects contemporary industry standards for this type of work, and generally consists of the following:

- 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:
  Davis Vantage Pro2

The instruments will be maintained in good working order and will be calibrated on a regular basis, as per the manufacturer's recommendations, and results will be recorded in a field book for future reference if needed.

A.2.4.6 Record Keeping

A detailed record of all monitoring events and field measurements will be maintained in a dedicated field book, and results will be QA/QC'ed against previous data and then entered into the monitoring database for the quarry in a timely manner. Any seemingly anomalous results will be investigated immediately, and will be re-measured in the field for verification if necessary.

Once the monitoring results have undergone the internal QA/QC process, they will be posted to the Walker Aggregates Inc. web-site that has been established for the Duntroon quarry expansion. The results for the current monitoring event should be available on the web site no later than seven days following the event, excluding any laboratory chemistry data which will be posted within 48 hours of receipt from the laboratory. Any seemingly anomalous results will be identified as such, and the verification process that will be underway will be documented.

Results pertaining to compliance aspects with respect to the Performance Indicator Trigger Monitoring program will be compiled into a tabular format summary report that will identify any non-compliance concerns which will be posted to the web-site on a monthly basis.

Since extraction in most of Phase 1 is not expected to result in any off-site impacts to ground water or surface water resources or the associated natural heritage features, the reporting time-lines noted above should be satisfactory. As the extraction nears the end of Phase 1, it may be necessary to re-visit the reporting time-lines and develop a system of real-time reporting for specific key parameters, if that is deemed appropriate. Such decisions will be made in consultation with the MNR, MOE and the Conservation Authorities.

A.3 Reporting and Adaptation

The report for the Performance Indicator Trigger Monitoring will document the scope of the monitoring program that was completed for that reporting period, and it will provide the results of the monitoring. The report will identify if, when, and where the early warning values (yellow zone) and trigger values (red zone) were exceeded, as well as what additional mitigation measures were implemented and the outcome of that mitigation. Recommendations will be provided with respect to any modifications to the program that are considered appropriate, based on the monitoring results for that reporting period combined with historical trends.

Adaptation

The integrated AMP report will include conclusions and recommendations on:

- Ongoing integration with the long term trend ground and surface water monitoring program;
- Whether long term changes are occurring in the site and or regional environment, and whether they are quarry related or as a result of other factors;
- Updated environmental baseline for both site environment and regional environment;
- The implication of any climate trends and adaptations that may be required as a result to any of the AMP components;
- Adaptations to the quarry operations;
- Adaptations to mitigation measures;
- The long term effectiveness of the performance indicator targets specified in the Performance Indicator Trigger (PIT) Monitoring Program;
- Adaptations to the performance indicator trigger monitoring program; and
- Adaptations to the long-term trend monitoring program.

A.4 References

MHBC Planning Ltd. 2009. ARA Site Plans; Proposed Duntroon Quarry Expansion.

Jagger Hims. 2005. Duntroon Quarry Expansion Geological Report and Level 2 Hydrogeological Assessment.

Jagger Hims. 2007 a. Level 2 Hydrogeological Assessment Addendum Cumulative Impact Assessment Proposed Expansion and Proposed MAQ Highland Quarry Computer Groundwater Modelling Response to Agency Review Comments.

Jagger Hims. 2007 b. Duntroon Quarry Expansion Ground and Surface Water Monitoring Program Addendum.

Karst Solutions and Worthington Groundwater. 2007. Karst Investigation of the Duntroon Quarry Expansion Lands.

Stantec Consulting Ltd. 2005. Duntroon License Expansion – Level 2 Natural Environment Technical Report

Stantec Consulting Ltd. 2007. Duntroon License Expansion – Level 2 Natural Environment Report Technical Report Addendum: Response to Agency Comments and Cumulative Effects Assessment

S.S. Papadopolous & Associates Inc. Duntroon Quarry Expansion Model Peer Review. Final Report. March 2009

Daryl Cowell & Associates Inc. Karst Report Peer Review 2008 / 2009.

APPENDIX A: PERFORMANCE INDICATOR TRIGGER MONITORING PROGRAM
DUNTROON QUARRY EXPANSION
AGGREGATE RESOURCES ACT APPLICATION
LOT 25 AND PT. LOT 26, CONCESSION 11
TOWNSHIP OF CLEARVIEW

ATTACHMENT A-1: FIGURES

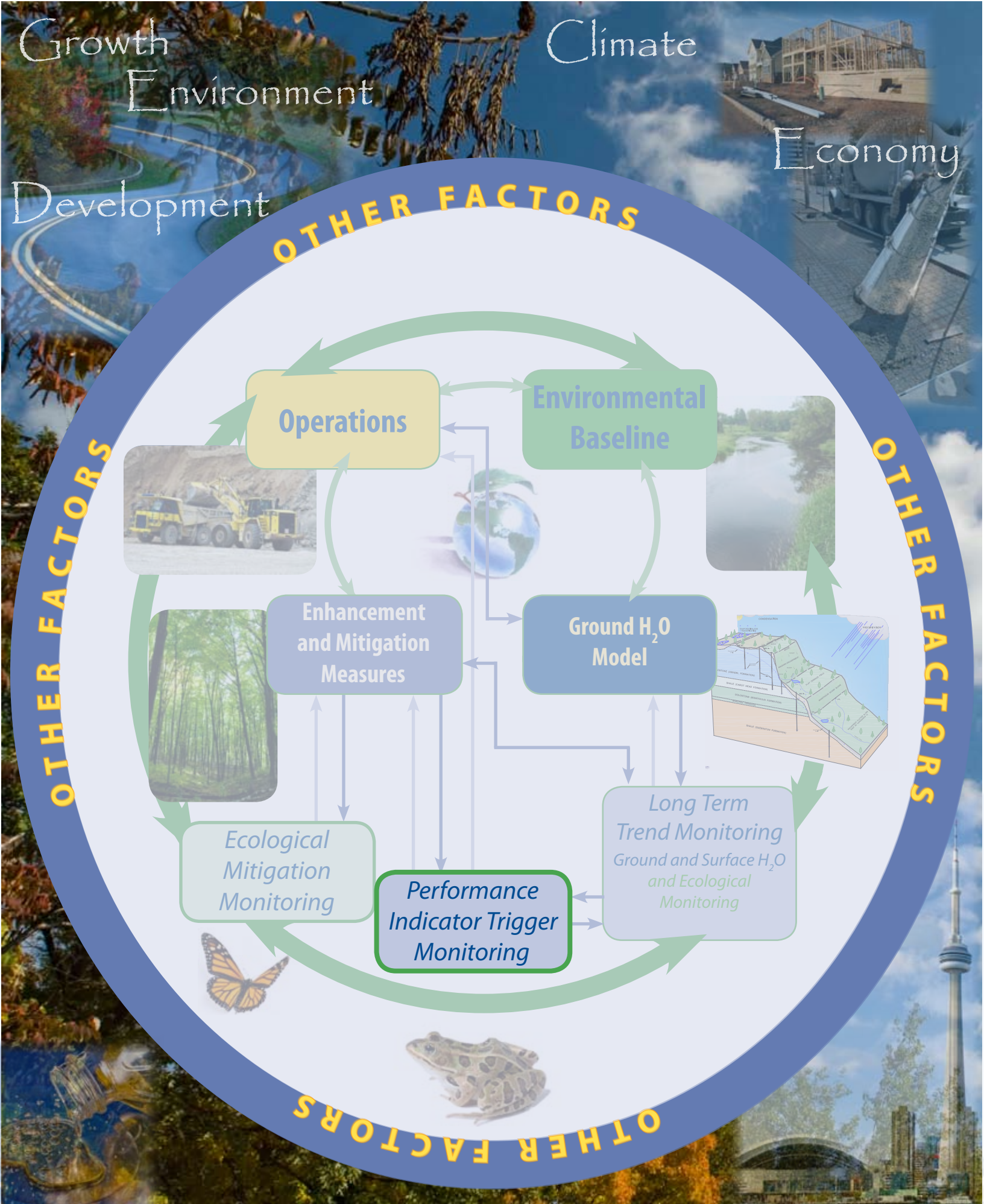
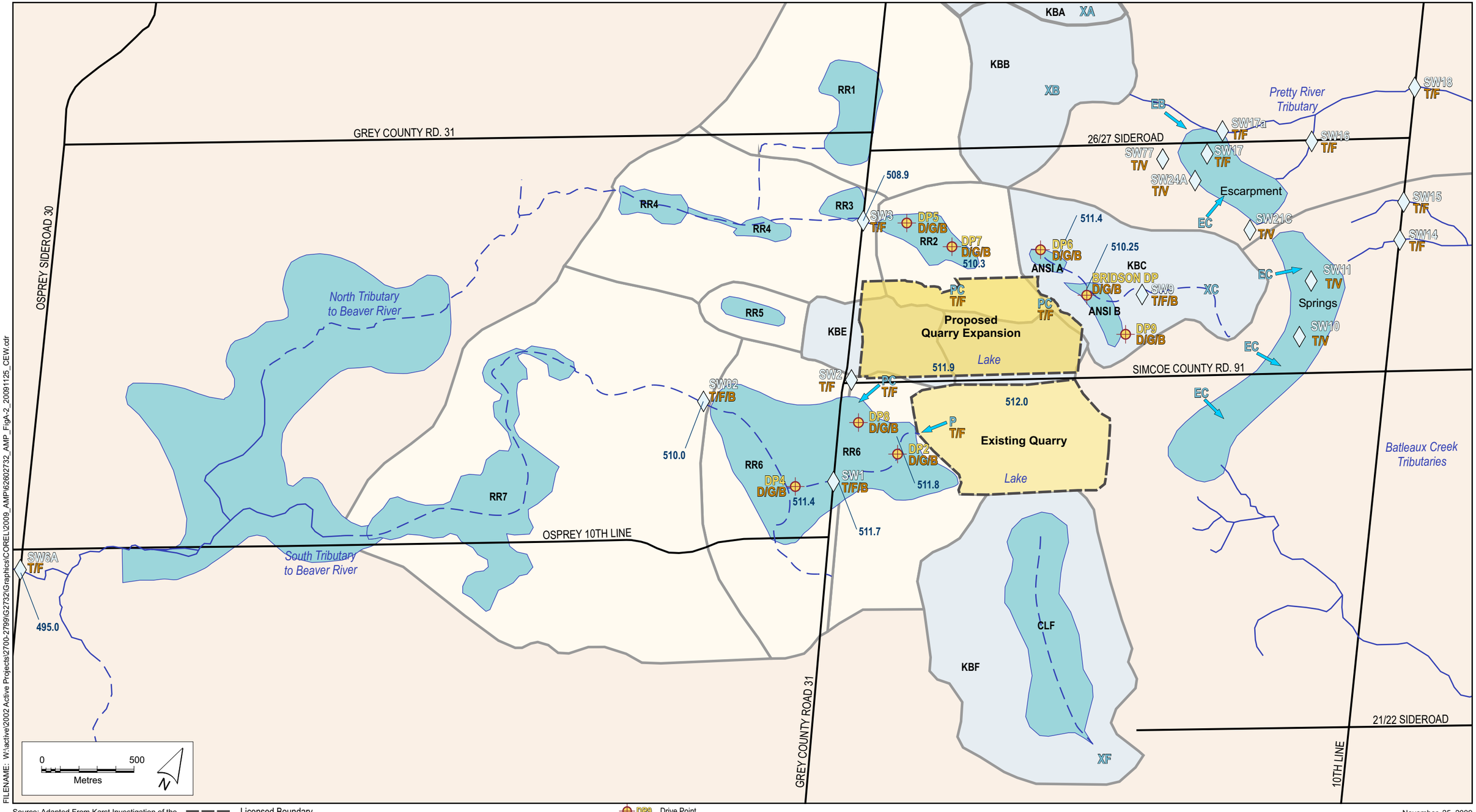


Figure A-1: Adaptive Management Plan Component Interactions and Influences



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Source: Adapted From Karst Investigation of the Duntroon Quarry Expansion Lands - Fig. 1 for Jagger Hims Ltd., April2007

Walker Aggregates Inc.

	Licensed Boundary
KBC	Karst Basin C
XC	Conceptual Location of Karst infiltration for Basin C
EC	Conceptual Location of Karst exfiltration for Basin C
RR7	Rob Roy Wetland Complex Unit 7
ANSI A	Unevaluated ANSI Wetland A
CLF	Unevaluated Wetland at Camarthen Lake Farm
Escarpment Springs	Unevaluated Wetlands Associated with springs at base of Manitoulin formation
512.0	masl - Spot Elevations and Predicted Average Lake Levels (lake levels will fluctuate seasonally)

DP9	Drive Point
P	Discharge from Existing Quarry
PC	Conceptual Location of Discharge from Proposed Quarry
SW01	Surface Water Monitoring Location
	Monitoring
T	Temperature
D	Depth of Surface Water
G	Ground Water Elevations
F	Flow
B	Biological Monitoring
V	Visual Flow

November 25, 2009

Client/Project

WALKER INDUSTRIES
DUNTROON LICENSE EXPANSION - AMP

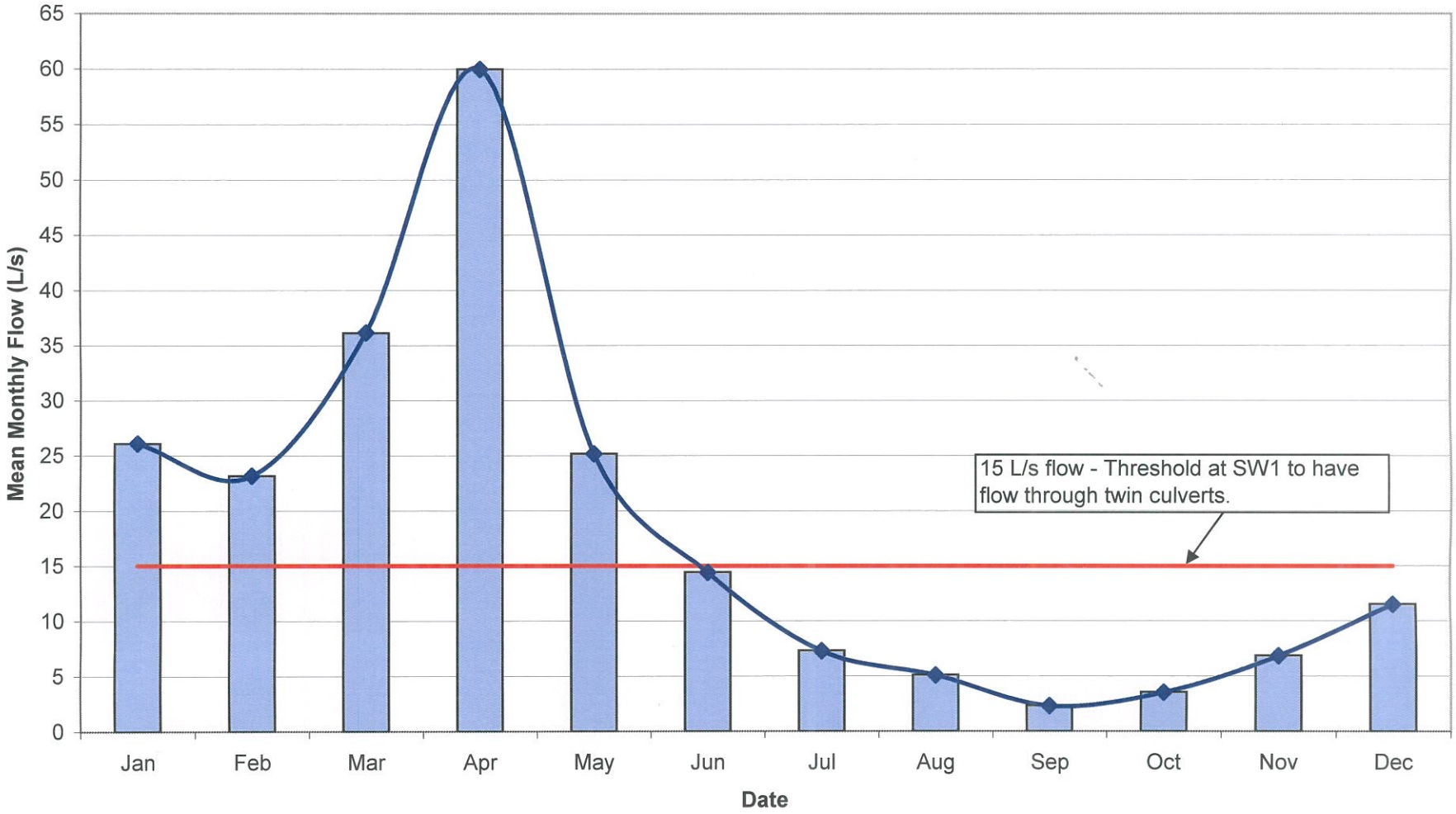
Figure No.

A-2

Title

PROPOSED WATER MONITORING LOCATIONS

FIGURE A-3
COMBINED MEAN MONTHLY HYDROGRAPH AT GREY RD 31 (STATION SW1)
SPRING SW2 AND PRE-EXISTING QUARRY LANDS/WETLANDS CATCHMENT



H:\Proj\93\521\51\Tech\Combined Mean Monthly Flow at SW1.xls

Figure A-4: Swamp with Vernal Pool Target Hydrograph

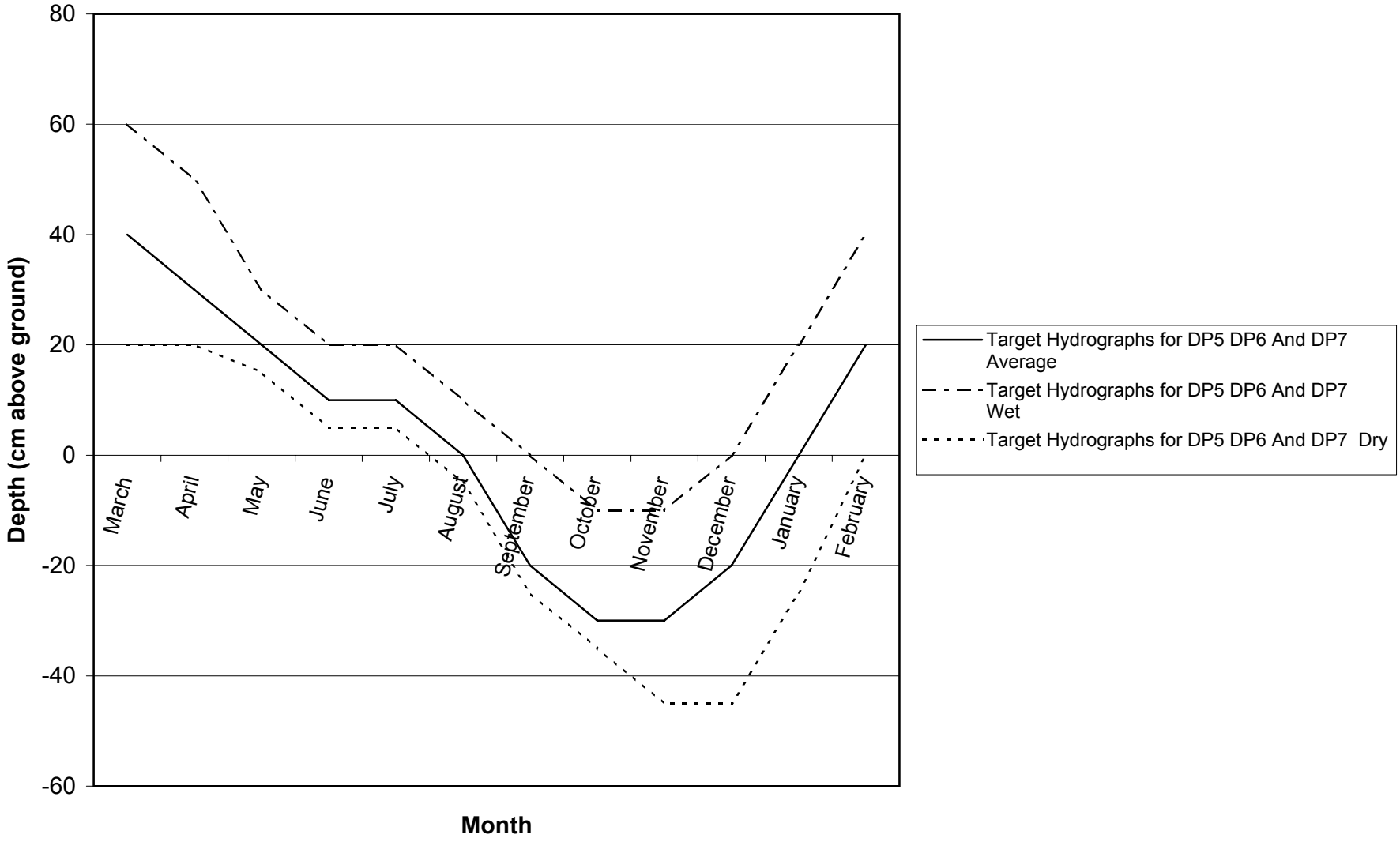


Figure A-5: Swamp/Marsh Shallow Over Bedrock Target Hydrograph

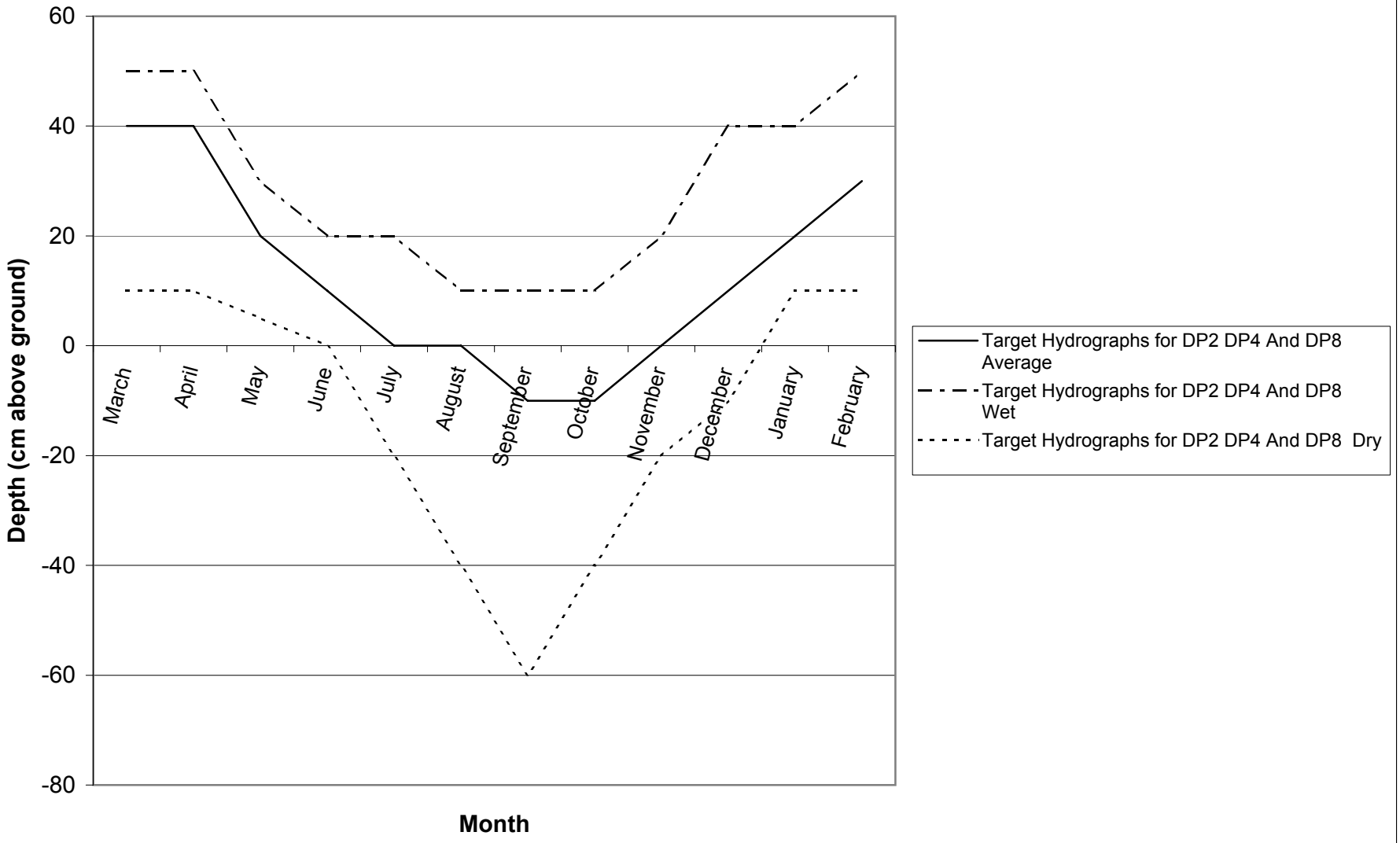
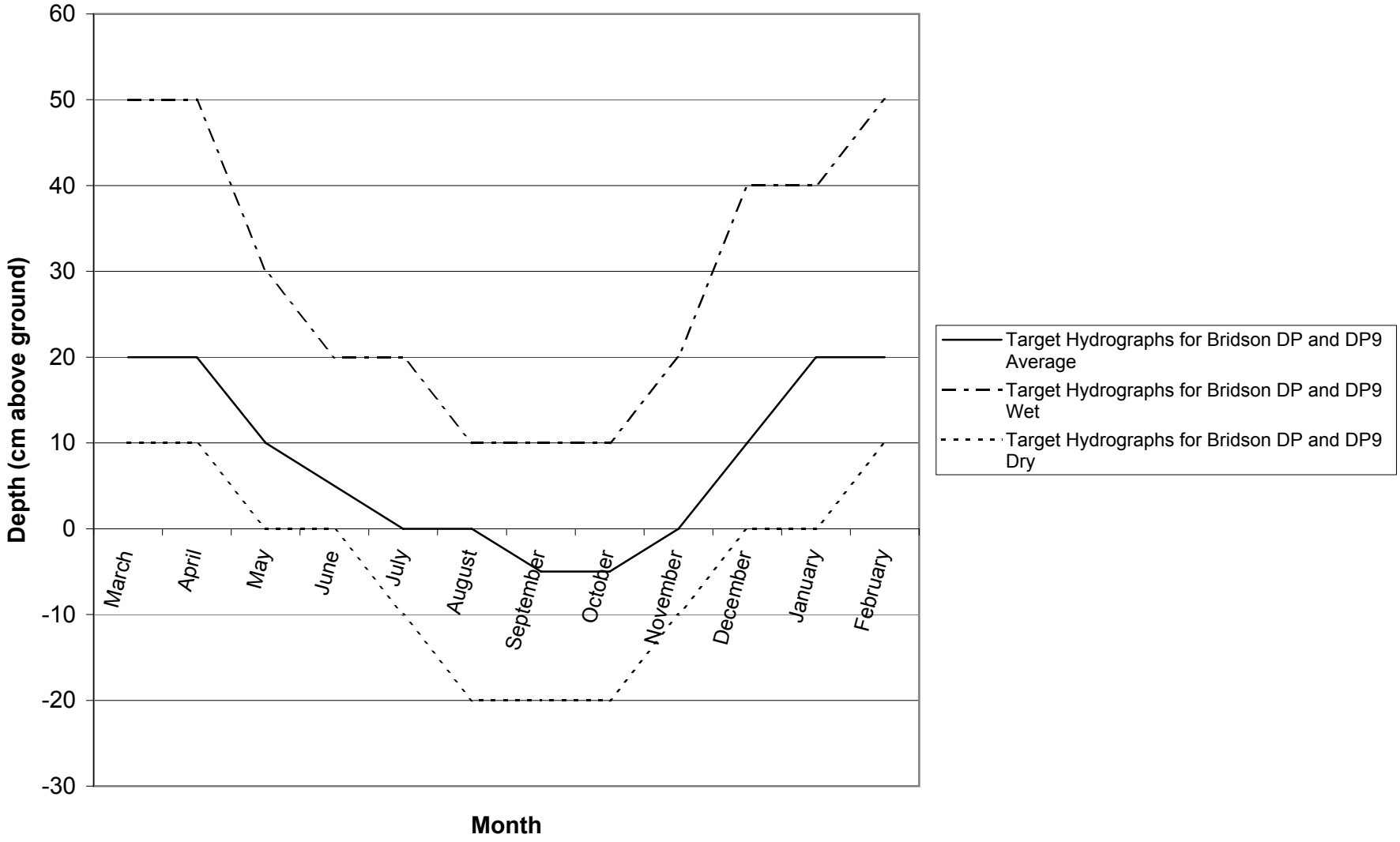


Figure A-6: Wetlands Associated with Channel and Karst Target Hydrograph



ATTACHMENT A-2: WALKER AGGREGATES INC. WATER WELL INTERFERENCE COMPLAINT RESPONSE PROCEDURES

[It is noted that this procedure is reviewed periodically and updated by Walker Aggregates Inc. as necessary]

Title: 4.8 – Water Well Interference Complaint Response Procedures | Page: 1 of 3

Section: 4 - Environmental Operating Procedures | Date Issued: April 15, 2009

Authorized By: Dwayne McKenzie & Ed Lamb, Directors of Aggregates Operations (North & South) | Rev: April 28, 2009

1.0 Purpose

To provide Walker employees with direction on how to respond to and manage water well interference complaints.

2.0 Background

Prompt investigation of Water Well interference complaints received from neighbors is paramount and should be given high priority. It is important to immediately satisfy the water needs of a complainant while investigating the complaint

3.0 Community Approach

A proactive approach to complaint response provides WAI with the opportunity to build harmonious relationships with our neighbors. Through assisting complainants WAI can utilize available experience and expertise to educate neighbors about our operations.

Positive and informative interaction with our neighbors is essential. A compassionate and understanding complaint response is essential to building strong positive relationships with our neighbors that are important to the long term viability of our business.

3.1. Initial Investigation

Following initial investigation of any water well interference complaint, action will be undertaken to address the concerns of the complainant as per requirements outlined in site specific Government permits or approvals.

3.2. Notifying Local MOE District Office

3.2.1. The site operator will immediately notify the local Ministry of the Environment District Office of any complaint arising from the taking of groundwater.

3.2.2. The site operator will report any action which has been taken or is proposed with regard to such complaint.

3.3. Mitigation of Water Well Interference

If the taking of groundwater is determined to have interfered with a neighboring water well supply (in use prior to initial issuance of the site specific permit or approval), the site operator shall take such action as is necessary to make available to those affected, a supply of water:

3.3.1. Equivalent in quantity and quality to their normal takings; or
3.3.2. Compensate the affected party for their reasonable costs of doing so; or
3.3.3. Reduce the rate and amount of taking to prevent or alleviate the observed interference.

3.4. Addressing Permanent Water Well Interference

If permanent interference is caused by the water taking, the site operator shall restore or replace the water supplies of those permanently affected.

4.0 Procedure

Procedures outlined below are consistent across all WAI sites and will not be deviated from, ensuring that aggregate operations do not unduly interfere with available groundwater resources for local residents.

WAI shall, in close cooperation with its environmental consulting firms, continue working diligently to developing extensive groundwater and surface water monitoring programs intended to provide early warning of off-site groundwater interference, before it occurs, so that suitable mitigation measures can be implemented to prevent unacceptable impacts. However, in the event that an unforeseen water interference problem does arise, the following procedures are in place to address and resolve the issue.

4.1. When a Well Water Interference Complaint is received

The complainant shall be directed to the site Superintendent.

4.1.1. The site Superintendant shall collect the following information:

- Date and time of complaint;
- Name, address and phone number of the complainant, and
- Details of the interference problem that has occurred and the level of urgency.

4.1.2 The site Superintendant will notify the Environmental Performance Department of the complaint and provide a report of all information and communications pertaining to the complaint.

4.1.3 The acting Environmental Specialist (Walker Industries Holdings Limited employee) shall notify the local Ministry of the Environment District Office the water well interference complaint, as well as any actions taken or proposed with regard to such complaint.

4.1.4 The acting Environmental Specialist will log all relevant complaint details in the WIHL complaint database. To access the complaint database:

- Navigate to the Environmental Performance Department intranet site.
- Click on the Complaint Database icon located to the right of the page

4.2 Complaint Investigation (Environmental Specialist and Site Superintendent)

4.2.1 Conduct a review of all relevant site specific Government permits or approvals, in consultation with the Environmental Manual and determine the appropriate course of action for addressing the complaint.

4.2.2 If the problem is related to insufficient water supply and may be a result of aggregate operations, the site Superintendent will make arrangements to provide a temporary alternative supply as quickly as possible.

4.2.3 If necessary, the water well interference complaint will be referred to the site's groundwater/surface water consultant for investigation within 24 hours

4.2.4 The complainant will be kept informed of the investigation and the actions and recommendations that result

4.3 Complaint Reporting

4.3.1 Advise the local office of the Ministry of the Environment and other applicable Government agencies that a complaint has been received and that an investigation is underway.

4.3.2 Inform Government agencies if WAI is providing an alternative water supply.

4.3.3 Keep Government agencies informed as to the progress of the investigation and the conclusion and recommendations made.

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4.4 Response Procedure

4.4.1 Meet with the complainant to discuss the outcome of the investigation.

4.4.2 If the interference problem is determined to be the result of site operations:

- Develop a program to mitigate and resolve the issue.
- Discuss the plan with the Ministry of the Environment.
- Let the complainant know the actions that are to be taken, if any.
- If the proposed mitigation requires action to be taken on the complainant's property, attempt to attain the agreement of the complainant.

4.4.3 If the problem is not a result of site operations:

- Provide details of the investigation to the complainant; also communicate details to the MOE.

4.4.4 Should the complainant continue to be of the opinion that the issue is a result of site operations, provide MOE contact information.

4.4.5 Prepare a report documenting the results of the investigation; mitigation and resolution of the interference problem.

4.4.6 If requested by the Ministry of the Environment submit a copy of the report.

ATTACHMENT A-3: ADDITIONAL TABLES